A design guide for HS2

Part 1 - Design Principles

First draft
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Prepared by LUC for the Trent-Sow Parklands and Cannock Chase AONB HS2 Group

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Contents




1 Introduction

1.1 Background

High Speed 2 (HS2) Phase 2a (West Midlands to Crewe), passes through and close to a notable collection of nationally and locally important landscapes in Staffordshire. These include the washlands at the confluence of the rivers Trent and Sow; the historic designed landscapes of Shugborough, Ingestre and Tixall; 18th and 19th century transport infrastructure; the Conservation Areas of The Trent & Mersey Canal, Staffordshire & Worcestershire Canal, Ingestre, Tixall, Great Haywood and Shugborough and Colwich and Little Haywood; together with numerous listed buildings and environmental designations. Part of this landscape is within or in its setting of the Cannock Chase Area of Outstanding Natural Beauty (AONB).

1.2 Scope and Purpose

The integration of HS2 within this special landscape requires careful consideration through design to mitigate the scheme and its effects. A high standard of design is required, especially for substantial structures such as the Great Haywood Viaduct, and mitigation measures which seek the sympathetic integration of the railway within the wider historic landscape.

The overall aim of this commission is to develop a Trent-Sow Parklands and Cannock Chase AONB Design and Environmental Enhancement Plan comprising the following elements:

- Stage 1: Design Principles - both general and detailed principles, for works across the project area.
- Stage 2: Environmental Enhancement Plan - for enhancement projects located outside the Act Limits.

The purpose of the Design and Environmental Enhancement Plan is to inform the design of key railway infrastructure and landscape works and help the Group identify environmental enhancement measures that can be implemented as part of the construction and subsequent operation of HS2, integrating the railway in this special landscape.

Whilst the Plan will be delivered in two separate reports, it will be developed in a holistic manner, with the Enhancement Projects building on the Design Principles established in the first stage, reflecting the deep understanding of the project area.

Review Group

During the passage of the HS2 Phase 2a Act through Parliament it was agreed that a partnership group would be established, the Trent-Sow Parklands and Cannock Chase AONB HS2 Group, 'the Review Group'.

The purpose of the Review Group in relation to the Design and Environmental Enhancement Plan is twofold. Firstly, the Review Group work together to agree a set of general and detailed design principles that could be used as guidance by HS2 and their Contractors to inform the detailed design of the route through the locally important and nationally designated status and environmentally sensitive landscapes. This creates an opportunity to influence the design of the scheme to ensure a locally responsive, high quality design that reflects these important landscapes. The terms of reference of the Review Group recognise that the design principles must be:

- developed from the 'Phase 2a Great Haywood Illustrative Design Plan' which illustrates the current design response;
- developed not to impact on the timely economic and safe delivery or operation of the railway;
- consistent with HS2 Environmental Minimum Requirements; and
- relevant to the grounds on which the relevant planning authority would be entitled to refuse approval under Schedule 17 to the Act.

Secondly, the Review Group decide how a budget of £1.5m will be spent on enhancement projects that would be over and above the mitigation measures provided as part of HS2 outside of the (Act area).

In undertaking this task LUC, working on behalf of the Review Group, has identified natural overlap between design principles and enhancement projects. This is a product of good design and an iterative design approach that seeks to achieve maximum value from the funds available. It is recognised and accepted that any proposals outside of the powers of the Act would need to be considered for consent separately by the relevant authorities, secure separate landowner agreements and potentially form part of the enhancements projects, to be funded by the £1.5m budget.

Project Area

The project area (see Figure 1.1 opposite) has been developed in collaboration with the Review Group to provide a focus for both the design principles and the enhancements projects.

This area covers just over 3,500ha, extending approximately 3.0km north and south from the HS2 centre line in order to cover issues that might affect the important landscapes surrounding the route.

The Detailed Design Principles focus on the direct above ground impacts resulting from 7.2km of HS2 between Trent Walk Underbridge (ch.209+814) in the west to Colwich Bridleway 23 Accommodation Green Overbridge (ch.202+600) in the east of the project area.

Audience

This Guide is aimed at HS2's contractors and their design teams who will be producing proposals for submission to HS2 and the relevant local planning authorities. It is equally aimed at those who will be reviewing these proposals with regard to Schedule 17. In both cases it assumes a reasonable degree of skill and knowledge in both relevant professions and of the environmental context of the proposals.

The use of checklists and direct referencing of the Design Principles aims to facilitate this process. So too does the document structure by providing high level information in the initial section detailed guidance on different functional elements under the 'Elements' section, before illustrating how both can be brought together in the last section of sketch designs for the complete above ground alignment within the project area.

Within Act Limits

Act Limits have been taken from the 2019 HS2 documents. These include land temporarily required for construction purposes. In common with our understanding of the approach to date our proposals assume that land used for construction is returned to agriculture on completion of the scheme. In some cases we suggest setting aside this process, and more commonly in others we suggest enhancement by means of making good or in the design of permanent features such as attenuation facilities.

Outside Act Limits and Enhancement Projects

This Design Guide forms one part of a commission that also includes the identification of Enhancement Projects. These Enhancement Projects will be funded separately from a £1.5m budget to be used for integration or enhancement works/ initiatives in the project area but outside of Act Limits. These are covered in The Environmental Enhancement Plan as a separate linked document.

1.3 Document structure

This Design Guide sets out the protection of important features and integration of the HS2 scheme into its surroundings, as well as enhancement to the project area and is intended to guide detailed design and delivery of the project vision for the area. This Guide therefore presents:

- An overview of the spatial context of the project area;
- The Vision;
- The General Design Principles;
- The Detailed Design Principles for each of the major elements of the HS2 scheme; and
- How the Detailed Design Principles could be applied to the alignment of HS2 in sketch form.

The final chapter of this Guide presents a sketch masterplan of the scheme to illustrate how the Detailed Design Principles could be manifest in the project area.

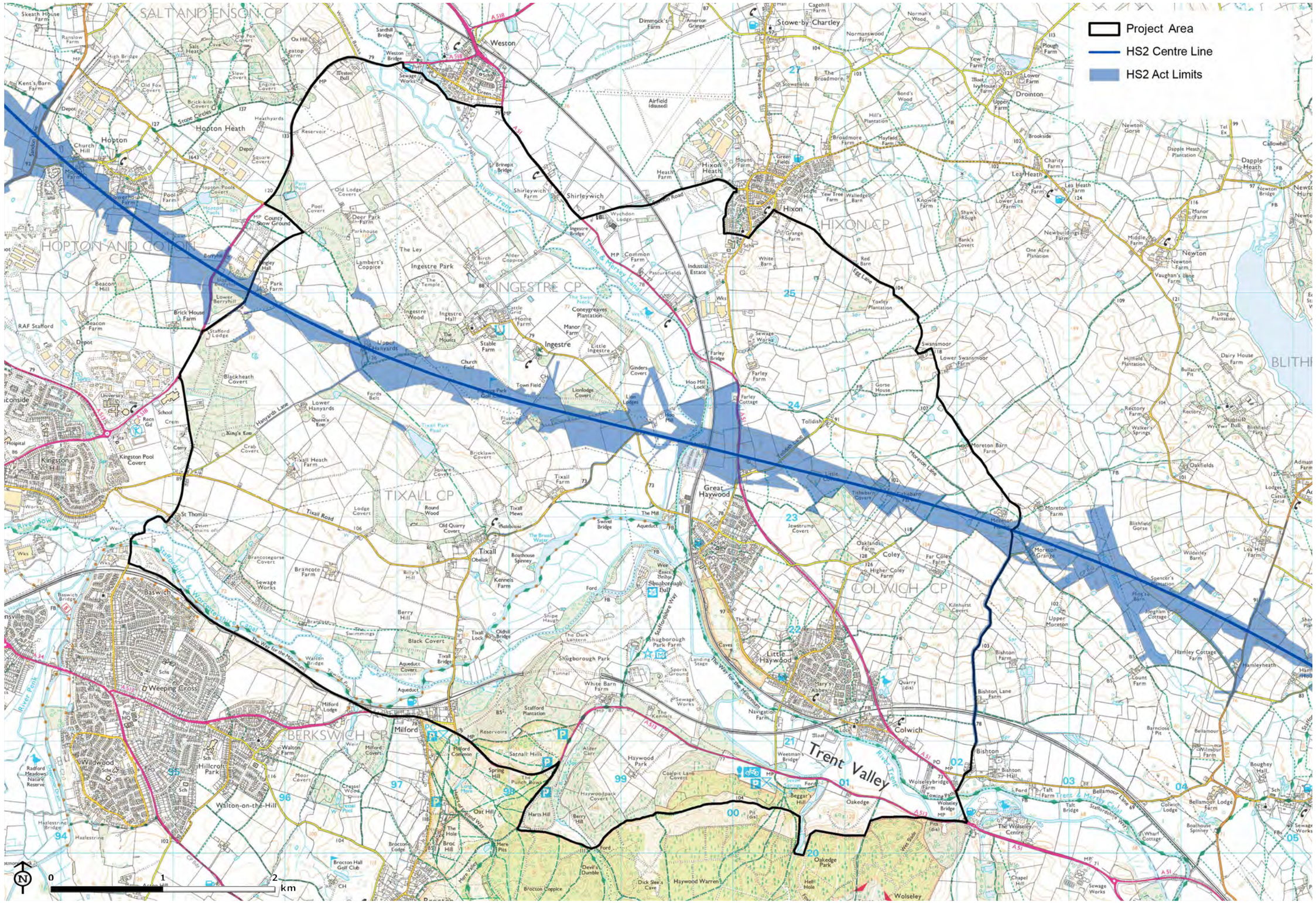

Figure 1.1 - Project Area

2 Context

Settled Estatelands LCA

Riparian Alluvial Lowlands LCA

Settled Farmlands LCA ©Cookson&Tickner

Sandstone Hills and Heaths LCA ©Cookson&Tickner

2.1 Purpose

The project area and its special character was a subject of considerable discussion by the Review Group. It was agreed that there are five basic groups of characteristics which contribute to this character; and that an understanding of these characteristics is central to achieving integration of the railway into this landscape. This chapter briefly describes the baseline condition of each of the five groups of characteristics:

- Landscape;
- Historic Environment;
- Ecology and Hydrology;
- Access, Enjoyment and Connectivity; and
- Communities.

Their description is not intended to be exhaustive and it is assumed that designers will inform themselves further by reference to relevant documents, some of which are noted below. We would also recommend a thorough site survey and analysis of the project area and its setting by walking (or cycling).

These groups of characteristics lie at the heart of this document informing directly the General Design Principles (GDPs) set out in Chapter 4 each of which relates directly to these groups, and Chapter 5 Detailed Design Principles (DDPs) reference each group where relevant.

2.2 Landscape

The Design Principles have been developed to respond to landscape character. The project area lies within four Landscape Character Areas (LCAs) which are shown on Figure 2.1, taken from the Staffordshire SPD, Planning for Landscape Change, Volume 3. Further information can be found in the Planning for Landscape Change document and February 2019 HS2 SES2 and AP2, Volume 5: Technical Appendices, CA2 (LV-001-002). A summary of key landscape characteristics of each LCA is provided below.

Settled Estatelands LCA

A gently rolling, open, lowland with acid sands and sandy brown soils over Triassic sandstones and sparse dispersed settlement often between straight roads. Vegetation comprising remnant silver birch woodlands, heathland and intact well-treed stream corridors, and degraded lost and fragmented hedgerows with trees.

Riparian Alluvial Lowlands LCA

Flat river valley with alluvial soils and occasional peat overlie alluvial drift and Triassic mudstones with pastoral floodplain farming, little settlement and small, narrow lanes resulting in a rural landscape of quiet, peaceful character. A large scale landscape with boundaries of fencing and hedges with trees. Views across the landscape are framed by woodland blocks and contained by surrounding well wooded valley slopes. Watercourses are well wooded.

Settled Farmlands LCA

Strongly rounded lowlands and hills with steeper slopes and narrow stream valleys draining the plateau with non-calcareous loamy brown soils overlying Triassic mudstones. An arable, varied irregular pattern of small to medium sized hedged fields and scatter of small woodlands (often ancient) contrasts with distinctive historic designed parklands with parkland trees and increased woodland cover.

Sandstone Hills and Heaths LCA

An undulating landscape with steep sided hills and dissected plateaus with acid sands and sandy brown soils over Triassic sandstones, and dispersed settlement linked by sunken and winding lanes. Large regular fields in lower, flatter areas allowing expansive views across and small fields on the steep valley sides bound by hedgerows with mature oak trees. Broadleaf woodlands (often ancient), copses and heathland typically lie in clusters and along ridgetops.

Cannock Chase AONB

The Cannock Chase Area of Outstanding Natural Beauty (AONB) is located in the south of the project area. Further information on the AONB can be found in the Cannock Chase AONB Management Plan 2019-2024 (Cannock Chase AONB, 2019). A summary of relevant Special Qualities of the AONB is provided below arranged in contributing factors that contribute to natural beauty.

Landscape Quality

- A largely intact landscape of heathland and wood pasture, providing a historical and spatial continuity of scale, openness, semi-natural land cover, public ownership and access.

Scenic Quality

- A scenic and varied landscape of heathland, woodland, wood pasture, parkland, mixed pastoral and arable farmland and traditional farmsteads.
- Domed plateau landform particularly influenced by the River Trent to the north.
- Inspiring views both to the elevated plateau of the Chase from surrounding areas and from the high ground of the Chase across the farmed vales.
- Relative wildness and tranquillity
- A haven of tranquillity and wildness providing popular spaces for informal recreation.

Relative wildness and tranquillity

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Natural Heritage Features

- Underlying red sandstone containing sand-cemented pebbles contributing to the economic prosperity of the area.
- Extensive areas of lowland heathland and associated habitats of EU importance.
- Rivers, wetlands and waterways including the Trent and Sow rivers and the Staffordshire and Worcestershire canal.
- Ancient broadleaved woodland and wood pastures, containing veteran oak trees, woodland flowers, birds, bats and insects.
- Wildlife that is nationally rare, protected and/ or strongly associated with the Chase.

Cultural Heritage

- A rich history, including historic houses and parkland, historic field patterns, the rich heritage of iron and glass working and coal mining, the Staffordshire and Worcestershire canal.
- Historic parkland, ornamental landscapes, and the relationships between them, often associated with fine houses and landed estates such as Shugborough.
- Common land which has an ancient history providing grazing for local farms and smallholdings.

Connectivity and Community

In addition to the typical contributing factors to natural beauty, there is deep public understanding and enjoyment of the Chase which makes it special. There is a strong network of local communities and interest groups who cherish and help care for the Chase and its designated status. There is a network of well-maintained rides and paths through woodland and heathland providing opportunities for stimulating exercise and exploration.

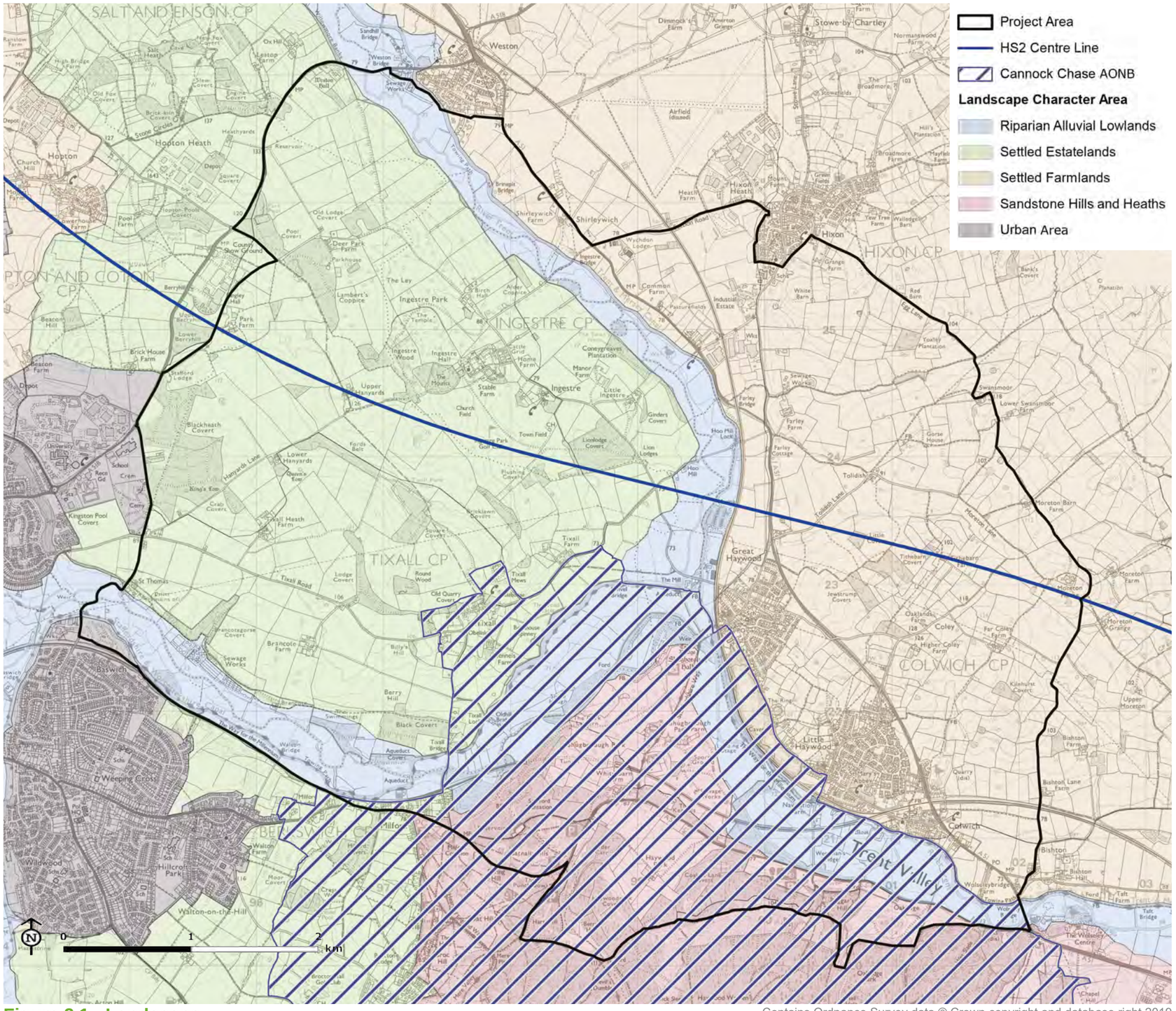


Figure 2.1 - Landscape

2.3 Historic Environment

The Design Principles have been developed in consideration of the rich historic environment within the project area. This section provides an overview of the key elements that should be referred to and considered in any design process. Figure 2.2 opposite illustrates the historic environment designations.

