Plans and Specifications for Western Valley Slopes and Portal Structures Schedule 17

Design and Access Statement

ALIGN Consent Ref ALJ-TP-0206

Document no: 1MC05-ALJ-TP-REP-CS02_CL03-000008

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Colne Valley Western Slopes
Design & Access Statement

HS2

HS2 Ltd 1MC05-ALJ-TP-REP-CS02_CL03-000008 February 2021

Contents

1.0
Introduction

This section summarises the purpose and scope of the project and this Design and Access Statement, together with Schedule 17 requirements.

Executive Summary

1.1

1.1.1 Purpose

This Design and Access Statement (DAS) has been prepared to support the submission of Schedule 17 request for approvals of plans and specifications for the Colne Valley Western Slopes (CVWS) to Three Rivers District Council and Buckinghamshire Council. The approvals requested relate to the following components of the design:

- CVWS earthworks;
- Earthworks and fencing for the realignment of Tilehouse Lane;
- Erection of the Chiltern Tunnel south portal buildings;
- Erection of supporting infrastructure including noise barriers, fencing and gates; and
- Creation of balancing ponds and associated drainage infrastructure.

The CVWS represent one of the largest single parcels of land for restoration on the High Speed 2 (HS2) Phase 1 route. It is the construction hub for works to build the Colne Valley Viaduct and the Chiltern Tunnels; and is the location for the Chiltern Tunnel south portal which is a Key Design Element (KDE). The CVWS is also identified as the location to accommodate the chalk arisings coming out of the Chiltern Tunnels, which equates to approximately 3million m^3 of material.

At the hybrid Bill stage, the CVWS was identified in the Environmental Statement as an area with the potential for biodiversity mitigation. As the design has progressed, opportunity has been sought to also deliver significant biodiversity enhancement and contribute meaningfully to the ecological and sustainability targets of HS2.

This DAS explains the context of the CVWS and justifies the rationale for the design of the scheme with reference to key opportunities and constraints. The proposals are supported by visualisations of the landscape design and key structures which sit within the landscape. The DAS supports the Written Statement and should also be read in conjunction with the suite of drawings and reports which accompany this submission of Schedule 17 request for approvals.

1.1.2 Team

ALIGN JV are working on behalf of HS2 Ltd to design and construct the CVWS. They are a consortium of three companies which comprise:

- Bouygues Travaux Publics
- Sir Robert McAlpine
- VolkerFitzpatrick

Their combined experience, both in the UK and worldwide, in delivering high-profile infrastructure projects safely, on time, and on budget, has established their reputation.

1.1.3 Document structure

This DAS has been subdivided into the following sections:

- **Context:** An appraisal of the physical, environmental, recreational, and cultural features of the local context.
- **Brief:** A summary of briefing material, from HS2 design requirements and guidelines, hybrid Bill requirements, technical requirements and stakeholder aspirations.
- **Design vision:** A description of the overall design vision explained through a series of key design principles and visualisations, and the illustrative masterplan.
- **Environmental design:** A summary of the integrated design proposal with reference to the key components of the landscape masterplan comprising the earthworks; landscape and ecological design including habitat creation and management; and associated infrastructure including highways and drainage elements.
- **Portal structures and buildings:** A summary of the design for principal architectural elements in the masterplan comprising the Chiltern Tunnel south portal and associated buildings; the track-side noise attenuation barriers; and Tilehouse Lane overbridge.
- **Sustainability:** A summary of how environmental, social and economic considerations have influenced the design proposals.
- **Engagement:** A summary of the various methods and results of engagement with local authorities, stakeholders, the local community and the HS2 Independent Design Panel undertaken to date.
- **Summary and conclusion:** A summary of the CVWS proposals.
- **Appendices:** Supporting information including References and the HS2 Independent Design Panel Report.

HS2 Project

1.2

1.2.1 Project overview

HS2 is a new high speed railway network that will connect major cities in Britain. It will bring significant benefits for inter-urban rail travellers through increased capacity and improved connectivity between London, the Midlands and the North. It will release capacity on the existing rail network and so provide opportunities to improve existing commuter, regional passenger and freight services, particularly on the West Coast Main Line (WCML).

1.2.2 Phase One

Phase One of HS2 will provide a dedicated high speed rail service between London, Birmingham and the West Midlands. Phase Two of HS2 will extend the railway to the north-west and north-east: to Manchester with connections to the WCML at Crewe and Golborne; and to Leeds with a connection to the East Coast Main Line approaching York.

1.2.3 Central Section C1

Central Section C1 comprises 22km of the high-speed rail line, running between the Colne Valley and the Chilterns. It includes the 3.4km long Colne Valley Viaduct and its approach embankments, the Chiltern twin-tunnels and five ventilation shafts and headhouses (refer to Figure 1.1).

Fig.1.1_ Route plan - Central Section C1

1.2.4 Colne Valley Western Slopes

The CVWS is located within the Colne Valley Regional Park and straddles two local authority boundaries comprising Buckinghamshire County and Three Rivers District Council. The majority of the land (approximately 138 ha) is situated within the Three Rivers District Council administrative boundary with the remainder, in the north western and south eastern portions, within the Buckinghamshire County administrative area (refer to Figures 1.2 and 1.3).

The Schedule 17 application boundary defines the request for approval area for the CVWS earthworks, fencing and structures, in particular:

- Buildings and structures – principally the Chiltern tunnels twin portal structures and buildings;
- Significant earthworks associated with the trace and wider landscape restoration including the south portal cutting; the West Hyde embankment, Tilehouse Lane cutting and the northern embankment for the Colne Valley Viaduct;
- Habitat features;
- Drainage infrastructure;
- Highways including the realigned Tilehouse Lane;
- Rights of way earthworks;
- Fencing and security features; and
- Noise barriers on the Colne Valley Viaduct north embankment.

The Schedule 17 request for approvals for the Colne Valley Viaduct, including the north abutment, was submitted in September 2019 and was part consented by Buckinghamshire Council's predecessor South Bucks District Council in February 2020 (ref: PL/19/3332/HS2); and the remainder by the Planning Inspectorate (within the London Borough of Hillingdon area) in November 2020. The proximity of the CVWS to the viaduct corridor is an important consideration in design terms and the same multi-disciplinary team has been involved on both asset areas to ensure continuity in design approach and thinking.

1.2.5 Strategic importance

The CVWS is an important strategic asset on the Phase One route and has the potential to be a substantial net contributor to biodiversity gain at a local and project-wide scale. More broadly, the CVWS has the potential to contribute significantly to regional environmental infrastructure delivery and has a role in securing carbon net-zero commitments.

The strategic importance and relevance of the CVWS can be summarised as:

- Located within the outer London 'green ring' and a subset of the Colne Valley Regional Park with potential significance as a key recreational resource for the surrounding areas, including West Hyde, Maple Cross, Denham and Harefield;
- Identified at hybrid Bill stage as an area with habitat creation and mitigation opportunity (albeit largely undefined at that stage);
- One of the largest construction sites on the HS2 Phase One project and the launch point for the Chiltern Tunnels Boring Machine; and
- Will be the location for the deposit of approximately 3 million m³ of chalk tunnel spoil.

Fig.1.2_ Existing site plan - Key dimensions

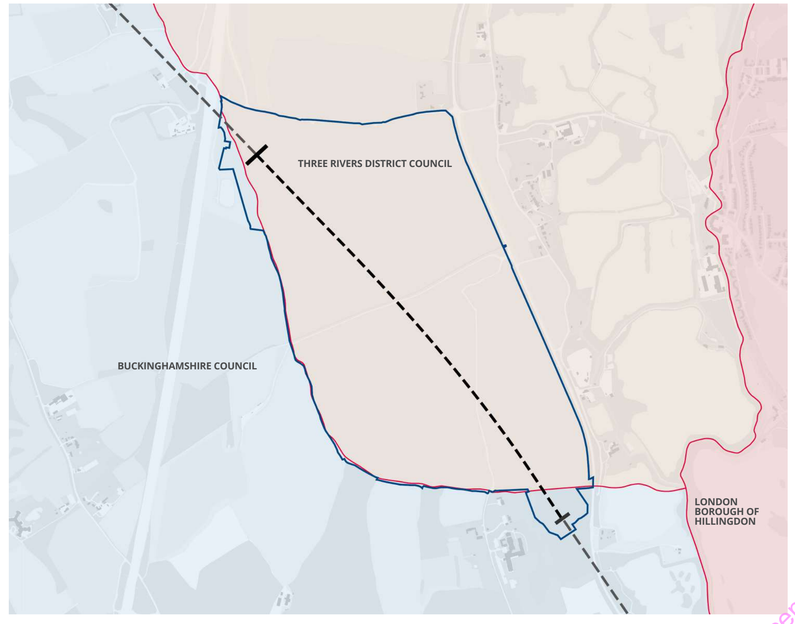

Fig.1.3_ Existing site plan - Schedule 17 application and local authority boundaries

1.2.6 Project development

The CVWS as a component of the wider HS2 project was granted deemed planning permission upon Royal Assent of the High Speed Rail (London - West Midlands) Act 2017 (referred to in this report as the HS2 Act) in February 2017. An initial preliminary design for the CVWS was prepared as part of the HS2 Act in order to define the spatial extents of works including the arrangement of built structures, earthworks and mitigation for landscape and ecological elements. This established the 'kit of parts' and set broad parameters in terms of scale, composition and appearance. It was not a detailed design and the HS2 Act parameters provide sufficient flexibility to allow the contractors to deliver a design within the parameters, as long as it meets the environmental obligations set out within the Environmental Minimum Requirements (EMRs) for the HS2 project.

The ALIGN JV has developed the hybrid Bill design into first a scheme design and subsequently a mature detailed design for Schedule 17 request for approvals.

The design has responded positively to the character of the Colne Valley, which is highly valued by the local community. The design has followed the general approaches (as applicable) in the HS2 Landscape Design Vision which are to:

- Conserve
- Enhance
- Restore
- Transform

Engagement with the Local Authorities, environmental bodies, communities, the Colne Valley Regional Park Panel and the HS2 Independent Design Panel have all been a crucial part of the design process. As the design has developed, proposals were shared with local planning authorities, statutory consultees, environmental groups and local communities at public engagement events. Feedback from this engagement process has influenced and steered the design submitted as part of these Schedule 17 request for approvals.

The CVWS has now reached a level of design maturity where approvals can be sought for both design and highways.

Sections 2 and 10 of the Written Statement (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000007) set out how this Schedule 17 request for approvals fits into other Schedule 17 request for approvals that have been made previously both within and in the vicinity of the CVWS.

These request for approvals, being made in early 2021, concerns the large extent of land that is being re-profiled and restored to both mitigate the permanent effects of the railway and deliver new habitat and improved rights of way and circulation within the site.

While this Schedule 17 request for approvals seeks approval for the final landform, position of structures and highways earthworks, it is important to note that the consents for restoration (including planting mixes and typologies) will be submitted at a later date. However, the landform and highway design are intrinsically related to the landscape restoration and habitat creation.

The purpose of the DAS is to fully set out and justify the overall design intent and provide confidence that the planting and habitat works can be delivered on the landform that will be consented and constructed in advance of those final restoration consents.

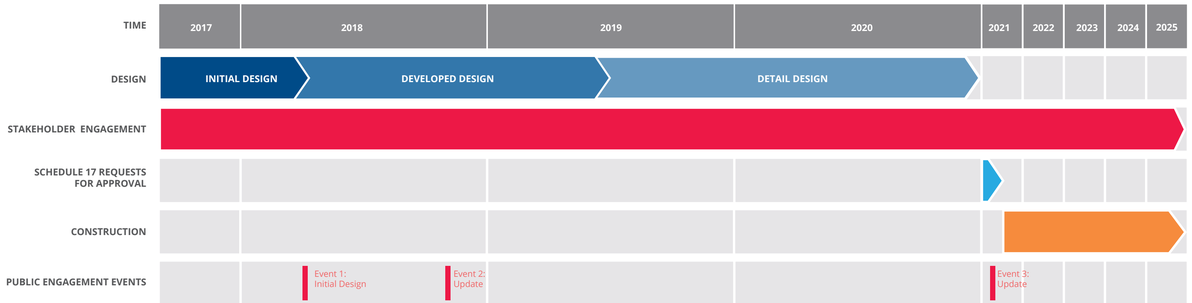

Fig.1.4_ Programme - CVWS design, Schedule 17 and delivery programme

1.2.7 Construction

At the time of this application, much of the CVWS has been substantially cleared and a large construction operation has commenced including site establishment and access, earthworks to construct the railway trace, material stockpiling, temporary drainage, structural works and utility works. The extent of the construction works on the ground is illustrated in the annotated drone photography taken in December 2020 (refer to Figure 1.5). Components of these works were covered by earlier Schedule 17 approvals and include:

- Chalfont Lane bund (TRDC ref: 19/2059/HS2);
- Tilehouse Lane overbridge (TRDC ref: 20/0779/HS2);
- Railway trace including the south portal cutting and access road (TRDC ref: 19/0945/HS2 and SBDC ref: PL/19/1782/HS2); and
- Colne Valley Viaduct north abutment (SBDC ref: PL/19/3332/HS2).

Construction of the earthworks which are the subject of this application is due to commence formally in June 2021 and will be followed by landscape restoration works, construction of portal buildings and structures, and construction of highways and drainage infrastructure over a period of four years with substantial completion of the civil engineering expected in the autumn of 2025. A period of ongoing aftercare and monitoring of the landscape and ecological works will continue beyond the practical completion stage together with long term maintenance and management.

Key

- Site access from M25 slip road
- Temporary construction stockpiles (topsoil, subsoil and general fill)

1. Chiltern Tunnel south portal
2. Chiltern Tunnel south cutting
3. Site offices and parking
4. Main construction and fabrication area
5. Tilehouse Lane overbridge
6. Tilehouse Lane cutting (approximate extents)
7. Colne Valley Viaduct north embankment (approximate extents)
8. Chalfont Lane bund (approximate extents - detail not shown)
9. M25 slip road (temporary)

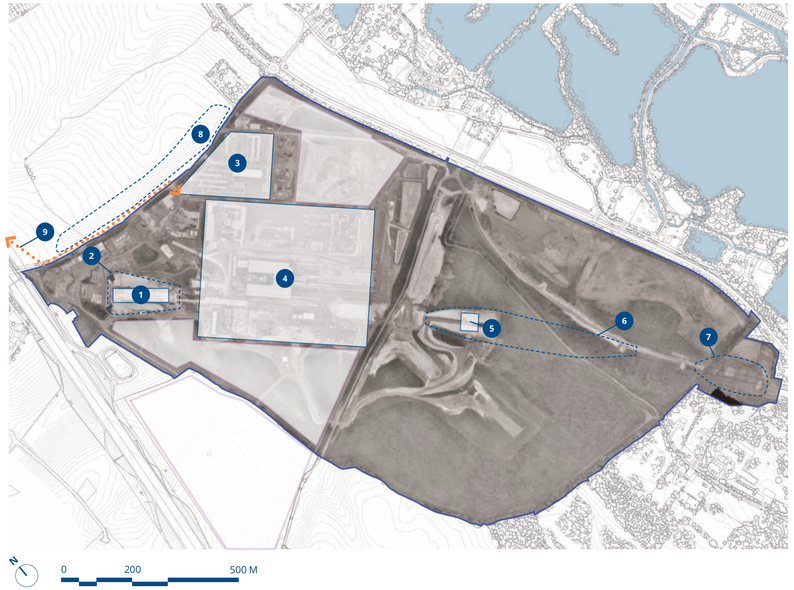

Fig.1.5_ Aerial photography - Compound Zero construction site (December 2020)

Schedule 17

1.3

1.3.1 Overview

The key documents, including Planning Forum Notes that are relevant to this DAS and Schedule 17 request for approvals are:

- High Speed Rail (London-West Midlands) Environmental Minimum Requirements Annex 2: Planning Memorandum, HS2 Ltd
- High Speed Rail (London - West Midlands) Act 2017: Schedule 17 statutory guidance, Department for Transport
- HS2 Phase One Planning Forum Note 1: Content of Submissions and Standard Templates, HS2 Ltd
- HS2 Phase One Planning Forum Note 2: Drawings for Plans and Specifications Approvals, HS2 Ltd
- HS2 Phase One Planning Forum Note 3: Written Statements and DASs, HS2 Ltd
- HS2 Phase One Planning Forum Note 10: Indicative Mitigation, HS2 Ltd
- Planning Forum Note 14: Operational Noise from the Railway & Altered Roads, HS2 Ltd

1.3.2 Schedule 17 documentation

The Schedule 17 request for approvals of plans and specifications for the design of the CVWS is supported by other documentation that sit alongside this DAS, including:

- Written Statement (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000007): This document sets out the rationale and detail of the complete Schedule 17 submission, including landscape earthwork proposals and future planting and seeding proposals. The Written Statement also sets out the environmental justification for the proposed works subject to this Schedule 17 request for approval. The document cross refers to this DAS in several places.
- Indicative Mitigation Details (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000009): This document sets out the approach to mitigation and restoration that will be subject to future approvals, although the indicative mitigation does form part of the integrated design for the CVWS as a whole. This document is a consultation on the proposed landscape mitigation and treatment as well as the long term proposals for restoration.
- Railway Operational Noise Assessment (ref: 1MC05-ALJ-EV-REP-CS02_CL03-000088): This report documents the indicative operational noise modelling that has been undertaken to inform the design.
- Drawings: A series of plans, elevations, sections and visualisations showing the proposed landscape elements, ecological features including ponds and scrapes, buildings and structures, drainage infrastructure, indicative tree loss and highway design.

A full list of Schedule 17 request for approvals plans and documents is provided in the Appendices of this DAS (refer to Section 10.2).

Illustrative Visualisations

1.4

1.4.1 Overview

Within this DAS, a selection of computer generated visualisations of the CVWS have been included for illustrative purposes only. Viewpoints have been selected to present key design features and the relationship of the CVWS with important site locations within the Colne Valley. The visuals are typically set in the year 2040, approximately 15 years after completion, to portray the railway and associated infrastructure within a relatively mature landscape setting.

1.4.2 Visualisation schedule

The visualisations and associated viewpoint locations are listed and numbered below (these reference numbers are used throughout the DAS):

1. Elevated view over the CVWS looking north west
2. Ground level view from the Chiltern Tunnel south portal viewing area looking south east
3. Ground level view from the Tilehouse Lane viewing area looking north west
4. Ground level view from the Tilehouse cutting viewing area looking north west
5. Ground level view from the Tilehouse cutting viewing area looking south east
6. Ground level view from the Footpath Rickmansworth 004 looking south west
7. Ground level view towards the Chiltern Tunnel south portal looking south west
8. Ground level view from Old Shire Lane bridleway looking north east (1)
9. Ground level view from Park Lane, Harefield looking west
10. Ground level view from the Old Orchard Pub at Harefield looking west
11. Elevated view above rail level looking north west
12. Elevated view above viaduct looking north
13. Ground level view from Tilehouse Lane looking south
14. Elevated view over the Chiltern Tunnel south portal looking north
15. Ground level view from Old Shire Lane bridleway looking north east (2)

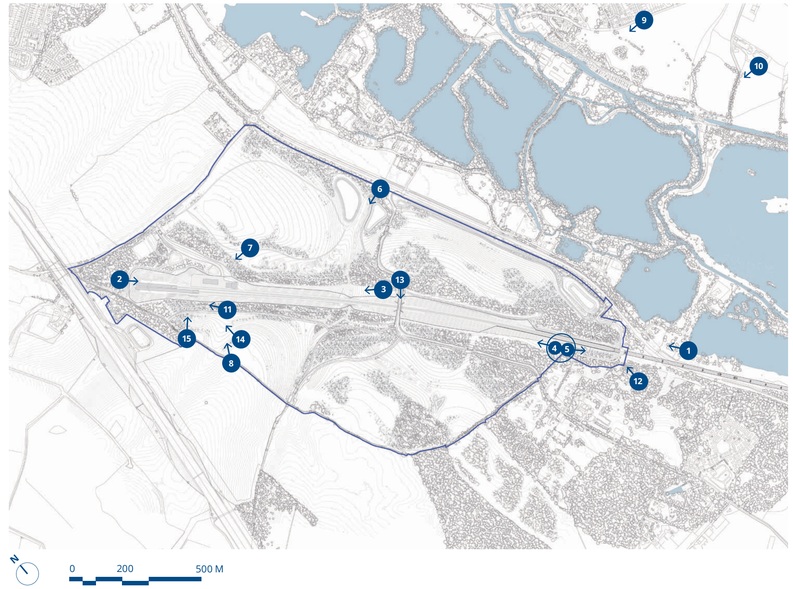

Fig.1.6_ Site plan - Visualisation and viewpoint locations

Acronyms

1.5

1.5.1 Acronyms

- AFARP - As Far as Reaonably Practicable
- ATS - Autotransformer Station
- AOD - Above Ordnance Datum
- AONB - Area of Outstanding Natural Beauty
- BGS - British Geological Survey
- BREEAM - Building Research Establishment Environmental Assessment Method
- CDE - Common Design Elements
- CDM - Construction (Design and Management Regulations)
- CVWS - Colne Valley Western Slopes
- CVRP - Colne Valley Regional Park
- DAS - Design and Access Statement
- EA - Environment Agency
- EMR - Environmental Minimum Requirements
- ES - Environmental Statement
- FORS - Fleet Operator Recognition Scheme
- FRA - Flood Risk Assessment
- GFRP - Glass Fiber Reinforced Plastic
- GGBS - Ground Granulated Blast-furnace Slag
- HS2 - High Speed Two (the project)
- HS1 - High Speed One
- HS2 Ltd - High Speed Two Ltd (the nominated undertaker)
- HS2 IDP / IDP - HS2 Independent Design Panel
- KDE - Key Design Element
- LCA - Landscape Character Assessment
- LLAU - Limits of Land to be Acquired or Used
- LOD - Limits of Deviation
- LPA(s) - Local Planning Authority (Authorities)
- MWCC - Main Works Civils Contract
- NNL - No Net loss
- NVC - National Vegetation Classification
- OCS - Overhead Catenary system
- OHLE - Overhead Line Equipment
- PiR - Passive Infrared Sensor
- PRoW - Public Right of Way
- South Bucks District Council - SBDC
- SSSI - Site of Special Scientific Interest
- SuDS - Sustainable Urban Drainage System
- Three Rivers District Council - TRDC
- U&A - Undertakings and Assurances
- WFD - Water Framework Directives
- WCML - West Coast Main Line
- YSWD - You said, We did (event)

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2.0
Context

An appraisal of the physical, environmental, recreational, social and cultural features of the Colne Valley Western Slopes and the surrounding Colne Valley.

Planning Context

2.1

2.1.1 Local authority boundaries

The extent of the Schedule 17 request for approvals incorporates land within the boundaries of two local planning authorities (LPAs): Three Rivers District Council and Buckinghamshire Council, a single unitary authority. Three Rivers District Council lies within the Hertfordshire County Council administrative area. The LPA boundary where it crosses the CVWS is illustrated in Figure 2.1 and broadly follows the line of the Old Shire Lane bridleway.

This DAS supports the Schedule 17 request for approvals to each LPA, where the submission incorporates the portal structures which are designated as a Key Design Element (KDE) as part of the hybrid Bill. KDEs are identified as key elements of infrastructure in sensitive areas, requiring engagement with the public on the detailed design development.

Extensive engagement has taken place with each of the LPAs at key stages of the project and design evolution. This has been in both a formal and informal capacity through pre-application meetings and via other regular forums with feedback helping to inform the final design proposals presented in these Schedule 17 request for approvals. Further details on the engagement process are included in Chapter 8 of this DAS.

Key

- Proposed railway alignment
- Schedule 17 boundary
- LPA boundary
- Three Rivers District Council
- Buckinghamshire Council
- London Borough of Hillingdon

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Fig.2.1_ Site plan - Local authority boundaries

Regional Context

2.2

2.2.1 Spatial and planning context

The CVWS is situated at the northern and western extents of the Colne Valley Regional Park (CVRP) within an area characterised by agricultural land and extensive waterbodies, interspersed with urban development linked to commuter towns and villages and major road and rail corridors including the M25 to the west and the Chilterns railway to the south. The nearest main settlements include Harefield, Denham Green, West Hyde and Maple Cross.

The CVRP forms part of a multi-functional landscape which establishes an extended green corridor on the western fringes of Greater London. It has both local and strategic significance and, although not designated for its landscape quality, has environmental value and sensitivities. It is also highly valued as a community resource and supports a range of leisure and recreational activities.

The CVRP's proximity to the Chilterns AONB is also important and provides one of several key contextual drivers which have informed the design proposals for the CVWS.

Investment in high quality green/ environmental infrastructure associated with major development such as HS2 and Heathrow is promoted in several local and regional strategies; the *Colne and Crane Valleys Green Infrastructure Strategy* (CVRP, 2019) in particular provides a key framework reference for the CVWS design, and *inter alia* promotes:

- Creating high quality and diverse open spaces for local and regional communities;
- Improvements for wildlife; and
- Resilience to climate change.

Key

- Schedule 17 boundary
- Proposed viaduct
- Proposed embankment
- Proposed cutting
- Proposed Chilterns Tunnel south portal
- Proposed Chilterns Tunnel
- Colne Valley Regional Park boundary line
- Local authority boundary line

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Fig.2.2_ Aerial photograph - Section C1 alignment in the Colne Valley

Landscape Context

2.3.2 Overview

The area that forms the wider landscape setting and context for the CVWS is defined by the pronounced valley of the River Colne, marked by slopes that rise from the floodplain to an elevated plateau to the west and undulating farmland and the edge of London to the east.

Much of the elevated area to the west of the valley floor shows typical characteristics of chalk scenery with smooth rounded rolling landforms, with interlocking spurs and wooded skylines. This landscape which includes the CVWS forms transitional slopes to the west of the Colne Valley but predominately feels separate from the Valley with only limited views towards the concentrations of poplar and willow vegetation in the valley floor, with rising valley sides beyond. This landscape is valued for the backdrop it provides in elevated views from the eastern slopes of the Colne Valley. Immediately to the north of this area is the Chilterns AONB.

There is a good network of footpaths, bridleways and rural lanes which connect small towns and villages across the area; this includes important routes such as the South Bucks Way, Chiltern Way long distance routes and Old Shire Lane Circular Walk.

Whilst the M25 and pylons pass through this landscape, the M25 is in cutting for much of its length and the folds in landform help to integrate these features such that only small sections are visible at any one time, and views are often glimpsed.

Despite the varied character and quality of the landscape, the Colne Valley is not a nationally designated landscape in its own right, although it is recognised in various local policy documents as an important regional landscape. The only landscape designation which has relevance to the CVWS is the Chilterns AONB which at its closest point lies approximately 2km to the north.

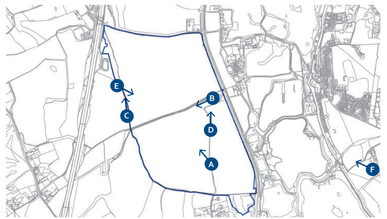

Fig.2.3_ Key plan

A Fig.2.4_ Photograph - CVWS from Tilehouse Lane, looking north west

B Fig.2.5_ Photograph - view long PRoW Rickmansworth 004, looking west

2.3

C Fig.2.6_ Photograph - view along Old Shire Lane, looking north

E Fig.2.7_ Photograph - view towards Harefield from Old Shire Lane, looking south east

D Fig.2.8_ Photograph - view along Tilehouse Lane, looking north

F Fig.2.9_ Photograph - view towards the CVWS from the Old Orchard Pub (Harefield) car park, looking west

Landscape Character

2.4.1 Landscape character

The area is covered by a number of local and regional landscape character assessments and these are important reference documents which have been used to inform the design response.

The CVWS is located wholly within overlapping character areas described within the Buckinghamshire Landscape Character Assessment (LCA) as the Chalfont St Peter Mixed Use Terrace (*Buckinghamshire Landscape Character Assessment,* Land Use Consultants for Buckinghamshire County Council and Chiltern District Council (October 2011)); and within the Hertfordshire LCA as the Maple Cross Slopes (*Hertfordshire Landscape Character Assessment,* Hertfordshire County Council (2000)). The Colne Valley Landscape Character Assessment (*Colne Valley Landscape Character Assessment,* Colne Valley Landscape Partnership (August 2017, updated April 2018)) represents a later refinement of boundaries and identifies the CVWS as part of the Rickmansworth to Uxbridge LCA with the Heronsgate/Chalfont Farmland LCA located to the immediate west (with Old Shire Lane forming the character area boundary). Reference should be made to Figure 2.12.

Within these assessments, common landscape qualities, sensitivities and pressures are identified which are of relevance to the CVWS and its immediate environs.

Fig.2.10_ Photograph - View across the Heronsgate/ Chalfont Farmland Landscape Character Area from Tilehouse Lane, looking north west

2.4.2 Key qualities and characteristics

The key qualities and characteristics of the landscape which forms the immediate context for the CVWS is summarised below:

- Presence of dry tributary valleys which cut through the valley slopes form a varied landscape of undulating, large scale open farmland interspersed with mature blocks of woodland (many of which are ancient)
- Upper Cretaceous chalk around Maple Cross reflects the rolling hills of the nearby Chilterns. Within the low-lying valley, bedrock is overlain by sands and gravels and by alluvium along the course of the River Colne which catalysed the mineral extraction industry to the area.
- Varying degrees of openness and enclosure. Within the context of the Colne Valley Regional Park this landscape provides open views to the Colne Valley and acts as a backdrop to elevated views from the east.
- There are few watercourses on the valley sides due to the well-drained calcareous soils and underlying chalk, a contrast to the watery environment of the river valley.
- The M25 marks a break between strong east-facing slopes and a broader plateau to the west. Visibility of the road varies and is often set in cutting which reduces its presence and impact; the audibility of the road is equally varied and substantially influenced by topography.
- On the steeper tributary valley slopes, winding sunken lanes are distinctive features.
- Several recreational routes cross the area, following historic field boundaries, such as Old Shire Lane.

2.4.3 Pressure and agents of change

The landscape infrastructure of the valley is becoming increasingly fragmented, reducing its resilience and benefit to nature and people. The agricultural base which sustained the valley for long periods has seen enormous change, first through the extraction of minerals to leave extensive waterbodies and latterly through urban expansion and major infrastructure development including HS2. Natural habitats such as calcareous grassland and grazing marsh have disappeared as agricultural practices and land management have adapted to changing social and economic pressures. There are equally recreational and enjoyment pressures on the landscape given the proximity of large population centres. Whilst local visitor attractions and activity centres are highly valued there remains substantial scope and opportunity to reconnect people with the Colne Valley and to create a more cohesive and coherent landscape, which will be managed.

Fig.2.11_ Photograph - View across the Colne Valley at Broadwater Lake: Rickmansworth to Uxbridge Landscape Character Area, looking north east

2.4

Key

- Proposed railway alignment
- Schedule 17 boundary

Colne Valley Character Area*	Corresponding LCAs in Local Authority Assessments
Heronsgate/ Chalfont Farmland	Herts: Maple Cross Slopes Bucks: Chalfont St Peter Mixed Use Terrace
Colne Valley: Rickmansworth to Uxbridge	Herts: Colne Valley Gravel Pits Mid Colne Floodplain - Broadwater Lake to Shire Ditch

* Referenced from the *Colne Valley Landscape Character Assessment,* Colne Valley Landscape Partnership (August 2017, updated April 2018)

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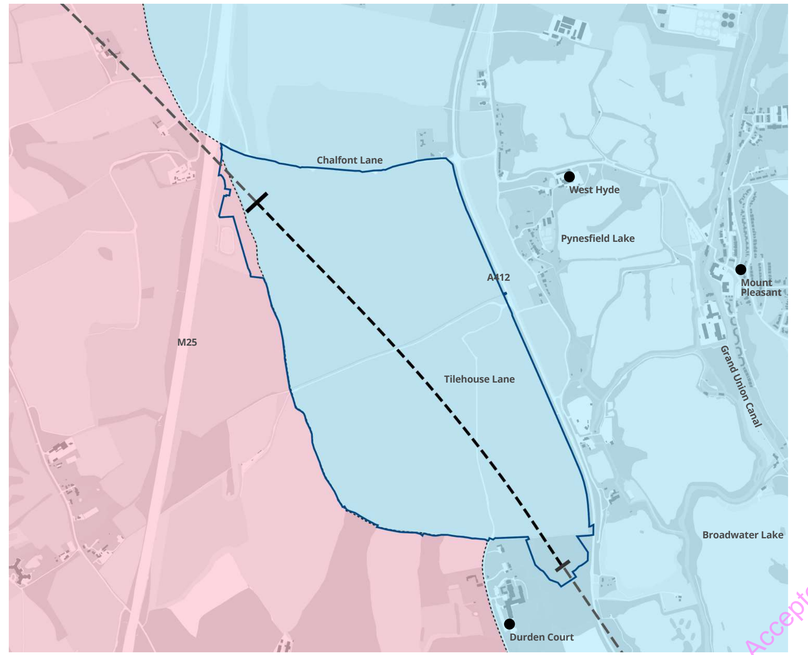

Fig.2.12_ Site plan - Landscape character areas

Ecological Context

2.5.1 Overview

The wider Colne Valley contains a diversity of habitats and species. Historic mineral extraction has created a series of large lakes, several of which are crossed by HS2. These lakes, as well as areas of wetland, wet woodland, and ancient woodland support nationally important populations of breeding birds and wintering waterfowl.

2.5.2 Ecological designations

There are a number of designated and local wildlife sites within the wider area, which include the Mid Colne Valley Site of Special Scientific Interest (SSSI) through which the Colne Valley Viaduct would be constructed. There are no designated sites within or adjacent to the CVWS or any that would be negatively affected by the proposals.

The application site is markedly different ecologically from the nearby Colne Valley floor, although there are some areas of ancient woodland immediately to the south of the site that reflect the habitat further south and east.

The habitats within the extent of the Schedule 17 request for approvals area are of limited ecological value, dominated by large arable fields with some boundary features (hedgerows and trees) that provide additional interest, including Old Shire Lane bridleway.

Although the range of species recorded during survey work is also limited, the area has previously supported breeding corn bunting (although not apparently recorded since 2013) and lapwing, good numbers of breeding skylark, barn owl (not apparently breeding) and a badger main sett.

Further detail is provided within the Indicative Mitigation Plan (1MC05-ALJ-TP-REP-CS02_CL03-000009) and Written Statement, section 3 (1MC05-ALJ-TP-REP-CS02_CL03-000007).

