Chilterns AONB

HS2 Chilterns Enhancement and Integration Plan (CEIP)

Part 1: Detailed Design Principles

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Environmental Planning
Design & Management

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1. Introduction

1.1 Background

A Special Landscape

1.1.1 The Chilterns AONB was designated for its outstanding natural beauty. The elements of natural beauty are set out in the Chilterns AONB Management Plan (2014-2019) as special qualities. These include the steep chalk escarpment with areas of flower rich downland, ancient woodlands, commons, tranquil valleys, the network of ancient routes, villages with their brick and flint houses, chalk streams and a rich historic environment of hillforts and chalk figures.

The Chilterns as Context

1.1.2 HS2 will pass through the Chilterns AONB, partly in tunnel (with vent shafts) and for some 9km above ground in a combination of cutting and on viaduct. At the northern extent it cuts through the escarpment within the Wendover Gap into the flat vale landscape which forms the immediate setting to this part of the AONB. The Chilterns is the only section of nationally protected landscape along the route of HS2 Phase 1. AONBs have the highest level of protection afforded to landscape in the UK, and there is a duty on public bodies to have regard to the conservation and enhancement of their natural beauty.

The Story so Far

1.1.3 In their petitioning to the House of Commons and the House of Lords Select Committees, the Buckinghamshire local authorities together with the National Trust and the Chilterns Conservation Board have made the case for a more sensitive landscape-led approach to HS2 within the nationally protected AONB.

In response, HS2 Ltd agreed the following measures:

I To establish a Chilterns AONB Review Group, bringing together the local authorities affected by HS2 in the Chilterns, the Chilterns Conservation Board (CCB), Natural England and other bodies as necessary.

II To fund the running costs of the Review Group, including a dedicated post to support the work of the Group and this commission.

III To fund (up to £3m) the implementation of projects to further integrate the scheme into the AONB landscape - over and above the mitigation identified in the Environmental Statement/ pursuant to the Hybrid Act.

IV To fund a consultancy commission (the 'Chilterns Enhancement and Integration Plan') to develop:

a Design principles that could reasonably be applied to HS2 works in the Chilterns AONB and its setting, which aim to achieve **an exemplar landscape design for the project.**

b Additional environmental integration and enhancement measures that may further integrate the scheme into the AONB (in the form of a Plan - commonly known as Additional Projects).

This document will be supported by a separate document on the Additional Projects (Part 2) which aims to integrate and embed the railway within the wider landscape setting. The two parts work together to create a cohesive and connected plan for HS2 through the Chilterns and its setting.

Assurances

1.1.4 The following assurances were provided, which all contractors will be expected to comply with:

1. "The Promoter will require the nominated undertaker to work with Chiltern District Council in developing design principles that could reasonably be applied to the design and appearance of HS2 works in the Chilterns Area of Outstanding Natural Beauty (AONB) to ensure that they provide appropriate guidance for HS2 works in the AONB. These design principles must be consistent with the operational requirements of the railway, implementable within the allocated HS2 budget and the powers in the HS2 Bill and in accordance with any other relevant approvals required under the Bill, consistent with the HS2 EMRs, and material to the consideration of requests for approval under Schedule 17 of the HS2 Bill."
2. "When developing its detailed design for building and construction works (including landscaping) in the Chilterns Area of Outstanding Natural Beauty (AONB), the Promoter will require the nominated undertaker to take into consideration the design principles developed for the HS2 works in the AONB insofar as these relate to the grounds specified in the relevant paragraphs of Schedule 17, have had regard to the nominated undertaker's reasonable comments in their preparation, and have been established and agreed by such time as is required to meet the HS2 programme for development of detailed design for these HS2 works."

3. “The Promoter will require the nominated undertaker to use reasonable endeavours to ensure the design of any earthwork created in the Chilterns Area of Outstanding Natural Beauty (AONB) as a result of the HS2 works, which is subject to approval under Schedule 17 of the Bill, sensitively integrates into its surroundings by respecting natural contours and existing landscape features.”

AONB Review Group

1.1.5 During the passage of the HS2 Act through Parliament it was agreed that an AONB Review Group (AONBRG) would be established. The purpose of the AONBRG would be twofold. Firstly, to agree how a budget of £3m would be spent on additional integration and enhancement projects that would be over and above the mitigation measures provided as part of HS2.

The second purpose of the AONBRG would be to develop a set of design principles that could be used as guidance by HS2 Ltd and their contractors to inform the detailed design of the Route through the Chilterns AONB and its setting. This would be an opportunity to influence the design of the scheme to ensure locally responsive, high quality design that reflects the Nationally designated status and environmental sensitivity of the Chilterns AONB. The terms of reference for the AONBRG recognise that the design principles must be:

- compatible with and so as not to compromise or impact on the construction and operational requirements of the railway;
- within the limits and powers of the Act and not add unreasonable additional cost;
- in accordance with other relevant approvals required under the Act, including any highways approvals required under Schedule 4 and Part 1 of Schedule 33 to the Act;
- consistent with the HS2 Environmental Minimum Requirements; and
- material to the consideration of requests for approval under Schedule 17 of the HS2 Act.

In undertaking this task Land Use Consultants (LUC), working on behalf of the AONBRG, has in some instances identified the natural overlap between design principles and additional projects, which itself is a product of good design and seeks to achieve maximum value from the funds available. It is recognised and accepted that any proposals outside of the powers of the HS2 Act would need to be considered for consent separately by the relevant authorities, secure separate landowner agreements where required and potentially form part of the additional integration and enhancement projects, to be funded by the £3m budget.

This Document (DDP)

1.1.6 This DDP document draws on and complements the detailed design work being undertaken by HS2 in the form of their Design Vision, Landscape Design Approach and detailed Design Documents (key and common design elements).

Together, these documents will inform the design of the rail line and mitigation to be implemented by the Main Works Civil Contractors (MWCC) and the detailed proposals which will form the basis of Schedule 17 submissions for approval by the Local Planning Authorities (Aylesbury Vale DC and Chilterns DC).

The Vision

1.1.7 The elements of natural beauty are set out in the Chilterns AONB Management Plan (2014 – 2019) as special qualities which include the steep chalk escarpment with areas of flower rich downland, woodlands, commons, tranquil valleys, network of ancient routes, vernacular villages, chalk streams and rich historic environment.

HS2 should be a catalyst to improve the natural capital and delivery of ecosystem services in ways that conserve and enhance natural beauty. This landscape scale approach encompasses the wider Misbourne valley and the Chilterns setting to the north of the AONB boundary towards Stoke Mandeville. It connects across the 'Act Limits' to present a coherent approach for the design principles and additional projects. It also looks at wider landscape scale connectivity for recreation and biodiversity.

Chilterns Conservation Board (CCB)

1.1.8 Users of this document should refer to CCB's Position Statement on Development Affecting the Setting of the Chilterns AONB.

Vision

1.1.9 The HS2 corridor through the Chilterns AONB will be a beautiful, resilient and connected landscape

Beautiful An aesthetically pleasing and distinct landscape appealing to the senses especially visually. HS2 will fit the subtle landscape structure and pattern of the valley, plateau and scarp, concealed where possible and celebrated as a superbly designed feature at key locations. Existing valued features and patterns will be conserved with enhanced levels of tranquillity/reduced noise intrusion where possible. Visually discordant/intrusive features that currently clutter the corridor will be removed or mitigated through land management.

Resilient A future proofed and resilient landscape, adaptable to change, especially climate change and extreme weather events and with enhanced ability for carbon capture. To include appropriate new planting to fit the landscape context and renewal/management of existing trees and woodlands. This will include the creation of permeable connected green corridors across the Misbourne valley to aid species movement and careful management of soil and water resources, including management of feeder streams to the Misbourne and creation of new wet habitats.

Connected A connected landscape avoiding severance for people and wildlife, with all land associated with the railway line being in functional use. For people, the valley offers health enhancing and enjoyable outdoor experience through the improvement, creation and connection of rights of way and routes, particularly in relation to existing populations/transport hubs at Wendover, Great Missenden and Amersham. For wildlife there will be a focus on enhancing connectivity of high value habitats at the landscape scale including woodland, chalk grassland and heathland, and core areas for target species. In addition small scale enhancement will seek to create and manage habitats and conditions to allow the everyday and ordinary species of the Chilterns to thrive.

1.2 The Design Principles

1.2.1 A significant amount of work led by the AONB Review Group resulted in the publication of 17 agreed Design Principles (DPs) in October 2016. These principles are to be adopted in subsequent design development within the AONB and its setting by HS2 and its contractors.

The overarching purpose of the Design Principles is the conservation and enhancement of the distinctive and nationally recognised landscape of the Chilterns AONB and its setting. This includes its ecological, heritage and recreational assets. The principles draw on existing policy and guidance relating to the Chilterns AONB including the AONB Management Plan.

The principles contain a number of recurring themes notably integration with the AONB's environment, design treatments that are appropriate to character and special qualities, and overall design excellence.

They offer a starting point for the Detailed Design Principles in this document and the detailed work that will go into HS2 Ltd.'s contractor's proposals for specific locations.

Each of the Principles is considered in turn here:

1 **INTEGRATION**

The railway is integrated into the landscape by design measures that are in keeping with the particular local landscape context and that meet associated ecological, heritage and social objectives.

1.2.2 This document provides a framework for detailed design and on-going management, ensuring that the layout and design of the HS2 route, associated infrastructure and mitigation measures are fully integrated within the landscape character of the Chilterns and its setting. This document encompasses all aspects of natural beauty as set out in the AONB Management Plan, and the local landscape and historic character assessments. This includes the fine grained landform, distinctive pattern and form of woodlands and hedgerow networks, flower-rich downland, chalk streams, network of ancient routes, local vernacular and rich historic environment.

The Misbourne Valley from Kings Lane (photo credit John Morris)

2 MITIGATION

The detailed design seeks to reduce significant effects on landscape character and visual resource identified in the HS2 Ltd Phase 1 Environmental Statement by using mitigation measures which are in keeping with the scenic beauty, character and context of the location.

1.2.3 This document shows how the significant effects identified in the Environmental Statement can be reduced through small scale adjustments and changes to the scheme design at Royal Assent. Section 3 deals with individual components of the proposals. Additional mitigation measures both within the Act Limits and linked to the wider Additional Projects in the Misbourne Valley, Wendover Gap and Chilterns setting, are also identified. Illustrative sketch plans in Section 4 show how this mitigation could be integrated.

Typical Chiltern's character - rolling topography, hedgerows, sparse habitation and wooded crests

3 QUALITY

Where large scale features, such as viaducts, cannot be integrated into the landscape, highest quality design should be adopted to create elegant features of interest, complementary to the character and intrinsic beauty of the Chilterns.

1.2.4 Although these elements cannot be concealed they can be partially integrated in the landscape through appropriate design. Component 3.2, Section 3 deals specifically with the two viaducts at Wendover Dean and Small Dean, and in particular their form, setting and landscape integration. It suggests that within this special landscape these features are best treated as elements of elegant design rather than aiming at being stand-out or iconic per se.

Example mark of quality - Civic Trust Award

4 EARTHWORKS

Design of permanent earthworks avoids change to the character of the chalk landform and its topography of dip slope, ridges, dry valleys and coombes, and all permanent earthworks are designed to integrate with their particular landscape context.

1.2.5 Whilst there will be significant and inevitable change to landscape character irrespective of earthworks design, appropriate design can potentially mitigate some of this change. Conversely inappropriate design can exacerbate negative impacts.

Detail design - including that not directly associated with the line - should take note of local topography so that new landform appears as an extension of existing topography. This is particularly the case at the large earthworks at South Heath portal (Sheet33, Section 4) near Hunts Green Farm (Sheet 35), the substantial false cutting between the two viaducts (Sheet 36), and the Wendover Green Tunnel and alignment to the north (Sheet 38).

Dry valleys and wooded crests, Kingsash

5 WOODLAND

Woodland infill within dry valleys is avoided so as to maintain the pattern of woodland cover along steep valley sides and the plateau top. Preference is given to native species typical of the area that are resilient to disease, while giving consideration to climate change.

1.2.6 The subtle pattern of dry valleys and coombes that intersect the eastern slopes of the Misbourne Valley are a key component of local character. This landform is overlain by a distinct pattern of woodland with larger blocks located on the adjacent plateau tops and steeper slopes contrasting with the relatively open valley sides.

Each of the design components and associated mitigation (Section 3) takes cognisance of local character as set out in relevant assessments. The planting strategy is designed to blend in with character rather than create screening that would serve to highlight the route of the line on the valley side. Selective tree and woodland planting is proposed to conceal key elements including anchoring bridge and viaducts into the surrounding landscape (see 3.2). Visual concealment would be achieved, in part, by a wider initiative of hedgerow strengthening as a potential Additional Project (Part 2).

Mantles Wood and dry valley

6 HISTORY

The small scale landscape structure and pattern of co-axial[1] and other historic field patterns is maintained by respecting and re-instating where possible any historic hedgerows and boundaries that are disrupted (ref. 'Chilterns Historic Landscape Characterisation' 2009)

1.2.7 The Chilterns Historic Landscape Characterisation provides evidence on field pattern and origins, including the pre 18th century co axial fields close to the South Heath tunnel portal, which are severed by the railway. The network of hedgerows and field boundaries create a landscape mosaic, historic record and ecological resource. While in general field boundary restoration is not practical for the land within Act Limits, the restoration and reinstatement of field boundaries is a prime candidate for the Additional Projects (Part 2).

Footnote 1. Field patterns in long roughly parallel lines dating from the pre-enclosure period

One of the ridgetop historic farmsteads, Hunts Green Farm

7 HOLLOWAYS

The character of the distinctive lanes, including holloways, that climb the valley sides to the higher plateau land and form part of the fabric of this historic landscape is respected. As far as possible, these lanes should be conserved (including truncated sections); restored where disrupted during construction; or, where sections are replaced, their character is reflected in the design of the new sections.

1.2.8 Section 3.5 specifically covers this design principle using a worked example of Liberty Lane together with detailed general and site specific guidance. Although outside the scope of this document equal attention needs to be paid to significant potential impacts likely to be caused by construction access.

Bowood Lane (holloway). Hedges should ideally be higher and less managed.

8 RIGHTS OF WAY

Where rights of way are severed, diversions will maintain the overall countryside experience, connectivity and enjoyment of the landscape and, where possible and desirable, the length of diversions will be minimised.

1.2.9 Whereas the location and extent of temporarily or permanently diverted rights of way is essentially fixed there are still important opportunities to mitigate the experience of the users of these routes. This experience will be substantially altered through these diversions and by the inevitable operational effects of the line. This is likely to result in changes in the pattern of use, particularly of routes that traverse the valley side.

Mitigation could be achieved through further extension of the footpath and bridleway network both through the addition of critical missing links and also through the provision of longer lateral links parallel to the line, particularly for cyclists. This will provide added choice and an expanded network and could be delivered through Additional Project funding. The proposals for the Wendover Link (Section 3.13) and the north side link (Section 4 sheets 33-36) are examples.

The quality of these routes is also important with associated hedgerow planting/ strengthening to provide added screening and biodiversity.

In some places existing vantage points will be inevitably lost and new vantage points will need to be created such as south of Jenkins Wood at South Heath.

This expansion of the network can extend beyond Act Limits by means of potential Additional Projects, and could include consideration of strategic and longer distance paths especially to the north-west and south-east, including the Colne Valley.

Public rights of way are numerous and well-used

An essentially rural landscape with dark skies and considerable tranquillity

9

NOISE AND LIGHT

The impact of noise and light from the operation of the railway on the tranquillity and dark skies of the rural landscape and settings of its historic assets, is minimised with remaining impacts mitigated by measures that respect the local landscape character.

1.2.10 The acoustic measures, standards and assurances given by HS2 are set out in the Environmental Statement and other proposals covered by the Act. Wherever possible detailed design should seek to maximise the effectiveness of these measures and their integration into the Chilterns landscape. (For example opportunities to place noise screening at the base or inside face of cuttings rather than being visually exposed on the top of embankments.) These are illustrated through the detailed design principles and components in Section 3. Landscape integration will take account of other factors including maintaining the integrity of historic environment resources.

The Misbourne Valley currently experiences relatively dark skies and will continue to do so. Lighting associated with the construction and operation of HS2 will be limited to that required for technical and safety standards with appropriate mitigation and cut off, to prevent wider light glare within the valley. There is a presumption of no operational lighting on the alignment through the Chilterns. Maintenance task lighting (mainly around portals/ vent shafts and viaducts) will conform to industry standards for minimising light pollution.

Visual disturbance, noise, light pollution and the effects of motion have been noted by the Chilterns Conservation Board[1].

Footnote 1. See CCB model planning policy for the Chilterns AONB for use in Local Plans. This includes reference to 'Tranquillity, dark skies and remoteness and the need to avoid intrusion from light pollution, noise and motion.'

10 STRUCTURES

All structures should respect and respond sympathetically to the distinctive rural character of the AONB, including its historic buildings and their settings.

1.2.11 Structures range in scale from the two viaducts, bridges and ancillary buildings to more prosaic elements such as culverts, noise barriers and overhead line equipment. Whilst the location of these elements is broadly fixed, their expression is yet to be determined. Almost without exception the delivery strategy of this design principle will be based on reducing visual intrusion either by concealment or by integration both of which will subject to the overriding Detailed Design Principle 1.

Any concealment should use local landscape elements and materials to avoid the means of concealment being intrusive in itself.

Reducing visual intrusion should focus on design excellence, simplicity and elegance of form, avoidance of clutter, the use of recessive colour and appropriate materials, and on a clean insertion of the new elements into the existing landscape with damage limited.

Durham Farm and the immediate context of the proposed Wendover Dean Viaduct. The farm will be demolished.

11 HYDROLOGY

The hydrological and physical characteristics of the chalk landscape and associated dry valleys are respected in the design, in particular ensuring water attenuation features are well designed and integrated within the existing landscape, with potential for providing wildlife habitats.

1.2.12 The essential discharge of surface water into a dry chalk landscape poses particular design issues where ditches and ponds are not common local features. This is specifically covered in Section 3.6.

A dry and generally open landscape with few ditches or waterbodies, by James Harrison, CC BY-SA 2.0, via Wikimedia Commons

12

ECOLOGY

Opportunities are sought to reduce ecological fragmentation by facilitating ecological permeability of the route and creating/enhancing valuable habitat to improve connectivity across the route. Interconnected networks incorporating a range of habitats (habitat mosaics) will improve wildlife connectivity across the wider landscape. All such measures should respect the local landscape character.

1.2.13 The Detailed Design Principles and potential Additional Projects provide opportunities to instigate landscape scale connectivity across the Misbourne Valley linking into ecological networks on the adjacent plateau, escarpment and vale. These include designated/protected habitats and species as well as the everyday and ordinary, such as hedgehogs. Examples are provided in Section 3.3 and in Section 3.2, Wendover Dean Viaduct, where the proposal includes a programme of habitat reinstatement and long term management to funnel to this key HS2 crossing point.

The potential Additional Projects will seek to connect along and across the valley including enhancing permeability and connectivity in relation to the existing linear transport corridors (A413 and Chilterns rail).

Ecological connectivity and landscape character combined, holloway below Chesham Lane

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GREENING

Greening of bridges, wildlife underpasses and other design solutions, are considered in order to minimise disruption to wildlife movement and habitat connectivity, deliver a range of other ecosystem services benefits, and improve integration with the landscape surroundings.

1.2.14 Although current proposals do not include large scale green bridges, all opportunities to explore a degree of greening to both existing and proposed bridges over the line should be considered. Guidance in Section 3.4 covers both the detail and how to maximise ecological synergy with provision on either side of the bridges. The proposals will enhance people's experience of crossing the rail line, help visual integration, and provide connectivity for wildlife movement. All proposals would of course need to be compatible with the construction and operational requirements of the railway.

Local example of a 'greened' overbridge on Lamberhurst bypass

14 CLUTTER

The use of additional infrastructure such as fencing, signage and lighting is minimised to reduce visual clutter and is designed to integrate with its particular context.

1.2.15 Visual clutter is at odds with both the Chilterns landscape and a high speed railway and its reduction should be a common cause. This is notably the case for repeating vertical elements (particularly overhead line equipment (OLE) and signals) within the valley, and clutter associated with the A413. Reducing the number of such elements needs to be balanced with their technical and safety requirements. The key word is therefore 'visual' – the extent to which these elements are seen. This in turn is a result of the siting, scale, materiality, colour and screening of these elements in a similar way to that of structures under Detailed Design Principle 10.

There are also opportunities under the Additional Projects (outside Act Limits) to undertake enhancements works which mitigate the visual impact of intrusive elements through appropriate screening including promoting a connected field boundary network throughout the Misbourne Valley.

Another particular opportunity involves signage both within and outside Act Limits (as a potential Additional Project). Signage should be kept to the minimum in Hs2 related works and other existing signs subject of review to remove those that are redundant or replace with more suitable signs.

Landscape clutter, (photo credit David Levenson from Alamy Stock Photo)

15 VERTICAL ALIGNMENT

Options for adjusting vertical alignment to reduce landscape and visual impact should be fully explored.

1.2.16 The contractor's proposals may vary the vertical alignment to the extent permitted by the Act, and provided that the environmental effects are no greater than those reported in the Environmental Statement. Given that there is a very substantial excess of cut in this section it is more likely that contractors will seek to raise the vertical alignment if at all. Those reviewing the Schedule 17 submissions should pay close attention to any proposed changes in vertical alignment and the extent to which this might involve increased visibility of the line and trains. If this is the case a concomitant increase in appropriate mitigation would be expected so that resultant visual effects are similar to that within the Environment Statement.

There is however opportunity to reduce the visual impact of ancillary works by lowering them into existing ground profiles and these are covered in Section 3.10, Vent Shaft buildings, and in Section 3.6, Infiltration & Ponds.


Minor changes in the vertical alignment could have significant changes in effect especially where the alignment traverses the valley side

16 CUTTINGS

Options for reducing the width of cuttings are considered where there are opportunities to reduce harm to landscape character, wildlife habitat, historic assets and their settings, including ancient woodland.

1.2.17 The scheme at Royal Assent proposals and Environmental Statement assume reasonable ground conditions and cutting face grades. Indications are that actual ground conditions may be better than expected and that cutting faces can be steeper in places. If this is the case the default position would be to steepen the cutting face and reduce the footprint of that cutting. However designers should be aware of other potential opportunities such as the introduction of a stepped upper profile of a cutting to accommodate either noise barriers and/or security fencing (and reduce their visual intrusion) or the introduction of a rollover profile at the top of the cutting.

A reduced width of cutting on the Chiltern Tunnel North Portal approach would particularly benefit the setting of Jenkins Wood

17 WIDER ENHANCEMENT

When developing proposals for mitigation for the Hs2 scheme, consideration should be given to how this mitigation might also contribute to wider landscape enhancement.

1.2.18 The Detailed Design Principles set out in this document apply to the work undertaken by HS2 within 'Act Limits'. These cannot operate in isolation and have been worked up to consider integration across 'Act Limits' and within the wider Misbourne valley and Chilterns setting. As such they provide the foundation for the Additional Projects to be worked up with stakeholders as a separate but fully integrated document (Part 2).

Act Limits and beyond...

1.3 Scope & Purpose

Coverage

1.3.1 The Detailed Design Principles (DDP) focus on the above ground impacts of HS2 within the Chilterns AONB and its setting. With the exception of vent shafts and ancillary buildings associated with the tunnelled section the area directly affected by HS2 will stretch from the north portal at ch 47.150 to the AONB boundary. Our study area extends by approximately 1.5km beyond this boundary to cover issues that might affect the setting of the AONB. (See Chilterns Conservation Board Position statement on development affecting the setting of the Chilterns AONB). If and where appropriate, selected principles could be applied to other parts of HS2.

Audience

1.3.2 The DDP 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. This document will be a material consideration when submissions under Schedule 17 are reviewed by Local Planning Authorities.

The use of checklists and direct referencing of the Detailed Design Principles aims to facilitate this process. The document structure provides high level information under the Strategy section, detailed guidance on different functional elements under the Components section, before illustrating how both can be brought together in the final section of illustrative sketch designs for the complete above ground alignment.

Within Act Limits

1.3.3 Act Limits have been taken from the 2015 scheme at Royal Assent 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. Any changes to the default position of a return to previous uses would require the agreement of the landowner.

Outside Act Limits & Additional Projects

1.3.4 The Detailed Design Principles forms one part of a commission that also includes the identification of Additional Projects. These Additional Projects will be funded separately from a £3m budget to be used for either integration or enhancement works / initiatives in the wider landscape outside Act Limits.

Our approach to both the Detailed Design Principles and Additional Projects has been that of a One Landscape design – investigating issues and opportunities regardless of whether they fall within or without Act Limits. We consider this vital to maximise both the delivery of the design principles, and to achieve full synergy between initiatives that extend into the wider AONB context. These wider strategic opportunities are particularly considered in Section 2, Strategy; and in greater detail in the separate Additional Projects document (Part 2).

Location plan to show coverage of DDP

2. AONB Context & Strategic Approach

2.0 Introduction

2.0.1 **Scope:** This section sets out a series of high level strategies for a number of key aspects of the Chilterns most likely to be directly affected by HS2. Because of this it considers primarily the above ground alignment. Issues connected to vent shafts on the Chiltern Tunnel are important but local and are therefore covered under Section 3.10.

The area covered by the strategies and remainder of this document stretches from the north portal of the Chilterns Tunnel at South Heath to approximately 1.5km beyond the AONB boundary on Nash Lee Road, north-west of Wendover. This 1.5km extends the study into the setting of the AONB and was agreed by the AONB Review Group.

2.0.2 **Characteristics and study zone:** The environmental character of this area is described through a number of key attributes and themes. These are not exhaustive but considered appropriate to both describe the AONB and to guide future action in particular the area's response to HS2. The width of the zone likely to be most affected is approximately 3km wide – roughly the width of the Misbourne Valley. Although some effects will almost certainly be experienced beyond this zone we believe most of the effects and therefore most of the focus of both this document, and its companion document on Additional Projects, should be on this zone.

2.0.3 **Baseline:** Each of the chosen attributes/themes is presented as a brief high level snapshot of the baseline condition, and on the facing page the recommended strategy and the main opportunities that could be realized through the Detailed Design Principles. The exception is the first theme of Landscape Character which is treated on a single page.

2.0.4 **Act Limits:** Each snapshot is graphically presented using an OS base on which the HS2 Act Limits are shown together with the rail alignment. These Act Limits generally act as a reasonable proxy for the land that will be directly affected by the construction of HS2. It is likely that the relevant Secretary of State will seek to dispose of land that is not required for the operational management of the railway. The strategy and mechanism by which this occurs has yet to be decided.

2.0.5 **Need and opportunity:** We consider that these Act Limits represent the focus of both need and opportunity. Need because they will be physically impacted by construction, and to a lesser extent, by operation. Opportunity because the requirement to 'make good' contains the potential to make cost effective adjustments and additions. Our study of the zone affected by HS2 has been partly opportunistic – identifying areas of inevitable change and seeking to coordinate the response to that change. This process starts with the study of the HS2 scheme at Royal Assent proposals and is complemented by study of the landscape affected by it. This has generated both guidance to help maximise integration of railway and landscape, and opportunities to heal and enhance that landscape where it is affected by HS2.

2.0.6 **One Landscape:** Both the guidance in this document and our assessment of these opportunities has been steered by a One Landscape approach which uses a holistic approach to the environment, changes to it and potential repair and enhancement. It notes both the impacts and mitigation contained in the Environmental Statement and the opportunities generated by a project of the scale of HS2.

2.0.7 **Strategies:** The strategies set out in this section represent a high level position on how to respond to both the impacts and opportunities presented by HS2. This document will affect this response in a number of ways – through the design of permanent features both operational and mitigation; through making good of land not required for operation; and through a range of other actions which would support integration of railway and landscape.

2.0.8 **Coordinating strategies**: Each of the individual strategies needs to be considered in relation to the others. The inter-relationships between different strategies can be generally mutually supporting such as Recreation and Heritage. In other cases the opposite might apply – such as recreation and access and ecology. In each case a balanced view is required bearing in mind sensitivities, risks and benefits. For example both archaeological sensitivities and ecological mitigation need consideration when defining mitigation proposals at Bury Farm, South Heath.

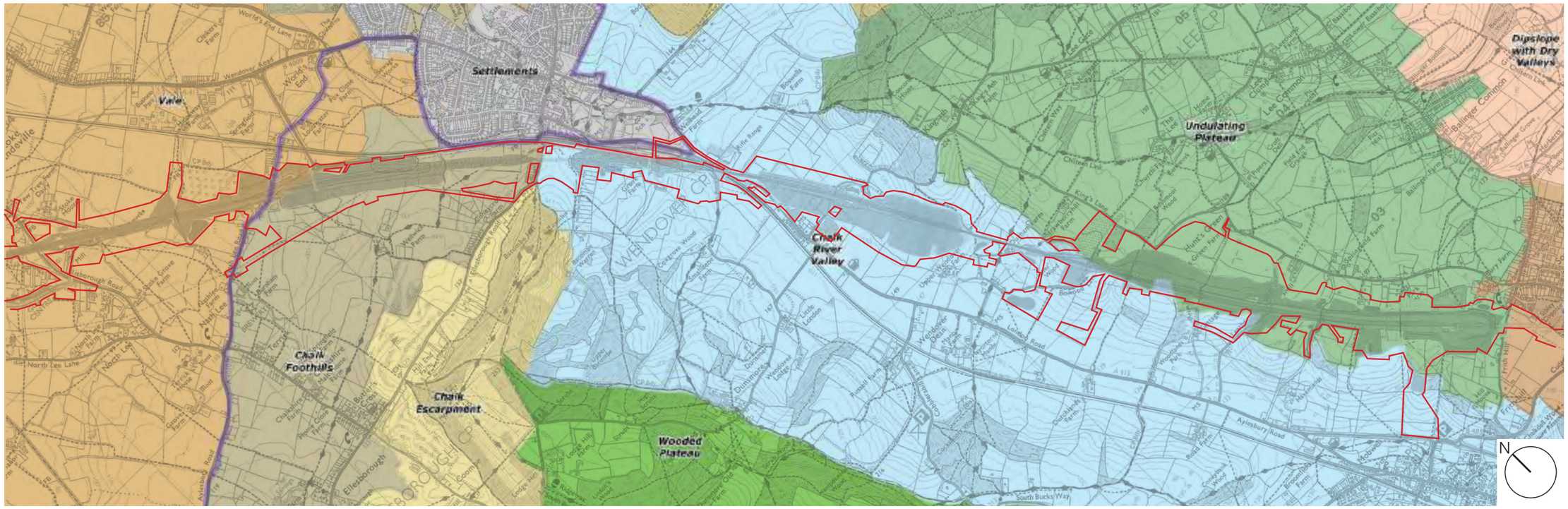
2.0.9 **Additional Projects and synergy:** Some of these projects might be funded as an 'Additional Project' using an agreed £3m budget set aside for such projects. Additional Projects will be covered by the companion volume to this document but will be heavily influenced by this document in terms of opportunities identified, their design and execution, and above all by their synergy with actions stemming directly from this document.

If Severance is probably one of the biggest effects of HS2 then synergy between projects and Reconnecting the Landscape must be the primary aim – visually, physically, ecologically, recreationally, and historically.

The strategies in this section underpin guidance set out in Section 3, Components and the illustrative sketch plans contained in Section 4.

2.0.10 **Agreements:** All proposals outside of Act Limits will of course require agreement with the landowner, and those within Act Limits but outside operational limits, with both the landowner and HS2.

2.1 Landscape Character



Legend

- AONB boundary
- Act Limits
- Land affected by HS2 construction

Bucks Landscape Character

- Chalk Dip Slope (LCA 12.1B)
- Chalk Escarpment (LCA 11.3)
- Chalk Foothills (LCA 10.4)
- Chalk River Valley (LCA 13.5)
- Dipslope with Dry Valleys (LCA 17.2)
- Settled Plateau (LCA13.1)
- Settlements (LCA 0)
- Undulating Plateau (LCA 15.1)
- Vale (LCA 8.9)
- Wooded Plateau (LCA 14.1)

Context

2.1.1 The Chilterns National Character Area is varied and described at finer grain of classification in the Buckinghamshire Landscape Character Assessment. The above ground section of HS2 runs primarily through the Undulating Plateau (LCA 15.1), Upper Misbourne Chalk Valley River (LCA 13.5), Chalk Foothills (LCA 10.4) and finally the Vale (LCA 89) which acts as the setting to the AONB. Key elements of the landscape fabric are the subtle topography of the valley side cut by dry valleys, overlaid by the pattern of land cover including the large woodland blocks on the plateau top, and connected hedgerow network. Perceptually, a tranquil and strong rural character persists away from existing transport routes.

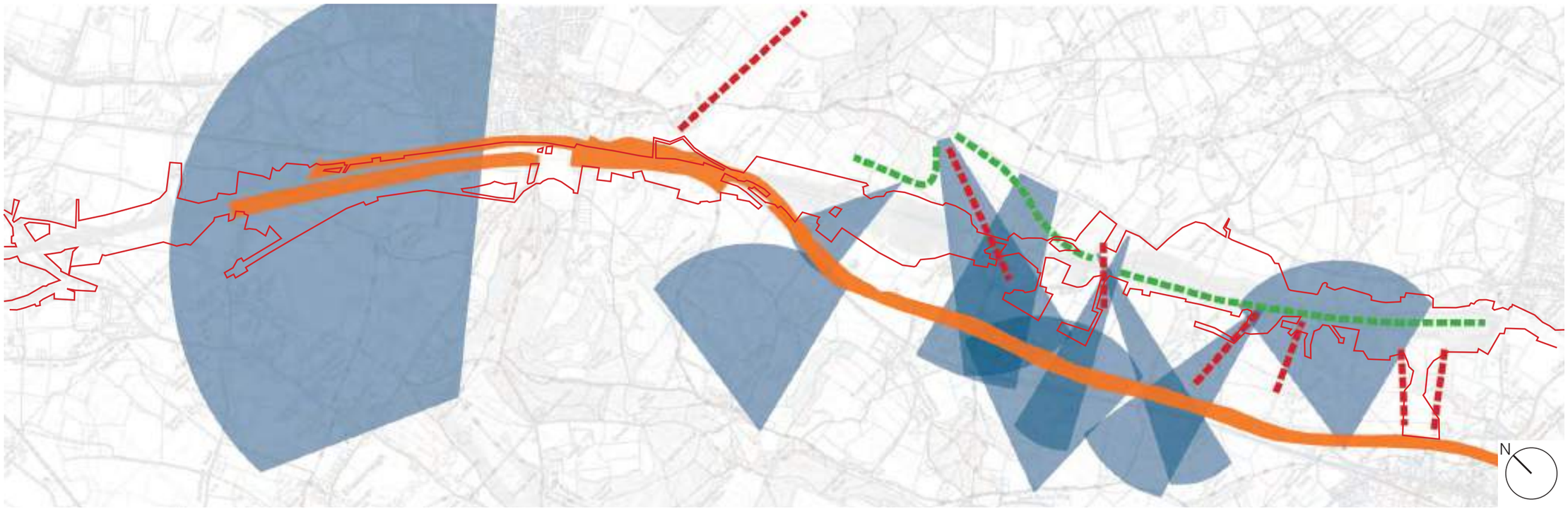
Strategic approach

2.1.2 Responding to natural beauty and local character and integrating HS2 into its local context through its design and mitigation measures.

DDP and potential Additional Project opportunities

2.1.3 The local landscape-led approach underpins all elements of the strategy in this document.

2.2 Visual Context



Legend

AONB boundary

Act Limits

Land affected by HS2 construction

Visual Baseline

Indicative views cones of vision

Negative landscape elements (opportunities)

Principal side valleys

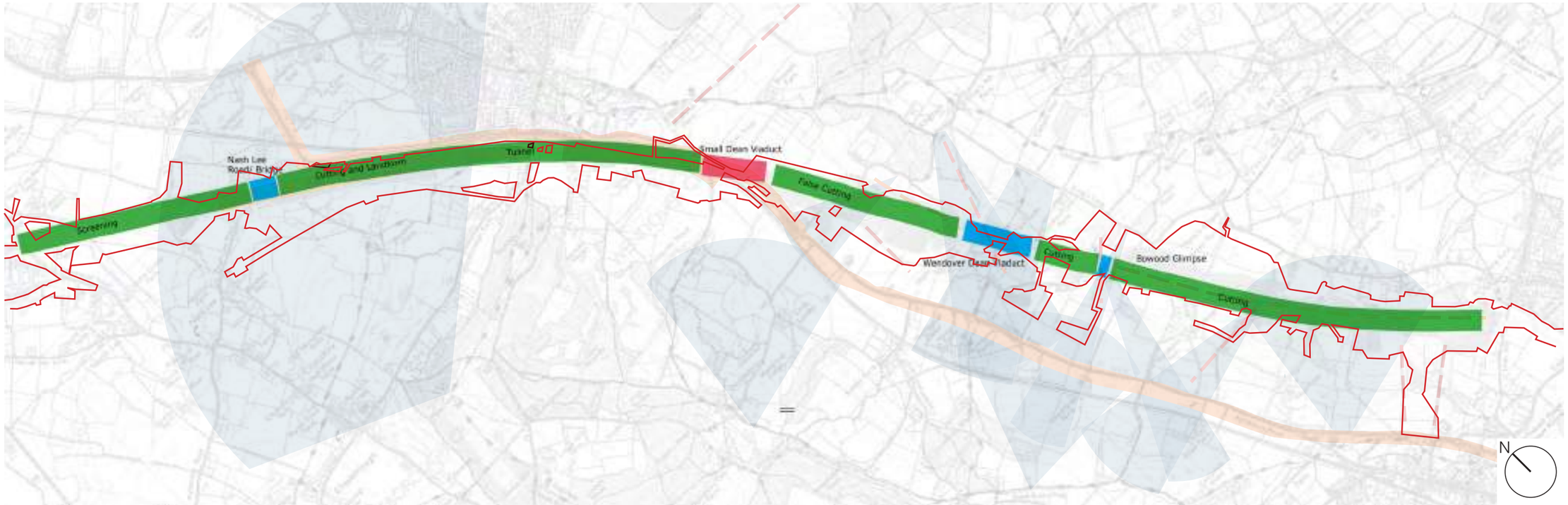
Sensitive valley tops

Context

2.2.1 Visually, HS2 is largely contained within the valley setting. On the north-eastern side, from King's Lane, there are relatively short views to the line where it cuts across the subtle dry valleys and coombes on embankment and at Wendover Dean on viaduct. From the south-western valley side, longer cross valley views - for example from the lanes running north of Great Missenden, the South Bucks Way and around Dunsmore - will include HS2 as a linear feature on the opposite valley side cutting across the local pattern and grain of the landscape. On the escarpment, for example at Coombe Hill, panoramic vistas open out over the vale; here the railway will be seen in context of the flat landscape with open views to the north of the AONB. Close views will be obtained from numerous points on local footpaths and lanes, and crossing points. Where the railway crosses the A413 road on viaduct at Small Dean it will form a highly visible new feature.