Assets on the National Heritage List

There are nine Grade I, ten Grade II* and 73 Grade II Listed Buildings within the project area, the majority of these are concentrated in the south east. There are four Scheduled Monuments in the south of the area associated with the Rivers Sow and Trent.

Shugborough Park located in the south of the study area is a Grade I Registered Park and Garden which was created mid to late C18th as a pleasure ground and landscape park with buildings in the Chinese and Greek Revival styles, associated with a country house. The formal garden layout by W.A. Nesfield dates from c1855.

Conservation Areas

There are six Conservation Areas (CAs) in the project area which are shown on Figure 3 adjacent. Full details of these CAs are contained in their respective Appraisals, which can be found on Stafford Borough Council's website: https://www.staffordbc.gov.uk/conservation-areas-list. Appraisals set out the key positive characteristics, protection and future management and therefore should be referred to, to inform any proposals. Summaries of the CAs Special Interest are provided below.

Colwich & Little Haywood CA: A relatively well-preserved street pattern, with ancient lanes and a greenway remaining with a collection of building types from the C13th Church of St Michael and All Angels, C16th and 17th cottages; C19th farms, railway architecture; and Victorian houses, reflecting strong time-depth and agricultural roots of the villages. The villages host a wealth of mature trees and historic boundaries of holly hedges, stone walls and contrasting orange brick walls. There are dramatic, unspoilt views of Cannock Chase.

Great Haywood & Shugborough CA: Great Haywood is a linear village comprising historic buildings and well preserved stone walls with a variety of building types and architectural styles including a wealth of surviving classical features, lending elegance to the village. There is a strong connection between the village and Shugborough estate, as a result of the estate cottages and preserved historic routes into Shugborough. There are countryside views from the Trent and Mersey canal towpath.

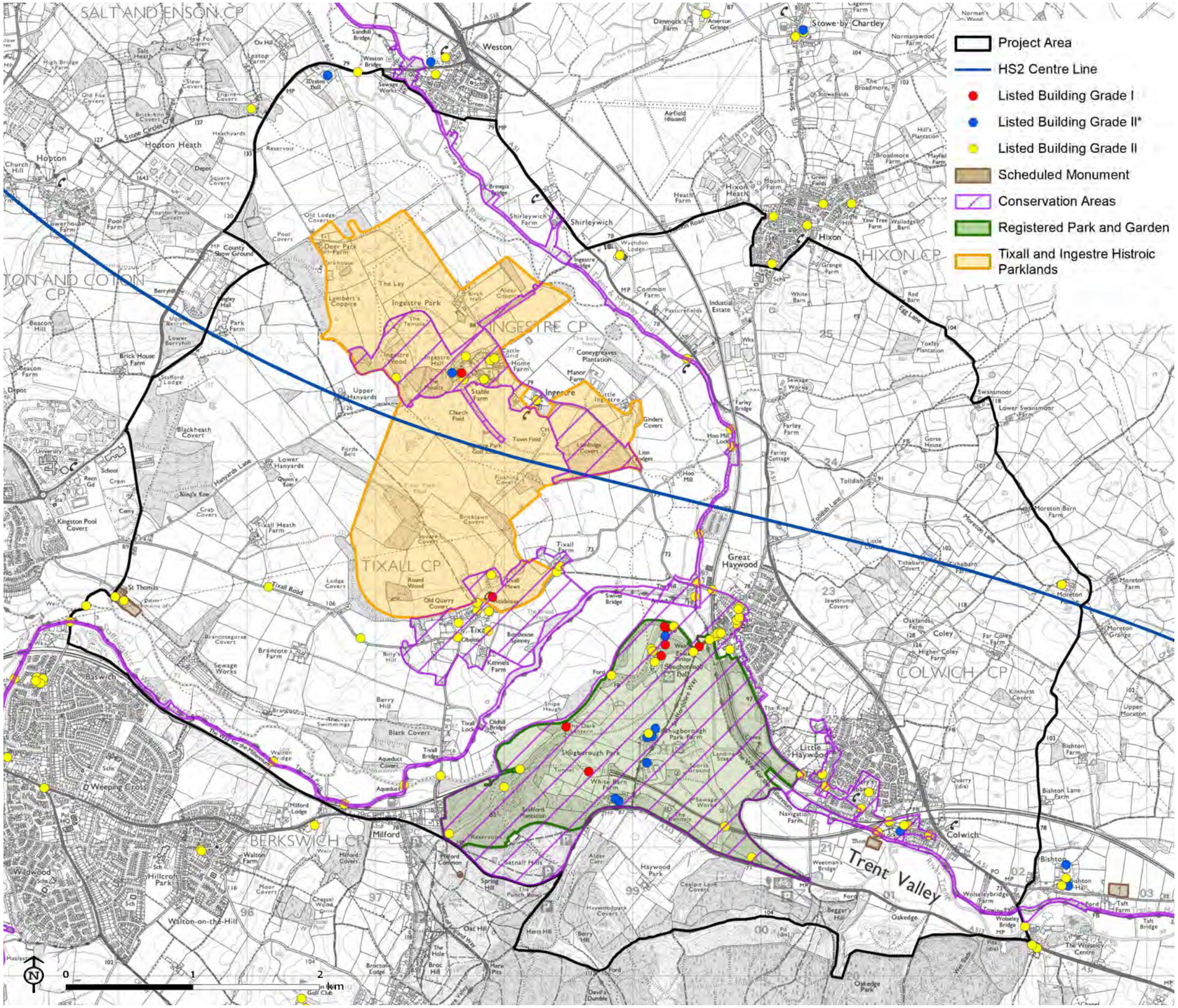


Figure 2.2 - Historic environment

View along the Staffordshire and Worcestershire Canal with historic buildings associated with the canal

View across Tixall Broad on the Staffordshire and Worcestershire Canal with waterside trees, looking towards Tixall model farm

Haywood Bridge Scheduled Monument, with surviving historic materials to the bridge and surfaces

Shugborough - a breath-taking parkland with an overarching classical style and an abundance of mature trees, Grade I registered Shugborough Park and C17th Shugborough Hall, many Scheduled Monuments and structures listed at Grade I and II*, and striking landmark bridges, reflecting the development of the railways, the canal network and the historical relationship between village and estate. Two well-preserved Model Farms demonstrating development in agriculture during the C19th link. The River Trent, River Sow and Trent and Mersey Canal meandering through the parkland create a peaceful character and there are picturesque views and vistas of the surrounding parkland and pastures.

Ingestre CA: A complete country estate including Hall, Church, stables, historic gardens, estate cottages, walled garden and pavilion reflecting its built historic development from the early C17th to the early C20th, with little loss or alteration to buildings and plan form. Historic assets are of an exceptionally high quality, including the grade I St Mary's Church, the sole building by Sir Christopher Wren outside of London; Grade II* Ingestre Hall with phases of development by Nicholas Hawksmoor 1688, Nash 1808-1810, and John Birch 1882; a Grade II Orangery thought to be by Samuel and Joseph Wyatt; and the landscaped gardens including elements of a Capability Brown design and the Grade II listed Ingestre Pavilion. The natural and designed part of a national network of navigations following the natural contours of the landscape with hardly any embankments or cuttings. Retains a C18th narrow pound lock and lock keepers cottage at Tixall and numerous single-span brick road and accommodation bridges with stone and brick copings, ironwork features, sandstone steps and copings and historic surfaces, contemporary with the canal. Surviving mill and wharf at Great Haywood, reflecting the importance of the canal for industry.

The canal has a predominantly rural setting characterised by long reaching views out over rolling countryside, water meadows, and historic landscaped parkland. The canal forms a distinctive part of the setting of the historic buildings and landscape of the Tixall Conservation Area, and includes a section of Capability Brown designed 'landscaped' canal at Tixall Broad. Canal-side trees and hedgerows form boundaries to give an enclosed setting to the canal in parts. There are strong visual elements of industrial transportation heritage due to the close proximity of the railway and navigations of the River Sow.

Tixall CA: Long associated with the parkland and estate of the former Tixall Hall (demolished in the 1920s), between Ingestre Estate to the north and the Shugborough Estate to the south. The village remains unaffected by unsympathetic modern development and retains unspoiled character. There is a collection of listed buildings, monuments and structures reflecting the history of the Tixall Estate and village and the Grade I listed C16 Tudor gatehouse to the former C16th and later C18 Tixall Hall and purpose built C19 model farm survive as landmarks.

There is a strong visual harmony and estate identity created through the use of local vernacular building materials of Tixall Stone and Staffordshire red brick. The former designed parkland attributed to Capability Brown, provides breath taking views and vistas of open countryside and the Staffordshire and Worcestershire Canal. There are a series of long and short vistas along the winding country road through the village and significant areas of woodland define spaces and frame views.

Trent & Mersey Canal CA: An outstanding area of industrial archaeological importance, both nationally and locally. An early narrow canal completed in 1777 forming part of a national network of navigations following the natural contours of the landscape with hardly any embankments or cuttings with changes in level being negotiated by simple pound locks or series of locks. There is a wealth of surviving single-span brick road and accommodation bridges with stone copings, sandstone steps and copings, historic paving surfaces, and narrow pound locks with gates, beams, pounds, sluices, weirs and culverts, many original to the canal and listed, the bridge at Great Haywood a Scheduled Monument. There are Early C19th cast iron mileposts and other canal ironwork features such as bridge plates and strapping posts. There are groups of industrial buildings, wharfs and boatyards strategically located close to the canal, such as Sandon lime kiln and the mill and wharf at Great Haywood, reflecting the importance of the canal for industry. The canal has a predominantly rural setting with surviving trees, hedgerows and water meadows.

2.4 Ecology and Hydrology

The project area is a rich biodiverse landscape, closely interlinked with the hydrology of the area which is made up of natural watercourses; River Trent and Sow and associated tributaries, as well as man-made Staffordshire & Worcestershire Canal and Trent & Mersey Canal.

Cannock Chase and Milford Quarry Sites of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) lie on the southern edge of the project area, acting as an important link in the wider ecological network. There is an aim for the wider Cannock Chase area to address structural issues in the heathland and feasibility for wood which will address the unfavourable habitat conditions.

Rawbones Meadow SSSI is located in the southern part of the project area, immediately adjacent to the Broad Water on the Staffordshire and Worcestershire Canal. It comprises 20ha of neutral grassland on permanently moist alluvium and is special due to the presence of species-rich rush pasture. This plant community comprises wet grassland and swamp, which supports regionally significant numbers of breeding snipe.

Pasturefields Salt Marsh SSSI is a modified remnant of the former saltmarshes of the Trent Valley lying west of Little Ingestre and is one of only two known extant brine spring marshes in the country. It is an extremely rare and vulnerable habitat, and important for the understanding of plant ecology, distribution and vegetation history in the British Isles. There are complex hydrological relationships between saline and freshwater inputs, as well as nutrient status, which influence the ecological communities on the site.

Shugborough is a Site of Biological Importance (SBI) for its Parkland and Wood Pasture Habitat (a UK BAP Priority Habitat), containing a wealth of ancient and veteran trees which support nationally-important communities of deadwood invertebrates, in addition to a range of wetland and woodland habitats. The park also supports protected species such as otter, bird and bat species, and nationally-scarce grass-wrack pondweed.

There are five Ancient Woodlands (ancient and semi-natural) in the project area; Tithebarn Covert, Ingestre Wood, Town Field Plantation, Flushing Covert, and Brocton Coppice covering approximately 86 ha. Lambert's Coppice is 14 ha of ancient replanted woodland. There are numerous notable, ancient and veteran trees across the project area, the majority of which are concentrated in Shugborough Park.

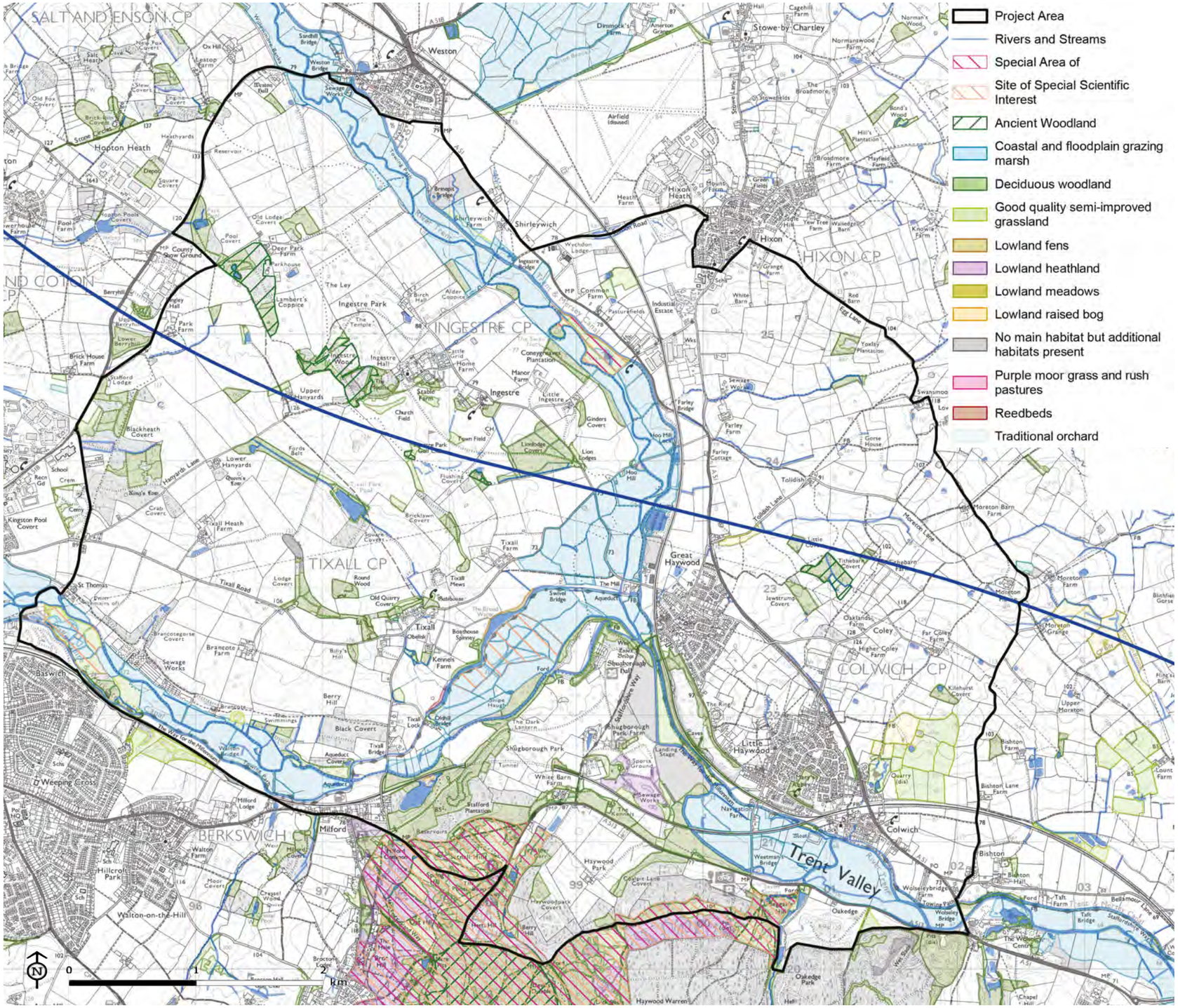


Figure 2.3 - Ecology and Hydrology

2.5 Access, Enjoyment and Connectivity

The eastern part of the project area benefits from a dense network of footpaths and occasional bridleways providing connectivity between settlements of Great Haywood and Little Haywood and enjoyment of the surrounding countryside and river valley. The western side of the project area, through the parishes of Tixall and Ingestre, has limited connectivity which is a result of the historic estate parklands.

The long distance Way for the Millennium (61 Km) runs along the Trent & Mersey and Staffordshire & Worcestershire Canals through the project area and spans the width of Staffordshire, passing through or close to Stafford, Colwich, Rugeley, Yoxall and Barton Under Needwood, providing connectivity to the wider area. Staffordshire Way is 152 Km long connecting Worcestershire and Cheshire, running through the project area across Shugborough Park and along the river Trent.

Shugborough Park is the largest park in the project area and connects to Cannock Chase Forest and Country Park which is Open Access Land to the south. There are a number of small incidental parks, recreation and play facilities are located within the larger settlements, often connected by footpaths.

2.6 Communities

The benefit of the project area is not limited purely to aesthetic qualities. Along with the wider environmental qualities the area delivers a wide range of natural capital value such as benefits to health and well-being, clean air and water to communities.

Everyone who uses, enjoys and experiences the area can play an active role in caring for it. Local communities have diverse social and recreational needs and there should be ways for everyone, including local businesses and voluntary bodies, to get involved and make a difference. Parties developing the design should give reasonable opportunity to engage with plan-making and planning application processes. Public consultation should be held take place and interested parties invited to comment on proposals.