Fig.2.13_ Photograph - Broadwater Lake - Mid Colne SSSI

Fig.2.14_ Photograph - Battlesford Wood Ancient Woodland

Fig.2.15_ Photograph - Historic hedgerows on Old Shire Lane

Fig.2.16_ Photograph - Arable farmland on CVWS (prior to HS2 mobilisation)

2.5

Key

- Proposed railway alignment
- Schedule 17 boundary
- Building
- Agricultural
- Green space/ private gardens
- Woodland
- Ancient and semi-natural woodland (refer also to figure 2.24)
- Lake / canal / river
- Site of Special Scientific Interest

N

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Fig.2.17_ Site plan - Ecological designations and environmental context

Archaeological and Historic Context

2.6.1 Overview

The alluvial plain of the River Colne forms the central feature of the Colne Valley. The surviving landscape features of archaeological and historic interest include historic farmsteads and estates, historic field patterns and boundaries, historic lanes and routes, remnant open land, navigable waterways and watercourses, ancient woodlands, hedgerows and veteran trees.

Over the last 12,000 years this landscape has changed considerably from the Ice Age environment of hominins and humans during the Palaeolithic, to a Holocene landscape. The early Holocene (circa 9,000 -7,500 BC) landscape of the Colne Valley was characterised by an extensive sedge swamp formed along the tributaries of the Thames by melting glaciers, with areas of extensive pine, oak, elm and hazel woodland.

Following the introduction of agriculture to Britain in Neolithic period (circa 4,000 BC), a more familiar man-made, farmed landscape developed. With the clearance of forests and the enclosure of land, a pattern developed which largely continued into the medieval and post-medieval periods.

Archaeological evidence for human activity in the valley during the Middle to Upper Palaeolithic period (circa 300,000 to 10,000 BC) exists in the form of flint hand axes, cores, numerous flakes and scrapers recovered from sites like Northmoor Hill on the western edge of Broadwater Lake Nature Reserve (CVA044). Later Mesolithic activity (circa 10,000 to 8,000 BC) within the study area is recorded at Dews Farm (CVA022).

More recent prehistoric sites in the valley include cropmarks identified near to West Hyde (CVA087), which indicate the presence of prehistoric ditches and pits and the archaeological site near to Tilehouse Lane (CVA080), which appeared to show Iron Age (circa 800 BC to AD 43) and Romano-British (circa AD 43 to 410 AD) enclosures and when excavated yielded Neolithic (circa 4000 - 2,500 BC) flints in unstratified contexts.

No Anglo-Saxon (AD 410 – 1066) sites have been identified within the study area although Pynesfield was a known late Saxon/early medieval estate and manorial site which was granted to the abbey of St Albans in AD 796. During the later Medieval period (AD 1066 – 1485) , the Domesday Book (1086) records a number of medieval manorial sites at Pinesfield (Pynchfield or Pynesfield Farm) (CVA091), South Harefield (CVA042) and Le Troy (CVA079).

It was during the post-medieval period (AD 1539 - 1900) that the widespread enclosure of the landscape created the present arrangement of hedged fields and winding tracks which may have begun with the Dissolution of the monasteries in the 16th century and was accelerated with the introduction of new farming techniques during the 17th century.

During the Industrial Revolution transport links developed from 18th century, like the Grand Union Canal (CVA102), and in the early 19th century the construction of Great Western Railway (GWR) (CVA020) and Uxbridge High Street Junction Railway (CVA003) dominated the Colne Valley.

The urban expansion of London and other settlements and infrastructure during the 19th and 20th centuries encouraged the development of local extractive industries to provide bricks, mortar, road stone and ballast. This quarrying industry led to extensive gravel, chalk and sand extraction pits during the Industrial Revolution which were later flooded to form the extensive system of lakes, including Broadwater, Korda, Harefield No.2, Savay and Denham Waterski Lakes.

In the 20th century the construction of the M25, A412, Harvil Road, Moorhall Road, M40, the Chilterns Railway and Denham Aerodrome continued the development of transport links.

Fig.2.18_ Site plan - Areas of archaeological investigation within the CVWS

2.6.2 Archaeological assessment

The understanding of the archaeological baseline was informed by desk-based data collation, non-intrusive and intrusive surveys, including test pitting. A comprehensive analysis of the archaeological baseline was presented within the Environmental Statement (ES).

Following the conclusions of the ES, further archaeological fieldwork including trial trenching and test pitting was undertaken along the route, followed by archaeological mitigation works in advance of construction.

A summary of the main archaeological baseline for the CVWS area is presented below:

- The archaeological remote sensing survey identified probable post-medieval quarrying sites, medieval or post-medieval field boundaries, and a possible Bronze Age round barrow feature on the western side of Pynesfield Lake (CVA107).
- South of Tilehouse Lane (C10010, C10051, C10052), evaluations identified Late Bronze Age ((1000 – 700 BC) to Early Iron Age (800 – 400 BC) remains including a cremation burial. Mitigation works have been completed for these features.
- At the Chiltern Tunnels south portal (C10037 and C10053), the evaluations identified extensive archaeological remains including Romano-British (AD 43 – 410) enclosure ditches, post-medieval (AD 1540 – 1901) trackways and large quarry pits. An extension to the excavation area and programme was approved for C10037 and the area was subject to 'strip, map and sample' strategy as mitigation.
- At Durdent Court (C10027), adjacent to the A412, prehistoric remains were discovered and a deposit model prepared to identify areas of potential occupation for Construction Integrated Recording (CIR).
- A post-medieval (AD 1540 – 1901) kiln, found at West Hyde (C10009), was also recorded and excavated.

Fig.2.19_ Photograph - Archaeological finds - Romano-British rectangular building 2nd-3rd Century AD

Fig.2.20_ Photograph - Archaeological finds Romano-British bow brooch 2nd-3rd Century AD

Fig.2.21_ Photograph - Archaeological finds Romano-British fired clay head

2.6.3 Built heritage in the Colne Valley

Whilst the Colne Valley has experienced rapid change during the past 200 years, the area's built heritage remains largely intact and includes:

- One Grade I listed building at Savay Farm (CVA 024);
- Two Grade II* listed buildings formed by footbridges over the Colne near Denham Court (CVA009);
- 24 Grade II listed buildings;
- One conservation area at Widewater Lock (CVA037); and
- One Scheduled Monument, consisting of a mound and ditch associated with Savay Farm (CVA 024)

Fig.2.22_ Aerial photograph - A412 in 1933

Fig.2.23_ Aerial photograph - 1946 Northmoor Hill Wood

2.6.4 Built heritage in CVWS area

In the immediate context of the CVWS, there are several historic buildings which taken together reflect the agricultural past of the valley, with these buildings showing examples of both the architecture and relative importance, in class terms, of their time. However, the setting of many of these assets has been somewhat eroded by both the linear transport corridors and the changed land use of the valley:

- The Lynsters Farmhouse and Cottage (CVA096)[1] (158857) is a Grade II listed 15th century timber-framed house encased in red brick and extended in the early 18th century, with later 19th century extensions and alterations;
- The Church of St Thomas of Canterbury, West Hyde (CVA095) (158860) is a Grade II listed neo-Norman style parish church which was built in 1844. The church's special interest is architectural and historic interest as an example of a Victorian church architecture. The setting that has been truncated to the west by the North Orbital Road and to the east by excavation of the gravel pits within the floor of the Colne Valley;
- May Cottage (CVA093) (158858) is a Grade II listed early to mid-17th century timber-framed house with brick noggin;
- Pynchfield Manor (CVA091) (158859) (also called Pinesfield or Pynesfield), adjacent Pynesfield Lake, is a Grade II listed late 15th century to early 16th century timber-framed manor house. The value of this asset lies in its historical and architectural interest as a modified late medieval and early post-medieval manor house. The landscape context in which Pynchfield Manor had developed has now been almost totally removed;
- Corner Hall (CVA085) is a Grade II listed late 16th to early 17th century timber-framed house, re-fronted and extended in the early 18th century. The value of this asset lies entirely in the historical and architectural interest as an early post-medieval rural residence. Its relationship with the agricultural landscape in which it developed has essentially been lost due to construction of the North Orbital Road to the west and excavation of the gravel pits in the Colne Valley; and
- Pinesfield Farm is a planned model 19th century model farm (original buildings still stand with some 20th century additions), added to the Pynesfield estate by the Thellusson estate that owned Pynesfield farm and possibly built on the site of an earlier farmstead closer to Pynesfield Manor. Land around the farm has since been quarried and now consists of two lakes

1 Refer to HS2 ES Gazetteer of heritage assets

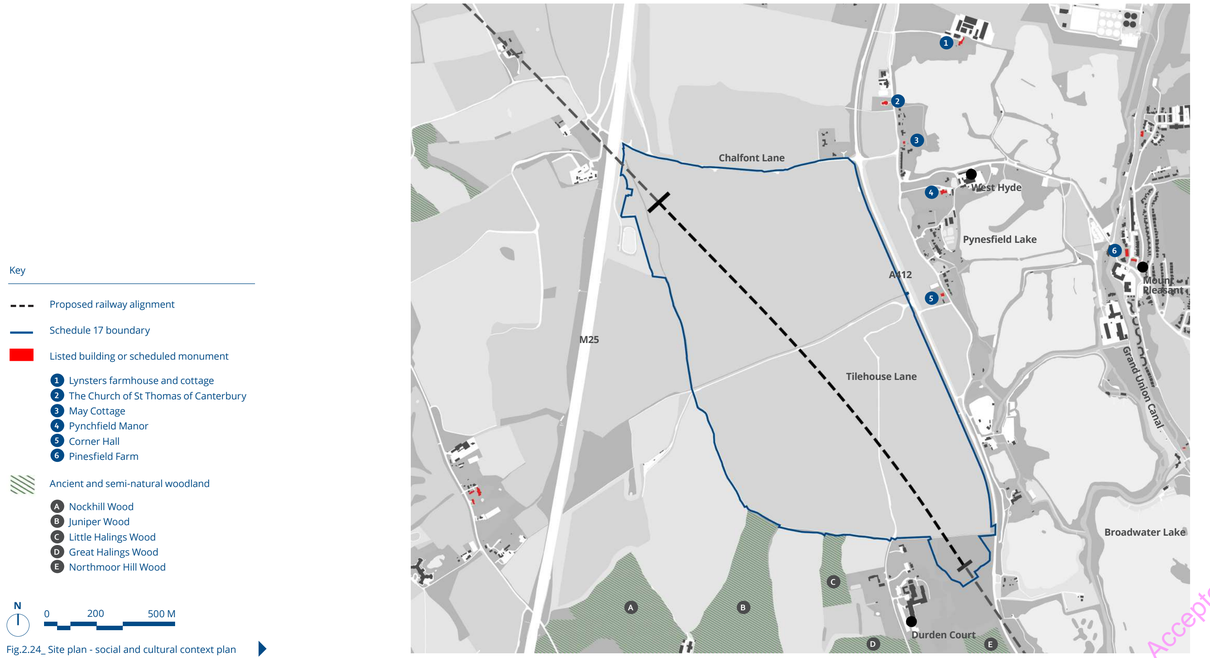
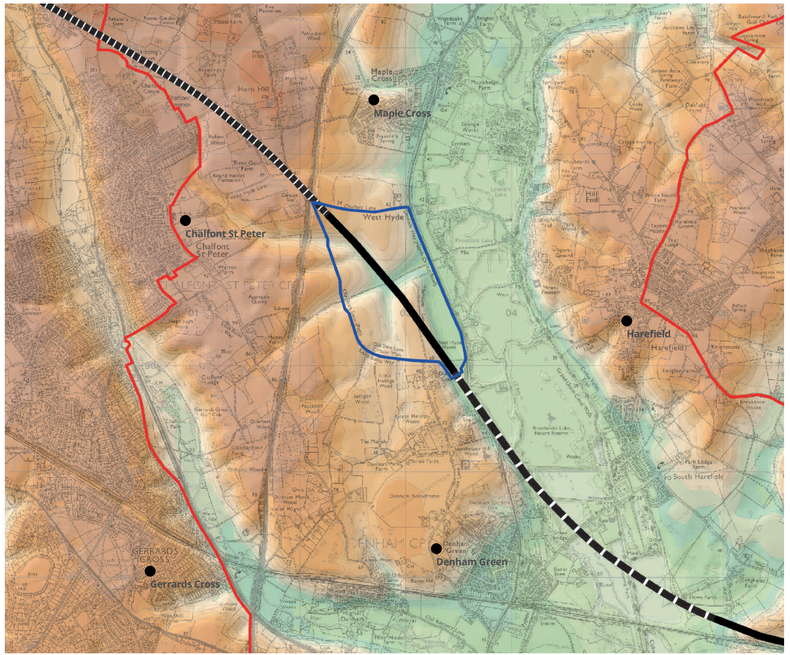


Fig.2.24_ Site plan - social and cultural context plan

2.7.1 Topography

The topography of the landscape is strongly defined by the valley and flood plain of the River Colne and several tributary valleys which connect into this. With specific reference to the northern valley extents, the land rises gently out of the valley to the east and west. The chalk geology gives rise to the highest topography (c. 115m AOD) to create a characteristic rolling landform. Within the CVWS, the presence of dendritic dry valleys are a particularly pronounced and defining topographical feature.



Key

- Proposed viaduct
- Proposed overground railway alignment
- Proposed Chilterns tunnel
- Schedule 17 boundary
- Colne Valley Regional Park boundary

Elevation (mAOD)

140 - 145	100 - 105	60 - 65
135 - 140	95 - 100	55 - 60
130 - 135	90 - 95	50 - 55
125 - 130	85 - 90	45 - 50
120 - 125	80 - 85	40 - 45
115 - 120	75 - 80	35 - 40
110 - 115	70 - 75	30 - 35
105 - 110	65 - 70	

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Fig.2.25_ Site plan - Topographical context

2.7.2 Geology

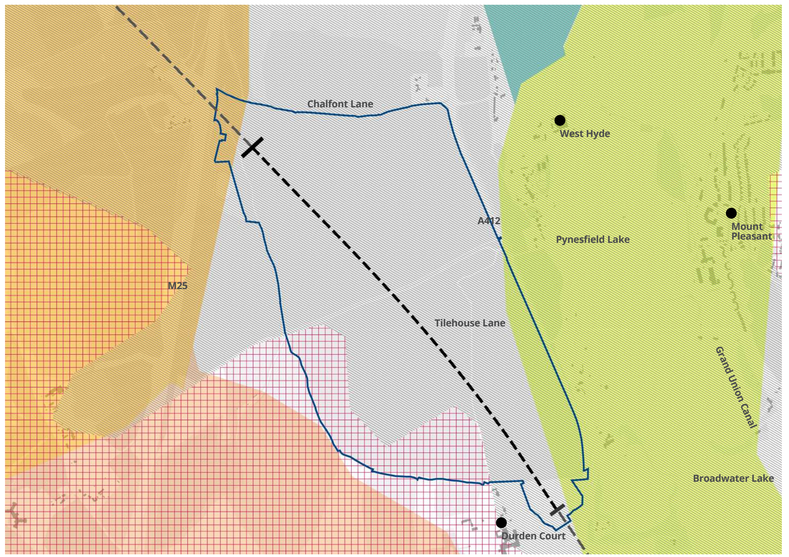
The geology of the area underlying the CVWS is relatively simple, with the majority of the area being underlain by the White Chalk to a significant depth. The underlying chalk has given rise to the landscape of dry valleys that extend westwards from the Colne Valley towards the M25. The alignment of the dry valleys appears to follow (non-active) fault lines, as a result of preferential weathering along these planar features. Erosion at the surface through hydrological action have allowed these to become more pronounced. The chalk is not naturally exposed anywhere within the area, being overlain by younger sedimentary and superficial deposits (refer to Figure 2.26).

The overlying deposits are variable, including sands, silts, gravels and clays, with the variability being exhibited both vertically and laterally across both the wider Colne Valley and the application site. In general, this layer is approximately 2m thick, but can vary in thickness from less than 1m to greater than 3m. This is typical of the chalk and superficial environment throughout the south of England and explains the reason for the sand and gravel workings in the vicinity of the site.

Due to the interface between the chalk and the overlying deposits being so uneven, a number of below-ground solution features have resulted. These are caused by long-term chemical weathering. Penetrating rain and surface water slowly dissolves the chalk with the resulting voids being infilled by silts, sands, clays and gravels from the overlying deposits. Occasional open voids can be found. These features rarely have a surface expression, and are often only found during excavation works.

2.7.3 Soils

Soil surveys have been undertaken across the CVWS, which show that the soils mainly comprise well-drained, alkaline silty clay loams. Due to historical agricultural use, the topsoils are enriched in phosphate, which tends to lead to poor floral diversity in grassland communities. Calcium carbonate was also found at lower levels in the soils than is desirable for supporting calcareous grasslands



Key

- Proposed railway alignment
- Schedule 17 boundary
- White chalk
- Clay/ silt/ sand/ gravel
- River terrace deposits
- Glacial sand and gravel
- Alluvium
- Clay with flints

N 0 200 500 M

Fig.2.26_ Site plan - Geological survey

2.8.1 Hydrogeology

As noted previously, the application area is underlain by chalk which is classified as a Principal aquifer and is extensively used for groundwater abstraction, including a significant quantity (approx. 100 Mega Litres per day in the local area) for public water supply. Superficial deposits are present in the study area, but they are not significantly exploited for water supplies.

The chalk aquifer is a dual permeability aquifer which is characterised by very low flow rates through the rock matrix and much higher rates of flow through fissures. In some areas these fissures are enlarged by solutional weathering which can result in extremely fast flow rates.

The majority of groundwater movement is likely to be in the top 50m of the saturated zone of the chalk aquifer and there are geological differences in the different chalk deposits resulting in horizontal layering in the aquifer with some horizons more permeable than others. Data collected by the British Geological Survey (BGS) indicates that transmissivity in the major valleys (Thames and the Colne) in the chalk in the Chilterns is high, typically in the range 1500 to 3000 m²/day. The BGS also cite leakage into the chalk from rivers and overlying sands and gravels as being part of the reason for the high transmissivity values, but also that in some areas the presence of putty chalk can locally reduce permeability.

Groundwater movement is generally in a north-west to south-east direction, albeit with some localised variations, and that there is flow from the south-west and north-east into the main river valleys which may be associated with water movement beneath dry valleys.

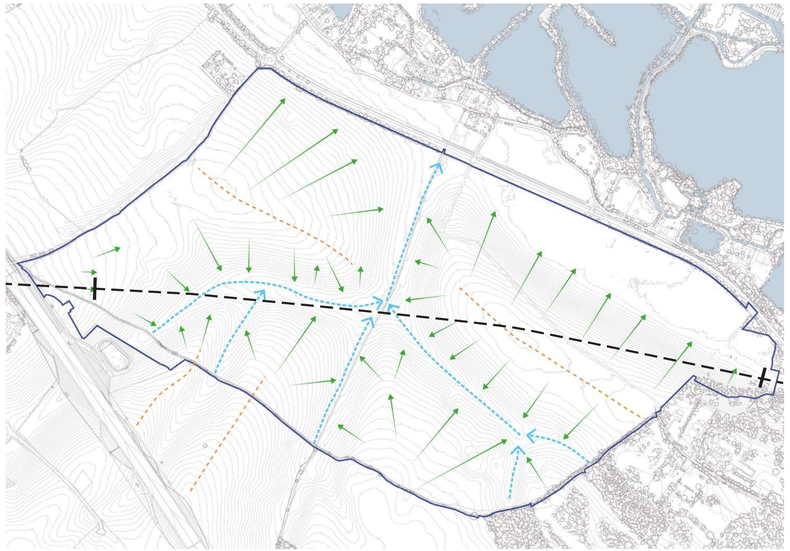


Fig.2.27_ Site plan - Water flowpath schematic

2.8.2 Flooding

Existing CVWS land drainage flows are generally from west to east towards a dry valley which conveys flows to an existing culvert under Denham Way (A412). Figure 2.27 shows the existing drainage flow paths. The majority of the run-off falls south east towards the River Colne which is considered to be the main receiving waterway of surface water runoff from the site.

The existing catchment includes land surface water runoff and highway drainage from the existing Tilehouse Lane which freely discharge into surrounding land and are conveyed to dry valley. The ultimate outfall is to a watercourse flowing around the perimeter of Pynesfield Lake at grid reference TQ 0347 9095.

The CVWS is located in an area identified as being at very low risk of flooding from rivers and reservoirs and low risk of groundwater flooding. The extent of flood zones and waterbodies is illustrated in Figure 2.28.

There is an existing Thames Water sewer crossing the site of the CVWS that will require an off-line diversion to facilitate construction. Additionally, there is an existing water main and sewer rising main adjacent to the CVWS site along the A412 corridor.

There is a low to high risk of flooding in localised areas of the site from surface water runoff. The area is currently drained through wide, shallow valleys which are usually dry but in large storm events are likely to receive runoff from the sides of the valleys. This may lead to pooling in low lying areas in the bottom of the valleys, which is indicated in the Environment Agency Risk of Flooding from Surface Water mapping.

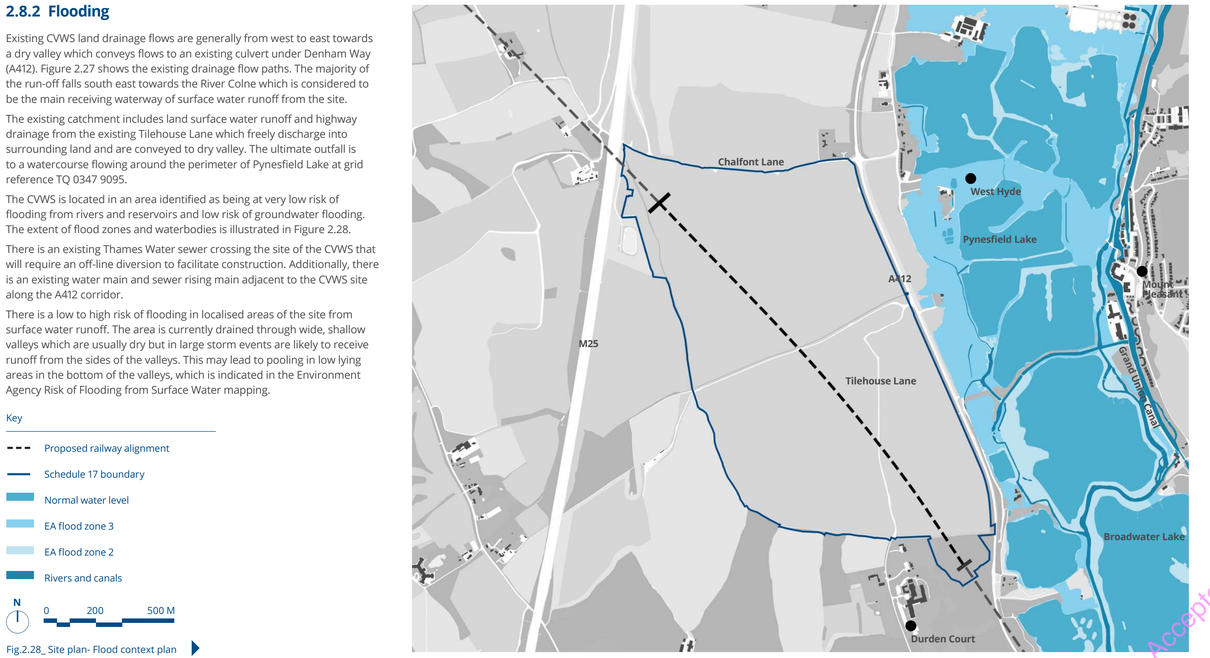


Fig.2.28_ Site plan- Flood context plan

Recreation and Access

2.9.1 Overview

The wider area supports an extensive network of road, rail and recreational routes (footpaths, bridleways and cycleways) providing local connections as well as serving strategic regional and national connectivity. These are summarised below with emphasis on those routes which are most relevant to the future of the CVWS.

2.9.2 Transport connections

Land within the vicinity of the CVWS is crossed by a number of major arterial transport routes, in particular the M25 and the A412 (Denham Way / North Orbital Road); and further afield, the M40/ A40 corridors and the Chiltern Main Line. Numerous local roads serve the area, many of which follow historic routes through the valley. Of particular relevance to the design of the CVWS is Tilehouse Lane which runs parallel with the A412, and Chalfont Lane which provides a connection from the A412 to neighbouring hamlets and to Chalfont St Peter to the west.

Tilehouse Lane will be realigned as part of the HS2 works, while Chalfont Lane is currently temporarily stopped up as a public highway while it is used as a construction access. Chalfont Lane will be reopened as a public highway with a slightly wider carriageway, once site works are complete.

2.9.3 Recreational routes

The area supports an extensive network of permissive and dedicated green routes serving walkers, cyclists and horse riders. A number of these routes have strategic importance whilst at a more local level they provide critical connectivity within the CVRP and between settlements and their broader hinterland. There are several Green Infrastructure Strategies for the area which set out future aspirations for expansion and enhancement of the Public Rights of Way (PRoW) network and these are touched upon in Chapter 5 in the context of the overall design vision for the CVWS.

The key strategic connections include:

- South Bucks Way Long Distance Path, which starts at Denham Country Park on the Grand Union Canal towpath and heads north-west, connecting the CVRP with Chalfont St Peter and areas beyond.
- Hillingdon Trail Long Distance Path, which spans the London Borough of Hillingdon from Cranford Park in the south to Springwell Lock on the Grand Union Canal in the north, passing through Bayhurst Wood.
- London Loop Long Distance Path, which provides a green ring route around London, generally towards the outer edges of the suburbs or in countryside and passes through numerous woods, commons and parks and on waterside paths alongside the Grand Union Canal and the River Colne.
- Old Shire Lane Circular Walk, which follows part of the Old Shire Lane and loops back through the villages of West Hyde and Maple Cross.
- Grand Union Canal Walk which follows the towpath and (as noted above) forms part of the London Loop long distance path

At the time of writing there are plans promoted by Buckinghamshire Council to create a new cycleway along the A412 from Denham Railway Station to the Buckinghamshire/ Hertfordshire county border.

Local recreational PRoW within and adjacent to the CVWS are also illustrated on Figure 2.29 and comprise:

- **Footpath Rickmansworth 004** – currently stopped up to allow construction of HS2.
- **Footpath CSP/44/1 and Rickmansworth 071 (Old Shire Lane)** – currently stopped up to allow construction of HS2 and diverted on to routes to the north Old Shire Lane continues to the south and south east of the site from where it meets Rickmansworth 004 as Bridleway Denham 2 and Denham 3, ultimately ending at the A412 in proximity to the Old Uxbridge Road.
- **Footpath CSP/43/2** which extends south west from Footpath Rickmansworth 004 and connects beneath the M25 towards Chalfont St Peter and Gerrards Cross

Each of these routes serve as important connections for non-motorised users between the valley landscape and settlements and the rural landscape further to the west and are an important consideration in the recreation and access proposals being brought forward for the CVWS.

2.9.4 Recreational facilities

In addition to the extensive network of recreational routes, as described above, there are other key recreational centres and activities which draw people to the area and could provide a cohort of potential visitors to the CVWS. These include but are not limited to:

- Denham Waterski Club, a private members facility located west of the River Colne.
- Broadwater Sailing Club, located at the northern end of Broadwater Lake.
- Buckinghamshire, Denham and Uxbridge golf clubs.
- Harefield Marina (with approximately 250 moorings) with additional moorings along the Grand Union Canal.
- Angling clubs, including Harrow Angling Society (Harefield No. 1 and No. 2 Lake), British Carp Study Group (Korda Lake). Savay Lake and lakes within Fray's Valley are also used for angling.
- Denham Country Park, which includes the Colne Valley Park visitor centre and its associated facilities.
- Bayhurst Wood Country Park (associated with the Ruislip Woods facilities beyond the park boundary to the east).
- Denham Quarry Park, a local nature reserve also used for rock climbing activities.
- Denham Aerodrome

2.9

Key

- Proposed railway alignment
- Schedule 17 boundary

Recreational Routes

- Public rights of way
- Long distance path
- Circular walk
- National cycle route
- Strategic highways

Environment

- Green space/ private gardens
- Woodland
- Ancient woodland
- Lake / canal / river

Recreation

- Golf Club
- Fishing
- Sailing
- Canoeing
- Wildlife
- Boat landing
- Water-skiing
- Swimming
- Sports ground
- Public park

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Fig.2.29_ Site plan - Recreation context

3.0
Brief

A summary of briefing material, from HS2 design vision and guidelines, hybrid Bill requirements, technical requirements and stakeholder aspirations.

HS2 Design Drivers

3.1.1 HS2 core design principles

The HS2 Design Vision sets out the role that design can play in making High Speed Two a catalyst for growth across Britain. HS2 is based on three core design principles of people, place and time. These have informed the design process for the CVWS at every stage and provide a basis against which design solutions have been tested.

People

Design for everyone to benefit and enjoy

1. Design for the needs of our diverse audiences
2. Engage with communities over the life of the project
3. Inspire excellence through creative talent

Place

Design for a sense of place

4. Design places and spaces that support quality of life
5. Celebrate the local within a coherent national narrative
6. Demonstrate commitment to the natural world

Time

Design to stand the test of time

7. Design to adapt for future generations
8. Place a premium on the personal time of customers
9. Make the most of the time to design

3.1.2 Other key design principles

Other key aspects of the HS2 Design Vision that have influenced the design of the CVWS are:

Identity

The HS2 Arts Strategy is an opportunity to foster HS2's vision to enhance national and civic pride through one-off expression and local design stories.

Environment

The HS2 Sustainability Strategy promotes an environmental rationale to deliver imaginative, appropriate and environmentally sensitive solutions.

Innovation

HS2 Ltd has brokered partnerships with industry bodies and centres of excellence, to create an ecosystem of resources to encourage and support innovation across the programme of work.

Fig.3.1_ HS2 core design principles - People, place and time

3.1.3 HS2 strategic goals

From an early stage of the project, core strategic goals were established as key outcomes for the new high speed line. These goals have guided the design approach to the CVWS with the following acting as key drivers for the design;

HS2 will create an environmentally sustainable solution and be a good neighbour to local communities:

- To design every part of HS2 and its service to be sympathetic to the people and places we affect and to stand the test of time.
- To actively communicate with neighbours and interest groups to minimise the impact of HS2 construction and operation on people and the environment.

3.1.4 HS2 sustainability goals

Sustainability is an important component to making HS2 an exemplar project. Therefore designing out and reducing waste, minimising our carbon footprint and protecting Britain's heritage shall be key drivers for the CVWS. The HS2 sustainability goals are set out in Fig. 3.3.

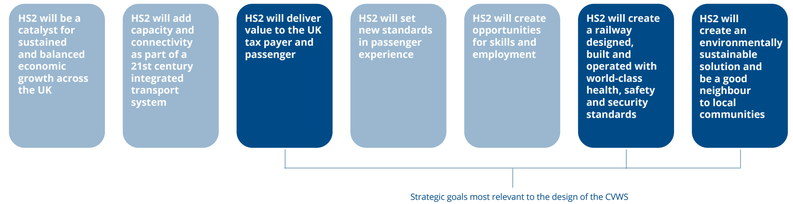

Fig.3.2_ HS2 strategic goals

Spreading the benefits

Economic growth and community regeneration

Being a catalyst for regeneration and economic growth across the UK, maximising the benefits to communities and individuals and minimising the negative impacts.

Opportunities for all

Skills, employment and education

Providing rewarding jobs and careers that are open to all in society, setting new standards for equality, diversity and inclusion and providing a legacy of skills, learning, expertise and experience.

Safe at heart

Health, safety and well-being

Creating a world-class 'safe at heart' culture where no one gets hurt, and which prioritises the health and well-being of those who build, operate, use and host HS2 services and infrastructure.

Respecting our surroundings

Environmental protection and management

Being a catalyst for breaking new ground wherever possible on environmental standards including resource use, waste, carbon minimisation, the protection of the natural and historic environment and safeguarding communities.

Standing the test of time

Design that is future-proof

Designing a network that is resilient to climate change, adaptable to future trends and demands, and built around the needs of the people who will use it.

Fig.3.3_ HS2 sustainability goals

HS2 Act

3.2

3.2.1 Location

The parliamentary plans and sections accompanying the HS2 Act show the centreline of works, the Limits of Deviation (LOD) and the Limits of Land Acquired or Used (LLAU). It is a requirement of hybrid Bills that some flexibility is provided to account for the fact that at the Parliamentary stage, the design is at an early level of maturity.

The LOD controls the horizontal and vertical extents that the Scheduled Works contained in Schedule 1 of the HS2 Act can be constructed within. The CVWS form an ancillary component, and are part of the mitigation for Scheduled Work 2/1 described in Schedule 1 to the HS2 Act. The railway trace and the Scheduled Works were approved in the summer of 2019 (TRDC ref: 19/0945/HS2 and SBDC ref: PL/19/1782/HS2).

Within the LLAU, other works incidental to the construction or operation of the railway, such as environmental mitigation, access creation, temporary construction compounds, may also take place.

Please refer to Section 6 for a more detailed description of the hybrid Bill design for the portal structures and building.

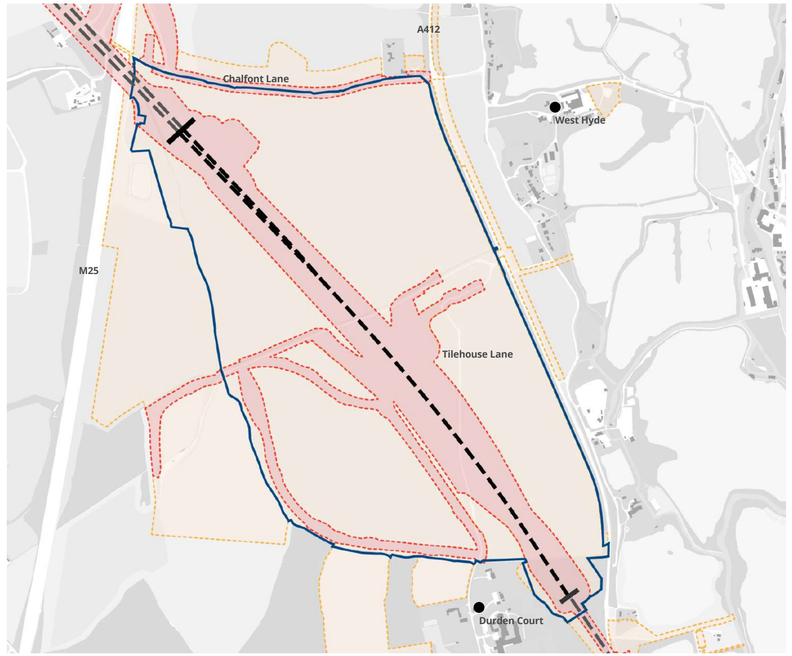

Fig.3.4_ Site plan - LOD and LLAU

Reference Documents

3.3

3.3.1 Overview

Reference documents have been provided to Align as key approaches to follow when developing the design. Some of these reference documents were developed with input from statutory bodies, either through consultation or engagement at relevant forums, such as the HS2 Phase One Planning Forum.

In some cases, such as the Colne Valley Regional Park Additional Mitigation Plan, the documentation has been developed by third parties directly as a result of assurances given by HS2 Ltd in Parliament.

There are, in addition, relevant strategies prepared by planning authorities and stakeholders which provide key references in the design for the CVWS. Those which relate to green infrastructure delivery are set out here.