2.2.2 Although there are some historical assets the landscape and visual quality of some of the valley floor is already compromised particularly along the A413 corridor. This will be exacerbated where HS2 runs in close proximity to the A413 west of Wendover. However HS2 provides opportunities to reverse this situation both through skilful use of screening of the line and potential Additional Projects connected with the A413 corridor.

2.3 Visual Approach



Visual Strategy

- Conceal
- Present
- Integrate

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

Strategic approach

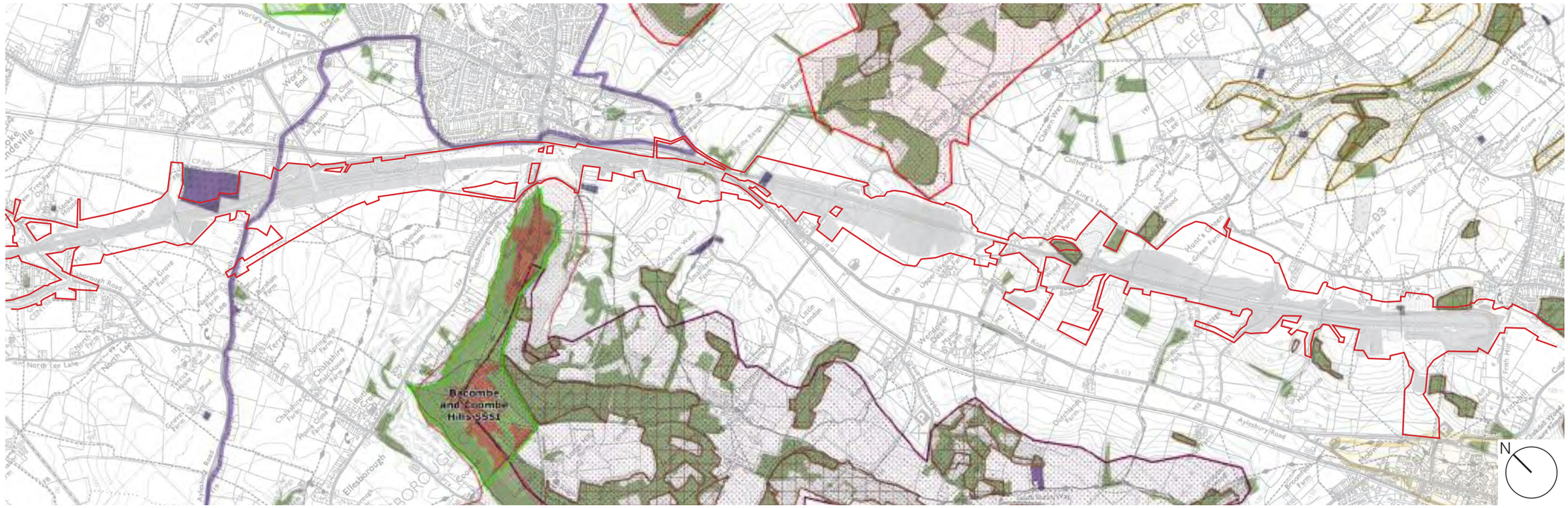
2.3.1 Concealing, presenting and integrating the railway and associated infrastructure as appropriate.

Any consideration of and design of further mitigation should reference detailed work already undertaken as part of the Environmental Statement.

2.3.2 **DDP and potential Additional Project Opportunities**

1. Visual screening of infrastructure through planting and landform where appropriate - avoiding highlighting the line in views
2. Maintaining open cross valley views and creating new viewing points
3. Targeted hedgerow strengthening outside Act limits including axial cross valley boundaries, reinstatement of boundaries in the large scale open landscape in the setting of the AONB, and additional screening of A413 around Wendover. (As potential Additional Projects)
4. Presenting the railway through elegant design at key locations notably the viaducts

2.4 Ecology Context



Legend

- AONB boundary
- Act Limits
- Land affected by HS2 construction

Ecology Baseline

- Ancient woodland
- SSSI

Priority Habitat Inventory:

- Deciduous woodland
- Good quality semi-improved
- Lowland calcareous grassland
- Lowland fens
- Reedbeds
- Traditional orchard

Biodiversity Opportunity Areas:

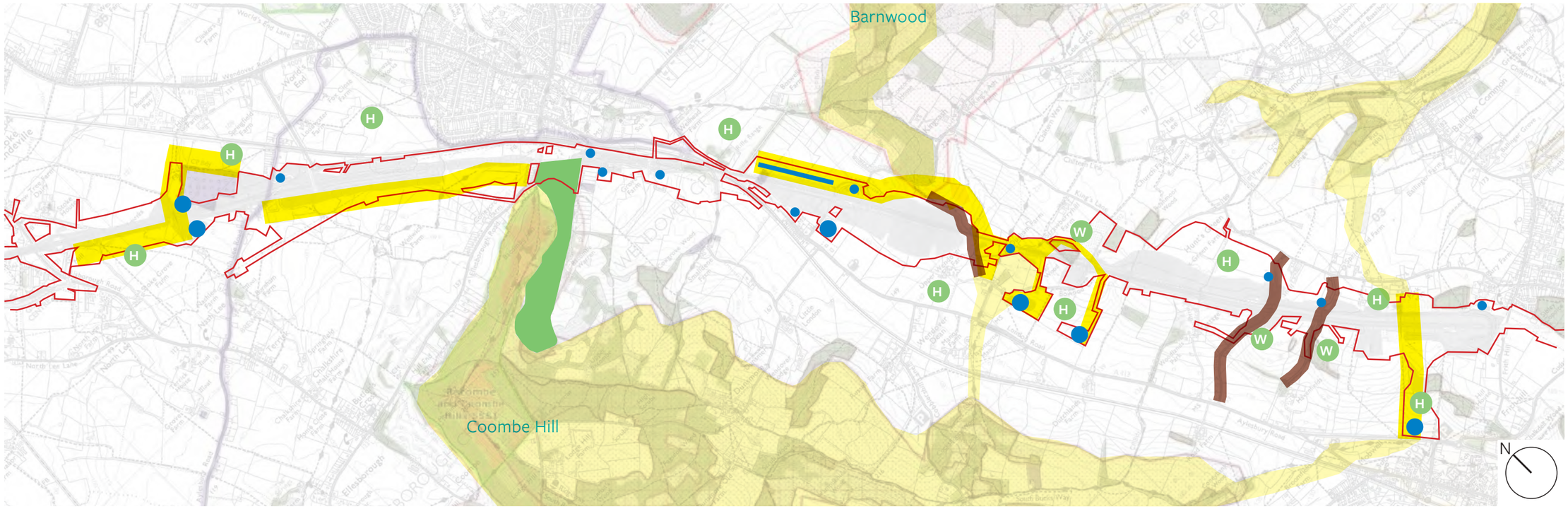
- Central Chilterns Chalk River
- Chess Valley
- Chiltern Escarpment
- Dunsmore Woods
- Wendover Woodlands

Context

2.4.1 The Misbourne, an ephemeral chalk stream, runs roughly parallel to HS2 and is part of the Central Chilterns Chalk Rivers Biodiversity Opportunity Area (BOA). Extensive broadleaved woodland, much of ancient origin, is a feature along the valley tops and skyline, notably with large woodland blocks on the plateau behind the scarp top at Wendover Woods and Dunsmore Woods (both of which are part of Biodiversity Opportunity Areas). Small isolated areas of chalk grassland occur on the steeper valley sides and scarp and occasional traditional orchards persist along the valley. The mixed arable and improved pasture is contained within mature hedgerows which provide a connected habitat network. Ancient routes and holloways are a further valuable biodiversity resource.

2.4.2 Bacombe and Coombe Hills on the escarpment relatively close to the construction boundary for the green tunnel is designated as an SSSI for its extensive, species rich areas of open chalk grassland and scrub. The Chiltern Escarpment is a further Biodiversity Opportunity Area.

2.5 Ecology Approach



Ecology Strategy and related DDP/AP Opportunities

- **Ecological corridors**
  (1. Ecological corridors - above and below the railway - including greening of bridges)
- **Holloway repair**
  (2. Reinstatement of ancient lanes and holloways)
- **Woodland planting**
  (3. Additional woodland planting)
- **Chalk grassland restoration**
  (4. Chalk grassland restoration at Wendover Gap linking to existing sites (Bacombe Hill)
- **Wet habitats**
  (5. Water attenuation and design for biodiversity)
- **Hedgerow strengthening**
  (6. Hedgerow strengthening)

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

Strategic approach

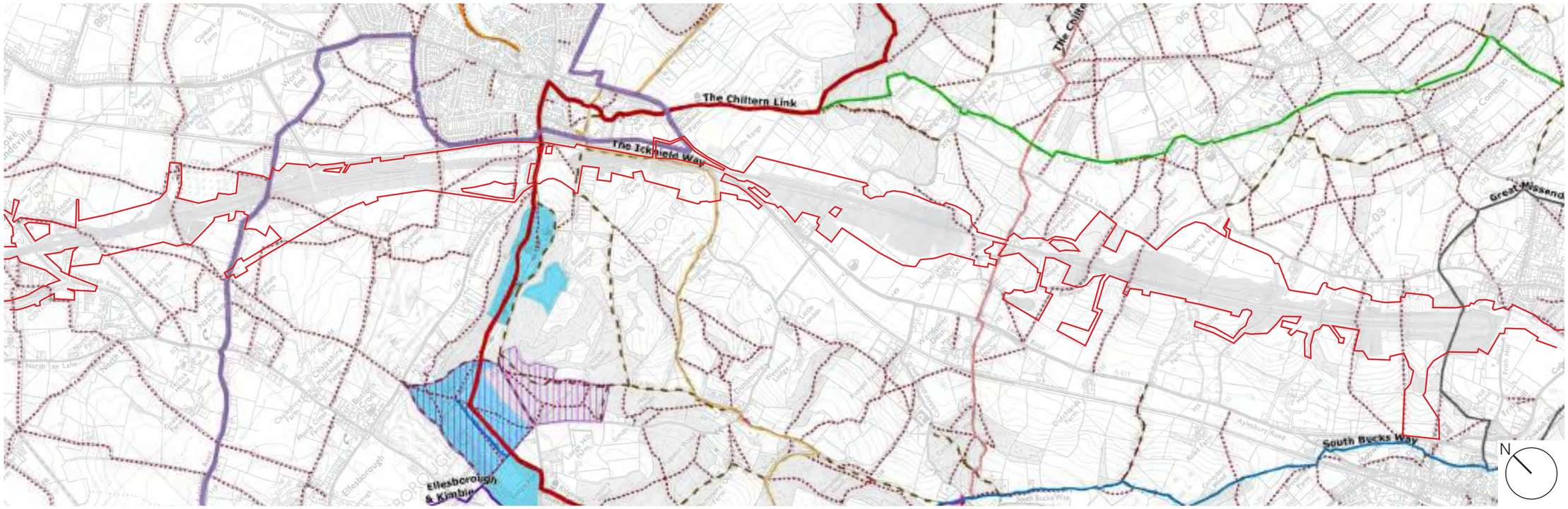
2.5.1 Reducing fragmentation by facilitating ecological permeability of the route and creating landscape scale habitat connectivity.

Where possible the strategy should be informed by already identified target species/ habitats and other relevant species, working with Local Wildlife Trusts.

2.5.2 **DDP and potential Additional Project (AP) Opportunities**

1. Ecological corridors (above and below the railway) including greening of bridges
2. Reinstatement of ancient lanes and holloways
3. Additional woodland planting
4. Chalk grassland restoration at Wendover Gap linking to existing sites (Bacombe Hill)
5. Water attenuation and design for biodiversity
6. Hedgerow strengthening

2.6 Access & Recreation Context



Context

2.6.1 The Misbourne Valley contains an extensive network of rights of way and access links, including the Ridgeway National Trail, regional promoted routes including the Icknield Trail, Chiltern Way and Chiltern Link and Aylesbury Ring as well as numerous local rights of way and lanes providing access across the valley linking into the main routes along the valley tops. This part of the Chilterns with its easy access by tube and rail is an important recreational resource both locally and for a wide catchment including much of north- west London and further afield.

Legend

- AONB boundary
- Act Limits
- Land affected by HS2 construction

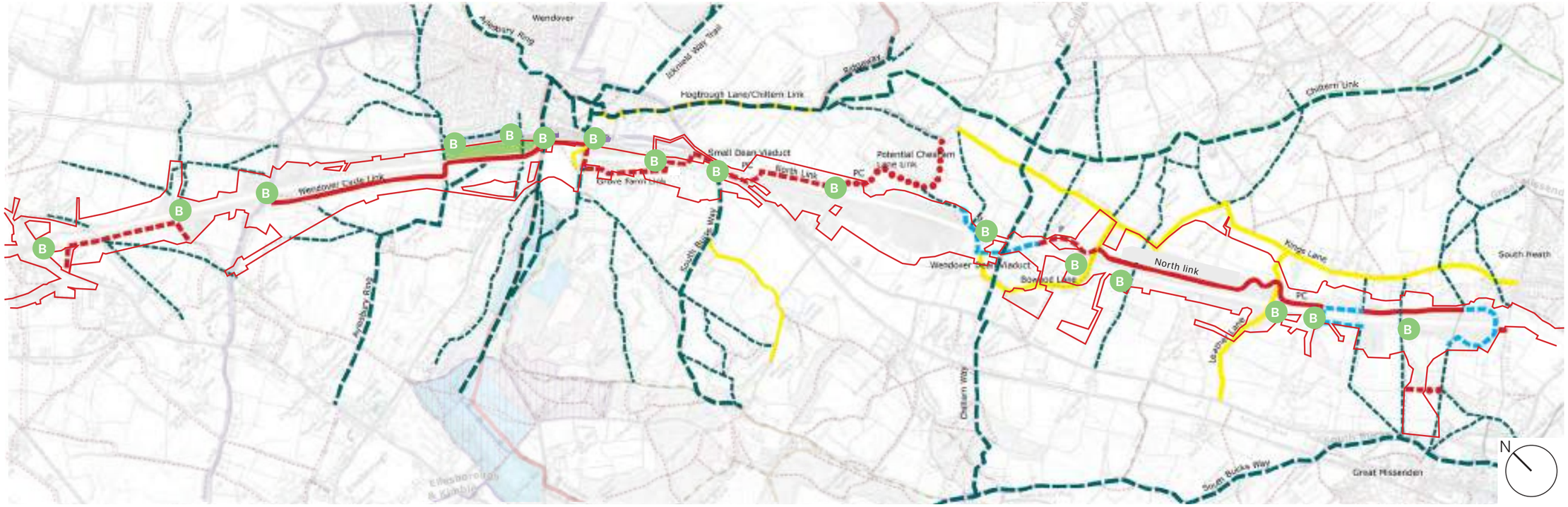
Access & Recreation Baseline

- National Trails
- South Bucks Way
- The Chiltern Link
- The Chiltern Way
- The Icknield Way
- The Wendover Arm
- Ellesborough & Kimble
- Great Missenden

Public Rights of Way:

- Footpath
- Bridleway
- Byway Open to All Traffic (BOAT)
- Open Access Land
- National Trust Ownership

2.7 Access & Recreation Strategic Approach



Access & Recreation Strategy and related DDP/AP Opportunities

- **Footpath diversion already in HS2 proposals**
  (6. Targeted planting)
- **Proposed Cycle Path/ Bridle Path**
  (1. North link)
- **Other proposed paths within and outside Act Limits**
  (2. Additional potential links)
- **Additional Proposed Open Access Land**
  (4. 10 ha new public open space at Wendover Link)
- **Bridges/Viaducts (existing or proposed by HS2)**
  (5. Greening of footbridges across the railway)
- **Lightly trafficked lanes**

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

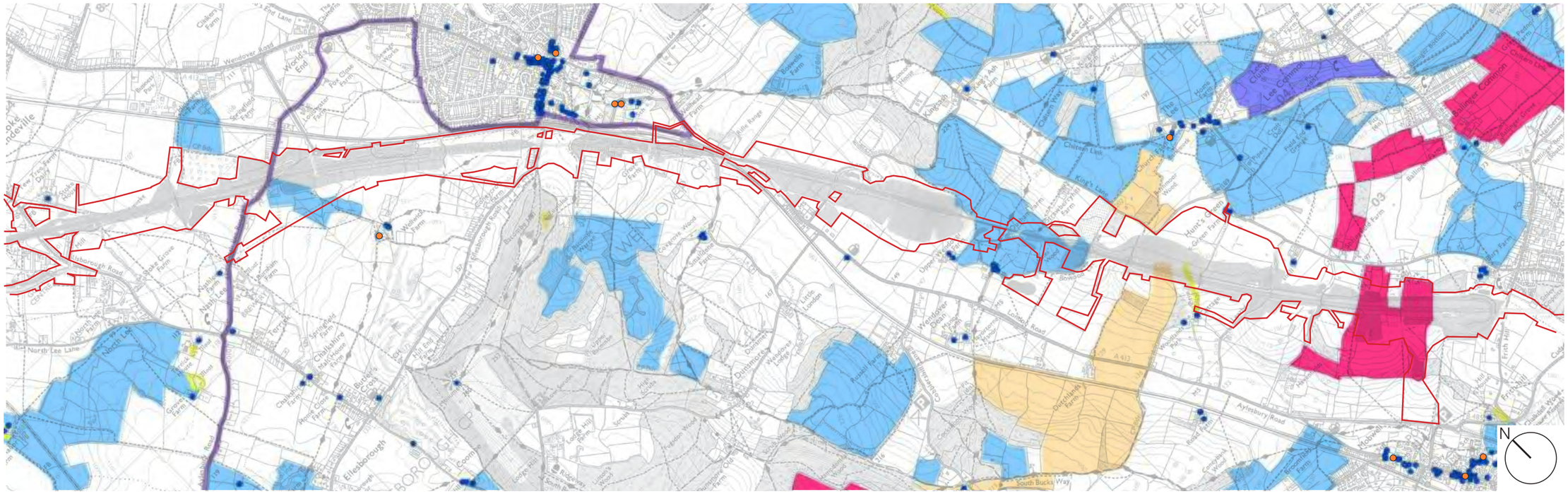
Strategic approach

2.7.1 Conserving and enhancing the connected rights of way network including the creation of new links. Creating a good recreational experience on the approach to, alongside and crossing of the railway, and longer distance links particularly south-east to the Colne valley.

2.7.2 **DDP and potential Additional Project (AP) Opportunities**

1. North Link. New access link parallel to the railway from South Heath
2. Additional potential links (Park Farm/Great Missenden; Grove Farm link; Stoke Brook link)
3. Wendover Link to Nash Lee Road
4. 10 ha new public open space at Wendover Link
5. Greening of footbridges across the railway
6. Planting to enhance recreational experience and create new valley reveals for example at the South Heath tunnel portal

2.8 Historic Assets Context



Legend

- AONB boundary
- Act Limits
- Land affected by HS2 construction

Historic Baseline

- Grade I and II* Listed Buildings
- Grade II Listed Buildings
- Scheduled Monument
- Assarts
- Greens/Commons
- Historic Field Patterns (Pre-18th Century Co-axial)
- Historic Field Patterns (Pre-18th Century Irregular)

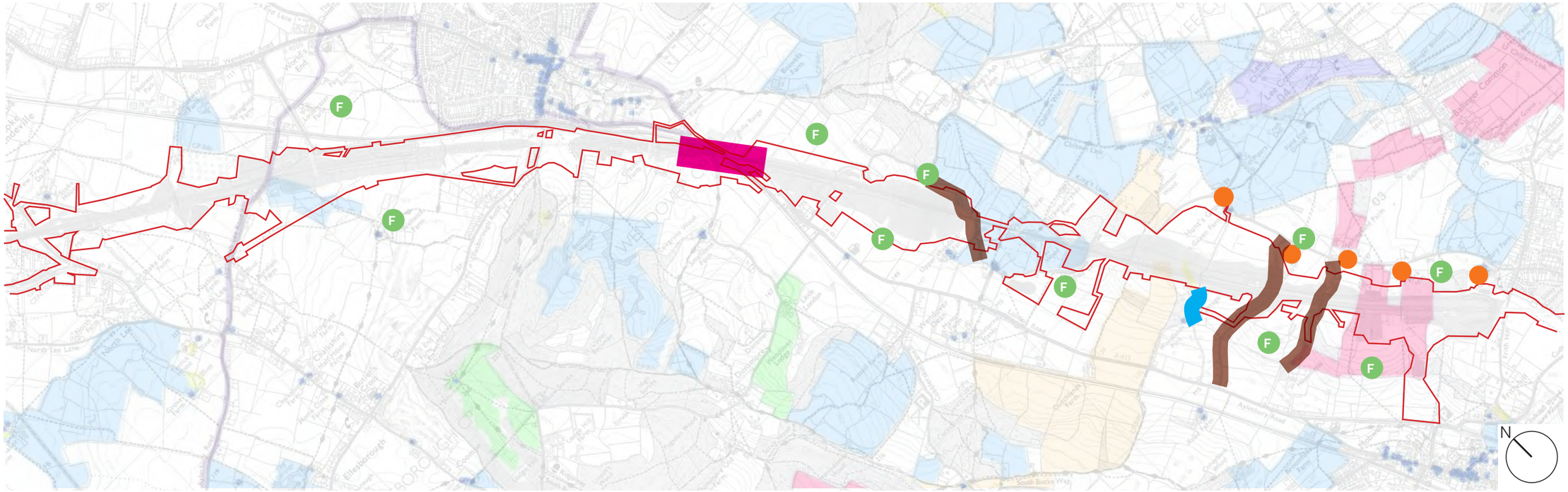
A full list of assets, including non-designated assets assessed is contained in the Environmental Statement

Context

2.8.1 This is a rich historic landscape in which past settlement points to highly distinctive use of the valley floor, valley slopes and plateau. Key features are the extensive areas of ancient woodland, pattern of commons on the plateau, linking axial cross valley holloways/droveways and ancient lanes and the mosaic of field patterns, including an area of pre 18th century 'co axial' fields close to the Chilterns North Portal at South Heath. The AONB and its setting include areas of intact medieval landscape revealed through the field patterns and historic buildings. To the south of Hunts Green HS2 cuts through a section of the Grim's Ditch Scheduled Monument. On the plateau edge along Potter Row, a series of historic farmsteads (Listed Buildings) at Bury Farm, Park Farm, Hammondshall Farm and Hunts Green Farm are in close proximity to the line.

2.8.2 On the plateau edge along Potter Row there is particularly distinctive evidence of early settlement, including banked enclosures at Jenkins Wood, the moated site at Bury Farm and a series of historic farmsteads at Bury Farm, Park Farm, Hammondshall Farm and Hunts Green Farm. These are in close proximity to the north-east of the line, while just below to the southwest lie the historic buildings and parkland of the early 19th century listed villa at Woodlands Park and Cottage Farm. The impact of the Wendover Dean Viaduct on the setting of listed valley farmsteads will be the strongest at Wendover Dean and Upper Wendover Dean Farms, while the Wendover Green Tunnel and north portal will affect the setting of the historic farmstead at Grade II* Wellwick Manor.

2.9 Historic Assets Approach



Historic Strategy and related DDP/AP Opportunities

- **Grim's Ditch**
  (1. Marking Grim's ditch – including opportunities for interpretation of archaeological finds)
- Historic farmstead
  (2. Maintaining viability of historic farmsteads as living places)
- **Reinstated field pattern**
  (3. Reinstatement of field patterns)
- **Historic landscape features**
  (4. Conserving distinctive historic landscape features such as droveways and holloways)
- **New heritage**
  (5. Creating new heritage)

Strategic approach

2.9.1 Conserving, enhancing and responding to the historic landscape in all elements of the Detailed Design Principles including archaeological and historic assets and their settings.

2.9.2 **DDP and potential Additional Project (AP) Opportunities**

1. Marking Grim's ditch – including opportunities for interpretation of archaeological finds
2. Maintaining viability of historic farmsteads as living places by conserving environmental quality.
3. Reinstatement of field patterns
4. Conserving distinctive historic landscape features such as droveways and holloways
5. Creating new 'heritage'/ tomorrow's listed structures
6. Enhancing understanding of the historic landscape.

3. Components & Detailed Design Principles

3.0 How to use this section

Overview

3.0.1 This section examines each of the elements that together make up the railway, its ancillary facilities and its surrounding physical environment. The section provides guidance to designers and reviewers on each of the components.

Section 4 shows how this guidance is combined through a series of illustrative designs for the complete above ground section north-east of the Chilterns Tunnel north portal.

HS2 Design Policy

3.0.2 All designs for HS2 are subject to the Design Policy for HS2 Phase 1 set out in Information Paper D1. This sets out that:

"The Promoter and the nominated undertaker will seek to ensure that:

- the design is safe, efficient, and meets with the requirements of whole life operation and maintenance alongside initial build-ability;
- the design contributes to the government's pursuit of sustainable development, as set out in the National Planning Policy Framework, which involves seeking positive improvements in the quality of the built, natural and historic environment, as well as in people's quality of life;
- design of all visible elements of the built and landscaped environment in both rural and urban areas is sympathetic to their local context, environment and social setting;
- the design cohesion is achieved through a strong aesthetic ethos and a recognisable architectural language;
- the design is developed through engagement to seek peoples' views and ideas on the aesthetic design of the visible buildings and permanent structures;
- the design has a culture of cost awareness to give cost/quality decisions which achieve best value for the funders;
- design innovation is encouraged to generate best value to funders, users and those affected by the railway; and,
- the design considers the passenger experience."

Specimen, Key and Common Design

3.0.3 There are three levels of approach to the design, level of public and stakeholder engagement and uniqueness of the design on HS2 Phase 1:

- Specimen – where feasibility and design studies are separately commissioned in advance of contractors being appointed. There are no Specimen designs within the study area.
- Key design elements –where there is a greater requirement for the Promoter to engage with the local public on the design development of these key elements of infrastructure in sensitive areas. There are eight key design elements within the study area – vent shafts at Chalfont St Peter, Chalfont St Giles, Amersham, Little Missenden and Chesham Road; Wendover Green Tunnel south portal; and viaducts at Wendover Dean and Small Dean.
- Common design elements – where the Promoter will develop a range of standard or common designs for certain permanent structures associated with the railway (such as road-bridges, foot-bridges, noise barriers). Selection from this palette of design options is then made to achieve a best match with specific needs and their context, or used as the basis for the development of adapted solutions to achieve a better match.

3.0.4 Elements that are not covered by specimen or key designs are not necessarily by default common design elements and HS2 are, at the time of writing, considering the 'Category' in which certain elements will fall.

3.0.5 Regardless of whether an element is considered a key design element it is expected that designers and designs should be responsive to the significance of the AONB designation and the special landscape qualities that underpinned the very reason for its designation. Designers are reminded of the duty of public bodies to have regard to the conservation and enhancement of the natural beauty of the AONB. The guidance and detailed design principles explored in this section should be given proper consideration so that the resultant designs are appropriate to the AONB.

Types of Components

3.0.6 There are three broad groups of components:

- Single elements (e.g. vent shafts and noise barriers).
- Components that are directly referenced in the Landscape Design Principles (e.g. Holloways).
- Groups of elements which deal with particular area-based opportunities (e.g. Wendover Link and ecological corridors).

Sheet Format

3.0.7 Each component is treated in a similar manner with the length of each guidance note varied to suit.

Each component has a unique designation and name (which is used in Section 4 to identify locations where the guidance applies) as shown n the example to the left.

Particularly relevant Design Principles (DPs) are shown immediately below the title of each component (by number cross-referencing the 17 DPs set out in Section 1) as shown here.

3.0.8 This is followed by a series of headings which include:

- The significance of the component
- How it is likely to be affected by the new line
- The issues and opportunities resulting from the effect
- The design intent or strategy for dealing with the effects
- The contractor's proposals
- A checklist of Detailed Design Principles, and
- Further locally specific Detailed Design Principles
- Cross references to other relevant components/ other HS2 or other guidance/ information
- Cross references to specific locations within the Illustrative proposals in Section 4

The text is accompanied by relevant illustrative material, sketch plans and sections.

3.0.9 All of this material is aimed at illustrating the Detailed Design Principles and how these principles could be brought forward in the emerging design proposals. It is the contractor's responsibility to apply the Detailed Principles where reasonably practical in their submitted designs , and for those reviewing the proposals to use this guidance to assess the design's compliance and suitability. This may require provision of some drawings/ information in excess of the content of Schedule 17 submission defined in Notes accepted by the Planning Forum.

3.1 Ancillary Buildings 1

Purpose

3.1.1 Ancillary facilities are vital to the operation of the railway. There are two categories in this section – portal buildings and auto-transformer stations.

Relevant HS2 documents

HS2 landscape Design Approach

Portal buildings

3.1.2 There are three sets of portal buildings, at:

- Chilterns Tunnel north portal, ch47.300
- Wendover Tunnel south portal, ch53.450
- Wendover Tunnel north portal, ch55.050

There are likely to be two buildings at each location. Those at Wendover have a slightly smaller footprint than those at Chiltern Tunnel. The Wendover buildings are joined together, those at Chiltern Tunnel are separate. Each site has a vehicle access track.

Issues and Opportunities

3.1.3 Both are similar to Section 3.10, Vent Shaft buildings although the issues are less pronounced due to the fact that the buildings are smaller, in close proximity to the railway and generally hidden by cuttings because of their proximity to their associated tunnel portal.

Issues

- The introduction of buildings which could add cumulative impacts on visual intrusion and on local landscape character.
- Lack of control over exact siting reducing opportunities to mitigate impacts.
- Stringent technical and operational requirements with reduced leeway to vary design and location.
- Further visual intrusion from security fencing, lighting etc (clutter).

Opportunities

- Adjustment of building design to reduce visibility.

General Detailed Design Principles (DDP)

3.1.4
- Consider building design in relation to the design of the nearby porous portal (see section 3.11).
- Use of arisings to supplement perimeter landform using simple structures such as gabions and crib-lock systems on the steep inner face and more natural outward-facing slopes. Where these structures may be visible consider use of simple cut faces into the native chalk landform with steepest angle of natural repose, hydraseeded with chalk grassland seed mix and with jute mesh protection to aid establishment.
- Building and external works design to be site specific reflecting both landscape context and landform.
- Reducing scale – use a combination of massing, colour and texture to reduce the scale of these buildings.

Ancillary Buildings 2

- Building colours to be generally recessive and specifically chosen in relation to its immediate context and backdrop. Mid to medium dark brownish grey tones guided by studies such as that undertaken for Cranbourne Chase and the Malverns are likely to be the norm unless there is a particular local reason to vary. HS2 to consider commissioning a similar study for the Chilterns.
- Colour articulation – consider the use of contrasting accents to modulate apparent scale and massing.
- Building form/massing to be simple and considered as a group of forms where there are multiple buildings
- Building materials – consider the effect of elevations regarding texture, scale and association. Profiled panels will produce variations of light and shade. Utilise opportunities presented by louvres and vents to provide added textural and/or colour contrast. Avoid issues of glare or reflection. Consider appropriate opportunities to reflect local vernacular avoiding pastiche. Unwanted weathering should be considered particularly if concrete is proposed.
- Building roofs and the view from above – consider the use of chalk grassland roofs to aid landscape integration and ecological mitigation. Consider angled or curved roofs to increase integration with adjacent landform especially when seen as backdrop in key views. Use man safe systems instead of parapet to maintain a clean silhouette.
- Hardstanding – minimise the extent of hardstanding and investigate the potential use of plastic cellular reinforced systems with grass or gravel fill in less trafficked areas. Wherever possible use permeable paving. Avoid the use of pale concrete block hardstanding with its greater visibility and urban character.
- Security – investigate the potential for the building to be the principal or sole secure envelope thereby removing or reducing perimeter fencing.
- Fencing – if required ensure minimum height, simple design and low visibility. Where possible screen fencing with native hedges and set back vehicle gates to reduce visibility. Visible elements to be powder coat paint finish to match building. Entrance gate location to be determined by speeds on adjoining roads as well as site security. Bellmouths and visibility splays to be kept to the minimum and to be designed to minimise opportunities for fly-tipping.
- External signage – keep to the minimum and unlit.
- Lighting and CCTV – minimise and ensure full vertical cut-off lanterns. If security lighting is essential ensure that this is the minimum possible with manually operated higher lighting levels when required for maintenance purposes. Use infra-red or similar CCTV cameras. Wherever possible lights and cameras should be building mounted.
- Screening strategy to consider whole Act Limits area (and beyond if necessary) and to identify key viewpoints/receptors. Proposals should include native hedgerow planting/strengthening, copse planting and landform modification as appropriate.
- Consider carefully the alignment of any vehicle access and its traverse of the cutting side. This may be equally visible as the building itself.

Ancillary Buildings 3

Location Specific DDP

3.1.5 **Chilterns Tunnel, north portal:** Oblique close-range views from the Park Farm pedestrian overbridge (400m) and immediate visual link with adjacent porous portal and tunnel portal. These elements must be considered as an integrated design solution. Particular attention required to appropriate roofscape with green roof preferred.

Wendover Green Tunnel, south portal: Partially hidden by proposed bund but roof of facility may be visible from properties along Bacombe Lane. Target notes on Illustrative sketch plan 38 identify potential to increase height of screen landform and incorporate ancillary buildings in this landform. This should be investigated as should visibility and appearance in views from the south. Design integration required with tunnel porous portal and extensive noise barriers in this proximity.

Wendover green Tunnel, north portal: Views from diverted PRoW at 200m distance need to be considered in particular the visual integration of the porous portal roof (in the foreground) and the ancillary buildings (in the middleground). The relatively low cutting means that the short term and close range visibility from the A143 of back of building needs consideration before growth of proposed screen planting. Vehicle access from the A143 also needs careful consideration to avoid obtrusive clutter in the view from the road and the opening up of views of trains and the line.

Example of an a typical compound arrangement (Note: it is expected that the building itself will be smaller)

Ancillary Buildings 4

Auto Transformer Stations

3.1.6 These boost the power supply for the railway and are essentially a collection of external fenced transformers and electrical equipment. They are sited at approximately 5km intervals adjusted to use locations that minimise visual intrusion. The amount of built development, if any, is likely to be limited.

There are three Auto-transformer stations (ATS) on the above ground section:

- South Heath Mid-Point ATS, ch48.900,
- Wendover ATS, ch51.800, and
- Stoke Grove ATS, ch 56.200

Each location has a vehicle access track and yard. South Heath ATS is larger than the other two.

Issues

- Visual intrusion from security fencing, lighting etc (clutter) and alien forms within the landscape
- Lack of control over exact siting reducing opportunities to mitigate impacts
- Stringent technical and operational requirements with reduced leeway to vary design and location

Opportunities

- Limited by technical and safety requirements

General DDP

3.1.7 These are similar to that for portal buildings with the emphasis being on maximising local screening, reducing clutter to the minimum in particular where seen from close range and, if feasible, using recessive colour to integrate the facility with its landscape backdrop.

Location Specific DDP

3.1.8 **South Heath Mid-Point ATS:** This facility is located on the valley edge where the alignment is in relatively shallow cut. It is likely to be seen from Kings Lane, the north and east until screening establishes, from the Leather Lane overbridge at 150m distance, and from greater distance across the valley. Its position immediately at the top of the cutting will exacerbate this visibility. Illustrative sketch plan 35 identifies the possibility of altering the siting of the feature so that it is set back from the cutting edge and benched into the slope with a leading edge of landform (false cutting and/or hedge bank feature). This would reduce its visibility from both the Leather Lane overbridge and from across the valley. Similarly the backdrop landform and woodland planting seems capable of wrapping around the facility to provide better immediate screening from views from Kings Lane and Hammondshall Farm.