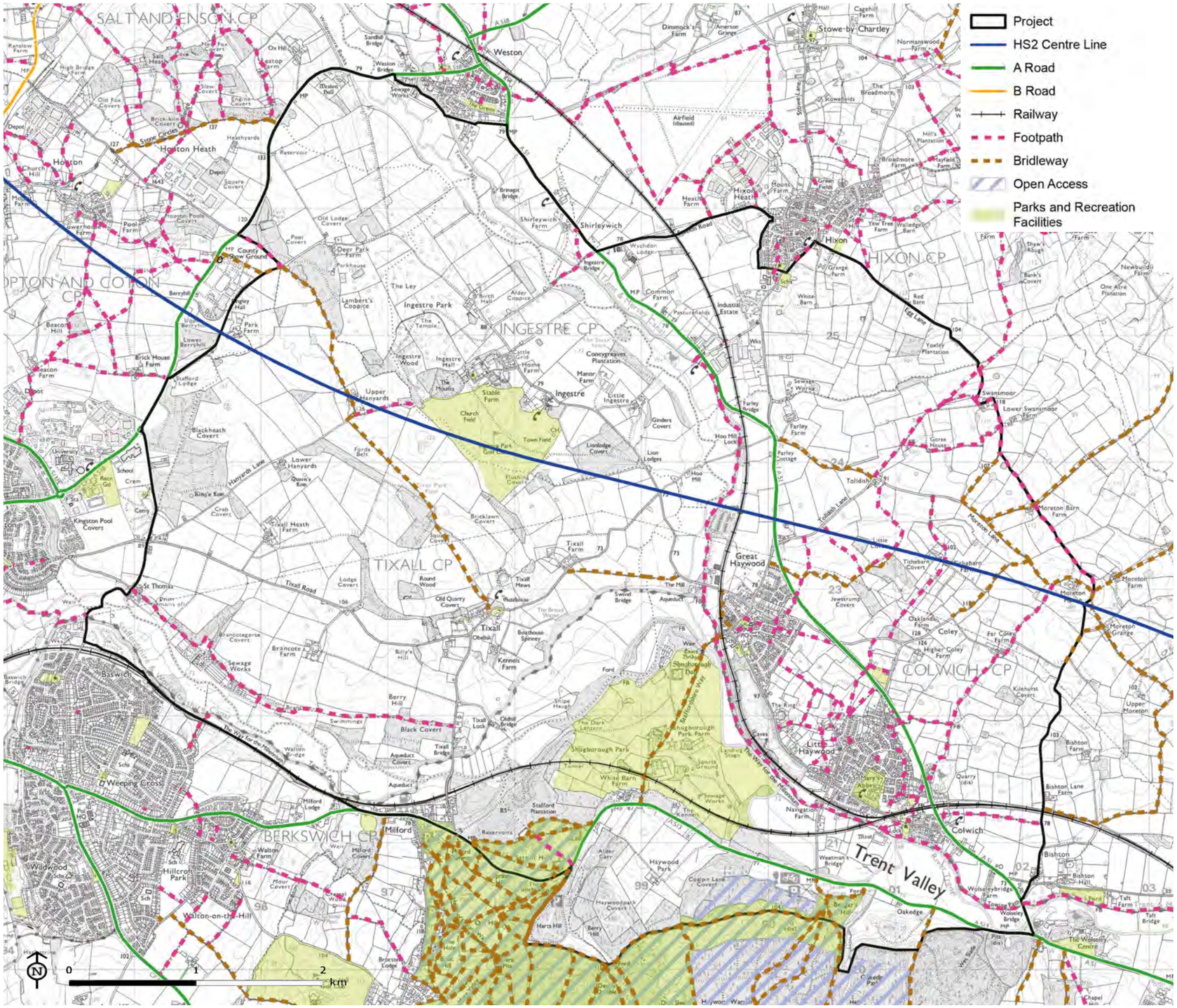


Figure 2.4 - Access, Enjoyment and Connectivity

3 Vision


‘Conserving and enhancing the area’s special character and qualities to provide lasting benefit for its communities’

4 General Design Principles

4.1 Introduction

The GDPs provide overall guidance for delivery of the Vision. This guidance applies irrespective of whether proposed initiatives lie within the Act Limits or the wider project area.

The principles have evolved from early work undertaken as part of the Great Haywood Illustrative Design Plan (May 2010) and finalised by the Sow-Trent Review Group in Summer 2019. There are five GDPs and an overarching principle of Quality. The five GDPs are:

- Landscape;
- Historic Environment;
- Biodiversity and Hydrology;
- Access, Enjoyment and Connectivity; and
- Communities.

Each of these five GDPs relate to different aspects of integration with the area's special character and qualities. These GDPs aim to ensure that proposals are appropriate to this special character.

4.2 Quality

Quality is an attribute in its own right irrespective of its appropriateness. Proposals need to demonstrate both attributes. Appropriateness without quality is insufficient.

Quality can be experienced through the choice of materials, design, construction and aftercare. In each case quality should relate to items such as purpose and lifespan. Appropriateness will affect the expression of this quality. Quality has particular relevance to HS2 with its stated design life of 125 years and very strict limitations on maintenance and repairs on many elements over that lifespan.

Robustness, reliability and changes in appearance over this lifespan are important considerations for all designers.

Equally so are considerations of anticipated and potential change – climatic, environmental or societal Designs should forecast conditions and context, building in adaptive capacity.

Above all, designs shall be of good quality and be appropriate. Both set piece elements, such as the Great Haywood Viaduct and the smaller details of culverts, fencing, noise barriers and making good will have significant collective impact. The project area has numerous examples of where previous infrastructure projects have left a legacy that contributes positively to the area's special character. The quality of the next layer of infrastructure must add another layer and become tomorrow's legacy.

4.3 Application

Both Quality and the five GDPs apply to all proposals connected with HS2 and the project areas both within and outside Act Limits as Enhancement Projects.

Some GDPs and their noted sub-principles are more applicable to works within Act Limits and others to Enhancement Projects outside Act Limits and some are applicable to both. This is noted under each separate GDP with a number in brackets.

4.4 Schedule 17 Applications

Many proposals within Act Limits require submission for prior approval by the Local Planning Authority (known as Schedule 17 Applications). Other proposals do not. Irrespective of this, the GDPs and the Detailed Design Principles (DDPs) are aimed at HS2's contractors and their design teams. The high level aim is to achieve awareness of the special character of the project area and buy in to the production of landscape led solutions; at the next level, an awareness of the challenges and opportunities associated with quality and the GDPs; and at the elemental level how this approach may be used on the design of different elements of the proposals.

4.5 Pre-Application Meetings

Acceptance of the approach, use of the guidelines, good dialogue between contractor teams and the Local Planning Authority and structured Pre-application meetings are all recommended. Evidence from implementation of HS2 in the Chilterns has illustrated the success of this approach. This reduces risk, saves time and helps deliver the vision and underlying design principles.

4.6 Enhancement Projects

The GDPs and to a lesser extent DDPs apply equally to Enhancement Projects. Quality and landscape fit are equally important on either side of the Act Limits line. The Enhancement Projects are covered in a separate document (Part 2).

4.7 Synergy

Whether between GDPs concerning different elements, between DDPs and components, or spanning Act Limits, maximising synergy is essential. Proposals that are holistically based consider all the GDPs and provide added value, increased resilience and lower risk.

4.8 The five General Design Principles

The five GDPs relate to the same groups of characteristics identified in Chapter 2. These principles apply to both as follows:

- Within Act Limits (1)
- Outside Act Limits (2)

1 Landscape

Aspiration

A slow, secluded and tranquil landscape, reinforcing and protecting the strong sense of place, maintaining local diversity and contrast between the distinctive elevated Chase to the south, valleys, open agricultural and wooded historic landscapes. A conserved, managed and restored network of canals and rivers, streams, wetlands, floodplain and water meadows, hedgerows, woodland, wood pasture, heathland and designed parkland landscapes. (1 and 2)

A multi-functional landscape providing benefits for farming and food production, nature, flood control, carbon storage, soil, air and water quality, recreation, access, enjoyment and health and well-being. (2)

General Design Principles

- Respect the open valley landscape and open, long views, maintaining the contrast and visual connection between open valley bottom and wooded hills. (1 and 2)
- Re-connect existing patterns of vegetation to integrate HS2 including the network of ancient woodland, species-rich hedgerows, flood meadows and water meadows, wood pasture and heathland, reinforcing a sense of place. (1 and 2)
- New structures to respond sympathetically to their context and setting, including scale and massing, layout and materiality. (1)
- Landscape earthworks and planting to integrate HS2 into the surroundings, considering the wider landscape character and the scale and form of new landscape elements, including grading the viaduct embankments allowing planting to tie into the wider vegetation pattern, where possible. (1 and 2)
- Conserve the tranquil and secluded character through appropriate visual and noise mitigation, balancing noise and visual requirements. (1)
- Relate new woodland planting to the landscape character, interpreting where there is a precedent for woodland and tree planting (including natural regeneration) to restore landscape integrity, to filter and channel views and reduce perceived linearity of the alignment. (1 and 2)
- Respond positively to existing landscape function and habitat e.g. wetland enhancement which complements the pattern of water meadows on the valley floor, and wood pasture or heathland restoration and enhancement to link into wider initiatives on the Chase. (2)
- Recognise the unique landscape character of the canal corridor through the landscape, considering the balance and importance of openness and enclosure. (1 and 2)
- Consider use of temporary enhancement measures during the HS2 construction phase e.g. viewing areas, use of stockpiles or public art. (1 and 2)

View from the towpath and The Way for the Millennium footpath along the Staffordshire and Worcestershire Canal

‘A slow, secluded and tranquil landscape with a strong sense of place’

2 Historic Environment

Aspiration

Celebration and enjoyment of the rich historic fabric through conservation, restoration, enhancement and management of historic assets including canals and agricultural heritage and the designed landscape. An enhanced setting emphasising key viewpoints and improved access provides interpretation and promotion of history. (1 and 2)

Historic Environment: General Design Principles

- Conserve and enhance natural and built features of historic interest in the landscape and promote wider understanding and access. (2)
- Promote and provide interpretation of historic assets. (2)
- Interpret the historic pattern of ancient woodlands, parkland trees, wood pasture, tree groups and linear belts to inform appropriate locations for woodland creation to help integrate HS2.(1 and 2)
- Use selective tree planting, consolidation and felling to provide screening and emphasise positive historic views, allowing the significance of the asset to be appreciated. (1 and 2)
- Consider and conserve the setting of natural and built features of historic interest in relation to noise, dust and vibration. (1 and 2)
- Conserve, restore, enhance and manage the canal network and associated vernacular buildings and features. (2)

River Sow at Shugborough Park, © Martinevans123

‘Rich historic fabric with deep agricultural, estate and industrial connections’

3 Ecology and Hydrology

Aspiration

An enhanced, re-created and re-connected mosaic of habitats incorporating the existing ecological priorities and landscape pattern of the area. Enhanced habitat and biodiversity through careful species selection, reflecting local species compositions and habitats, creating resilience to pest, disease and climate change. (1 and 2)

General Design Principles

- Conserve, restore, re-connect and re-create habitats to reflect the historic pattern, including wetland, water meadows and floodplain meadows, ponds, saline habitats, restoration of natural river channel features, connected ancient woodland, heathland and wood pasture. (1 and 2)
- Create broadleaved woodland and restore species-rich hedgerows using local species composition to connect habitat and provide visual integration to mitigate the new railway and enhance the wider landscape. (1 and 2)
- Integrate balancing ponds and drainage into the landscape, respecting the existing drainage pattern through creating new and enhanced habitats with marginal, woodland and hedgerow planting including natural regeneration. (1 and 2)
- Respect mature and veteran trees, managing them to provide increased biodiversity. (1 and 2)
- Provide a diverse age and species structure to increase longevity and resilience to pests and diseases in planting specifications for new planting. (1 and 2)
- Create opportunities for connectivity for all species specifically protected and notable species, including otter and bats, to mitigate habitat severance across the wider landscape. (1 and 2)

Meandering River Sow and floodplain ©StephenPearce

‘A biodiverse landscape closely interlinked to the rivers Trent and Sow, and the canals’

4 Access, Enjoyment and Connectivity

Aspiration

A connected landscape minimising severance for people between settlements, providing Green Infrastructure links and connectivity along the waterway networks of the Staffordshire and Worcestershire, Trent and Mersey Canals and the River Trent. People in the local settlements are able to access the local environment and landscape and its historic elements both physically and perceptually. (1 and 2)

General Design Principles

- Protect and enhance existing rights of way and permissive routes and positively promote new circular routes to replace routes that have been severed and link into the established linear routes. (1 and 2)
- Promote quiet, slow enjoyment of the area on land and water. (2)
- Improve and enhance access to allow for multi-user connections. (2)
- Create east-west links between Stafford, settlements in the study area and the wider Trent valley. (2)
- Provide access to and understanding or interpretation of key historic landscape assets and elements e.g. through the use of boards, apps and/or postcards. (2)
- Promote recreational use of the waterway corridors and where possible enhance and establish routes, access points and associated facilities to support use of the rivers and canal. (2)
- Improve wayfinding and interpretation on existing and promoted routes. (2)
- Provide new and enhanced access to the landscape, heritage and wildlife of the area, which could include the use of community walking routes and interpretation ‘apps’. (2)
- Protect and enhance the waterway corridor routes and facilities for powered boating and paddle sports. (2)

Public Right of Way FP5, Great Haywood

‘Physically and perceptually well connected countryside, waterways and historic assets’

5 Communities

Aspiration

Supporting the residential, commercial and recreation communities and rural areas affected by HS2 (1 and 2), engaging them in the development of the Enhancement Plan and user-led generation of potential Enhancement Projects to create a lasting legacy and foster a sense of local ownership. (2)

General Design Principles

- Allow for active community and stakeholder involvement in developing and implementing the Enhancement Plan including establishment of community led Enhancement Projects. (2)
- Provide opportunities for the community to connect to wildlife and the natural environment, increasing awareness of the area, habitats and species. (2)

Community event at Shugborough Park ©Express&Star

'A diverse and engaged residential, commercial and recreation community'

5 Detailed Design Principles

5.1 Purpose

This chapter examines each of the elements that make up the railway, its supporting infrastructure and its surrounding context. It provides guidance to designers and reviewers of designs submitted for approval. It is also partly applicable to Enhancement Projects.

Each element is addressed in a broadly similar manner which considers likely issues and opportunities, and then shows how these are best addressed. It is accepted that each element will invariably have numerous associated technical and operational requirements which are taken as a given. HS2 also have a legal framework of Assurances and Undertakings that apply to the scheme. It is assumed that designers establish these requirements.

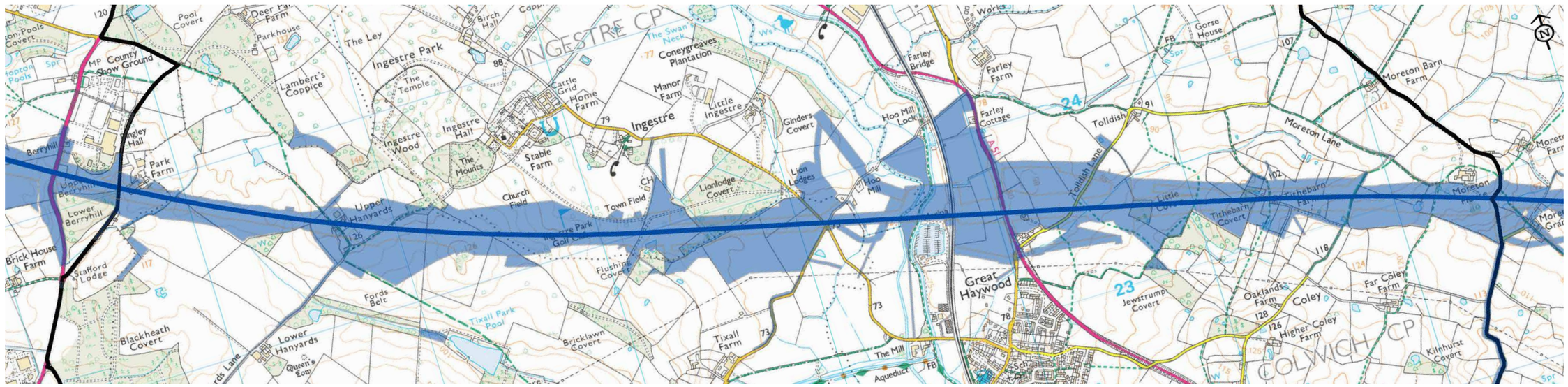
It is similarly assumed that designers are familiar with relevant HS2 design guidance. This will range from high level documents such as the HS2 Design Vision to detailed technical requirements. The following guidance aims to supplement these documents offering advice on how to maximise the integration of the railway with its special and particular landscape context.

Designers are strongly advised to reference the considerable and increasing amount of design work associated with HS2, and with other high speed railways. As always these solutions need to be considered in the context of the project area.

Each element notes General Design Principles that particularly apply to that element showing the numbers of these GDPs at the top right of the first page of each element. General guidance is supplemented by location-specific guidance where this is considered useful. Other contextual guidance is provided in the sketch plans contained in Section 6 [TO FOLLOW]. Illustrations and photographs are included as examples of solutions elsewhere which are considered potentially useful for designers in their own design process.

A Making good after construction

1 4 5



Extent of land used during construtions shown in blue hatch. Contains Ordnance Survey data © Crown copyright and database right 2019.

Introduction

Act Limits prescribe the maximum amount of land that can be used by HS2 for construction of the railway, access and associated work such as the diversion of services. Act Limits in the study area are extensive particularly adjacent to the Great Haywood Viaduct stretching to 800m of land adjacent to the A51 Litchfield Road. This is proposed for use by compounds, plant, materials transfer and stockpiles. The other very extensive area of Act Limits concerns land that may be used for the provision of replacement golf facilities, not construction, and is not covered by this guidance.

The Aim

The overriding aim of making good after access for construction is that of a full and lasting restoration of land and other assets affected by its temporary use for construction. It excludes by definition land that is permanently and deliberately changed to form the railway and its supporting works.

Guidance

Whilst many construction activities do not require approval under Schedule 17 it is hoped that this document is useful in reducing negative impacts and helping deliver optimal restoration.

