

**High Speed Rail: Consultation on the route from the
West Midlands to Manchester, Leeds and beyond**

Sustainability Statement

Appendix E4 – Biodiversity

A report by Temple-ERM for HS2 Ltd



July 2013

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1. INTRODUCTION

- 1.1.1. This report has been prepared to support the HS2 Phase Two proposed scheme for consultation Sustainability Statement (the Sustainability Statement, Volume 1), a report which describes the extent to which the Government's proposed scheme for HS2 Phase Two supports objectives for sustainable development. This document is a technical appendix which summarises the method for the Biodiversity appraisal, informing the Sustainability Statement main report. The Sustainability Statement places emphasis on the key impacts only. This technical report summarises all the conclusions relating to the Biodiversity appraisal.

2. METHODOLOGY

2.1. Scope of appraisal

- 2.1.1. The Ecology Consultancy (TEC) was commissioned to assist Temple-ERM in undertaking an Appraisal of Sustainability (AoS) of the Phase Two proposed scheme for consultation. TEC carried out the appraisal of the ecological resources present in the areas through which the proposed route passes.
- 2.1.2. Appendix B (AoS Method and Alternatives) provides an explanation of the methodology used for the AoS and the rationale behind it.
- 2.1.3. The appraisal was based initially on statutory sites of nature conservation importance, at a national level. More recent work has drawn upon other strategic studies of the geographic distribution and extent of habitats, including Natural England's Natural Area Profiles and landscape enhancement strategies and Living Landscape Schemes. Other ecological information was derived from aerial photographs.
- 2.1.4. The report draws on earlier stages of the AoS in which potential effects on sites of international and national nature conservation importance were identified. It also refers to a Habitat Regulations Appraisal (HRA) screening and appraisal work that provides detailed information on likely effects on Natura 2000 sites and sets out measures to avoid significant adverse effects.
- 2.1.5. The purpose of this report is as follows:
 - To summarise information on the potential effects on sites of international, and national importance;
 - Provide detail on the possible effects on sites of regional importance¹ Local Nature Reserves (LNR), Ancient Woodland, UK Habitats of Principal Importance (HPI), and publicly accessible information on Wildlife Trust Reserves; and
 - Identify affected landscape designations, with respect to any pertinent habitat types and ecological objectives.

2.2. Habitats of Principal Importance desk study

- 2.2.1. TEC assessed the ecological features along the route, describing the key features of national and regional importance that could potentially be affected by the presence of the proposed route.

¹ As used in earlier stages of the AoS, there is no guidance to state that HPI sites are automatically of regional importance - they could be of greater or lesser value as per designation or habitat quality.

2.3. Designated sites

- 2.3.1. A number of different nature conservation designations were drawn upon in carrying out the appraisal of the potential effects of the proposed scheme, as well as the opportunities for buffering sites from the effects of the scheme. Information on the status of these features has already been provided in the AoS framework and they are as follows, in order of importance:
- International and European Sites – Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar Sites²;
 - National Sites – National Nature Reserves (NNR), Sites of Special Scientific Interest (SSSI); and
 - Regional Sites – Local Nature Reserves (LNR), Ancient Woodland and habitats of principal importance (HPI).
- 2.3.2. There are also a number of non-statutory, locally listed designations, information on which is held by a number of sources, notably the Wildlife Trusts and local data sources. The occurrence of particular species is not known at this stage, other than where they are mentioned within citations for protected sites. Surveys of protected species and consideration of locally designated sites will be addressed in due course as part of the EIA.
- 2.3.3. Habitat designations may overlap for the following reasons:
- Transposing European designated sites into UK law (SPA, SAC, Ramsar)
 - SSSI sites partly designated for Ancient Woodland;
 - Large SSSIs containing smaller HPIs or Ancient Woodland;
 - HPI areas may be attributed to more than one habitat type, when crossed by the route loss from all the habitats present is recorded.
 - Sites designated as Ancient Woodland that are also designated as HPI woodland
- 2.3.4. Where statutory sites contain HPIs or where two or more HPIs are present at the same location, habitat loss has been recorded in each case. As a result actual habitat loss will be less than total sum of loss. Ancient Woodland has been subtracted from the overall HPI woodland area loss, avoiding double counting of woodland loss.