Wendover ATS: this risks being very visible in views from the north east and north west. The line is on a low embankment and although the Wendover Dean proposed landform to the west will provide some screening this will inevitably be compromised to some degree by the access track requirement and the reduction of the landform at its junction with Rocky Lane. Despite noise barriers it is very likely that a significant part of the facility will be visible. The addition of a crest top hedge on the west side and tree screen on the east should be investigated as should the possibility of placing the facility at a level lower than the track.

Stoke Grove ATS: although in a cutting this facility is within 150m of existing housing on Lee Nash Road and the Lee Nash Road overbridge. Whereas the former view will be screened by woodland the view from the bridge cannot be screened. Consideration should be given to the following: adaptation of foreground cutting slopes, and/or the use of a solid screen to reduce visibility; increasing landform and tree planting to provide stronger backdrop; revising the layout of access track and ATS so that the latter is pushed into the cutting face which is steepened through the use of retaining structures.

3.2 Viaducts & Bridges 1

B
Viaducts & Bridges

1 3 10 13

Why bridges matter

3.2.1 Bridges are acknowledged as having particular interest to both the public and the professional. This is partly because this will probably be the closest a viewer will come to the railway, and partly because of the symbolic and identifiable nature of bridges. The public's opinion of HS2's bridges could possibly be transferred onto that of the line as a whole particularly in the Chilterns where there are relatively few bridges. It follows that great care needs to be taken in all aspects of bridge design.

Key design

3.2.2 The two viaducts are subject of Key Design. All other bridges have Common Design elements such as parapets. These elements will feature a palette of proposals for different contexts (e.g. urban and rural bridge parapets). Regardless of the fact that each bridge may include Common Design elements this should not preclude the evolution of designs that are particularly appropriate to the Chilterns. Furthermore the design of each bridge should respond to specific site conditions. Viaducts should take note of the approach taken by the Specimen Design for the Colne Valley Viaduct by Knight Associates and aspire to a similar level of design excellence. The contractor should reference in particular:

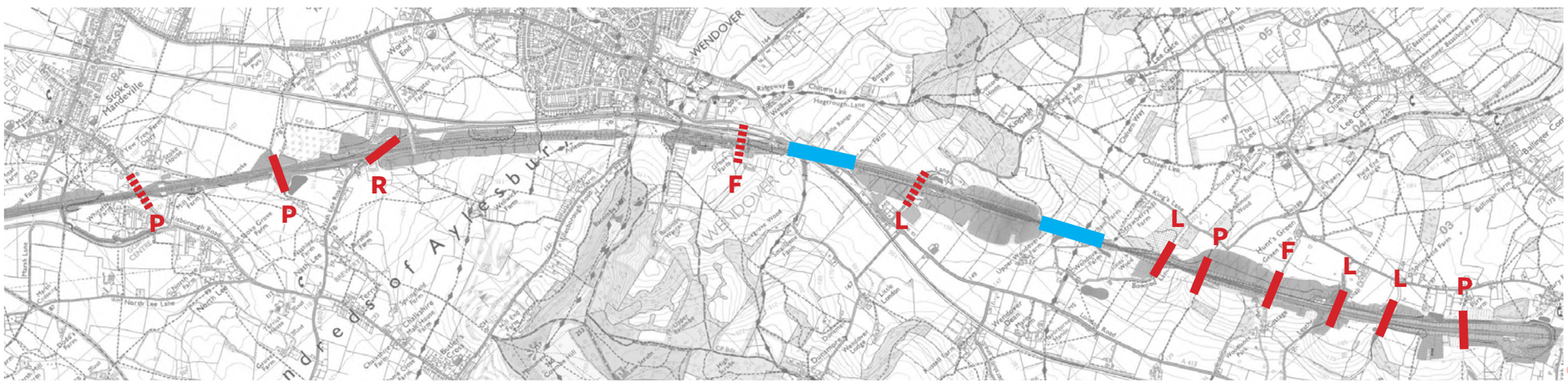
- HS2 Bridge Design Requirements
- Environmental Mitigation Requirements
- Colne Valley Viaduct Specimen Design
- Other Relevant HS2 presentations
- Relevant good practice

The Viaducts

3.2.3 There are two viaducts – the Wendover Dean Viaduct (500m long and west of Kings Lane) and the Small Dean Viaduct (425m long which crosses the A413 south east of Wendover). A relatively short distance separates the two viaducts. Given the local design speeds the passenger experience of crossing the viaduct will be short – just enough to register the middle distance landscape before re-entering a cutting when looking south west. The opposite view to the north east will be more extended as there is less cutting on this side of the track between the two viaducts.

Issues & Opportunities

3.2.4 Both viaducts are long and low with a maximum clear height of approximately 18m.



Proposed bridge & viaduct locations

Legend

- Viaduct
- Overbridge
- Underbridge
- R Road
- L Lane/ minor road
- F Farm access
- P Pedestrian

Viaducts & Bridges 2

Wendover Dean Viaduct Source LVIA View from King's Lane: Current baseline (2013)

Wendover Dean Viaduct Source LVIA Photomontage Wendover Dean Viaduct, Operation Year 1 (2026)

Issues, Opportunities & Detailed Design Principles (DDP): Wendover Dean Viaduct

3.2.5
- The Wendover Dean viaduct crosses open land with few ground level obstacles (Durham Farm which is directly under the bridge alignment will be demolished).
- There is a very short embankment section at the north end and a 150m long embankment at the southern end.
- The viaduct is subject of a visualisation from King's Lane within the Environmental Statement. This shows the alignment with its valley floor backdrop.
- The reverse view from the valley floor also shows its valley side backdrop and a degree of foreground screening from existing trees.
- In both cases there will be limited viewpoints from which there will be views of the underside of the bridge deck or with the bridge structure seen against the sky.
- The local landscape character is rural particularly when viewed from the west, the only visual intrusion coming from the pylon line close to the west of the viaduct.
- A low noise barrier is only required on the west side of the bridge. Overhead equipment and passing trains will be clearly visible.
- Unwanted light spill needs consideration.

The relative simplicity of the backdrop of this viaduct suggests a matching simple and elegant structure.

Viaducts & Bridges 3

Issues, Opportunities & DDP: Small Dean Viaduct

3.2.6
- The viaduct crosses a complicated mesh of existing routes including the A413 and Chiltern railway in cutting. This will have significant impact on the structural solution particularly as the crossing is skewed.
- This is exacerbated by further access roads, road junctions and the pylon line, all of which are at a variety of levels.
- The immediate landscape context is peri-urban, road-dominated and of low value.
- Road users will have direct experience of the bridge - both its elevation on approach, and close range views of its underside as they pass beneath it.
- Low noise barriers are required on both sides of the viaduct. These extend to the west for over 200m before passing into the Green Tunnel portal and pressure attenuation facility. Both are on embankment with little opportunity for meaningful screening to views from the north.
- To the east of the viaduct the alignment is on an embankment for nearly 1km on the north side with the large false cutting landform providing screening to the south side. No noise barriers are required in association with this part of the alignment.
- Both overhead line equipment and trains will be clearly visible from the north for over 1.5km.

The structural and logistical complexities of this viaduct, its greater visibility and less tranquil setting all indicate that a more visually dynamic structure may be appropriate. This might involve a deliberate contrast of the single central long span with the repetitive side spans.

3.2.7 The construction access requirements for both viaducts are complex and necessitate locally extensive Act Limits. The extensive Act Limits offer opportunity - with landowners' agreement - to carry out similarly extensive environmental repair and integration/screening in depth.

Wendover Dean Viaduct offers significant opportunities for the development of a large-scale ecological corridor beneath the span, see Section 3.3: Ecological Corridors for details.

Designed Visibility

3.2.8 Both viaducts will be visible and incapable of concealment because of their length and the potential multiple viewpoints. The suggested visual strategy is to maximise the exemplar design elegance of the structure itself, and its integration with its immediate and wider surroundings. The contractor should investigate opportunities for:

- Planting on or adjacent to the flanking embankments
- Planting/strengthening hedgerows on either side of the viaduct, and
- Careful location of tree groups to break the deck line of the viaduct

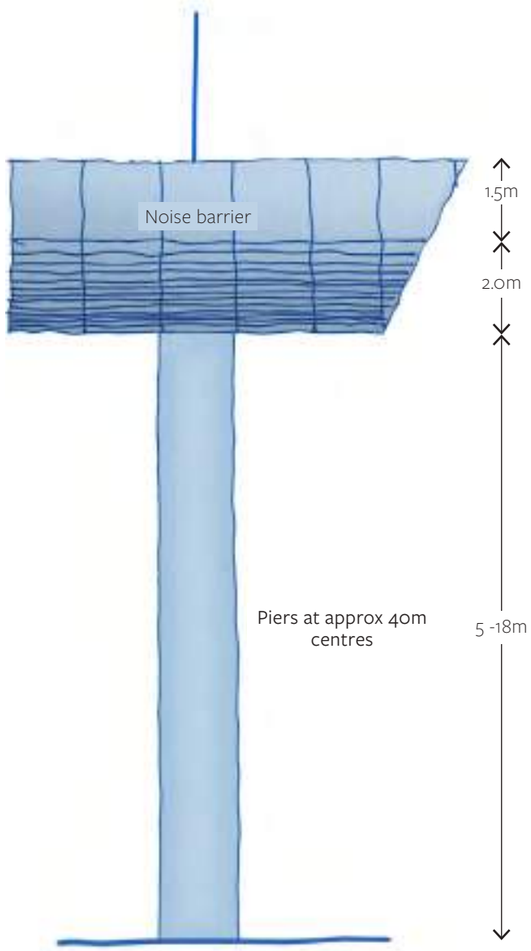
See illustrated example of Wendover Dean viaduct (p39).

General DDP for Viaducts: Structural Elegance

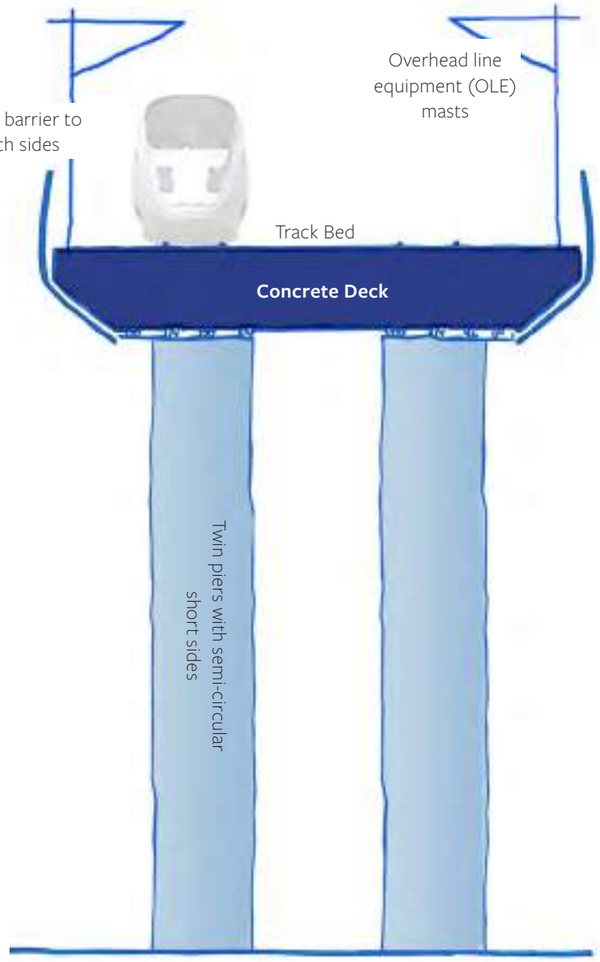
3.2.9 The viaducts' design must embrace the established tenets of good design to produce a wholly integrated solution of good proportions and excellent landscape fit. Both viaducts have a particular challenge posed by their relatively low height compared to their length. The larger scale illustrative material highlights a number of design principles including:

- **Rhythm:** Long and equal spans to create a consistent rhythm and avoid below deck visual clutter.
- **Exceptional spans:** Where a longer span is essential to negotiate existing constraints (such as at Small Dean) either design the complete viaduct using this span as standard or if this is not feasible, produce a design that celebrates this distinct break in the rhythm of the overall viaduct.
- **Slenderness:** Maximise apparent slenderness of piers through cross section, grouping and edge profile. Curved profiles introduce interesting variation of shadow and light and shade adding interest and increasing apparent slenderness.
- **Materials:** It is assumed that piers will be concrete in which case the principal issue is colour and visibility with additional issues of texture, joints and potential staining. Both viaducts need to consider close range appearance in addition to middle distance. Decks can be either concrete or steel provided they are over-clad as below to provide a controlled elevation.

Viaducts & Bridges 4

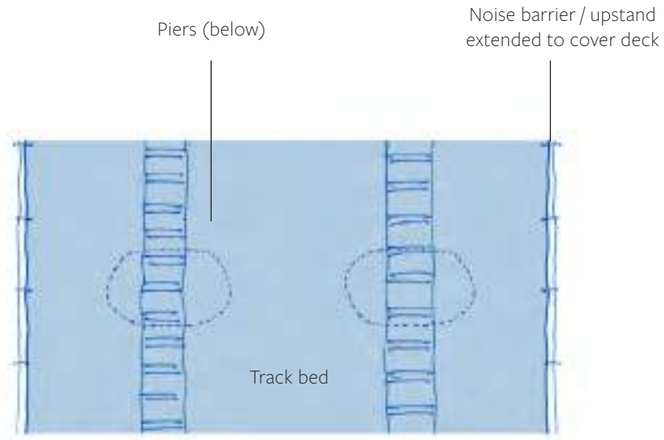


Elevation

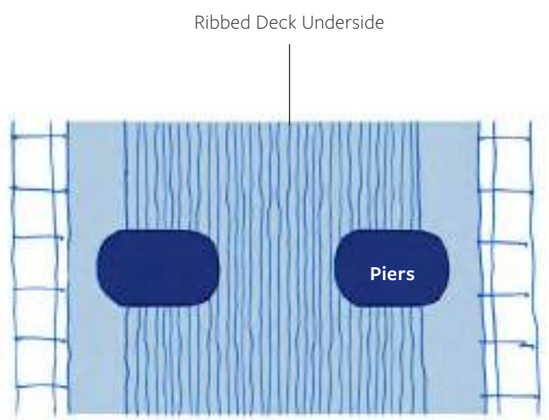


Section

Long Section

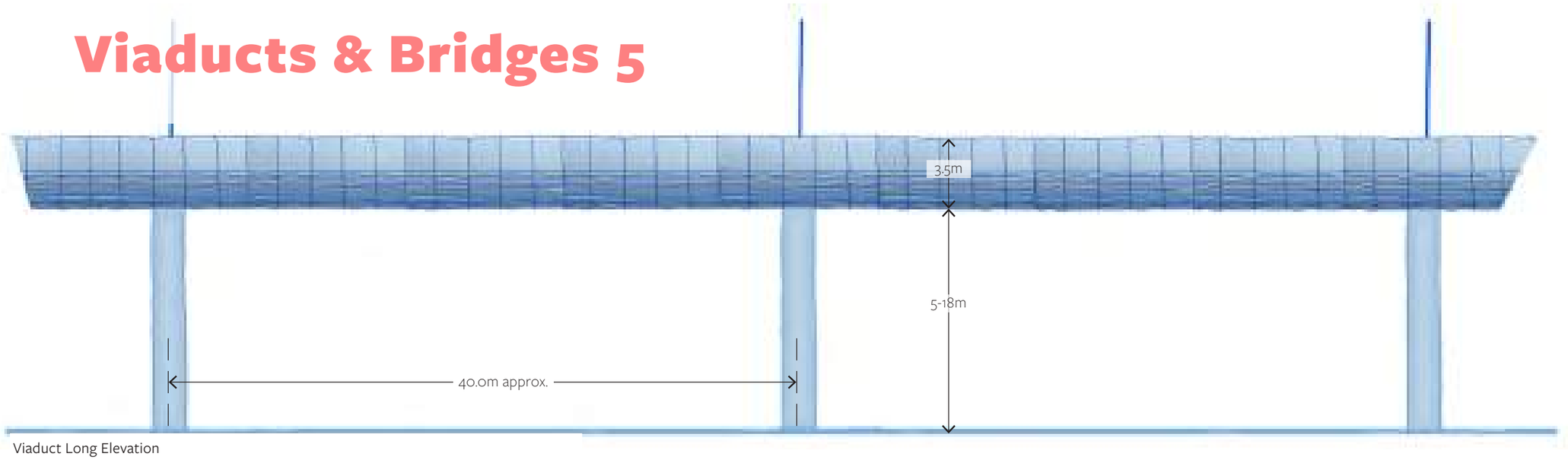


Plan at Deck Level



Underside Plan

Viaducts & Bridges 5



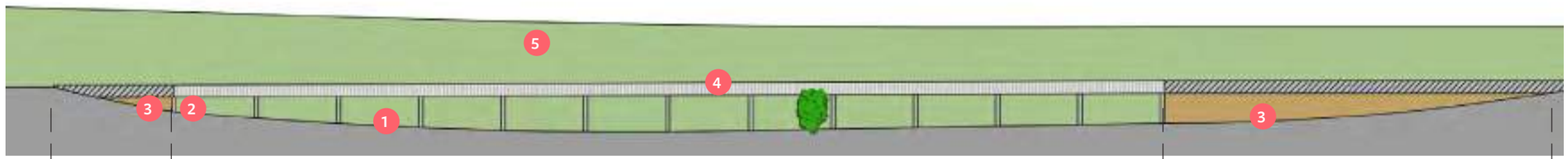
Viaduct Long Elevation

- **Pier to ground junction:** Ensure piers meet the ground in the simplest possible manner avoiding visible footings/supplementary bases, fencing and other clutter and making good ground profiles so that the piers emerge cleanly from the ground.
- **Pier to deck junction:** Pay similar attention to the junction of the piers and deck in particular movement joints and other technical necessities and their appearance in both elevation and from below.
- **Deck soffit:** At Small Dean pay particular attention to the underside of the deck which will have close range views from motorists. Consider ribs or other changes in profile to provide texture and light and shade.
- **Deck elevation:** Whilst the thickness of the deck will be determined by loads and spans its side elevation should be carefully considered to reduce apparent bulk and create shadow.
- **Barriers:** Noise barriers and edge parapets should appear similar regardless of function. This will avoid the potential asymmetry where one side of the viaduct requires a noise barrier and the other a parapet. Both barriers and parapets must be considered as integral parts of the bridge design not bolt on afterthoughts. The illustrations show their potential to provide a unified over-cladding to the side elevation of the deck with the added benefit of screening movement joints between deck and piers. Curved sections and their consequent graduation of light and shade have important potential to reduce the visual weight of the deck. Powder coat painted steel is the preferred material for barriers. Any cladding must be acceptable in terms of maintenance (PRAMs) for each viaduct.
- **Overhead line equipment (OLE):** Irrespective of the barrier height overhead line equipment (OLE) will be visible for the full extent of each viaduct. At Wendover Dean this will be at some distance from most viewpoints and with a landscape backdrop. At Small Dean OLE will be far more visible and seen in silhouette against the sky. OLE must be considered as part of the viaduct design. Considerations should include local variation in the design of OLE (simplicity, minimum thickness, avoidance of horizontal elements except wirescape, use of colour to minimise visibility especially in silhouette), synchronisation of uprights with the piers and spans so that OLE uprights reinforce the overall rhythm, and the avoidance of counterbalance of other visually heavy elements on the viaduct.
- **Signals and signs:** Signage should be fully coordinated between all agencies and fixed to OLE uprights.

General DDP: Two Viaducts or One?

3.2.10 Given the proximity of each viaduct to the other it suggests an approach which centres on a similarity of appearance of both structures. This similarity could take the form of the use of the same materials, and pier and barrier design, with a variation in deck depth and pier spacing to cope with their very different structural needs.

Standardisation of barrier design could for instance include the ability to vary the colour between the two viaducts with Wendover Dean being designed in colours that suited its landscape backdrop and Small Dean designed to be seen at closer range and against the sky. The contractor must undertake detailed colour studies which include consideration of seasonal changes in the landscape setting, and of apparent surface modelling through light and shade.

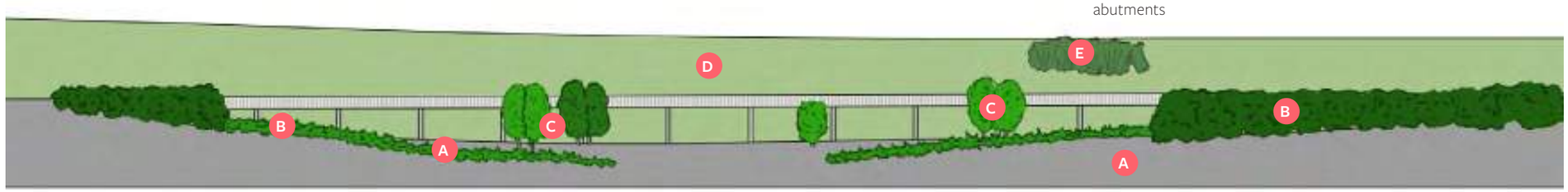


Wendover Dean Viaduct, west elevation looking towards Kings Lane with valley side backdrop

1. Low clearance requires maximum length spans to provide elegant solution.

2 & 3. Embankment and visible abutments

4. Low noise barrier
5. Valley side backdrop
6. Existing foreground tree



Wendover Dean Viaduct , west elevation: suggested landscape treatment

A. Hedgerow strengthening/ Holloway extension

B. Vegetated embankments and foreground tree planting to screen abutments

C. Additional foreground tree planting (screening in depth)

D. Valley side openness maintained

E. Limited valley-side planting (located to foil views from King's Lane properties)

Bridges

3.2.11 Parts of the remaining bridges will use common design elements adjusted as and where appropriate to reflect the particular characteristics of the Chilterns and to help in the integration of these bridges with the Chilterns' landscape. These adjustments must of course not reduce the functionality, technical performance or safety of the bridge. However with careful choice and combination of coordinated choices on selected aspects of the bridge design it should be possible to produce bridges that are of both high quality design and are sensitive to local landscape character. These choices should also be informed by a good understanding of each bridge's visibility, particularly the potential visual intrusion of overbridges in longer views, such as Bowood Lane overbridge. Due consideration should be given to accord with Design Principles 3 & 10 and 1 & 2 respectively. The aspects of each bridge that appear most easily varied are:

- Colour (landscape fit).
- Grounding (how the structure meets the ground – landscape fit).
- Components that will be directly experienced by users (association).

3.2.12 Issues such as structural solutions and general design would be subject to best practice and accepted principles of bridge design. Safety and maintenance requirements should be taken as given. Reference should be made to HS2 Case Study 1, Bridge Design Requirements and the emerging Common Designs.

DDP: Colour

3.2.13 Given the stringent requirements regarding maintenance and maintenance access that could affect operational issues, colour is likely to be integral to the materials used, rather than as applied colour. Potential materials need to meet structural and impact requirements generally, particularly for parapets. This reduces the apparent choice to:

- Concrete, and
- Corten steel (self-weathering steel)

3.2.14 **Concrete**: essentially a 'pale' material with consequently increased visibility in the landscape except where seen against the sky. Visibility can be reduced

Viaducts & Bridges 7

through added texture (ribbing, shot blast and other finishes), the use of exposed and special aggregates (darker rock such as granite) and dyes added to the matrix (these usually fade and are not recommended).

3.2.15 **Corten:** this has a tawny colour with natural variations giving a slightly mottled effect. Being darker this material would be less visible within the landscape. The steel produces a natural 'skin' and requires no subsequent maintenance and was specifically developed for use on bridges. The weathering process produces a rust coloured runoff which can stain adjacent surfaces and elements that come into contact with it although this can be avoided through the use of pre-weathered material.

This principal disadvantage of Corten is its 'image' - of rusty steel, neglect and industry by some members of the public. This might result in it being considered unpopular and/or inappropriate.

DDP: Grounding

3.2.16 A clean junction between pier and ground is equally important in shorter bridges. **Abutments** also require careful consideration.

- On overbridges the default approach should be for minimal abutments with open side spans extending the full width of the cutting. Ground under the bridge should be at the same incline as the cutting face on either side with a simple and appropriate surface finish if it is not feasible to carry though the soft finish of the cutting face. Exceptions where the side spans are reduced and brought closer to the track should only apply where this reduced visibility might usefully screen ancillary buildings or other intrusive elements.
- On underbridges the same principles should usually apply of maximising openness by using side spans and a raked profile beneath. This is provided that by doing so, the span of the bridge does not exceed that shown on the Act proposals. Where a shorter span is required and the abutment is vertical or near vertical very careful consideration is required to avoid visual intrusion particularly at close range to viewers. In these circumstances the abutment should be seen as a separate element to the span and use 'recessive' colours. These abutments could also explore the use of local materials such as flint and brick, particularly where adjacent to roads and footways.

Abutments: Exposed dark coloured exposed aggregate concrete, (photo credit Lovexin MC from Pixabay)

Corten (self-weathering) steel, (photo credit Greg Rosenke from Unsplash)

Ribbed concrete. Light and shade produces darker appearance, (photo credit the blowup from Unsplash)

No maintenance Corten structure on 180m long footbridge; University of Northampton, Waterside campus

Ribbed bridge soffit, Kings Cross

Stock brick, (photo credit Peter Muscutt from Unsplash)

Flint wall, (photo credit Derek Harper via Wikimedia Commons)

Engineering brick, (photo credit Paul Harris from Unsplash)

The design of abutments needs to be given proper consideration in particular its massing, detailing at the top and how it meets the ground, corners and the handling of elements such as expansion joints. Scale and texture will be crucial and should aim for simple elegance responding to the materials and their assembly.

See CCB guidance on the use of flint: http://www.chilternsaonb.org/conservation-board/planningdevelopment/buildings-design-guidance.html.

DDP: Parapets

3.2.17 Parapets on overbridges represent the closest point of interaction between the public and HS2. HS2 document Standard Parapets, March 2017 is an in depth study of this element and is an essential consideration in any design. It clearly sets out the requirements of each part of the parapet system in different scenarios including required heights and impact resistance. These requirements are essential to meet highway and railway safety standards. The HS2 document explores the use of a panellised concrete system with variations for different use contexts.

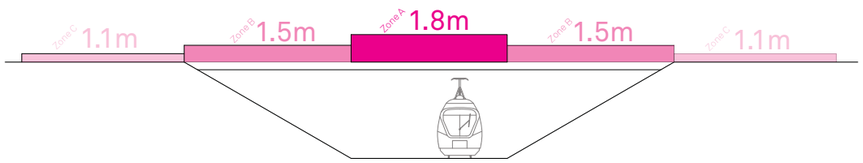
3.2.18 We understand that this study is currently not complete (September 2017) and that further parapet options will be investigated. We hope that as a result a range of simple parapets might be added. These would be capable of being executed using exposed aggregate concrete and could therefore have a darker and simpler appearance which we consider more suited to the Chilterns.

3.2.19 Another alternative for consideration would be the use of brickwork on the inner face of the parapet sitting within a pre-cast concrete panellised system. This would provide a darker toned and local material in areas with direct public contact.

3.2.20 Whether a parapet that is considered appropriate to the Chilterns is delivered through a revised choice of standard parapets or through the use of design generated specifically for the Chilterns will need to be agreed by HS2, the relevant local authorities and the Chilterns Conservation Board.

DDP: Bridge deck

3.2.21 The design of the deck surface of each overbridge will in part determine its character and the user's experience. Most overbridges in the AONB are for pedestrian, farm access or narrow rural roads. The character of the deck should be in keeping with that of the route on either side. Design considerations include:



Overbridge parapet: containment heights
(Source HS2 Standard Parapets documents March 2017)

- **Width** – generally wherever possible minimise carriageway width. Avoid bridges that are wider than the route on either side. See Section 3.4, Green Bridges for exceptions.
- **Subdivision** – avoid subdivision by use. Pedestrian and farm access bridges should be a single shared surface. Bridges on narrow lanes should either be shared surface, shared surface with suitably protected pedestrian route on one or both sides, or spaces separated by simple upstand kerbs on one or both sides.
- **Surface material** – this should as far as possible match that of the adjacent routes adapted as necessary. Grasscrete with soil and local native grassland and wildflower seed mix with central 1.5m strip backfilled with local aggregate for pedestrian bridges; the same for farm access with aggregate backfill for the full width; and open texture dense bitumen macadam throughout with epoxy bound local gravel surface coat on pedestrian zones for narrow lanes. See also Green Bridges.
- **Lighting** – only if the route on either side is lit.
- **Signage** – keep to absolute minimum.
- **Drainage** – keep unobtrusive and 'rural'. Avoid urban elements such Aco channels.
- **Transition** from bridge to adjacent route – care to be taken to achieve neat and appropriate junction between deck and approach, and approach and adjacent route. Particular attention to alignment and taper of verges/kerbs/barriers/parapets and to the extension of flanking hedges to meet the bridge approach. If possible avoid the use of standard kerbs if these are not used on the adjacent road.

3.2.22 Because of numerous local sensitivities it is suggested that bridge designs within the AONB are subject to a varied form of Common Design each of which addresses the above points.

3.3 Ecological Corridors 1

Relevant HS2 studies

Landscape design approach

Lawn, meadow and wetland plant procurement strategy

Information paper E02: ecological impact

Information paper E11: Green Infrastructure and the green corridor

Why does ecology matter?

3.3.1 Ecological impact and mitigation has been one of the central issues of HS2 and the environment and has been covered in great depth within the Environmental Statement. Subsequent work by HS2 has extended the proposals and further work is in progress.

3.3.2 This core component takes this work as read and focuses on specifics that are relevant to the Chilterns and in particular the potential synergies that can be released by the combination of proposals to provide ecological corridors and networks capable of extension outside of Act Limits by way of Additional Projects.

Current proposed ecological mitigation

3.3.3 This is shown on the scheme at Royal Assent proposals and consists primarily of site specific mitigation of:

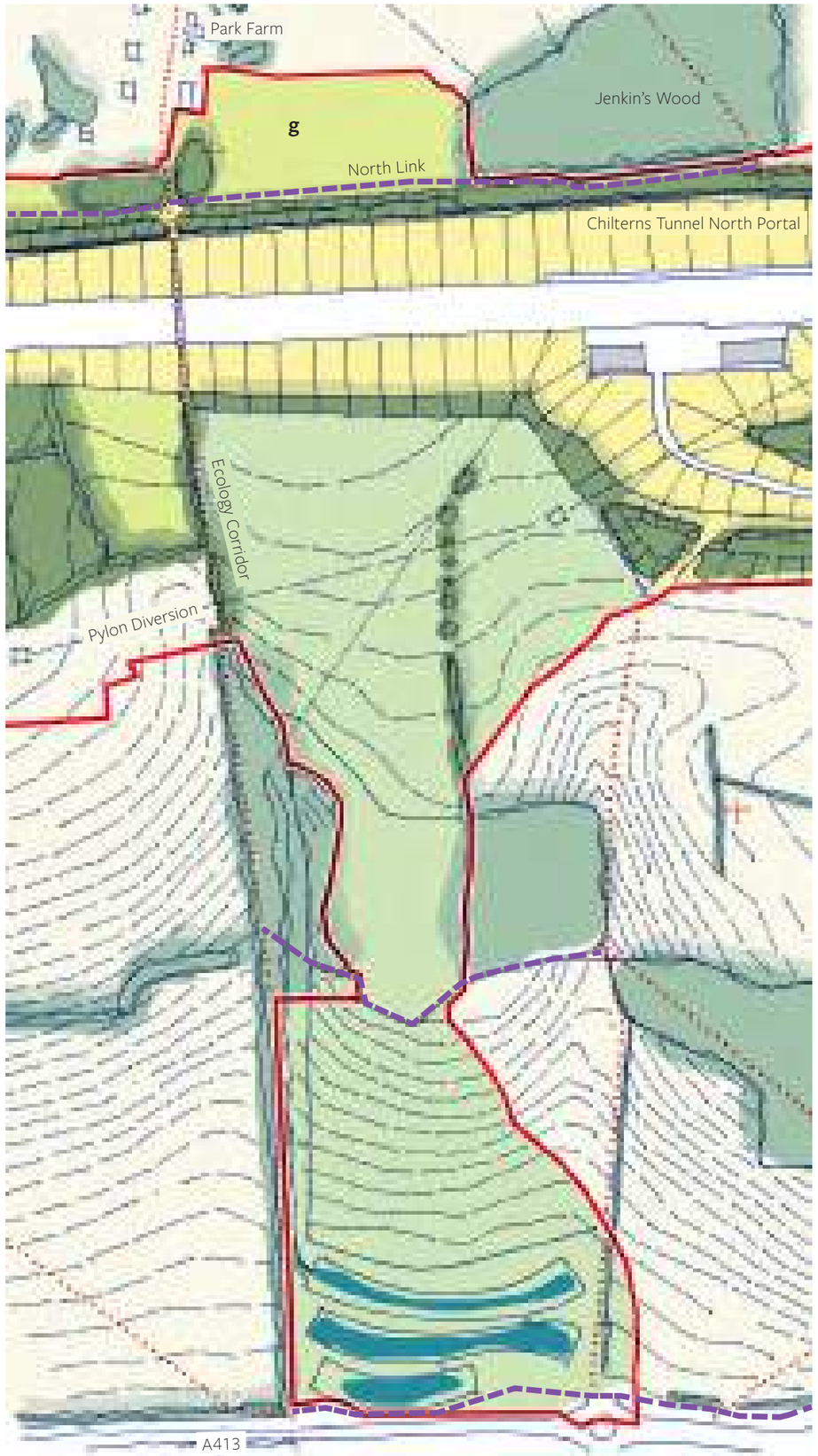
- Woodland habitat creation
- Wetland habitat creation
- Grassland habitat creation
- Ecological mitigation ponds

3.3.4 Proposals for each of these will be developed with reference to the Environmental Statement and other HS2 guidance and best practice. Reference to Section 4 Sketch proposals shows a limited number of locations where we suggest minor adjustment to these areas.

Detailed Design Principles for developing ecological mitigation proposals

3.3.5 Proposals must be site specific and be based on an excellent knowledge of that specific site. Generic solutions are acceptable provided that they are customised to suit the site. Particular attention should be paid to:

- Detailed ecological site survey of Enhanced Phase 1 Ecology and additional specifics where appropriate to inform the site specific design. Examples include soil testing (pH, nutrient levels, depth etc.), species analysis (of grassland for instance to inform making good), and protected species awareness (to avoid own goals)
- See section 3.12 Vegetation, in particular paragraph 3.12.7 for further guidance on species, local sensitivity and provenance.
- Opportunities should be investigated for all relevant species not just protected species.
- Target areas of low existing conservation value to maximise effectiveness of habitat enhancement.
- A clear understanding of the main ecological priorities. Some of the sites are very small and a wide variety of ecological enhancement is less likely to work compared to fewer well-chosen themes.
- Consideration of other environmental aspects particularly landscape character. Ensure that the ecological enhancement matches or even enhances landscape character, and is not at its detriment.
- Work within established boundaries – hedges, fences, ownership.
- Keep it local in terms of materials, and style. Use selected local excavation arisings for instance rather than imported hardcore for hibernacula (wildlife winter refuge for dormant animal. i.e. snake or bat)
- Management: who manages, who pays and what is the appropriate management to achieve the ecological intent?
- Reality check: work with the site and the broad context. Maximise certainty of sustainable delivery. Consider public access and levels of possible wilful or other damage
- Keep it simple and avoid over-complication.



Ecological Corridors 2

Further ecological opportunities

3.3.6 As explained earlier in this document our approach has been to identify other potential locations for cost effective enhancement/adjustment of proposals principally through varying the proposed repair of extensive areas heavily impacted by construction. Almost without exception this does not require adjustment of Act Limits or impact on anticipated operational areas.

3.3.7 These opportunities stem from the locally extended Act Limits and not from established ecological need for protection or linking of specific habitats or species. It is an opportunistic approach.

3.3.8 We have examined two areas in terms of their apparent ecological enhancement potential – the Wendover Link (see Section 3.13) and the Park Farm corridor. Other potential corridors are shown on sketch proposals in Section 4.

Park Farm Ecological Corridor

Legend

- Act Limits
- Realigned public path to scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- Infiltration ponds

For further details see Illustrative Sketch Plan Sheet 33 in Section 4

Ecological Corridors 3

Location specific DDP: Park Farm corridor

3.3.9 The Park Farm Corridor would provide a broad ecological corridor connecting the plateau with the valley floor. It would also include a number of existing and proposed pedestrian links together with a SuDS chain to dispose of surface water from the railway. As such it is an example of a multi-functional landscape or Green Infrastructure.

Of particular note is the way that it could:

- Incorporate and connect areas of ecological mitigation included in the scheme at Royal Assent proposals – grassland habitat creation south of Park Farm and a further area west of the proposed footbridge at Ch47.750; and two areas of wetland habitat creation north-east and west of Park Farm
- Connect existing and proposed woodland (in particular Jenkin's Wood and large scale woodland proposed at Ch48.000 and on the valley slopes
- Retain, enhance and extend hedgerows and headlands
- Incorporate new wet habitats (balancing ponds and ditches) with the existing pond south west of Park Farm
- Retain, divert and extend footpaths both within and outside the corridor
- Retain landscape character

In so doing it exemplifies the general guidance by suggesting minor amendments to boundaries and content of the two specific grassland habitat creation mitigation areas, adjusting their boundaries (whilst maintaining the same area) to utilise existing field boundaries.