3.3.2 HS2 design approach documents

These documents provide design guidance and cover all key areas of programme work. The Design Approach documents do not prescribe what is required but are intended as a resource to help the design team deliver the design of the railway to the standard that HS2 expects. The following approach documents have informed the developing design proposals for the CVWS:

- HS2-HS2-AR-GDE-000-000005: HS2 Open Route Structures Design Approach
- HS2-HS2-EV-STR-000-000010: HS2 Landscape Design Approach
- HS2-HS2-AR-GDE-000-000015: HS2 Art Approach

3.3.3 Other HS2 design documents

Other HS2 design documents that have formed part of the design brief and for the CVWS include but are not limited to:

- HS2-HS2-EV-STD-000-000017: HS2 Ecology Technical Standards
- HS2-HS2-EV-STD-000-000008: HS2 Technical Standard - Route wide soil resources plan
- HS2-HS2-EV-STD-000-000005: HS2 Technical Standard - Lineside Vegetation
- HS2-HS2-SU-STD-000-000003 HS2 Technical Standard - Climate Change Adaptation and Resilience
- HS2-HS2-EV-STD-000-000041: HS2 Landscape Design Approach – Requirements

These documents were also issued as part of the baseline technical standards.

3.3.4 HS2 technical standards

Technical standards provide the technical requirements and associated guidance for the design basis of the structural elements. Adoption of technical standards will help ensure a consistent approach to design across the whole project, minimising the assumptions that designers need to make to achieve the level of design quality demanded by a high speed railway.

3.3.5 Common Design Elements

Common Design Elements (CDEs) have been developed to address local context, deliver value for money and reinforce the identity of the HS2 along the line of the route. The only CDE within the CVWS design area is the Tilehouse Lane overbridge parapet; approval for this feature is not being sought as part of this Schedule 17 request for approvals.

3.3.6 Additional Mitigation Plan

The Colne Valley Regional Park Panel commissioned the Colne Valley Regional Park Additional Mitigation Plan (*High Speed 2: Additional Mitigation Plan for the Colne Valley*, Colne Valley Regional Park Panel (October 2017)) to identify additional landscape and ecological mitigation and enhancements within the CVRP. This plan encompasses proposals both within and outside the present HS2 Act limits. There were a number of strategic projects which have relevance to the CVWS including, but not limited to, rights of way strategies, community engagement and ecological improvements as well as a specific project area (Project 6) which set out more developed proposals relating to circular walks, biodiversity enhancement (including woodland planting and creation of calcareous grassland), visitor facilities, art opportunities and diversification of land uses.

3.3.7 Green infrastructure strategies

The CVWS has a substantial green / environmental infrastructure component to it and therefore relevant local and regional green infrastructure strategies have formed key reference documents. These include:

- Hertfordshire Strategic Green Infrastructure Plan (incorporating the GreenArc area), March 2011
- Three Rivers Green Infrastructure Plan, March 2011
- Colne and Crane Valleys Green Infrastructure Strategy, September 2019
- Buckinghamshire Green Infrastructure Strategy, April 2009
- Buckinghamshire Green Infrastructure Delivery Plan, 2013

Environmental Statement

3.4

3.4.1 Overview

The HS2 Phase One Environmental Statement (ES) was produced to accompany the High Speed Rail (London - West Midlands) Bill. The ES includes the likely significant environmental impacts along the route and measures to manage and reduce those impacts.

The effects set out in the ES are key to the design of the CVWS as the Environmental Minimum Requirements (EMR) require that the environmental effects set out in the original ES are not exceeded by the design and external appearance of the works. Particular environmental issues that the design should respond to are noise, ecology, surface water and landscape.

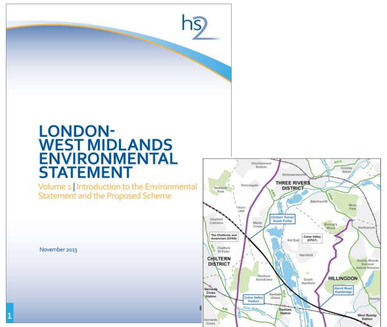

Fig.3.5_ Document - Pages extracted from the HS2 ES Volume 1

The main ES, published in November 2013, was set out in five volumes:

Volume 1: Introduction and background information

This provides an introduction to the ES and includes an overview of the impact assessment process and the consultation itself, and the main strategic, routewide and local alternatives considered.

Volume 2: Area reports and map books

Reports of the main environmental effects of HS2 in different geographical areas (known as 'community forum areas') along the HS2 Phase One route. This volume also contains books of maps relevant to each report. The relevant area for the CVWS is 'CFA07 Colne Valley'.

Volume 3: Routewide effects

This document sets out the likely routewide environmental effects of the construction and operation of HS2 Phase One.

Volume 4: Off-route effects

This document sets out the likely significant environmental effects of Phase One of HS2 expected at locations beyond the route corridor, such as rail stations, rail depots and rail lines. This volume covers areas not included in the community forum area reports in Volume 2.

Volume 5: Environmental topic reports and map books

Reports by topic for the environmental effects of the building and operation of Phase One of HS2. This volume also contains books of maps relevant to each report. The topic areas most relevant to the design of the CVWS are as follows:

- Volume 5 Cultural Heritage: CFA07 Colne Valley
- Volume 5 Landscape and Visual Assessment: CFA07 Colne Valley
- Volume 5 Sound, Noise and Vibration: CFA07 Colne Valley
- Volume 5 Traffic and Transport: CFA07 Colne Valley
- Volume 5 Water Resources: CFA07 Colne Valley

Further environmental information relevant to the Colne Valley was included in Supplementary and Additional Provisions Environmental Statements.

Fig.3.6_ Document - Pages extracted from the HS2 ES Volume 5

Undertakings and Assurances

3.5

3.5.1 Commitments relevant to the CVWS

The HS2 Act included a number of commitments made in relation to the development and delivery of the new high speed line. Recorded in a register accompanying the ES, a number of these Undertakings and Assurances (U&As) relate to the CVWS. The full register of U&As can be found online (https://www.gov.uk/government/publications/high-speed-rail-london-west-midlands-bill-register-of-undertakings-and-assurances), whilst those which are relevant to the CVWS and must be complied with are set out opposite:

- **716:** The ES reported 18 moderate impacts and 69 minor impacts at residential properties at Wyatt's Covert and Tilehouse Lane. The Secretary of State will require the nominated undertaker to implement a 4m [noise barrier] on the downside line of Work No. 2/1 from chainage 28+500 to 29+850, or implement noise mitigation measures which deliver equivalent performance in removing 16 out of 18 moderate noise effects and 53 out of 69 minor noise effects as reported in the ES.
- **2097:** The Promoter will consider an area within the Hillingdon, Denham, Ickenham, Harefield and Ruislip environs within which a no net biodiversity loss target will be applied.
- **2441:** The Secretary of State will require the Nominated Undertaker to enter into a discussion with the Petitioner (Hertfordshire County Council) regarding the design of PRoWs to be brought forward under Schedule 4 to the Bill within the area of the Council. As a part of these discussions, appropriate widths and gradients for bridleway Rickmansworth 0041 bridleway Rickmansworth 002 (also Buckinghamshire bridleways DEN/3/11 DEN/2/1 and CSP/44/11 and known as Shire Lane) to the extent they are within the administrative boundary of Hertfordshire County Council, will be considered on a case-by-case basis to take account of local constraints, existing widths, predicted usage and landscape character subject to such width being reasonably practicable under the powers to be conferred under the Act, and any existing fence, wall, hedge or individual tree, barrier or structure restricting that width.

  In the case of bridleways diverted across bridges, these will be designed at a width of 3.5m in accordance with Design Manual for Roads and Bridges standards and British Horse Society guidelines.
- **2442:** Subject to the agreement of Three Rivers District Council, the Secretary of State will require the nominated undertaker to engage with Hertfordshire County Council in any forward discussions relating to the restoration scheme to be agreed with the relevant planning authority under paragraph 12 of Schedule 17 or paragraph 5 of Schedule 16 to the Bill for the land within Bill limits occupied by, and surrounding, the Chiltern Tunnel Main Construction Compound, the Colne Valley Main Construction Compound and the Chiltern Tunnel South Portal Satellite Construction Compound.

  For the avoidance of doubt, matters to be discussed as part of the engagement referred to in paragraph 4.1 above are to include, without limitation, the provision of planting where it forms mitigation for any scheduled work.
- **2443:** In the design of road and rail embankments, the Secretary of State will require the Nominated Undertaker to comply with the 'HS2 Technical Standard - Earthworks (which incorporates the requirements of the Design Manual for Roads and Bridges (DMRB) standards for such earthworks), subject to any necessary amendments where used to support a high-speed railway rather than a road)'.
- **2450:** The Secretary of State will require that, as far as reasonably practicable, trees to be planted within Hertfordshire for the purpose of the Proposed Scheme will be species which are native to the UK grown from seed which has been collected and sourced from the UK and with a proportion of the material being of provenance from up to five degrees latitude south of the final growing site. Further, the Secretary of State will require that so far as reasonably practicable all trees planted in association with early works (ahead of main construction activity), where time does not allow for such trees to be grown from seed, will be species which are native to the UK.
- **2457:** The Secretary of State will require the nominated undertaker, at detailed design stage and prior to any works commencing on site, to prepare Ecology Site Management Plans for each area of habitat creation in Hertfordshire as set out in the Environmental Statement and to provide a copy of each Ecology-Site Management Plan to Hertfordshire County Council.

Operational Requirements

3.6

3.6.1 Key HS2 requirements

Key operational requirements for the Chiltern Tunnel south portal structure and building, the wider landscape design, and the other main infrastructure that have been considered include:

- **Performance** – Provide appropriate mitigation in terms of drainage and noise attenuation; roads to be designed to ensure safe operation to required standards.
- **Reliability** – Design buildings and structures that are able to perform a required function under stated conditions or for a stated demand.
- **Maintainability** – Provision to safely and efficiently maintain the rail infrastructure; provision of suitable access to maintain the land under HS2 ownership / handed to third party land owners/ managers.
- **Safety** – Design buildings, structures and other components of the landscape and ecological design that can perform safely, be maintained safely and not import or export any unacceptable risks under its stated function and operating conditions.
- **Monitoring** – Ability for inspections of the operational infrastructure to be undertaken safely when required; monitoring of landscape and ecological features as prescribed under the Habitat Management Plan (and associated land maintenance documents and reports).
- **Durability** – To meet the design life of the structure, i.e. the period during which the item is expected by its designers to work within its specified parameters.
- **Drainage** – Design an adequate drainage system for the railway assets and catchments impacted by the project within HS2's control.
- **Noise** – Requirement to meet commitments made through the hybrid Bill process that required noise mitigation measures to meet specific levels set out in assurances and in the ES.
- **Constructability** – Design buildings, structures and landscape components that can be efficiently and safely constructed, whilst limiting impact on the local community and environment where possible.
- **Affordability** – Design all components such that they that are affordable.

Please refer to Section 6 for a more detailed description of the functional requirements for the portal structures and building.

Fig.3.7_ Photograph - HS1 completed works (Arup)

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4.0
Design Vision

Encapsulates the overall design vision for the CVWS, setting out the narrative and key principles which have shaped the masterplan.

4.1

Design Narrative

The Colne Valley Western Slopes represent a unique opportunity to establish, at scale, a distinctive and multi-layered landscape, inspired by and grounded in context. This will be a landscape which is rich in biodiversity and where people can explore and connect with nature. It will be resilient and adaptable; be capable of mitigating impacts of the railway; be fully integrated with its surroundings including the Colne Valley Regional Park; be delivered and managed in innovative and sustainable ways to achieve multiple benefits; and will secure a lasting and fitting environmental legacy for the project.

Fig.4.1_ Photograph - Chalk grassland landscape (Matt Hobbs)

4.2

A contextual response

- Retain and enhance the most important landscape features such as chalk valleys, sunken lanes, and diversity of views.
- Recognise and respect the heritage and cultural assets of the area - protect and restore historic features within the valley including restoration of lost, rare and declining habitats and species, and preservation of the historic Old Shire Lane route.
- Promote and enhance the transitional nature of the landscape to act as the 'stitch' between the valley floor and the Chilterns.
- Ensure landscape and ecological design is suited to, and expressive of, the underlying soils and geological processes.
- Build in opportunity for creative interpretation of the landscape and natural environment; this may, by example, be expressed within land art installations.
- Use sustainable water management principles including replicating natural flow patterns and processes as far as practicable to reduce flooding.
- Consider the portal structures and compound building as a holistic set-piece nestled within the surrounding landscape.
- Screen the portal structures and building with landscape earthworks and trees to reduce their visibility from long-distance views.
- Enable snapshot views to the portal structure and building, as well as passing trains, providing a unique and interesting experience for recreational users of the CVWS.

Fig.4.2_ Visualisation (10) - View from the Old Orchard Pub looking west (Year 15)

Fig.4.3_ Visualisation (5) - View from the Tilehouse cutting viewing area looking south east (Year 15)

4.3

Connected and integrated

- Create an accessible and varied landscape which benefits the use and enjoyment of the Colne Valley Regional Park.
- Establish a network of formal and informal routes for walking, cycling and horse riding alongside open access land which is connected back into the wider strategic network.
- Provide ecological connectivity with the natural landscape to facilitate colonisation and dispersal of flora and fauna and to strengthen the resilience of the wider ecosystem.
- Offer opportunities to dwell and spend time in the landscape including opportunity to view and experience the railway in a variety of ways (both orchestrated and informal).
- Provide a canvas for future opportunities such as land art, education, community events which are not delivered as part of the main civils work.
- Use a simple palette of landscape materials which are typically expressive of the natural environment and built structures to create a cohesive design language.
- Use an integrated architectural and engineering design approach to ensure the portal structures are expressive of their function.
- Establish commonality between structures within Section C1 using similar concrete textures where structures meet the ground.
- Create a visual relationship between the portal structure and the compound building, ensuring they read as a cohesive group.

4.4

Rich in biodiversity

- Maximise biodiversity and habitat value in a contextually appropriate manner.
- Create habitats at scale that are varied in both structure and function to achieve their biodiversity potential in terms of both fauna and flora.
- Develop management approaches to secure the best ecological outcomes.
- Create multi-functional habitats which provide wider project benefits and efficiencies – including water management, soil protection, reuse of materials.

Fig.4.4_ Visualisation (4) - View from the Tilehouse cutting viewing area looking north west (Year 15)

4.5

Enduring and sustainable

- Create optimal soil conditions for securing the health and longevity of proposed plant communities and habitats.
- Adopt sustainable and flexible management approaches using extensive grazing and re-wilding principles to facilitate evolution of a dynamic and naturally regenerating landscape in perpetuity.
- Build in climate change adaptation at all stages of design and procurement to secure biodiversity and ecological resilience.
- Optimise reuse/ recycling of construction materials within the landscape and habitat design.
- Maximise carbon sequestration in soils and vegetation through habitat and planting design.
- Use low maintenance and robust materials in the landscape.
- Reduce the impact of water run-off to ensure the impacts of weathering are minimised over time.
- Specify self-finished, robust and low maintenance materials throughout to ensure the portal structure and compound building age gracefully over time.
- Reduce use of construction materials by minimising the scale of the Chiltern Tunnel south portal structure and compound buildings as far as practicable.
- Minimise the carbon footprint of the concrete Chiltern Tunnel south portal structures by specifying high proportions of Ground Granulated Blast-furnace Slag (GGBS) within the concrete mix.

Fig.4.5_ Visualisation (8) - View from Old Shire Lane bridleway looking north east (Year 15)

Colne Valley Western Slopes Masterplan

4.6

Key

Habitat types:

- Calcareous grassland
- Woodland
- Wood pasture
- Waterbodies
- Schedule 17 boundary *
- Planning authority boundary

*Areas outside of the S17 boundary are shown for context and information purposes only

1. Chiltern Tunnel south cutting
2. Chiltern Tunnel south portal and buildings
3. West Hyde embankment
4. Tilehouse Lane overbridge
5. Old Shire Lane bridleway
6. Tilehouse Lane and bridleway extension
7. Tilehouse Lane cutting
8. Colne Valley Viaduct north embankment
9. Colne Valley Viaduct
10. Shared-use permissive path
11. Diverted footpath - Rickmansworth 004
12. Cantering track
13. Land drainage basin
14. Track drainage basins
15. Quarry access road
16. Permissive walking route

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Fig.4.6_ Site plan - CVWS illustrative masterplan

Colne Valley Western Slopes Legacy

Fig 4.7 Photography - Drone photography of CVWS looking north, September 2020

Colne Valley Western Slopes 2020

Fig 4.8 Visualisation (1): Elevated view over the CVWS looking north west (Year 15)

Colne Valley Western Slopes circa 2040

4.8.1 West Hyde Hill

A landscape of contrast where footpaths and bridleways meander through colourful spring meadows and gentle tree-lined slopes conceal the railway as it pushes out across the valley. The south facing hills are a haven for wildlife and a place where people and cattle can freely roam. From the highest point a 'window' in the trees reveals the sculpted portals and the drama of trains as they emerge from the voids. A shallow valley wraps around West Hyde Hill with ephemeral ponds and woodland pasture forming a more secluded landscape where nature thrives.

Fig.4.9_ Key plan - Location and viewpoint plan

Fig.4.10_ Visualisation (14) - Elevated view over the Chiltern Tunnel south portal looking north (Year 15)

Fig.4.11_ Visualisation (6) - Ground level view from footpath Rickmansworth 004 looking south west (Year 15)

4.8.2 Pynesfield Slopes

The pronounced hillside draws views upwards towards the tree-lined ridge which cloaks the railway, forming a wooded backdrop to the grasslands below. Cattle graze freely on the hillside amongst the patchwork of scrub and meadow, while at the foot of the slope, walkers follow a well-trodden trail which connects the Western Slopes into the valley beyond. At its southern end, the trail turns sharply to the west where the railway emerges from deep cutting, sailing through the tree canopies and carried on large sculpted piers which carve through the landscape of woodland and lakes.

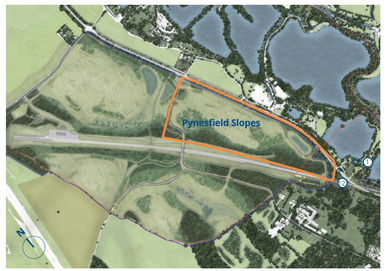

Fig.4.12_ Key plan - Location and viewpoint plan

Fig.4.13_ Visualisation (1) - Elevated view over the CVWS looking north west (Year 15)

Fig.4.14_ Visualisation (12) - Elevated view above viaduct looking north (Year 15)

4.8.3 Tilehouse Ridge

Land rises out of the enclosed valley where the Old Shire Lane bridleway follows an historic route into the Chilterns. A brief diversion takes walkers to a sculpted platform overlooking the railway where in spring and summer wild flowers sway in the wake of passing trains. Returning to the path, Old Shire Lane passes over the narrow sunken Tilehouse Lane and provides walkers with framed views of shallow valleys to the north where small ephemeral ponds are tucked in amongst chalk meadows and grazing cattle. Old Shire Lane continues north following the subtle ridges and valleys. Views of the wider valley come and go, frequently contained by the undulating land and by pockets of woodland which occupy ground where old copses once stood.

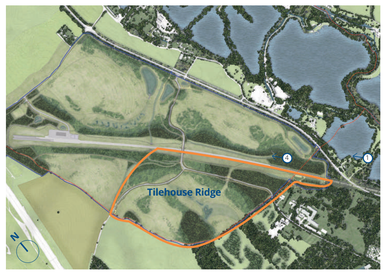

Fig.4.15_ Key plan - Location and viewpoint plan

Fig.4.16_ Visualisation (1) - Elevated view over the CVWS looking north west (Year 15)

Fig.4.17_ Visualisation (4) - Ground level view from the Tilehouse cutting viewing area looking north west (Year 15)

4.8.4 Portal View

The rolling landscape rises to the north where a distinctive beech woodland caps the deep cutting from which the tunnel portals and trains emerge. The grazing cattle have created a patch-work of scrubby pasture and belts of trees which hug and define the edge of the railway, whilst horses and their riders can often be seen galloping along the cantering track. As Old Shire Lane rises and falls it provides glimpsed views of the portals as their simple sculpted form rise above the embankment. The path eventually pushes into the woodland and leads to the 'portal view' – here the full drama of the railway and the wider landscape of the Colne Valley is revealed.

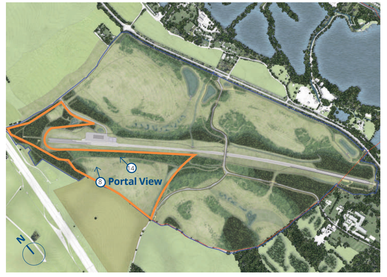

Fig.4.18_ Key plan - Location and viewpoint plan

Fig.4.19_ Visualisation (14) - Elevated view over the Chiltern Tunnel south portal looking north (Year 15)

Fig.4.20_ Visualisation (8) - Ground level view from Old Shire Lane bridleway looking north east (Year 15)

5.0 Environmental Design

This chapter sets out in detail the design of the environmental components of the masterplan with reference to the principal earthworks; landscape and ecological features; recreation and access provision; and highways and drainage elements.

Environmental Design

5.1

5.1.1 Introduction

This chapter sets out in detail the key environmental components of the masterplan and describes the evolution of the technical design in the context of the Design Vision; and in cognisance of HS2 operational requirements and standards, environmental and contextual drivers; and relevant area-wide policy and strategy.

Whilst the following section is set out under separate topic or discipline headings the design process has been collaborative to secure an integrated and optimised outcome.

Detail is provided on the following elements:

- Earthworks
- Soils and Substrates
- Landscape and Habitat Design
- Access and Recreation
- Visitor Experience
- Landscape Materials
- Art Strategy
- Site Security
- Highways Design
- Drainage Design

The design of buildings and structures is set out in Chapter 6.

Fig.5.1_ Photograph - Calcareous grassland precedent

Earthworks

5.2

5.2.1 Overview

The CVWS will require extensive ground modelling to create the trace for the railway and to restore large areas of land which have been utilised for construction purposes. This includes both structural earthworks to form the railway trace (refer to Figure 5.2) and the landscape earthworks which typically overlay or sit adjacent to the structural works. The soils and substrates which form the upper layer of the landscape earthworks are discussed in Section 5.3.

The requirement and general arrangement of the principal earthworks were established at hybrid Bill stage and included:

- A deep cutting to form the entry/ exit point into the Chiltern tunnels;
- A natural cutting alongside Tilehouse Lane to create level entry onto/ from the Colne Valley Viaduct;
- Earthworks to support the north embankment of the Colne Valley Viaduct;
- A false cutting at West Hyde to provide noise attenuation and visual mitigation; and
- A narrow cutting to provide vehicle access to the south portal from Chalfont Lane.

The final Parliamentary design also established a principle that all arisings from the Chiltern tunnels would be accommodated within the CVWS as a sustainable alternative to off-site disposal. This equates to circa 3million m^3 of chalk materials.

It should be noted that these Schedule 17 request for approvals do not request approval for earthworks within the trace or for those earthworks to create operational access from Chalfont Lane to the Chiltern Tunnel south portal access; these elements have previously been approved via separate Schedule 17 request for approvals (TRDC ref: 19/0945/HS2 and SBDC ref: PL/19/1782/HS2). These elements are however illustrated within this DAS for information and to show how they interface with the wider area landscape and structural earthworks.

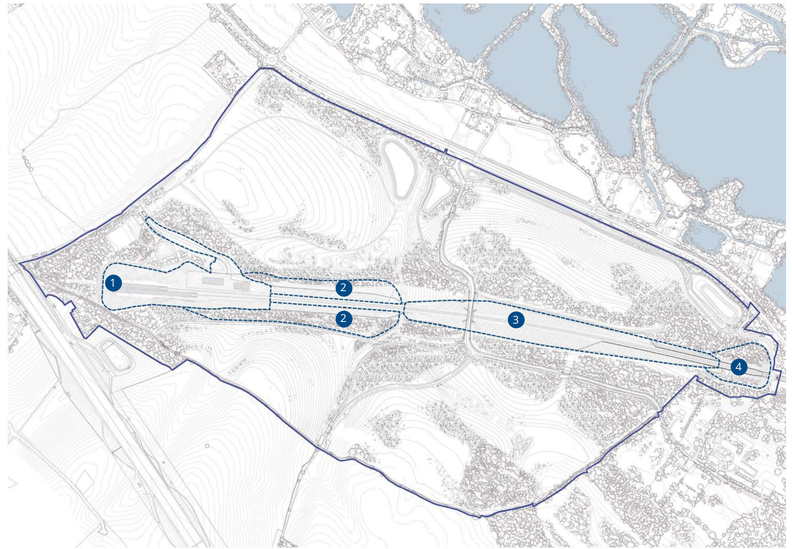

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Fig.5.2_ Site plan - Structural earthworks to create the railway trace

Key

1. Chiltern tunnel south portal cutting
2. West Hyde embankment - false cutting
3. Tilehouse Lane cutting
4. Colne Valley Viaduct north embankment

Earthworks

5.2.2 Developed design

The proposed landscape earthworks design is substantially predicated on creating a contextually appropriate landform. Key to this is to maintain and/ or replicate the existing shallow chalk valleys which are a defining characteristic of the CVWS.

The landscape and structural earthworks also have to ensure that the railway can operate safely, and that the relevant environmental obligations and requirements set out by the ES are fully met.

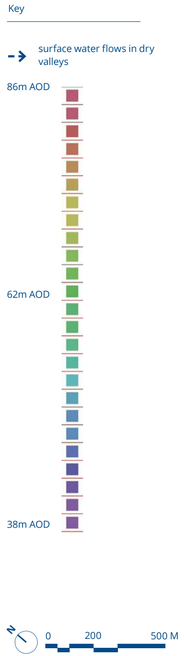
Consideration is also given to the buildability of the earthworks (with cognisance of the performance of materials used). This also includes securing efficiencies in construction sequencing and mass haul activities.

5.2.3 Contextual response

Figure 5.3 shows the profile of the land pre-mobilisation. The shallow ridges and valleys are dominant topographical features and form important flow paths for surface water. The tributary valleys coalesce into a single 'outfall' valley in the centre of the site which in turn connects to the lower and flatter land within the River Colne flood plain.

The developed earthworks design has been configured to reflect this same pattern and retains a comparable series of ridges and valleys which wrap around the new railway footprint. The surface water drainage design (which is discussed in detail in Section 5.11) also utilises the same flow paths within the valleys.

This approach is a departure from the ES design which largely looked to infill the dry valleys and did not consider in detail the drainage function of the valley. The principles of this are shown in Figure 5.4.



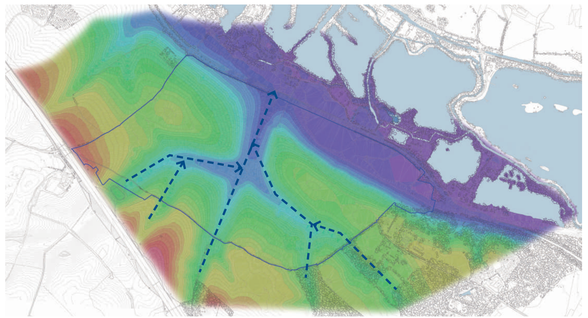


Fig.5.3_ Site plan - Pre-mobilisation site levels

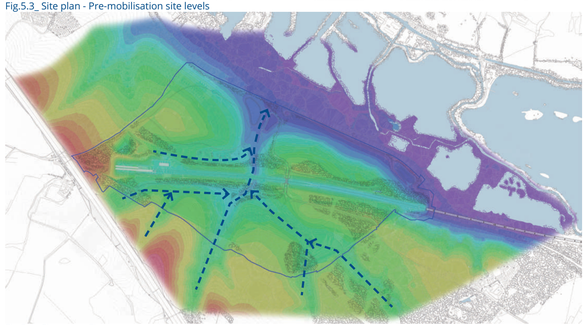


Fig.5.4_ Site plan - Final restored site levels

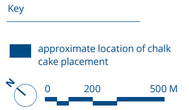
5.2

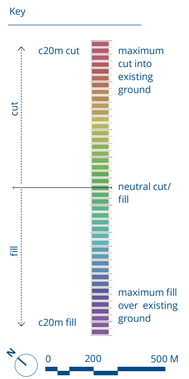
5.2.4 Material placement

In broad terms, the ground profiles are achieved by placing the majority of the material arising from the tunnel excavation on land within the south east and south west quadrants of the site, with relatively small volumes placed above the south portal areas (see Figure 5.5). This material is referred to as 'chalk cake', which comprises artificial blocks of de-structured chalk silt, created by reconstituting the chalk slurry generated as arisings by the tunnelling process. The areas where the chalk cakes are placed are substantially free from major compounds and contractor work areas throughout the construction period and can therefore accommodate the greatest quantity of treated chalk as it is excavated without the need to store and place at a later date.

The land parcels within the north east and north west quadrants are largely returned to their original profiles once the construction platforms are dismantled.

The relative changes in ground levels when compared to the pre-mobilisation site is illustrated in Figure 5.6. Reference should also be made to the section drawings and contour plans which accompany this application (Drawing refs: 1MC05-ALJ-TP-DPL-CS01_CL02-219191; 1MC05-ALJ-GT-DSE-CS01_CL02-213245 to 213247; 1MC05-ALJ-TP-DPL-CS01_CL02-219141 to 219148; and 1MC05-ALJ-TP-DSE-CS01_CL02-219201 to 219210). These show both the existing and proposed ground profiles.





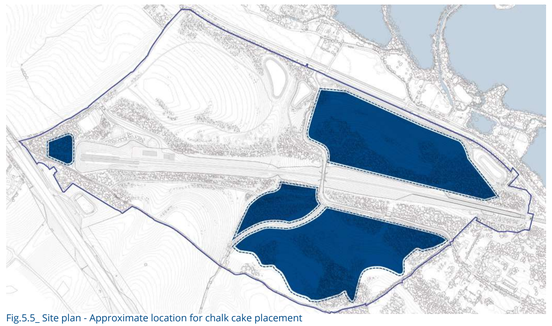


Fig.5.5_ Site plan - Approximate location for chalk cake placement

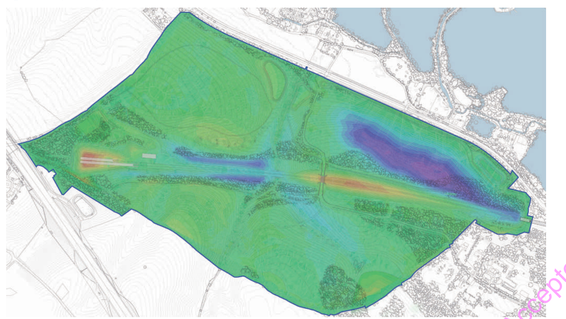


Fig.5.6_ Site plan - Cut / fill volumes compared with pre-mobilsation ground levels

Earthworks

5.2.5 Ground settlement

The technical design has undertaken an assessment of the likely level variants arising from materials settlement (after placement) and bulking factors. This is illustrated in Figure 5.7, while sample sections in Figures 5.8 and 5.9 show proposed slope profiles across the site (east to west) and how different fill materials are accommodated at key interfaces.

In summary the anticipated variance on the contours which are being submitted for approval is expected to be within +/- 500mm across all areas where fill material is placed. Settlement rates will not be uniform across the site and will lead to some variation. This is considered beneficial to creating a more natural landform in keeping with the wider landscape context.

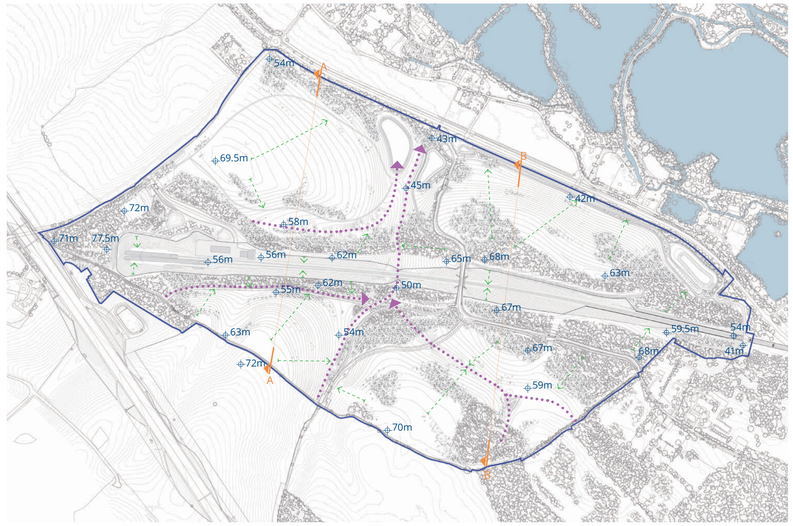


Fig.5.7_ Site plan - Site levels and slopes

Key

- Spot height
- Dry valley
- Slope fall

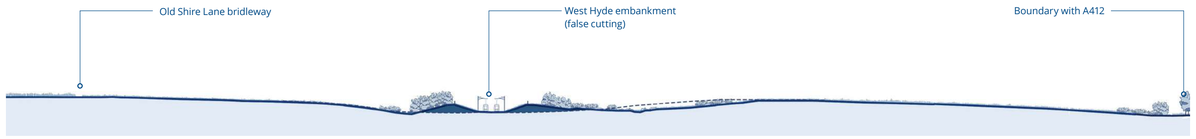


Fig.5.8_ Section - Site section A-A

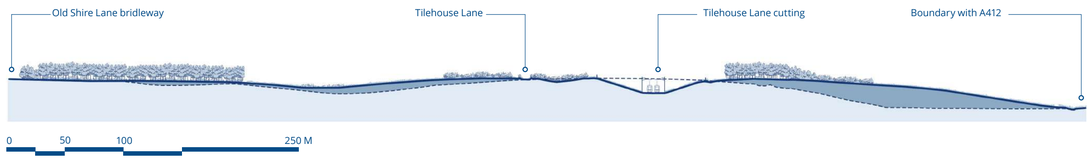


Fig.5.9_ Section - Site section B-B

Key

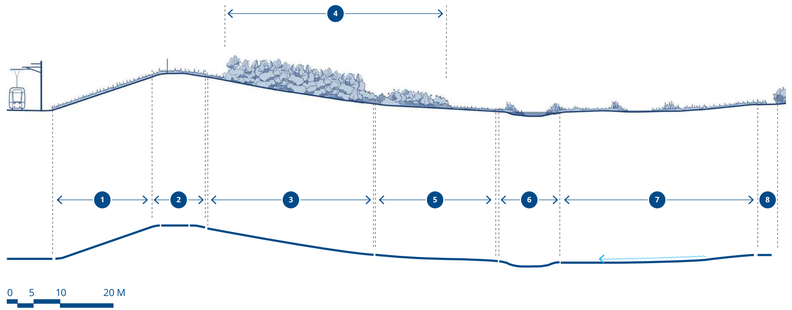
- Existing ground
- Chalk Cake fill material
- Structural fill material

5.2.6 Finessing the design

The earthwork design follows the approach set out in the Technical Standard (Technical Standard - Landscape Earthworks Design HS2-HS2-EV-STD-000-000021) to ensure integration within the landscape whilst meeting requirements associated with noise and visual mitigation. This includes adoption of the following design principles which are illustrated in a typical slope profile within the CVWS site (refer to Figure 5.10):

- Profiles incorporate smooth and gradual transitions, avoiding unnaturally steep slopes and square shoulders where possible.
- Planting on slopes (where contextually appropriate) to soften the visual appearance of earthworks.
- Landform (in combination with planting) to provide localised screening of infrastructure (including but not limited to roads, security fencing, noise barriers).
- Incorporation of local variations in landform to introduce a degree of naturalisation and variety in habitats as applicable – this will in large part be achieved through contractor supervision at the implementation stage.
- Use of earthworks within the design of wood pasture/ grassland and wetland habitat creation.
- Consideration of earthworks as an alternative to noise barriers.
- Slope gradients are designed to meet acceptable standards relating to end use of the land – this applies to the incorporation of rights of way and consideration of agricultural practices, notably the introduction and management of livestock.
- Consideration of the interfaces / interactions with structural earthworks and the soils and substrates which will sit above the landscape earthworks.