2.4. Landscape strategies

- 2.4.1. A number of strategic landscape management tools that integrate ecological matters with wider landscape were considered. For example, Natural Area (NA) Profiles, National Character Areas (NCA) and Living Landscape Strategies (LLS). NA profiles were devised by the former English Nature as a tool for nature conservation planning at the landscape level. They reflect the distribution of wildlife and natural features, underpinned by geology and land use patterns. NCAs are currently being updated, as such the AoS has used NA Profiles to convey the potential strategic ecological impacts of the proposed scheme.
- 2.4.2. At the EIA stage a package of mitigation and enhancement measures will be considered (in consultation with Natural England (NE) and other wildlife organisations) to address the impacts on habitats and species. These measures would seek to address both the direct

² The earlier stages of the AoS also considered effects on biosphere reserves, national geoparks, Biogenetic reserves, EU diploma sites and Sites of Community Importance SCI. None of these types of designated feature are present within 10km of the Manchester leg and a single EU diploma site that would be unaffected by the proposed scheme lies within 10km of the Leeds leg.

¹ WFD, European Commission, 2000.

impacts on designated sites, and to reflect the wider strategic ecological priorities of affected areas (be these NAs, or the updated NCAs, LLS or similar). Profiles for these areas contain a series of ecological objectives or opportunities to, for example, reinforce fragmented woodlands, re-establish hedgerows, or restore, create and manage grazing marsh. These objectives will help to shape both mitigation strategies and to support, where appropriate, any wider programmes of enhancement or compensation (such as LLS or Community Forests). They may also be coupled with initiatives on ecosystem services, which could be introduced in the future.

2.5. Watercourses and hedgerows

- 2.5.1. Effects on watercourses were determined with reference to their EU Water Framework Directive (WFD) ecological status. Member States must aim to achieve 'good' chemical and ecological status in inland and coastal waters by 2015 subject to certain limited exceptions. Amongst other factors, it is designed to ensure the enhancement of status and to prevent further deterioration of aquatic ecosystems and associated wetlands, which depend upon these aquatic ecosystems, and to reduce all water pollution.
- 2.5.2. The density and integrity of hedgerows were assessed using aerial photographs to provide a broad indication of relative quality.

2.6. Geographical scope

- 2.6.1. The appraisal assessed the potential impacts of the proposed scheme on designated sites at varying distances, as follows:
 - within 10km international sites;
 - within, 2km for national sites; and
 - Intersection by the proposed route for sites of regional importance, including Ancient Woodland, HPis, LNR, Wildlife Trust sites, the local hedgerow network and watercourses).

2.7. Evaluation criteria

- 2.7.1. The criteria for assessing effects on the sites and habitats described in Paragraph 2.3.1 above reflect the preliminary nature of the appraisal, and its purpose in guiding route selection rather than providing a detailed impact assessment. They were applied at the AoS stage to evaluate the magnitude of effects of specific receptors in a given route section and have not been used to evaluate route-wide effects, which are described in this report.
 - Major adverse effects are those that are a high priority (nationally or internationally significant) and of high magnitude, such as those which potentially permanently affect the integrity of a Natura 2000 site or a Ramsar site, and/or the special interest features of NNRs and SSSIs;
 - Moderate adverse effects are those, which potentially affect sites of national importance, that can be mitigated through scheme design and/or which are not likely to affect integrity. They also include loss from sites of regional importance considered to be of sufficient extent to undermine the regional resource (as defined within the relevant NA Profiles. Where significant works such as diversions are potentially required to rivers of moderate or good WFD status, effects were assessed as 'moderate adverse'. Large scale works at more than two locations on rivers of low WFD status were also classed as 'moderate adverse';
 - Minor adverse effects are those, which potentially affect limited areas, permanently or temporarily, of sites of regional importance consisting of habitats that are widespread in

the region. The significance of effects on hedgerows was generally assessed as ‘minor’ where well-connected hedgerow network was fragmented and occasionally ‘moderate’ where the hedgerow network provided linkages with Ancient Woodland or other HPI habitats. Minor effects were also recorded where hedges remained in an otherwise intensively arable landscape, and where removal would further compromise an already limited ecological resource; and

- Negligible effects are those which potentially affect such small and isolated areas of habitat either permanently or temporarily, that they are unlikely to be significant at the regional level. All river crossings, which may require limited vegetation clearance around viaduct piers, but no impact on the channel was assessed as negligible adverse impact due to the limited effect of shading on marginal vegetation.