3.3.10 It also seeks to provide substantially added ecological connectivity through consideration of the construction zone and ditches and infiltration ponds proposed as part of the permanent works (see also Section 3.6). These considerations include:

- the suggested amendment of the pipe and ditch surface water alignments to reduce severance and agricultural impacts and to produce a landscape and ecological corridor parallel with this ditch and field boundary and including the existing right of way
- relocation of proposed woodland to maintain existing landscape character and openness of views up and down the valley side

Location specific DDP: Wendover Dean Corridor

3.3.11 Illustrations on pages 45 and 105 show the potential for the 400m wide space centred on the Wendover Dean viaduct to act as a funnel for fauna moving along new and restored ecological corridors between woodland to the north-east, and the valley floor and habitats beyond. The contractor should investigate means of maximising the effectiveness of such a corridor in particular opportunities such as:

- The protection, enhancement, recreation and extension of the existing Holloway linking to Chesham Lane.
- The potential reuse/translocation of coppice stools from the existing Holloway removed by the adjacent works.
- The creation of a dual-use access and ecological corridor connecting with Jones' Hill Wood.
- Creation of a network of dual-use ditches and infiltration ponds to provide diverse and connected habitat.
- A programme of hedgerow strengthening and verge/ headland enhancement to extend the ecological corridor to the A413 and beyond.
- Localised copse planting using species of local provenance.
- Additional land management initiatives (with landowner's agreement) to reinforce the above.

3.3.12 And broader Green Infrastructure through:

- the possible North Link pedestrian and potential cycle link along the north side of the railway providing added connectivity to the pedestrian bridge and footpath GMI/12, and;
- new linking paths to aid lateral movements on the valley side and valley floor.

3.3.13 The detail of the possible corridor and their habitats would be informed by:

- local ecological desk and field study to establish detailed local sensitivities, issues and opportunities.

Ecological Corridors 4

- an understanding of the wider ecological context of the corridor and the ecological strategy set out in Section 2 above.
- consultation with local wildlife groups.
- consultation with landowner to agree extent of area that can be managed for biodiversity.
- agreement on detail, ownership and funding of ecological management.
- construction method and programme.
- potential and proposed Additional Projects.

Detailed Design Principles (DDP) and Contractor action

3.3.14 The Contractor shall investigate means of maximising the reasonable realization of the above opportunities working with the local authorities and the Chilterns Conservation Board to achieve synergies with any selected and relevant Additional Projects.

Wendover Dean Ecological Corridor

Legend

- Act Limits
- Realigned public path to scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- Infiltration ponds

For further details see Illustrative Sketch Plan Sheet 36 in Section 4

3.4 Greening Bridges 1

G Greening Bridges | 1 Integration | 3 Quality | 10 Structures | 12 Ecology | 13 Greening

Relevant HS2 documents

Information Paper E2, Ecological impact

Information paper E11, Green infrastructure and the green corridor

HS2 Landscape Design Approach

3.4.1 Particular reference should be made to Section 3.2, Viaducts and Bridges, and Section 3.3, Ecological corridors.

Refer also to best practice guidance and in particular to Natural England's 2015 Literature Review of Green Bridges, and the Landscape Institutes Technical Guidance Note.

Limitation

3.4.2 No Green Bridges are included in the latest HS2 proposals (i.e. all proposed and existing reused bridges are primarily for purposes of vehicle, pedestrian or other access requirements). Whilst green bridges are not included per se in this part of the alignment contractors are to explore any opportunities for greening bridges where appropriate. Deck width and depth are defined within the Act Limits and will be difficult to change. It is suggested that greening proposals work with these parameters.

Purpose of greening bridges

3.4.3
- To encourage use by fauna
- To connect ecology corridors on both sides of the line
- To reduce urbanising effects of new bridges particularly the walker's experience

Opportunities and potential Detailed Design Principles (DDP): new bridges

3.4.4 The principal opportunity relates to the deck surface. Opportunities connected with the structure and parapets are likely to be very limited.

3.4.5 Designers should investigate opportunities outlined in Section 3.2: Viaducts and Bridges relating to the use of porous material on bridge decks in particular on pedestrian and farm access bridges. This could consist of:

- A suitably waterproofed deck structure with drainage layer over a reinforcement system, such as an interlocking plastic cellular system of suitable strength to take expected load and traffic, laid on a suitable sub-base.
- Backfill consisting of lightly compacted local aggregate for walking/trafficked surfaces, and low fertility topsoil for the remainder of the deck extent.
- Seeding of all low fertility topsoil areas with a chalk grassland and wild flower mix customised to match local flora.

3.4.6 This will produce a more sympathetic appearance and provide some continuity of grassland habitat without detriment to the function, safety or maintenance of the bridge. Maintenance needs are unlikely to be significant but would need agreement with the agency responsible - Buckinghamshire CC (Highway Authority).

3.4.7 On more frequently trafficked overbridges it may be feasible to provide a chalk grassland 'footway' on one or both sides. This would be particularly suitable for the Holloway overbridges.

3.4.8 Soil depths could be increased on pedestrian bridges provided this was matched by an increase in parapet heights. This could allow the use of more substantial native planting providing this did not prejudice safety or maintenance (details of which will need to be agreed in advance). Deck widths could also be increased if there was a proven need. Fence protection may be required of planting (as opposed to meadow grassland) where bridges are used by farm traffic.

Greening Bridges 2

Greened pedestrian bridge, A3 Hindhead

Location specific opportunities and DDP

3.4.9 Each of the new bridges offer a degree of opportunity with the greatest opportunity provided by new pedestrian and farm access overbridges. These opportunities may also exist as verges to lanes on proposed overbridges. The best opportunities would appear to be pedestrian overbridges located as follows: west of Nash Lee Road, east of Bowood Lane, and west of the Chiltern Tunnel North Portal; together with the farm access bridge close to Grim's Ditch. These opportunities are given added value through connection to proposed ecological corridors on either side of the railway.

3.4.10 Opportunities for greening of underbridges are more limited with the best opportunities presented at the existing Risborough Road bridge where redundant carriageway could be significantly reduced in width, and at the proposed farm access underbridge south of the Green Tunnel South Portal.

Location specific opportunities and DDP: Existing Bridges

3.4.11 These opportunities may extend to the simple adaptation of existing bridges. For example Bacombe Lane bridge has a carriageway wider than the carriageway of the lane on either side of the bridge, and an additional macadam footway on both sides. The lane has no footways. It should be feasible to remove the macadam from the footway sections of the bridge and replace this with a locally matched chalk grassland seed mix on low fertility topsoil. The soil must be no higher than the macadam to avoid reduction of the parapet and the grass mix must not lead to any issues with sight-lines.

3.4.12 This would represent an ultra-cost-effective solution, funded as an Additional Project or from other sources.

Greening Bridges 3

Constraints

3.4.13 Many of the constraints identified in the Viaducts and Bridges Component will apply to greening of bridges whether these are new or existing bridges. The most significant include issues of safety of users and trains, loading and drainage of the deck, and maintenance and management responsibilities. These requirements may preclude greening of some bridges but that should not deflect from the intent to maximise bridge greening especially where this will provide key linkage between proposed ecological corridors.

DDP: Fauna Underpasses

3.4.14 The biggest opportunities for fauna underpasses are the two viaducts. These opportunities should be developed as Ecology Corridors without any changes to the viaduct structure or design.

3.4.15 There are only two new underbridges both of which are part of a fairly cramped and complex general arrangement at ground level. Despite this the design of both should if possible include elements to assist safe fauna movement. The third accommodation underbridge near Grove Farm should adopt the same approach.

3.4.16 There are particular opportunities associated with surface water conveyance at Rocky Lane underbridge.

Greened existing bridge; proposals for Bacombe Lane bridge

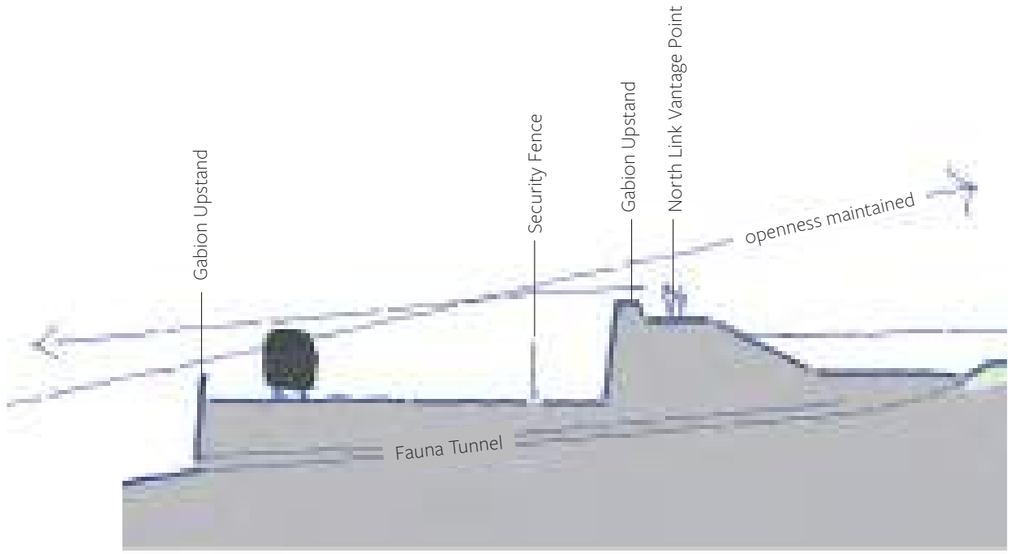
Greening Bridges 4

Bowood Glimpse

3.4.17 Bowood Glimpse is a short section of elevated track flanked by cuttings on both sides. The embankment bridges a small side valley that is proposed as an Ecology Corridor. This would funnel fauna movement down the side valley connecting the woodland habitats above with those on the opposite side of the valley via a network of enhanced hedgerows and widened headlands.

3.4.18 However fauna would still need to cross the line and negotiate associated retaining structures. A surface water drain connection will be inevitably required at this point to convey water under the line. There is a potential low cost opportunity to oversize this pipe/culvert and to design its cross-section to act as a dual use fauna underpass and drain. Specialist ecological advice should be obtained to investigate the level of expected use of this facility.

3.4.19 This could work in conjunction with the design and layout of the retaining structures, maintenance access and the possible North Link path to provide a vantage point with views of the valley below and trains in close but safe proximity; hence Bowood Glimpse.



Bowood Glimpse

3.5 Holloways 1

H Holloways | 1 Integration | 7 Holloways | 8 Rights of Way | 10 Hydrology | 14 Clutter

Why do Holloways Matter?

3.5.1 Holloways are an iconic feature of the Chilterns – sunken lanes formed by centuries of traffic and rainfall on routes that traverse the valley sides. These are classic multi-functional features that contribute to both landscape character and the experience of users as well as acting as ecological corridors, low speed/quiet lanes and 'living' heritage assets. Some are already under pressure from traffic; others form an ideal cycling or pedestrian link.

3.5.2 Typical Holloways are narrow, with steep banks 1-2+m high on both sides often with locally native hedgerows, coppice or larger trees on one or both sides.

How are they Affected?

3.5.3 Four Holloways are affected by the alignment:

1 **The unnamed public footpath between Chesham Lane (also a Holloway) and Wendoverdean Farm:** This feature is already significantly degraded with sections of both bank and hedgerow removed but the remaining stretches have excellent character – a simple unsurfaced path and enclosing tunnel of vegetation.

HS2 proposals will cause significant damage directly and indirectly through construction of the Wendoverdean Viaduct (over) and the west abutment/ embankment (on top of) and extensive cut slopes (adjacent to). Part of the footpath is permanently diverted as a result.

2 **Bowood Lane:** a single track surfaced lane with moderate banks with some enclosing vegetation.

Approximately 300m will be removed through the construction of an overbridge and its approaches.

Leather Lane

Holloways location plan

Holloways 2

3 **Leather Lane:** slightly wider than Bowood Lane but still single track and surfaced. More substantial vegetation and higher banks especially along its southern edge.

Approximately 600m will be affected by the construction of an overbridge and associated earthworks, vehicular access points to ancillary buildings/functions and regrading on the existing alignment of the lane. Approximately 200m of the existing Holloway could potentially be retained as the new lane has a different alignment. The remainder of the lane is threatened by likely construction access requirements to the proposed ancillary elements. These elements, unless carefully handled, could further weaken the landscape character of the lane's immediate context.

4 **Private track between Potter Row and Havenfields (Liberty Lane):** this feature may be a more recent heavily wooded drive rather than a Holloway (there is no public access).

A considerable length of this drive and its flanking trees will be removed by the overbridge and the new track both on and off the alignment of the existing drive. About 250m of the drive and trees could possibly be saved were the new track to take a different alignment.

Holloway near Chesham Lane

What are the Issues & Opportunities?

Issues

3.5.4
- Actual loss of asset;
- Inappropriate modification/removal of redundant Holloway sections subsequent to transfer from public highway to landowner;
- Loss of physical and experiential continuity;
- Further loss/damage caused by construction;
- Loss of positive context to remaining segments;
- Potential visual intrusion of new earthworks associated with overbridges (lane locally on embankment to achieve necessary headroom for trains under bridge);
- Loss of character through inappropriate design of replacement links (width, edges, banks, enclosure, vertical and horizontal alignment); and,
- Increased traffic speed and reduced experience of pedestrians and cyclists.

Opportunities

3.5.5
- Creation of new 'Holloways';
- Full integration with local landscape context;
- Creation of improved conditions for pedestrians and cyclists;
- Effective restoration/enhancement of retained sections;
- Extending enhancement outside of Act Limits, and;
- New uses for now redundant sections of Holloway (with landuser's agreement).

Holloways 3

The Design Intent

3.5.6 Designs should maximise the retention, protection and enhancement of existing Holloways (inside and outside the Act Limits). There should be a seamless join to new 'Holloways' that recreate the character and multi-functionality of the adjacent existing sections. Any construction requirements should be a separate and temporary provision with full and effective removal and repair.

Contractor's Proposals

3.5.7 Proposals will need to be sensitive to a number of complex and interrelated 3D aspects and juxtapositions with existing retained landscape and assets. The treatment of these new replacement links has the potential to introduce a significant element of unwanted urbanisation which will be experienced by a relatively high number of people using these links for a number of reasons. Detrimental effects on landscape character will be felt more keenly than in less accessible locations.

3.5.8 Because of this we suggest that the level of information supplied needs to be greater and the issues of interface and integration further developed than for more typical parts of the alignment. Submitted information should include large scale detailed area plans, sections and relevant supporting information, in addition to plans and sections usually required for highways consent; and plans and specifications for earthworks set out and agreed in the relevant Planning Forum Notes. This is to ensure that proposals are appropriate, compliant and capable of review by both highway engineers and other professionals with a particular interest in achieving appropriate "landscape fit."

General Considerations and Detailed Design Principles (DDP)

3.5.9
- Has retention of existing Holloways been maximised?
- Are retained Holloways adequately protected?
- What are the construction access arrangements and are these feasible? Off line access parallel to the existing Holloway is almost always preferable/essential. (NB Construction access is not a Schedule 17 consideration).
- Is the horizontal and vertical alignment of the new lane appropriate? (Width – generally to match existing lane with passing places; deliberate limits on forward visibility/curvature to reduce speed; retention of appropriately steep gradients to reduce miss-fit with adjacent slopes etc.).
- Hedgerow/coppice stools, where removed by the works, should be translocated and used to form new Holloways where feasible.
- Is the detailed highway design appropriate to its rural context? (Avoid upstand kerbs if at all possible; surfacing generally to match existing; low key drainage; minimal signage, markings etc.;).
- Landscape corridor – is this rural? (Particular attention to how the edge bank is formed, its junction with the carriageway, the recreation of vegetative enclosure using locally native species and understory based on survey of actual constituents of existing corridors on adjacent sections).
- Integration with adjacent landscape – has this been properly considered through both section and plans? What forms the highway boundary – if fenced this should be appropriate and informed by local precedent relevant to functional requirements.
- Safety through coordinated design not enforced through added measures to a standard highway solution.
- Maintenance and ongoing safeguarding of Holloway, following HS2 opening.

Location Specific Considerations and DDP

Chesham Link

3.5.10
- Has the opportunity been grasped to create extensive new Holloway even where the existing element is severely degraded?
- Are the proposals fully integrated with the extensive nearby attenuation elements?

Bowood Lane

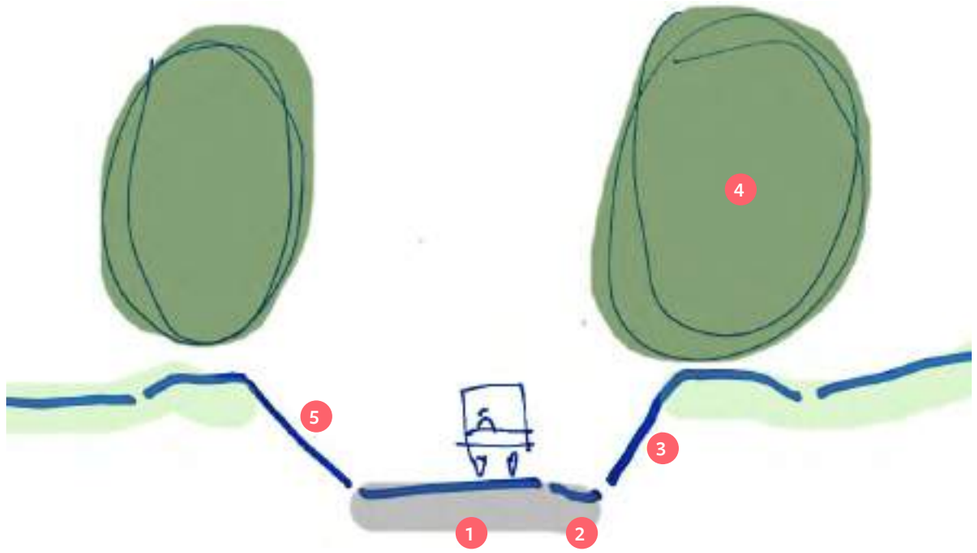
3.5.11
- Is the design of the overbridge deck appropriate (similar in width to the adjacent carriageway; are the 'verges' appropriate; does the Holloway enclosure come as close as possible to the bridge structure?).
- Are the vehicular access points appropriately rural?

See also

Sketch design proposals in Section 4

Further guidance on related Components in particular overbridges, attenuation facilities and ancillary buildings

Holloways 4



Typical Holloway Cross Section

1 Narrow width, no kerbs if hard surfaced
2 No drainage provision
3 Steep banks, 1-2m high
4 Thick native hedgerows and trees on one or both sides
5 Lack of signs, lights and road marking, rural character

Leather Lane

3.5.12 Generally as Bowood Lane plus...

- What are the proposals for the redundant sections of Holloway?
- Are the proposed attenuation elements integrated?
- Is access to the Ancillary building sensitively scaled/designed?
- Are the surroundings to the building appropriately designed (minimising urban influence) and adequately screened? Particular attention to lighting, security and signage.

Liberty Lane

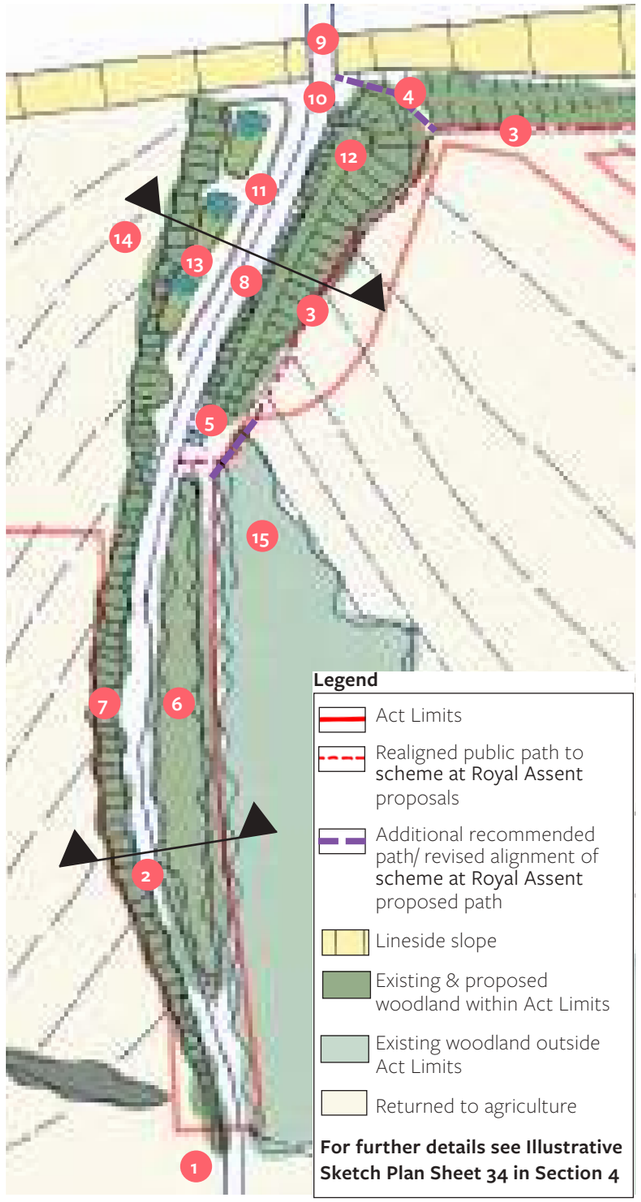
3.5.13 Generally as Bowood and Leather Lanes plus...

- Particular attention to proposed attenuation elements in visible locations outside of HS2 proposed tree planting.

Associated Structures

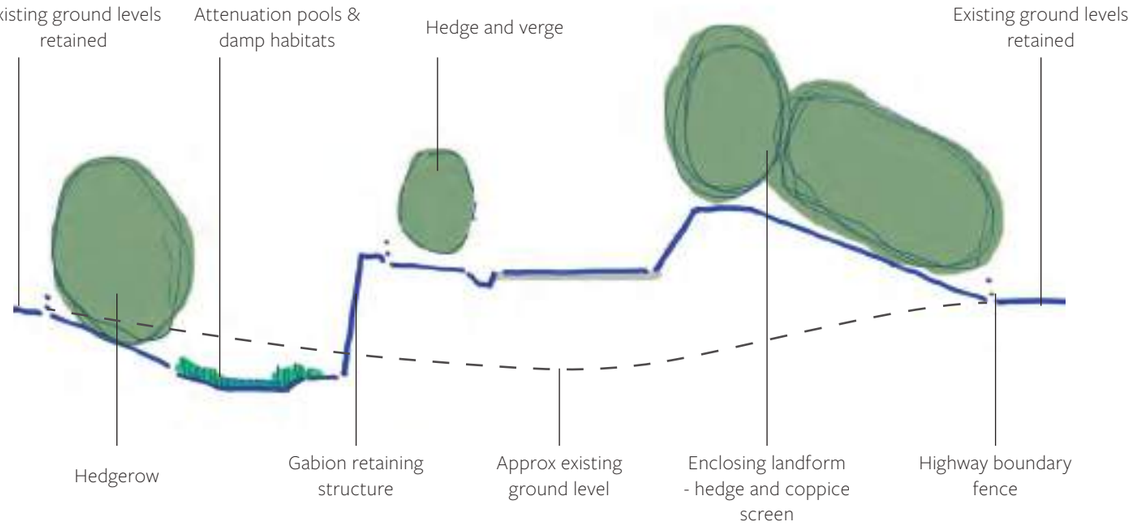
3.5.14 Associated structures to the new highway will need to comply with relevant structural and Highway standards and receive approval from the relevant Highway Authority. For this reason and for ongoing maintenance, retaining or similar structures should generally be avoided if at all possible.

Holloways 5

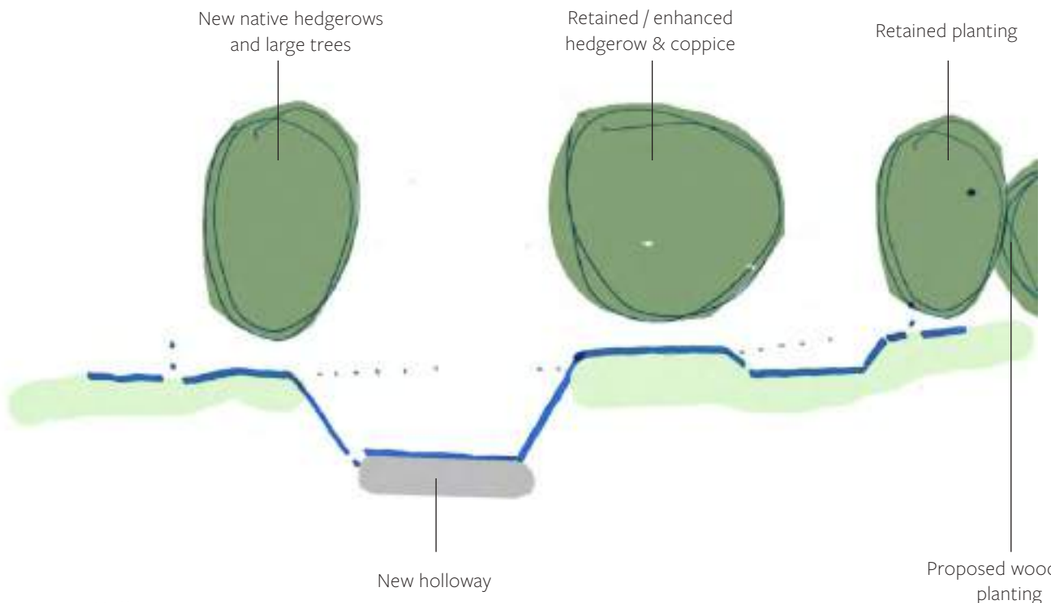


Liberty Lane Holloway Detail

1 Existing holloway retained, hedgerow strengthening programme.
2 New "holloway'
3 Realigned footpath in HS2 proposals
4 Additional footpath link
5 Stepped connection
6 Retained and additional native woodland / coppice
7 Proposed native hedgerow
8 New holloway - vertical profile now above existing levels
9 Overbridge - minimum width or standard width with grass verge
10 Proposed planting as close as possible to bridge abutment to avoid 'leaky views'
11 Gabion retaining structure to accommodate change of level to attenuation below. May include grass verge and/or native hedgerow
12 Proposed landform to create holloway enclosure. Hedgerow/ coppice planting with highway boundary with fence set well back using translocated coppice stools where appropriate.
13 Attenuation pools (see Section 3.6)
14 Cutting slope and field boundary
15 Existing woodland planting

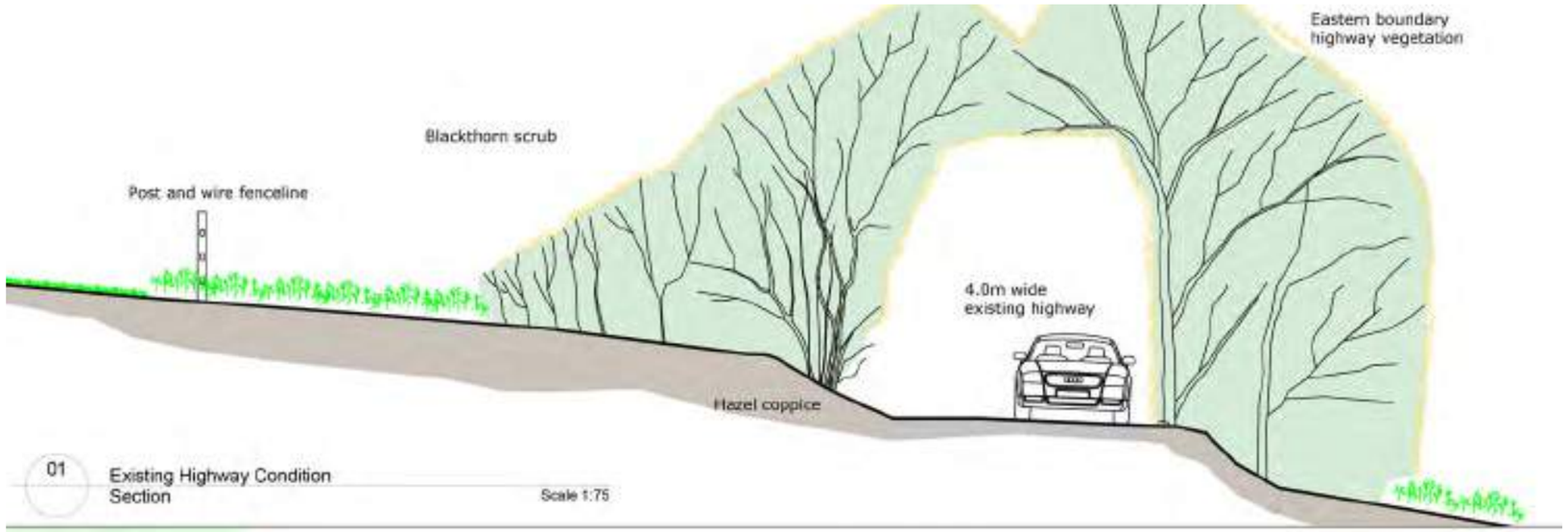


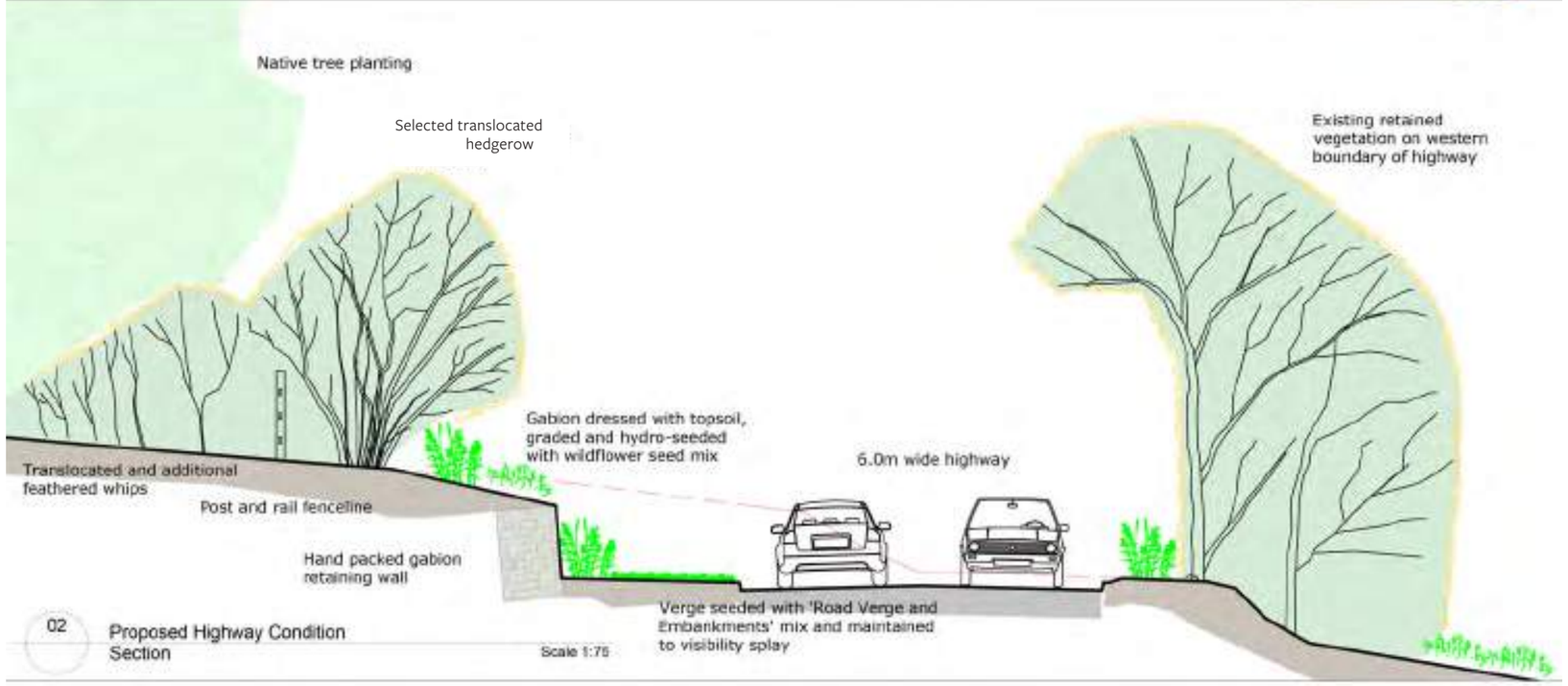
New Upper Holloway



New Lower Holloway

Upgraded Rural Lanes 6





Exemplar lane widening scheme at High Wycombe

1. If widening is essential widen on one side only
2. Avoid use of kerbs wherever possible
3. Verges only where required for visibility splays for access points to ancillary facilities
4. Use of translocated hedgerows / coppices and whips

Notes for users of the Detailed Design Principles

- Only use kerbs if there are already kerbs on the existing Holloway
- Only use retaining upstands/ gabions where required by sight lines

Upgraded rural lanes

Both the design intent and many of the Detailed Design Principles should also apply to the required upgrading of rural lanes as part of HS2 proposals. In every case, all attempts should be made to retain the rural and local landscape character of the road and , where particularly relevant, its tranquillity.

The illustrations show an example of a similar initiative elsewhere in the Chilterns. (NB. The kerbs and sight lines were only required at junctions).

3.6 Infiltration Ponds & Ecological Mitigation Ponds 1

Why these features matter?

3.6.1 Disposal of surface water is essential for the safety of the railway in particular its tunnels and cuttings. Collection of surface water will be part of the main contract civils package. It will then be disposed of through a network of drains and ditches connecting a series of attenuation and infiltration ponds many of which are of significant size.

3.6.2 The approved proposals are partly schematic with ponds shown diagrammatically. Both the scale of the ponds and their locations indicate considerable potential to be visually intrusive and alien to local landscape character. The guidance below aims to avoid this situation and to unlock their equally considerable landscape and ecological potential.

3.6.3 The landscape of the upper Misbourne Valley is essentially dry. There are few ponds or ditches in the valley floor. The introduction of these new functions requires a good understanding of local landscape character.

Relevant HS2 documents

HS2 Landscape Design Approach

Issues

3.6.4
- Introduction of alien features in the landscape.
- Introduction of intrusive engineering elements such as headwalls, concrete channels, safety/security fencing.
- Ditch lines that conflict with existing field boundaries.
- Slopes and run-off velocity could require intrusive engineered solutions.
- Ancillary buildings/pump stations with associated maintenance access and security.

Opportunities

3.6.5
- Full landscape integration through excellent awareness of local landscape character.
- Habitat creation and enhancement.
- A key component of new ecological corridors.
- Additional landscape assets.

General Considerations and Detailed Design Principles (DDP)

Ponds

3.6.6 Full details as to volumetric requirements, return periods within the features and the sizing of ditches etc. are currently unknown. However the following assumptions are most likely to apply:

- The ponds will remain dry for much of the year. Only in exceptional circumstances will it be appropriate for ponds to be over-deepened and lined.
- Even when in use water depths will be fairly shallow with high water levels soon lowering as attenuated water is passed down the system.
- Infiltration ponds will be slower to empty as this will depend on the rate at which groundwater recharge takes place.
- An additional freeboard will be required above the maximum water level in case of blockages.
- The features are more landform than water body.
- Side slopes of ponds and ditches to be designed to generally avoid engineered slopes/structures and to include suitable safety features such as shelves where drowning is a potential issue.
- Alignment of ponds parallel with contours to minimise disturbance of natural landform.
- Plan shape that fits with existing micro landform.

Infiltration Ponds & Ecological Mitigation Ponds 2

Typical field ditch, photo by DS Pugh/Goit at Whitwell on the Hill point to point course

Concrete channels - inappropriate and to be avoided, photo by Tstreitz, CC BY-SA 3.0 via Wikimedia Commons

- Allow for greater than minimum land-take to accommodate the above refinements all of which will reduce capacity/efficiency.
- Grass cover should extend adjacent existing mixes or provide added locally-appropriate biodiversity.
- Generally planting is permitted within these ponds provided that this does not affect their performance or their periodic inspection. HS2 specific guidance to be sought.
- Fencing should be minimised in extent and visibility being rural in appearance. The feature itself should be in essence 'safe' and not have to rely on high and intrusive safety fencing.
- Headwalls, valve gear, equipment housing etc. should be minimised, sited and designed to have minimum visibility and incorporate screen planting if necessary.
- Any required maintenance vehicle access should use compacted MOT Type 1 or granular stone.
- No fixed lighting unless absolutely essential in which case this should be manually operated with a default mode of 'off'.
- Refer to the Pond Survey carried out by Queen's Awards Prestwood Nature to inform design development.

3.6.7 In all cases the feature should appear to be a feature in keeping with the landscape, and one that is acceptable to relevant landowners.

Pond locations

Infiltration Ponds & Ecological Mitigation Ponds 3

Location

3.6.8 These features are located in each of the three principal local landscape character areas – the plateau, the valley slopes and the valley floor. Each area provides clues as to the successful integration of these engineering features.