Some of these principles are explored further in the landscape and ecology section and the access strategy. Earthworks design specific to noise mitigation is discussed in Section 5.2.7.



1. Earthworks designed for noise and visual attenuation
2. Rounded shoulders at transition points (flattened top for maintenance access)
3. Concave transition slope
4. Planting incorporated to soften appearance of slope
5. Gradual change in gradient at bottom of slope to flatter profile
6. Localised variations to break up slope - optimised for habitat purposes
7. Shallow profiles to control rate of surface water flows
8. Flat areas created to provide inclusive public access

Fig.5.10_ Section - Section A-A: principles of slope design

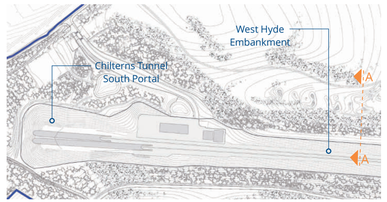


Fig.5.11_ Key plan - Section A-A

5.2.7 Noise mitigation

While the proposed earthworks design has not been undertaken solely or specifically for the purpose of mitigating adverse noise effects, it does inherently offer acoustic benefit due to the screening it provides between the proposed HS2 alignment and the surrounding sensitive receivers. The earthworks which provide noise attenuation function are illustrated in Figure 5.12 together with the location of the acoustic receptors identified in the ES; the location of noise attenuation barriers is also illustrated for context, while a description of the design of these structures is provided in Section 6.

The earthworks design and noise assessment has been a collaborative and iterative process with an aim to achieve the best combination of acoustic screening performance without detriment to other considerations including the landscape and visual context and operational demands on the land.

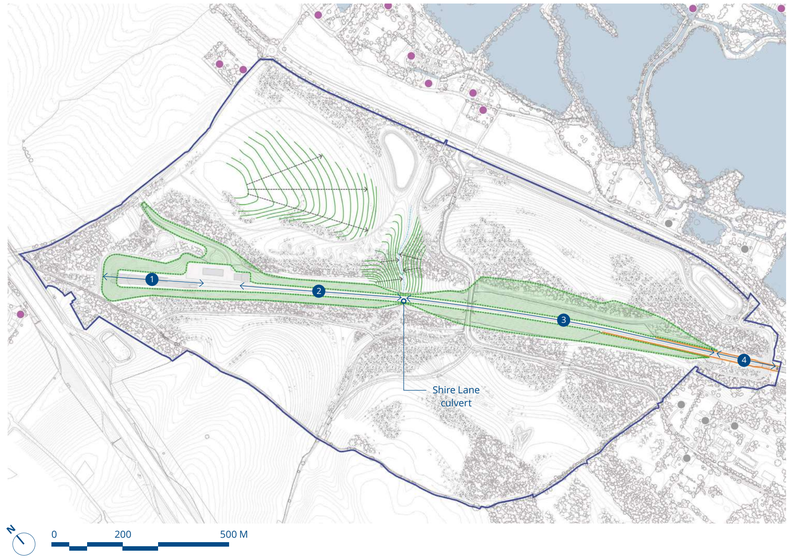
Overall, the adapted earthworks design has achieved the acoustic performance levels assessed by the ES. Potential opportunities to replace acoustic barriers with earthworks to the immediate north of the viaduct embankment have also been considered but were ultimately discounted on geotechnical and space proofing grounds.

The one area where increased noise levels have been predicted, based on modelling, is around the Shire Lane culvert, with likely effects impacting residential receptors to the immediate east on the A412. This has arisen, in part, because of the adapted culvert design and associated reconfiguration of earthworks which are constrained in this area by several factors. Further refinement of the earthworks design in this area has therefore been undertaken to maintain noise levels within allowable parameters, and without the need to revert to use of noise attenuation barriers. This approach follows the requirements of HS2 Information Paper E20 which advocates the principle of reduction in noise as far as reasonably practicable (AFARP).

Further technical detail can be found in the Operational Noise Assessment Report (ref:1MC05-ALJ-EV-REP-CS02_CL03-000088).

Key

- Receptor location
- Receptor location (Colne Valley Viaduct)
- North Embankment noise barrier
- Landscape earthworks noise mitigation
- Landscape earthworks refinement to mitigate noise impacts from Shire Lane culvert



1. Chiltern tunnel south portal cutting
2. West Hyde embankment - false cutting
3. Tilehouse Lane cutting
4. Colne Valley Viaduct north embankment

Fig.5.12_ Site plan - Noise mitigation earthworks

Soils and Substrates

5.3.1 Introduction

Soils are critical to terrestrial ecosystems, with a large proportion of their biodiversity living below the ground. The physical and chemical characteristics of the soils lead to the development of diverse communities of soil organisms interacting within complex food webs that are intimately linked to plants and above ground fauna.

The ambitious habitat creation proposals at the CVWS have been led by the soils and substrate design as these components of the living landscape dictate what it is possible to create. The proposals include careful consideration and balancing of all stages of the process: stripping of soils across the entire application area; extensive earthworks; re-profiling of most areas incorporating all tunnel arisings and temporary works materials (concrete and limestone aggregates); and finally, placement of final soil profiles corresponding to planned habitat types. Some land will also be returned to agricultural use, for which it is equally important that soils are maintained in a good condition to support productive farming.

This section provides an overview of the work undertaken to ensure that the soil profiles created will support target habitats (and species); be protected and enhanced through appropriate management; and provide the best chance of long-term success for the habitats we are aiming to create, particularly calcareous grassland.

5.3.2 Design requirements

When the soils are restored across the CVWS, they will need to function over the large volumes of chalk 'cake' placed during construction mainly in the south of the site (refer to Section 5.2.4).

Large volumes of aggregates and concrete will also be needed during construction for haul roads and compounds and this material will be retained and re-used within the calcareous grassland soil profiles (where chalk 'cake' is not available). Such sustainable re-use will achieve the twin goals of achieving suitable soil profiles for calcareous grassland across all the grassland areas as well as wider construction materials sustainability.

The different soil profiles which will be distributed across the site are illustrated in Figure 5.13.

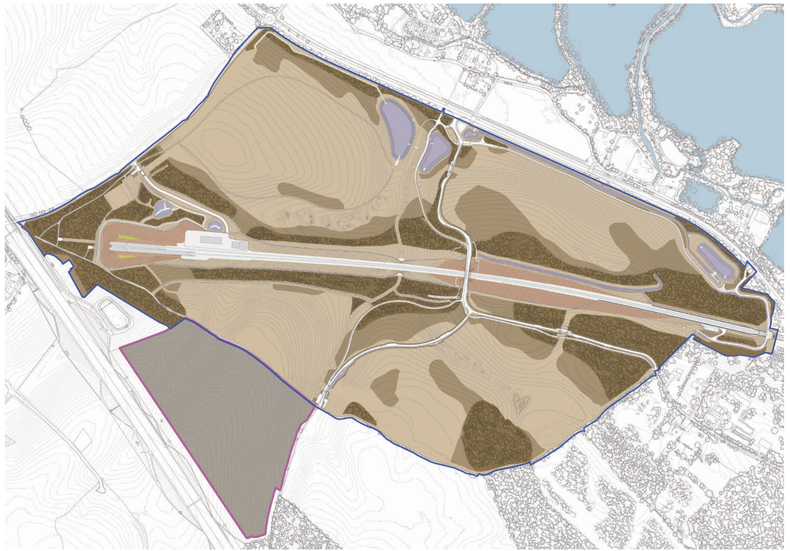


Fig.5.13_ Site plan - Soil profile plan

5.3

5.3.3 Technical solutions

To provide the right conditions for the proposed habitats to thrive, specific soil profiles have been designed for each habitat type. Figure 5.14 illustrates the components of the main soil profiles that are being proposed.

For woodland areas, fertile, nutrient-rich soils will be created with sufficient depth for rooting, over chalk 'cake' or drift deposits left in situ during construction. The calcareous grasslands will develop within a thin upper subsoil layer placed at the surface immediately above a free-draining calcareous substrate. The soil will provide a low-nutrient medium sufficiently low in phosphorus and nitrogen and high in organic matter to support herb-rich communities of plants that will not become dominated by coarse grasses. These upper subsoils will be ameliorated with crushed concrete, limestone aggregate (from use in construction) and/or chalk cake to increase calcium carbonate levels. There is confidence that there will be a sufficient supply of crushed concrete and limestone aggregate to deliver amelioration across all areas where it is needed. Any surplus aggregate materials will simply be incorporated within the soil profiles.

Free drainage is an important characteristic of calcareous grasslands. Options to achieve this are being explored, including stabilisation and de-compaction of upper chalk cake layers, calcareous aggregate drainage blankets, soil amelioration and vertical drainage trenches.

Between the woodland and calcareous grassland will be a transitional woodland edge habitat with scrub planting proposed as a third tree/shrub habitat type. Soil profiles will be slightly thinner for the latter two habitat types than the woodland. All habitat types, including grassland, scrub, woodland edge, woodland and wetland will eventually (once sufficiently established) be subject to grazing to allow a natural wood pasture and wetland mosaic to develop. Where agricultural restoration is proposed, soils will be reinstated to similar profiles to those originally present to maintain agricultural land quality.

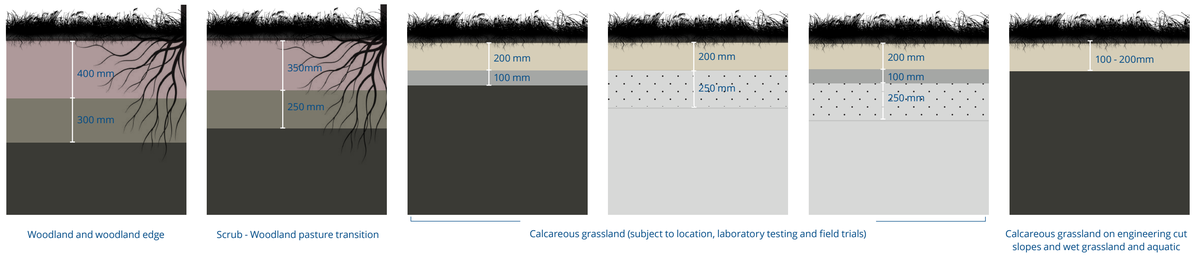
5.3.4 Challenges and opportunities

There are some challenges related to the chalk 'cake', limestone aggregate and crushed concrete in terms of how they will interact with the soils, and by extension, how the calcareous grassland in particular will develop.

Align and HS2 Ltd will undertake research in partnership with Cranfield University and Tim O'Hare Associates to limit risks for the habitat creation. A series of laboratory and field trials will test the performance of the soils (incorporating chalk/ limestone/ concrete ameliorants) with a phased approach to refine the trials as results become available. This research will be of wider applicability, both within other parts of HS2 and for other projects where species-rich grasslands are proposed on similar materials.

In addition to ongoing research to inform the final restoration, there is a need to manage the soils appropriately during construction to ensure that they are maintained in a suitable condition for the proposed landscape works. Align's construction works follow protocols set out within the Area C1 Soil Resource Plan and HS2's Technical Standards and specifications to maintain soil quality, and monitor compliance. These measures are required as part of the HS2 construction arrangements Class Approval.

Fig.5.14_ Diagram - Soil profiles



Landscape and Habitat Design

5.4.1 Overview

The landscape and ecological elements of the design are intrinsically linked and serve a common purpose which is to create a contextually rich and varied environment, balancing the needs of people and the natural environment, whilst ensuring that the railway can be safely operated and maintained and environmental impacts fully mitigated.

This section considers, in detail, the design of the planting and associated habitats. It also sets out the implementation and management approach which will secure the long-term viability of the land that the project will look to restore.

Fig.5.15_ Photograph - Calcareous grassland and woodland

5.4.2 Principles

The overall ambition is to create a chalk downland mosaic of tree-lined ridges, wood pasture, scrub grassland, and wetland habitat within two of the valley bottoms, set within extensive areas of calcareous grassland. This approach is reflective of the wider landscape character and draws inspiration from several sources including the wooded character of the valley floor and the chalk landscape of open fields with wooded enclosures which push into the fringes of the Chilterns. This juxtaposition between the valley and the Chilterns is a key driver and is reflected in the transition of planting (and habitat) types within the site as land rises northwards and westwards out of the valley.

This is intended to be a dynamic landscape with the quantum and character of vegetation changing and maturing over time, shaped by management and natural processes which are discussed in more detail later in this section.

The planting and seeding design is, in part, a means to deliver landscape and ecological led mitigation; but is also a component of the wider ambition to deliver enhancement and betterment on many levels which is rooted in good contextual design.

The two objectives are not mutually exclusive. By example:

- The planting responds to historic precedent and includes replanting of woodland and hedgerows which have been lost over time; as well as creating large areas of chalk grassland which have disappeared from much of the Colne Valley and adjacent Chiltern Hills.
- Planting character and structure is also important in creating place and identity and shaping how people use and experience the landscape including connecting with nature; the description of character areas provided in Section 4 draws heavily on the planting design as a component of place making.
- The planting design in conjunction with the reshaping of the topography is fundamental to achieving environmental requirements which include integration and visual screening (refer to Section 5.6.1), and appropriate settings for a host of engineering design and architectural elements, including the portal structures and the viaduct. The mitigation approach using planting also extends more broadly to reducing impacts from adjacent major transport corridors.
- The planting and seeding is intrinsically linked to the habitat and biodiversity objectives. Species schedules have been developed to reflect the range of native species which thrive in the area and are aligned with the design of the soils and substrates to ensure their success. The consideration of climate change and the associated resilience of the planting has been an important driver in both the choice of species and approach to management, and to the procurement processes.

The framework/ structure of planting and seeding shown on Figure 5.16 will be implemented as part of the main restoration works to be delivered by Align as the Main Works contractor. This will be managed in the long term in a manner which will encourage heterogeneity and variety in character to develop over time and in balance with soils and conditions. It is assumed that planting/seeding will provide a starting point for the habitats to develop in a dynamic way that evolves over time.

5.4.3 No Net Loss

The HS2 Environmental Minimum Requirements seeks to achieve the goal for Phase One resulting in no net loss (NNL) in biodiversity for replaceable habitats at a route-wide level, where reasonably practicable. In addition, there is an Undertaking & Assurance (no. 2097) that states:

"The Promoter will consider an area within the Hillingdon, Denham, Ickenham, Harefield and Ruislip environs within which a no net biodiversity loss target will be applied."

This area is largely contained within C1 and is taken to be the area between the Northolt tunnel western portal and the M25 adjacent to the Chilterns tunnel southern portal. It borders both Denham and parts of West Hyde as it leads into Harefield.

Habitat creation in the CVWS area has a vital role in achieving the NNL U&A for area C1 of HS2. The proposed creation of over 90 ha of calcareous grassland, plus associated wood pasture, represents the single largest area of habitat creation in area C1 and across Phase One of HS2. There is the potential to deliver approximately a 10 % gain within area C1.

5.4.4 Habitat design

The following section provides further detail on the habitat design with reference to target habitat types, planting and seeding species mixes, planting approach, and the faunal species that the habitats will be suitable to attract.

The process described earlier in Section 5.2, involves putting in place the building blocks – soils and substrates - from which biodiverse and enduring habitats can be created. The next steps involve establishing the habitats through planting and seeding, then providing a framework through which long term management can be delivered, in this case through conservation grazing.

The planting and seeding specifications are critical to the success of this project for one main reason: the establishment phase starts from a blank canvas of bare ground with very few sources of local seed to start the process, particularly in the case of the calcareous grassland. It will be necessary to give the habitats a push in the right direction by using appropriate planting and seed mixes but also allowing space for the habitats to develop over time through natural processes and careful management.

Establishment is expected to be contained in a five-year maintenance period that will be geared towards the introduction of grazing animals once the grasslands have established sufficiently to withstand them, and to flourish and diversify because of them. The tree and scrub planting areas will take longer to mature sufficiently to survive grazing pressure and will be fenced for approximately ten years after planting. Design of the infrastructure necessary to support grazing animals is a key part of designing conservation pasture habitats that will stand the test of time. Consultation with experienced land managers coupled with detailed consideration of the limitations and constraints of the site has led to a mature design that is capable of delivering a key aim of the project, natural habitats that support largely un-managed livestock comprising free-roaming animals that should not require supplementary feeding or watering year-round. This 'rewilding' approach to grazing is known to be important to help establish natural processes that lead to high soil biodiversity and increased carbon sequestration. Given the uncertainty of delivering this long term and the potential need for more intensive management at certain periods, infrastructure will be provided to ensure compliance with animal welfare regulations at all times (refer to Section 5.4.15 - 5.4.18).

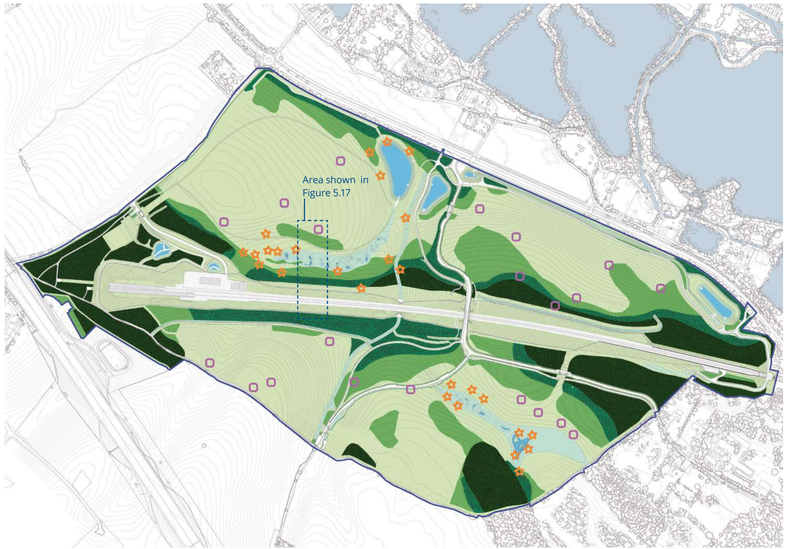
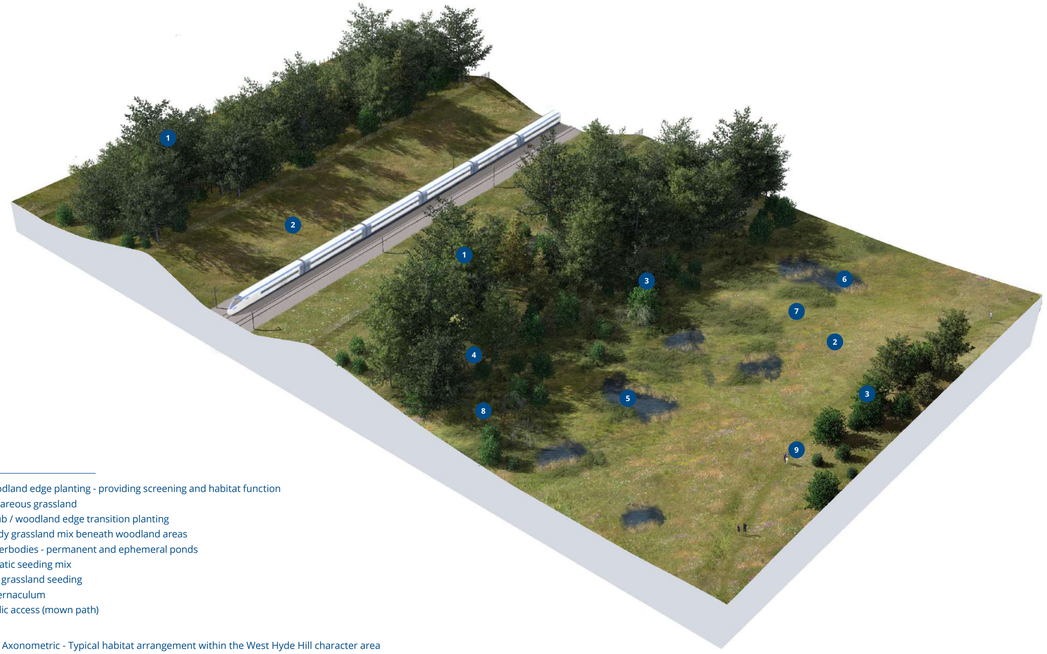


Fig.5.16_ Site plan - Planting and habitat types



Key

1. Woodland edge planting - providing screening and habitat function
2. Calcareous grassland
3. Scrub / woodland edge transition planting
4. Shady grassland mix beneath woodland areas
5. Waterbodies - permanent and ephemeral ponds
6. Aquatic seeding mix
7. Wet grassland seeding
8. Hibernaculum
9. Public access (mown path)

Fig.5.17_ Axonometric - Typical habitat arrangement within the West Hyde Hill character area

5.4.5 Target habitats and species

Although target habitats and species are referred to in this section, they are not targets in the sense of being a binding measure of success. They more broadly refer to what is expected to happen given the conditions that will be created. Inevitably some plant species introduced through planting or seeding will not thrive and some faunal species that we hope to colonise will not, either because the conditions are not right for them or because these are not found in the surrounding area and do not arrive at the site.

The draft Habitat Management Plan prepared for the CVWS provides details on all target habitat types as well as planting and seeding species, and a rationale for selecting those habitats as appropriate targets to aspire to. Although this document is not provided as part of this application, its content is summarised here and in the Mitigation Strategy. In most cases, habitat types can usefully be defined according to National Vegetation Classification (NVC) communities.

Fig.5.18_ Photograph - Precedent habitats

5.4.6 Woodland

It is difficult to accurately predict how woodland planting areas will develop and look over time as it takes decades or even centuries for woodland to develop properly into a mature habitat. However, the areas initially planted as woodland will equate to approximately 26ha. For this reason, specific faunal species have not been targeted for woodland. For woodland, the planting specifications have been based on delivering an approximation of the following NVC communities:

- W7 Alder-ash woodland with yellow pimpernel
- W8 Lowland mixed broadleaved woodland with dog's mercury
- W10 Lowland mixed broadleaved woodland with bluebell
- W12 Beech-ash woodland with dog's mercury

An NVC W8 woodland community will be targeted overall as it is predicted to be the most appropriate woodland type on this substrate, but W10 and W12 preferential species will be included in places depending on soil and aspect and will tend to grade into one another. Wet woodland (especially NVC woodland type W7) will be targeted on lower-lying damper soils and close to wetland areas.

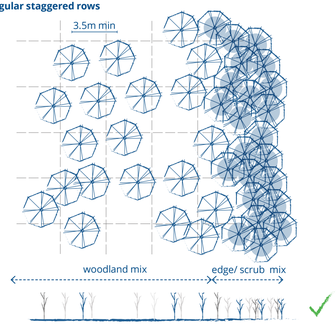
Overall the species mixes have been carefully selected to reflect the context as well as the substrate/soil types to reflect what is found in the wider Chilterns on predominantly chalk substrates, for example the inclusion of species like box *Buxus sempervirens*, hornbeam *Carpinus betulus*, common whitebeam *Sorbus aria*, yew *Taxus baccata*, and beech *Fagus sylvatica*. Variations in the frequency and density of planting species have been incorporated between distinct planting areas to avoid uniformity and to try to replicate a natural woodland landscape. In addition, the layout of planting will use wide planting centres and avoid geometric grids and other uniform spacings to simulate natural woodland succession. Proportions/ numbers and planting locations are set out in the landscape planting drawings (Drawings 1MC05-ALJ-EV-DPL-CS01_CL02-214111-18) and the principles of this illustrated in Figure 5.19.

An additional woodland type is included on planting drawings, which is referred to as 'Beech woodland'. This woodland type includes a higher proportion of beech to reflect the composition of an established Chilterns beech woodland, and some of the ancient woodland found in the adjacent Colne Valley. This woodland type will be planted extensively on the elevated land around the South Portal.

Woodland planting principles:

- Trees species to be randomly distributed within planting areas in same species groups of between 9 and 35
- Distance between trees in rows: minimum 3.5m random centres.
- Distance between rows: various from 1.0m -3.0m apart.
- Plant in irregular staggered rows.
- For understorey tree and shrub mix: species to be interspersed and randomly mixed in groups of 9 min and 35 max.

Irregular staggered rows



Regular staggered rows

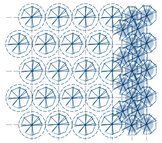


Fig.5.19_ Diagram - Woodland/ woodland edge planting principles

5.4.7 Woodland edge and scrub

Woodland edge habitat has been included as a separate planting type and specification to woodland and scrub to encourage development of a transitional habitat that will soften the edges between areas of woodland where a closed canopy type habitat is expected to develop and scrub, where scattered patchy shrubby vegetation will establish. As such, woodland edge planting does not conform to standard target habitat types, for example in relation to NVC communities. In terms of quantifying the areas, the initial planting of woodland edge species will equate to approximately 10.6 ha, with approximately 19.4ha planted as scrub. Proportions/ numbers and planting locations are set out in the landscape planting drawings (Drawings 1MC05-ALJ-EV-DPL-CS01_CL02-214111-18).

For scrub habitat, vegetation communities are not specifically targeted, with a varied mix of species included that are typical of the area on both deeper, more fertile soils, e.g. hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, and bramble *Rubus fruticosus*, as well as on shallow, calcareous soils including: box *Buxus sempervirens*, common dogwood *Cornus sanguinea*, juniper *Juniperus communis*, common privet *Ligustrum vulgare*, purging buckthorn *Rhamnus cathartica,* sweet briar *Rosa rubiginosa,* wayfaring tree *Viburnum lantana* and guelder rose *Viburnum opulus*. Two of the species, box and juniper, are declining and scarce with the latter providing the key characteristic species within the Annex 1 habitat - 5130 *Juniperus communis* formations on heaths or calcareous grasslands, which does occur naturally on the Chilterns (for example at Aston Rowant National Nature Reserve).

It is expected that scrub species will thrive in soil profiles with topsoil and subsoil where they will be planted but that, to some extent, they will also colonise areas of grassland over time but that this will be limited by the poor soils, establishment of the grassland sward and by grazing pressure.

As for woodland, variations in the frequency and density of planting species have been incorporated to try to replicate a natural scattered scrub habitat with areas of denser and less dense planting. Proportions/ numbers and planting locations are set out in the landscape planting drawings (Drawings 1MC05-ALJ-EV-DPL-CS01_CL02-214111-18).

Scrub habitat is of great importance to a wide range of species, especially when part of a diverse habitat mosaic. Key target species include species of declining 'farmland' birds which are naturally found in highest densities in invertebrate and seed-rich grassland and scrub mosaics, for example corn bunting *Emberiza calandra*, turtle dove *Streptopelia turtur*, linnet *Linaria cannabina*, and yellow hammer *Emberiza citrinella*. In addition, scrub supports many species of invertebrates, common reptiles and small mammals.

Fig.5.20_ Photograph - Woodland edge and scrub planting precedent

5.4.8 Hedgerows

Hedgerow planting will be limited to retaining and enhancing all existing species-rich native hedgerows on site and creating approximately 3.4 linear km of additional sections of hedgerow within the area, typically forming field boundaries and edges to roads and footpaths. The mix is diverse and draws suitable species from the woodland and scrub mixes to establish some commonality. The principles of hedgerow planting are set out below and illustrated in Figure 5.21.

Hedgerow planting principles:

- New hedgerows will typically be planted using double staggered rows at 45 cm centres. Subject to location this may increase to three staggered rows
- Hedge plants will be transplants (approximately two years growth), these will also be supplemented with 1.5-3m high feathered trees at no closer than 8m centres
- Composed of native hedgerow woody species from Schedule 3 of the Hedgerow Regulations 1997 and contain, on average, five or more native woody species within a 30-metre length
- Shrub/ tree guards installed to provide protection from predation by rabbits

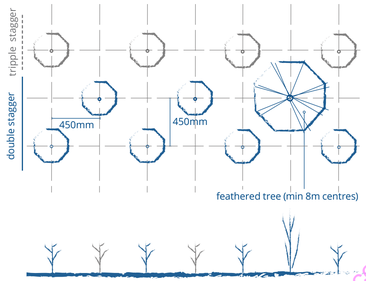


Fig.5.21_ Diagram - Hedgerow planting principles

5.4.9 Calcareous grassland

Calcareous grassland will occupy the largest proportion of the site of any habitat type, equating to approximately 87.5ha. This habitat will be delivered through careful engineering of soil profiles to create suitable conditions for development of the habitat. A single seed mix will be used across the habitat area that contains a relatively generic commercially-available seed mixture. This will form a basis for the natural development of the grassland which will tend towards one or other of the NVC vegetation types listed below depending on influencing physical and chemical parameters that will vary across the site, as well as management. This can subsequently be augmented by further seeding, addition of green hay or plug planting involving introducing key emblematic species appropriate to the Chilterns dependent on the availability of suitable locally-sourced material.

The target NVC plant communities for open dry grassland are as follows:

- CG2 *Festuca ovina-Avenula pratensis* grassland
- MG5 *Cynosurus cristatus-Centaurea nigra* grassland
- MG1 *Arrhenatherum elatius* grassland

Although MG5 and CG2 are rare and not thought to be realistic targets for habitat creation, these community types are proposed as target vegetation for open areas at the CVWS, as they are the natural vegetation types on these soils and in this geographical region that should be an aspiration. It is possible that after 5 to 10 years of appropriate management, a facsimile of these habitat types can be established supporting many of the key plant species.

There are many key faunal species associated with calcareous grassland. The high diversity of plants that this habitat supports in turn supports a high diversity of other trophic levels particularly invertebrates, reptiles, amphibians, mammals and birds. A number of emblematic invertebrate species are found in calcareous grasslands and these include butterflies such as Adonis blue *Polyommatus bellargus*, chalkhill blue *Polyommatus coridon*, marbled white *Melanargia galathea* and small heath *Coenonympha pamphilus*, chalk carpet moth *Scotopteryx bipunctaria* , as well as bee species important in the Chilterns such as small scissor bee *Chelostoma campanularum*, red bartsia bee *Melitta tricincta* and large meadow mining bee *Andrena labialis*.

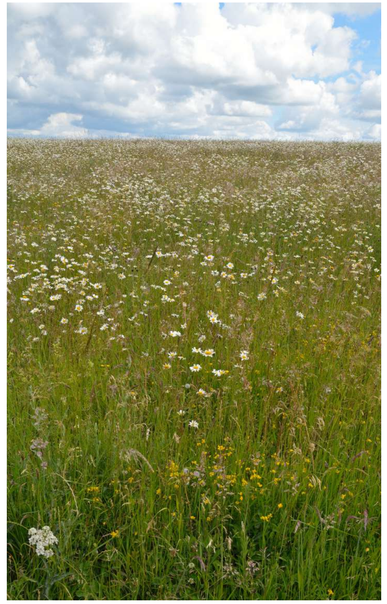


Fig.5.22_ Photograph - Calcareous grassland

5.4.10 Shady grassland

A seed mixture which is more shade-tolerant for sowing the ground layer in edge habitats in and around the tree and shrub planting areas has been selected.

This vegetation is likely to be ill-defined within this area as it will occur in transitional zones between open and shaded habitats so cannot be easily correlated with a clear NVC community type but will most likely resemble MG1 *Arrhenatherum elatius* grassland.

Fig.5.23_ Photograph - Chalkhill blue butterfly *Polyommatus coridon*

Fig.5.24_ Photograph - Cistus forester moth *Adscita geryon*

5.4.11 Wetland including wet grassland

A diverse seed mixture of wildflowers and grasses which includes moisture-loving species for sowing in wet grassland areas with another mixture for aquatic seeding (a 5m sown strip centred on predicted average water levels of waterbodies) has been selected.

Both the wetland grassland and aquatic seed mixtures are intended to develop into a sward most closely resembling MG8 *Cynosurus cristatus-Caltha palustris* grassland, grading from luxuriant pond-edge vegetation immediately around waterbodies into damp grassland surrounding this.

A series of ponds, scrapes and small channels will form wetland mosaic habitats in two valley areas of the site. In these areas chalk cake material from tunnel arisings will be placed as the substrate before being 'puddled' into an impermeable layer that will collect water and form permanent and ephemeral waterbodies and seasonally inundated grassland areas around the margins of the waterbodies. The larger balancing ponds providing land drainage are also designed to function as habitat features. The principles of the wetland habitat design are illustrated in Figures 5.25 and 5.26.

Creation of these wetlands will provide high quality habitat for a wide range of aquatic invertebrates and herpetofauna and provide feeding and nesting areas for birds such as lapwing *Vanellus vanellus* and reed bunting *Emberiza schoeniclus*, bats and other mammals.

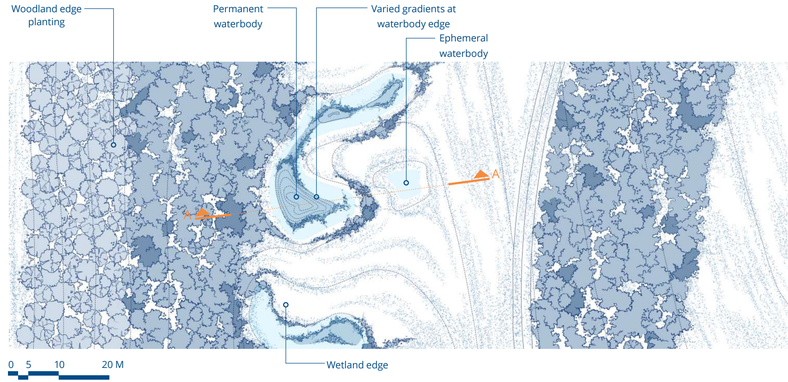


Fig.5.25_ Site plan - Ecological water bodies

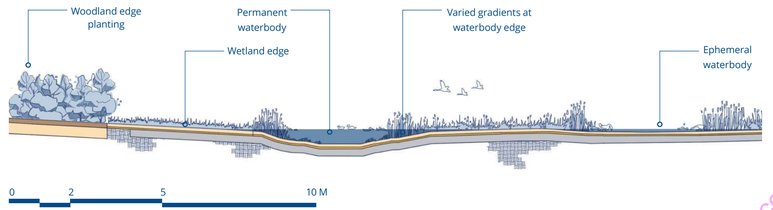


Fig.5.26_ Section - Section A-A through ecological water bodies

5.4.12 Habitat Features

Micro-scale habitat features will also be included as part of the habitat design (the illustrative locations for these are shown in Figure 5.16).