2.8. Reporting potential impacts

- 2.8.1. A precautionary approach has been adopted for sites of national value and below (which haven’t undergone previous assessment through the HRA). For example, the potential effects on qualifying or special interest features of SSSI’s have generally been considered likely to affect integrity, as there is insufficient information for a more detailed appraisal at this time.
- 2.8.2. In addition to the potential direct effects of habitat loss, and killing and injury of species, the following have been assessed for potential effects on ecological features:
- Loss of supporting habitat;
 - Fragmentation of habitats;
 - Water-borne pollution;
 - Changes to ground and surface water flows;
 - Disturbance of species; and
 - Shading.

2.9. Data sources

- 2.9.1. The GIS Digital Boundary Datasets held by Natural England are available for downloading via the internet. These cover all the principal statutory terrestrial nature conservation designations in the UK as well as some relevant non-statutory data such as Ancient Woodland, NAs, Nature Improvement Areas (NIA) and some HPIs. This data was downloaded from NEs website in March 2013. This information was exported into GIS where it could be overlaid onto aerial photographs of the entire scheme.
- 2.9.2. Information on statutory and non-statutory nature conservation sites and key objectives on relevant landscape strategies was obtained from the following sources, most being accessed between February and April 2013.
- Information on the recently updated National Character Areas for Needwood and South Derbyshire Claylands (NCA 68) was obtained from Natural England website at: <http://publications.naturalengland.org.uk/publication/4492587?category=587130>
 - GIS digital boundary datasets downloaded from Natural England website at: http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp
 - Joint Nature Conservation Committee or information on European sites including candidate sites from: <http://www.jncc.gov.uk>;
 - Citations for NNRs and SSSIs was obtained from Nature on the Map hosted by the Natural England website at: <http://www.natureonthemap.org.uk>;

- Citations for LNRs was obtained from the Natural England website: <http://www.english-nature.org.uk/Special/Inr/office.htm> and from local authority websites;
- Information about NAs was obtained from the Natural England website at: <http://www.english-nature.org.uk/Science/natural/role.htm>;
- Information about National Character Areas obtained from the Natural England website at: <http://www.naturalengland.org.uk/publications/nca/default.aspx>;
- Information about the North East Derbyshire Woodland Project was obtained from the North East Derbyshire Council website at: <http://www.ne-derbyslocplan.net/chapter2.html>;
- Information about Chat Moss was obtained from Lancashire Wildlife Trust website at: <http://www.lancswt.org.uk/Our-Work/conservation/mosslands/save-chat-moss>;
- Information about the coalfield landscape character in Nottinghamshire was obtained from Nottinghamshire Council website at: <http://cms.nottinghamshire.gov.uk/home/environment/landimprovements/landscapecharacter/countrysideappraisal/countrysideappraisal-chapterthree.htm>;
- Information about Natural England's National Character Areas was obtained from <http://publications.naturalengland.org.uk/publication/category/587130>;
- Information about the Humber Green Infrastructure Project was obtained from the Natural England website at: http://www.naturalengland.org.uk/regions/yorkshire_and_the_humber/ourwork/yandhgrreeninfrastructurereproject.aspx;
- Information about England's Community Forests was obtained from <http://www.communityforest.org.uk/map>;
- Information about the Red Rose Community Forest was obtained from <http://www.redroseforest.co.uk/web/content/view/37/178/>;
- Information about the White Rose Community Forest was obtained from <http://www.whiteroseforest.org.uk/Explore-The-WRF.aspx>;
- Information about the South Yorkshire Community Forest was obtained from <http://www.syforest.co.uk>;
- Information about the Wildlife Trusts' Nature Reserves (partial coverage only) was obtained from <http://www.wildlifetrusts.org/>;
- Information about other designated sites was obtained from MAGIC at <http://magic.defra.gov.uk/>; and
- Information about England's Nature Improvement Areas (NIAs) was obtained from <http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/funding/nia/projects/default.aspx>.