- **Assurances, Undertakings and Agreements:** Areas covered by Act Limits have been subject of considerable consultation with landowners. Designers need to be fully aware of the details of such assurances and agreements. This should fundamentally influence their designs for both temporary and restoration works.
- **Construction needs:** Whilst these are paramount and optimal working should always be the aim, there are often equally suitable approaches/ designs. In such cases those that are more environmentally sensitive should be preferred.
- **Damage limitation:** Damage should be minimised through the choice of construction method and effective protection of assets outside the working zone. The working zone should be minimised in order to limit the impacts of construction. (Note the working zone should not necessarily be considered the same as Act Limits).
- **Temporary works:** The design of temporary works should be influenced by an awareness of the area's special landscape qualities and an overall intention of integrating even temporary works with this landscape, particularly given the lifespan of such works.
- **Temporary screening:** Effective visual and acoustic screening should be considered even if not specifically required by the Environmental Minimum Requirements. Careful placing of medium-term stockpiles is an example of how to provide this.
- **Advanced works:** Where possible designers should facilitate early implementation of permanent works either to help screen construction works or to achieve accelerated establishment of mitigation proposals.
- **Standards:** Temporary or advanced permanent works should be designed and executed to appropriate best practice adjusted to respond to local conditions, issues and expectations.
- **Permanent restoration works/ making good:** Should be realistic and effective making proper assessment of the likely damage and producing making good proposals that address all relevant issues. Particular attention is required to de-compaction, soil placement and conditioning, rectifying impeded drainage, and soft landscape works. These making good works require a similar level of design and specification to other works directly associated with the new railway and its integration.
- **Future use:** The majority of land affected by construction will be returned to its former use. Specifications and designs, and their delivery should ensure that this is achieved. In some locations Assurances, Undertakings and Agreements may have already agreed alternative uses, or there may be subsequent changes in proposed use as a result of this document or the proposed Enhancement Projects. This might, for instance, include the creation of new habitats or landscapes to form ecology corridors. In all cases - irrespective of change of use or resumption of previous use - guidance within this document should apply.
- **Decommissioning:** Full and effective decommissioning and deconstruction of all temporary works is assumed unless specifically agreed otherwise. This includes improvements to public highways for construction and access, bell mouths and access tracks, security fences etc. all such elements have an inbuilt and unwanted urbanising effect that is detrimental to local landscape character and contrary to the effective integration of railway and landscape.

Experience of early construction work on HS2 in the Chiltern and Colne Valley has shown that contractors and their designers appreciate the need for locally sensitive design of temporary works and see this as part of their positive community outreach. This attitude should be encouraged with for this phase of HS2 in the project area.

B Bridges

1 3 4

Introduction

There are a number of under and overbridges within the study area at locations as follows:

- Colwich Bridleway 23 Accommodation Green Overbridge (Ch 203.600)
- Colwich Bridleway 35 Accommodation Overbridge (Ch 203.400)
- Colwich Bridleway 58 Accommodation Underbridge (Ch 204.600)
- Tolldish Culvert (Ch 204.700)
- A51 Lichfield Road Underbridge (Ch 205.200)
- Great Haywood Viaduct (Ch 205.400 - 206.700)
- Lionbridge culvert (Ch 206.700)
- Ingestre Underbridge (Ch 207.050)
- Ingestre Green Overbridge (Ch 207.750)
- Tixall Bridleway and Footpath Accommodation Overbridge (Ch 208.500)
- Trent Walk Underbridge (Ch 209.800)

This section covers all of the above with the exception of Great Haywood Viaduct (Section 5.2 C) and the Green bridges (Section 5.2 D).

Bridge designs must seek to:

- Maximise landscape integration through consideration of both bridges and ancillary elements.
- Consider various key elements such as bridge decks, parapets, abutments and approaches.
- Be locally sensitive.

Significance

Although considerably smaller than the Great Haywood Viaduct other bridges in the study area still have the potential to influence the landscape setting in the way explained in Section 5.2 C. Overbridges also provide important elevated viewpoints along the alignment.

Issues & Opportunities

Issues include:

- Visual disturbance and blocking of views
- The introduction of alien elements in the landscape
- Resolution of bridges and approaches with character of existing landscape on either side
- Impacts on users of routes affected
- Construction impact

Opportunities:

- Design quality
- Landscape integration into embankments and cuttings
- Dual use functionality and enhanced connectivity

These opportunities are likely to be restricted to within Act Limits and this guidance is therefore directed at HS2 and its contractors and designers.

Landscape Strategy

Bridges will be Common Design elements produced to standard designs that comply with HS2's Bridge Design Requirements. As such, there will be limited opportunity to affect bridge design, particularly safety and functional requirements and structural materiality. Effort should be focused on maximising integration of these elements with their landscape setting by the:

- Adoption of simple and elegant design solutions that are appropriate to function, location and setting
- Careful design of ancillary works that are essential to the bridges (e.g. abutments, approach roads, etc.)
- Maintaining openness

Design Excellence and Structural Elegance

Advice provided for the Great Haywood Viaduct (Section 5.2 C) applies to all bridges.

Integrated design

Designers should consider all elements as part of a holistic design approach. 3D virtual models should be produced showing bridge approach, railway and surroundings. These models should be used proactively as part of the design process.

Schedule 17 Applications

Submissions should include 3D virtual models of each set of proposals. Proposals should demonstrate adherence to this guidance.

Bridges and their impact on landscape setting

The location and functional requirements of all bridges is broadly fixed. However the potential impact of each bridge is still in part dependant on the design of ancillary works - abutments, their interface with embankments/ cuttings, approach roads and tying in with existing routes and landscape features. Designers are encouraged to consider how these elements can maximise the integration of bridge and landscape.

Overbridges

Overbridges present potentially critical issues of separation of a standards-driven design of bridge and approaches with that of the existing road or public right of way and its rural context. Particular attention to the following elements will ensure this is avoided.

Bridge deck: Ensure carriageway is not significantly wider than the existing road/ path; avoid the use of upstand kerbs and other urban elements if possible. Provide continuity of surface material. Ensure design speed standards do not exceed that of the existing road and consider the use of appropriate speed reduction

mechanisms such as single carriageway over the bridge deck.

Bridge parapet: Safety requirements will dictate heights and extent of parapets. Ensure elegant transition between different heights. Vehicle barriers on the approach to the bridge should be integrated with landscape elements by the use of hedges and grass verges.

Ancillary elements: Avoid the use of lighting, excessive signage and road markings that will cause unwanted urbanisation.

Approach road: The above approach should extend to the design of new roads (widths, curvature, and any required embankments) and their careful tying in with existing retained roads or tracks. Where appropriate soften embankment side slopes especially where these sit above cuttings to provide adequate bridge clearance. This combination of circumstances has potential to be very intrusive.

Relationship with lineside cuttings: To maintain openness and views along the rail alignment assume open span bridges with set back below deck splays with appropriate hard surfacing.

Underbridges

Portal: Minimum height and shape will determined by functional requirements. Design should be fully integrated with abutments and any required fencing especially noise barriers if required.

Abutments: These will be experienced at close range by users of the bridge. Consider appropriate material and scale of surface treatment including the soffits of underbridges. Assume the use of splayed abutments with raked tops so that the abutment matches the angle of the adjacent embankment.

Location specific advice

Colwich Bridleway 35 Accommodation Overbridge (Ch 203.400): Headroom in cutting therefore low embankment required to approach track on north side of alignment. Consider easing embankment grade using material from adjacent temporary material stockpile. Extend hedgerow treatment along both embankment slopes.

Colwich Bridleway 58 Underbridge (ch 204.600): designers must resolve junction of eased embankment and diverted approach track on north-east side of bridge; junctions between bridge and embankments on both sides of the alignment; use splayed retaining structures of minimum length and vary embankment grades locally.

Tolldish Culvert (Ch 204.700) and Lionbridge Culvert (Ch 206.700): Designers should explore the creation of a two stage channel profile to facilitate use as fauna underpass, satisfactorily and elegantly resolve and integrate protective grilles to prevent use by humans, design appropriate and integrated wingwalls and consider alignment and treatment of diverted ditches. This requires a considered and holistic design solution.

A51 Lichfield Road Underbridge (Ch 205.200): This is an important opportunity involving a major road and a 125m long sequence of cuttings and bridge with a bridge deck over 20m wide and a 5.3m minimum opening height. Noise barriers are required on both sides. Designers must consider the bridge, abutments, fencing and road corridor as part of a road user's experience and potential gateway element to Great Haywood. Consideration should be given to increased opening height and/ or other special treatment of the portal/ abutment design; the introduction of avenue and hedge planting on either side of the bridge; and enhancement of pedestrian/ cycle provision both within and outside Act Limits. There is major potential for positive place-making and landscape integration.

Ingestre Underbridge (Ch 207.050): Minimum dimensions and surfacing are in part dependant on use by golfers. Underbridge will be well screened by proposed woodland on both sides of the alignment.

Tixall Bridleway and Footpath Accommodation Overbridge (Ch 208.500): Surface treatment of bridge deck and approaches to be informal but suitable for horses. Complex embankments to north of alignment to be eased and broad verges provided to avoid the need for safety fencing.

Trent Walk Underbridge (ch 209.800): Multi-functional use for access and drainage. Designs to facilitate use of drainage link by fauna and avoid need for separation fencing; two stage channel to be considered and extended on both sides of the bridges as a broad swale. Junction between alignment, embankment and access route cutting to be resolved without the use of structures.

Scherkondetal railway viaduct near Weimar, Germany. Slender piers are elegant and piers at regular intervals allow reduced bridge deck. ©NormanHallermann

Railway bridge over Trent Lane creates a gateway into Great Haywood ©BritishListedBuildings

Single span overbridge with distinctive piers and planting to visually break up bulk and integrate with adjacent planting. ©Klauswithk

C Great Haywood viaduct

1 3 4

The proposed Great Haywood Viaduct is the largest and most significant proposed element within the study area.

View north from Triumphal Arch, Shugborough Park (Viewpoint 009-03-013 from LV-01-526) ©HS2

Summary of proposals

- Great Haywood Viaduct 797.5m long
- Crosses Trent and Mersey Canal, the River Trent, the Macclesfield to Colwich railway and the Mill Lane/Great Haywood Road/Ingestre Road junction
- Passes in proximity to Great Haywood Marina
- Extensive embankment on either side
- A51 as underbridge close to the East Abutment
- Very extensive adjacent areas required for construction

Significance

The significance of the viaduct lies in its potential impacts per se, and as a focus for public opinion of HS2 through this most visible element. The viaduct will therefore attract considerable public interest in all stages of its existence – design, construction and operation. Added to this is the established public interest in bridges and their symbolism. As a result public opinion on the viaduct is likely to reflect that of HS2 as a whole, and vice versa.

Issues & Opportunities

Issues include:

- Noise and loss of tranquillity
- Visual disturbance and blocking of views along the river corridor
- Changes in landscape character (alien associations, changes in landscape scale)
- Impacts on marina and canal activities
- Very significant construction impact (some potentially irreversible)

Opportunities:

- Design quality
- Environmental performance (particularly noise and visual mitigation)
- River corridor enhancements through post construction making good (landscape and ecology)
- Selective adaption of construction related initiatives
- Enhanced connectivity
- Improved safety

These opportunities could be realised mainly through the design and construction of the viaduct by HS2 and its contractors, and to a lesser extent by selected Enhancement Projects.

Landscape Strategy

- Achieving design excellence of the viaduct
- Integrating its embankments with their landscape context
- Controlling views to aid integration (screening neither possible nor advisable)
- Maintaining landscape openness especially views along the river corridor
- Maximising all round environmental enhancements involving all five General Design Principles and integration with other Detailed Design Principles

Design Excellence and Structural Elegance

Designers are assumed to reference all relevant HS2 Design Guidance and other Best Practice design approaches to viaducts (both specific to Great Haywood and general). This guidance relates to a range of requirements including construction and operational needs as well as appearance. Many operational and safety needs are both stringent and ono-negotiable with consequent implications on structures, materials and design. Visual considerations must work within these set parameters and produce structural elegance.

Special attention should be paid to the following:

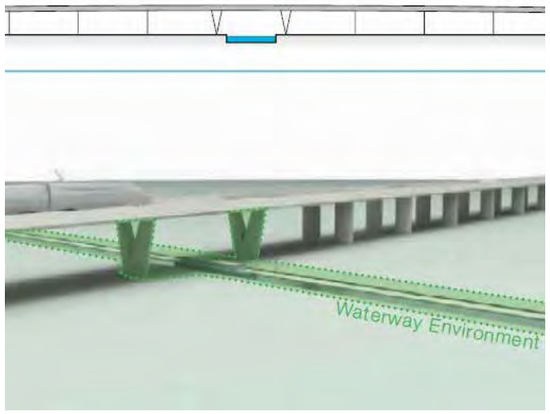
- Rhythm
- Exceptional spans
- Slenderness
- Materials
- Pier to ground junction
- Pier to deck junction
- Abutments and embankments
- Deck soffit
- Integrated noise barriers
- Overhead Line Equipment (OLE) and their integration with the overall design
- Landscape treatments

Great Haywood Viaduct: Canal & River Trust Design Principles for Waterway Crossings

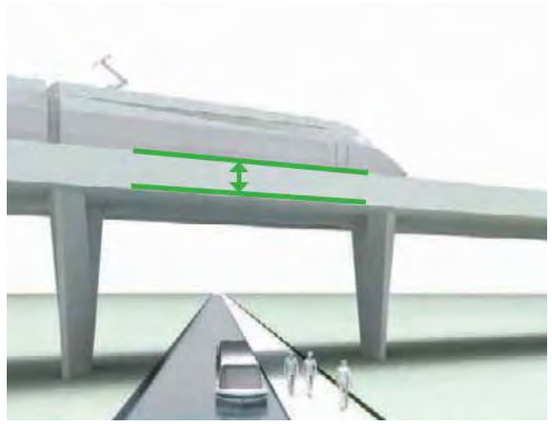
This document relates to waterway crossings on HS2. It is directly relevant to the design development of the Great Haywood Viaduct. It should be an essential reference point for the designers of the viaduct.

Whilst issues such as the viaduct height are broadly fixed as part of the horizontal and vertical alignment of the Approved Proposals (AP), other principles have already been embodied in the APs (and need to be delivered) or should inform more detailed aspects of the design not considered to date.

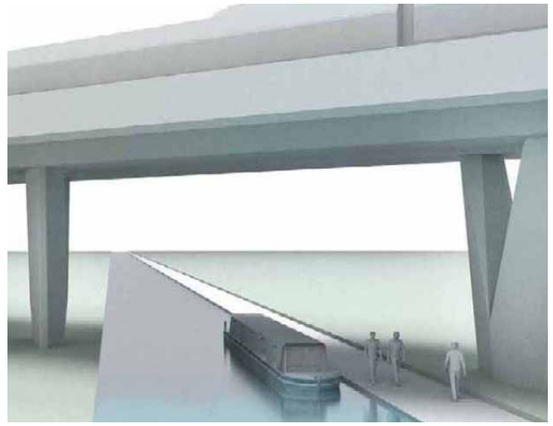
This page highlights the most relevant principles using illustrations from the Design Principles for Waterway Crossings document. See also further considerations on the following pages of this section.



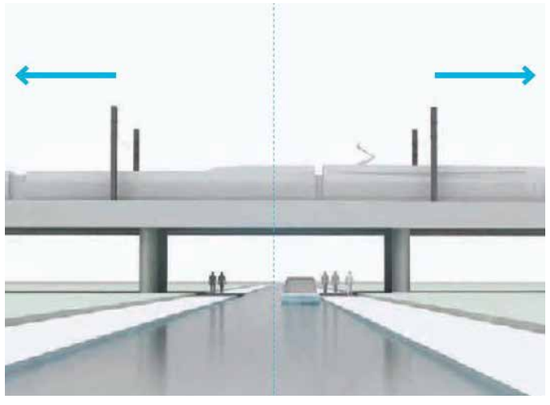
Visually open piers respond to canal environment ©CRT



Reduced spans result in reduced structural depths ©CRT

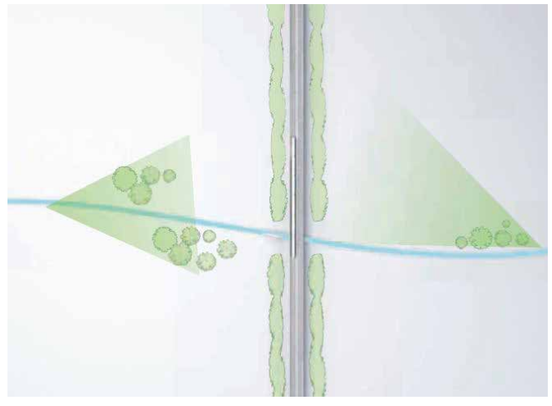


Multiple piers should aim to reduce scale of infrastructure to create a human scale ©CRT



Well coordinated OLE appears well considered and harmonious ©CRT

Sloped abutments with tapered textured materials blend into landscape anfd soft treatment to top of embankments blend well into skyline ©CRT



Strategic offline planting frames views ©CRT

Great Haywood Viaduct: Particular challenges

Colour and materiality: Colour and materials are important in determining the degree of visibility of the structure in the landscape and the apparent mass and bulk of the viaduct in closer range views.

Reference to the visualisation from the Triumphal Arch in Shugborough Park demonstrates that at that distance colour will be the most important aspect of the viaduct's design, particularly as the rhythm of piers and spans will be partly obscured by intervening trees. Much of this visibility will be caused by noise barriers. Assuming that the viaduct will be predominantly constructed using concrete this suggests the use of transparent noise barriers and of a carefully profiled deck to provide light and shade.

Closer range views and the need to reduce the apparent bulk of the bridge deck would suggest consideration of the use of a different darker coloured Corten beam structure set well back from the overhanging and profiled deck. This is proposed on the Chilterns viaducts (see illustration). Profiling is an excellent way of creating light and shade (colour by other means). Texture can be used to further accentuate these differences especially in close range views.

Pier/ span rhythm: The Great Haywood Viaduct will be a long a low structure with a deep deck to cater for the extreme dynamic loads associated with High Speed trains in particular their containment in case or a derailment. Added to this will be noise barriers. The principal issue will be how to achieve an elegance of form given these requirements; followed by the structure's rhythm given the erratic spacing of river/canal and railway it crosses.

Designers are encouraged to reference other viaducts on HS2 phase 1 currently in more advanced design. Those in the Chilterns (Wendover Dean and Small Dean) and the Colne Valley Viaduct are particularly relevant. All are long and low structures in a landscape context.