Two distinct feature types have been designed: reptile and invertebrate banks and hibernacula. In addition, there is a general aspiration to avoid even and smooth finished profiles through creating localised bumps, lumps and dips across the site to encourage diversity in habitat profiles and variation in soil depths, slope, aspect etc.

Localised variations in the slope profile will be achieved through site supervision and instruction to the contractor, rather than through detailed prescriptive specifications.

These features will not be seeded but left to colonise naturally.

5.4.13 Reptile and invertebrate banks

These features will be located frequently in various locations across the site and will be incorporated into the earthworks design. The exact locations will be determined by an ecologist prior to construction. The banks will be designed to create a small-scale mosaic of bare ground and poorly vegetated habitat that will create a warm micro-climate suitable for supporting a variety of species, e.g. reptiles, bees, solitary wasps, spiders, beetles and butterflies, as well as a distinct grassland/bare ground mosaic habitat. Illustrations of these features are shown in Figures 5.27 and 5.28 and on drawing 1MC05-ALJ-TP-DDE-CS01_CL02-219441.

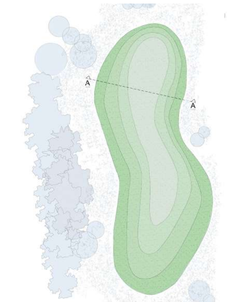


Fig.5.27_ Diagram - Typical basking bank

Fig.5.28_ Section - Typical basking bank

Key

1. 100-200mm depth of capping medium. Material expected to be 40-70% upper subsoil with 30-60% limestone (or similar calcareous) aggregate, with some larger 100mm to 300mm stone or crushed concrete incorporated.
2. 900-1800mm clean site materials such as stone (hardcore, rubble, aggregate) timber, and/or tree stumps/roots
3. Entrance to basking bank/ hibernacula

5.4.14 Hibernacula

Hibernacula will be included in various locations across the site. The exact locations will be determined by an ecologist prior to construction but will be concentrated between the valley wetlands and surrounding grasslands. This will provide habitat for species of reptile and amphibian to hibernate although hibernacula may also be used during the active period. Illustrations of these features are shown in Figures 5.29 and 5.30 and on drawing 1MC05-ALJ-TP-DDE-CS01_CL02-219441.

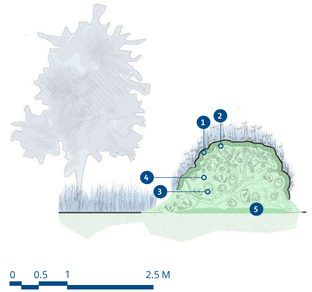


Fig.5.29_ Section - Typical hibernaculum (above ground section)

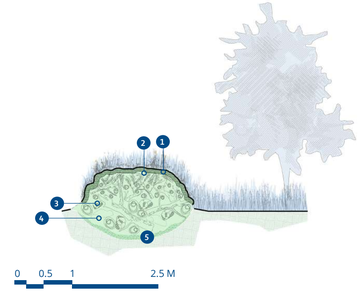


Fig.5.30_ Section - Typical hibernaculum (below ground section)

Key

1. 50- 100mm upper subsoil
2. 100-200mm depth of capping medium. Material expected to be 40-70% upper subsoil with 30-60% limestone (or similar calcareous) aggregate, with some larger 100mm to 300mm stone or crushed concrete incorporated.
3. 200-400mm of clean sized site materials such as logs and/or branches
4. 500-700mm of clean site materials such as hardcore, brick rubble, logs, and/or tree roots
5. Entrance points (free of subsoil)
6. 100mm free draining sand or gravel

5.4.15 Management approach overview

While much of the CVWS site will remain, after restoration, in the ownership of HS2 Ltd, certain areas will have to be offered back to their previous agricultural landowners. This section describes the general approach to land management which is being proposed for the land which remains under HS2 Ltd's control.

The management phase will be split into two periods, the initial establishment and maintenance period and the subsequent long-term management of the site.

The initial maintenance stage refers to the establishment of the newly created habitats and corresponds to the defects period for the contractor creating the new habitats on site, which is likely to be five years from the earthworks re-instatement. The second management period will begin once that five year initial period has been completed and the intention is that this would be delivered by a conservation land management organisation, under agreement with HS2. The process for appointing a future land manager is ongoing and will be discussed further with relevant parties, including the local planning authorities, through the pre-application meetings for Site Restoration.

The following sections provide an overview of the key management measures associated with each stage.

5.4.16 Initial landscape maintenance

The key tasks to be delivered during this stage of the project for a five year period after planting and seeding establishment include:

- Establishment of seeded areas and re-seeding of failed areas, if necessary.
- Cutting of grasslands prior to grazing, with arisings collected and removed. Cutting will be wildlife friendly by leaving small-scale mosaics of cut and uncut patches.
- Establishment of planted trees and shrubs with replanting of failed plants where necessary.
- Annual maintenance checks of hibernacula and reptile and invertebrate banks.
- Monitoring and management of vegetation growth and sedimentation in wetland areas.
- Control of invasive plants.
- Maintenance of temporary and permanent fencing.

5.4.17 Maintenance of livestock infrastructure.

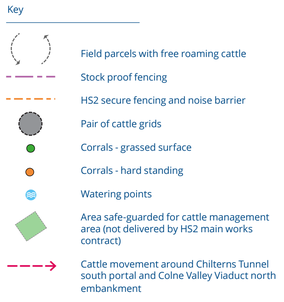
The Indicative Mitigation Plan (provided for information as part of this Schedule 17 request for approvals) summarises the habitat creation and maintenance requirements and draws from the detailed specifications and Habitat Management Plans which are being prepared for the construction phase of the project.

The period for initial maintenance of the land that remains under HS2 control will be for around five years after completion of the establishment stage.

5.4.18 Long term management – habitats

A central aim of the management plan for this area is to intervene as little as possible and only undertake selective management actions. These will be decided by monitoring the conditions of different habitats by the land managers. There are a range of management measures and indicators likely to be required, which are summarised below:

- Monitor invasive plant development across the site and take remedial action where necessary to treat/ remove colonising invasive plant material.
- It is intended that woodland habitat forms a balance with other site features such as scrub and grassland habitats with up to 40% cover of wooded habitats overall across the site as a whole – i.e. 10-30 % cover of woodland and 10-30 % cover of scrub habitat. This will involve regular hedge cutting/laying and woodland management, including scrub cutting and possibly coppicing.
- There should be a high proportion of cover provided by wildflowers and sedges (more than 30 %) in grassland areas, excluding undesirable/ invasive plant species.
- Develop and maintain structural diversity in grassland areas by encouraging a range of vegetation types and heights including very early successional stages, bare ground, short turf and taller vegetation.
- Maintain diverse wetland features including permanent waterbodies, damp hollows, temporary pools and vegetated banks of high value for wildlife.
- Implement rotational management, where necessary to create a varied age-structure across the wetland habitat, giving different levels of vegetation cover.
- Monitor disturbance to ponds and wetland areas by cattle, dogs etc. to ensure that excessive impacts are avoided in waterbodies where access is permitted – fencing off certain ponds, or sections of pond margin should be considered where needed to mitigate this effect.
- Carefully consider timing and extent of maintenance operations to avoid any potential conflicts between maintaining the effective functioning of the drainage systems with that of nature conservation and visual amenity where feasible or appropriate.



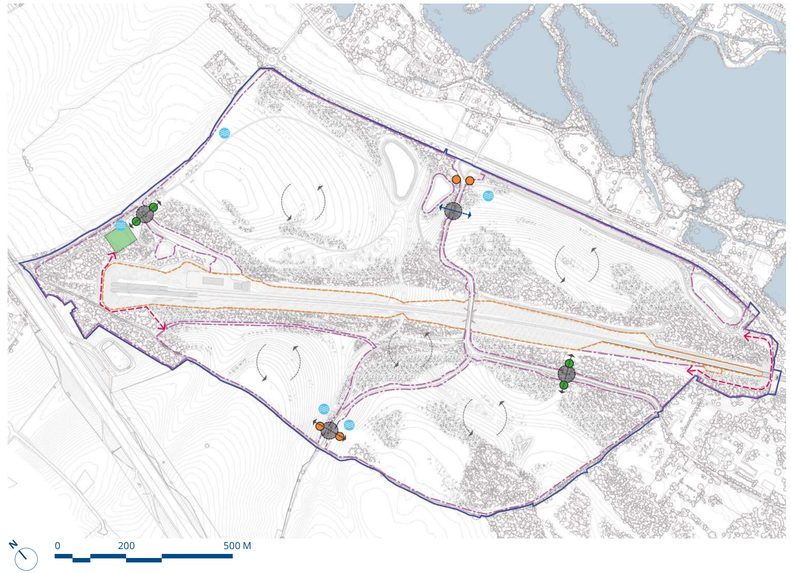


Fig.5.31_ Site plan - Habitat management infrastructure

5.4.19 Long term management - grazing

The habitat creation is designed to support the needs of long-term management, and specifically low-intensity conservation grazing, which will be the key management tool for the habitats on site. The following general principles will be followed:

- Cattle are the preferred livestock currently, at a density of ca. 0.5 head of cattle per hectare.
- Supplementary feeding and watering will not be provided, unless deemed essential for animal welfare reasons, to encourage natural processes to operate.
- Livestock will be present year-round with minimal management. Livestock should be able to move freely around the site without human intervention, although the necessary infrastructure to allow both managed and un-managed movement of animals across Tilehouse Lane and the quarry access road using a cattle grid system will be implemented, in case the need arises.
- Stocking will be managed to achieve optimum levels of grazing and appropriate livestock welfare.
- Fencing of tree/scrub planting areas will be removed or opened, when appropriate, to allow wood pasture habitats to develop - this will be determined by future land managers.

Infrastructure necessary to manage livestock will be provided as part of the main contract works and will include 4no. corrals; 3no. pairs of cattle grids (on Tilehouse Lane and the quarry access road); stock fencing and gates; and water troughs. The location of these features is illustrated in Figure 5.31 (previous page), while a typical arrangement and principles of corrals and cattle grids is illustrated in Figure 5.34.

Passive provision for a larger cattle management area is provided in close proximity to the Chilterns Tunnel south portal and would be accessible from the Chalfont Lane entrance, albeit the details for this will be provided at a later date and do not form part of this Schedule 17 request for approvals. Additional infrastructure such as cattle shelters will also be considered as part of later and separate applications.

Fig.5.32_ Photograph - Conservation grazing on calcareous grassland

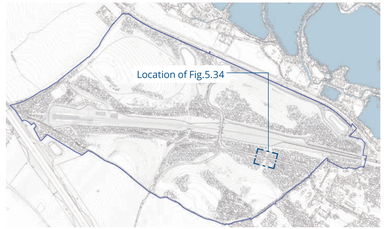


Fig.5.33_ Key plan - Location of axonometric

Key

1. New definitive bridleway (pedestrian, cycle and equestrian use)
2. Pedestrian & equestrian access gate with cycle-friendly cattle grid
3. Tilehouse Lane cattle grid
4. Tilehouse Lane cattle grid bypass
5. Cattle crossing control gates, with timber bollards to stop unauthorised vehicle access onto site
6. Cattle crossing corral area control gates

Cattle corral area (grassed)

Cattle corral area gates to be left open to enable free roaming grazing. If managed grazing of an individual land parcel is required, the control gates will be used to safely manage cattle between grazing areas in a controlled manner.

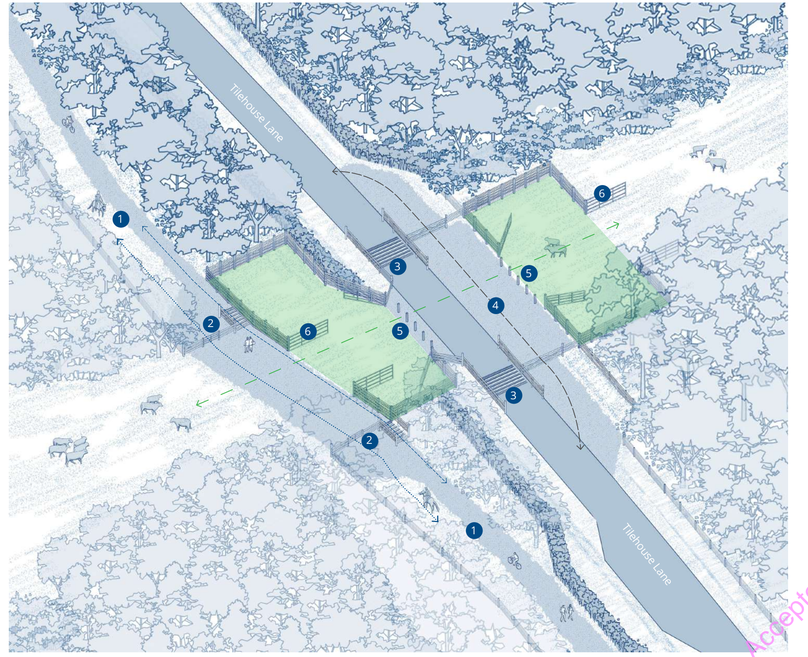


Fig.5.34_ Axonometric - Tilehouse Lane cattle crossing and access principles

Access and Recreation

5.5

5.5.1 Introduction

The CVWS represents an opportunity to create, at scale, a well-connected and diverse community space which provides access to nature and the natural environment and which can contribute meaningfully to promoting health and well-being and active green travel.

Proposals include several new footpaths, cycle routes and bridleways together with the realignment and partial upgrade of existing rights of way impacted by the railway. These routes will be connected to the wider footpath and cycle network where they interface with the CVWS boundary, and will form part of a broader recreational offer which will be delivered by the HS2 project.

In addition to the designated public rights of way and informal paths, there will be areas of open access land for informal recreation. Parts of the site will be offered back to their previous agricultural landowners and any access to this land will be at their discretion. Access to land that remains in HS2 ownership may need to be restricted, to allow grazing and to manage the nature conservation interest. This will need to be decided by the land management organisation on an ongoing basis, informed by monitoring of the habitats, as they evolve.

The 'visitor experience' will include opportunity to view the railway from three 'set piece' locations, connected by the footpath network, at the Chiltern Tunnels south portal; adjacent to the Tilehouse Lane bridge; and at the north embankment in close proximity to the viaduct. Views of the CVWS from the wider landscape have also been considered.

A public arts strategy is being developed by HS2 Ltd in association with Align. While this strategy does not form part of the Schedule 17 request for approvals, the CVWS has been identified as a key location for future commissions and broad opportunities are set out within this DAS. Land art proposals will be brought forward under separate applications at a later date.

5.5.2 Recreational access provision

The full proposed network of recreational routes (including immediate context) is illustrated in Figure 5.35 and in the Schedule 17 request for approvals drawings (ref: 1MC05-ALJ-TP-DPL-CS01_CL02-219181). A summary of construction details, dimensions and interfaces are illustrated in Figures 5.37 to 5.42.

The PRoW and other paths where they form part of definitive routes will, as a minimum, be signposted using standard highways authority wayfinding signage.

Boundary fencing will be provided alongside the PRoW where this is required to control access (or control livestock movement). Reference should be made to the accompanying Schedule 17 request for approvals drawings (ref: 1MC05-ALJ-TP-DPL-CS01_CL02-219171 and 1MC05-ALJ-TP-DDE-CS01_CL02-219401 to 1MC05-ALJ-TP-DDE-CS01_CL02-219403).

The proposed recreational routes which are submitted within this Schedule 17 request for approvals comprise (letters cross reference to the routes plan in Figure 5.35):

Diverted Rights of Way

- Footpath CSP/44/1, Den3/1 and Rickmansworth 071 – referred to henceforth as 'Old Shire Lane bridleway' – this will remain substantially on its existing alignment other than for a short section in the south east where it is diverted around the northern viaduct embankment. The path will be unsurfaced except for the diverted section which has a dual purpose as a maintenance access.
- Footpath Rickmansworth 004 – this route will be substantially diverted from its original alignment from its point of entry at the A412, passing over Tilehouse Lane bridge, to its junction with Old Shire Lane. It will be a multi-user route incorporating a surfaced shared use path for pedestrians and cyclists and a parallel reinforced grassed strip for horse riders.

New Informal or Permissive Routes

- North eastern loop (West Hyde Hill character area) - this will be a permissive path and is located in an area where free access will be encouraged. The path will be a mown grass path and will not have any form of surface or subsurface treatment.
- South eastern route (Pynesfield Slopes character area) – this will be a permissive route and is located in an area where free access will be encouraged. The route will connect the Rickmansworth 004 path and Old Shire Lane. The footpath will follow the alignment of the temporary works haul road and will use the same sub-base with a surfacing course laid over the top.
- Cantering track (Portal View character area) – this is provided as replacement for a 1km 'straight' on the existing Rickmansworth 004 footpath and was identified at the hybrid Bill stage and shown on the Final Parliamentary design. The cantering track has been designed for equestrian uses only.
- Tilehouse Lane extension (Tilehouse Ridge character area) – this route runs parallel to the southern section of Tilehouse Lane and joins with the diverted Rickmansworth 004 route on the south side of the Tilehouse Lane bridge. It will be a multi-user route incorporating a surfaced shared use path for pedestrians and cyclists and a parallel reinforced grassed strip for horse riders.

Realignment of Tilehouse Lane

- In addition to the provision of recreational paths within the landscape, alternative routes for cyclists and equestrians have been considered along Tilehouse Lane. Special measures have been built into the road design where cattle grids are required. This includes gated bypass routes designed specifically for horse riders (including horse drawn carriages). The technical design of the highway is set out in several accompanying Schedule 17 request for approvals drawings (refs: 1MC05-ALJ-HW-DDE-CS01_CL02-231401 to 1MC05-ALJ-HW-DDE-CS01_CL02-231406).

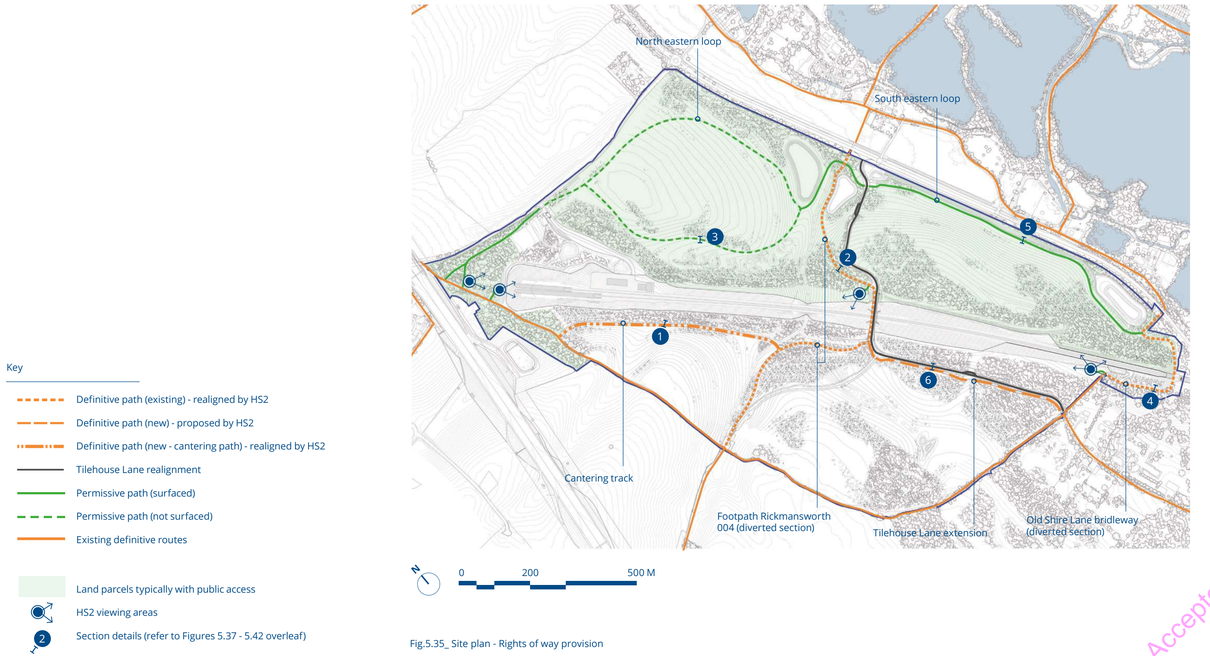


Fig.5.35_ Site plan - Rights of way provision

5.5.3 Footpath design

The design and specifications for the PRoW meet specific use and performance standards and are responsive to the character of the rural landscape particularly in respect to the detailing and choice of surface materials. The proposals have followed best practice guidance as applicable.

Construction details for the different paths which will be provided are set out in Figure 5.36; while Figures 5.37 to 5.42 show where each detail is applied and includes proposed path widths.

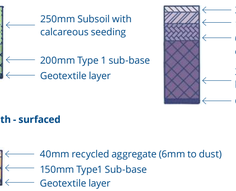
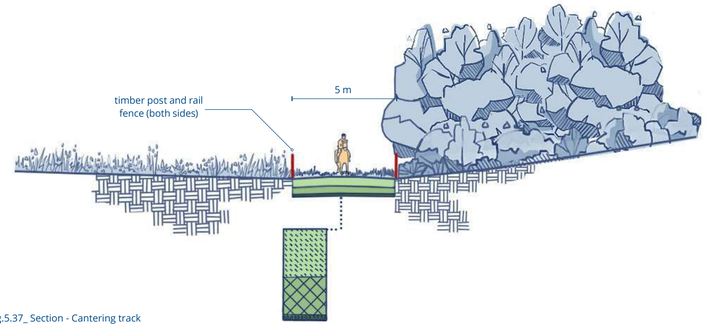
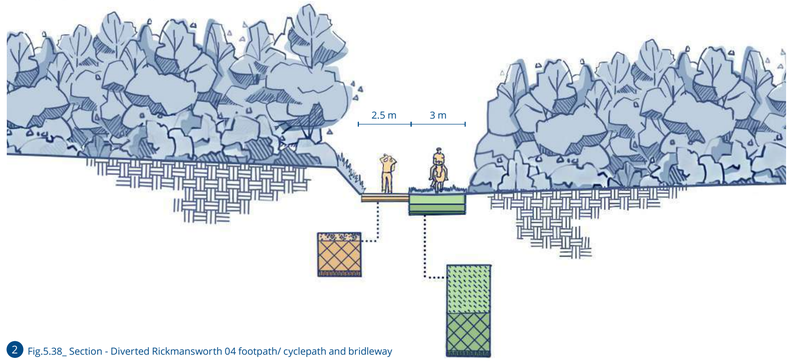


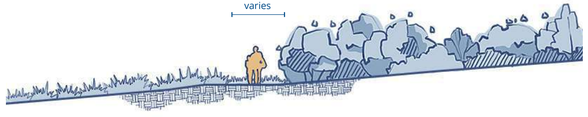
Fig.5.36_ Key diagram - Proposed footpath and highway construction details



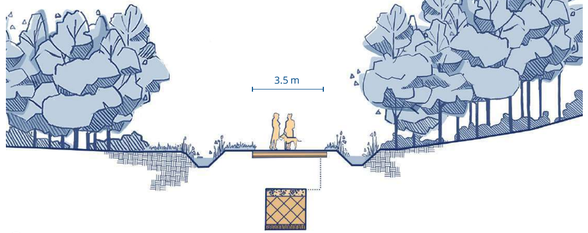
1 Fig.5.37_ Section - Cantering track



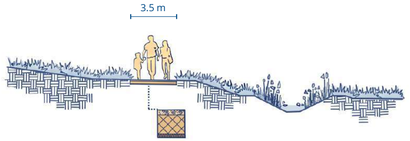
2 Fig.5.38_ Section - Diverted Rickmansworth 04 footpath/ cyclepath and bridleway



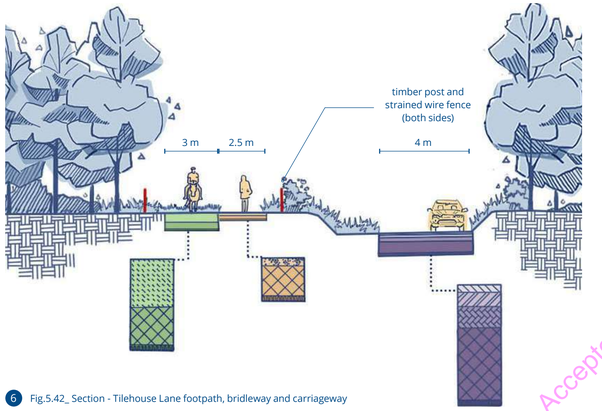
3 Fig.5.39_ Section - Permissive footpath (West Hyde Hill character area)



4 Fig.5.40_ Section - Diverted section of Old Shire Lane



5 Fig.5.41_ Section - Permissive footpath (Pynesfield Slopes character area)



6 Fig.5.42_ Section - Tilehouse Lane footpath, bridleway and carriageway

Fig 5.43 Visualisation (6): ground level view from footpath Rickmansworth 004 looking south west (Year 15)

Visitor Experience

5.6.1 Views and visual context

The masterplan has been shaped, in part, by a consideration of views from within the CVWS, and towards it from the wider landscape. The design seeks to enhance the visual experience and provides opportunities to view the railway from 'set-piece' locations; and also to view the CVWS in its broader setting by establishing open vistas from higher ground. In other locations, where HS2 infrastructure has the potential to be an incongruous element, views of the railway are concealed typically using a combination of planting and/ or landform.

The CVWS is also valued for the backdrop it provides in views from the eastern slopes. This has guided the design to ensure as far as practicable that the principal built structures are fully 'stitched' into the landscape in key views. This includes careful consideration of planting and land shaping to promote a logical character transition from the wooded valley floor to a more open character comprising fields and tree lined ridges.

The following section describes the visual context more fully with reference to the function of landscape and earthworks design; and the design and rationale for the viewing areas. Computer generated visualisations are also presented to illustrate specific views.

Fig.5.44_ Visualisation (5) - View from the Tilehouse cutting viewing area looking south east (Year 15)

Key

- 2 HS2 viewing area
- HS2 viewing area - no visualisation provided
- 7 Other illustrated viewpoint

Visualisation references:

2. View from the Chiltern Tunnel south portal viewing area looking south east
3. View from the Tilehouse Lane viewing area looking north west
4. View from the Tilehouse cutting viewing area looking north west
5. View from the Tilehouse cutting viewing area looking south east
7. View towards the Chiltern Tunnel south portal looking south west
8. View from Old Shire Lane bridleway looking north east
9. View from Park Lane, Harefield looking west
10. View from the Old Orchard Pub looking west

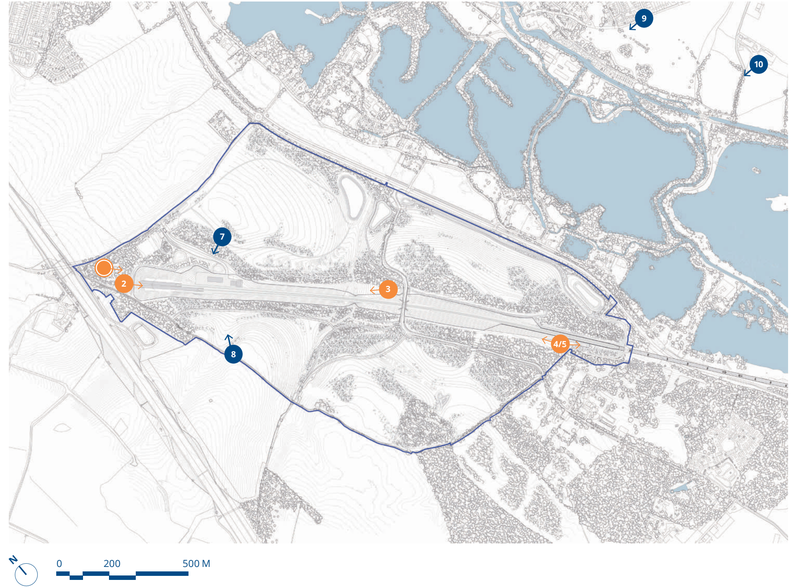


Fig.5.45_ Site plan - Illustrated viewpoints

5.6.2 Views and visual context (Continued)

The reprofiling of the landform together with planting design is used to control views within the site and to the wider landscape beyond. Typically the earthworks and planting are used in combination or separately to screen the railway including the security fencing which runs the length of the trace. In specific locations gaps in the tree and scrub planting are introduced to create framed views of the Chiltern Tunnels south portal and Colne Valley Viaduct. The effectiveness of the proposed tree and scrub planting for screening purposes will not be fully realised until a degree of plant maturity has been reached, which may take up to 15 years subject to growing conditions.

Figure 5.46 shows, in simple terms, how views of the railway will be controlled from within the site by earthworks and planting. The principles are also shown with reference to a part of the planting and earthworks design in the Pynesfield Slopes character area - refer to Figure 5.47.

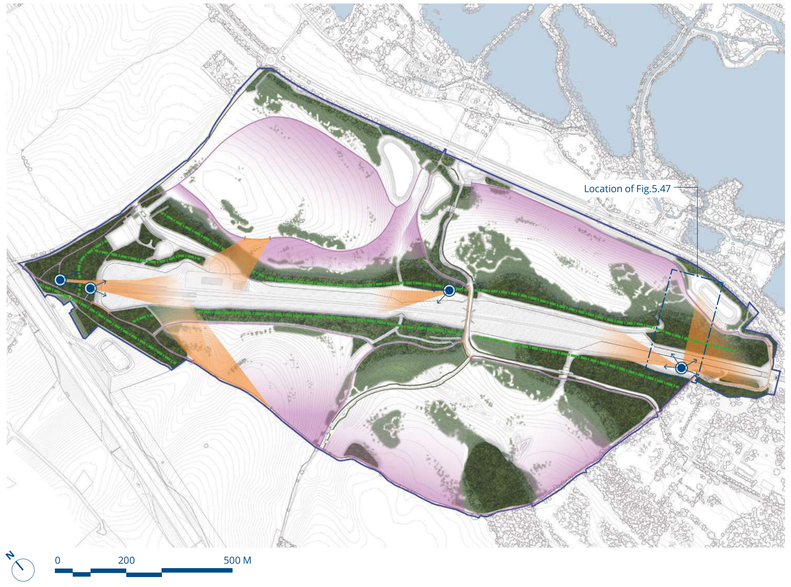
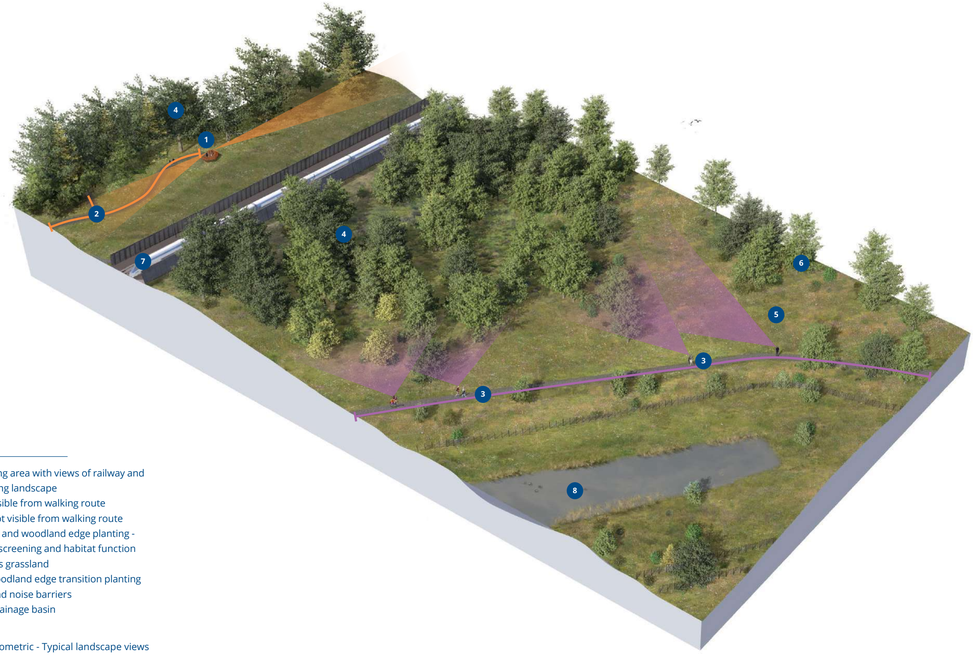


Fig.5.46_ Site plan - Landscape views



Key

1. HS2 viewing area with views of railway and surrounding landscape
2. Railway visible from walking route
3. Railway not visible from walking route
4. Woodland and woodland edge planting - providing screening and habitat function
5. Calcareous grassland
6. Scrub / woodland edge transition planting
7. Railway and noise barriers
8. Railway drainage basin

Fig.5.47_ Axonometric - Typical landscape views

5.6.2 Viewing areas

Viewing areas are placed at strategic locations along the railway trace, orientated ostensibly towards the track but also providing broader views of the landscape. Figure 5.48 illustrates the locations of these.

The four areas are connected by the footpath routes and are perched above intervening fences to give a clear view of trains as they emerge from the portals and from the viaduct.

Each of the platforms include a weathering steel 'wrap' around the front face; this is both a sculptural element and provides a restraint on the 'down slope' side of the viewing area.

The design of the weathering steel wrap differs at each location and uses some of the architectural language of the tunnel portals; the overbridge; and the viaduct. This is set out in the following illustrations (Figure 5.49) which show the general design intent for each of the viewing areas.