Area specific DDP

3.6.9 **Plateau:** The historic field patterns include a number of small ponds scattered between Potter Row/King's Lane and the top of slope with the valley side. The pond near Park Farm is suggested as a prototype for new attenuation ponds to the north-east of the alignment and in this area. Notable features are the steep sides and flanking vegetation that incorporates perimeter fencing.

3.6.10 An alternative 'model' is that of a marl pit (a relic from the localised extraction of marl and the production of fertiliser) – generally a relatively steep sided, broadly circular often wet pit with natural vegetation.

3.6.11 Both of the models would require modification of side slopes to avoid safety issues and permit maintenance access.

3.6.12 **Valley sides:** These are the most challenging sites with no precedent for visible water features and technical and design challenges for accommodating temporary water storage on steep slopes. This is further accentuated by a far greater footprint of direct impact by volume because of the temporary and permanent engineering works generated by working on such steep slopes. For these reasons it is recommended that valley side infiltration ponds are avoided if possible with the facility provided either on the plateau above or valley floor below where engineering and landscape fit issues are far less demanding. If this cannot be achieved the guidance below applies.

3.6.13 The balance between excavation and usable attenuation volume favours simple, steep-sided and deep dishes cut into the chalk valley sides. The construction of retaining berms will be difficult. These features would be excavation only and because of this can take advantage of the steep cut slopes achievable in chalk without recourse to engineering structures, or to fully engineered slopes. A typical solution might consist of a near vertical engineered lower back slope with a visible chalk cut slope above. This would be hydraseeded with a local chalk grassland mix and jute mesh protected if necessary.

Valley floor potential exemplars:

Simple recreation opportunities (photo credit Shaun Ferguson)

Ridge and Furrow landscape, (photo credit Matt Neale from UK, CC BY-SA 2.0 via Wikimedia Commons)

Sub-surface archaeology

Natural shapes, (photo credit Danny Oates from Usplash)

Watercress beds

Natural edges, (photo credit R. Henrik Nilsson, CC BY-SA 4.0 via Wikimedia Commons)

Infiltration Ponds & Ecological Mitigation Ponds 4

3.6.14 The design intent would be to mimic a small valley-side chalk pit, inclusive of natural regeneration and surrounding rural livestock fencing. These could be 'stacked' above each other if attenuation volumes so require. Additional capacity could be achieved through over excavation of the base and infill with plastic water storage crates with soil cover over, provided durability and maintenance access requirements can be met.

3.6.15 This idea could be extended to the sole use of a buried crate system placed on a platform cut into the slope and then soiled over and chalk grassland seeded. This would be suited to areas where visible change needs to be minimised.

3.6.16 **Valley floor:** These are generally bigger features and more publicly visible. Although close to the underground course of the Misbourne they will sit in a dry and open landscape. Hiding them through perimeter planting could accentuate awareness of them.

3.6.17 We suggest that these features are informed by:

- Analysis of the optimum balance between minimising footprint (which would favour single, larger ponds) and minimising landform disturbance particularly on the up-slope edge (which would favour a string of linear pools parallel with the slope and each slightly benched into it). The shallower the slope the more natural single, larger ponds will appear.
- Larger ponds would be more suited to over-deepening but unlined to create a degree of more permanent open water which could be accentuated as a continuum of habitats from open water, through marsh to damp meadow complete with groups of water loving trees.
- The use of linear ponds would be at the expense of attenuation capacity given the geometries of the cross-section. It follows that these features will be more like parallel ripples of landform the shape of which could be informed by landforms such as 'ridge and furrow', sub-surface archaeology or abstract land art. Whatever the case these landforms need to be designed with great care and skill using 3D modelling and an acute sensitivity to the integration of the new and existing landforms to produce sculpted, not engineered, forms.
- Should fencing be unavoidable this should be fully integrated with the proposals and in the case of the linear features incorporated into the outer ripples which would act as screens.

Groundwater recharge

3.6.18 An added benefit of these valley floor ponds is groundwater recharge. A potential Additional Project is an investigation as to whether this can be directly harnessed to help 're-wet' the Misbourne and help halt its retreat down the valley.

DDP: Ditches

3.6.19
- Ditch capacity to be determined but a typical trapezoidal section is assumed appropriate.
- Provide adjacent hedge where local precedent does so.
- Where ditches may be subject to potential scour due to water volume and velocity, use appropriate bio-engineering measures to accelerate establishment of close cover vegetation (including jute mesh erosion protection) and/or local stone base to ditch and/or local small weirs to reduce velocity. Where these or similar methods would be ineffective because of slope gradients use piped systems.
- Do not use concrete channels or flume systems.
- Associated fencing and access points should use simple components appropriate to the local, rural character.

Infiltration Ponds & Ecological Mitigation Ponds 5

Ecological Mitigation Ponds

Why these features matter

3.6.20 The provision of ecological mitigation ponds is directly related to the Environmental Statement and mitigation that has been agreed to be provided in accordance with HS2's scheme at Royal Assent. The purpose and ecological specifics are therefore a given. This note relates more to the appearance of such features and the need to maximise both landscape fit and ecological connectivity and value. This will avoid anomalies in the landscape.

Relevant HS2 documents

HS2 Landscape Design Approach

Information paper E02: Ecological impact

Information paper E11: Green Infrastructure and the green corridor

Design approach and general Detailed Design Principles (DDP)

3.6.21 The above detailed design principles apply equally to Ecological Mitigation ponds. Specific additional considerations are set out below:

- **What mitigation is required?** Reference to relevant parts of the Environmental Statement and supporting documents will provide basic information on expected impacts and agreed and proposed mitigation. The level of detail will vary.
- **Site and contextual knowledge** will be vital in developing the mitigation so that it maximises the specific opportunities for mitigation at each location. This will inevitably increase the chances of both successful and lasting mitigation and its connectivity with the wider ecological context within which it sits. This may require further survey or may simply be a matter of 'opportunity spotting' by an experienced and observant ecologist.
- **Local knowledge**: make use of the immense local knowledge both general and locally and species specific. The local Wildlife Trust and Chilterns Conservation Board will almost certainly be able to provide relevant local contacts.
- **Landowner agreement**: the landowner will not only have probably the greatest local knowledge but must also agree to all proposals and their management requirements.
- **Looking ahead**: both the design of ponds and ecological mitigation generally needs to consider and anticipate trends (national issues such as climate change adaptation or trends specific to the Chilterns such as increased recreational pressure, changes in water table etc). Designs need to anticipate these changes and acknowledge that designs need to be able to adapt even if we don't know what they need to adapt to.
- **Landscape fit**: designs need to perform ecologically AND look and feel part of the Chilterns' special landscape character. The resulting landscape needs to appear to be managed. These two requirements are not mutually exclusive. It follows that the design will almost certainly require dual working between ecologists and landscape architects. Guidance on the design characteristics of ponds on the plateau and valley bottom is equally applicable to mitigation ponds.

Infiltration Ponds & Ecological Mitigation Ponds 6

DDP: Selected specifics

3.6.22

- **Permanent water**: avoid the use of butyl liners or similar and use traditional puddled clay (if locally available) or possibly bentonite systems (provided there are no unwanted ecological side-effects). Consider the source of water, its quality, and its certainty. Design pond profiles such that some degree of drying out is anticipated.
- **Safety**: profiles should be 'safe' even if on private land. Two or three stage profiles with relatively gentle transition slopes suit both ecology and safety.
- **Natural colonisation v landscaped feature**: in absolute ecological terms an observed natural colonisation of a mitigation pond could be argued to be more ecologically interesting and 'truthful'. Expectations usually lead to a ready planted scheme at project completion. Whichever is chosen (or a half-way house of structural landscape allowing for subsequent natural colonisation) ensure that this meets the expectations of key stakeholders.
- **Translocation**: Consider the use of targeted translocation of both substrates and plant material/water fauna if feasible. This could include translocation of turf and propagation of plant material from flora affected by the alignment, particularly locally unusual varieties or clones.
- **Direct stakeholder involvement**: mitigation ponds could be ideal candidates for the involvement of local communities and schools. They are generally away from the main construction areas, are small enough to foster 'ownership' and are likely to result in future return visits. The local Wildlife Trust will be able to advise.
- **Management**: a management plan needs to set out the principal aims and detailed objectives of each pond. The plan should also contain details of regular and periodical management including who is responsible and funding arrangements.

3.7 Lineside Slopes 1

Relevant HS2 Documents

HS2 Landscape Design Approach

3.7.1 Lineside slopes are assumed to be cuttings, embankments or other land that is within Operational Limits. Land outside of Operational Limits is covered by Section 3.12, Vegetation.

3.7.2 Landscape treatments of lineside slopes are very much controlled by technical and operational requirements which are mandatory. Technical requirements include slope stability and its surface protection against erosion. Operational requirements include an overriding need for minimum maintenance, avoidance of any maintenance activities that are incompatible with continued operation of the line, and leaf fall.

Cutting and embankments: Opportunities and Detailed Design Principles (DDP)

3.7.3 Cuttings offer less opportunity than embankments because of their greater operational restrictions. Cuttings will generally be less visible than embankments, although there is a predominance of cut faces on this section because of its vertical alignment. Although directly visible from the train, running speeds will reduce awareness of cutting to a blurred sense of increased enclosure.

3.7.4 Cuttings will be visible in two scenarios – in the middle distance in cross-valley views (where colour/ tone will be evident), and in closer range oblique views from overbridges and any PRoW along the cutting top with no noise barriers/ landscape screen (where colour and texture will be noticeable). Otherwise lineside cuttings will tend to be hidden by intervening topography.

3.7.5 Embankments present both greater opportunities and a greater need for screening of the landform, OLE, trains, and in places, embankment-top noise barriers. Planting on these slopes could meet technical and operational requirements if it is relatively shallow rooting (to avoid penetration of the structural core of the embankment), small leaved and of a height lower than the embankment top (or top of noise barrier) to avoid leaf fall issues. Height of vegetation would be best controlled by periodic coppicing.

3.7.6 Despite this, lineside slopes can still contribute towards integration of line and landscape. There are three issues that need to be considered as part of this process:

- Chilterns specific
- Wildlife control
- Feasibility

DDP: Chilterns specific

3.7.7 Visual integration of cuttings into the Chiltern landscape could be assisted by a possible rounding of the profiles at the top of the cutting. Otherwise the intention should be to neutralise the appearance of cut slopes, avoiding grass mixes that are too ‘green’ and using local wildflower and grass mixes. These mixes should be low-growing, tuned to match local soils as the line moves through plateau, valley slopes, and valley floor to The Vale.

3.7.8 Planting on embankment slopes should use local native species capable of meeting technical and operational requirements. These mixes should also flex to suit local lineside landscape character.

DDP: Wildlife control

3.7.9 Concern has been raised about the possibility of bird strike where birds are attracted to the extensive cut slopes because of small mammals and other prey that would colonise these slopes. Owls are believed to be under particular threat both to themselves and to trains. Whether birds would become habituated to trains and avoid the lower parts of cuttings is unknown. Research is needed into the likelihood of this scenario and where and how this has been addressed on other High Speed railways. Making the grassland cover of cut slopes less attractive to potential prey would be difficult because of their inherently attractive aspect, the lack of ground predators and the prohibition on mowing.

Lineside Slopes 2

DDP: Feasibility

3.7.10 Both cuttings and embankments will use steep gradients unsuited to conventional cultivation and seeding in particular. Hydra-seeding would seem best suited to these conditions with its ability to work from the bottom of the slope, to use nominal topsoil; its quick application, germination and establishment; and its ability to use a wide variety of seed/ wildflower mixes with added woody scrub species if so desired.

Contractor outputs for review

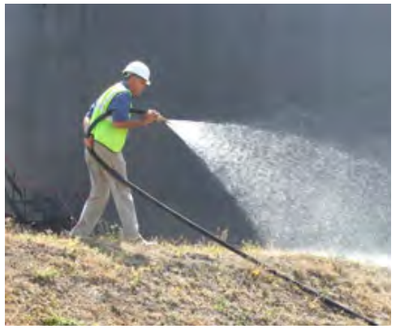
3.7.11 The contractor shall provide the following as a minimum to demonstrate their use of DDP and for review by the local authority planning team:

- Landscape proposals (planting/ soiling/ fencing plans; planting schedules with full details of species, specification, size, density and mixes; full specification)
- Management plan including objectives and detailed management regimes
- Landscape supporting statement including a landscape strategy and landscape objectives for lineside slopes, and specific method statements for implementation

Grassland embankment (photo credit N Chadwick, CC BY-SA 2.0 via Wikimedia)

Orchids, (photo credit John Wilson)

Barn owl, (photo credit Bob Brewer on Unsplash)



Hydroseeding, (photo credit Franklynmelvillebrown at English Wikipedia, CC BY-SA 3.0, via Wikimedia Commons)

3.8 Noise Barriers 1

N Noise Barriers | 1 Integration | 2 Mitigation | 9 Noise and Light | 10 Structures | 14 Clutter

Common Design

3.8.1 Noise barriers are a feature of the whole route from London to Birmingham. It is unclear at this stage whether noise barriers will be subject of a Common Design of a palette of standard designs or whether designs can be individually formulated to suit local circumstances. Whichever is the case, guidance provided in this section relates to the potential choice of design to be used and the manner in which barriers are used.

Why do Noise Barriers Matter?

3.8.2 Tranquillity is a key part of many parts of the AONB including much of the alignment between South Heath and south-east of Wendover. Noise barriers are a critical component in reducing noise and preserving this tranquillity. The location and performance of these barriers has been subject of considerable study and public debate culminating in the agreed position as set out in the Environmental Statement and on the scheme at Royal Assent set of drawings. This guide assumes and encourages investigation and all reasonable use of the scope for technical efficiencies in design such as to minimise noise intrusion or visual impact as particularly relevant to the AONB context.

3.8.3 Mitigating the effect of noise is a first priority of the Secretary of State and needs to comply with HS2 Environmental Mitigation Requirement (EMRs).

3.8.4 These documents set out the maximum noise levels of the operational route and the required full compliance by the contractor. Noise barriers are likely to be extensive over this section of line. This guide does not challenge either the level of noise protection to be provided or the assumption that it shall be adequately mitigated through noise barriers. Wherever possible detailed design should seek to maximise the effectiveness of the noise barriers and their integration into the Chilterns landscape.

3.8.5 The guide focuses on the potential visual impact of these barriers particularly their appearance and, in certain cases, their location.

Noise barrier location on scheme at Royal Assent proposals

Noise Barriers 2

What are the Issues & Opportunities?

3.8.6 **Issues**

- Potential visual intrusion especially when seen in silhouette against the sky
- Blocking of views or vantage points
- The introduction of alien features and impacts on landscape character
- Actual or perceived impact on feelings of personal safety
- Technical requirements regarding maintenance lifespan and ease of replacement
- Severance and extended barrier to wildlife

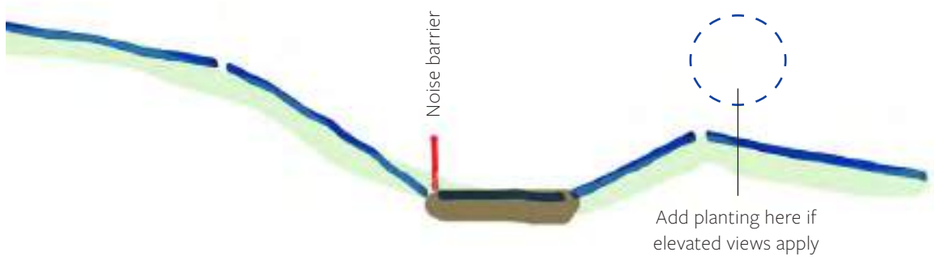
3.8.7 **Opportunities**

- Integration into the landscape and/or screening
- Channelling of people or fauna towards crossing points of the line

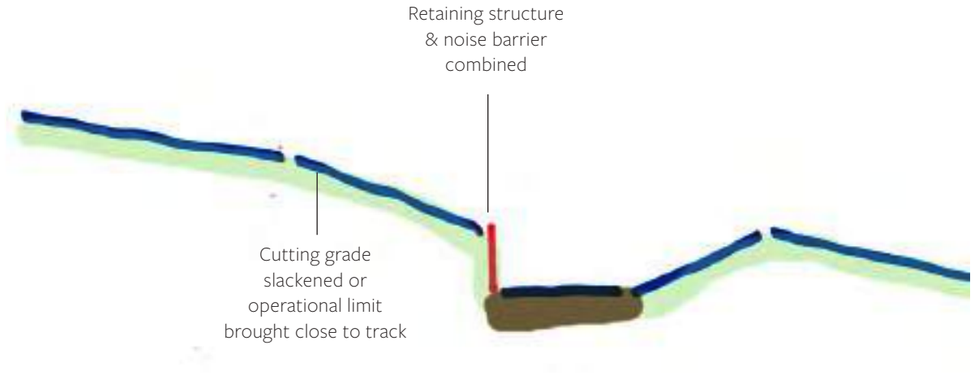
Noise mitigation at the cost of visual intrusion, HS1 crossing the M25, Thurrock (photo credit N Chadwick https://www.geograph.org.uk/photo/5729146)

Noise Barriers 3

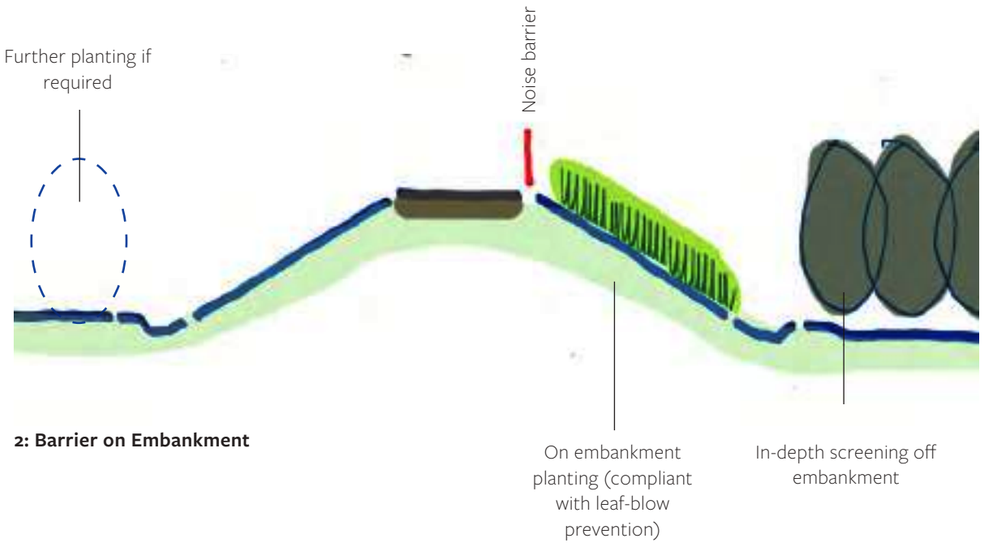
Barrier Locations



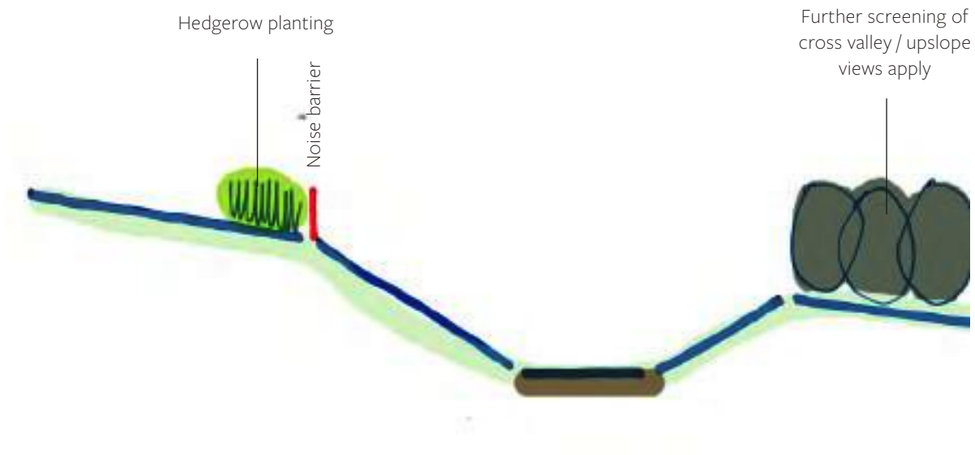
1: Trackside Barrier within cutting



1A: Alternative Trackside Barrier



2: Barrier on Embankment



3: Barrier at Cutting Top

Noise Barriers 4

The Design Intent

3.8.8 Integration and concealment are the twin aims using a variety of means. Where noise barriers form part of viaducts these will be treated differently (see Viaducts).

Location

3.8.9 Noise barriers are proposed in three types of location - trackside within cutting, trackside on embankment or at grade, and at top of cuttings. Each of these locations has a different degree of potential intrinsic visibility or visual intrusion.

Trackside within Cutting: Location 1

3.8.10 These have the least potential for visual intrusion being screened by the cutting face itself. If visible from overbridges, for example, awareness will be reduced because of the oblique angle of view and the immediate context which will be dominated by track and overhead line equipment. The view from the train will not be an issue because of proximity and speed.

Trackside on Embankment: Location 2

3.8.11 These barriers are likely to be visible and possibly also seen in silhouette. Screening will only be possible through planting on the embankment slope and/or off the embankment, and elsewhere within Act Limits or outside Act Limits if considered necessary. Any planting on the embankment will need to satisfy potential issues of leaf fall on to the tracks and the long-term stability of the earthworks. All planting must be in keeping with local landscape character.

Top of Cutting: Location 3

3.8.12 Barriers in these locations have potential to be seen from a distance and in silhouette. In both cases this would undermine the screening benefit of the cutting and the strategy of concealment. In such locations the contractor shall:

- Examine whether a similar level of noise reduction can be achieved by moving the noise barrier to the base of the cutting and trackside.

If this is not possible seek to mitigate its visual impact by:

- Investigating the possibility of screen planting on the inner face to mitigate cross-valley visibility,
- Plant on the outer face to mimic a native hedgerow providing both screening and backdrop,
- Consider planting on the opposite side of the cutting, or
- If openness is required, to place an additional false cutting above the noise barrier so that it is seen against landform rather than in silhouette (as near Hunts Green Farm)

Noise Barriers 5

General Detailed Design Principles (DDP): Design

3.8.13 Unless designed as an extension to a viaduct the design of the noise barrier should be effective, simple and easy to maintain or replace.

- Timber cladding is preferred on a steel or timber structure.
- Plastic should be avoided except possibly Perspex on viaducts
- Cladding should generally face outwards (and the structure inwards) unless the cross-cutting view is more important
- Vertical cladding is to be preferred. In particularly visible locations a ribbed finish would provide a degree of texture and light and shade. Sections of horizontal cladding could be included to provide variation on particularly long stretches of noise barriers.
- Where noise barriers are combined with retaining structures heavy duty galvanised gabions with rock fill could be considered or sheet pile structures with vertical timber cladding. In no circumstances should the use of gabion systems pose durability issues that might affect slope stability or the operation of the railway. Gabions should be hydraseeded with a locally native grass and wildflower mix to accelerate natural colonisation.
- There should be a consistency of design of free standing noise barriers throughout the section to provide a coordinated response.
- In appropriate and selected locations consider living noise barriers and/or barriers that support wildlife such as invertebrates.
- Consider carefully the silhouette of the barrier particularly on sloping ground where a stepped profile may result.
- Include suitable openings for movement of fauna where barriers cross known or likely fauna routes.

High timber, vertically clad noise barrer at Hinksey Railway Yard, (photo credit Steve Daniels)

Ribbed timber barrier, (photo credit Walter Walraven from Unsplash)

Living noise barrier, (photo credit Maigheach-gheal, CC BY-SA 2.0 via Wikimedia Commons)

Criblock foot of slope barrier, (photo credit Eurico Zimbres Zimbres, CC BY-SA 3.0 via Wikimedia Commons)

Contractor's Proposals

Noise Barriers

3.8.14 The contractor shall propose designs in accordance with the above information and the context of each barrier. To show use of the above DDP and for review by the local authorities the contractor's proposals should include:

- General arrangement drawings showing location, height and type of each barrier
- Detailed designs for each barrier type including plans, sections and front and rear elevations
- Information on how vertical and horizontal changes in height and direction are accommodated
- Visualisations from key viewpoints where considered appropriate
- Detailed information regarding materials, design life and maintenance requirements
- Details on associated elements such as screen planting including plant sizes and densities (the use of semi-mature plant material may be required where rapid screening is required)

3.9 Overhead Line Equipment 1

O Overhead Line Equipment | 1 Integration | 2 Mitigation | 14 Clutter

Why does it matter?

3.9.1 Overhead line equipment (OLE) is the name given to the assembly of masts, gantries and wires that supplies power to the trains on most electrified railways. Like many elements of railway design, it comes with complex technical, safety and engineering requirements. That said there are many designs of OLE, ranging from portal frames, to wire headspans, cantilever or T-shaped masts. Unlike the trains which pass through the landscape, OLE is a permanent fixed feature, and because it consists of a regular series of tall vertical metal structures, it forms one of the most visible parts of a modern railway and can highlight the rail corridor in the landscape. It is not covered by Schedule 17.

3.9.2 The design of OLE for HS2 will be developed under a contract that comes after the Main Works Civils Contract (MWCC). However it is encouraging that in 2013 HS2 teamed up with FutureRailway to launch an international competition for the design of Aesthetic Overhead Line Structures run by the Royal Institute of British Architects. The brief recognised that OLE can be considered ugly and/ or obtrusive, and referred to sensitivity of the route passing through the AONB. Some novel and promising structures resulted (see http://www.ribacompetitions.com/ols/shortlisted.html), which appear more elegant and less cluttered than conventional structures. It will be of crucial importance that the vision and aesthetic innovations from this competition continues through to the final installed design.

Relevant information

HS2 Information paper D1, Design Policy

Overhead Line Electrification: Landscape and Visual Guidelines, by Network Rail, Balfour Beatty and B2B Landscape Consultancy (draft)

3.9.3 Other rail overhead electrification schemes in Britain are also considering ways of reducing the potential impacts of OLE, notably Network Rail's scheme on the GWR system out of Paddington. HS2's proposals should be informed by this work in particular guidelines specific to OLE. The issues generated on these lines are likely to be similar to that on HS2 with the possible exception of colour in the landscape (see below).

The High Speed T - 'HST' by Bystrup Architecture, Design and Engineering

Cantilever OLE mast at Großhelfendorf Station, (photo credit Flocci Nivis, CC BY 4.0 via Wikimedia Commons)

Signal gantry with OLE portal system west of Rugby railway station, (photo credit Andy F via Wikimedia Commons)

Overhead Line Equipment 2

Schedule 17

3.9.4 We understand that Schedule 17 does not specifically apply to OLE. It is agreed, however, that OLE represents a highly visible and repetitive component of the railway. It has, therefore, considerable effect on both the perception of the railway in the landscape and it's effect on the character of that landscape. OLE has an important part to play in the successful integration of the railway and the Chilterns and in fulfilling it's aim to be a design exemplar. Guidance set out below aims to help these objectives.

Issues and opportunities

3.9.5 OLE is particularly visible where railways are on embankment or at grade (where seen from the side) or from elevated hilltops (where OLE highlight the rail corridor), and when seen from overbridges (where seen as a repeating system). OLE look prominent on viaducts or where they break they skyline. OLE seen from the side in shallow cuttings can appear as an anomaly.

OLE appear jarring in sensitive rural and historic environments. On curved lines they stack up in the view and can appear to the eye almost as continuous solid structures of considerable scale. The cumulative visual effect of noise barriers and OLE needs to be considered.

Issues

- Clutter and visual intrusion per se
- Impact on landscape character

Opportunities

- Design, colour and system type can significantly reduce intrusion
- Location specific lineside planting

Recommended strategic approach & Detailed Design Principles (DDP)

3.9.6 Both issues and opportunities need to be approached in a pragmatic manner with full knowledge of the OLE technical requirements. We suggest the following:

Early consideration: given its potential effects issues of OLE design need to be considered early in the overall design process. This will allow the MWCC to include landform and planting proposals that will provide screening.

Design principles: the selected system should satisfy a number of criteria including:

- **Consistency** of type within each field of view unless locational requirements overrule
- **Rhythm** – regular spacing of uprights unless there is obvious need or visual sense in varying (i.e. to coordinate with viaduct piers, or to avoid any intrusion into any key funnelled views such as at Bowood Glimpse)
- **Simplicity** of all components and connections using minimum apparent section sizes
- **Uniformity** of wire heights of all types (as opposed to 'stacked' types)
- **Height** - minimum and consistent
- **Decluttered** with additional required equipment designed in, not bolted on
- Careful placing of any bulkier structures (e.g. tensioning/ anchor portals or signalling gantries) where possible placing these in cuttings or screened behind existing trees or buildings
- Co-fix the wires where possible on other structures like overbridges, the sides of cuttings or on signalling to eliminate the need for some vertical structures.

Overhead Line Equipment 3

- **Reducing visibility - system type:**

3.9.7 These criteria would suggest that post mounted systems would be more suited than gantries or portals generally and in particular within the AONB. In the AONB achieving minimal visibility is critical both because of the landscape sensitivity and because of the number of elevated views along the alignment including those from bridges over the alignment. (Consider the comparative visibility of post and gantry type systems in these views).

By contrast gantry systems should be avoided.

- **Reducing visibility – colour**:

3.9.8 Using the right colour and the finish can help minimise the visibility of structures. The choice of colour should be informed by the location. If the main views will have a background of landform and vegetation, generally neutral darker tones will help. If mainly seen against the sky, generally neutral lighter tones will assist – England's 'grey-white sky'. Within the AONB most views of OLE will have a background of landform and vegetation where unpainted galvanised elements would appear lighter than this background. The principal exception will be Small Dean viaduct where views from the A413 in particular will see both the viaduct structure and OLE above and against the sky.

3.9.9 This would suggest that OLE within the AONB avoids the use of galvanised elements and adopts a matt finish. Vertically graduated or stealth solutions should be explored. The exact colour or colours should be informed by an Environmental Colour Assessment (ECA). The chosen colour should be consistent with (but not necessarily the same as) colours chosen for ancillary buildings and vent shafts. Colour should be applied within the manufacturing process rather than painting afterwards (with knock on maintenance requirements).

3.9.10 A different colour approach should be adopted for OLE associated with the Small Dean Viaduct where lighter tones, stealth or graduated colours may reduce visual intrusion.

- **Reducing visibility – screening**:

3.9.11 Where required screening should avoid accentuating the linear effect of the alignment through excessive use of screening that runs parallel with its alignment except where these can mimic hedgerows. Screening options should explore the potential of planting on embankment sides, as well as at the embankment foot. Any local screening strategy should consider the full Act Limits and beyond if necessary and feasible, where it would form an Additional Project.

Overhead Line Equipment 4

Contractor Proposals

3.9.11 The contractor shall propose designs in accordance with the above information and the context of each section of OLE. Contractor's proposals should demonstrate how they have applied the Detailed Design Principles through the production of material such as:

- General arrangement drawings showing the location of all OLE and any difference in types proposed.
- Detailed designs for each type of OLE including elevations, sections and plans of typical sections of layout.
- Large scale details of each type of mast, boom, gantry or similar.
- Details as to materials including colour and finish.
- Visualisations from key viewpoints where considered appropriate.
- Details regarding design life and maintenance requirements.
- A commentary on the relative associated effects of the proposed system in particular noise and visual disturbance (flashes).
- Details of how this system will coordinate with other components in particular viaducts, bridges and tunnel portals.

Gantry OLE structures, (photo credit Julien Bertrand via Wikimedia Commons)

3.10 Vent Shafts 1

S Vent Shafts | 1 Integration | 2 Mitigation | 3 Quality | 10 Structures | 14 Clutter

Key Design

3.10.1 These facilities are covered by Key Designs. Reference should be made to HS2's study, AONB Vent Shafts WIP April 2017, and subsequent work on the subject.

Summary

3.10.2 The tunnelled section of the alignment south-east of South Heath has vertical vent shafts to control pressure and to provide air and emergency access. Because these vents are at a set 3km intervals and are centred on the alignment below, their location cannot be altered beyond rotation of the building footprint around the shaft. Their potential landscape impact is therefore greater.

3.10.3 Each vent has a broadly similar set of components including one or two head-house and transformer buildings set within a hard-surfaced and secure fenced and gated perimeter with vehicular access. Each site is used for construction access and the Act Limits line is locally extended to provide space for extensive stock-piles.

3.10.4 There are five proposed vent shafts at Amersham, Chalfont St Peters and Chalfont St Giles, Little Missenden and Chesham Road, South Heath.

Relevant HS2 documents

HS2 Landscape Design Approach

Vent Shaft and Head Houses Design Approach

Detailed HS2 Vent Shaft & Head Houses Design Study

Issues

3.10.5
- The introduction of large-scale buildings within generally a rural context with adverse impact on local landscape character.
- Lack of control over exact siting with consequent increased visual intrusion in some cases.
- Further visual intrusion from security fencing, lighting etc. (clutter).
- Indirect impacts on local roads caused by widening.

Extract from HS2 Study: Aerial photograph showing vent shaft locations

Vent Shafts 2

Opportunities

3.10.6
- Adjustment of building datum to lower development relative to surrounding ground profiles.
- Making good of land used in construction phase can include land modelling to increase screening.
- Outside Act Limits planting to provide screening in depth (A potential Additional Project).
- Site specific designs to maximise landscape potential.

Suggested Strategy

3.10.7 For all sites except Amersham the strategy should be maximum concealment and integration within the landscape context. This is likely to be through a combination of adjustment of ground levels, building design and screen planting, both within Act limits and outside as an Additional Project.

3.10.8 At Amersham the site particulars will prevent this approach. This development should acknowledge its inevitable visibility and aim to make an appropriate architectural statement.

General Detailed Design Principles (DDP)

3.10.9
- Reduce visibility where possible by lowering buildings within existing ground profiles, providing maintenance access and gravity drainage can be achieved.
- Maximised reuse of arisings provided this is consistent with local landscape character.
- Use of arisings to supplement perimeter landform using simple structures such as gabions and crib-lock systems on the steep inner face and the use of more natural outward-facing slopes. Where these structures may be visible consider use of simple cut faces into the native chalk landform with steepest angle of natural repose, hydraseeded with chalk grassland seed mix and with jute mesh protection to aid establishment.
- Building and external works design to be site specific reflecting both landscape context and landform. However, form and appearance can be similar provided they can accommodate site specific requirements.
- Reducing scale – use a combination of massing, colour and texture to reduce the scale of these buildings which are far larger than most agricultural buildings.
- Building colours to be generally recessive and specifically chosen in relation to its immediate context and backdrop. Mid to medium dark brownish grey tones guided by studies such as that undertaken for Cranbourne Chase and the Malverns are likely to be the norm unless there is a particular local reason to vary. HS2 to consider commissioning a similar study for the Chilterns.
- Colour articulation – consider the use of contrasting accents to modulate apparent massing and scale of building
- Building form/massing to be simple and considered as a group of forms where there are multiple buildings.
- If possible orient building footprint to minimise visibility from any key viewpoints and align with any landform backdrop.
- Building materials – consider the effect of elevations regarding texture, scale and association. Profiled panels will produce variations of light and shade. Utilise opportunities presented by louvres and vents to provide added textural and/or colour contrast. Avoid issues of glare or reflection. Consider appropriate opportunities to reflect local vernacular avoiding pastiche. Unwanted weathering should be considered particularly if concrete is proposed.
- Vernacular styles are generally considered inappropriate.
- Local building materials - If used must be sensitive to association and scale of typical use, so are more likely to be suitable as panels/insets. Distinctive local materials include orange/red/vitreous blue brick; some forms of flint usually with brick dressings; colour-washed render; dark stained timber on agricultural buildings Pre cast flint faced blocks should not be used.

Vent Shafts 3

- Concrete - the extensive use of concrete as part of the visible building envelope should be avoided because of its urban connections and pale colour (and likely visual intrusion) in the landscape.
- Building roofs and the view from above – consider the use of grassland roofs to aid landscape integration and ecological mitigation. Consider angled or curved roofs to increase integration with adjacent landform especially when seen as backdrop in key views. Use man safe systems instead of parapet to maintain a clean silhouette or if not acceptable, vertically extend elevation and drop roof line to provide integral upstand.
- Hardstanding – minimise the extent of hardstanding and investigate the potential use of concrete or plastic cellular reinforced systems with grass or gravel fill in less trafficked areas. Wherever possible use permeable paving. Avoid the use of pale concrete block hardstanding with its greater visibility and urban character.
- Vehicular approach road gradients to be consistent with safety requirement especially in emergency operations.
- Security – investigate the potential for the building to be the principal or sole secure envelope thereby removing or reducing perimeter fencing.
- Fencing – where required ensure minimum height, simple design and low visibility. Where possible screen fencing with native hedges and set back vehicle gates to reduce visibility. Visible elements to be powder coat paint finish to match building. Entrance gate location to be determined by speeds on adjoining roads as well as site security. Bellmouths and visibility splays to be kept to the minimum and be designed to minimise opportunities for fly-tipping.
- External signage – keep to the minimum and unlit.
- Autotransformer stations - these should be considered by the MWCC locating this facility to maximise natural screening or that provided by proposed building. Other potential visibility should be prevented by modified screen fencing allowing sufficient room for the mandatory double safety fencing. Site planning should also allow room for this facility despite it not being required for inclusion in planning applications and its latter installation.
- Lighting and CCTV – minimise and ensure full vertical cut-off lanterns. If security lighting is essential ensure that this is the minimum possible with manually operated higher lighting levels when required for maintenance purposes. Use infra-red or similar CCTV cameras. Wherever possible lights and cameras should be building mounted.
- Screening strategy to consider whole Act Limits area (and beyond if necessary) and to identify key viewpoints/receptors. Proposals should include native hedgerow planting/strengthening, copse planting and landform modification as appropriate. This could be undertaken as an Additional Project.
- Construction access routes – make good on completion reinstating any disturbed landscape assets and ensure all works respect local landscape character.