Wendover Dean demonstrates an elegance of rhythm achieved with equal spans and supports.

Small Dean uses a structural solution similar to Wendover Dean but includes a large skewed central span to negotiate an existing trunk road and railway.

The Colne Valley Viaduct uses far longer spans many of which are over lakes with piers rising from both water and land.

Weathering steel can form a positive elements to pedestrian environments ©CRT

Texture and shadow gaps mask joints and reduce mass of structures ©CRT

Exposed dark coloured exposed aggregate concrete

Well detailed, uniform concrete creates a high quality environment ©CRT

Illustration of Wendover Dean Viaduct, HS2 Phase I ©HS2

Ribbed cantilevered deck on the Mersey Gateway Bridge ©VincentPhillips

View south west along Trent Mersey Canal towpath towards proposed Great Haywood Viaduct (Viewpoint 009.03.021 from LV-01-658) ©HS2

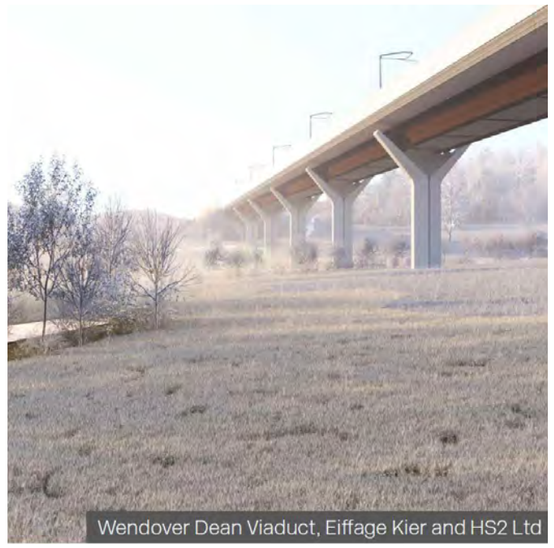
Depth of deck: Deck depths are inevitably massive irrespective of span lengths and pier spacing. Designers need to consider carefully how to break up this mass through its profile, texture and colour. There are many examples as to how appropriate modelling of the profile can introduce shadow lines to reduce apparent bulk. Examples are shown below. The deck soffit will be particularly visible from the canal, towpath and marina and should consider profile and texture to provide interest.

Piers: Short piers present real problems of proportion given that the cross section of each pier is driven more by the dynamic load of the trains and the deck above than their height. Particular attention is required to the profile of the pier and means of reducing apparent bulk.

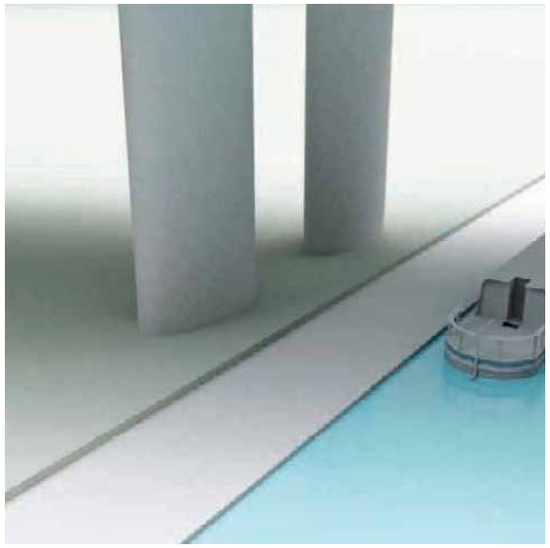
Pier junctions: The pier/deck junction is critical both technically (movement joints and their access requirements) and aesthetically (the creation of a 'clean' and slender junction). The pier/ground junction should aim for the same simplicity through the avoidance of any fenced surround and surrounding landscape treatments taken right up to the pier with no visible hint of foundations of break in ground profile.

Visually open piers respond to canal environment ©CRT

Shadow and materials create visually reduced deck depth ©HS2



Slim, well proportioned piers and visually reduced deck depth ©HS2



Piers should spring seamlessly from the ground ©CRT

Chamfered edge to deck creates slender appearance ©CRT

Well detailed pier junction ©HS2

Noise barriers and visual bulk: Noise barriers requirements are directly related to mitigation related to predicted noise levels. Their effectiveness is predominantly related to their height, proximity to the noise source and their design and materiality. On viaducts there is reduced number of variations because of the need to minimise the viaduct's width (and therefore proximity of barrier to source) and an overriding need to ensure full integration of the barrier with the viaduct structure. Height of noise barrier is often a given as a result; and this height can effectively double the apparent mass of the viaduct structure.

Considerable work has been done on the Colne Valley Viaduct to advance an innovation which uses transparent panels as part of the noise barrier. Although introduced to provide a view from the train over the 2.5km viaduct it will also reduce the apparent bulk of each span. The design solution includes a constant height upstand along almost all the viaduct with the materiality of the upstand varying dependent on the level of noise attenuation required. (The transparent Perspex viewing infill performs less well than the solid louvered panels). Contractors should consider this approach when resolving the issue balancing required noise attenuation at the same time as maintaining visual openness.

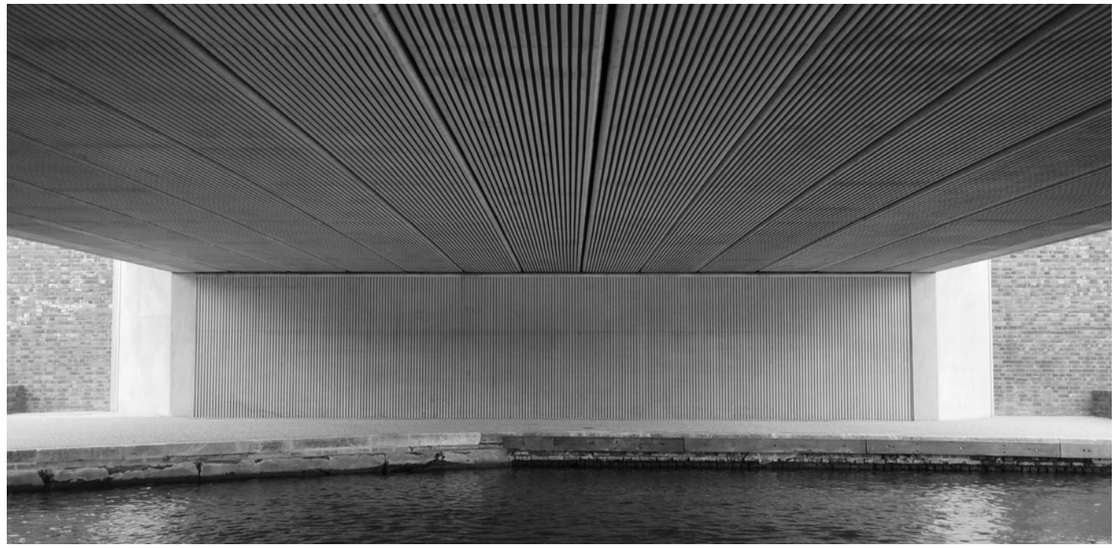
This is of particular concern in the vicinity of the canal and marina. Designers should undertake noise modelling to determine the likely noise climate in the marina and the extent to which the viaduct structure will shield noise transmission to receptors close by. Existing trees along the northern edge of the viaduct must be retained as screening per se and to obscure what are likely to be solid panels to a noise barrier which could transit to transparent panels over the majority of the valley.

The use of transparent panels has not knowingly been used to date in the UK. Schedule 17 submissions are due in summer 2019 and until their submission details are not yet in the public domain.

View north along Trent and Mersey Canal Towpath adjacent to marina (LV-01-524) ©HS2

Use of transparent panels can reduce visual intrusion but can cause glare © Huanyu

Use of transparent panels for noise barriers, integrated with parapet ©BoscoItalia



Ribbed bridge soffit, Kings Cross - texture and shadow visually reduce bulk of soffit ©KnightArchitects

Fully integrated design: All design elements need to be fully integrated irrespective of delivery package. Overhead line equipment and its spacing for instance needs to be coordinated with spans and the deck upstand and noise barrier panels even though they are delivered by a separate and later contract and not subject to Schedule 17.

Damage avoidance: The contractor's design and delivery must be capable of providing full and appropriate protection of adjoining land and assets. This is of particular importance to underlying river, canal, and rail systems, the users of the marina and any public rights of way that are not temporarily stopped up, and terrestrial and aquatic habitats. Full details will be required of measures and monitoring proposed at all stages of construction and once the railway is operational.

Canal crossing: The effect of noise barrier requirements will become most visually evident in the crossing of the canal. A combination of public towpath passing directly under the viaduct and flanking trees require great care. Designers are advised to consider the following:

- Use of a minimum length span to accentuate the frame already provided by existing trees
- Piers set immediately behind towpath with equal offset opposite to ensure canal is centred on the span
- Piers parallel to canal not span above
- Use of special piers different to those on the remainder of the viaduct
- Take maximum advantage of reduced deck thickness resulting from shorter canal span and accentuate through use of materials and profiling to create light and shade and 'A Special Span'.
- Pay particular attention to bridge soffit, profile of upstand and the junction between the two. Modelling of soffit should produce an interesting and relevant 'ceiling' for users of the canal and towpath.

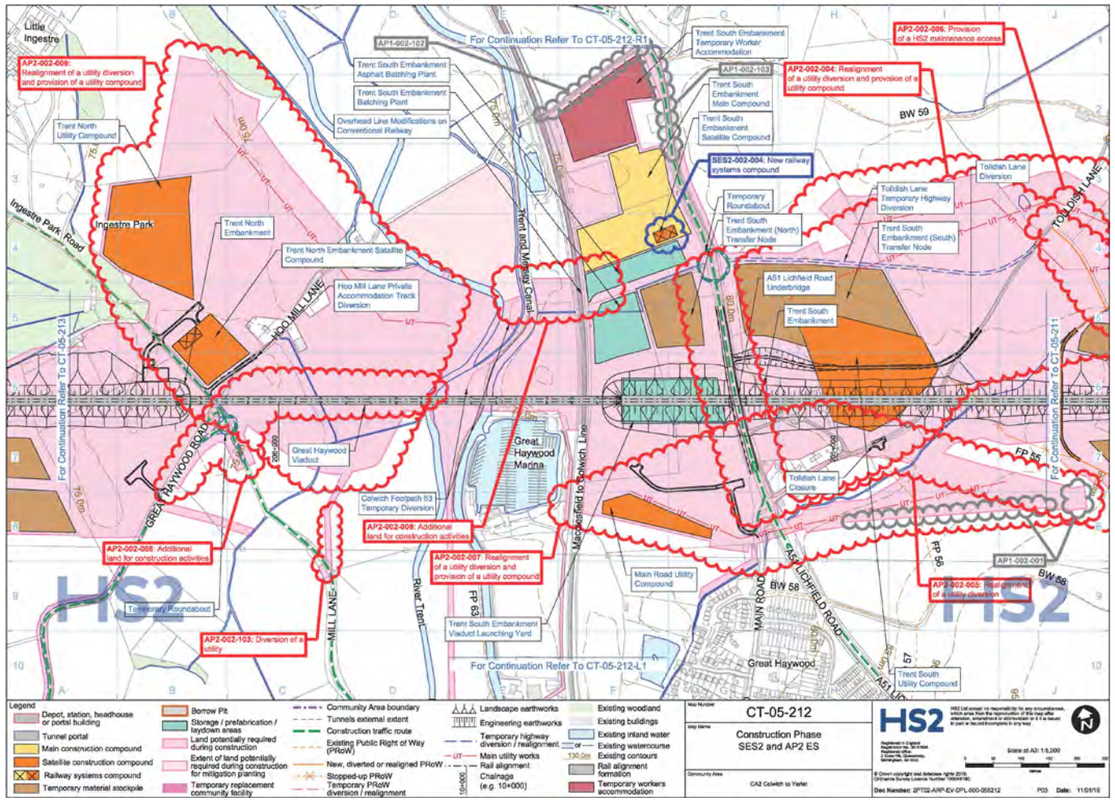
Marina: The interface between the marina and the viaduct is important for both the users of the marina and the towpath opposite. Noise barrier requirements are likely to be at their greatest (with noise barriers at their highest) as will be the visual disturbance of trains at close range. Retention of existing trees between the viaduct and marina/canal is therefore critical. Act Limits are drawn tight to the span presumably for this reason. Designers must ensure that their designs can be constructed and all trees outside Act Limits are retained.

Chamfered parapet reducing bulk. Wendover ©HS2

View north along Trent and Mersey Canal Towpath adjacent to marina (Viewpoint 0009.03.007 from LV-01-636) ©HS2

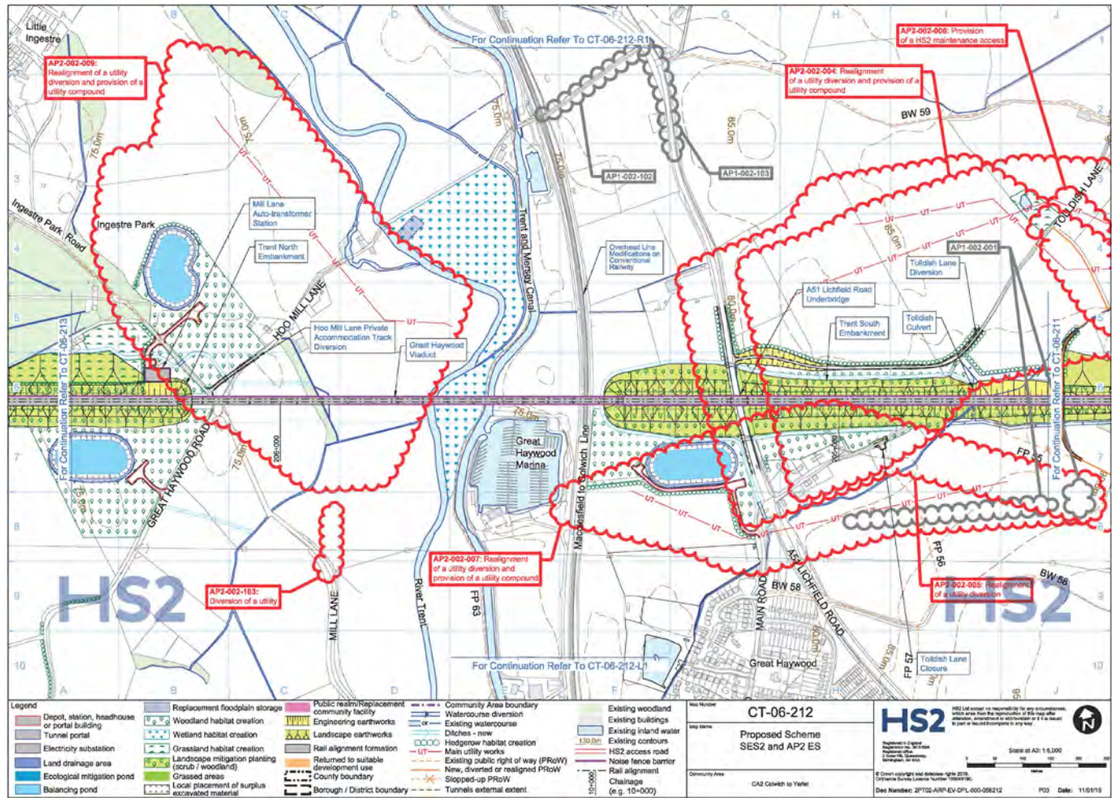
Exposed crossheads interrupt the viaduct soffit creating rhythm. Deck soffit colour and shadow reduces depth ©HS2

View north along Trent and Mersey Canal Towpath adjacent to marina - retention of existing vegetation is crucial ©CRT



Extent of land used during construction

The Act Limits associated with the viaduct show the worst case extent of construction. Even allowing for more effective use of land for construction and access, the actual extent of land directly affected will be very considerable and the local construction impacts very significant. The Environmental Statement, Assurances and Undertakings will all mitigate these impacts. Designers should also refer to Section 5.2 A in seeking to reduce further these impacts.



Extent of land used at operation

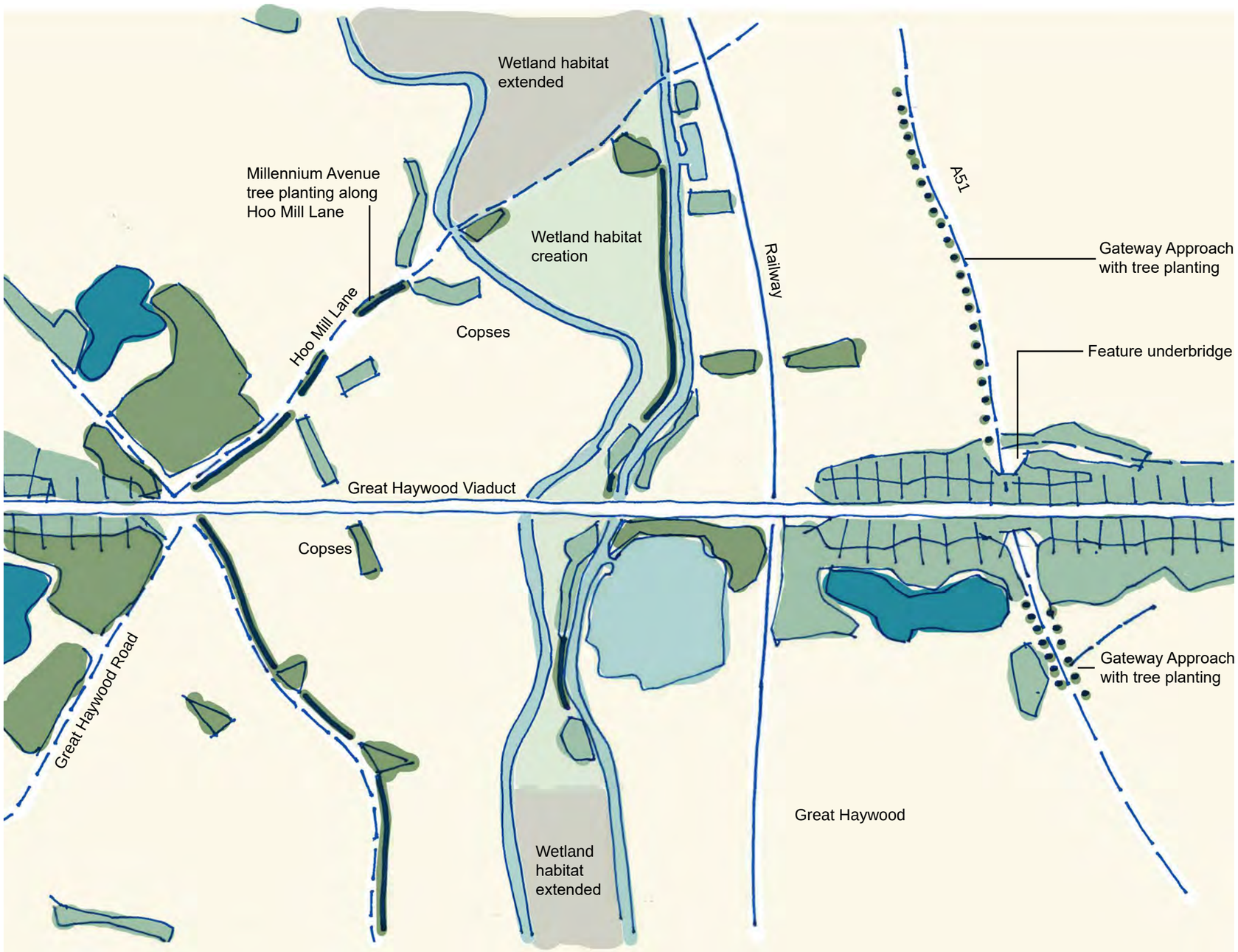
The great majority of land within Act Limits is returned to owners on completion of the railway, the land having been restored so that its previous use can be continued. Some areas will be changed through the provision of mitigation set out in the Environmental Statement and shown on HS2's scheme proposals. This includes extensive areas of woodland planting, three large balancing ponds, and wetland habitat creation.