2.9.3. Hydrology information and engineering options for watercourse crossings was obtained from Water Environment Ltd and included:

- Reference to potentially necessary river diversions, embankment, and culvert design, alterations to viaduct design etc;
- WFD status of watercourses crossed; and
- Potential for river enhancement through requirements of WFD and proposed works.

2.10. Limitations

- 2.10.1. National Character Areas (NCA) are currently being updated by Natural England to include fuller information on Ecosystem services and biodiversity (including inventories for all HPIs), within a use-friendly format. These are expected to be available online in April 2014. Currently, information is only available for the Needwood and South Derbyshire Claylands NA/JCA only.
- 2.10.2. Data on other features of ecological value including ponds and hedgerows was not available. As a result these features were assessed primarily from information provided in the NA Profiles, and from aerial photographs.
- 2.10.3. Potential indirect effects such as changes in ground water flows, population fragmentation, or the off-site effects of pollution could not be judged accurately based on the information provided. Rather, these impacts have been addressed in terms of the risk of an effect.
- 2.10.4. The appraisal of the proposed route is based solely on available information on scheme design provided by plan and profiles as well as information on potential effects on hydrology at statutory sites (The Water Environment, 2012 and 2013) and a Habitats Regulations Assessment Screening Report (ERM, 2012).
- 2.10.5. Areas of habitat loss had been derived from the preliminary likely extent of earthworks and therefore represent the loss occurring at construction. The final extent of permanent habitat loss is not known at this stage. Temporary landtake for construction would increase the overall scheme footprint and have long term impacts in terms of habitat loss. Habitat re-instatement would be undertaken as part of later mitigation proposals.
- 2.10.6. The appraisal is likely to change as further information on the ecology baseline and scheme design, particularly temporary land take is available (during the EIA).

3. FINDINGS – WESTERN LEG

3.1. Sites of European importance

- 3.1.1. A parallel HRA screening exercise identified the potential for significant effects at four sites of European importance, namely:
- Pasturefields Salt Marsh Special Area of Conservation;
 - Midland Meres and Mosses Phase 1 Ramsar site
 - Rostherne Mere Ramsar site; and
 - Manchester Mosses Special Area of Conservation.
- 3.1.2. The screening exercise is reported separately, but their conclusions are repeated below. In each case, given the alignment adopted and the impact avoidance measures to be used, no likely significant effects would occur at any of the sites.
- **Pasturefields Salt Marsh SAC.** The scheme would have no likely significant effect on the site as it is to the south and downstream of Pasturefields Salt Marsh SAC, outside of the surface water catchment of the River Trent at Pasturefields (and therefore the Pasturefields Salt Marsh SAC). It is also downstream of the groundwater catchment of the SAC. Appropriate Assessment would therefore not be required for the proposed route as described.
 - **Midland Meres and Mosses Ramsar site (The Mere, Mere SSSI).** Based on available information, and incorporating avoidance measures such as a groundwater underpass [as agreed with the Environment Agency (EA) and presented in the

screening report], it is considered that any impacts on the groundwater regime would be avoided. After the principle of these avoidance measures has been implemented by design, the impacts on the groundwater regime (and therefore the water levels and water quality in The Mere, Mere SSSI) would be insignificant and there would be no likely significant effect to the Midland Meres and Mosses Ramsar site. The overall conclusion is that with the appropriate avoidance measures in place and agreed with NE and the EA, there would be no likely significant effect to the Ramsar site and an Appropriate Assessment is not required.