Each of these detailed design principles needs to be considered in relation to three sets of mandatory operational constraints:

1. Function: there should be no reduction in operational functionality
2. Accessibility: maintenance and emergency access should not be compromised
3. Security: levels of security are yet to be finalised but are likely to include requirements of the building envelope, and for CCTV and the site perimeter

3.10.10 Given the special site constraints this is likely to result in individual layouts for each site possibly extending to different building designs or at least variations in a design that is appropriate to the Chilterns. It follows that the design for Amersham is likely to be significantly different from the other four which might benefit from having a communality of appearance given their common purpose of concealment.

Vent Shafts 4

Location specific DDP: Chalfont St Peter

65m deep vent and evacuation shaft and single building. The site is outside the AONB.

3.10.11
- Move hardstanding away from Chesham Lane as part of design development within Act Limits or supplement planting outside of Act limits through Additional Projects. A minimum width of hedgerow/copse should be provided adjacent to the lane.
- Protect existing lane-side trees and hedges during construction and reinstate on completion (subject to visibility splays which should be kept to the minimum)
- Use existing copse north of site to inform character of new copse planting on all sides of the facility within Act Limits and also outside Act Limits to north, west and east where leftover space is insufficient for viable agriculture.
- Use mix of semi-mature, feathers and forestry transplants to accelerate effective screening.
- Sink building to the maximum whilst providing feasible grades on vehicle access. Use vertical retaining structures on the inner face but avoid substantial bunding above existing landform as this would be out of character with local landscape context.

Control lighting, signage and fencing to minimise impact on rural character of the lane.

Extract from HS2 Study, Chalfont St Peter
(Act Limits may vary from those shown)

Location specific DDP: Chalfont St Giles

The facility will consist of 25m deep vent and intervention shafts, a head house and auto-transformer, with 4m wide single lane access track with passing places.

3.10.12
- Particular care is required to minimise damage to the long approach track (Bottom House Farm Lane) and consequent loss of local landscape character through appropriate and full protective fencing and the use of an alternative parallel alignment if and where possible. Careful consideration should be given to the crossing of the River Misbourne to avoid further damage and , if possible, to include suitable remediation works.
- The lane should be made good on completion avoiding unessential

Extract from HS2 Study, Chalfont St Giles
(Act Limits may vary from those shown)

Vent Shafts 5

‘improvements’ such as the provision of macadam surfacing or kerbs.

- Any permanent widening of the lane for essential subsequent access should avoid the introduction of kerbs and have replacement native screening hedgerows and a recreated appearance informed by existing landscape character.
- Key viewpoints should be identified and the orientation of the building adjusted to minimise visual impacts and to take advantage of it siting on the floor of a shallow side valley.
- Extend existing copses to the east (to meet the lane) and the south west (to screen the access) using both within and outside Act Limits land and minimise up slope views from the main valley floor. Bench buildings and hardstanding into the valley floor keeping openness of areas up slope of the facility, but avoid excessive cut which would be obtrusive in itself. Augment with native planting.
- The building form and its roof in particular should be sensitive to views from the lane (with and without backdrop of existing copse dependent on viewpoint); and from footpaths on higher ground.
- Protection of the building from potential flooding from overland flows in extreme rainfall events should not result in infilling of the valley floor or bunds, both of which would be intrusive.

Any temporary construction access routes and off site works (such as soakaways) to be made good promptly and in a manner fully sympathetic to local landscape character. Specific proposals required for the protection of the listed Granary structure.

Location specific DDP: Amersham

3.10.13 A highly visible and less rural site heavily constrained by surrounding roads. The site will form a new gateway to old Amersham and designs should have regard for the character of Amersham as a small town with distinctive historic character. This may require a different approach where the buildings or fenced envelope is deliberately ‘expressed’ whilst potential clutter is avoided. This will inevitably involve the use of non-standard designs which are specifically crafted for the site. The facility will consist of a large diameter vent and intervention shaft with only one head house building.

- The site will form a new gateway to old Amersham. There should be regard for the character of Amersham as a small rural town of very distinctive historic character. It is not urban.
- Key viewpoints should be identified and photographed and accurate visualisations produced. There are potential overlooking issues from high ground to both north and south.
- Particular attention should be paid to silhouette and massing to respond to the multiple and moving viewpoints from users of the surrounding road. Sculptural forms may be appropriate.
- Level constraints, sight lines for adjacent roads and opportunities should be explored through the use of 3D modelling.
- The datum of the building platform will be determined by the location of the access from Whielden Street. Moving the access northwards towards the existing A413 over-bridge should be investigated as this will lower the buildings within the landscape.
- All technical requirements of the facility, its access and the surrounding highways should be clearly understood and complied with. A Constraints Plan should form part of the Schedule 17 application.
- The compound design and perimeter fence or wall should be considered an integral part of the buildings with particular attention to the design of lighting and security elements which may be higher than the perimeter fence.
- The area is considered at high risk from fly-tipping. Designs should provide

suitable deterrent measures.

- If concealment of the perimeter fence is not possible its design should be enhanced and designed as an extension of the building or indeed be the apparent building itself. The latter would offer significant opportunities to express this envelope in a number of different options some of which could reflect local building materials or even reinforced earth 'earthworks' if the level of containment and internal operational hardstanding and buildings can be achieved within the area available. There may even be a case for extending Act Limits to the highway edge to ensure a fully integrated solution, or design to be fully integrated with a potential associated Additional Project.

3.10.14 These represent a singular set of circumstances and significant challenges. However reference to a recently completed set of ancillary buildings associated with Brighton's sewer upgrade shows how integration can be successfully achieved with a similar tight site, immediate highway context and sensitive landscape. Selected photographs are shown adjacent. Refer to Streetview (Marine Drive, Brighton immediately north of the Marina) for driver's experience. Whilst the context is different to that at Old Amersham the Brighton scheme illustrates the benefits of a fully integrated design. The design expression at Amersham would almost certainly be different in order to complement its context.

3.10.15 A small visitor centre could form part of this development if agreed by the Local Authorities and Chilterns Conservation Board.

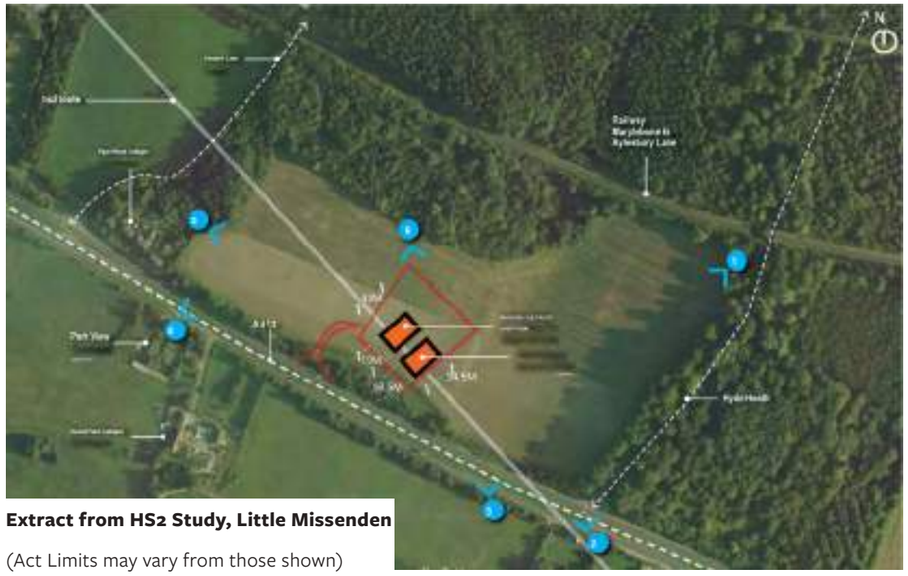
Extract from HS2 Study: Aerial photograph with building and compound overlay, Amersham
(Act Limits extend to kerb line of adjacent roads)

Drivers View (Image credit google maps)

Aerial View (Image credit google maps)

Ancillary Facilities for major underground infrastructure - exemplar of integrated building and envelope, Marine Drive, Brighton

Vent Shafts 7



Extract from HS2 Study, Little Missenden

(Act Limits may vary from those shown)

Location specific DDP: Little Missenden

Head house building and autotransformer

3.10.16
- Benching of buildings/compound and access road into the slope. Investigate whether buildings can be sited on separate but adjacent platforms each benched into the slope. Avoid excessive cut which could be excessive in itself and augment screening with native planting.
- Consider curved corners of buildings to soften profile.
- Grassland roofs with pitch angled to match angle of valley side. Consider integration of roof structure into landform.
- Use of arisings to model foreground to views from the A413.
- Thickening/extending existing hedgerows adjacent to the A413.
- Consideration of agricultural viability of severed land and planting of screen copses if not viable, particularly downslope of the facility.
- Consider views from above and provision of appropriate backdrop to views from the A413. This might require a mix of grassland and planted slopes.
- Sensitive handling of access from the A413 with access control set well back

Extract from HS2 Study, Chesham Road

(Act Limits may vary from those shown)

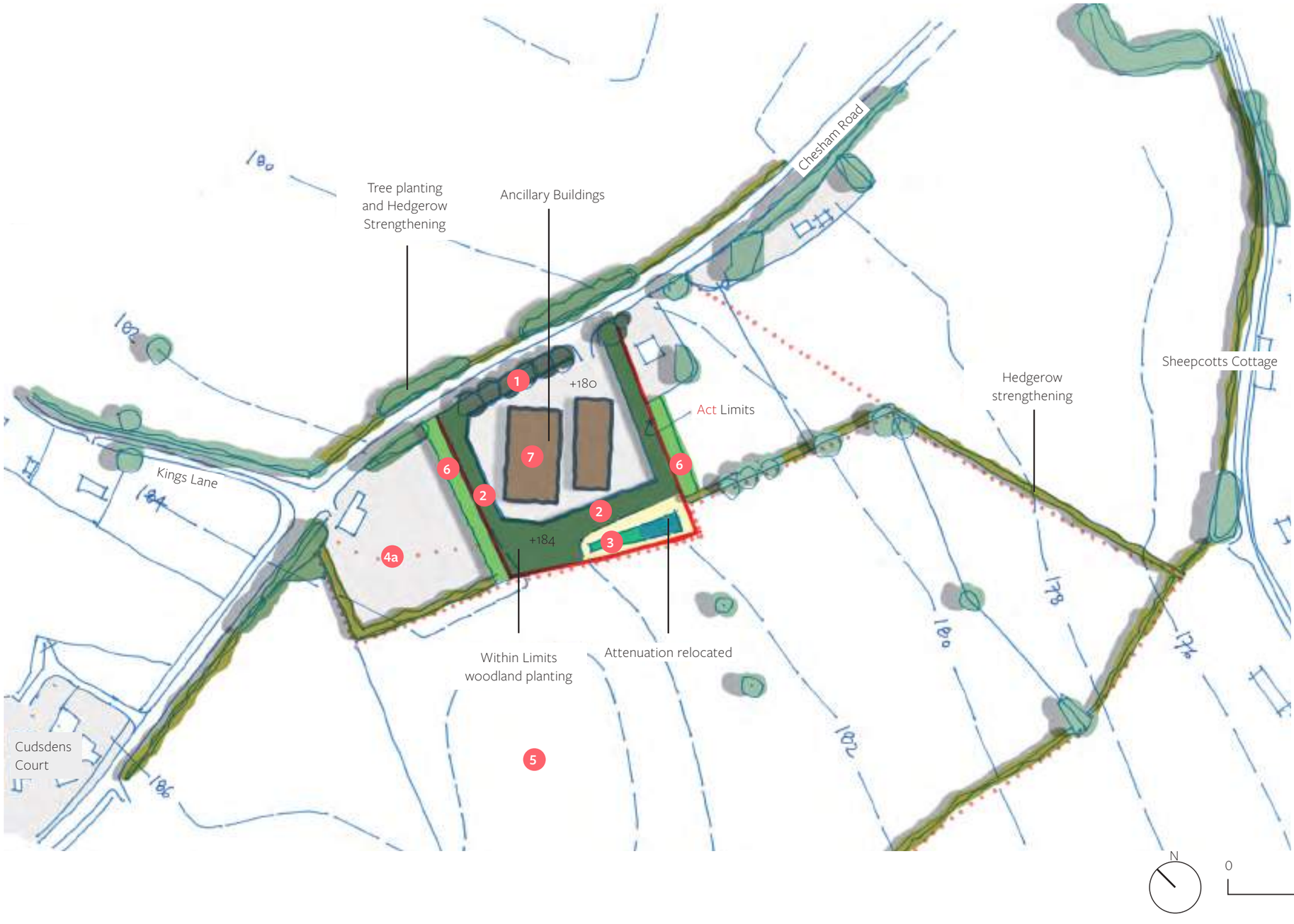
and access road benched into the slope with arisings placed as low false cutting on down slope side and cut face as steep grassland bank. Avoid, if possible, fencing and lighting to this road allowing the perceived landform an uninterrupted flow. Investigate separate access and egress to reduce size of access bellmouths; and no provision of no right turn facility on exit.

Location specific DDP: Chesham Road, South Heath (see illustrated example)

Intervention shaft only. No venting function. Building likely to be 25x25x4m ht approx.

3.10.17
- Retention of roadside trees.
- Permanent rather than temporary diversion of public footpath.
- Naturalistic land-raising as part of making good of construction spoil-heap area.
- Additional outside Act Limits screen planting with landowner's permission.
- Tree planting and hedgerow strengthening to provide in-depth screening.
- Avoidance of excessive and potentially intrusive bunding with hedgerow/ copse screening preferred instead.

Vent Shafts 8



Chesham Road Tunnel Vent & Transformer Station

1. Existing mature trees protected and underplanted
2. 4 m high criblock retaining structure and associated earth modelling
3. Attenuation facility moved. Piped connection from compound.
4. Proposed public footpath reinstated on changed alignment. Existing alignment (4a) stopped up.
5. Naturalized and minor land raising as part of making good after use as temporary spoil heap
6. Additional off Limits screening with landowner's consent.
7. Careful attention to form, and appearance of structures particularly use of recessive colour.

- Existing vegetation
- Hedge strengthening
- Tree planting
- Within limits tree planting
- Potential additional tree planting
- Footpaths
- Act Limits

3.11 Tunnel Portals 1

T Tunnel Portals | 1 Integration | 2 Mitigation | 3 Quality | 9 Noise and Light | 10 Structures | 14 Clutter

Key design

3.11.1 Wendover Green Tunnel south portal is a Key Design element. The other two portals (Wendover Green Tunnel north, and Chilterns Tunnel north) are subject of Common Design.

3.11.2 However given the sensitivity of the AONB context and to ensure a matching response of portals at both ends of the short Wendover Tunnel we suggest that all three portals are adapted to suit local environmental sensitivities.

Relevant HS2 documents

HS2 Information Paper D8; Tunnel shafts and portals

HS2 Landscape Design Approach

Porous Portals

3.11.3 All three portals are 'Porous Portals'. These are special devices to reduce unwanted pressure and noise effects as the high speed train enters and exits the tunnel. The porous sections effectively extend the tunnel by 100-200m and include openings in the tunnel envelope that help dissipate the pressure build up in front of the train.

Issues and opportunities

3.11.4 Historically tunnel portals were elements of celebration that were specifically designed to impress (despite their very limited visibility by passengers). Brunel's Box Tunnel (GWR) is internationally known. Others include the Clayton Tunnel (BSCR) which included an inhabited dwelling.

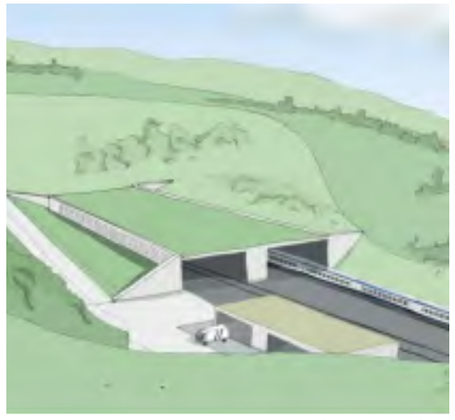
3.11.5 The typical contemporary approach to tunnel portal design is based on simplicity and elegance with the portal displaying the same elliptical section as the tunnel and the portal angled to match that of the hillside. Where required, security and safety elements are incorporated into the portal structure.

3.11.6 Achieving this simplicity of design in a porous portal is more difficult as there are in effect two portals – that of the bored tunnel and that of the extended porous tunnel extension which is not bored. Within the AONB this is further complicated by the close proximity of portal buildings. This raises the following issues and opportunities.

Brunel's Box Tunnel (photo credit Stephen Richards)

Clayton Tunnel, Sussex, (photo credit Oast House Archive)

Hellenberg Tunnel, north portal, Germany (photo credit Wo st 01 via Wikimedia Commons)



HS2 typical porous portal (illustration from HS2 Info Paper D2)

Tunnel Portals 2

Issues

3.11.7
- Potential for ad hoc elements not being integrated with the surrounding landform or other buildings;
- Opportunities for exemplar design lost amongst operational clutter;
- Wider visual impact (especially Wendover south portal), and;
- Visibility by users of nearby pedestrian overbridges.

Opportunities

3.11.8
- Fixed viewpoints and lack of wider access should be used to inform each specific design solution. There should be a degree of shared materials and design.

Location Specific Issues: Chilterns Tunnel North portal

3.11.9
- 200m length porous section.
- Tracks are a greater distance apart (with some taper) because the tunnel is bored.
- Two portal buildings and a vehicle access road add potential clutter. One building is immediately adjacent to the porous tunnel.
- There is direct line of sight from the pedestrian overbridge at 380m distance towards the portal.

Location Specific Issues: Wendover Tunnel South

3.11.10
- 100m length porous section.
- Lines are closer together because this is a cut and cover tunnel.
- High noise barriers on both side of the line leading up to the porous section.
- Noise barriers continue at lower height to and over the Small Dean viaduct.
- Portal buildings and vehicle access offset from porous section.
- Narrow corridor to the north east which is further compromised by pylon line and attenuation reducing screening potential.
- Properties in close proximity to tunnel portal and porous extension.
- Line of sight from public footpath along track alignment to top of porous extension at 80m distance (until screen planting has matured).
- Likely significant visibility of north side of porous extension and noise barrier from users of public footpath between HS2 and A413 road corridors.

Location Specific Issues: Wendover Tunnel North

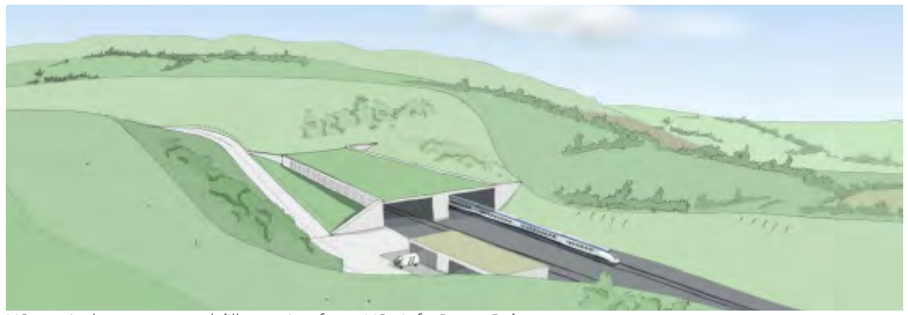
3.11.11
- 150m length porous section.
- Lines are closer together because this is a cut and cover tunnel.
- Portal buildings and vehicle access offset from porous section.
- Line of sight from public footpath along track alignment to top of porous extension at 120m distance.
- Potential views of top of porous extension from Ellesborough Road.

Tunnel Portals 3

Typical porous tunnel as illustrated in HS2 Information paper

3.11.12 The proposed roof of the porous extension is 'green' with biodiversity and visual benefits. However these benefits could be increased significantly by:

- Better integration of the roof with the surrounding landform
- Portal openings that are less utilitarian and reflect better the shape and nature of the tunnel itself, especially where this is a bored tunnel
- External facing vents could be made less visually intrusive
- Ancillary buildings and access road could be better integrated.



HS2 typical porous portal (illustration from HS2 Info Paper D2)

Detailed Design Principles (DDP): Chilterns Tunnel North

3.11.13 The longer length of porous extension, the greater cutting depth, the wider distance between the tracks and the more rural context all indicate an approach that maximises screening of the main structure and controls views from the pedestrian overbridge.

3.11.14 The opportunity to place the vent sections on the inner face of each track (rather than on the outer face) should be investigated. If this is feasible the cutting landform can be modified so that the roof of the porous section is not only 'green' but also contoured. An alternative could be investigating the feasibility of placing the vents in the roof of the porous extension and combining this with modified landform; (this would require the use of dark coloured vents). The relative visibility of the vents should be the deciding factor in choosing between options.

3.11.15 This treatment could be extended to the portal building by means of a green roof at a minimum, and if possible by the buildings being or appearing to be sunk into the landform with some elevations combining with retaining structures.

3.11.16 The portal opening could use a circular form with 'green' roof and curved perforated Corten or powdered coated steel mesh panels set within a structural frame sides with the tunnel forms expressed and standing clear from the main part of the landform covered porous portal. (See sketch illustrations). Side panels will need to provide appropriate levels of pressure and noise damping.

Porous materials - sponge (photo credit Walter Walraven from Unsplash)

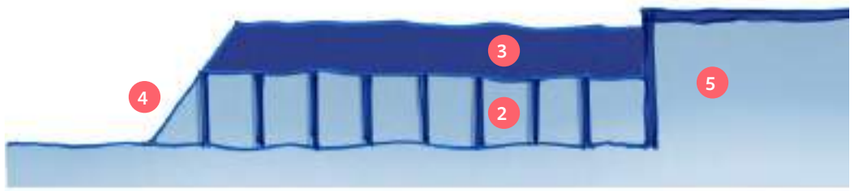
Perforated Corten steel, (photo credit Athena Sandrini via Pexels)

Corten screen (potential for vents), (photo credit Zarateman, CCo, via Wikimedia Commons)

Corten artwork (potential use for Wendover South Portal noise barriers and Chiltern North portal)

Tunnel Portals 4

Typical Porous Portal Openings

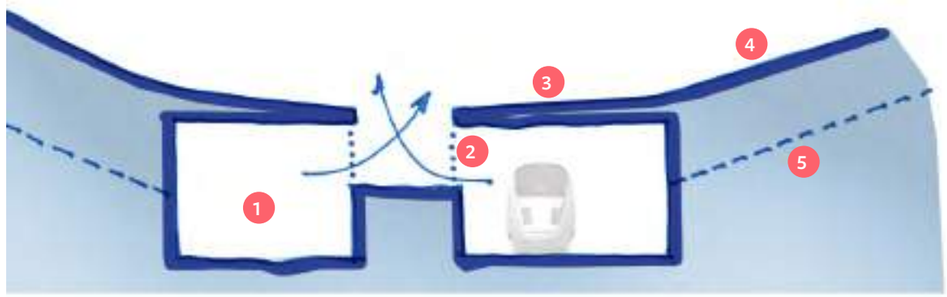


Elevation

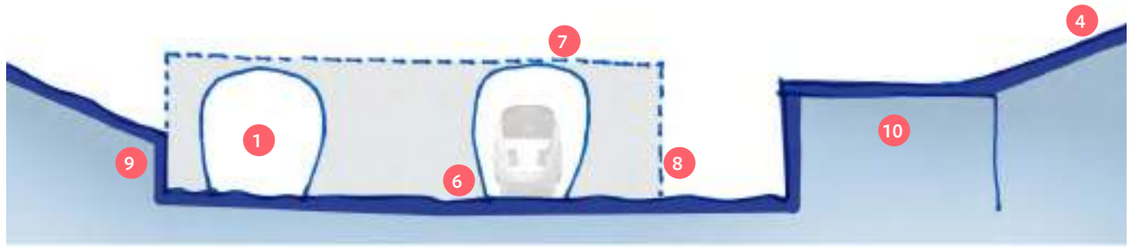
Elevation Detail

1 Freestanding steel/ concrete structure
2 Perforated corten screen
3 'Green' roof & mansafe system
4 Optimal raked portal opening to match cutting slope
5 Box section portal

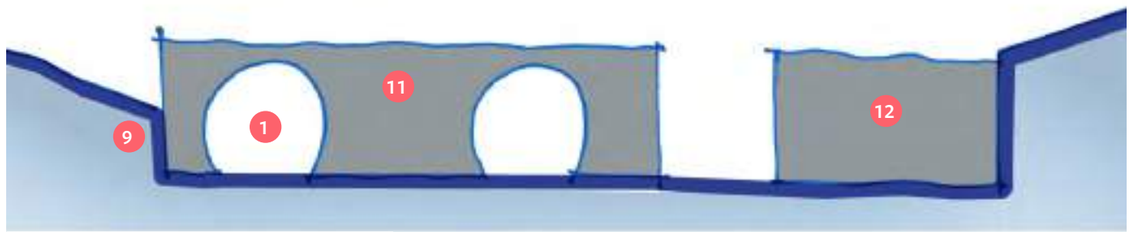
Chiltern Tunnel North



Green roof portal box section



Freestanding portal section



Portal elevation

1 Track (south bound) & structural box
2 Vents moved to inner face
3 Extensive green roof
4 Cutting profile raised/ cutting width reduced
5 Scheme at Royal Assent cutting profile
6 Elliptical freestanding tunnel vent sides in Corten steel
7 Green roof to top of upper sides
8 Box section elevation in background
9 Scheme at Royal Assent cutting profile unchanged
10 Portal building sunk into raised cutting profile. Retained elevation and 'green' roof
11 Portal screen (either dark exposed aggregate concrete or perforated corten steel)
12 Portal building elevation to match 11.

Tunnel Portals 5

DDP: Wendover Tunnel South

3.11.17 This porous portal is the culmination of a series of linked elements - the Small Dean viaduct, the embankment and noise barriers immediately south of the A413 and the porous portal to the cut and cover tunnel. Because of a combination of level changes and limited land for effective screening the first two of these elements will be clearly visible from the A413 and areas to the north and east. The porous portal will have lesser visibility.

3.11.18 The proposed strategy is to consider this visibility as a whole and provide a unity of visible elements whilst seeking to maximise screening.

3.11.19 The materiality of the visible elements – the noise barriers/parapet on the viaduct, the freestanding noise barriers and the visible vents of the porous extension – are dictated by the technical and maintenance requirements on the viaduct, and the approach to colour set out in the viaducts and bridges, Section 3.2. This suggests the use of Corten steel panels to provide a broad continuity of colour with surface treatment varied to provide noise attenuation and venting as determined by location.

3.11.20 This would be combined with the use of retaining structures where possible to maximise the ability to raise levels around the tunnel portal on both sides of the line, to extend this treatment on the A413 side of the tracks and to sink ancillary buildings into the proposed landform.

3.11.21 Designers should investigate whether relocation of the vents from the sides of the porous extension to its roof would allow greater screening by raising adjacent landform

3.11.22 Native planting would augment landform screening but is likely to be influenced in height by issues of leaves on the line.

3.11.23 The design of the portal opening and flank walls should be informed by design guidance within Viaducts and Bridges and should use dark exposed aggregate concrete. Protection against drops around the portal should either be integrated into an extended upstand or provided by fencing set within the planting.

DDP: Wendover Tunnel North

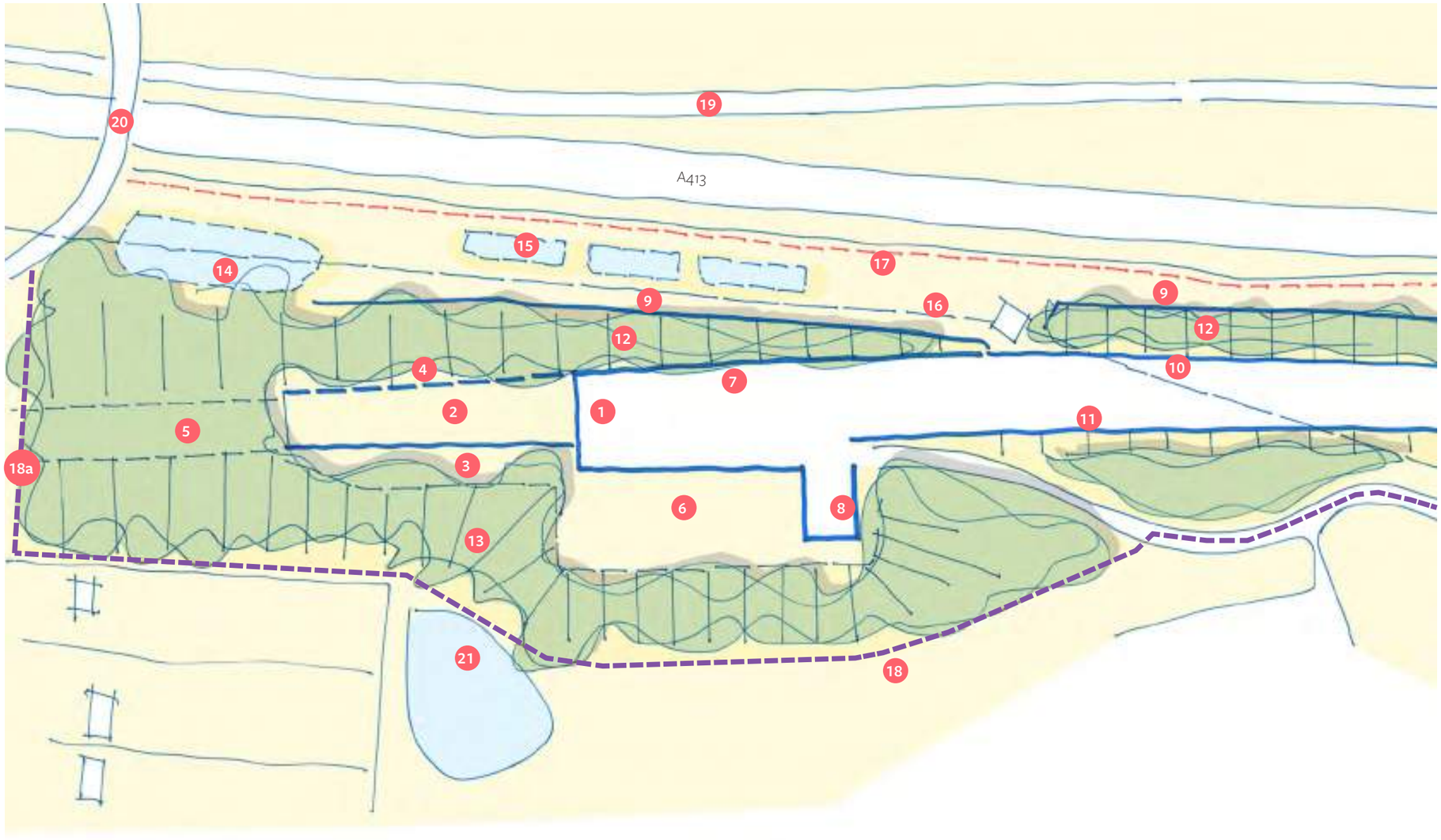
3.11.24 The strategy here should be the reduction of visual intrusion on views from higher ground to the south, both from Ellesborough Road and from higher and more distant ground.

3.11.25 The portal opening and flank walls should match those of the south portal.

3.11.26 Designers should investigate the feasibility of placing all of the vents on the A413 side of the structure. This would allow greater roll-over of landform on the south facing side.

3.11.27 The portal building is likely to be visible in some views from the south. It should have a ‘green’ roof and should be sunk into the cutting face if possible. Its south facing elevation and the adjacent noise barrier should use recessive colours, avoid reflective material and use sensitively designed lighting.

Tunnel Portals 6



Wendover Green Tunnel South Portal

1 Porous portal opening
2 Porous portal 'green roof'
3 Landform extended to structured porous portal
4 Porous portal structure designed to accommodate planted landform on the north side and vents moved to roof, if necessary
5 Cut & cover tunnel; planting over
6 Portal buildings incorporated into landform, inc. retaining structures and 'green roof'
7 Retaining structure and noise barrier
8 Retaining structure
9 Toe retaining walls to provide added landform screen
10 Noise barrier (corten)
11 Noise barrier (timber)
12 Native planting (coppiced)
13 Woodland planting on landform
14 Attenuation modified
15 Additional attenuation
16 Pylon line
17 Public footpath
18 Optional additional link path
18a Disconnected Bacombe lane potentially retained as a footpath
19 Chiltern Railway
20 Existing overbridge with verges 'greened'
21 Attenuation.

3.12 Vegetation 1

V Vegetation | 1 Integration | 2 Mitigation | 3 Quality | 5 Woodland | 7 Holloways | 12 Ecology | 13 Greening | 17 Wider Enhancement

3.12.1 This Component covers vegetation outside of Operational Limits. Vegetation within Operational Limits is covered by Section 3.7, Lineside Slopes.

3.12.2 Vegetation refers to a range of planted and sown material ranging from woodland to grassland and including coppice, scrub, and hedgerow planting. The scale of planting varies too from extensive woodland planting and grassland repair to smaller interventions such as gapping up of existing hedgerows.

3.12.3 This component offers possibly the greatest means of accelerating the integration of the line with the Chilterns landscape.

Relevant HS2 documents

HS2 landscape design approach

Lawn, meadow and wetland plant procurement strategy

3.12.4 Other best practice guidance will also be relevant

Issues and Opportunities

Issues

3.12.5 Potential issues include:

- Inappropriate planting (out of keeping with local landscape character)
- Planting that struggles to establish (not suited to local conditions or poorly executed)
- Inappropriate/ inadequate management
- Fails to deliver expected mitigation

Opportunities

3.12.6 New planting represents a significant opportunity to improve the local environment particularly in terms of its landscape, visual and ecological attributes. This opportunity relates both to mitigation specifically attached to HS2 and to the wider landscape and cultural context. It is at a hitherto unprecedented scale.

Aims & Detailed Design Principles (DDP)

3.12.7 Effective integration will be seamless and undifferentiated from the character of its immediate context. The following six aims shall guide the design and delivery of all planting and seeding outside Operational Limits.

1. **Delivers Mitigation:** the principal purpose of most of HS2's scheme at Royal Assent landscape proposals is the delivery of mitigation. Designers must reference the Environmental Statement and other relevant documents to inform themselves of the purpose behind the proposed mitigation. This should include any specifics related, for instance, to replacement of lost features (such as woodland), screening to reduce visual intrusion, ecological connectivity, or simply repair following construction access.

   Landscape proposals must deliver this mitigation.

2. **Land ownership:** Land to be retained by HS2 will require appropriate subsequent land management, the limitations of which should feed back into the design proposals. Where landscape works are on another landowner's property, their intended use of the land and their agreement to the proposals is needed, as is the responsibility for its subsequent management.

3. **Chilterns Sensitive:** the whole driving force behind this document rests on a recognition of the need to react to the Chilterns' distinct landscape character. Vegetation is a central part of that character. Landscape proposals must reflect and reinforce the local landscape character and landscape types in which they are located.

   Designs should flex to respond to these different character types whether on the plateau, valley sides, valley floor or out on The Vale.

4. **Super local response:** designs must also be informed by their immediate context. This will maximise integration at the most local level. Information should be gathered by observation in the field, and by contact with the landowner, local Wildlife Trust, Chiltern Conservation Board or local authority landscape officer. Note that local conditions are likely to change partly as a result of HS2 with obvious parts of the immediate context not only radically

changed through construction of the line, but also through indirect changes such as to soils, drainage and micro-climate. Consider areas left unplanted to enable natural regeneration.

A successful scheme will knit seamlessly with the adjacent retained planting.

5. **Effective establishment:** quick and certain establishment of the new landscape proposals is important, although this should not result in a more conservative "everywhere" approach which places certainty of establishment above planting mixes and ultimate diversity of species. HS2 and best practice guidance/ specification/ methods should be varied to suit local conditions. Cultivation and protection of young plants against unwanted grazing will require special attention. Woodland may require nurse crops. Protection against weeds and the difficulty of watering will both require technical solutions. Contact with local foresters may be useful to understand local solutions.

Beech Woodland in spring

Photo credit Sandy B, CC BY-SA 2.0 via Wikimedia Commons

6. **Local provenance and enhanced biodiversity:** the HS2 document on plant procurement applies. This should guide the use of material of local provenance and its production. This should extend to the use of donor match seed for the creation of chalk grassland on areas of repair such as at Bacombe Lane or on Wendover Link. In all planting schemes consider means of increasing biodiversity through the choice of species and mixes.