There is potential for further change if this is considered beneficial and acceptable to landowners and HS2. Such change could strengthen proposals in areas already identified for change/mitigation or could extend change into new areas within Act Limits or beyond. This could be achieved through Enhancements Projects covered under Part 2 of the document or through cost neutral changes to making good. Whichever vehicle is used changes will have maximum effect if they are coordinated. This synergy between projects/actions will provide real added value.

Trent Valley landscape and ecology opportunities

The illustrative plan adjacent shows a series of opportunities to enhance the landscape and ecological setting of the viaduct. These are:

- **Copses:** a programme of creating a series of small copses dotted around the valley floor. These will provide a loose network of foreground and middle ground tree groups which will help break up the apparent length and continuity of the viaduct in views from most parts of the valley floor. It will achieve this without reducing the openness of the valley. Copses would be best located in field corners or other locations where they will not interfere with agriculture. Their specific locations are mostly non-critical and should be agreed with the land owner who's approval will be required. Locally native species should be used and block sizes kept small
- **Woodlands:** these are all as current HS2 proposals and would consist of larger scale and denser woodland, their purpose being to frame views of the viaduct and obscure the massive flanking embankments. Locally native woodland species from drier land should be used
- **Hedgerow reinforcement:** a programme of hedgerow gapping up, reinforcement and creation should use locally native species to provide an additional layer of screening particularly adjacent to public highways and selected footpaths across the valley floor. Care is need to avoid loss of openness
- **Gateway Approach:** designers should explore the opportunities of a dual-purpose landscape treatment of the west side of the A51 Lichfield Road. This should allow perforated views to the river valley and viaduct between widely spaced specimen tree planting at the same time as creating an approach to the underbridge below the rail alignment. As noted in section 5.X this bridge should have a special design treatment.
- **Wetland habitats:** HS2 proposals already include substantial wetland habitat creation as part of ecological mitigation. This habitat should include a broad range of habitats including standing water and ephemeral water, scrapes, water meadow and wet woodland. This should be designed to ensure that this reinforces the visual foiling provided by copses. Opportunities to extend this to both the north and the south should also be explored with landowners both as alternative making good following construction access and as Enhancement Projects outside of Act Limits



Other access opportunities such as towpath improvements and cycle ways are shown on the relevant sketch plan in Section 6. [Section 6 to follow in draft 2]

D Green bridges

Introduction

This section should be read in conjunction with Section 5.2 B Bridges. Guidance provided in that section is relevant to all other aspects of green bridges including their deck, parapet, abutments and approaches.

Two green bridges are proposed within the study area:

- Colwich Bridleway 23 Green Overbridge (Ch 203.400)
- Ingestre green overbridge (Ch 207.750)

These bridges are an important part of the proposed ecological mitigation.

Summary of proposals

The proposals suggest general and location-specific means of ensuring delivery of expected ecological mitigation, increased landscape fit and access improvements.

Significance

Green bridges have an important role in providing both meaningful mitigation - in particular against severance – and improved landscape connectivity. The location, configuration and width of these bridges is broadly fixed by the approved plans under the Act.

Issues & Opportunities

There are a number of general points common to all green bridges. These include:

- The effective and cost effective means of creating suitable habitat on the bridge deck;
- Avoidance of extreme loadings and consequent impact on structure and appearance; ensuring maximum use by targeted species (if any);
- Effective and unobtrusive deterrence of unwanted users particularly humans or larger species with associated safety issues; and
- Enhanced connectivity through a network of ecological corridors.

Guidance

Designers should refer to an established set of precedents and literature on green bridges. Particularly relevant are:

- Natural England (2015). Green Bridges: A literature review (NECR181);
- Landscape Institute (2015). Green Bridges Technical Guidance Note 09/2015;
- Iuell, Bjørn et al (2003). Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions; and
- HS2 (2016). Landscape Design Approach (HS2-HS2-EV-STR-000-000010).

Two documents specific to the study area are essential reading – the HS2 Phase 2a Great Haywood Illustrative Design Plan (May 2018) and C861 HS2 Green Overbridges: Part 2. The first sets out the design approach for the Ingestre Green Overbridge and the second provides additional detail on both proposed bridges. Designers should follow this guidance unless it is varied or amplified as set out below.

Green Bridges - Aims

- Respond to ecological requirements to provide habitat connectivity and mitigation.
- Reconnect communities, cultural/ historic landscapes and facilitate permeability.
- Integrated and aesthetic design through responding to and enhancing local landscape character.

Green Bridges - Performance Indicators

- To maintain safe movement and dispersal of animals and plants from one side of the railway to the other.
- To provide clear connectivity across the route for the target species.
- To achieve healthy plants and vegetation communities that are not unduly water-stressed.
- The establishment of viable vegetation communities and provision of long-term habitat connectivity.

Contractor requirements

The contractor shall develop detailed proposals based on the above and a thorough understanding of site context and location-specific requirements (specific to bats, wider ecology, landscape and access). This will require demonstrable input from appropriate specialists. The overall intention must be to maximise lasting multi-functional gains across a broad spectrum of fauna, flora and habitat connectivity, and landscape and access.

We recommend that designers investigate the following variations:

- Placing hedges on low bunds (to provide adequate soil profiles without variations in the depth of the bridge deck, to enhance immediate effect, to reference typical hedge-bank features local to the area and to provide added variation in micro-habitat);
- Location of security/ safety fencing within these hedges and reduction of the need for heightened bridge parapets;
- Placing bridleway or footpath within the hedge corridor;
- Tying in of security/ safety fencing on bridge deck with that along top of cutting and inclusion of solid barrier to 1m height and 0.3m below ground level for 100m on either side of the entrance to the bridge (to funnel fauna towards bridge);
- • Provision of hedgerows and trees connecting with adjacent existing/proposed hedgerows/ ecological corridors set out to funnel fauna towards bridge
- Hedge and grassland species to match adjacent local hedge and grassland assemblies established by ecological survey;
- Consideration of the use of translocated established hedgerow coppice and/ or grassland removed as part of the local works;
- Avoidance of lighting. Bat specialist to advise on the necessity for screening given likely traffic volumes at Colwich and, if required, designers to consider innovative alternatives (substantially increased locally native evergreen content to hedge/use of dipped headlights etc); and
- Avoidance of clutter through the use of intuitive design and avoidance of signage.

Users of the green bridge should be as far as possible unaware of the railway below.

Schedule 17 Applications

Schedule 17 submissions should demonstrate clearly their integrated design intent and how this meets the key objectives and KPIs.

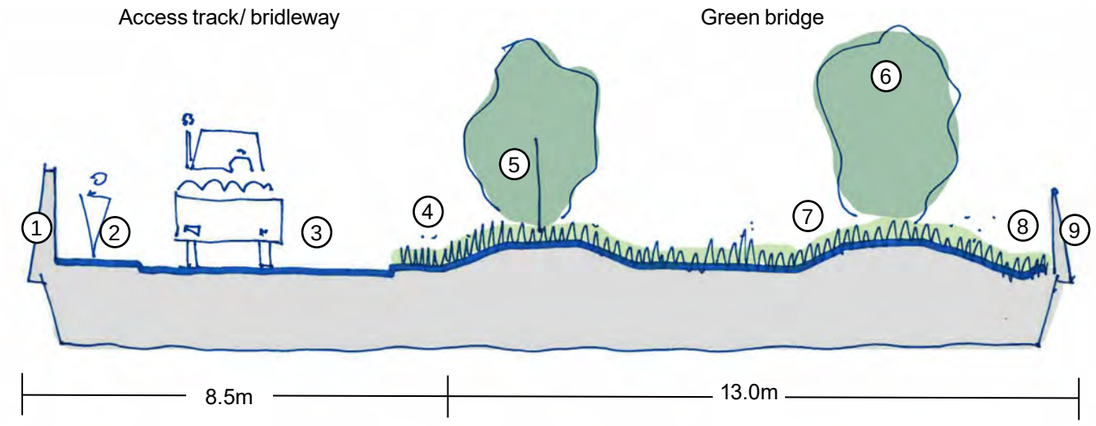
Well vegetated ecoduct, France ©LauriKlein

Grassland ecoduct, A50 Netherlands ©HenriCormont

Location specific advice

Colwich Green Bridge

The bridge is multi-use combining green features, accommodation access to Moreton House and Farm and diverted Bridleway 23. Current proposals indicate a 21.5m wide bridge split between access (8.5m) and green bridge (13.0m) broadly as illustrated on page 5 of C861 Green Overbridges: Part 2. See sketch plan for local considerations.



Illustrative Cross Section

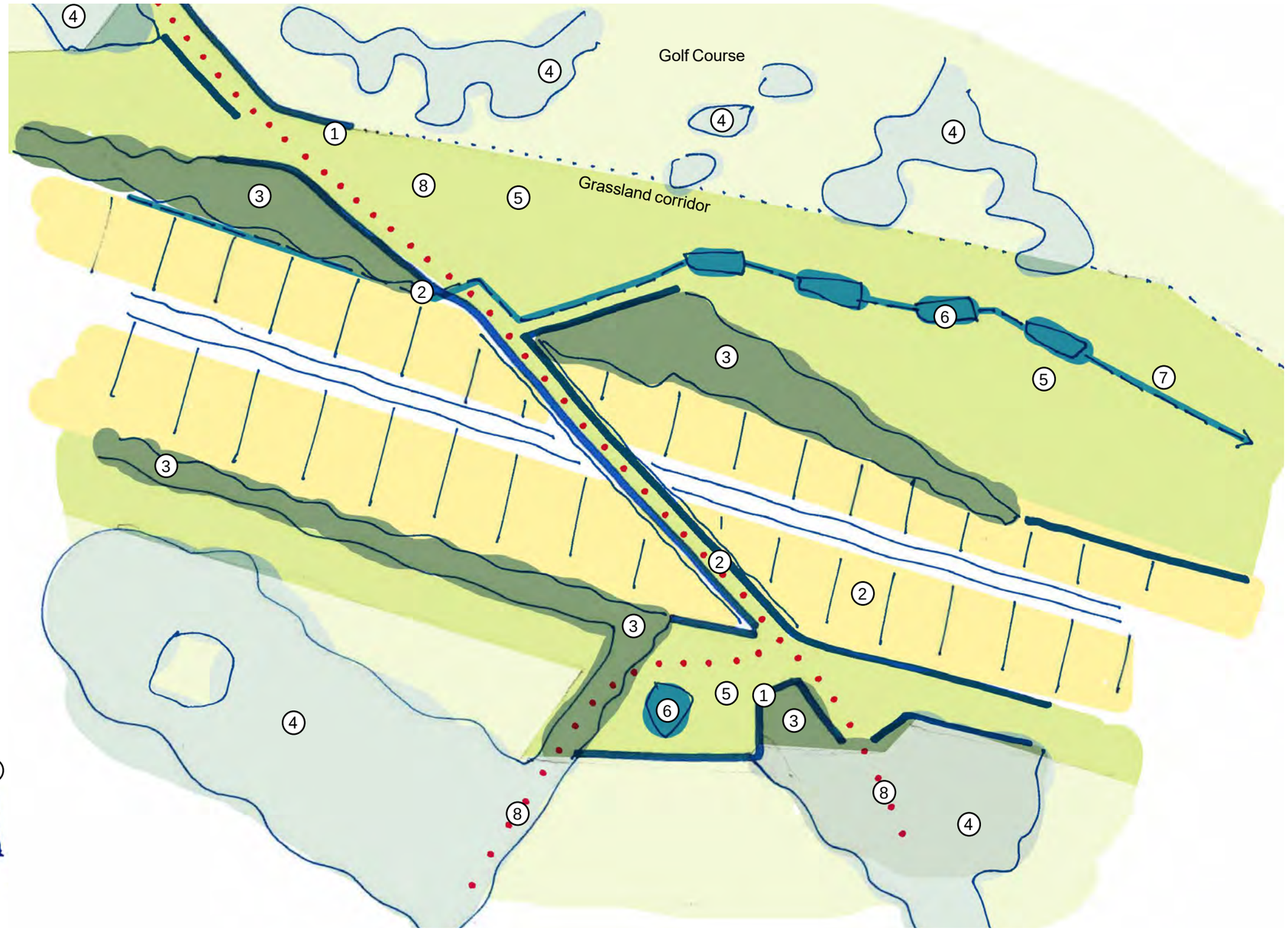
1. 1.8m height parapet
2. Footway
3. 5.5m wide carriageway
4. 1m wide green verge
5. 1.8m height security fence
6. Semi-mature hedge planting on 0.75m high berm managed at 4m height
7. Meadow grass
8. Optional perimeter drain/swale
9. Standard height parapet

1. Hedgerow network funnelling fauna towards bridge
2. Solid fauna barrier incorporated into safety fence
3. Woodland planting
4. Grassland
5. Ecological mitigation ponds
6. Scrub/ grassland/ scrape mosaic
7. Access track/ bridleway
8. Ditch

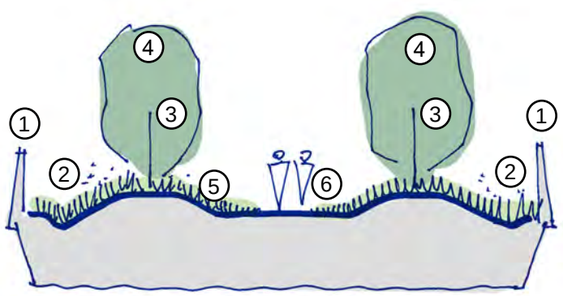
Location specific advice

Ingestre Green Bridge

The overall functional requirements of the bridge are currently unclear but there are significant benefits if the design can be adapted to allow use as a footpath or bridleway link in addition to the required ecological corridor. Failure to provide for such access will result in the inevitable exclusion of larger fauna from using the bridge as well as a large lost opportunity for extending the local public access network. Such access can easily be accommodated within the double hedge corridor, would require no hard paving and would not be detrimental to ecology. Security fencing should be incorporated within the hedgerows allowing lower edge parapets to the bridge. See sketch plans for local considerations.



1. Hedgerow network funnelling to a green bridge
2. Solid fauna barriers incorporated into safety fence
3. Woodland planting
4. Existing woodland
5. Grassland proposed
6. Ecologcal mitigation ponds
7. Ditch network
8. Footpaths



Illustrative Cross Section

1. Standard height parapet
2. Edge drain/ mini-swale
3. 1.8m height security fence
4. Semi mature hedge, 0.75m height berm managed at 4m height
5. Meadow grass
6. Unsurfaced footpath

E Noise barriers and fencing

1 2 4 5

Introduction

This section provides suggestions on how the visual impact of barriers can be improved, the selection of barriers and their siting and screening. In all cases barriers must be considered as an integral part of the design of the railway and its successful landscape integration. Barriers are proposed in the following locations:

- Moreton Cutting south lineside (Ch 203.114 – 203.153)
- Moreton Cutting north lineside (Ch 204.000 – 204.175)
- Trent South Embankment north lineside (Ch 204.175 – 205.387)
- Trent South Embankment south lineside (Ch 204.300 - 205.387)
- Great Haywood Viaduct (Ch 205.400 - 206.700)
- Trent North Embankment north lineside (Ch 206.184 – 207.400)

Significance

Noise barriers provide essential mitigation for expected and unwanted noise effects. Their acoustic performance is a given and should not be in any way reduced. This section relates to the appearance of noise fence barriers, parapets and barriers on viaducts.

Issues & Opportunities

Issues:

There is potential for considerable visual impact.

- Especially where sited on top of embankments.
- Potential for visual intrusion and significant added bulk where sited on overbridges/ viaducts.
- Can appear as alien elements contrary to landscape character.
- Can accentuate linearity of the alignment (visual severance).
- Possible issues of glint/ glare and inappropriate colour and materiality.
- Design life and maintenance considerations limit materiality of inner (rail facing) elevation.
- Siting is invariably mandatory and dictated by maximising effectiveness (i.e. closest to noise source).

Opportunities:

- Materials, colour, scale and texture can reduce apparent mass and intrusion and aid landscape integration.
- Landscape screening can reduce visibility.