- **Rostherne Mere Ramsar site.** Based on the available information, there are engineered solutions which would ensure that impacts on the groundwater regime are avoided. The principles of these measures have been assessed [in the screening report], having first discussed them with the EA who have confirmed that they would be effective in preventing potential impacts to the Ramsar site. On this basis, the impacts on the groundwater regime (and therefore the water levels and water quality in Rostherne Mere) would be insignificant and no likely significant effect to the Ramsar site would occur. The overall conclusion is that, with inclusion of the design-led avoidance measures as described here, should they prove necessary, an Appropriate Assessment is not required.
- **Manchester Mosses SAC (Holcroft Moss SSSI).** Based on the conceptual models developed for Holcroft Moss SSSI, the only hydrology impacts that could occur would be either as a result of increased drainage of the surrounding area, or as a result of piling works or surface loading affecting the permeability of the peat mass or providing vertical pathways to more permeable geological strata surrounding the sites. Assuming the adoption of suitable foundation piles, track construction techniques and a design which does not increase the drainage in the area surrounding the SAC, it would be possible to ensure that the surface water and groundwater levels were not affected and therefore there would be no likely significant effect on the SAC. It would be possible to avoid any significant impact on the groundwater or the surface water regime, through the use of a viaduct structure along the western boundary of the site. Provided the appropriate avoidance measures [set out in the screening report] are implemented, there would be no likely significant effect to Holcroft Moss as a result of either construction or operation of any of the extant scheme proposals. Appropriate Assessment is therefore not required.

3.2. Sites of National importance:

- 3.2.1. The constituent SSSIs of the Natura 2000 sites that are within 2 km of the route, would be at risk from similar effects and subject to the same avoidance through design to that described for the relevant SAC or Ramsar Sites above.
- 3.2.2. The reasons for designation of the constituent SSSIs can include additional features to those for the relevant SAC/Ramsar site. As well as its importance as an example of wetland habitat Rostherne Mere SSSI and NNR is designated for wetland birds. The proposed route (HSM28A Winterbottom to Rostherne and HSM30 Rostherne to Warburton) is close to the site and there is some potential for disturbance during construction but this likely to be minor, limited by intervening agricultural land and woodland. The proposed route is in cutting and therefore unlikely to have any such effects during operation.
- 3.2.3. The proposed route and Golborne depot (HSM22 Lowton to Bamfurlong) comes within close proximity (minimum distance of 98m) of Abram Flashes SSSI. There is potential for changes in ground and surface water availability, disturbance of birds (mainly during construction), and air and waterborne pollution both during construction and operation of the Rolling Stock Maintenance Depot. It is likely that all effects could be partially avoided through design and implementation of the Code of Construction Practice, as well as

sensitive planting to buffer the SSSI. Therefore, adverse effects are unlikely exceed moderate.

- 3.2.4. The proposed route (HSM10 Hough to Pickmere) would be within 2 km of Sandbach Flashes, Wimboldsley Wood, Plumley Lime Beds and Tabley Mere SSSIs. There is potential for affecting surface water flows to all sites, but the magnitude of effects is likely to be negligible as the proposed route affects a small proportion of the catchment or is situated downstream of the sites. Any effects could be mitigated through scheme design.

3.3. Sites of Regional importance:

3.3.1. The proposed route directly affects a number of sites as follows:

- Five Ancient Woodland sites would be directly affected, with notable effects on Whitmore Wood, Leonards & Smokers Wood and Winnington Wood (HSM06 Swynnerton to Madeley), Coroners Wood (HSM21 Warburton to Lowton), Hancock's Bank (HSM28A, Winterbottom to Rostherne).
- Eight HPI woodland sites would be affected. These tend to have limited habitat loss owing to their small size and peripheral nature of the impact.
- A site designated as HPI lowland meadow and purple moor grass rush pasture would be directly affected and would be a moderate adverse impact (HSM03 Streethay to Swynnerton).
- Seven coastal floodplain and grazing marsh HPIs located at two locations (within HSM03 Streethay to Swynnerton and one in HSM06 Swynnerton to Madeley) are crossed on viaduct with minor-negligible impact.