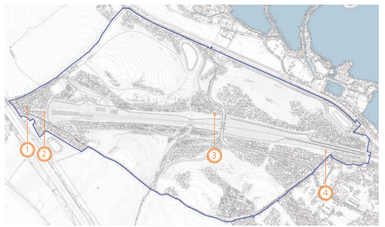


Fig.5.48_ Key Plan - Viewing area location

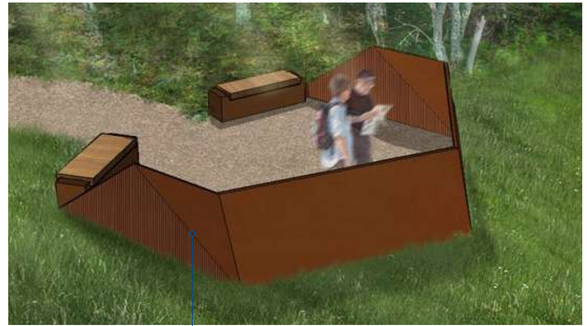
1 Chiltern Tunnel south portal viewing area

2 Chiltern Tunnel south portal viewing area

Curved architectural language of Chiltern Tunnel south portals integrated into the form of weathering steel viewing areas

Fig.5.49_ Illustrations - Viewing area details

3 Tilehouse Lane viewing area



4 Tilehouse cutting viewing area

Architectural language of Tilehouse Lane overbridge integrated into the form and texture of the weathering steel viewing area

Architectural language of Colne Valley Viaduct integrated into the form and texture of the weathering steel viewing area

View from the Chiltern Tunnel south portal viewing area looking south east (Year 15)

Fig.6.50_Visualisation (2)

View from the Tilehouse Lane viewing area looking north west (Year 15)

Fig 5.51 Visualisation (3)

View from the Tilehouse Cutting viewing area looking north west (Year 15)

Fig.5.52_ Visualisation (4)

View towards the Chiltern Tunnel south portal looking south west (Year 15)

Fig.5.53_ Visualisation (7)

View from the Old Orchard Pub at Harefield looking west (Year 15)

Fig.5.54 Visualisation (10)

View from Park Lane, Harefield looking west (Year 15)

Fig.5.55_ Visualisation (9)

Landscape Materials

5.7

5.7.1 Choice of materials

The palette of materials used for structures and surfaces in the landscape has been informed by the colours and textures which are part of the existing fabric and character of the site and its environs. Consideration of the form and appearance of the other built structures on the railway have also helped to establish a broad palette.

The key references are as follows and illustrated in Figure 5.56:

- Earthy colours reflected in the use of weathering steel – used extensively in a suite of landscape structures across the site (and extended along the recreational routes beneath the viaduct to provide a common design language).
- Stone aggregates used in the construction of paths will use muted tones such that paths blend into the landscape rather than stand out (important particularly in more distant views).
- Use of timber and natural materials in the construction of habitat features.
- Use of timber and weathering steel within the design of seating (ties in with the language of the viewing areas).
- Brief for future arts strategy includes requirement to reflect similar palette of materials

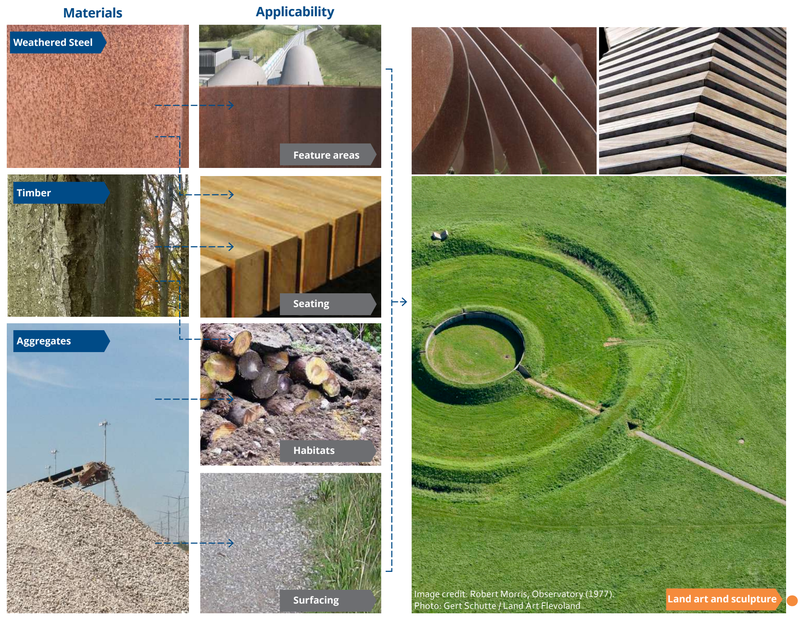


Fig.5.56_ Photographs and illustrations - Landscape materials

Arts Strategy

5.8

5.8.1 Arts Strategy

This Schedule 17 request for approvals does not provide specific details for what is generically referred to as 'public art'. However, the HS2 project recognises the role and importance of art as vehicle for enhancing and defining place and identity; the essence and rationale for this is set out more comprehensively in the HS2 Arts Strategy [HS2-HS2-AR-GDE-000-000015: HS2 Art Approach].

Under the umbrella of this project-wide strategy there are proposals to deliver arts-based projects which will be inspired by the context of the Colne Valley and draw upon many potential themes including the natural environment, social and cultural context, and engineering innovation by example; where practicable the arts approach will also promote the sustainability agenda including reuse/ repurposing of materials which may otherwise be seen as 'waste' products from the construction phase for example, 'land art'.

The approach will include the appointment of an artist(s) to work alongside HS2 and the ALIGN JV Design Team who will develop the brief for these commissions. The briefs will be fully cognisant of the Vision for the CVWS as described in Section 4 of this DAS, as well as other technical work which underpins the Main Works contract. These appointments will not be limited to commissions within the CVWS section but will extend into the Colne Valley Viaduct areas where HS2 has control over land. It is the intention that this strategy will be brought forward in consultation with local stakeholders to help shape outcomes and maximise benefits.

There is a broad canvas of opportunity for art within the CVWS and Figure 5.57 represents some early stage thinking on where these may be delivered in the context of the design which is being brought forward. Details of art, where they fall under Schedule 17 request for approvals, will be applied for at the site restoration stage if applicable.

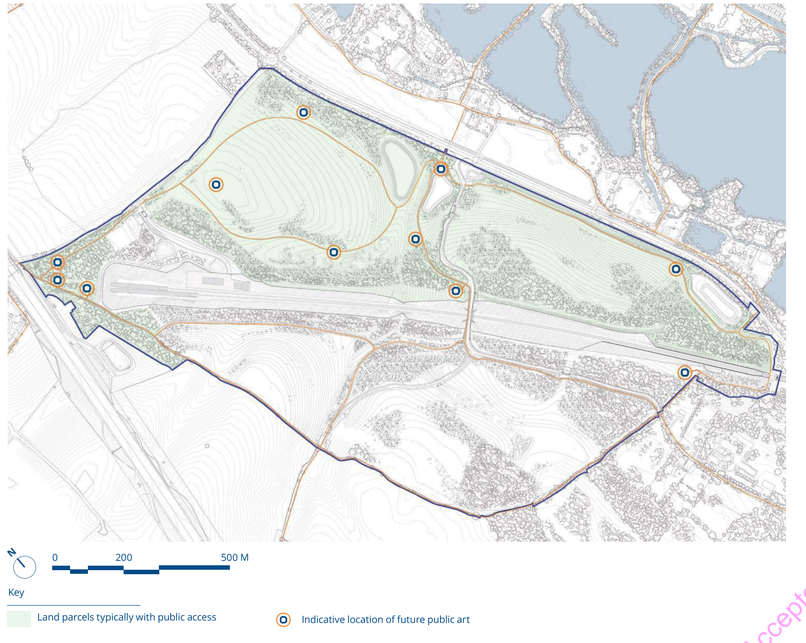


Fig.5.57_ Site plan - Art Strategy indicative plan

Site security

5.9.1 Overview

The operational railway needs to be secure and measures put in place to prevent unauthorised pedestrian / vehicle access to the track and other critical infrastructure including the portal buildings and areas which are accessed for regular maintenance such as railway drainage basins. The following section describes the principal security features within the masterplan relating to security fencing, gates and earthworks. The location of these is shown in Figure 5.58

Key

- Security fence
- Secure fence gate
- Bridge parapet
- Hostile vehicle earthwork
- Noise barrier (as secure boundary)
- Hostile vehicle barrier
- Field gate
- Operation/ Maintenance access route
- Public highway
- Private highway
- HVM bund pedestrian cut through

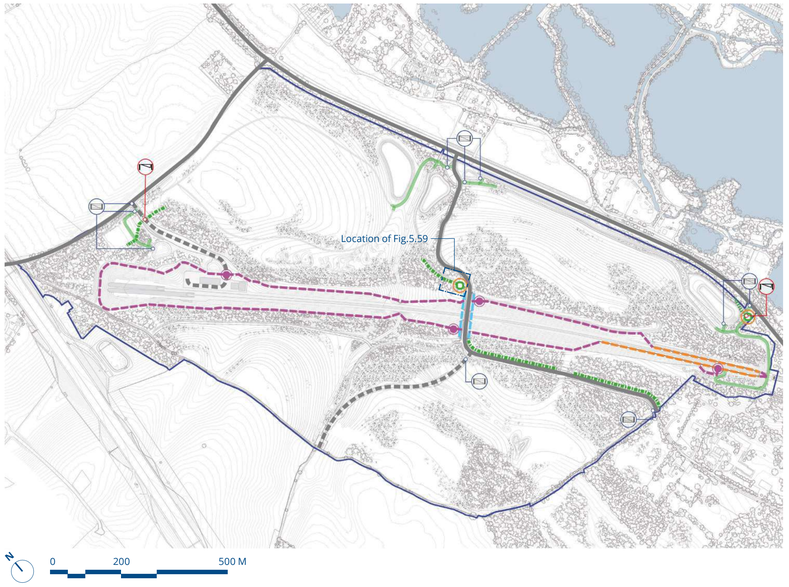


Fig.5.58_ Site plan - Security features

5.9

5.9.2 Security fencing

The track and associated infrastructure will be secured by weldmesh fencing and matching gates. These follow the security standards as set out in the HS2 Technical Standard ref: HS2-HS2-CV-STD-000-000002; the design specification has been adapted based on its proximity to and type of feature which is being protected. The fencing colour will typically be black to be as recessive as possible, and in most locations fences will be set against a planted backdrop and/ or a substantial earthwork to provide screening

5.9.3 Gates and barriers

Gates are needed to control access in locations where vehicle entry is required for routine operational and maintenance purposes outside of the secure areas. These will be lockable timber or steel field gates akin to the type of boundary treatment found in rural/ semi rural landscapes. In addition, timber bollards are proposed in specific locations to prevent vehicle access onto rights of way

5.9.4 Security earthworks and barriers

In a number of locations a specially designed earthwork bund is provided which will prevent hostile vehicle access onto land surrounding the railway. These earthworks will be 'blended' into the adjacent land and/ or incorporated within planting areas so that they do not stand out as incongruous features. A secure barrier is also provided to tie into these earthworks where HS2 vehicle access is needed. In addition, where proposed rights of way need to breach the earthworks a specially designed breakthrough using weathering steel 'wraps' is provided; this is illustrated in Figure 5.59.

Fig.5.59_ Illustration - Hostile Vehicle Mitigation bund: pedestrian cut through detail

Highways Design

5.10.1 Overview

Highway works are a key component of the CVWS proposal. The works are required to maintain continuity of public access along Tilehouse Lane; to facilitate ongoing private access to Denham Park Quarry (until such time as quarrying operations cease); and to provide HS2 Ltd with access to its key assets for operational and maintenance purposes.

The location of the main highway works is set out in Figure 5.58. These comprise:

- The realignment of Tilehouse Lane between the A412 and the point at which the existing road enters the CVWS site boundary;
- Provision of private vehicle access from Chalfont lane to provide operational and maintenance connections to the south portal and associated buildings and infrastructure;
- Vehicle access from the A412 to provide maintenance access to the north viaduct abutment

These components are described in more detail in this section and supported by the highways drawings.

5.10.2 Tilehouse Lane

The existing Tilehouse Lane is to be realigned from a point approximately 90m west of its existing junction with the A412 North Orbital Road south to rejoin the existing Tilehouse Lane at its junction with the retained Bridleway (Old Shire Lane DEN/3/1), a distance of approximately 1075m. The realigned Tilehouse Lane will cross the HS2 railway via an overbridge.

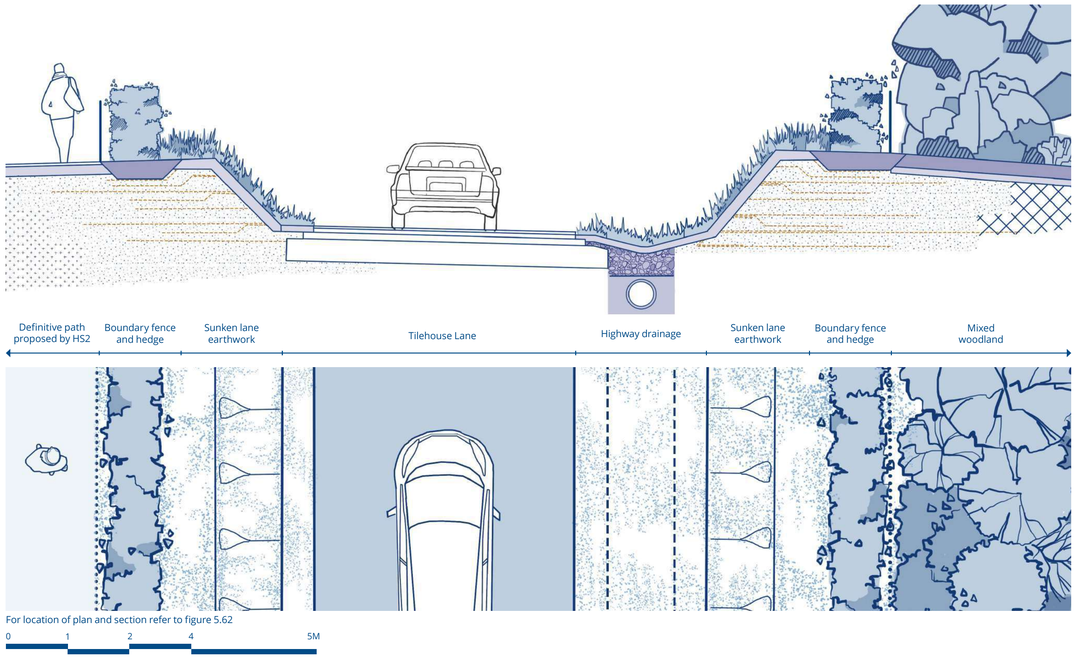
The road has been designed to recreate a rural sunken lane character, substantially replicating both the existing road and other country lanes in the area. The lane design incorporates a reduced carriageway width to help limit speed and includes appropriately spaced passing bays. Reduced horizontal curvature and optimised forward visibility are other key design features which contribute to a safe driving environment.

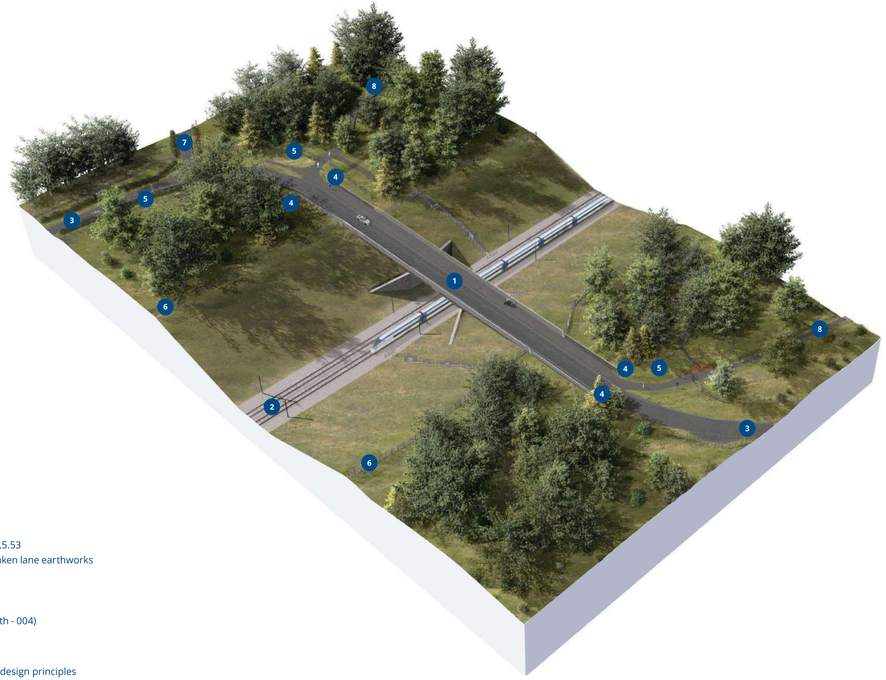
The key design principles are shown in Figure 5.60.

At the overbridge the highway runs parallel to the diverted bridleway (Bridleway DEN/3/1 Ricks 002 PRoW) and has an increased width of 5.5m. Key safety features are incorporated into both the highway and bridleway design to ensure safe access for vehicles and riders.

To allow management of the land by livestock grazing, two cattle crossings over Tilehouse Lane have been provided, one to the east and one to the west of the overbridge. Gated bypass lanes are provided to allow both pedestrians and cyclists to proceed along the lane safely without having to cross the cattle grids. The cattle grids will be connected to the road drainage system and will have an internal ramp to allow small animals to climb out of the cattle grid and not be trapped.

Fig.5.60_ Plan and section -Tilehouse Lane key design principles





Key

1. Tilehouse Lane overbridge
2. HS2 rail alignment
3. Sunken Tilehouse Lane, refer to Fig.5.53
4. Bridge parapets integrated into sunken lane earthworks
5. Post and wire stockproof fencing
6. HS2 security fencing
7. Quarry access road
8. Realigned Bridleway (Rickmansworth - 004)

Fig.5.61_ Axonometric - Tilehouse Lane design principles

5.10.3 Operational and maintenance access

Maintenance access to three drainage basins, the Landscape Drainage Basin, Highways Drainage Basin and Track Drainage Basin, is provided from the existing junction of Tilehouse Lane with the A412. The access utilises tracks which provide part of the proposed permissive rights of way network.

Access to Railway Drainage Basin 2 uses part of the realigned Bridleway (Rickmansworth 004). These include gated entrances to prevent unauthorised vehicle access onto HS2 land.

A new private road will also be constructed from Chalfont Lane to provide access to the tunnel portal area for maintenance and operational purposes, as well as for emergency vehicle access in the event of a major incident in the tunnel. This will be secured in two locations (refer to Figure 5.58) to prevent unauthorised vehicle use: a hostile vehicle barrier at the northern end and steel mesh gates at the southern end (incorporated into the south portal compound boundary fencing).

The principles of the maintenance and operational accesses are shown in Figure 5.62.

Key

Single lane | Two lane

- Tile House Lane
- Tile House Lane – passing bay
- Access bell-mouth
- Quarry Access
- Quarry Access - passing bay
- Operational and maintenance access
- Operational and maintenance access - passing bay

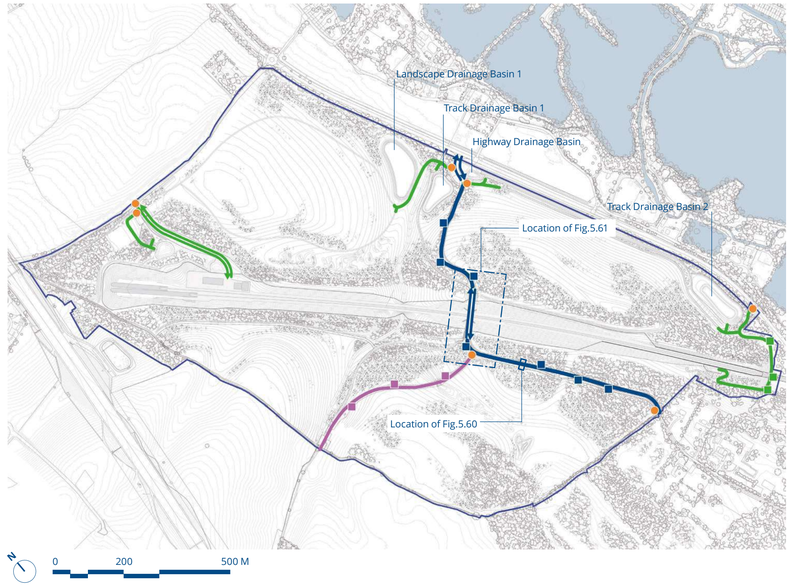


Fig.5.62_ Site plan - Highways provision and principles

Drainage Design

5.11.1 Track and land drainage

A new drainage system is required for the CVWS to protect the operational railway assets and to mitigate impacts on surrounding land and property by adequately controlling rates of over land flow and designing appropriate points of discharge to mitigate any flood risk. This section deals with the permanent drainage works only and describes built infrastructure such as ditches, attenuation basins and piped systems, and modifications to the landform to mimic existing flow patterns within the shallow valleys.

The drainage infrastructure is split into three components as follows:

- HS2 track and structures drainage;
- Landscape drainage capturing flows across the site and from wider linked catchments; and
- Highway drainage

These elements are summarised in Figure 5.63 with further technical detail provided in the Written Statement (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000007).

5.11.2 Flood risk

A comprehensive description of how the proposals mitigate flood risk is provided in the Written Statement (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000007). In summary the proposals retain the principles set out in the ES Flood Risk Assessment (FRA) of conveying the surface water runoff from the dry valleys under the railway, including appropriate allowances for climate change, blockage and siltation, whilst avoiding reductions in down-stream conveyance times.

The track drainage, surface water from the railway and highway drainage from the realigned Tilehouse Lane will be drained through a series of attenuation ponds to ensure that the overall discharge from the scheme is restricted to the pre-development runoff rate as in the ES/FRA to avoid an increase in flow rates.

No works will be carried out in areas indicated as being within Flood Zone 2 or 3, and therefore flood storage compensation is not required.

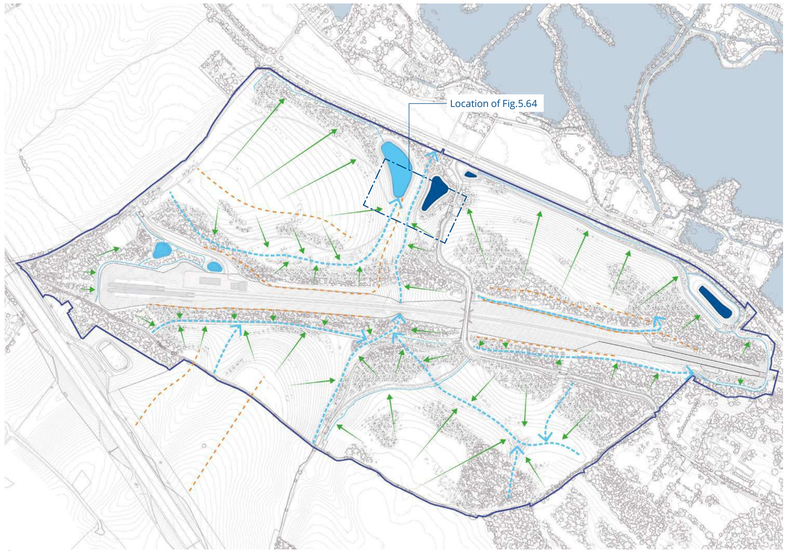


Fig.5.63_ Site plan - Track and landscape drainage strategy

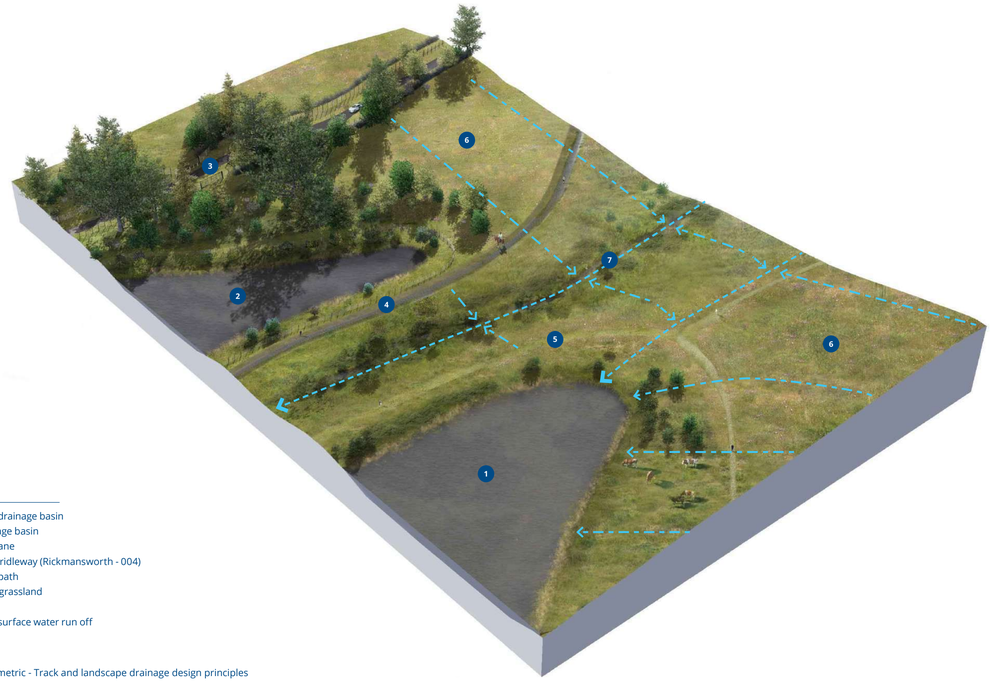


Fig.5.64_ Axonometric - Track and landscape drainage design principles

6.0 Portal Structures and Building Design

Summary and justification of the design proposals for the portal structures and compound building, relating to layout, use, scale, appearance and access.

Key Considerations

6.1.1 Hybrid Bill scheme

The hybrid Bill scheme for the Chiltern Tunnel south portal comprised two expose reinforced concrete twin 'box' structures and flaring laterally to 200m in length. These were located approximately 50m east of the M25 and 75m from the Chalfont Lane overbridge structure, which spans the M25. The landscape cutting which houses the structures was approximately 213m long and 22m deep at the headwall location.

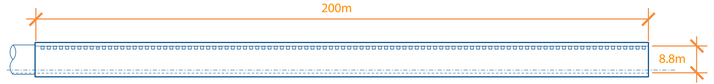


Fig.6.1_ Elevation - Hybrid Bill portal hood

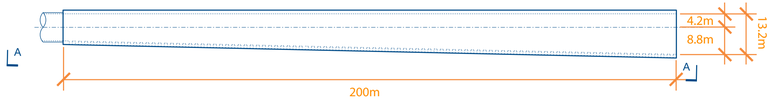


Fig.6.2_ Plan - Hybrid Bill portal hood

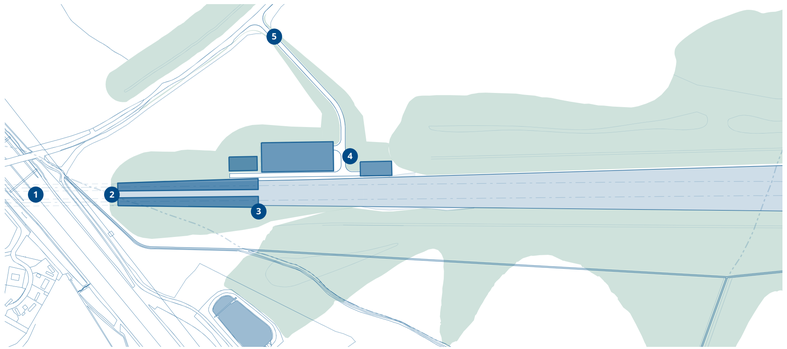


Fig.6.3_ Site plan - Hybrid Bill proposal

Key

1. M25
2. Tunnel headwall
3. Portal mouth
4. Portal compound
5. Access road
- Earthworks

N 0 60 100 200 M

6.1.2 Hybrid Bill scheme (continued)

The compound associated with the portal structures included the portal building, which accommodated tunnel plant and control rooms; an HS2 substation; the West Hyde ATS and associated tunnel access, safety and security facilities.

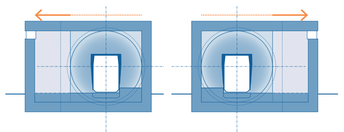


Fig.6.4_ Section - Hybrid Bill portal hood

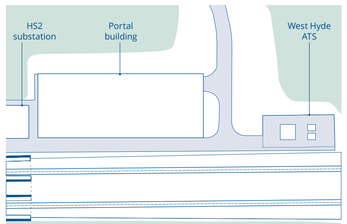


Fig.6.5_ Site Plan - Hybrid Bill compound arrangement

6.1.3 Reference design scheme

The reference design considered by HS2 Ltd was for an exposed rectangular, reinforced concrete twin box structure similar to the hybrid Bill scheme, which flared both vertically and laterally along its 200m length. The portal was sized to accommodate twin circular bored tunnels at the tunnel eye and transition at the head wall to a rectangular structure externally. Perforations were located within the side walls of the structures and sized to provide 1 m^2 ventilation for every 2m in portal length.

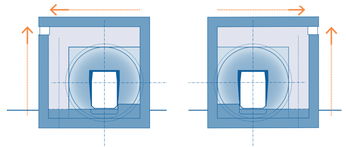


Fig.6.6_ Section - Reference Design portal hood

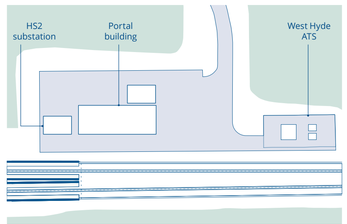


Fig.6.7_ Site Plan - Reference Design compound arrangement

6.1.4 Initial design

Several key design updates were made during the initial design development in order to optimise the layout of the portal compound and reduce its land take within the surrounding environment, these included:

- Removal of Heathrow Spur to reduce width of track bed by 50m.
- Narrowing of the track alignments at the tunnel entrance to the Chiltern Tunnel.
- Relocation of the headwall 150m south to provide greater clearance and reduced disruption to the M25.
- Reduction in compound hardstanding area.

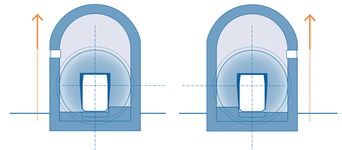


Fig.6.8_ Section - Portal hood at mouth of structure

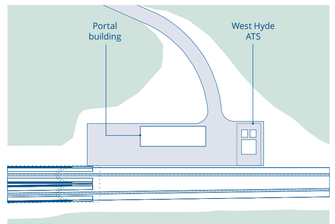


Fig.6.9_ Site Plan - Compact compound arrangement

6.2.1 Portal structures

Following the initial design stage, subsequent design development incorporated aerodynamic modelling, acoustic design updates in response to on-going engagement with key stakeholders and the HS2 IDP.

The main outcomes included:

- Staggering the portal arrangement.
- Incorporating different vent perforation arrangements on the entrance and exit portal structures.
- Expressing the compound building as a simple object in the landscape, so as not to distract from the more prominent portal structures.

Initial design development considered two 200m long portal structures, with a flare along the length to increase the cross-sectional area of the structure from the tunnel eye. During the design development, the following aspects were considered:

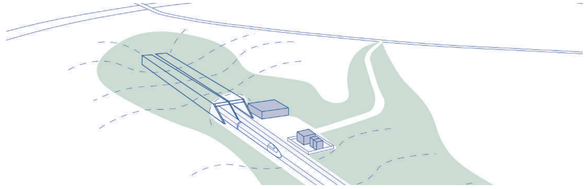
- The external form of the structures.
- A vertical or lateral flare.
- The extent to which the structures are visible within the landscape.
- The location of perforations along their length.

The following options were explored as exposed structures or buried within the landscape:

- Rectangular box structure with vertical flare
- Rectangular box structure with lateral flare
- Arched hood structure with vertical flare

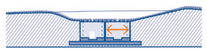
The preferred option was for an exposed structure due to optimised constructability and the requirement for side wall perforations to dissipate air pressure. The exposed structure was deemed suitable due to it being well screened by the surrounding landform and woodland, while providing an opportunity to express the functionality and form of the portals from closer viewpoints.

The design adopted an arched form hood to respond to aerodynamic requirements. The curved hood was more expressive of the circular tunnels that pass beneath the Chilterns and suited the undulating landscape.



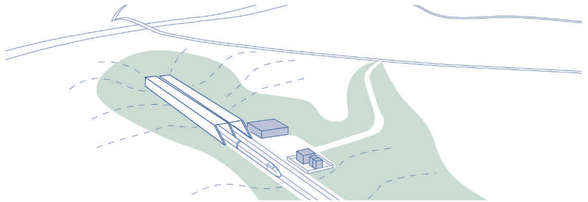
3D view

Long section



Short section

Fig.6.10_ Diagrams - Buried rectangular box structure with lateral flare

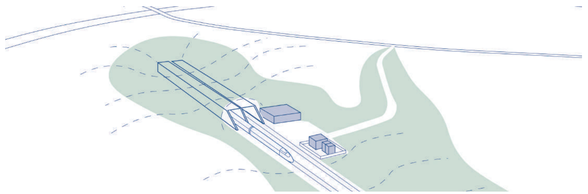


3D view

Long section

Short section

Fig.6.11_ Diagrams - Exposed rectangular box structure with a lateral flare

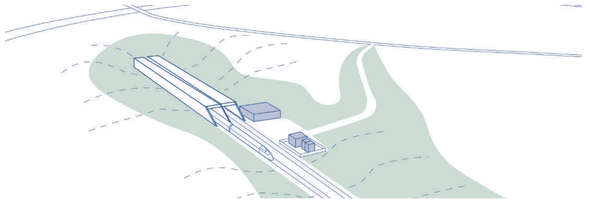


3D view

Long section

Short section

Fig.6.12_ Diagrams - Buried rectangular box structure with a vertical flare

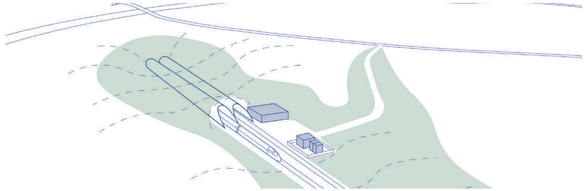


3D view

Long section

Short section

Fig.6.13_ Diagrams - Exposed rectangular box structure with a vertical flare

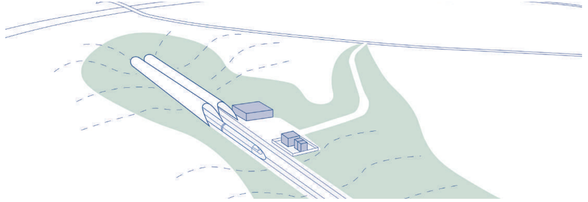


3D view

Long section

Short section

Fig.6.14_ Diagrams - Buried arched hood structure with a vertical flare



3D view

Long section

Short section

Fig.6.15_ Diagrams - Exposed arched hood structure with a vertical flare

6.2.2 Portal compound and building

The portal compound and building is set within the cutting adjacent the tunnel portal entrances. In order to reduce visual impact from distant views within the Chilterns AONB, design options explored reducing the building footprint, minimising building height and partially submerging a portion of the building within the landscape earthworks. The options explored included:

- Square building footprint
- Long thin building built up to retained earthworks
- Semi-buried L shaped building
- Mid-rectangular building footprint

Each of the building options were single storey with a flat roof to minimise height as far as possible. Options that were built up to or partially submerged within the landscaped earthworks were rejected due to limited access to plant areas for maintenance and increased spatial requirements for the building. The preferred option maintained access to all facades to ensure the building footprint could be a compact as possible.