Guidance

Noise barriers are likely to be Common Design elements with a suite of models using different materials and colours. Designers should review this range of models and select suitable options dependant on the technical and aesthetic requirements relevant to location. Aesthetic requirements should be guided by local landscape character in particular colour, texture and scale. Noise barriers on underbridges and viaducts will require bespoke solutions that relate to the overall design of the bridge.

Noise barriers in cuttings

Given local topography and the absence of many significant cross-valley views, trackside barriers at the base of cuttings will be invariably screened by the landform of the cutting itself. Where the top of barrier may be visible over a relatively low cutting consider hedge planting along the top cutting. Use the same approach on flat land.

Noise barriers on embankments

These barriers are likely to be intrusive and will often be seen in silhouette rather than against a landscape backdrop. Screening can be achieved by foreground planting which extends as far as possible up the embankment. Vegetation should be locally native, proven to be compatible with the stability of the embankment, easily maintained and not pose issues of leaf drop with unwanted operational effects on trains. Where possible embankment grades should be modified to provide non-structural easier slopes capable of planting and/ or a wider flat ‘verge’ between the noise barrier and top of embankment slope.

Where total screening is not possible the intention should be to break up long stretches of noise barrier seen in silhouette using informal groups of trees planted on lower slopes of the embankment or offset within Act Limits.

Even allowing for screening, barriers on embankments need to use recessive natural colours, include a degree of texture (either actual or through shadow lines on a ribbed surface), and have rhythm expressed through differentiation between panels and supporting uprights.

Noise barriers on bridge structures

These represent the ‘worst case’ location and can easily prevent even a well-designed bridge from appearing bulky and overbearing. The Great Haywood Viaduct and Lichfield Road underbridge provide the greatest challenges with a number of close-range viewpoints. Designers must:

- Establish early noise barrier requirements and seek input from noise specialist. This will determine the height of barrier required and other detailed characteristics.
- Prepare fully integrated designs where the noise barrier is considered part of the overall bridge. ‘Stick on’ barriers will be rejected.
- Consider in particular the materiality, colour, texture, massing and rhythm of the barrier and its relation to the bridge structure and balustrade.
- Consider maintenance and replacement requirements.
- Consider carefully the transition between different heights of barriers and where barriers stop or transition. Transitions should use gently stepped or tapered panels over the maximum possible length available.

Designers are encouraged to reference designs produced for the Colne Valley and Chilterns viaducts. See also Section 5.2 C, Great Haywood viaduct.

Schedule 17 Applications

These should show clearly the location, height and types of proposed noise barriers, detailed designs and elevations of each type and visualisations of selected instances of barriers on embankments. Details of barriers on bridges must be submitted as part of each bridge submission.

Fencing

The extensive fencing that will form part of the proposals will be of two types – security fencing that surrounds the operational areas of the railway, and other fencing for various types of access control. The selection of the type and height of fencing and gates should be informed by a clear understanding of its purpose tempered by the aim to maximise its integration with the local landscape and avoid unwanted ‘urbanisation’.

Designers should reference HS2’s Landscape Design Approach and pay particular attention to alignment (avoiding ‘sky lining’), the use of local fencing styles and materials (noting differences between agricultural and parkland areas), potential effects on fauna movement (generally and specifically regarding green bridges/ ecology corridors), and considering augmentation with hedges (to screen).

Gently curved ribbed timber barrier gives natural and textured appearance ©Wijma

Integrated parapet and noise barrier system © BoscoItalia

Green noise barriers © BAMWegen

F Auto-transformer stations

Typical appearance of Auto-transformer Station ©RailTechnologyMagazine

Intrusive Auto-transformer Station with harsh materials and fencing ©WJPServices

Station located in the open landscape could be screened by vegetation or landform or both ©ABB

Summary of proposals

Auto-transformer Stations (ATS) are an essential component of the railway regulating and boosting the electrical current that is delivered by the overhead line equipment. Each station consists of a collection of large transformers and electrical equipment, enclosing security fencing and access track. They are the epitome of alien development in the countryside, located at approximately 5km intervals along the route of HS2.

There is one ATS within the project area located to the north of the Trent North Embankment immediately west of the Great Haywood Viaduct and accessed from Mill Lane.

Significance

Auto-transformer Stations are ‘alien’ elements within the landscape. Emphasis should therefore be given to maximising localised screening, reducing clutter and using recessive colour to integrate the facility with its landscape backdrop.

Issues & Opportunities

Issues include:

- Introduction of ‘alien‘ built form/ structures in a predominantly open landscape and negative effect on local landscape character caused by the facility
- Lack of control over exact siting reducing opportunities to mitigate impacts
- Visual intrusion from security fencing, CCTV, lighting, signage (clutter) within the landscape
- Stringent technical and operational requirements reducing opportunity to influence location and design
- Further unwanted urbanisation caused by maintenance access track from Mill Lane, fencing, signage and possible lighting
- Although proposals include woodland to screen unwanted views from Mill Lane the effectiveness of this screening is likely to be significantly diminished by sightlines for the entrance and the need to accommodate a new drainage ditch close by.

The facility is currently proposed at a minimum of 15m from Mill Lane and will almost certainly to be visible from the public highway. This will be visually intrusive and will also compromise the presentation of the viaduct and its northern abutment.

Opportunities:

- Limited by technical and safety requirements.
- Use of fencing types to balance requirements for security and safety against visual intrusion.

Suggested design modifications

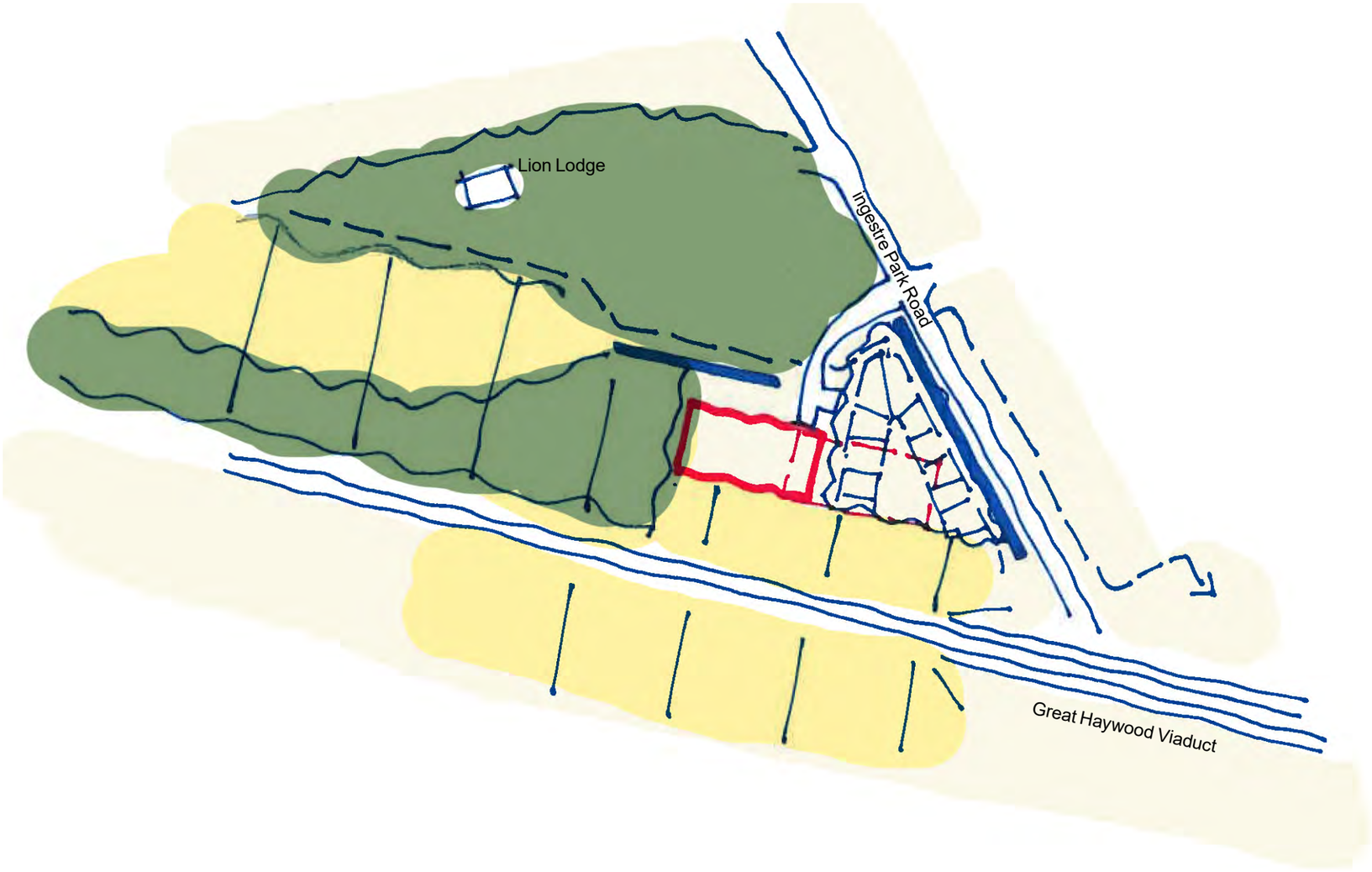
Designers should investigate the following (numbers in brackets reference to the sketch plan):

- Move to auto-transformer station westwards by approx. 35m by adjusting proposed landscape earthworks (1). The alignment of the access track could remain unchanged.
- Site the station low down in the landscape.
- Realigning the proposal ditch (3).
- Increasing the width of the woodland screen and potentially vary additional landform (4).
- Provide additional hedge and woodland screening between the auto-transformer and adjacent existing Lion Lodge Covert (5).

This would provide effective screening of views from Mill Lane without adversely affecting the setting of Lion Lodge Covert.

The maintenance access track should be of minimum width, with a carefully considered entrance and well set back access gate, visibility splays kept to a minimum and large vehicle overruns surfaced with cellular reinforced grass system or similar. The access route and carriageway should mimic an agricultural track, avoiding the use of kerbs and surfaced with a simple dense bitumen macadam, secured with an agricultural field gate or similar and discrete signage (6). The secure line should envelope the facility and be compliant with HS2 security requirements. Any fixed lighting should be manually controlled and used only at times of maintenance access (7). Associated service elements and clutter should be kept to a minimum to reduce urbanisation of the surroundings.

These changes should ensure that awareness of the facility is significantly reduced.



Mill Lane ATS, Illustrative sketch plan

G Ponds - balancing and ecological mitigation

Introduction

The project area includes proposals for four balancing ponds and 13 ecological mitigation ponds associated with the alignment within Act Limits but outside of Operational Limits. Many kilometres of ditches will collect and discharge water from the track. The balancing ponds in particular are large elements (> 1ha). Collectively these elements have significant potential effect on landscape character, trees, ecology and the successful integration of HS2 and the landscape.

Issues and opportunities

These features have the ability to be harmful in a similar way to auto-transformers – through their direct impact and through their supporting infrastructure such as access and fencing - with a combined result of unwanted, but avoidable, urbanisation. The fact that effective drainage and attenuation are essential to an operational railway and that ecological ponds provide mitigation should not be at the detriment of landscape character and landscape integration.

Careful and location-specific design can avoid these negative landscape impacts and even provide additional ecological benefits.

Balancing ponds

Designers should:

- Obtain a clear understanding of the engineering requirements of the facility (its purpose, volume, return period, freeboard and intake/ discharge systems).
- Obtain an equally clear understanding of the ‘art of the possible’ with regard to potential ecological mitigation and landscape fit (whether planting or over-deepening to create standing water is permissible, maximum slope gradients etc.).
- Have preference for ponds that are mainly excavated with raised containment berms kept to the minimum (to aid landscape fit and ecological benefit). If this is not possible consider two or more linked ponds.
- Use shallow (>1:7) outer faces of berm that are ‘feathered’ into existing ground profiles.
- Use steeper inner faces generally with cut faces up to 1:3.
- Use two or more multiple stage inner slopes to avoid the need for safety fences.
- Use these stepped slopes as the basis for ecological mitigation in possible combination with different soil profiles and/or planting and seed mixes.
- Exercise extreme care in the design and location of engineering elements such as inlet / outlet pipes, headwalls, grilles etc. keeping them to the minimum to reduce visual clutter.
- Avoid at all cost the need for security and/ or safety fencing, using suitable locally styled. timber post and rail or stock fence if access is to be deterred.
- Treat with care all required access tracks, bell mouths etc. ensuring these are kept to the minimum (see Section 5.2 F, Auto-transformer station for further guidance on accesses)
- Shape and footprint: footprint considerations contain a trade-off between efficiency and complexity (with a simple circular pond being the most space-efficient). If space and assurances permit more complex forms can be used especially where landscape fit is a consideration and/ or ecological mitigation can be introduced (slacker slopes, islands etc.). Naturalistic forms echoing the local landscape would be the default approach but there may be opportunity to consider more stylised ‘land art’ approaches.

Ecological mitigation ponds

Much of the above applies to ecological mitigation ponds which are generally much smaller and have no direct hydrological function. Designers must:

- Be fully aware of the mitigation required/ included in the Environmental Minimum Requirements (general, habitat, species specific, etc.).
- Understand the management requirements and arrangements for the proposals.
- Set clear ecological objectives based on the above.
- Design to meet these objectives.
- Consider water supply/ discharge context (ditch, ground water, scrape).
- Avoid the use of butyl/ synthetic liners.
- Avoid any potential safety issues through the use of stepped edge profiles and side slope gradients.
- Use local style timber or stock fence if access is to be restricted.
- Reference local pond features in design of footprint and shape.
- Determine approach to achieve vegetation cover (natural colonisation/ starter kit of limited planting/ seeding/ full completion on day one)

These ponds must be considered as part of the wider ecological habitat whether existing, enhanced or proposed. See Section 5.2 H Ecological corridors.

Well vegetated informal two stage channel/ ditch ©Susdrain

Attenuation pond and meander at Batheaston, River Avon. Ecological features include scrapes, wetland and scrub mosaic. The feature takes run off from the A4 Batheaston Bypass. ©2019 Google

Well integrated mitigation pond ©Susdrain

Well integrated attenuation pond, Wetherby Services ©AnthonyDixon

Ecological mitigation ponds providing habitat and amenity value at Attenborough Nature Reserve ©RichardRogers

Drainage ditches

Standard trapezoidal section ditches are assumed, sized in accordance with estimated flows. Large ditches and/ or ones with variable flows should use two stage channel sections. Side slope gradients and maintenance access requirements should meet local requirements.

Footpath crossings, piped inlets, grilles etc. should be designed carefully keeping infrastructure to the minimum, siting sensitively and using elements and materials that are appropriate to their landscape context.

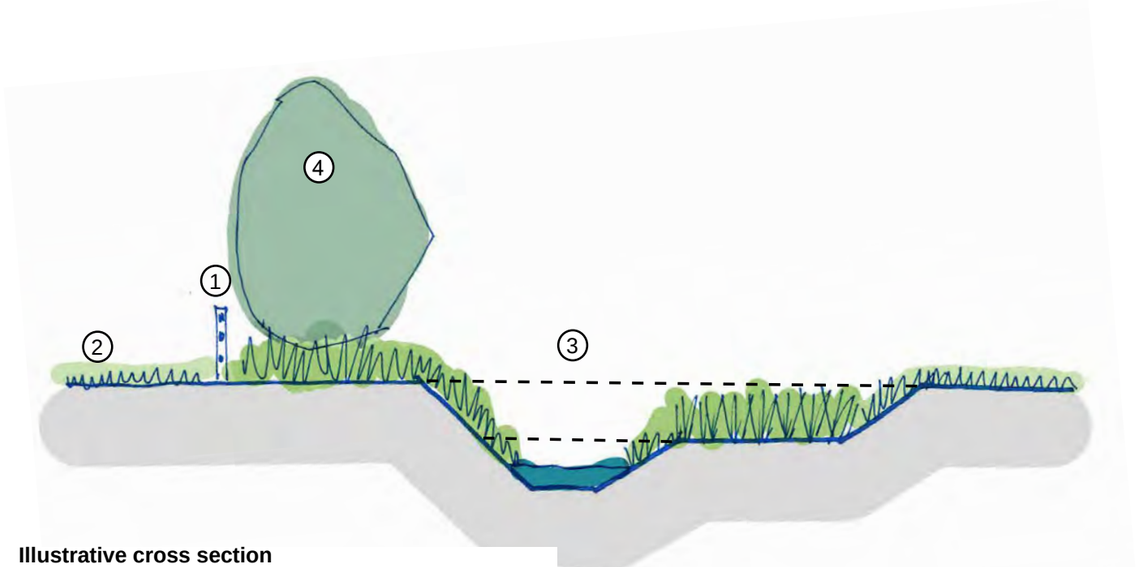
Location specific guidance

Balancing pond south of Trent South Embankment (Ch 205.250): Fed by >1.5km ditches draining extensive embankment slopes, ditches are therefore likely to be of considerable size. The ecological potential of this ditch corridor should be exploited. The pond outflow needs to be resolved. The relationship of the pond to the surrounding proposed woodland needs resolution and the permissibility of creating wet woodland within the pond investigated, likewise the ecological possibilities for the pond sides and base. The access track (>300m length) requires careful handling and treatment as an agricultural track.

Balancing ponds north and south of western end of Great Haywood Viaduct (Ch206.250): Both ponds have considerable potential for significantly increased landscape fit and provision of landscape and ecological amenity. This should include consideration of their shape, visual and physical access, proposed surrounding woodland and maintenance access arrangements.