DDP: Beech woodland

3.12.8 Beech woodland and Holloways are two of the prime special characteristics of the Chilterns. Beech woodland is generally considered to be under threat from a combination of climate change, disease and damage by deer, grey squirrel and glis glis. HS2 and its extensive woodland creation programme represents a major opportunity to address this decline. Woodland planting on the plateau should include a proportion of beech. In places beech and holly woodland should be considered. A decision will be required on the benefits of using locally sourced stock or beech sourced from warmer climates. Only Fagus sylvatica shall be used.

Contractor outputs for review

3.12.9 The contractor shall provide the following as a minimum to demonstrate how they have applied the DDP and for review by the local authority planning team:

- **Landscape proposals** (planting/ soiling/ fencing plans; planting schedules with full details of species, specification, size, density and mixes; full specification)
- **Management Plan including objectives**, detailed management regimes and those responsible for their execution
- **Landscape Supporting Statement** including a landscape strategy; details as to how each of the above six Aims are to be met by the proposals; and any specific method statements for implementation

3.13 Wendover Link 1

3.13.1 This is an exemplar study of one of the largest opportunities presented by HS2 in the study area. Potential Additional Projects will be required to help deliver many of these opportunities.

HS2 relevant documents

3.13.2 Because these opportunities are multi-functional this component needs to be read in conjunction with a number of other HS2 studies/guidance and other components within this document, in particular:

HS2 Information Paper E11: Green infrastructure and the green corridor

HS2 Technical Paper on Green tunnels

3.13.3 And in this document...

- Green Bridges
- Ecological corridors

These opportunities arise because of a combination of the Wendover Green Tunnel and the deep false cutting to the north – a total length of 2.5km. It is caused by the alignment running parallel to the A413 and pylon line thereby leaving a significant length of severed land or land that would be difficult to restore to agriculture. There are two parts to the link – the 1400m long Green Tunnel which stretches from Bacombe Lane to the footpath and existing overbridge to the A413 and Chilterns line, and the 1100m long large landform between the north portal and Nash Lee Road.

Detailed issues and opportunities

3.13.4 Both components are the result of mitigation of potential environmental impacts particularly noise and visual impact. These are major engineering functions which result in extended Act Limits and significant construction impacts particularly the construction of the cut and cover tunnel. In resolving these issues the current proposals raise further issues and significant opportunities particularly in the creation of new access and recreational links, and habitat creation and ecological corridors.

3.13.5 Travelling northwards these opportunities are:

- Bacombe Lane overbridge and realignment of Bacombe Lane: can the existing lane be reused as footpath separate from the realigned lane? Can the existing bridge be greened and used as a vital ecological connection to land to the north?
- Open grassland between Bacombe Lane and Ellesborough Road: should this be restored to an identical landform to existing and returned to agriculture or should the opportunity be taken to strengthen ecological links?
- Land between the A413 and the existing footpath: the current HS2 proposals are a 100 - 150m wide strip between the land returned to agriculture and the highway boundary. This includes the existing pylon line. The width of this strip is determined by the need to provide a partially above ground landform to form the green tunnel. The current design appears to maximise the area returned to agriculture by using the steepest feasible slopes on the tunnel landform.
- The false cutting landform to Lee Nash Road: this is designed to reduce visibility of the alignment which would otherwise be in shallow cutting and widely visible from the south-west. This strip is 75 - 100m wide. It is not clear where the proposed operational HS2 boundary will lie.

Wendover Link 2

Potential benefits

1 Recreational links, (photo credit Annie Spratt from Unsplash)

2 Habitat creation, (photo credit Robert Flogaus-Faust, CC BY 4.0 via Wikimedia Commons)

3 Local species specific opportunities, (photo credit gailhampshire, CC BY 2.0 via Wikimedia Commons)

4 Precedent landform (Devils Dyke, East Anglia), (photo credit Bob Jones via Wikimedia Commons)

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Suggested strategy

3.13.6 There are large areas of land shown not returned to agriculture but currently without a defined use. The suggested strategy is to provide a major piece of new green infrastructure using this land. This strategy is illustrated in plan and section on pages 92-95 and includes:

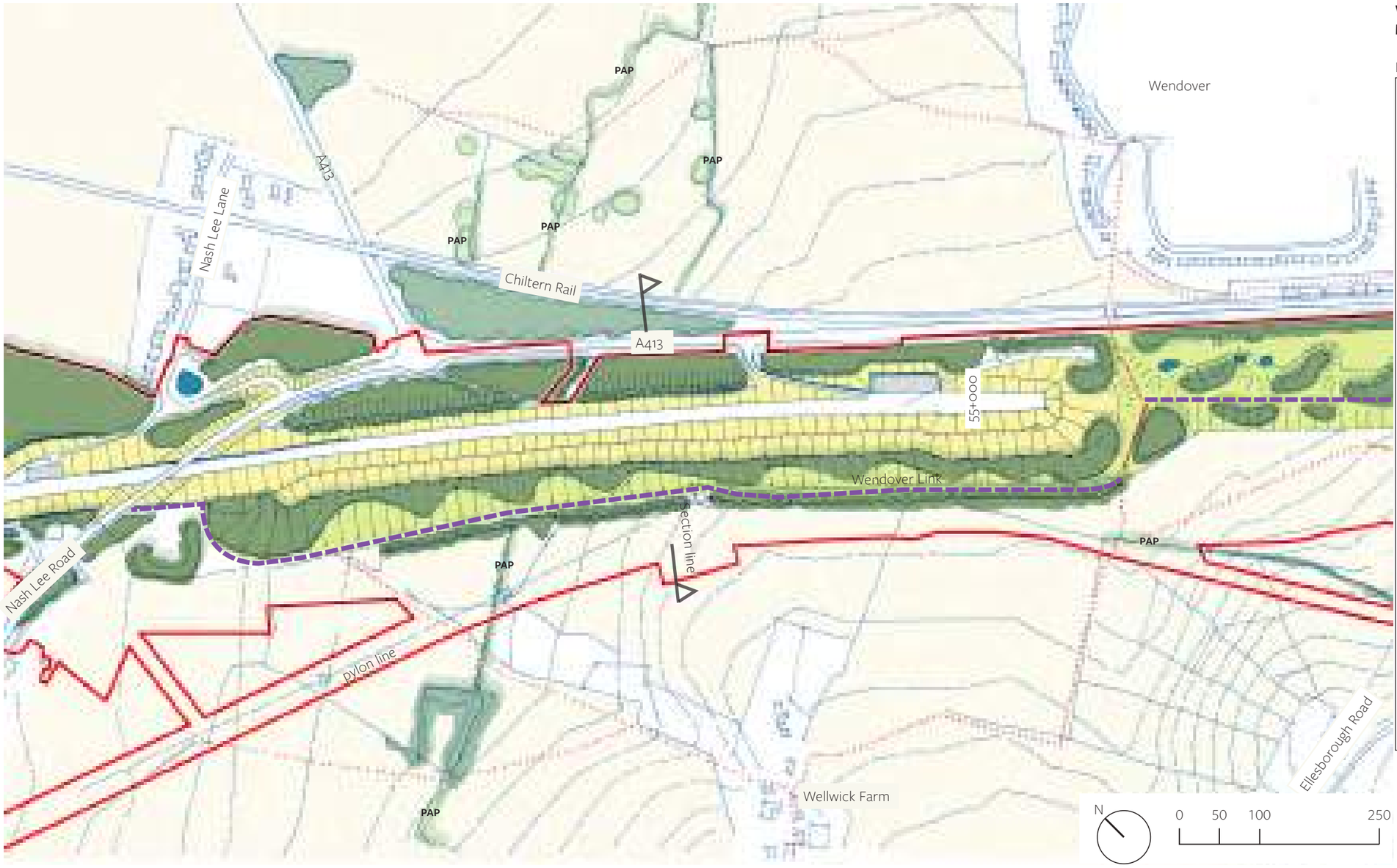
- A new 2km cycle link from Ellesborough Road to Nash Lee Road. This would provide a badly needed strategic link between Wendover and countryside north of Nash Lee Road. This could be accessed by four existing overbridges over the A413 and Chilterns line providing both additional network and an alternative to the inherently unsuitable condition for cyclists on the A413. This is envisaged as a low key unlit shared surface with pedestrians and 3-4m wide.
- A major new ecological corridor on either side of the cycle link using variations in slope and aspect to create a mosaic of grassland and scrub augmented with native hedgerow and local copses where additional screening is required. Scrapes and ephemeral waterbodies could extend these habitats in addition to a foot of slope ditch to take run-off from both the new landform and restored agricultural land to the south and east.
- If considered locally appropriate further health benefits could be added such as an associated trim trail, measured walk etc, and even a multi-use games area on the site of the current cricket club.
- Removal of National Grid pylons by undergrounding of electricity infrastructure within the Wendover Gap would offer landscape improvement and public benefit. However, current consensus is that this would be too expensive so it is not considered further in this document.

Maximising return of land to agriculture

3.13.7 Reference to Option #2 (sketch plan on page 95) shows the provision of much of the green infrastructure benefit can still be achieved even where the return of land to agriculture is maximised. This option provides:

- The same length of cycle link
- Ecological habitat creation on the slopes of the Green Tunnel (and potentially also in the narrow strip of land between the tunnel top and the A143)
- A degree of ecological connectivity provided by the crest top hedgerow adjacent to the cycle link next to the false cutting. This could be strengthened by ecological provision/management of the upper part of the inner slope of the false cutting. (This would be in part dependent on the alignment of the Operational Limits)
- Other potential Additional Projects on land to the south and west are still feasible and would provide added value.

Wendover Link 3



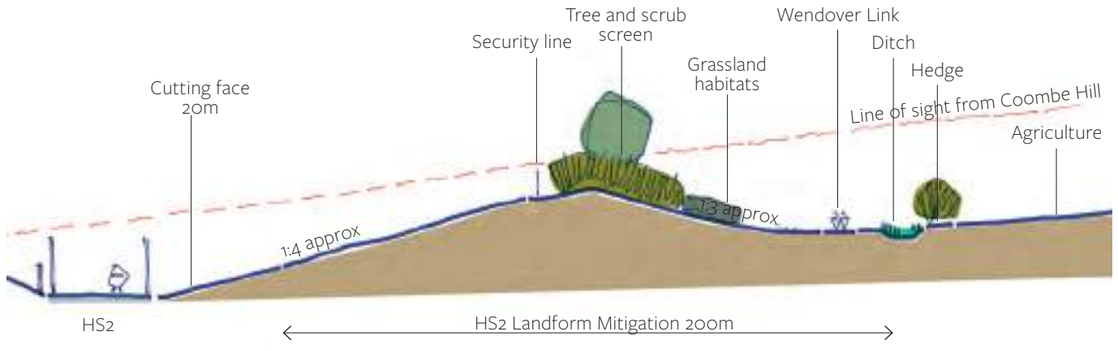
Wendover Link North: Option #1
Maximising Green Infrastructure

Legend

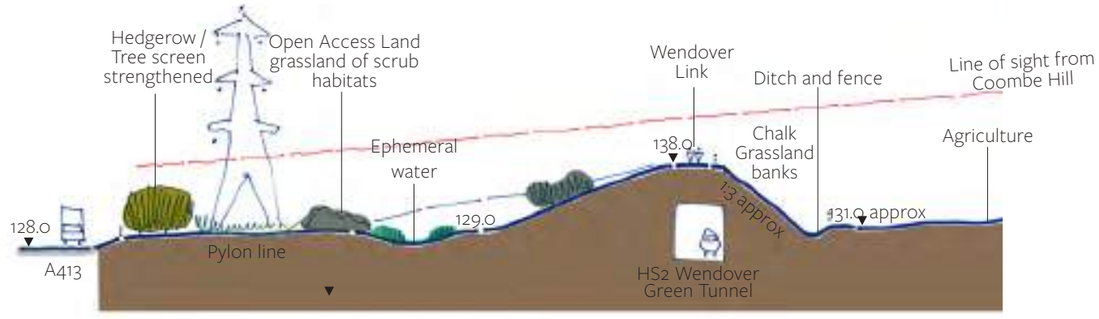
- Act Limits
- Realigned public path to scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- Infiltration ponds

For further details see Illustrative Sketch Plan Sheet 39 in Section 4

Wendover Link 4



Wendover Link North, typical section: Option #1 Maximising Green Infrastructure



Wendover Link South, typical section: Option #1 Maximising Green Infrastructure

3.13.8 These two illustrations demonstrate the range of possibilities and hint at further potential variants of each.

3.13.9 The strategy would need development in conjunction with the landowner and the local community. Certain aspects will need particular attention:

1. The management arrangements and funding of the admittedly limited ecologically based land management: the formation of a locally managed trust might be considered with joint funding by HS2 and the local community. Again this would mainly consist of an adjustment to required HS2 management within operational or Act Limits.
2. Resolution of any potential conflict between ecological enhancement and mitigation required by the Environmental Statement and the proposed access arrangements, and
3. The landscape design of the proposed landform: Preliminary discussion with Aylesbury District Council has identified two options for the green tunnel section – a more conscious landscape intervention and an extended agriculture option.

3.13.10 The landscape intervention option illustrated utilises the steep landform over the tunnel to create a ridge top shared surface with relatively steep banks on either side similar to that on ancient ridgeways or the Devils Dyke near Newmarket. This provides the opportunity for hot south and west facing slopes and grassland managed for invertebrates and butterflies and minimises disruption to existing agriculture.

3.13.11 The alternative would be the creation of a far more gentle outer face so that the tunnel landform is not evident from views from the south and west. The height of the landform and profiles and habitats to the north and east would be similar in both options.

3.13.12 Irrespective of which option is chosen the Wendover Link and its ecological corridor offers very significant and lasting green infrastructure benefits. It demonstrates the ability of HS2 to add to local environmental assets and to act as a catalyst for further benefit delivered through linked Additional Projects.

Detailed Design Principles (DDP) and Contractor action

3.13.13 The Contractor should investigate means of maximising the reasonable realization of the above opportunities working with the local authority and Chilterns Conservation Board to achieve synergies with any selected and relevant potential Additional Projects.

Wendover Link 5

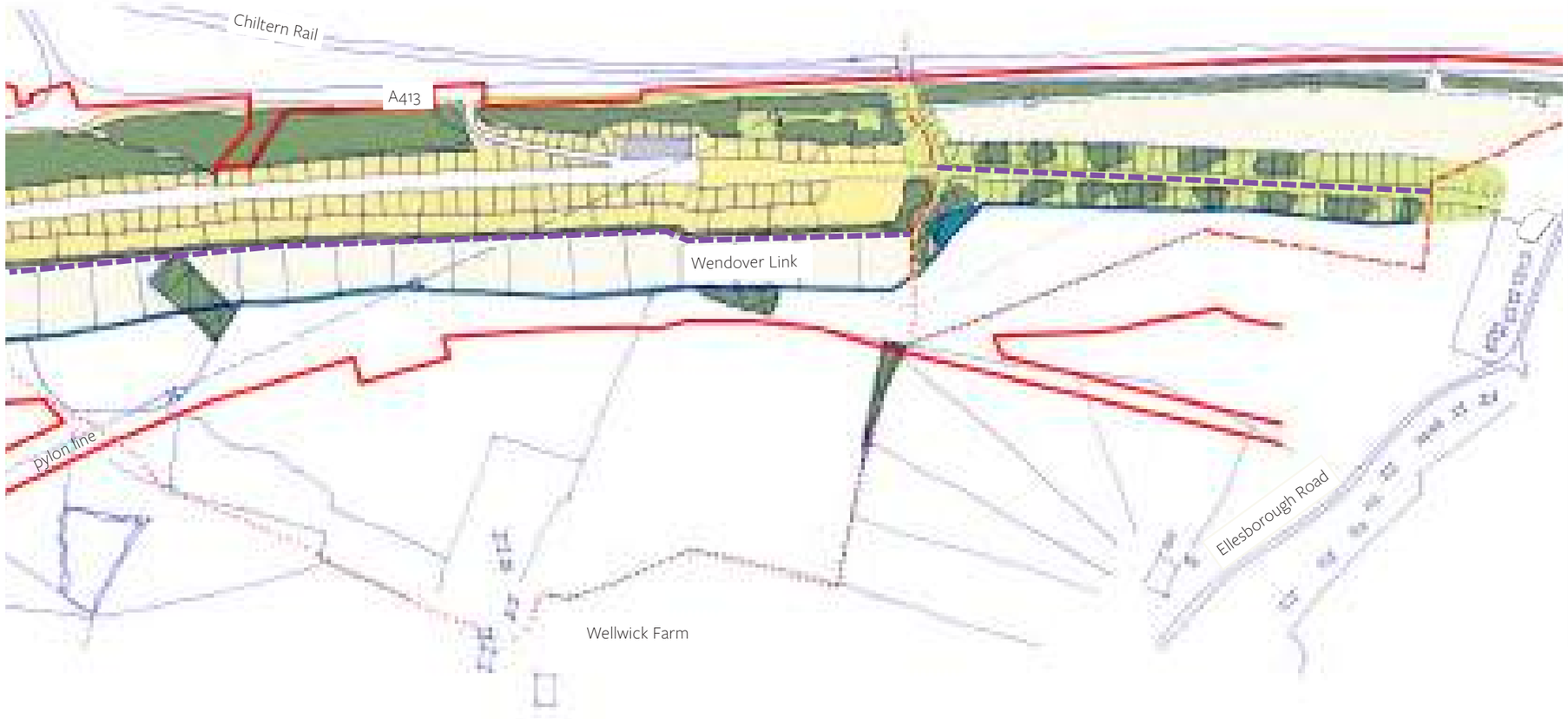
Wendover Link South: Option #1 Maximising Green Infrastructure

Legend

- Act Limits
- Realigned public path to scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g/w/t Ecological mitigation (g, grassland; w, wetland; t, woodland)
- Land potentially subject to proposed management agreement
- Returned to agriculture
- Infiltration ponds

For further details see Illustrative Sketch Plan Sheet 38 in Section 4

Wendover Link 6



Wendover Link: Option #2
Maximising Return to Agriculture

Legend

- Act Limits
- Realigned public path to scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- Land potentially subject to proposed management agreement
- Returned to agriculture
- Infiltration ponds

For further details see Illustrative Sketch Plan Sheet 38 in Section 4

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4. Illustrative Sketch Designs

4.0.1 This section includes illustrative designs for the complete above ground alignment north of the Chilterns Tunnel north portal. The aim is to show how both Strategy and Components combine in an integrated and location specific manner. This integration is fundamental to the whole design process ensuring that proposals are both appropriate and connected. This way they will add up to more than the sum of their parts.

4.0.2 Each sheet is accompanied by summary text on the issues and opportunities relevant to the illustrated section of the line shown opposite. The sheets focus on the recommended changes and additional works within and outside Act Limits to achieve an integrated design solution. Some of these recommendations will be taken forward for consideration as Additional Projects in Part 2 of this study - Potential Additional Projects.

4.0.3 The drawings are annotated to assist in referencing Components and include target notes cross referenced to the text opposite. These assist in alerting the designer to location specific needs and to where and how the guidance in the Components should be varied to suit local conditions.

4.0.4 The drawings are illustrative and will need considerable design development. We hope that they are of assistance in familiarising designers with the character, issues, opportunities and, above all, the expectations and requirements of an appropriate set of proposals that apply the Detailed Design Principles where reasonably practical.

4.0.5 Each drawing is based on HS2's proposals shown on the Act (scheme at Royal Assent) plans. Sheet numbering follows that of the scheme at Royal Assent plans with Sheets 32 and lower and 41 and higher not relevant to this document. Contours and baseline contextual information have been added together with potential proposals described in the text opposite.

4.1 Illustrative Sketch Layout; South Heath, Sheet 33

4.1.1 The alignment outside of the Chiltern Tunnel north portal offers considerable challenges and opportunities. The Act Limits are very extensive to cater for intensive construction access and activity over many years. Whilst this will inevitably generate significant construction impact it does also present equally significant opportunity to create lasting environmental benefit connected with the making good of those areas affected. Sensitive design should be capable of meeting all of these construction requirements and at the same time providing adequate and appropriate mitigation for both construction and operational impact.

4.1.2 The current landscape character of plateau with historic farmsteads and woodland blocks (principally Jenkin's Wood) provides fine down-slope views across minor side valleys. The alignment, and in particular the deep cutting and operational facilities connected with the portal, will sever this transition from valley side to plateau. However well this is treated this will result in permanent change in landscape character and the experience of those that use the footpaths in particular.

4.1.3 This realization together with the extensive Act Limits suggests four principal improvements to the scheme at Royal Assent proposals:

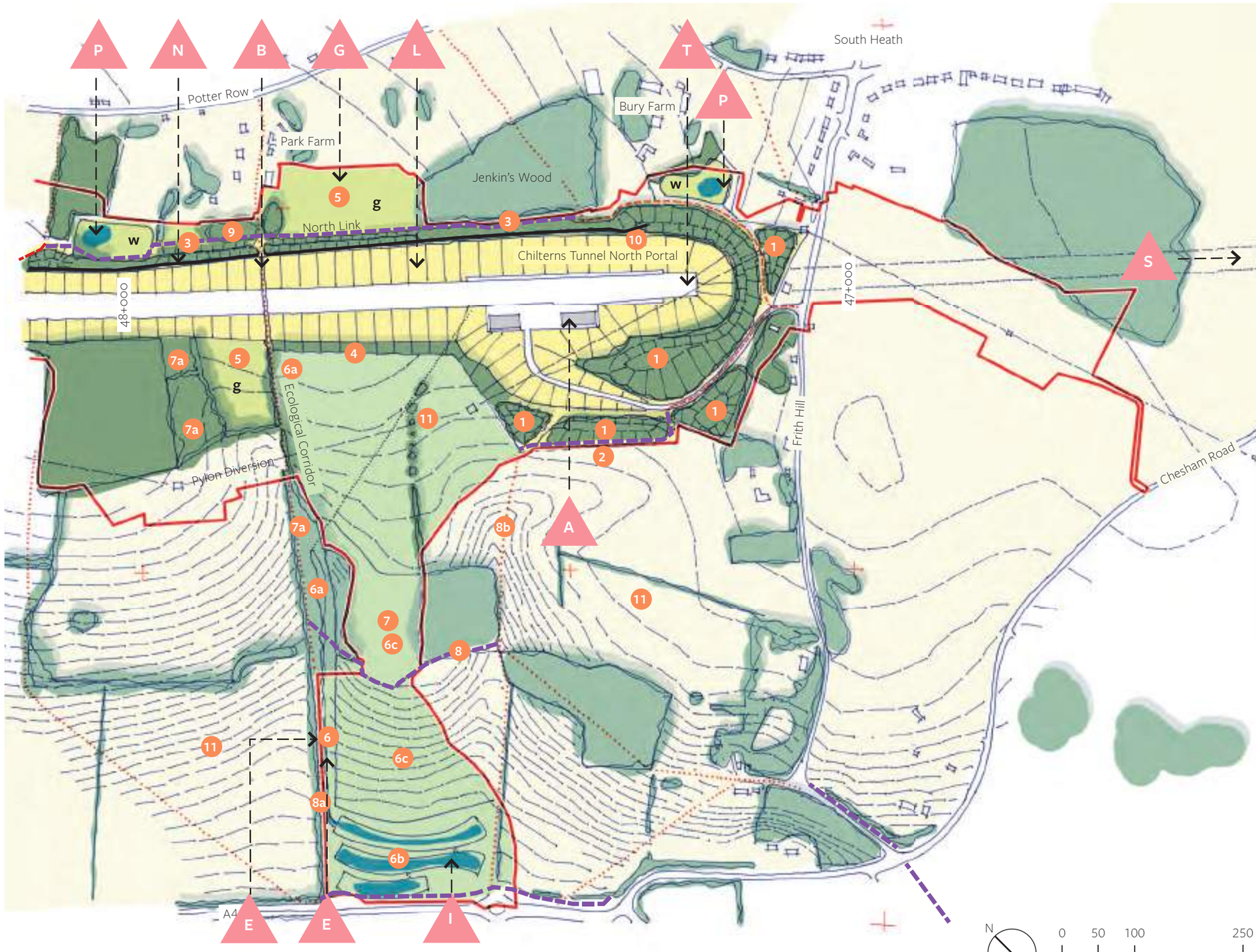
- Creation of an **Ecological Corridor** connecting plateau and valley floor, investigating how this can be extended into Boug's Meadow Nature Reserve on the opposite side of the A413.
- **Enhancement of the footpath network** including a new link parallel to the alignment – the North Link,
- Adjustment of currently proposed **woodland planting** to retain a sense of openness in selected locations, and
- Adjustment of **Porous Portal** arrangements and investigation of potential revised adjacent cutting slopes with consequent reduced cutting land-take.

4.1.4 The Ecological Corridor would provide very significant improvement in ecological connectivity and habitat creation. It would however require both agreement with the landowner and some works outside the Act Limits. An acceptable solution might consist of a more narrow corridor with the open fields above and below the central gap between woodland blocks subject of unchanged agricultural practice. The main aim should be improved ecological connectivity from plateau to valley floor and cross-slope ecological connectivity between woodland blocks.

4.1.5 **Recommended improvements to scheme at Royal Assent proposals (and Target Note)**

- Land modelling extended; extent of screen planting unchanged. Provides enhanced screening for adjacent properties. **(1)**
- Improved alternative alignment of footpath diversion. Provides better separation from operational area. **(2)**
- Proposed North Link: Additional footpath/bridle path link to provide for expected increased demand for lateral connections, enhanced choice of routes and extended network, noting presence of Jenkins Wood historical earthworks. **(3)**
- Woodland planting changed to thick native hedgerow and copses. Landform unchanged from HS2 proposals. **(4)**
- Arrangements for grassland habitat creation adjusted to match field boundaries and improve feasibility. **(5)** Habitat creation at Park Farm may move to Bury Farm.
- Park Farm Ecology Corridor: alignment of proposed surface water ditch moved towards edge of field to avoid disruption to agriculture, **(6)**. Ditch corridor developed as Ecology Corridor and extended upslope to Park Farm overbridge, **(6a)**, and downslope to modified attenuation facility, **(6b)** and thereafter across A413 to existing and enhanced valley floor habitats potentially under Additional Projects. Further areas marked **(6c)** potentially subject to further management agreement. All subject to agreement with landowner(s), and HS2.
- Currently proposed woodland planting relocated to maintain attractive upslope views and openness of valley side **(7)**. Relocated planting shown as **(7a)**.
- Potential additional footpath link to reorientate local network. This would be partly within Act Limits with a short section immediately outside and undertaken as an Additional Project. (Footpath GMI 12, **(8a)**, is considered likely to become more popular than GMI 13, **(8b)**, because of the diversion of the latter and its proximity to operational areas. GMI 12 will become the key link between Potter Row and the valley floor coming to the existing underpass on the A413. The proposed added link will provide an important connection to Great Missenden.)
- Proposed woodland subject to habitat creation/ enhancement. **(9)**
- Extent of cutting reduced if geotechnical investigations allow steepening of cutting face. **(10)**
- Hedgerow strengthening programme (as potential Additional Project inside and outside Act Limits.) **(11)**

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.



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

Key cross-references to Section 3, Components guidance

- A Ancillary Buildings
- B Viaducts & bridges
- E Ecological corridors
- G Greening Bridges
- H Holloways
- I Infiltration ponds
- L Lineside slopes
- N Noise barriers
- O Overhead line equipment
- P Ecological mitigation ponds
- S Vent Shafts
- T Tunnel portals
- V Vegetation
- W Wendover Link

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits (and sometimes within Act Limits but outside Operative Limits) are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

Legend

- Act Limits
- Realigned public path to the scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of the scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H — Component
- 1 — Target note

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Illustrative Sketch Plan; South Heath, Sheet 33

4.2 Illustrative Sketch Layout; Leather Lane, Sheet 34

4.2.1 The alignment on this plan continues along the edge of the plateau landscape with its historic field pattern, farmsteads and Holloways. The alignment is in cut throughout and there are four overbridges at close intervals (two lanes, a farm access track and a footpath). Act Limits are extensive especially to the north of the alignment. Some of this is a legacy of the now much reduced landform proposals south of Hunt's Green Farm.

4.2.2 The issue here is striking a balance between screening (to limit visual intrusion) and maintaining a sense of openness that is characteristic of the leading edge of the plateau where it meets the valley slopes.

4.2.3 Because the alignment is in cut designers need to undertake careful studies to determine the exact location and height of screening required (noise barriers, landform and planting). Woodland planting needs to be handled carefully to avoid blocking up slope views from the valley floor, and cross valley views from the plateau landscape. It is likely that a combination of cuttings and hedges will provide sufficient screening in many places, possibly augmented by hedge bank features if added height is required.

4.2.4 However the critical issue involves the successful integration and screening of ancillary elements in particular the two road bridges, ancillary buildings at chainage 48.900, top of cutting noise barriers and a number of attenuation pond drainage areas. Guidance within the relevant Components should be used to evolve locally appropriate solutions.

4.2.5 All design solutions must be informed by the significant changes in local landscape character between the plateau, valley sides and valley floor, and by the historic elements ranged along the plateau edge.

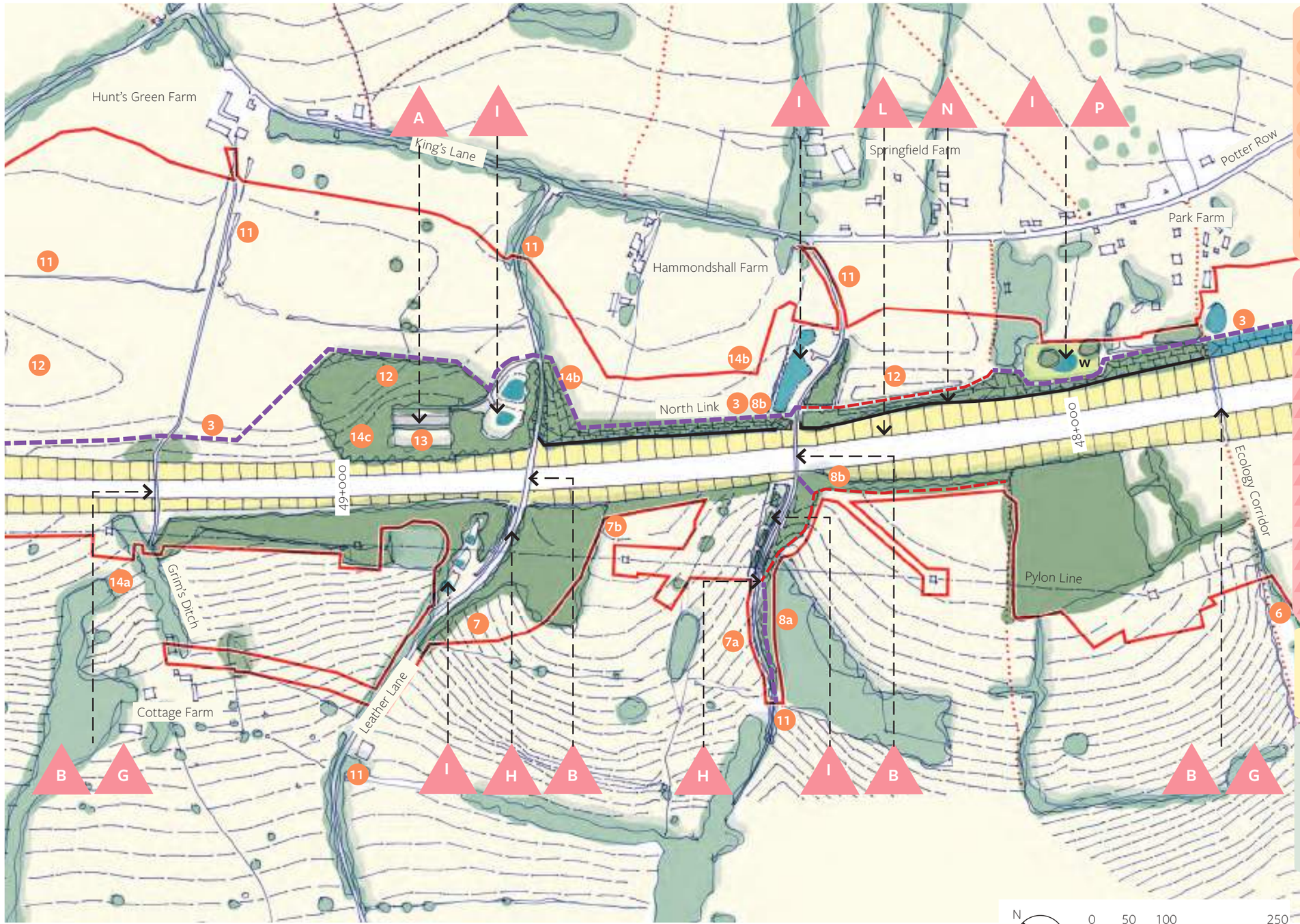
4.2.6 There are 4 main improvements to the scheme at Royal Assent proposals:

- Adjustment of **landform and woodland** to maintain a sense of openness without affecting mitigation of noise effectiveness of screening.
- Specific proposals for **Holloways**, and further suggestions in the setting of historic fields, farmsteads and Grim's Ditch
- Extension of the possible **North Link**
- Location specific advice on integrating **attenuation ponds**

4.2.7 **Recommended improvements to scheme at Royal Assent proposals (and Target Note)**

- North Link: additional footpath/bridlepath link to provide for expected demand for lateral connections, enhanced choice of routes and extended network. **(3)**
- Park Farm Ecology Corridor. **(6)**
- Adjustment of proposed woodland planting to increase retained sense of openness, with extent reduced at **(7)** and increased at **(7a)** (between Holloway and new road alignment) and **(7b)**.
- Local extension to diverted footpath alignment, **(8a)** on Holloway, and additional link **(8b)**.
- Hedgerow strengthening programme. **(11)**
- Land modelling designs advanced and varied to maintain open views from historic farmsteads and to reduce impacts on historic field pattern provided there is no impact on noise. **(12)**
- Reconfiguration of ancillary buildings layout to move back from top of cutting. **(13)**
- Adjustment of proposed woodland planting in sympathy with historic elements (**(14a)** to enhance setting of Grim's Ditch; **(14b)** setting of Harmondshall Farm and historic fields; **(14c)** screening of ancillary buildings within the setting of Hunt's Green Farm).
- Investigation of potential to reduce cutting land take by steepening cutting slope particularly adjacent to Grim's Ditch.

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.



Target Notes

3 North Link
6 Park Farm Ecological Corridor
7 Currently proposed woodland reduced; increased (7a)
8 Additional footpath link
11 Hedgerow strengthening
12 Historically sensitive landform and planting
13 Ancillary buildings reconfigured
14 Woodland planting varied to suit historic assets

Key cross-references to Section 3, Components guidance

A Ancillary Buildings
B Viaducts & bridges
E Ecological corridors
G Greening Bridges
H Holloways
I Infiltration ponds
L Lineside slopes
N Noise barriers
O Overhead line equipment
P Ecological mitigation ponds
S Vent Shafts
T Tunnel portals
V Vegetation
W Wendover Link

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits (and sometimes within Act Limits but outside Operative Limits) are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

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Legend

- Act Limits
- Realigned public path to the scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of the scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H — Component
- 1 — Target note

Illustrative Sketch Plan; Leather Lane, Sheet 34

4.3 Illustrative Sketch Layout; Bowood Lane, Sheet 35

4.3.1 Both landscape character and issues are similar to that in the preceding sheet. The alignment continues in cut descending to the north as it starts its traverse of the valley side. It does in fact momentarily appear where it cuts across a shallow side valley south of Bowood Lane before re-entering a further cutting. This visibility – Bowood Glimpse – is considered better than blocking both side valley and views which are attractive local landscape features; so no direct screening is proposed, just planting to frame this glimpse.

4.3.2 There are four bridges each over cuttings – two narrow lanes, a farm access track and a footpath. The pedestrian bridge in particular will offer excellent views along the line. Treatment of the bridges and approaches carrying the lanes will need particularly careful handing. Guidance in Sections 3.2, 3.4 and 3.5 applies.

4.3.3 The illustrative proposals show how the landform in the foreground to the view from Hunt's Green Farm can be successfully integrated into existing profiles and combined with woodland planting to screen ancillary buildings.

4.3.4 Significant woodland planting proposed in the vicinity of Jones' Hill Wood has been adapted to act as part of an Ecological Corridor connecting these woods. A possible fauna underpass at Bowood Glimpse and the drainage ditch and attenuation ponds on the valley floor (all within Act Limits) are also proposed.

4.3.5 The principal improvements to the scheme at Royal Assent proposals are:

- **Hunt's Green Farm landform** and planting that retains openness
- **Bowood Glimpse and Ecological Corridor** retaining and enhancing views of both the valley and, fleetingly, the train; and making important ecological connections
- Further extension of the **North Link**
- Detailed proposals for **Leather Lane holloway**
- Location specific advice on integrating **attenuation ponds**

4.3.6 **Recommended improvements to scheme at Royal Assent proposals (and Target Note)**

- North Link extended providing additional connectivity with existing network of lanes and paths to valley floor. **(3)**
- Bowood Ecological Corridor: connecting woodland habitats on plateau with grassland habitats on valley side and floor **(6a)**
- Proposed woodland planting adjusted to retain sense of openness - reduced **(7);** increased in extent **(7a)**
- Hedgerow strengthening programme to enhance/conserve historic co-axial field pattern. **(11)**
- Land west of Hunt's Green Farm: landform adjusted to mimic local ground profiles. **(12)**
- Ancillary buildings: layout amended, guidance provided under Section 3.1. **(13)**
- Woodland proposals adjusted to benefit the setting of historic assets (farmsteads, co-axial fields **(14c);** and Grim's Ditch - Fencing and other clutter minimised to enhance setting of this historic asset **(14a)**
- Maintenance access at Bowood Glimpse amended and local viewpoint created. **(15)**

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.