3.4. Natural Area Profiles

- 3.4.1. The cumulative impact from the loss of woodland (Ancient Woodland and HPI woodland) within the Meres & Mosses NA is a moderate adverse impact primarily due to substantial loss of habitat at Whitmore Wood (HSM06). The combined loss of HPI lowland meadow, purple moor grass rush pasture, coastal floodplain grazing marsh in the Needwood and south Derbyshire Claylands is a moderate adverse impact as these habitats are of limited distribution but are characteristic of pastoral agriculture that defines the NA.

3.5. Other sites and features

- 3.5.1. One Wildlife Trust site namely Sean Hawkins Meadow could be directly affected by the proposed route, but its precise location and extent is uncertain.
- 3.5.2. Along the proposed route, the network of hedgerows are generally weak due to the intensive nature of the land use. Hedgerow trees are generally few except in localised areas, in association with small fields. Field ponds are numerous throughout, except where arable cultivation dominates, where they become more scarce. The impact on these features is generally minor adverse.
- 3.5.3. A number of watercourses are crossed along the proposed route. Impacts are generally negligible, due to the proposed route crossing on viaduct, with permanent habitat loss limited to localised areas around the viaduct piers and shading. However, if alternative engineering options, such as diversions or culverting are required then impacts could be minor adverse on water-bodies with a moderate-high ecological quality/ potential.
- 3.5.4. No LNR's are affected by the proposed route.

4. FINDINGS – EASTERN LEG

4.1. Sites of European importance

- 4.1.1. An HRA screening exercise identified the potential for effects at one site of European importance, namely the River Mease Special Area of Conservation.
- 4.1.2. The screening exercise is reported separately, but conclusions are repeated below. Given the alignment adopted and the avoidance measures to be used in the design of the crossing a draft Appropriate Assessment has shown that there would be no adverse effect on the SAC. Further Appropriate Assessment would be carried out on the finalised design.
- **River Mease SAC (Screening Report).** The findings of the screening assessment show that a number of elements of the construction and operation of the proposed scheme could affect the River Mease SAC. However, the implementation of best practice guidance and other control and avoidance measures would be likely to prevent any significant effect on the SAC through direct physical impacts, disturbance, pollution or disruption to surface or groundwater flows. However, having reviewed the requirements of Article 61(1) of the 2010 Habitats Regulations, it has not been possible, in the absence of a confirmed design or the description of more detailed impact avoidance measures, to conclude no likely significant effect with respect to shading. As a result an Appropriate Assessment was undertaken to determine potential impacts from shading.
 - **River Mease SAC (draft Appropriate Assessment report).** The proposed bridge crossing of the River Mease will not result in the dense shading that has prevented growth of *Ranunculus* communities beneath some of the existing bridges over the River Mease. The findings of this assessment indicate that a bridge can be built across the River Mease that will not result in adverse effects on the integrity of the SAC. The AA will be finalised in parallel with the EIA on the basis of the preferred design and on-going consultation with NE and EA will be maintained.

4.2. Sites of National importance:

- 4.2.1. The River Mease SSSI is designated for similar reasons to the River Mease SAC, i.e. as a clean, diverse, unmodified river with varied aquatic vegetation and a diverse fish assemblage, of which populations of bullhead and spined loach are nationally significant. Populations of white-clawed crayfish and otter are further reasons for designation. As such, the effects on the SSSI from the proposed crossing would be negligible, as they are for the SAC.
- 4.2.2. Bogs Farm Quarry SSSI would be crossed by the proposed route on viaduct. The site is designated for species rich grassland and the botanical interest of base-rich seepages and pools on the quarry sides and floor, as well as for diverse streamside woodland. It is assumed that the placing of viaduct piers in the SSSI would be avoided in further iterations of design and thus direct habitat loss is unlikely. The wetland flora and streamside woodland would be vulnerable to changes in groundwater flows but it should be possible to present a design to ensure hydrological impacts are minimised. Grassland and wetland habitats may be adversely affected by shading, but the route would cross the narrowest and largely wooded part of the site and is distant from open grassland in the east. Overall effects on the site are likely to be major adverse, but at least partly mitigable through design and therefore unlikely to exceed moderate, but this to be confirmed by detailed design. Effects could be compensated by restoring wet grassland following construction, and the creation of wet grassland and lowland meadows on any land in an adjacent inactive quarry that is unviable following construction.