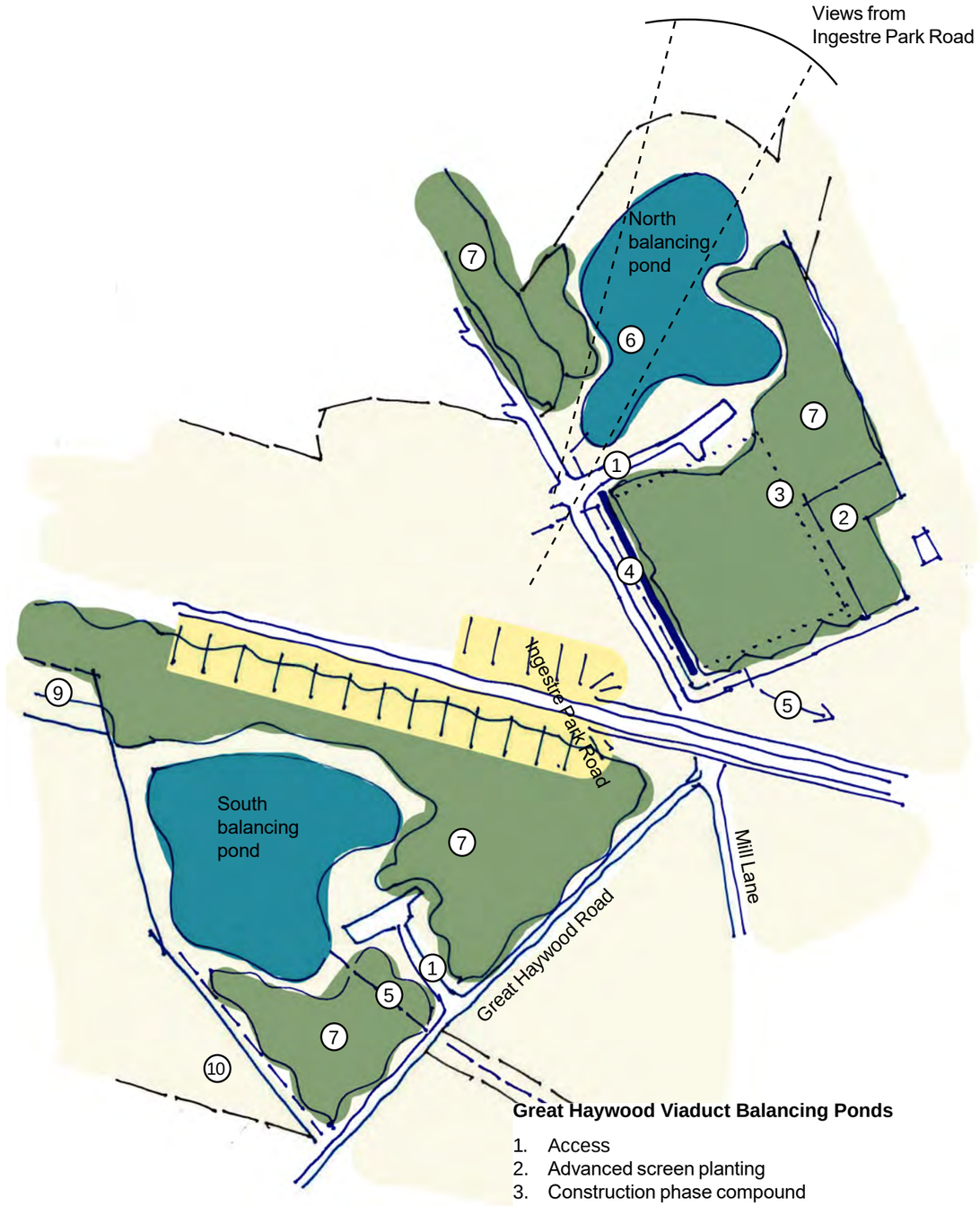
Balancing pond south of Hopton embankment (Ch 209.700): Designers should consider carefully the relationship of the pond and the nearby Trent Walk so that it can provide visible landscape and ecological amenity.

See Chapter 6, alignment related sketch plans for further suggestions.



Illustrative cross section

1. Fence
2. Meadow grass
3. Two stage ditch/ channel
4. Semi-mature hedge



Great Haywood Viaduct Balancing Ponds

1. Access
2. Advanced screen planting
3. Construction phase compound
4. Advanced planting perimeter hedge bank screen
5. Realigned ditch connection
6. Naturalistic balancing pond, openness maintaned, views to pond and flood plain from Ingestre Park Road
7. Proposed woodland
8. Ecological flows for balancing pond design. Variation of water conditions and slopes etc
9. Local adjustment of permanent land take to provide widened woodland screen
10. Matching adjustment of permanent land take with land returned to agriculture

H Ecological corridors

Introduction

Chapters 2 and 4 set out the ecological baseline condition and the Ecology General Design Principle (GDP) respectively. This section provides guidance on how this GDP can be delivered.

The ecology of the project area is rich and varied but still capable and deserving of significant enhancement, so issues and opportunities arise from protection, conservation and enhancement to the creation of new habitats.

Act Limits

Ecology knows no boundaries. This guidance applies equally to areas within and beyond Act Limits. It has an overarching principle of maximising connectivity.

Five Levels of Connectivity

Designers are encouraged to consider all five levels of connectivity to ensure that ecological provision is effective and that synergies are maximised.

Level 1 - Agreed ecological mitigation: current proposals include extensive ecological provision to achieve a position of 'No Net Loss'. These include creation of a variety of habitats – woodland, grassland, wetland and others – and are shown on HS2 proposals drawings. Designers need to maximise the effectiveness of these proposals by:

- Developing designs through reference to local conditions established by ecological surveys of each site's context. This will ensure optimal match with local species and assemblies, and improved chance of successful establishment.
- Understanding management responsibilities and agreeing regimes and proposals that are appropriate, achievable and mutually supportive.

Level 2 - Effective and connected assemblies: designers should look beyond the measurement-based provision of mitigation under Level 1. The location of and interface between the same area (m2) of the same mitigation can yield significantly different results. Designs should be holistic and consider in particular movement corridors and connections of fauna, flora and water. Maximising the amount of 'edge' between habitats and the micro-design of this edge (intricacy, aspect and variation) will significantly improve the quality of mitigation.

Level 3 - Added ecological value of other HS2 proposals: most of the detailed design principles in this chapter refer to engineering and railway-based elements. This does not preclude the inclusion of ecological considerations in their design solutions and construction provided this is not detrimental to its primary function. Guidance under Section 5.2 G Ponds is a prime example.

Level 4 - Making good after construction: Section 5.2 A provides specific guidance on this very extensive operation. In ecological terms it raises important questions of both alternative means and endpoints of 'making good'. Returning to previous conditions should not necessarily be the default position particularly for ecology where relatively minor changes could reap substantial ecological benefits.

Level 5 - Extending beyond Act Limits: Act Limits are an arbitrary line determined by the assumed extent of land required during construction which will be invisible provided making good after construction is appropriate and effective. For all the effectiveness of Levels 1 – 4 above, real benefit lies in connecting to and enhancing existing ecological assets outside Act Limits. This is one of the key opportunities for Part 2 of this project – Enhancement Projects. The above strategies and guidance should be applied.

Landowner agreement

Ecological corridors are particularly dependent on the agreement of respective landowners, their anticipated future use of the land, and their ability and willingness to co-operate with and/ or deliver appropriate land management. Establishing individual positions will take time and opinions may change. Ecological corridors need therefore to be robust by:

- Proposing a network of routes with some degree of inbuilt redundancy – this will reduce the chances of harmful gaps.
- Connecting to known existing areas of ecological value/ management.
- Focusing on elements where HS2 has control (drainage ditches, access track corridors, balancing ponds etc.) to maximise ecological gains.
- Adjusting proposals to known attitudes of landowners ('pushing on the open door').
- Developing a strategy that can be delivered over time as funds and conditions permit.
- Reinforcing investment and grasping opportunities set up by HS2 proposals, notably the two green bridges and the Great Haywood Viaduct.

The European Greenbelt forms an 12,500 kilometre Pan-European ecological corridor from Finland to Greece located in the former Iron Curtain ©Lifegate

J Vegetation including lineside slopes

1 2 3 4

Introduction

This section refers to vegetation both inside and outside of Operational Limits. Vegetation refers to material that is either planted or sown and ranges from woodland to grassland and includes scrub, heathland, wetland and hedgerows.

The scale of planting varies from largescale mitigation for habitats lost through construction, to small-scale landscape treatments within Act Limits and outside, as Enhancement Projects.

Chapters 2 and 4 describe the baseline condition and relevant General Design Principles. The Study Area contains landscape and habitats of value with existing vegetation contributing significantly.

Significance

Vegetation proposed is crucial to integrating the scheme into the surrounding landscape, reducing the overall severance, visually and perceptually. Vegetation anchors and integrates, connects and rehabilitates habitats, screens views and enhances landscape character and time-depth.

Issues & Opportunities

Potential issues include:

- Inappropriate planting (out of keeping with local landscape character/ enclosure of the open valley landscape).
- Inappropriate/ inadequate management.
- Poor establishment (incorrect species and/ or poor implementation).
- Failure to deliver promised mitigation.
- Drawing attention to HS2 (exaggeration of linear expression of scheme in the landscape).

Opportunities:

After structures and landform, vegetation presents the greatest opportunity to influence perception of the railway and its integration into the local landscape.

- Habitat connectivity.
- Enhanced quality.
- Improved or focused setting to historic features.
- Framing of key views across the landscape.
- Increased resilience to pest, disease and climate change.

Guidance

Effective integration will be dependent on a seamless join with its landscape context. This in turn will be dependent on an excellent understanding of local landscape character and in particular its vegetation. Designers should:

- Familiarise themselves with local landscape character (study of relevant landscape character assessments and personal knowledge of the immediate context of the line)
- Where appropriate undertake detailed site assessments to understand species, assemblies and local idioms whether designed or semi natural. (e.g. adjacent to proposed green bridges, on ecological corridors and site-specific design opportunities such as the A51 underbridge ‘Gateway’)
- Anticipate super-local environmental change caused by HS2 (changes in drainage patterns, site conditions after making good etc.)
- Ensure effective delivery of mitigation included in HS2 proposals by reference to the Environmental Statement, Assurances and after relevant documents. This applies equally to screening, replacement of lost landscape features, ecology or making good construction access
- Understand the ability and willingness of landowners to provide or organize subsequent land management
- Chose techniques and species/mixes that are both locally appropriate and have good chances of rapid and effective establishment. Base choices on good site knowledge (soils, slopes, aspect and drainage) and suitable implementation techniques. Reference local knowledge / experience; observation of local species and varieties; and consider field trials
- Local provenance: HS2 guidance applies and should guide where and how local provenance material is used. Local donor matched seed should be used close to SSSIs, nature reserves and other sites that are flora-sensitive

HS2 documents should be referenced where appropriate and augmented by local investigations as noted above. Designers are encouraged to make use of the considerable local embedded knowledge particularly in relation to SSSI, nature reserves, the National Trust, rivers and waterways.

Mixed native hedgerow used to define boundaries, screen/ foil structures and fencing and connect habitats

Native locally sourced planting integrating new equestrian overbridge on the A34 Chieveley/ M4 Junction 13 within the North Wessex Downs AONB. New planting linked into existing adjacent woodland and downland, in keeping with landscape character. ©Google

Radford Meadows nature reserve. Restoration scheme included scrapes to help retain flood waters in the River Penk floodplain. ©StaffordshireWildlifeTrust

Allimore Green SSSI, traditionally managed wet grassland ©StaffordshireWildlifeTrust

Lineside slopes

Lineside slopes include cuttings, embankments and other land within Operational Limits. All such areas are controlled by obligatory technical and operational requirements of the railway. Technical requirements include slope stability and erosion control. Operational requirements include an overriding assumption on minimum maintenance and zero impact on the railway's operation (caused by either the maintenance operation itself or other impacts such as leaf blow).

Designers should reference HS2 technical guidance and evolve solutions that are appropriate to local landscape character.

Cuttings will have the greater technical restrictions resulting in a likely land cover of grassland, the species mix of which should relate to local semi-improved grassland or meadow species compositions.

Embankments provide greater need for screening (especially of embankment-top noise barriers) and greater opportunities. Many of the embankments in the project area consist of steep-sided engineering landforms completely or partly overlaid by shallower landscape fill. Designers need to establish and work to the restrictions on planting materials in both of these conditions. Considerations should also include the risks of vegetation and root damage, wind-blow, and leaf fall; poor establishment and subsequent management; and poor landscape fit.

Lineside slopes can contribute positively towards the integration of railway and landscape and should follow other guidance provided above. Care should be taken to avoid accentuating awareness of the railway's presence through screening that emphasises its visual severance (i.e. extensive narrow and even width planting strips parallel with the alignment). With the exception of noise barriers – where hedges are likely to be the most appropriate – visibility of the railway should be generally reduced by creating a series of planted buffers placed in depth within and beyond Act Limits. This 'foiling' rather than 'screening' is more appropriate to the multiple viewpoints and local landscape character of the project area.

Lineside grassland might become attractive to hunting fauna such as Barn Owl which might then cause bird strike. Specialist advice should be taken as to risks and deterrents.

Parkland trees

The project area, particularly west of the River Trent, contains numerous excellent specimen parkland trees many of which are at their height of maturity. They make significant contribution to local landscape character and are landscape assets in their own right. Proposals within and outside of Act Limits should respect the setting of these trees. Proposals should also consider production of a strategy for their conservation and interpretation including proposals for next generation planting. Designers should distinguish between woodland and parkland planting, observe the species, grouping, location and setting of the latter, and avoid the temptation to over-provide replacements and cause visual clutter.

Careful slope gradients marrying into existing land form, with landscape and ecological planting in the Devil's Punch Bowl SSSI for the A3 Hindhead ©Natural England

Mature specimen trees make a significant contribution ©Daderot

Blakeshall Common - restoration of 19ha lowland heath ©NationalTrust

6 Alignment related sketch plans

Purpose

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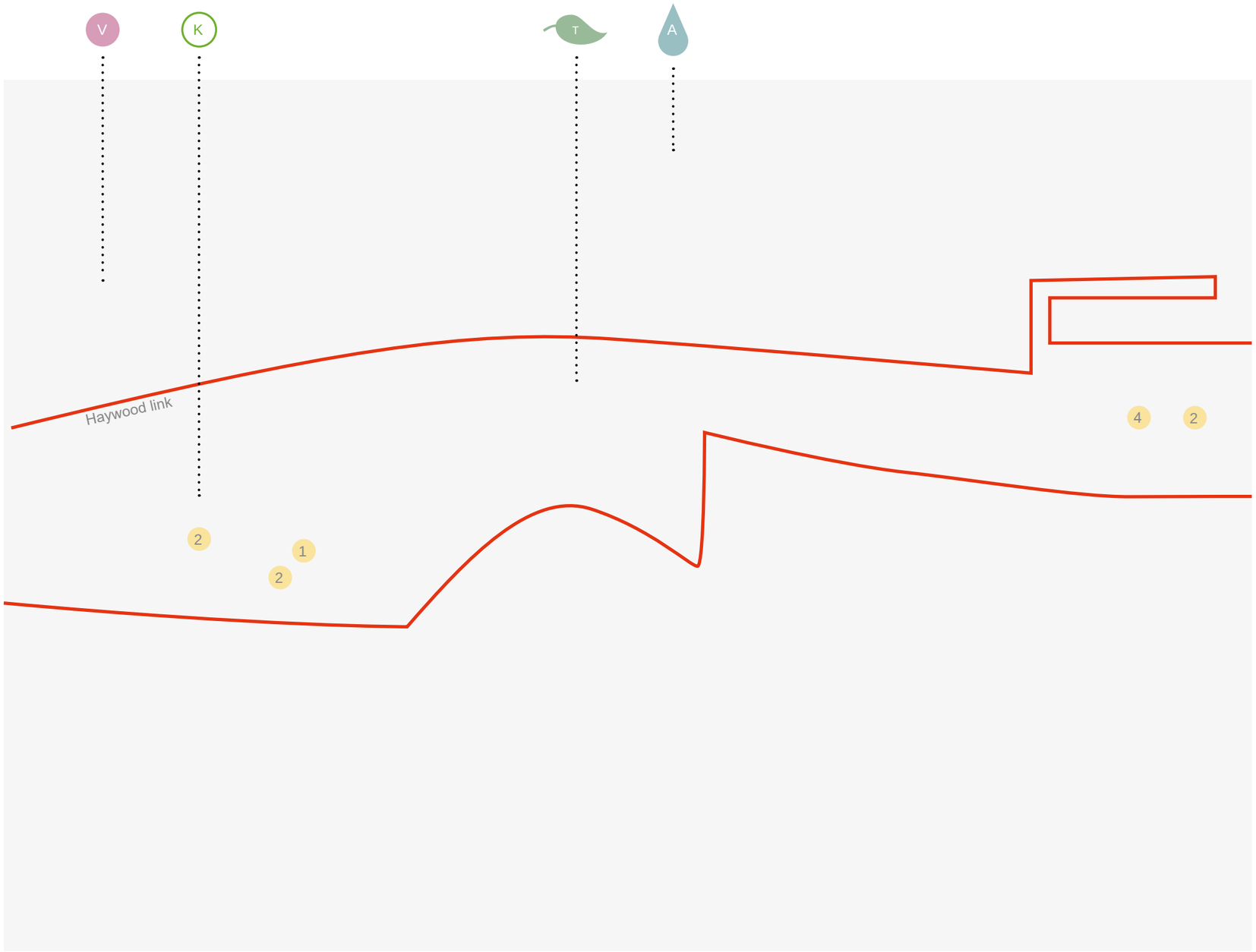
Illustrative sketch plan 1
Great Haywood Viaduct (Sheet xx)



Target notes

1. Additional land modelling
2. Alternative footpath alignment
3. North Link
4. Planting modified, landform unchanged
5. Grassland habitat creation
6. Park Farm ecological corridor
7. Currently proposed woodland reduced; increased (7A)
8. Additional footpath link
9. Woodland habitat creation
10. Potential cutting reduction
11. Hedgerow strengthening

Legend

1. Act Limits
2. Relianged public path to the scheme at Royal Assent proposals
3. Additional recommended path/revised alignment of the scheme at Royal Assent proposed path
4. Existing path
5. Lineside slope
6. Noise barriers
7. Ancillary building
8. Existing and proposed woodland within Act Limits
9. Ecological mitigation (g: grassland; w: wetland; t: woodland)
10. Potential additional projects
11. Land potentially subject to proposed management agreement
12. Returned to agriculture
13. Component (refer to detailed design principles)

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7 Sketch Masterplan

Illustrative masterplan

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