Numerous design options were explored for the building envelope, which required a large extent of ventilation and access to the plant spaces inside. Options explored different architectural expressions, which particular focus on overall scale, composition, proportion and materiality. The most successful options adopted a flexible, consistent skin which wrapped the entire building, expressing the building as a simple yet recessive object within the landscape.

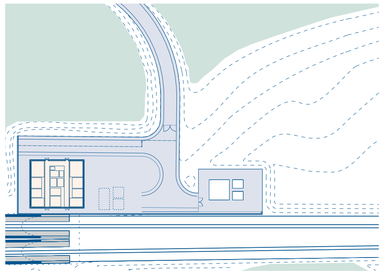


Fig.6.16_ Site plan - Square building footprint

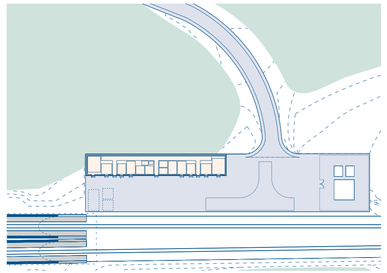


Fig.6.17_ Site plan - Long thin building built up to retained earthworks

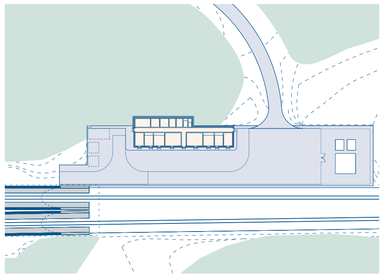


Fig.6.18_ Site plan - Semi-buried L-shaped building footprint

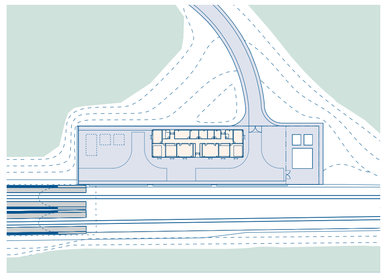
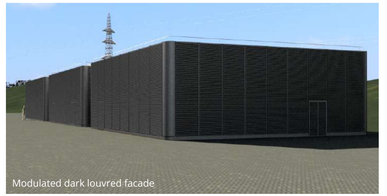


Fig.6.19_ Site plan - Preferred option showing mid-rectangular building footprint

Key

- Compound Building
- Site Compound
- Earthworks
- Portal

N 0 20 50 100 M



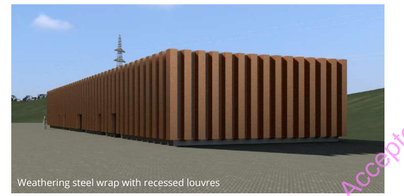


Fig.6.20_ Preliminary visualisations - Initial facade options for the portal building

Layout

6.3.1 Compound arrangement

The compound has an area of approximately 7000 m2. The compound arrangement is designed to be as compact as practicable, whilst providing the necessary hard surfacing to accommodate functional requirements.

The access road to reach the site is from Chalfont Lane approximately 330m to the north of the compound. The compound is oriented to be parallel and adjacent to the portal structures.

The portal building and compound is located adjacent to the portal structures with hardstanding areas in close proximity to the portal entrances and track access points for emergency requirements. Below ground water tanks are situated to the left side of the compound entrance gate.

The portal building is sited to the north of the compound, with a turning head which wraps around the north façade of the building to facilitate access and sufficient manoeuvring space for tunnel maintenance and evacuation.

The Auto Transformer Station (ATS) is located to the south of the compound and is not subject to this Schedule 17 request for approvals. The ATS accommodates rail track equipment within a fenced enclosure.

Access to the site is via a permanent access road off Chalfont Lane, which enters the north side of the compound. The compound is surrounded by a security fence. The compound does not require frequent vehicular or staff access and is generally unmanned with no permanent lighting. It has been designed as efficiently as possible to minimise the overall footprint whilst maintaining sufficient accommodation for infrequent access via vehicles for fire fighting and maintenance purposes.

Key

1. Portal 1 - Chiltern Tunnel entrance
2. Portal 2 - Chiltern Tunnel exit
3. Portal compound
4. Portal building
5. West Hyde ATS
6. Water tank
7. Access road

Site Compound Access

Compound Building Access

N 0 20 50 100 M

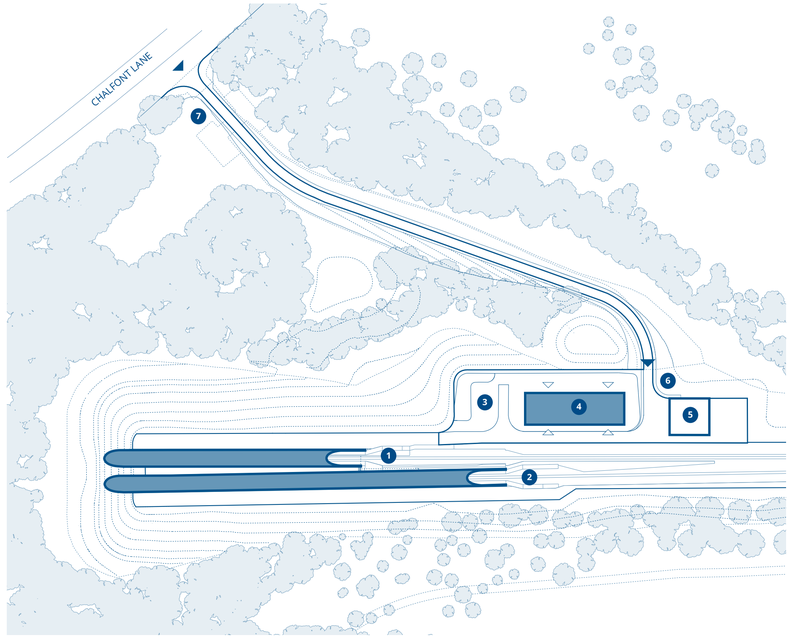


Fig.6.21_ Proposed site plan - Showing compound access road and tunnels

6.3.2 Portal structure arrangement

The portals are located at the Chiltern Twin Tunnel entrances. The lengths of the entrance and exit portals are staggered at 243m for the entry portal and 158m for the exit portal to respond to differing air pressures created by passing trains. This is explained further in Section 6.2.1 Portal structure. The portals mostly sit within a cutting in the landscape but do extend beyond this cutting.

6.3.3 Compound building arrangement

The portal building is a single storey rectilinear form. Internally the rooms, which accommodate mechanical and electrical plant for the operation of the railway, are accessed from a central corridor with two means of escape in the event of a fire. Some spaces can be accessed directly from the compound area. The external air condenser area is included within the footprint of the portal building so that it can be screened by the louvered façade for visual simplicity, but this area is open to the air with no roof cover.

Key

Compound Building Access

Mechanical and Plant Equipment Room

Circulation

External Plant Equipment

N 0 2 5 10 20 M

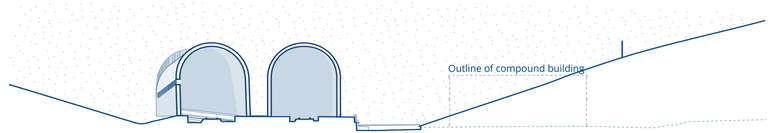


Fig.6.22_ Proposed short section - Portal structure and compound building

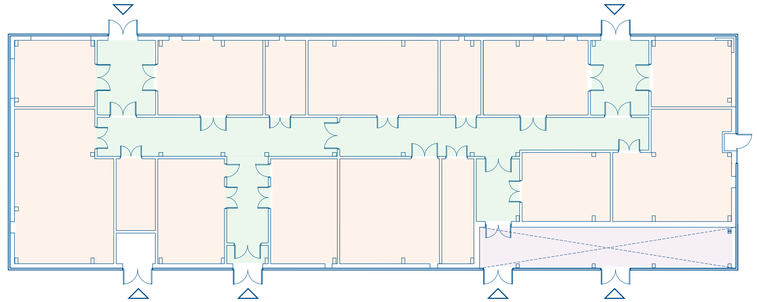


Fig.6.23_ Proposed plan - Compound building internal arrangement

Fig.6.24 Visualisation (14) - Aerial view of South Portal compound (Year 15)

6.3.4 Site arrangement

The portal structures and compound building have been considered as a holistic 'set-piece', nestled within the CVWS. As such their location and composition have been carefully considered within the new surrounding landscape, with particular focus on creating snap shot views through the proposed landform and tree planting. The proposals also seek to create a visual relationship between with the portal structure and the compound building, ensuring they read as a cohesive group.

Key

1. Portal 1 - Chiltern Tunnel entrance
2. Portal 2 - Chiltern Tunnel exit
3. Portal compound
4. Portal building
5. West Hyde ATS
6. Viewing platform
7. Portal compound access road
8. Chalfont Lane
9. M25
10. Old Shire Lane - PRoW DEN/2/1
11. Proposed cantering route

6.4.1 Portal structure

The portals are structural elements which perform several functions:

- Air pressure and noise relief from high speed train operations entering and leaving the tunnels.
- Intervention access point for the emergency services to respond to an incident such as fire within the tunnels.
- Provide support to the ground at the transition from open-cut to tunnelled excavation.

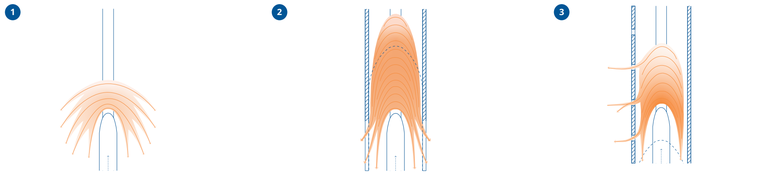
The portal structures are a functional structure that must be open to the surrounding air in order to dissipate the air pressure of a train entering and exiting the tunnel at high speed. The train pushes a pressure wave of air ahead of itself through the tunnel. This phenomenon, known as a micro-pressure wave becomes much more pronounced over 250 km/h. If this effect is not mitigated, a sonic boom is created at the exit end of the tunnel soon after a train enters the other end of the tunnel.

The porous portal acts as a funnel with slots in the side. Instead of going from no confinement in fresh air to total confinement inside the tunnel, the porous portal structure is tapered to create a more gradual increase in the confinement and at the same time allow some of the pressure being created to escape through the slots, before the train fully enters the tunnel. In this way the residual micro pressure wave pushed ahead of the train is much reduced.

Trains also create a different phenomenon known as exit waves behind them. These are of a different amplitude and are best treated by a slightly different configuration of slots in the porous portal at the tunnel exit. It is for this reason that the lengths of the entrance and exit portals are staggered and the exit portal has larger holes, whilst the entry portal has more uniform narrow slots.

To mitigate the possible reflection of the pressure wave effect from an exiting train off the face of the adjacent longer entry porous portal, the circular hood shape adopted will help to dissipate pressure up into the air rather than towards any adjacent people or buildings.

Entry Portal



1 Outside the portal structure, pressure dissipates into the surroundings

2 With nowhere to escape to, pressure builds up as the train enters the portal structure

3 Small vent openings prevent the build up of excess pressure in the entry portal

Exit Portal

4 Larger vent openings in the exit portal allow the passing train to draw air in from outside

5 This reduces the suction effect as the train exits the portal, preventing a sonic boom

6 Once outside the portal structure, pressure dissipates into the surroundings

Fig.6.25_ Diagrammatic sequence of pressure reduction and dissipation - see fig. 5.26 for behaviour locations

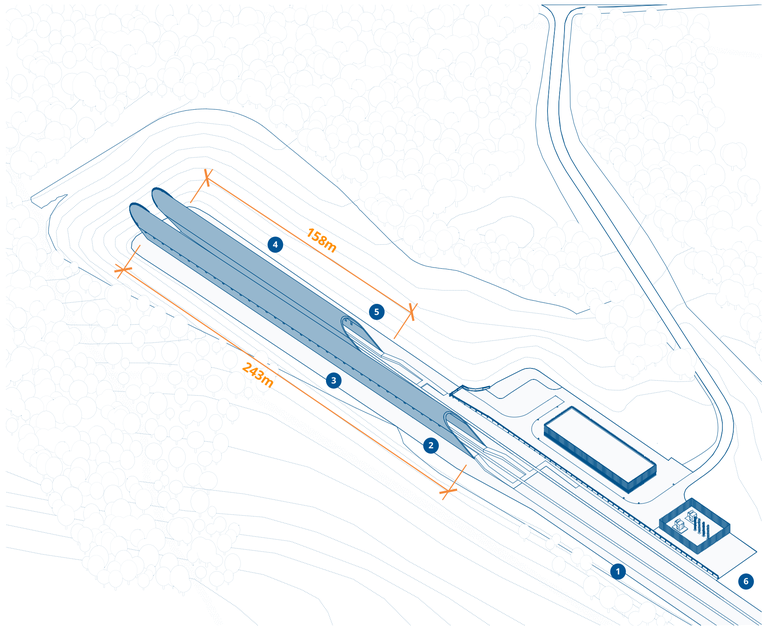


Fig.6.26_ Entry portal and exit portal operation - pressure dissipation through portal perforations

Porous portals

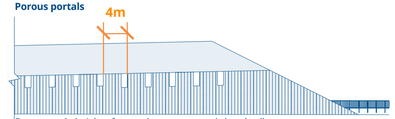


Fig.6.27_ Diagram - Portal perforations for up and down line

Tapering

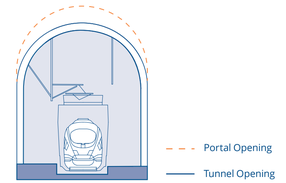


Fig.6.28_ Diagram - Vertical flare of portal hood

Pressure wave reflection

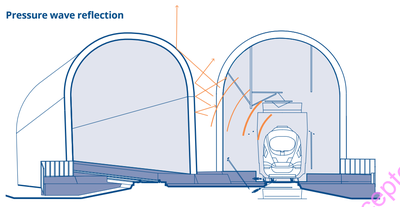


Fig.6.29_ Diagram - Rounded portal hood reflects pressure waves

Use (continued)

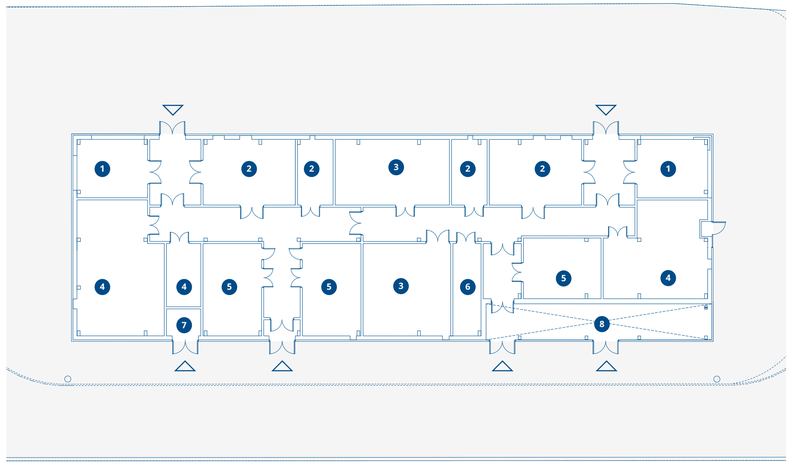
6.5.1 Compound building

The functional requirements for the portal compound and building are:

- Providing the necessary space for mechanical and electrical plant equipment to support the operation of the railway.
- Providing an area within the compound and a water tank for the emergency services to respond to an incident within the tunnels or at the portal building.
- Access to the West Hyde ATS, which is located adjacent to the east side as part of HS2 traction power supply.

For operational and maintenance purposes the plant and operation rooms are located at ground level within the portal compound. The building is single storey with no basement. It accommodates transformer rooms, mechanical and electrical plant rooms, switch rooms, comms rooms and a fire suppression room.

External lighting will be on a Passive Infrared sensor (PIR) which will illuminate the compound in the case of unwanted intrusion or in an emergency. There will be no permanent lighting of the portal building or compound.



Key

1. Transformer room
2. Electrical plant room
3. Mechanical plant room
4. Switch room
5. Comms room
6. Fire suppression room
7. Firefighters trolley room
8. External area for air condensers

Compound building access

Vehicle mitigation

N 0 4 10 20 M

Fig.6.30_ Proposed plan - Ground floor layout

Fig.6.31_ Visualisation (11) - Elevated view of portal building and Chiltern Tunnel entrance and exit (Year 15)

Scale

6.6.1 Portal structure

The exit portal to the Chiltern Tunnel is 135m long, whilst the entry portal is 220m long. The height at the opening of each portal is 12m and the width is 10m. This is 1.5 times the cross section of the tunnel, creating the tapering effect of the portal to reduce the build-up of air pressure.

The exposed porous portals define the entrances to the Chiltern Twin Tunnels and provide an aesthetic termination to the extent of engineering works within the CVWS. The simplicity of the curved portal forms helps to reduce their perceived scale, whilst the textured band breaks up the visual bulk of the structure.

6.6.2 Compound building

The compound building footprint is approximately 1200 m^2 and has been kept as compact as possible. The building is 60m long and 20m wide. It is a single storey building with a total height of 8m, with a flat roof to keep the overall height as low as possible. The architectural expression of the building emphasises its horizontal orientation and disguises door openings, further reducing its perceived scale.

Fig.6.32_ Visualisation (15) - View looking north-east towards portal structure and compound building in elevation (Year 15)

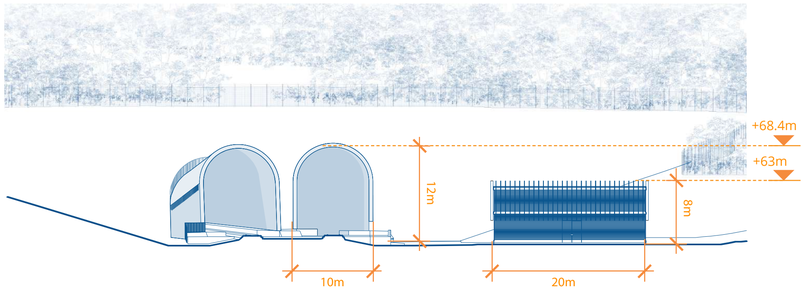


Fig.6.34_ Proposed south-east elevation - Key dimensions of portal structure and compound building

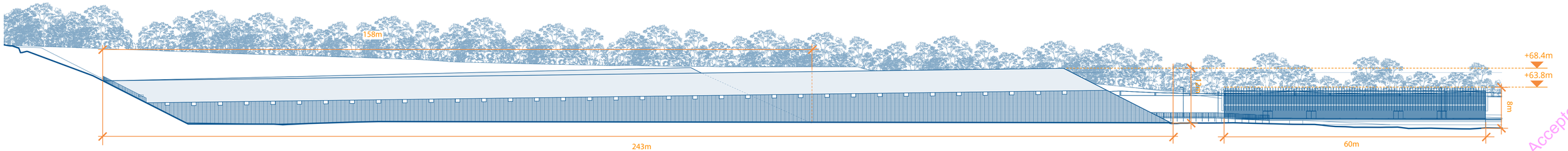


Fig.6.33_ Proposed long south-west elevation - Key dimensions of portal structure and compound building

Appearance

6.7.1 Portal structure

The hood of the portals uses a smooth concrete finish, while a textured concrete finish is proposed at low level where the portal structure meets the ground. A rough ribbed texture helps to ground the porous portal within the landscape. Vertical ribbing establishes a relationship with the appearance of the compound building. Proposals will use rubber form work liners to achieve a high level of finish and consistency to textured faces. Liners shall be joined and fixed to prevent visible joints and blemishes.

The portal structures have been considered as part of a family of structures along the HS2 route thorough the Chilterns and Colne Valley. They share a common language with the concrete finishes used on the Colne Valley Viaduct and Tilehouse Lane Overbridge.

Ground granulated blast-furnace slag cements are specified to achieve a light grey colour and reduce the carbon footprint of construction. The concrete colour shall be as consistent as possible across all structures within the Colne Valley and Chilterns. The aggregate and concrete batching will be controlled to seek colour consistency as far as reasonably practicable.

The use of self-finished concrete will ensure that the portal structures weather uniformly over its 120 year design life. The risk of staining has been minimised by incorporating drip details where necessary and vertical ribbed textures to the portal walls.

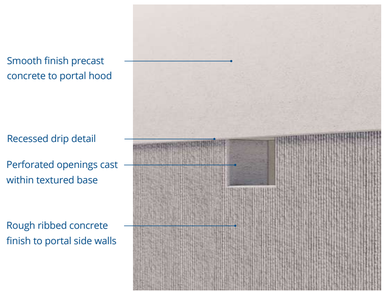


Fig.6.35_ Diagram - Portal finish composition

Fig.6.36_ Visualisations - Colne Valley Viaduct and Tilehouse Lane Overbridge

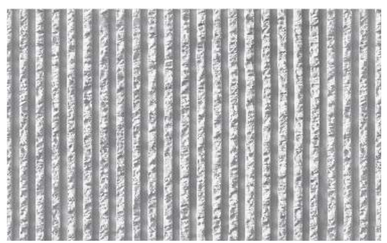


Fig.6.37_ Material samples - Formliners used to create rough ribbed texture

Fig.6.38_ Material samples - Long term visual change (illustrative only)

6.7.2 Portal structure key details

Portal entrance

The angle of the portal entrance matches the angle of the slope where the portals go into the ground. This helps the portals sit elegantly in the landscape and appear integrated with the surrounding landform.

Portal wall and perforations

The junction between the smooth hood of the portal and the textured wall of the portal has a chamfered step so that the vertical ribbed texture is set back slightly and has a clear line where it transitions to the smooth portal hood. The slots in the side of the portal have a chamfered smooth concrete frame to prevent the ribs of the concrete texture breaking off.

Portal headwall

At the portal headwall a dark grey Glass Fiber Reinforced Plastic (GFRP) handrail is proposed as fall protection to anyone maintaining the landscape of the headwall. A simple discrete vertical flat plate handrail design is proposed to work with the vertical texture of the portal walls and not draw attention. The handrail is aligned with the textured wall of the portal and runs parallel to the earthworks. The textured wall is also aligned with the first vent opening.

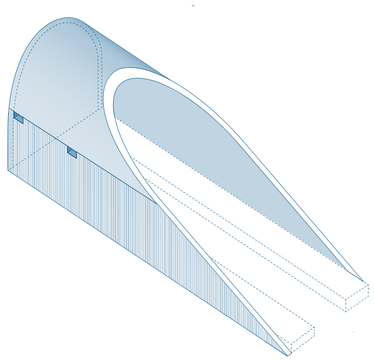


Fig.6.39_ Diagram - Portal entrance profile

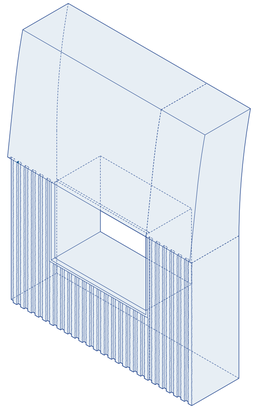


Fig.6.40_ Diagram - Portal structures perforation detail

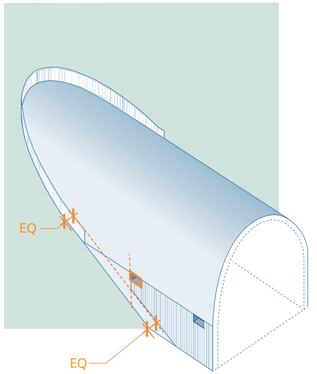


Fig.6.41_ Diagram - Portal headwall handrail and textured wall detail

6.7.3 Compound building

The compound building is conceived as a simple object within the landscape designed to not distract from the more expressive porous portal structures. The portal building uses a restrained material palette to simplify its appearance.

The cladding is comprised of dark painted steel louvres which appear recessive against the surrounding landscape, whilst a band of lighter anodised aluminium fins emphasise the horizontal orientation of the building. The louvre cladding of the building allows for irregular ventilation openings behind the louvres to suit the functional requirements of the building whilst maintaining a simple and clean appearance.

The vertical grid of the fins establishes a visual relationship with the ribbed concrete texture of the porous portals. The fins are raised to simplify the façade when viewed alongside various rail side equipment. Any elements which may be used as a reference to perceive the scale of the building, such as door openings, are integrated within the band of dark grey painted steel louvres so they are made less visible.

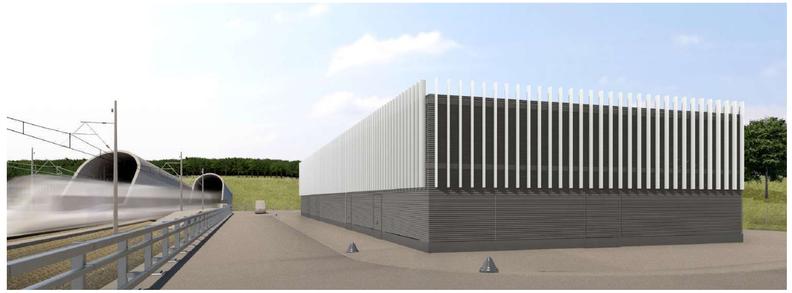


Fig.6.42_ Visualisation - Portal building from compound

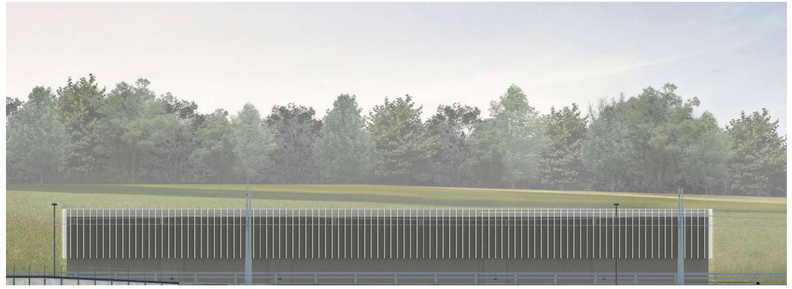


Fig.6.43_ Visualisation - Proposed south-west elevation - Compound building

6.7.4 Compound building key details

Key details include the following:

- Louvred Corners: The corners of the building enclosure will have a louvred corner piece. A corner piece will be used and fitted into the straight horizontal louvres to ensure the louvres appear as continuous horizontal elements.
- Plinth: The plinth of the building will be a constructed using precast concrete, to provide a robust base to the building. The material will be pigmented to match the dark grey colour of the louvres. It will be set back slightly from the face of the louvres to allow water run-off from the louvres.
- Parapet: The parapet of the louvred cladding will be slim in profile so as not to be noticeably different from the scale of the louvres and will be set flush with the outer face of the louvres below.
- Vertical fins: The natural anodised aluminium vertical fins will be discretely fixing back to the louvered cladding. The horizontal fixing plate will be flush with the face of the louvres and finished in the same powder coated steel so that they do not disrupt the simple louvered box appearance of the building. The fins extend above the parapet of the building by approximately 600mm, which will give a softened, feathered top edge to the building.
- Doors: The external doors of the building will be frameless and louvered to match the louvered cladding. The doors will be in the same plane as the cladding so as not to disrupt the simple louvered box appearance of the building and give a visual reference to the scale of the building.

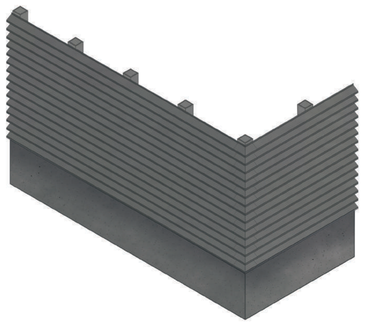


Fig.6.44_ Diagram - Louvred corner detail with robust plinth at base

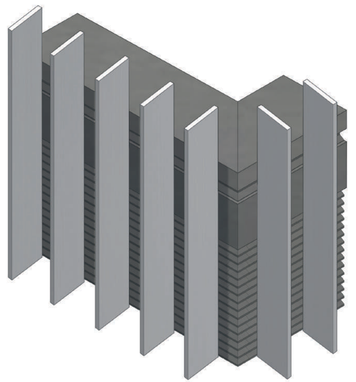


Fig.6.45_ Diagram - Vertical fins applied as regular facade module

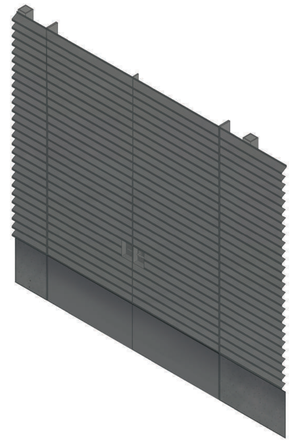


Fig.6.46_ Diagram - Frameless louvered doors to continue external skin

6.7.5 Tilehouse Lane Overbridge

Tilehouse Lane Overbridge has received approval under Schedule 17 as part of a separate application. As the structure is part of an integrated design for the CVWS, it has been included in this report for completeness.

The overbridge spans the railway cutting, providing an access route for vehicles, pedestrians and equestrians. Concrete parapets on either side of the deck have been designed to provide H4a standard vehicle containment. To comply with HS2 security standards and equestrian requirements for bridges over railways, the parapets step up from 1.5m to 1.8m over the railway cutting. At each end, the parapets splay out to maximise onward visibility.

In accordance with the HS2 CDE guidance for overbridge parapets, the parapet incorporates a fold along the lower third line, visually breaking up the outer face. The contrast between light and shadow is emphasised by the texturing of the lower section of the parapet, which also helps to minimise staining from water run-off. The effects of weathering are further reduced by a small step detail along the fold line, which also providing a clear definition between the smooth and textured concrete surfaces.

As demonstrated in Figure 6.48 and Figure 6.49, on both the inner and outer parapet faces, the transition in height is expressed by a 45 degree sloped groove and contrasting finishes. On the inner face, the 1.8m and 1.5m parapets are expressed by smooth and textured surfaces respectively.

A concrete abutment and two triangular wing walls on either side of the tracks are used to retain the cutting earthworks. The form of the wing walls closely follows the topography of the earthworks, tapering to a point at either end. To break up the concrete faces, the wing walls are textured, helping to mitigate the risk of staining through weathering. Guarding is required along top of the wing walls to protect against falling.

A ribbed rough-cast concrete texture has been used to establish a visual relationship between infrastructure elements along the C1 route, including the Colne Valley Viaduct and the Chilterns Tunnel south portal.

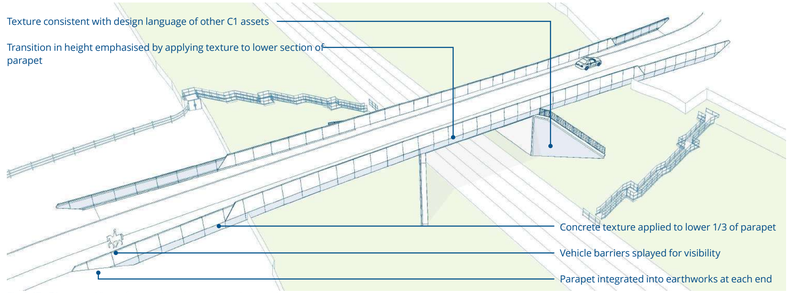


Fig.6.47_ Diagram - View of overbridge from viewpoint, looking south

Fig.6.48_ Visualisation - View of overbridge from viewing point, looking south west

Fig.6.49_ Visualisation - View of overbridge from bridleway, looking south west

6.7.6 North embankment noise barrier

At the north embankment, the noise barriers comprise 4m high by 2m wide precast concrete panels with an acoustic inner lining. Externally, an outer lip to the panels conceal the steel I-sections behind, and a vertical rough rib texture helps to conceal joints between panels. The texture minimises staining from water run-off and makes the panels appear darker and more recessive against the surrounding woodland.

Where the barrier meet the Colne Valley Viaduct, two angled concrete masking walls form a 'sleeve' to the abutment. They are offset from the noise barriers and the top edge is angled to minimise the risk of climbing. The walls are constructed from precast panels with a smooth finish, which will visually contrast with the darker appearance of the noise barriers

Fig.6.50_ Visualisation - View of embankment noise barrier detail

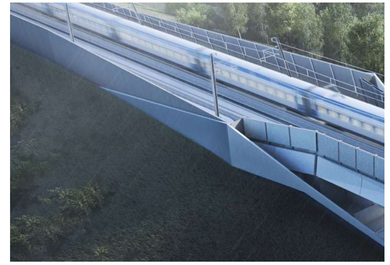


Fig.6.51_ Visualisation - Aerial view of embankment noise barrier and masking wall

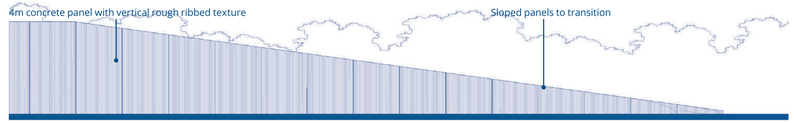


Fig.6.52_ Proposed elevation - North embankment noise barrier transition

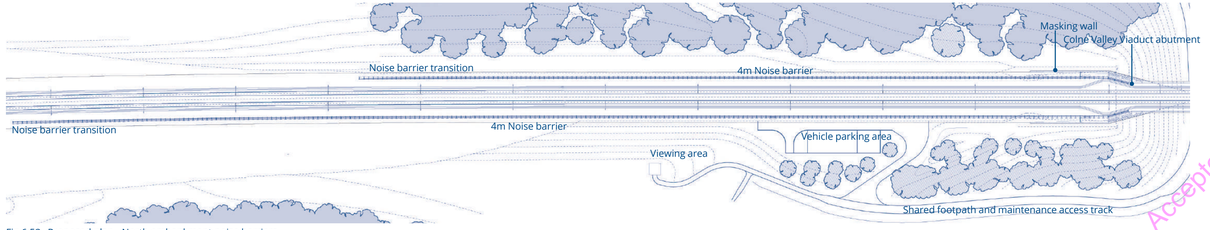


Fig.6.53_ Proposed plan - North embankment noise barriers

Views

6.8.1 Framed views and landscape screening

The portal structures and buildings are designed to be partially screened with landscape earthworks and tree cover to reduce their visibility from long-distance views. Openings in tree cover at specific locations will enable snapshot views to the porous portal and building. In these locations, low level visual clutter associated with rail systems will be screened from view.

Key

- Visibility - high (dark) to low (light)
- Section of visibility
- Vegetation
- 1 Visualisation viewpoints

N

Fig.6.54_ Aerial sketch - Visibility of portal structures and buildings

Fig.6.55_ **Visualisation (2) - View 1 of the compound from the viewing platform (Year 15)**

Views (continued)

6.8.2 Public right of way viewpoint

The visualisations to the right show the view of the south portal structure and compound building from Old Shire Lane, the PRoW path to the south-west, in year 1 and year 15. In year 15 the proposed planting would have achieved substantial growth, providing some screening of the structures from long distance views while creating framed views from closer vantage points.