- 4.2.3. A number of SSSIs that are not crossed by the proposed route may require mitigation to avoid adverse effects.
- 4.2.4. Alvecote Pools SSSI (HSL06 Birchmoor to Tonge) would be at potential risk from disturbance during construction, and water born pollution during construction and operation. There would also be a limited loss of supporting habitat and increased risk of bird strike. The potential for disturbance and bird strike are both limited by the M42 which is situated on embankment and viaduct between the site and route. Overall, effects on the site are likely to minor.
- 4.2.5. Lount Meadows SSSI (HSL13 Trowell to Killamarsh) Units 2 and 4 would be at potential risk from changes in hydrology due to contributing surface-water catchment to these sites. The embankment would need to be designed in order to allow the free-passage of surface-water beneath the proposed route in order to avoid isolating any of the contributing surface-water catchment to these parts of the site. Effects on the site are likely to major adverse but mitigable through detailed design.
- 4.2.6. There is limited potential for disturbance of birds a Lockington Marshes SSSI (HSL09 Tonge to Long Eaton) during construction. The proposed route crosses a branch of the Hemington Brook that flows into the site, but there are no known diversions and effects on surface water flow are unlikely. The effects of disturbance are likely to be minor adverse at most.
- 4.2.7. There is potential for minor adverse effects at Sellers Wood SSSI (HSL13) from reduction in ground water flows due to the presence of cuttings upslope of the sites.
- 4.2.8. The proposed route close to Annesley Woodhouse Quarries SSSI (HSL13) may remove terrestrial habitat likely to be used by the site's population of great crested newt. Due to the limited extent of affected habitat any adverse effects are likely to be minor adverse. The risk of killing and injury during construction would be addressed by translocation in advance of works.
- 4.2.9. At Bulwell Wood careful design would be needed to avoid cutting off approximately 50% of the contributing surface-water catchment to the wood. As such it is likely that the major adverse effects can be mitigated.
- 4.2.10. At Robinettes SSSI (HSL13) surface water flows would need to be maintained, and measures to avoid waterborne pollution would be required. Assuming this can be achieved effects are likely to be negligible.
- 4.2.11. The proposed route would be close to Dorts Dyke upstream of Kirkby Wharfe SSSI (HSL17 Cold Hiendley to Church Fenton). Currently, no diversions or culverting of the Dorts Dyke are proposed, but it is possible a minor tributary may be affected, in which case it would be necessary to ensure that down stream flows and water quality in the SSSI are not impaired. It would also be necessary to control runoff and pollution during construction and operation.

4.3. Sites of Regional importance:

- 4.3.1. The proposed route directly affects a number of sites as follows:
- Nine Ancient Woodland sites, with notable impacts to New Farm Wood and Watnall Coppice (both within HSL13) and Smithy Wood, Hesley Wood and Wombwell Wood (all within HSL16 Blackburn to Cold Hiendley). Impacts on these woodlands would be a moderate adverse effect.
 - Twenty-eight HPI woodland sites. These are in addition to those which overlap with Ancient Woodland. Some of these sites are large and occur around Rennishaw, Hucknall (HSL13), Chapletown and Worsborough (HSL16) and would be a moderate adverse effect. Woodland also occurs in conjunction with wood pasture and parkland HPI at Strelley Hall (HSL13), Coleorton Park (HSL06) and Thrumpton Hall (HSL09);

and along watercourses (e.g. along the River Tame HSL01 Water Orton to Birchmoor and the River Aire, HSL17 (Cold Hiendley to Church Fenton). These areas are generally small, isolated with peripheral habitat loss and would be generally a minor-negligible adverse impact.