Target Notes

3 North Link
6a Bowood Ecological Corridor
7 Currently proposed woodland reduced; increased (7A)
11 Hedgerow strengthening
12 Historically sensitive landform and planting
13 Ancillary buildings reconfigured
14 Woodland planting varied to suit historic assets
15 Bowood Glimpse

Key cross-references to Section 3, Components guidance

A Ancillary Buildings
B Viaducts & bridges
E Ecological corridors
G Greening Bridges
H Holloways
I Infiltration ponds
L Lineside slopes
N Noise barriers
O Overhead line equipment
P Ecological mitigation ponds
S Vent Shafts
T Tunnel portals
V Vegetation
W Wendover Link

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits (and sometimes within Act Limits but outside Operative Limits) are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

Legend

- Act Limits
- Realigned public path to the scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of the scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H — Component
- 1 — Target note

Illustrative Sketch Plan; Bowood Lane, Sheet 35

4.4 Illustrative Sketch Layout; Wendover Dean Viaduct, Sheet 36

4.4.1 This is a critical section of the alignment where the line traverses the valley slopes from the plateau to the valley floor. It makes this transition using the Wendover Dean Viaduct – which will be clearly visible from both the valley floor and the plateau edge – followed by a major screen landform and false cutting south of Rocky Lane underbridge.

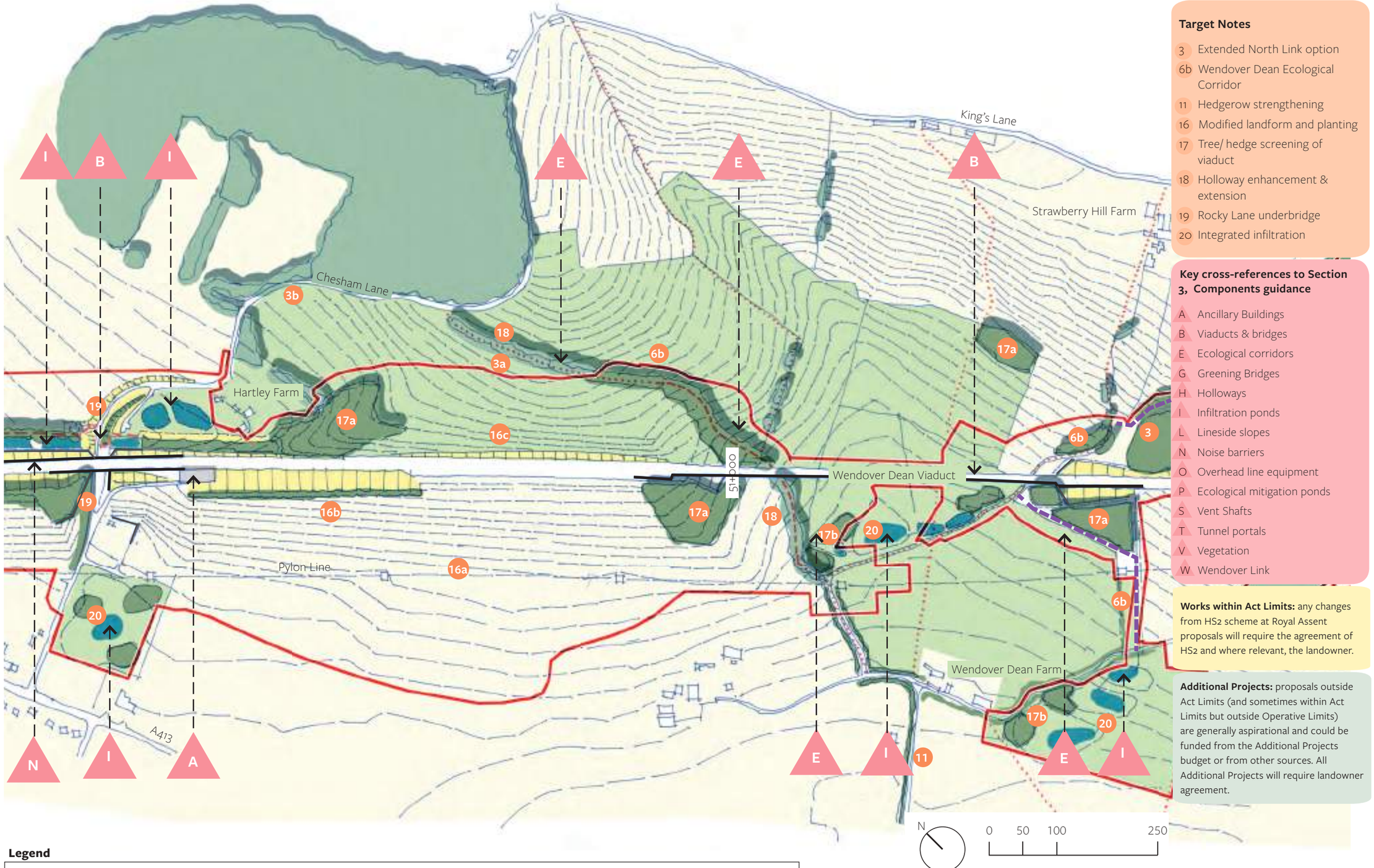
4.4.2 A considerable number of different Components are referenced in this section each of which is keyed on the illustrative plan.

4.4.3 **Recommended improvements to the scheme at Royal Assent proposals (and Target Note)**

There are also a number of suggested variations to the scheme at Royal Assent proposals. These can be summarised as:

- **Potential further extension of North Link:** a study should investigate the feasibility of, **(3)** using the Holloway and the creation of an off-line connection parallel to Chesham Lane descending to the Rocky Lane underbridge **(3a)**/ **(3b)**. These proposals could combine within Act Limit works and an Additional Project.
- **Creation of an Ecological Corridor** taking advantage of the space under and on either side of the Wendover Dean Viaduct **(6b)**. This is the largest opportunity for ecological connectivity within the AONB – 500m of effective fauna underpass with the viaduct 5-18m above ground level. Section 3.3 uses this as an exemplar of how such opportunities can be realised working in tandem with other initiatives such as Infiltration Ponds (Section 3.6), hedgerow strengthening, and enhancement of access networks. All should be supported by local management agreements to provide a substantial piece of new Green Infrastructure, and delivery of HS2's Green Corridor.
- **Modifications to proposed landform and planting** above and below the alignment north of the Wendover Dean Viaduct. Studies indicate that the west side landform may have to be truncated to maintain adequate clearance to the pylon cables **(16a)**. A return to agricultural use is still proposed. Careful modelling of these slopes should be capable of screening views of the alignment for most of the landform but may need additional hedgerow screening towards the north end **(16b)**. Careful design of the cutting slopes on the east side of the alignment **(16c)** should mean that in key views from the A413 the new landform on the west side of the line appears as a natural extension of slopes to the east. This will require 3D modelling to finesse.
- **In depth screening** of the viaduct particularly of the embankments and abutments at either end. This should be achieved through a combination of native tree clumps and hedge strengthening. **(17a),(17b)**
- Reconnection of the currently degraded **Holloway** from Chesham Lane and its extension and enhancement to Wendover Dean Farm. **(18)**
- **Rocky Lane underbridge:** see in particular Section 3.2. This element will require a detailed study to resolve the integration and design of a number of interrelated local issues including: the design of the bridge soffit, abutments and flanking retaining structures; the accommodation of culverts/drains, access and footways within the layout; and the retention and expression of the rural qualities of its location. At best this can be an appropriate and low key gateway to the rural Chilterns landscape to the east; at worst this could be intrusive and inappropriately urban. **(19). An added broad hedgerow on the west side of Rocky Lane can provide a degree of ecological connection with infiltration facilities (20).**
- Integrated proposals for **infiltration and drainage facilities** noting guidance in Section 3.6 regarding valley floor location. **(20)**
- **Wendover Dean Viaduct:** see exemplar study and guidance in Section 3.2, and note proposals as illustrated for the adjustment of abutments and additional screen planting of flanking embankments.

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.



Target Notes

- 3 Extended North Link option
- 6b Wendover Dean Ecological Corridor
- 11 Hedgerow strengthening
- 16 Modified landform and planting
- 17 Tree/ hedge screening of viaduct
- 18 Holloway enhancement & extension
- 19 Rocky Lane underbridge
- 20 Integrated infiltration

Key cross-references to Section 3, Components guidance

- A Ancillary Buildings
- B Viaducts & bridges
- E Ecological corridors
- G Greening Bridges
- H Holloways
- I Infiltration ponds
- L Lineside slopes
- N Noise barriers
- O Overhead line equipment
- P Ecological mitigation ponds
- S Vent Shafts
- T Tunnel portals
- V Vegetation
- W Wendover Link

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits (and sometimes within Act Limits but outside Operative Limits) are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

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Legend

- Act Limits
- Realigned public path to the scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of the scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H — Component
- 1 — Target note

Illustrative Sketch Plan; Wendover Dean Viaduct, Sheet 36

4.5 Illustrative Sketch Layout; Small Dean Viaduct, Sheet 37

4.5.1 The line completes its descent to the valley floor and crosses to the west side of the valley. This manoeuvre entails a highly complex negotiation of existing roads and the Chiltern rail line by means of the Small Dean Viaduct The route then continues parallel to and in close proximity to both the A413 and the Chiltern line.

4.5.2 The line on either side of the viaduct is on embankment. West of the embankment a large landform and false cutting screens visibility from the west but there will be significant visibility from the slopes above and to the east. North of the viaduct, space between the A413 corridor and the alignment is very limited leading to extensive short and medium range views of the alignment. With this exception Act Limits are extensive throughout this section.

4.5.3 The viaduct and its approaches dominate the issues here. Unlike the remainder of the route through the AONB, the visual strategy accepts that the viaduct will be highly visible and suggests how this should be handled. This is covered by Section 3,2. The structure itself requires an elegant design solution to the twin challenges of a long central span and a skewed alignment over other existing routes. Given the visibility from the east it is recommended that the viaduct and the visible and extensive embankments on either side are treated as a single design solution inclusive of noise barriers, retaining structures and all visible elements. This could include noise barriers/parapet as suggested for the viaduct being extended on either side (rather than reverting to the types of noise barrier recommended for use elsewhere in the AONB). Other means of reducing visibility should also be investigated such as the use of toe retaining structures at the base of embankments to reduce their slope and increase their ability to receive screen planting; maximising the height of embankment screen planting whilst avoiding issues of leaf fall; the provision of substantial wooded backdrop to these views to avoid 'skylining' of OLE, barriers and trains; and the adaptation of infiltration facilities south and east of the viaduct so that these could accommodate a degree of tree screen planting.

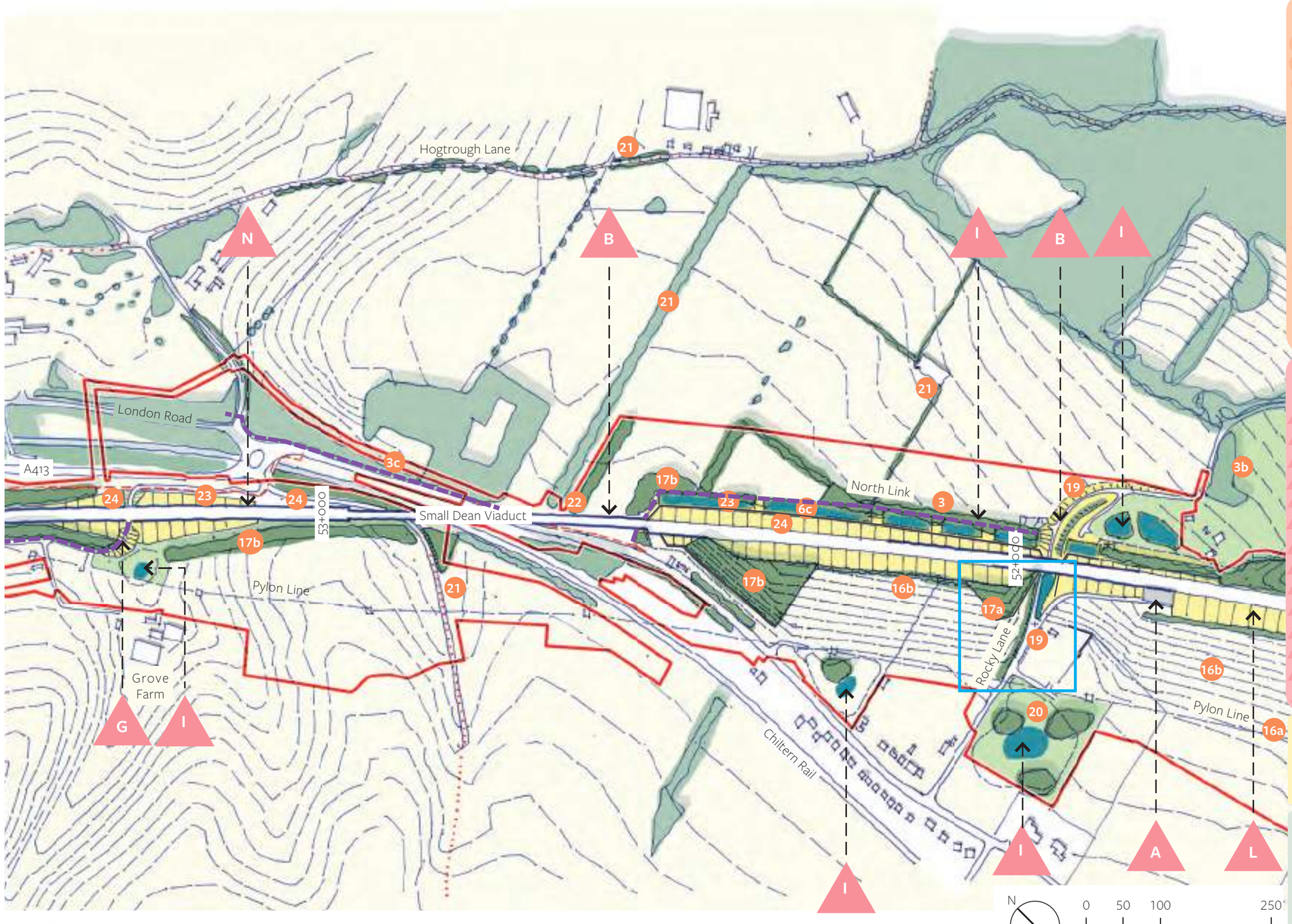
4.5.4 These actions should be supported by a programme of screening in depth consisting of tree planting and hedgerow planting/strengthening both within and beyond Act Limits. This exercise should be sympathetic to the variations in local landscape character and field pattern.

4.5.5 Extensive infiltration ponds on the valley floor should be guided by Section 3.6. The series of pools to the east of the line should be designed to incorporate tree screening and could take the form of a belt of poplars within a series of periodically wet basins the outer bank of which carries the North Link extension. This extension should connect with the A413 and with a possible parallel off-line shared cycle/ pedestrian route to London Road, Wendover.

4.5.6 **Recommended improvements to the scheme at Royal Assent proposals (and Target Notes)**

- Extension of North Link **(3)** and possible added link to Wendover parallel to A413 and London Road **(3c)**.
- Development of ecological corridor incorporating infiltration and screening east of alignment. **(6c)**
- Modification of landform and planting west of the line including resolution of junction with adjacent properties. **(16a/b)**
- Provision of wooded backdrop. **(17b)**
- Resolution of Rocky Lane underbridge issues (see previous sheet). **(19)**
- Site specific attenuation and drainage facilities. **(20)**
- Screening in depth within and outside Act Limits. **(21)**
- Key design of the viaduct including embankments on either side. **(22)**
- Use of toe retaining structures to ease embankment slopes and allow planting. **(23)**
- Maximising embankment planting (24)

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.



Target Notes

- 3 North Link
- 3c Potential Wendover Link
- 6c Ecology corridor with attenuation & screening
- 16 Modified landform & planting
- 17a / 24 Embankment planting maximised
- 17b Wooded backdrop
- 19 Rocky Lane underbridge
- 20 Integrated infiltration & screening
- 21 In depth screening
- 22 Integrated design of viaduct & approaches
- 23 Toe retaining structures

Key cross-references to Section 3, Components guidance

- A Ancillary Buildings
- B Viaducts & bridges
- E Ecological corridors
- G Greening Bridges
- H Holloways
- I Infiltration ponds
- L Lineside slopes
- N Noise barriers
- O Overhead line equipment
- P Ecological mitigation ponds
- S Vent Shafts
- T Tunnel portals
- V Vegetation
- W Wendover Link

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits (and sometimes within Act Limits but outside Operative Limits) are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

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Legend

- Act Limits
- Realigned public path to the scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of the scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H Component
- 1 Target note

Illustrative Sketch Plan; Small Dean Viaduct, Sheet 37

4.6 Illustrative Sketch Layout; Wendover Green Tunnel, Sheet 38

4.6.1 This sheet covers the transition from the Small Dean Viaduct and its embankments to the Wendover Green Tunnel and its south portal. The line continues in close proximity to the A143 with significant ancillary buildings associated with the portal. The green tunnel uses a cut and cover construction and partly in consequence there are extensive areas for construction and broad Act Limits. There are a number of temporary and permanent diversions of roads (Ellesborough Road and Bacombe Lane) and PRoWs. It is assumed that most areas outside future operational areas will be returned to agriculture. However the feasibility of this may be questionable in places because of the gradients associated with the green tunnel cover, and because of restricted access.

There are three principal areas of recommended improvements to HS2's scheme at Royal Assent proposals:

4.6.2
- Associated with the **Green Tunnel portal and surroundings** including potential changes to landform, access and surface water drainage proposals: This area has been of considerable public concern particularly over noise and visual issues and whilst the revised, scheme at Royal Assent, proposals have addressed these concerns there are other opportunities to further reduce impacts
- Creation of the **Bacombe Ecological Corridor** through potential variation of proposals connected with the permanent diversion of Bacombe Lane, and the reinstatement and subsequent management of land used for construction and then returned to the landowner. This would provide an important improved connection with Bacombe SSSI.
- Creation of the **Wendover Link** involving significant potential benefits for access, recreation and biodiversity on land over and adjacent to the Green Tunnel. This is covered in greater detail under Section 3.13.

4.6.3 **Recommended improvements to scheme at Royal Assent proposals (and target notes)**

- Provision of wooded backdrop. **(17b)**
- Consideration of the addition of toe retaining structures to provide extra room for screen planting **(23)**
- Embankment planting maximised **(24)**
- Modification and raising of landform and introduction of retaining structures to improve screening of ancillary buildings and portal structure (Sections 3.1 and 3.11, target note **25**)
- Optimisation of landform and planted screening between line and PRoW/A143 taking into account drainage and pylon requirements. **(26)** This should include consideration of replacement of drainage facility and additional screen planting. See also Section 3.13.
- Inclusion of hedge/bank feature to screen new alignment of Bacombe Lane **(27)**
- Thickened scrub planting along A143 boundary **(28)**
- Ecological enhancement achieved through land management agreement with landowner **(29)**
- Potential reinstatement of existing PRoW to provide off-line pedestrian link **(30)**
- Retro-greening of existing Bacombe Lane overbridge to Section 3.4
- Wendover Link, (see Section 3.13): new shared surface pedestrian cycle line over green tunnel under **(31)**
- Slopes managed for nature conservation (with landowners agreement) **(32)**
- Habitat creation with grassland scrub matrix **(33)**
- Extensive hedgerow/scrub screening to A143 compatible with pylons **(34)**
- Ditch realigned from scheme at Royal Assent proposals to reduce severance on agriculture **(35)**
- Existing and diverted PRoW **(36)**
- Field boundary rationalisation/hedge and copse programme within and outside Act Limits (potential Additional Project) **(37)**

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.

Target Notes

17b Woodland backdrop
23 Toe retaining structures
24 Embankment planting maximised
25 Landform & planted screen
26 Additional screening study
27 Hedge/ bank feature
28 Scrub screen
29 Managed for ecology
30 PRoW reinstated
31 Shared pedestrian/ cycle link
32 Native conservation management
33 Grassland/ shrub matrix
34 Hedgerow/ scrub screen
35 Ditch realigned
36 Existing/ diverted PRoW
37 Field rationalisation & hedge copses

Key cross-references to Section 3, Components guidance

A Ancillary Buildings
B Viaducts & bridges
E Ecological corridors
G Greening Bridges
H Holloways
I Infiltration ponds
L Lineside slopes
N Noise barriers
O Overhead line equipment
P Ecological mitigation ponds
S Vent Shafts
T Tunnel portals
V Vegetation
W Wendover Link

Works within Act Limits: any changes from HS2 scheme at Royal Assent proposals will require the agreement of HS2 and where relevant, the landowner.

Additional Projects: proposals outside Act Limits (and sometimes within Act Limits but outside Operative Limits) are generally aspirational and could be funded from the Additional Projects budget or from other sources. All Additional Projects will require landowner agreement.

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Legend

- Act Limits
- Realigned public path to the scheme at Royal Assent proposals
- Additional recommended path/ revised alignment of the scheme at Royal Assent proposed path
- Existing path
- Lineside slope
- Noise barriers
- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
- PAP — Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H — Component
- 1 — Target note

Illustrative Sketch Plan; Wendover Green Tunnel, Sheet 38

4.7 Illustrative Sketch Layout; Wendover Cutting, Sheet 39

4.7.1 The line has now left the Wendover Gap and the Chilterns and has entered the Vale with its flatter topography, larger fields and more open landscape character, although it is still within the AONB. This section is dominated by the long cutting after the line's emergence from the Wendover Green Tunnel north portal and before the line passes under the Nash Lee Road overbridge. This cutting is extended on the south-east side of the line by a substantial false cutting. The tunnel has a short porous portal and adjacent ancillary buildings with access down the cutting slope from the A143. The relatively narrow corridor between the above ground line and the A143 contains extensive existing and proposed woodland planting with further existing trees on the far side of the road. More woodland planting is proposed north of the line beyond Nash Lee Road. This should provide a good level of screening from adjacent land although the screening may draw attention to the presence of the line by contrast with an otherwise open landscape.

4.7.2 The construction zone and Act Limits extend beyond the base of the false cutting and in corridors following the locally realigned pylons. A number of PRoWs are diverted and these and the foot of the proposed landform sever a number of field boundaries.

Possible Wendover Link (Section 3.13)

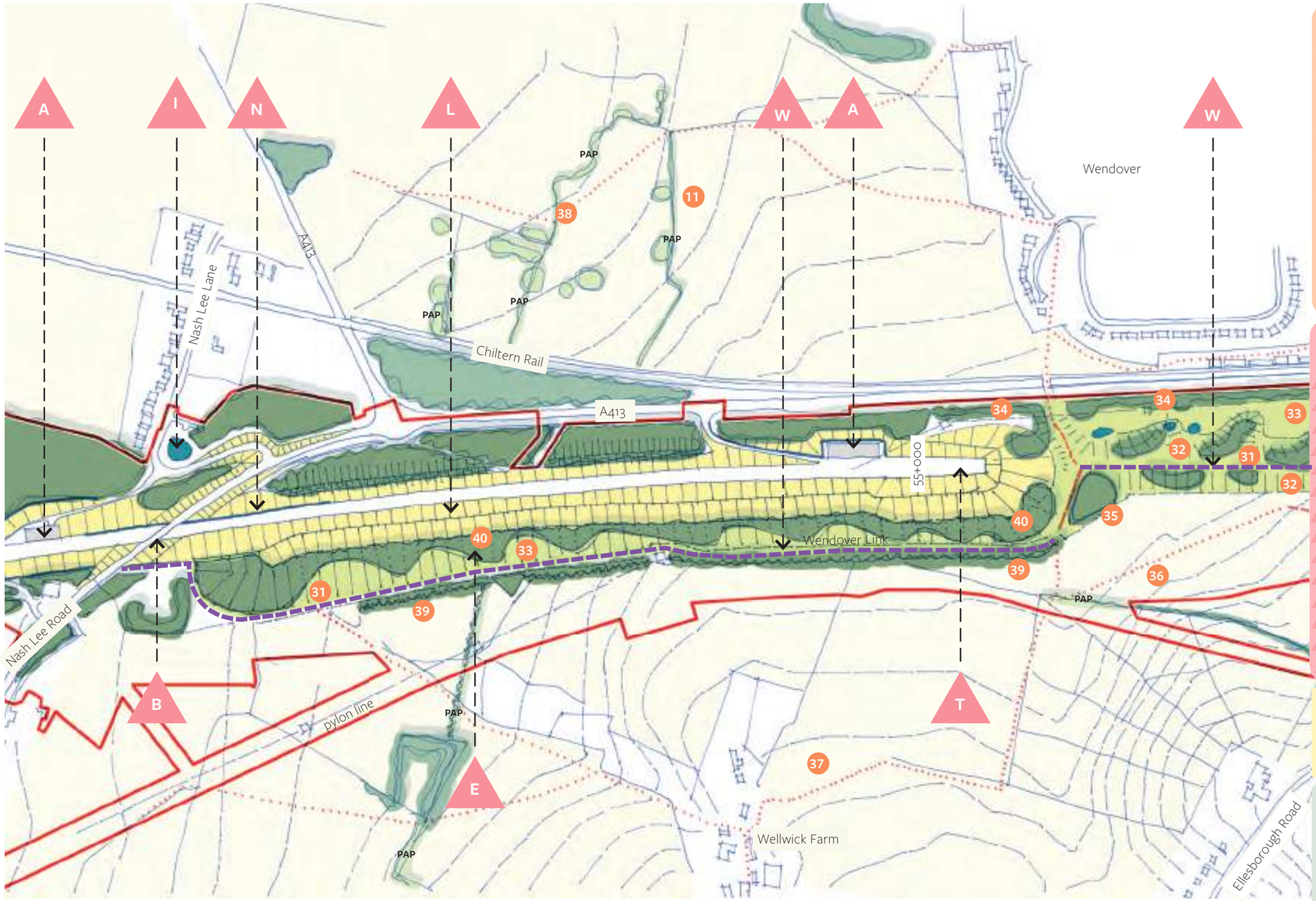
4.7.3 The outer face of the false cutting landform presents the main opportunity on this section. Labelled 'landscape earthworks' on the scheme at Royal Assent proposals it is unclear whether this is land that will be returned to the landowner for agricultural use. Although the proposals show no levels it is likely that the resulting gradients will be too steep for the extension of adjacent arable farming particularly with the addition of a ditch along the foot of the landform. We consider that this area offers an opportunity to extend the Wendover Link already proposed over the Green Tunnel to the south-east. Section 3.13 explores this opportunity to provide significant recreational, access and ecological benefit in addition to the screening of views of the line from the Chilterns scarp. The section investigates two options of varying land take.

4.7.4 The remaining proposals concern landscape and ecological initiatives outside of Act Limits. These would provide improved integration of the lineside landscape with its landscape context.

4.7.5 **Recommended improvements to the scheme at Royal Assent proposals (and target notes)**

- Possible Wendover Link: major new Green Infrastructure component providing significant access, recreation, biodiversity and landscape benefit, and additional screening of the rail corridor, Section 3.13)
- Green Tunnel North portal proposals (Section 3.11)
- Ecological and landscape enhancement of streams and ditches outside Act Limits (potential Additional Project) **(38)**
- Possible Wendover Link, (see Section 3.13): new shared surface pedestrian cycle line over green tunnel under **(31)**
- Slopes managed for nature conservation (with landowners agreement) **(32)**
- Habitat creation with grassland scrub matrix **(33)**
- Extensive hedgerow/scrub screening to A143 compatible with pylons **(34)**
- Ditch realigned from scheme at Royal Assent proposals to reduce severance on agriculture **(35)**
- Existing and diverted PRoW **(36)**
- Field boundary rationalisation/hedge and copse programme within and outside Act Limits (potential Additional Project) **(37)**
- Hedgerow strengthening (potential Additional Project **(11)**
- Hedge/ditch corridor creation (potential Additional Project **(39)**
- Scrub/hedge screen **(40)**

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.



Target Notes

31 Shared pedestrian/ cycle link
32 Native conservation management
33 Grassland/ shrub matrix
34 Hedgerow/ scrub screen
35 Ditch realigned
36 Existing/ diverted PRoW
37 Field rationalisation & hedge copses
38 Stream/ ditch corridor enhancements
39 Hedge/ ditch corridor
40 Scrub/ hedge screen

Key cross-references to Section 3, Components guidance

A Ancillary Buildings
B Viaducts & bridges
E Ecological corridors
G Greening Bridges
H Holloways
I Infiltration ponds
L Lineside slopes
N Noise barriers
O Overhead line equipment
P Ecological mitigation ponds
S Vent Shafts
T Tunnel portals
V Vegetation
W Wendover Link

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Legend

- Act Limits
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- Lineside slope
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- Ancillary building
- Existing & proposed woodland within Act Limits
- Existing woodland outside Act Limits
- g / w / t — Ecological mitigation (g, grassland; w, wetland; t, woodland)
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- Land potentially subject to proposed management agreement
- Returned to agriculture
- H — Component
- 1 — Target note

Illustrative Sketch Plan; Wendover Cutting, Sheet 39

4.8 Illustrative Sketch Layout; Maintenance Loop, Sheet 40

4.8.1 The principal environmental issues here relate to the Maintenance Loop. This facility consists of two loops parallel to and on either side of the running lines. Permanent way trains will remain in these loops for much of the time. This will result in issues of visual intrusion and disturbance caused by the parked trains, lighting and night time activity (most maintenance will be undertaken overnight), noise barriers and additional lineside clutter including extra overhead line equipment (OLE), signalling and storage facilities. These effects will be increased by the line being on embankment throughout this section. The impact will be felt by local residents on Risborough Road, and on the local landscape character. Impacts on the AONB will be reduced because of distance but are still a consideration.

4.8.2 The current HS2 proposals provide mitigation for these impacts with most of the mitigation located immediately adjacent to the alignment.

4.8.3 Because of the wide and complex Act Limits in this area (mostly related to flood storage and habitat creation) there is opportunity to increase the effectiveness of screening of these impacts. This could be done by using a strategy of screening in depth – the use of a number of different means in a scatter of locations. This is considered better than simply thickening perimeter planting (which would reinforce awareness of the line in the landscape). This approach will also be more effective with screening elements being closer to the viewer. The menu of proposals include hedgerow strengthening, tree lines and free-standing tree groups including within habitat creation and flood storage areas. Tree species should be locally native and appropriate to each habitat rather than chosen for screening purposes per se; however well placed and quick growing blocks of local provenance black poplar or willow would be suitable.

4.8.4 These actions could be extended where feasible beyond Act Limits and include widening of field headlands in selected locations. Some degree of greening of the pedestrian overbridge would help to integrate the Ecology Corridors on either side of the alignment. (See also Section 3.3)

4.8.5 The elements directly associated with the Maintenance loop should have a consistent design intent that reduces clutter and reduces visibility. OLE could require a gantry system which if used should have minimum section steelwork and be painted in colours referenced in the OLE component, Section 3.9. Wherever practical the gantry system should also accommodate lighting and signalling. Lighting masts above OLE height should be avoided and all light fittings must have full vertical cut-off. Security lighting should be minimised and general purpose lighting only used when necessary for maintenance operations. Issues re buildings, fencing, signage and access arrangements should follow appropriate parts of Section 3.1 and 3.10 on Ancillary buildings and Vent shafts.

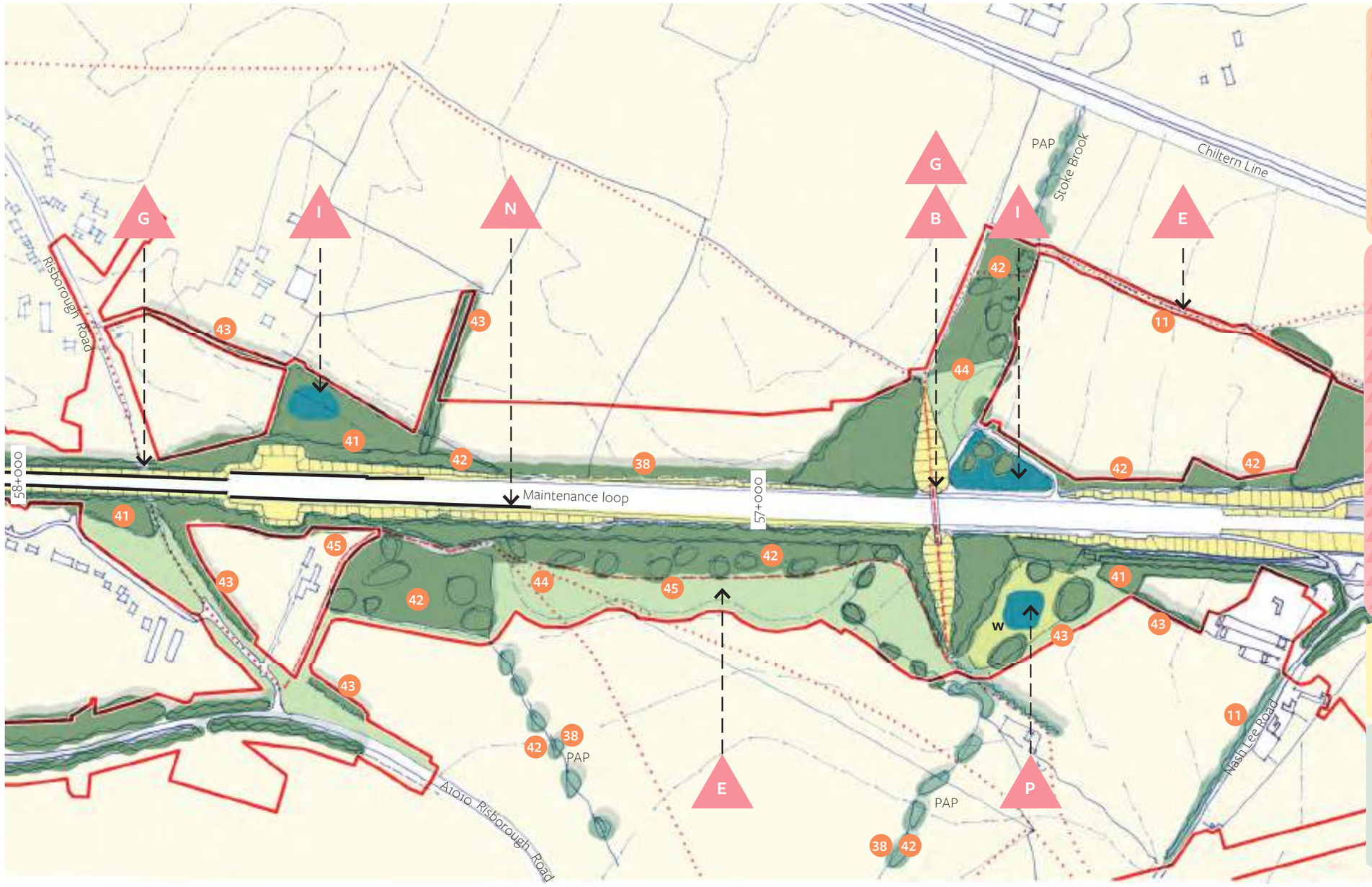
4.8.6 The principal suggested improvements to HS2 proposals are:

- A strategy of **'extra screening in depth'** across Act Limits,
- **Control of visual impact** through guidance in relevant Components
- **Added connectivity of habitats** to create an Ecological Corridor that spans the line
- **Additional footpath linkage**

4.8.7 **Recommended improvements to scheme at Royal Assent proposals (and Target Notes)**

- Hedgerow strengthening within and outside Act Limits. The four actions above will provide added screening 'in depth' **(11)**
- Increased woodland/screen planting **(41)**
- Increased tree planting in clumps inside and outside Act Limits including within replacement flood storage areas **(42)**
- Hedgerow with 'standards' tree and hedge screens within and outside Act Limits **(43)**
- Ecological corridor connecting wetland habitats and Stoke Brook corridor on both sides of the alignment including overbridge greening. This will enhance ecological connectivity **(44)**
- Additional footpath link to south of proposed maintenance loop. This will enhance recreational connectivity **(45)**

A number of these initiatives may involve Additional Project funding. Each of these adjustments would need the agreement of HS2 and landowner, if outside Operational Limits.



Target Notes

- 11 Hedgerow strengthening
- 38 Stream/ ditch corridor enhancement
- 41 Woodland/ screen planting
- 42 Tree planting/ small copses
- 43 Hedge/ tree belts
- 44 Stoke Brook Ecological Corridor
- 45 Extra footpath link

Key cross-references to Section 3, Components guidance

- A Ancillary Buildings
- B Viaducts & bridges
- E Ecological corridors
- G Greening Bridges
- H Holloways
- I Infiltration ponds
- L Lineside slopes
- N Noise barriers
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Legend

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- PAP Potential Additional Projects
- Land potentially subject to proposed management agreement
- Returned to agriculture
- H Component
- 1 Target note

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Illustrative Sketch Plan; Maintenance Loop, Sheet 40