- Five coastal floodplain grazing marshes are directly affected, but are generally a minor-negligible impact due to their small size and limited habitat loss.
- Three fen HPAs are crossed with notable impacts on one small site at Long Eaton (HSL12 Long Eaton to Sandiacre), which would be entirely removed and is a moderate adverse impact.
- Wood pasture and parkland would be directly affected. Notable impacts occur around Strelley Hall (HSL13), where wood-pasture and parkland, lowland meadow and HPA woodland habitat are crossed in close proximity. These are a moderate adverse impact.
- One LNR Norbriggs Flash (HSL13), crossed by the proposed route on viaduct through the centre of the site with a loss 2.6% of the total site area. This is of moderate adverse impact.
- Two further LNRs would be crossed by the route Carlton Marsh, (HSL16), designated for its wetland habitats, would be crossed on viaduct with a loss at construction of 2.2% of the site. Nottingham Canal (HSL13) would be crossed on embankment and 5.6% of site would be lost. In both cases impacts would be limited and peripheral, and minor adverse.
- A third LNR, Toton Fields in Long Eaton (HSL27) has no direct habitat loss and is likely to have limited indirect impact.

4.4. Natural Area Profiles

- 4.4.1. Southern Magnesian Limestone NA (HSL13) and Coalfield NA (HSL16) are where most of the adverse impacts are located with particular focus around Chapletown, Worsborough (HSL16) and Hucknall (HSL13). The cumulative loss of Ancient Woodland and large areas of HPA woodland would be of regional importance and a major adverse impact.
- 4.4.2. Ancient and HPA woodlands are a key feature within the Coal Measures NA (part of HSL06, 17 and 13 and all of HSL12, 14 Killamarsh to Tinsley, 16, 21 Cold Hiendley to Woodlesford, 22 Woodlesford to Hunslet and 31 Hunslet to Neville Street) and their cumulative loss would be of regional importance and a major adverse impact.
- 4.4.3. Within the Southern Magnesian Limestone NA, there would be cumulative loss of lowland meadow HPA in a cut and cover tunnel at Strelley Hall (HSL13), and under a viaduct at Bog's Farm Quarry SSSI and east of Pinxton (HSL13). Species rich grassland is a key habitat within this NA and is highly fragmented and of very limited distribution and there would a moderate adverse impact.
- 4.4.4. Within the Coal Measures NA (HSL06) there is limited habitat loss of HPA wood-pasture and parkland near Ashby de la Zouch at Coleorton Hall. The impact would be minor adverse as only recently planted habitat (part of the National Forest) is affected.
- 4.4.5. Within the Trent Valley and Rises NA (HSL09) HPA wood-pasture and parkland located at Thrumpton Park, south of Long Eaton would be affected. This is a minor adverse impact due to the limited and peripheral loss, and the route does not appear to affect old trees in open habitat.

4.5. Other sites and features

- 4.5.1. Along the proposed route, the condition of the hedgerow network and related features including trees and ponds varies depending on the dominate land use. Where the route crosses the Midlands Plateau (part of HSL01), Trent Valley and Rises NA (part of HSL 01 and 06) and the Southern Magnesium Limestone NA (part of HSL 13 and 17) intensive arable cropping has a general weak hedgerow network and associated features. The impact on these features is of minor adverse effect.
- 4.5.2. Conversely, in the Coal Measures NA (northern part of HSL06, southern part of HSL17, northern part of HSL13 and all of HSL12, 14, 16, 21, 22 and 31) the hedgerow network is notably stronger in areas dominated by pastoral land use, with frequent trees and ponds. The cumulative impact from the loss of these features and the severing of connectivity over a large distance is of moderate adverse impact and of regional importance to this NA.
- 4.5.3. Potential effects on the smaller watercourses are generally negligible adverse based on the assumption that no in-channel works will be required. If alternative engineering options are taken forward on watercourses with a WFD status of moderate–good potential / quality then impacts could be minor adverse. However, there is potential for moderate adverse impact on five rivers comprising the River Rother (HSL16), River Doe Lea (HSL14,16), River Erewash (HSL12, HSL13), River Aire (HSL17, HSL21) and the River Calder (HSL17, HSL21) due to the cumulative impact of multiple crossing points and the potential for in-channel works including diversions.