Key plan

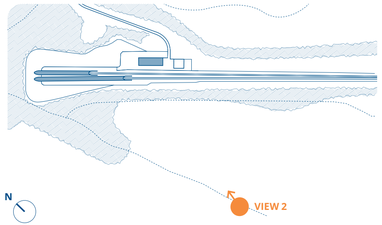


Fig.6.56_ Visualisation (8) - View south of the compound from View 2 (Year 1)

Fig.6.57 Visualisation (8) - View north of the compound from View 2 (Year 15)

Views (continued)

6.8.3 North-west footpath viewpoint

The visualisations to the right show the view of the south portal structure and compound building from the proposed permissive path to the north-east in year 1 and year 15. In year 15 the proposed planting would have achieved substantial growth, enabling snapshot views to the portal structure and building, as well as passing trains, providing a unique and interesting experience for recreational users of the CVWS.

Key plan

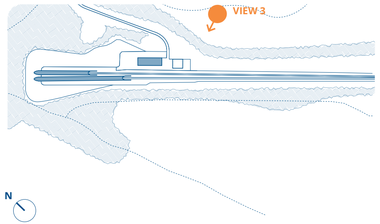


Fig.6.58_ Visualisation (7) - View south of the compound from View 3 (Year 1)

Fig.6.59_ Visualisation (7) - View north of the compound from View 3 (Year 15)

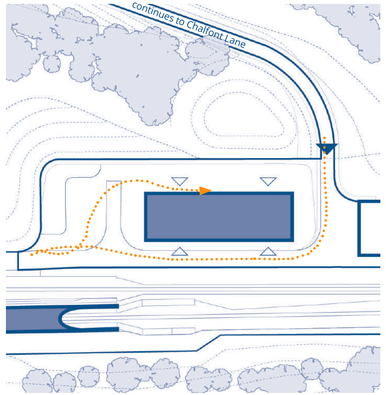


Fig.6.60_ Diagram - Articulated vehicle building ingress

6.9.1 16.5m Articulated vehicle tracking path

This worst-case FTA Design Articulated Vehicle (1998) was tracked right turning into the compound from the access road. The vehicle then described a path around the south west of the building to the north west end of the compound. A reversing manoeuvre is required to track round to the north east side of the building.

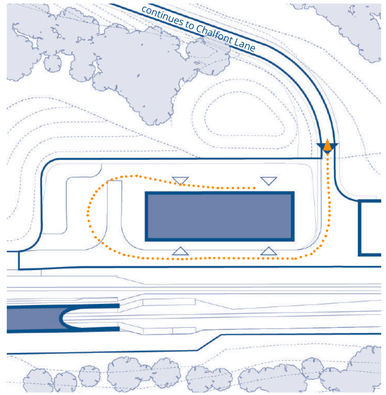


Fig.6.61_ Diagram - Articulated vehicle building egress

6.9.2 16.5m Articulated vehicle egress tracking

To exit the compound the articulated vehicle describes a path anti clockwise around the portal building from the north east side of the compound to exit the compound with no additional reversing manoeuvre.

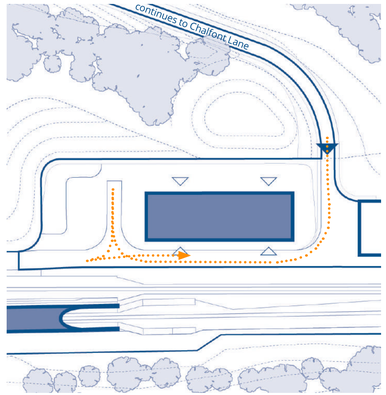


Fig.6.62_ Diagram - Rigid vehicle hammerhead turn

6.9.3 10m Rigid vehicle tracking path

This vehicle was tracked right-turning into the compound from the access road. The vehicle then described a path around the south west of the building to the north west end of the compound. A reversing hammerhead turn manoeuvre is required to exit the compound.

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7.0
Sustainability

Summary of how environmental, social and economic considerations have influenced the design proposals.

7.1 Overview

HS2 Ltd.'s ambition is to build the most sustainable high speed railway of its kind in the world. The HS2 sustainability policy identifies five themes reflecting the economic, environmental and social aspects of sustainability. These are:

- Spreading the benefits: Economic growth and community regeneration
- Opportunities for all: Skills, employment and education
- Safe at heart: Health, safety and well-being
- Respecting our surroundings: Environmental protection and management
- Standing the test of time: Design that is future proof

7.1.2 Sustainability commitments

The Main Works Civil Contracts (MWCC) include specific sustainability related commitments. These include:

- The Infrastructure works will be designed and constructed to meet an aspirational rating of 'Excellent' under BREEAM Infrastructure (Pilot) scheme.
- Develop a carbon management strategy with a carbon reduction target of 50%.

7.1.3 BREEAM Assessment

The design of the HS2 Phase One development is being assessed against the BREEAM New Construction Infrastructure (Pilot) scheme. ALIGN is required by HS2 to ensure that all works under the MWCC C1 contract are fully compliant with the HS2 BREEAM requirements and that the C1 project aspires towards achieving a BREEAM rating of Excellent and a minimum target score of 70%.

The Colne Valley Western Slopes (CVWS) will be assessed as a part of the C1 assessment and its design and construction will aim to meet the target Excellent rating with a score in excess of 70%.

A BREEAM Infrastructure assessment is broken down into a Strategic Assessment and Project Detail Assessment, which includes the design/ interim stage assessment and final/post construction stage.

A single Strategic Assessment has been undertaken by HS2 Ltd for the whole of the HS2 Phase One development. The Strategic credits awarded in this assessment total a score of 20.78%. This will be carried over to the Project Detail Assessment.

The assessment involves meeting best practice sustainability criteria (set out as a series of individual 'credits') across the following categories:

- Integrated Design
- Resilience
- Stakeholders
- Local Well-being
- Transport
- Land use and Ecology
- Landscape and Heritage
- Pollution
- Materials
- Carbon and Energy
- Waste
- Water
- Innovation

Integrated Design

A collaborative and fully integrated design approach has been nurtured from the outset drawing in professional expertise across several design disciplines from within the Align JV and wider stakeholders. Sustainability has been embedded into this integrated design process and BREEAM objectives are captured in all aspects of the design. This approach has been tested as part of the integrated design check (IDC) and integrated design review (IDR) process. The later stages of delivering the project on the ground will utilise expertise within design team to ensure that the intent at the design phase is fully realised at the construction stage.

Resilience

A Climate Change Adaptation & Resilience report has been prepared identifying measures to mitigate and adapt for potential climate impacts. The CVWS is located in an area identified as very low risk of flooding from rivers and low risk from groundwater flooding. There is a low to high risk of flooding in localized areas of the site from surface water runoff in large storm events, there is a risk that runoff from the sides of the valleys may lead to pooling in low lying areas, such as the Tilehouse Lane/A412 junction.

Sustainable drainage systems (SuDS) will be provided with allowance for climate change, in accordance with current best practice planning guidance in order to reduce the risk of surface water flooding. Proposed design includes track drainage and surface water to be drained through a series of attenuation ponds to ensure that the overall discharge from the scheme is restricted to pre-development runoff rates as in the ES/FRA. The ponds will be dry outside of storm events and have been sized to accommodate flows arising during the 100-year return period event (with allowance made for climate change) in order to mitigate against the potential to increase flood risk.

All materials specified for the portal structures and building are highly durable and robust, maximising the design life and ensuring they will age gracefully over time. Highly robust concrete is specified for the portal structure and base of the compound building, where structures are most susceptible to damage.

Responsibility towards Stakeholder

An extensive programme of engagement for the CVWS has been undertaken, which has assisted the design of the structure and landscape. Three public engagement events have been held throughout 2018 and 2019 where the designs were exhibited, and feedback received. The stakeholder engagement will continue as the design develops and throughout construction stage.

The engagement process began with a round of "seeking views and ideas" events across the valley prior to which ALIGN met with key stakeholder groups to warm them up. Four public events were held which were attended by over 700 local residents, and issues discussed were asset designs, recreational activity, traffic and landscaping. During these events residents were asked to rank their priorities for the design of the slopes and provide any comments.

In order to minimise impacts to the local residents, responsible construction practices will be undertaken such as minimising light pollution, noise and vibration and dust. The site will be registered with the Considerate Constructor's Scheme to ensure continual auditing and improvement. Responsible fleet operations are required such as Fleet Operator Recognition Scheme (FORS) silver certification for all construction traffic.

A workforce welfare plan will be developed which will promote sustainable working practices and monitor workforce satisfaction.

Local Well-being

Measures will be identified for creating a positive economic impact. These will include:

- Providing training opportunities that up-skill locally unemployed and other vulnerable groups.
- Contribute to a legacy of enhanced training and skills for local residents and businesses.
- Provide on-site employment during construction and operation of the asset, which will be locally advertised.
- Provide procurement opportunities during construction and operation for products or services. Relevant local businesses will be identified and invited to tender.
- The Stakeholder engagement process has identified a number of high priority items which provide a positive social impact. For the Western Slopes these include the reinstatement of habitat areas, reducing lorry movements on open roads and maintaining a balance between farmland, wildlife habitat and recreation.
- Measures will also be prioritised to reflect the needs of the community taking into account any strategies for the local area; and will be implemented beyond the regulatory minimum.

Transport

Detailed travel and logistics plans have been developed for the construction stage which aim to encourage sustainable modes of transport and movements of materials and people. To reduce impact on local roads during construction, a haul road will be constructed running directly from the main compound at Maple Cross through the Colne Valley, alongside the line of the viaduct.

Permanent assets will include proposed new pedestrian paths will increase connectivity in the local area and open-up previously inaccessible areas.

The transport of construction materials and waste will be monitored to and from site and the data will be recorded to capture carbon emissions.

Land Use & Ecology

Provisions will be made to protect and enhance the local habitat and species of principal importance.

The CVWS represent, by a significant margin, the largest single opportunity for habitat creation and enhancement (and net biodiversity gain) within the C1 section. The entire area of the CVWS will be used to create habitats and increase as much as possible the local biodiversity.

There is a potential to create around 130ha of wildflower and invertebrate-rich calcareous grassland, 'wood pasture', woodland and wetland habitat. This will include the largest area of calcareous grassland in the Chilterns. Elsewhere, large areas of calcareous grassland have been lost due to agricultural practices and with it there has been a major decline in wildlife. By reintroducing this type of grassland to the region will help to increase local wildflowers, bumblebees, butterflies and other rare species. The CVWS will provide the largest single contributors to net biodiversity gain on the HS2 route, with a potential 8% net gain within C1 contract area.

Landscape & heritage

The CVWS landscape design will aim to ensure the character of the landscape is respected and, where possible, enhanced through the location of features and design appropriate to the local environment. The habitats created for the CVWS will reflect and enhance the existing landscape and ecological character of the adjacent Colne Valley and Chilterns Hills. It will consist of complex and functional mosaic of semi-natural habitats providing multiple benefits for wildlife, landscape and amenity.

The landscape design will aim to mitigate the visual impact of the railway and reinstate the existing valley form once the construction compounds have been removed. The project goal is to reuse the soils and materials excavated in the project in the CVWS area for the landscape remediation works.

The design will create an area that also brings benefit to the public by the reinstatement of Public Rights of Way and Bridleways, remodelling of Tilehouse Lane, and the creation of viewing platforms.

The development will aim to minimise any impacts on the archaeological and heritage assets. All archaeological remains in the CVWS area, which may be affected by the construction works were subject to archaeological evaluation through test pitting and trial trenching. Where required, this was followed by archaeological mitigation. Areas identified included Late Bronze Age to Early Iron Age remains and an Early Iron Age cremation burial to the south of Tilehouse Lane.

At the South Portal, evaluation identified extensive archaeological remains including Romano-British enclosure ditches, post-medieval trackways and large quarry pits. An extension to the excavation area was undertaken and the area was subject to strip, map and sample strategy as mitigation. A post-medieval kiln was also found at West Hyde and was also recorded and excavated.

Within the Colne Valley area there are a number of designated historic buildings. None of these structures are directly affected by the scheme.

7.1.3 BREEAM Assessment (continued)

Pollution

Air quality is unlikely to be affected as a part of the CVWS design, with any potential impacts occurring during the construction process as a result of top soils stripping, temporary material stockpiles and increased lorry movement. However, mitigation measures for dust suppression will be implemented.

All non-road mobile machinery engines will be required to comply with current versions of EU Directive Staged Emission Standards (97/68/EC).

Minimising pollution of watercourses and groundwater is one of the highest priorities of the project as the CVWS site is over a Principal Aquifer and before breaking ground consent is required from Affinity Water and the Environment Agency. All activities will be subject to management and control as well as regular monitoring. Landscape earthworks will be compacted when laid and most rainfall will runoff the surface to infiltration ponds. All appropriate consents will be in place from the Environment Agency where required (either through Schedule 33 to the HS2 Act, or as part of the Environmental Permitting Regime).

The CVWS design will aim for the operational noise and vibration to be less than the Significant observed adverse effect level (SOAEL) through the use of appropriate design and noise reduction measures. This has been demonstrated in the noise demonstration report provided with the Schedule 17 request for approval ref: 1MC05-ALJ-TP-REP-CS02_CL03-000010. In order to protect against both airborne and impact noise sources, landscape earthworks will provide acoustic screening with noise barriers being provided to mitigate effects on Tilehouse Lane. During construction, on-site mitigation measures and Best Practical Means will be employed and section 61 consents will be sought under the Control of Pollution Act 1974. The Environmental Health Officers for both Buckinghamshire Council and Three Rivers District will be kept fully informed during the works, including through the use of Statements of Intent for minor works. Light pollution will be minimised for the temporary lighting on the CVWS during construction. The lighting will be directed onto the site, away from the sky, dwellings and areas containing wildlife and will be in line with the measures contained in the HS2 Class Approval.

Materials

A life cycle assessment has been calculated to determine materials with lower embedded carbon to be included in the design. This has been based on the Bill of Quantities (BoQ) provided for the design.

Environmental Product Declarations will be required for key products with high embedded carbon but essential to the development such as concrete, steel rebar and lime. The EPDs provide environmental information for the product from extraction, through manufacture, distribution to end-of-life.

A Sustainable Procurement Plan has been prepared to make sure all major materials including for the temporary works will be responsibly sourced. Discussions have taken place with suppliers to make sure both EPDs and BES 6001 certification can be provided.

In addition, the HS2 guidance for procurement of planting stock sets out the project-wide approach to climate change and disease resilience. It follows inter alia:

- Advice from Natural England and the Forestry Commission that 1/3 of all planting stock should be from the same region of provenance as the site, 1/3 from up to 2° latitude south of the site and 1/3 from 2-5 ° latitude of the site to increase resilience to climate change (with some exceptions in relation to ancient woodland compensation and planting in areas such as Sites of Special Scientific Interest (SSSIs)); and
- Specifies that all planting stock is obtained from nurseries that follow best practice in bio-security and plant quarantines to minimise the risk of spreading disease
- The volume of concrete required for the construction of the portal structures has been minimised where possible. The specification of concrete will include a proportion of ground-granulated blast-furnace slag (GGBS), to achieve high levels of durability and strength. GGBS is obtained by quenching molten iron slag from a blast furnace in water or steam, to produce a granular product that is then dried and ground into a fine powder. As a by-product of the steel manufacturing process, the use of GGBS in concrete provides environmental benefits.

Carbon & Energy

A baseline and design stage carbon assessment has been undertaken for the C1 scope of works. The design assessment was based on the Bill of Quantities (BoQ) available for the design in October 2019.

The assessment considers the carbon footprint over the life-cycle of the asset, including material production (A1-A3), transport of materials to site (A4), construction (A5), maintenance (B2) and replacement (B4).

The scope of the assessment for this document includes the following assets:

- Tilehouse Lane Cutting
- West Hyde Embankment
- Tilehouse Lane Overbridge
- Shire Lane Culvert
- West Hyde ATS
- South Portal
- Chiltern Tunnel South Cutting

The baseline and preliminary design carbon footprints are reported in the table below for each asset:

Asset (%)	Base carbon (tCO2e)	Design carbon (tCO2e)	Reduction
Tilehouse Lane Cutting	15,135	15,135	0%
West Hyde Embankment	190,850	190,432	-0.3%
Tilehouse Lane Overbridge	778	559	-28.1%
Shire Lane Culvert	959	477	-50.3%
West Hyde ATS	18,566	18,566	0%
South Portal	19,575	12,585	-35.7%
Chiltern Tunnel South Cutting	2,408	2,408	0%

The design stage earthworks data, which includes the quantities of material that will be excavated and treated for reuse on site, has been used for both the baseline and design carbon assessment. This is due to a lack of data available for the baseline earthworks quantities. This has resulted in a 0% carbon reduction for some assets which comprise of earthworks activities only including Tilehouse Lane Cutting, West Hyde ATS and Chiltern Tunnel South Cutting. The assessment does not include the removal of the Heathrow Spur which would be expected to yield a further carbon reduction between the baseline and design stage assessment.

The key carbon reductions for the remaining assets are as follows:

- West Hyde Embankment – small reduction from use of GGBS in concrete mixes
- Tilehouse Lane Overbridge – reduction from use of GGBS in concrete mixes
- Shire Lane Culvert – reduction in volume of concrete from reduced size of the culvert (630m to 28m)
- South Portal – reduction in volume of concrete and steel for the portals due to reduction in size of portal and size if base slab

Carbon sequestration happens in soils when the plant life above ground absorbs carbon dioxide through photosynthesis. Plants are formed of organic vegetative material which dies back outside of the growing season, decomposes and forms topsoil. Carbon is added to the soil year after year up to a point where no further carbon can be stored.

The assessment assumed the soil carbon capacity was reached over 40 years after creation of the habitat, based on information from available studies. The sequestration per type of habitat was used with the baseline habitat assumed to be 'agriculture'. The carbon impacts associated with the materials include embodied carbon of materials, transportation of materials to site, reprocessing of materials and the emission from plant and equipment used to place materials on site.

The table below shows the outcome of carbon sequestration and carbon impacts derived from the planting and soil/ substrate treatments described in Section 5

	Unit	Totals
Carbon Sequestration	tCO2e	-54,317
Carbon Impacts	tCO2e	719

In conclusion, the benefits from the additional sequestration of soil carbon outweigh the carbon impacts from the additional materials and/or reprocessing of available materials.

Waste

A waste management plan has been produced covering all non-hazardous construction waste. The plan applies the waste hierarchy in relation to the reduction and sustainable management of solid waste generated from the design and construction of the Proposed Scheme.

The project aims to divert up to 95% (tonnage) of construction waste from landfill and divert 95% excavated material for beneficial reuse on site. The CVWS has been identified as a key area for incorporating the material excavated from the Chiltern Tunnels. The material from the tunnels will be processed on site at a slurry treatment plant and will comprise of a 'cake' material, which will be treated with lime and/or cement. This will be incorporated into the landscape earthworks.

Water

The development aims to adopt efficient ways to use water during the construction and operation of CVWS. Measures to reduce water consumption and reuse where possible is being considered during the construction process. The construction site drainage at the South Portal compound has been designed to consider reuse of treated surface water where possible and the collection and use of rain water. The land runoff, roof runoff and runoff from hard surfaces will be collected and routed to the on-site attenuation and treatment system. This water can then be directed for use in different areas of the construction works such as wheel washing, the tunnel boring machines and the slurry treatment plant. The water treatment plant at the worksite will operate under Environmental Permits to be obtained from the Environment Agency. The permanent design has attenuated rates and volumes of runoff to prevent any increases in off site rates and volumes when compared to the existing situation, in line with both HS2 technical standards and best practice.

Innovation

Innovation has been key to achieving a design that meets design requirements and stakeholder aspirations, whilst also achieving all technical, operational and environmental standards. This design approach can be exemplified by the portal structure which has been designed to meet acoustic requirements and withstand high levels of fatigue from passing trains. To achieve this, iterative acoustic and aerodynamic modelling was used to inform the portal geometry and arrangement, resulting is a structure that is both expressive of it function and responsive to its sensitive context.

HS2 Sustainability Goals

7.2.1 Design response summary

HS2 sustainability goals have been key drivers throughout the design process. The design responses are outlined below:

Safe at heart

Landscape Design

- New recreational routes to provide safe and level access where possible.
- Vehicle access controlled at the A412 and Chalfont Lane entrances.
- Slope angles are as gentle as possible to facilitate landscape maintenance operations.
- Provision of appropriate fencing and wayfinding to keep as a means to control access.
- Passive surveillance promoted by increasing access to the landscape

Building and Structures Design

- Constructability ensured through integrated team
- Design maintains the same roof shape for single formwork, with just vertical wall height varied to achieve cross sectional area change required
- Regular HAZID reviews with maintainer as well as CDM reviews
- Design developed with local Fire Brigades through regular Qualitative Design Reviews
- Bollard Protection of portal building structure
- Hostile Vehicle solution integrated in the landscape design

Respect our surroundings

Landscape Design

- Landscape strategy responds to local landscape character.
- Minimising tree loss where possible.
- New pedestrian routes to enhance amenity and recreational access.
- Design balances land use and access provision with protection of new (and potentially sensitive) habitats.
- Maximising biodiversity value in response to context.
- Addresses flood risk through integrated landscape features.

Building and Structures Design

- Design is highly contextual in its response to character areas and the location of special structures at key site features.
- Preservation of expansive landscape views.
- Protection of the community from noise through noise mitigation measures.
- Minimising the volume of concrete required, reducing carbon impact.
- Construction strategy minimises impact on local community and environment.
- Minimising use of local roads by locating construction compound next to the M25.

Standing the test of time

Landscape design

- Re-purposing of construction materials (concrete and limestone) within soil profiles
- Low intensity management regimes adopting principles of rewilding to create a dynamic and flexible landscape
- Maximising long-term biodiversity through resilient habitat creation.
- Low maintenance / robust planting to minimise future management.
- Climate change adaptation and resilience informing planting and seeding specifications.
- Adoption of natural drainage processes as far as practicable to protect against flood

Building and Structures Design

- Simple yet distinctive design achieves a timeless aesthetic
- Use of robust, durable and low maintenance materials throughout
- Ease of maintenance components
- Low maintenance/ robust planting to minimise future management
- Climate change adaptation and resilience informing planting specifications

Spreading the benefits

Economic growth and community regeneration

Being a catalyst for regeneration and economic growth across the UK, maximising the benefits to communities and individuals and minimising the negative impacts

Opportunities for all

Skills, employment and education

Providing rewarding jobs and careers that are open to all in society, setting new standards for equality, diversity and inclusion and providing a legacy of skills, learning, expertise and experience

Safe at heart

Health, safety and well-being

Creating a world-class 'safe at heart' culture where no one gets hurt, and which prioritises the health and well-being of those who build, operate, use and host HS2 services and infrastructure

Respecting our surroundings

Environmental protection and management

Being a catalyst for breaking new ground wherever possible on environmental standards including resource use, waste, carbon minimisation, the protection of the natural and historic environment and safeguarding communities.

Standing the test of time

Design that is future-proof

Designing a network that is resilient to climate change, adaptable to future trends and demands, and built around the needs of the people who will use it.

Fig.7.1_ HS2 sustainability goals

8.0
Engagement

Summary of the various methods and results of engagement with local authorities, stakeholders, the local community and the HS2 Independent Design Panel undertaken to date.

Engagement Process

8.1

8.1.1 Overview

This section outlines the engagement that has taken place with the LPAs and statutory consultees, as well as the ongoing programme of public engagement.

ALIGN JV has worked closely with key stakeholders to understand concerns and to seek views and ideas to help develop the design the landscape and ecological features (including the management approach), earthworks, portal structures and the realignment of Tilehouse Lane, as well as the construction methodology.

The key stakeholders engaged during the design process to date include:

- LPAs including Hertfordshire County Council, Three Rivers District Council and Buckinghamshire Council;
- HS2 Ltd Independent Design Panel;
- Colne Valley Regional Park Panel;
- Historic England;
- Natural England;
- Environment Agency;
- Hertfordshire and Middlesex Wildlife Trust; and
- Local communities and the wider public.

For a detailed account of the engagement process and outcomes please refer to the Written Statement (1MC05-ALJ-TP-REP-CS02_CL03-000007) and the HS2 Independent Design Panel Report submitted as part of these Schedule 17 request for approvals.

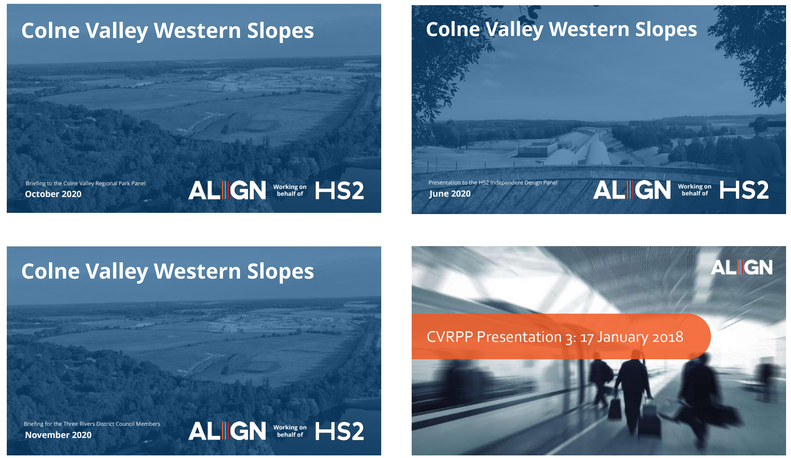

Fig.8.1_ Selection of stakeholder presentations/ workshops

Stakeholder Engagement

8.2

8.2.1 Stakeholder engagement overview

A series of design presentations and workshops has been held with Hertfordshire County Council, Three Rivers District Council and Buckinghamshire Council during relevant stages of the design progression including at Scheme Design (August 2017 – August 2018) and Detailed Design (January 2019 – December 2020).

Engagement meetings have intensified between June 2020 and December 2020 as part of a formal pre-application process and have been widened to include separate sessions with the CVRP Panel and Three Rivers Council Members.

These workshops have covered a wide range of topic areas including, but not limited to, drainage and highways elements and separate components of the landscape and ecology design including *inter alia* rights of way, fencing and boundary treatment, planting and softworks, soil treatment, and the landscape and ecological management approach. The matters for discussion and responses and feedback are documented in the Written Statement (1MC05-ALJ-TP-REP-CS02_CL03-000007).

The ALIGN JV design team has also engaged extensively with the Hertfordshire and Middlesex Wildlife Trust and has actively sought expert advice on matters of landscape and ecological design including biodiversity gain, habitat creation, and long term management approaches adopting low intensity intervention and re-wilding principles. We have also sought expert advice from Natural England on similar matters as applicable.

Notwithstanding matters of concern on aspects of detail, the response from stakeholders has generally been supportive in terms of the broad aspirations for habitat creation, biodiversity gain, landscape and ecological mitigation and promotion of a positive and integrated visitor experience; there has also been support for the approach to the design of the key buildings and structures at the south portal.

8.2.2 HS2 Independent Design Panel

The HS2 IDP has been involved at key stages of the design process and has provided guidance on the portal structures and the wider landscape and ecological proposals. The most recent presentations and feedback occurred in June 2020 – the IDP report received in response to the latest round of engagement is provided in the Appendices of this DAS (Section 10.1) with additional commentary provided in the Written Statement (1MC05-ALJ-TP-REP-CS02_CL03-000007).

Fig.8.2_ Selection of presentation slides from the HS2 Ltd IDP presentation

Public Engagement

8.3.1 Overview

In accordance with HS2 Information Paper D1 and the HS2 Community Engagement Strategy, a series of engagement events were held in 2018. This will be followed up with 'You Said, We Did' (YSWD) events in 2021.

The initial round of public engagement comprised four public events, held in spring 2018, which provided an opportunity for the local communities to view initial design proposals for the Colne Valley area, including the Chiltern Tunnel south portal and the CVWS. The event also focussed on the design of the Colne Valley Viaduct.

Local communities and the wider public were invited to provide views and ideas on the following areas of design:

- Landscape and ecological design for the CVWS;
- Recreational Opportunities;
- Tunnel Portal Design;
- Noise Barriers; and
- Construction.

A selection of the consultation panels are illustrated in Figures 8.3 - 8.6.

Responses were sought at the 2018 events with questionnaires asking responders to comment on and prioritise our key design objectives comprising recreational activities, the portal structures and the long-term land management of the CVWS. The full questionnaire, an online link to the panels, as well as the results, are contained in the Feedback from public engagement - CVV and Tunnel Portal report (ref: 1MC05-ALJ-SE-REP-C001-000001) submitted for information alongside these Schedule 17 request for approvals.

Several key themes emerged as part of the initial round of consultation which have informed how the design has progressed. These included but were not limited to:

- The importance of the 'visual outlook' including maintaining views across the valley
- Use of landform to help minimise noise impacts
- Consideration of the size of plants specified within our proposals
- Increase the extent of tree planting
- Ensure that habitats are connected
- Consider screening the railway
- The importance of 'sensitive' land shaping
- Ensure built proposals are integrated with the landscape
- Extend the tunnel further to mitigate its visual performance.

Fig.8.3_ Engagement boards - Landscape and context

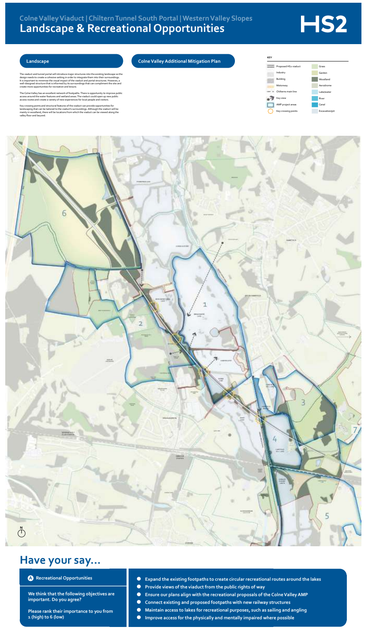

Fig.8.4_ Engagement boards - Landscape and recreational opportunities

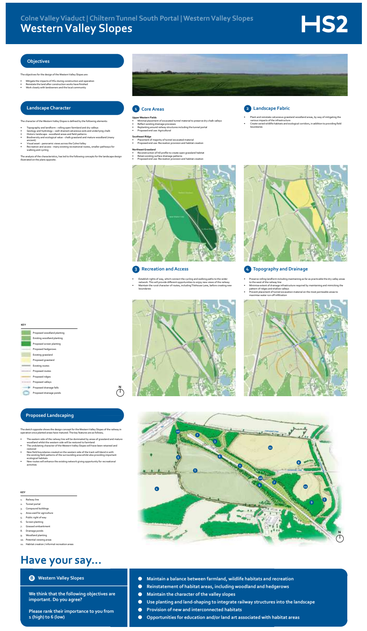

Fig.8.5_ Engagement boards - Western Valley Slopes

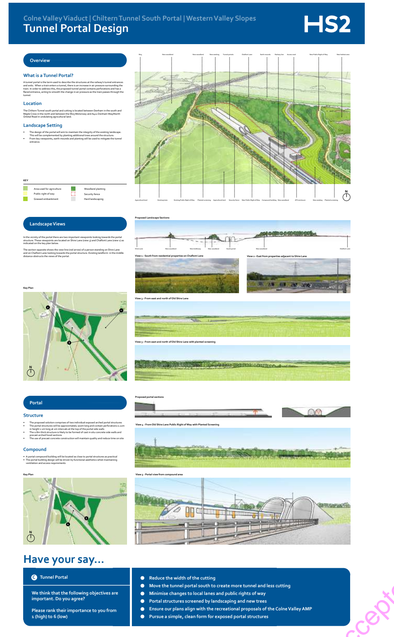

Fig.8.6_ Engagement boards - Tunnel portal design

Public Engagement

8.3

8.3.2 You said, we did event

A subsequent 'You said, we did' (YSWD) online public event will be held in March 2021 to provide feedback on how we have taken forward the comments and suggestions received in the early engagement. This also provides opportunity to give information on broader changes to the design (since 2018) which includes:

- Expanding the extent of habitat creation to include land to the west of the railway;
- Refinement of planting areas and habitat mosaics;
- Modelling of landform and placement of materials;
- Integration of cattle management 'infrastructure';
- Further thought given to visitor experience including expanding PRoW (alignment with AMP aspirations); and
- Changes to the location and alignment of the Chilterns Tunnel south portal.

Early drafts of some of the YSWD boards are provided for information in this version of the DAS (refer to Figure 8.7).

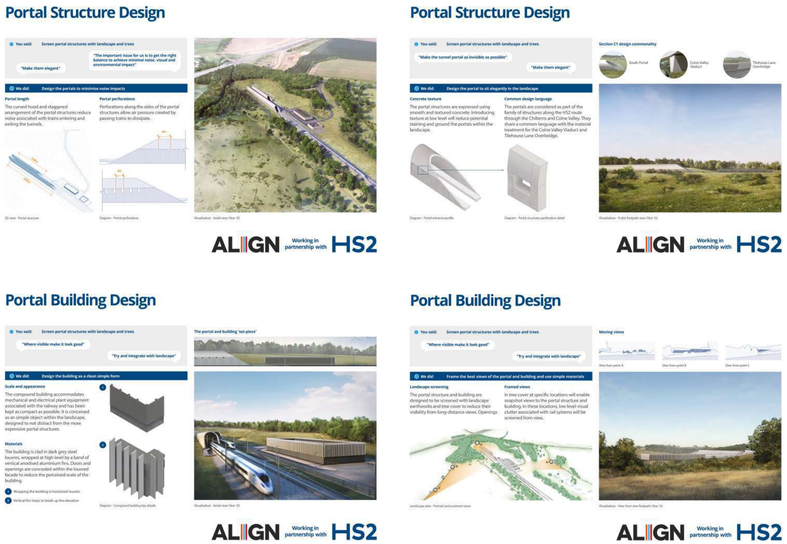

Fig.8.7_ Selection of draft YSWD engagement boards

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9.0
Summary

This section summarises the Design and Access Statement and provides an overall conclusion.

Summary and Conclusion

9.1.1 Design summary

The Colne Valley Western Slopes represent one of the most important opportunities along the entire HS2 Phase 1 route for large scale and transformational environmental change. The design is underpinned by ambition to create an exceptional, biodiverse landscape which is fully integrated with and connected to its wider context and setting; is resilient and adaptable; can be managed in innovative and sustainable ways; and is enduring to secure a meaningful legacy.

The CVWS masterplan draws together the component parts of the landscape and ecological design; the earthworks design; the buildings and structures; and ancillary infrastructure including drainage and highways. For each of these elements, the proposals address technical challenges; respond to commitments and obligations set by the Act including mitigation of effects; and incorporate HS2's design and operational standards.

The landscape and ecological design will create almost 140ha of high value habitat reflective of a chalk downland mosaic of tree-lined ridges, wood pasture and scrub set within extensive areas of calcareous grassland. This new landscape is inspired by its environmental context and expresses a logical transition between the deeply wooded valley floor to the east and the undulating landscape of the Chilterns Hills to the west.

The creation of optimal soil and substrate conditions is critical and consideration has been given to all stages of the process including stripping, storage and re-profiling; this includes an innovative solution incorporating tunnel arisings and temporary works materials (concrete and limestone aggregates) within soil profiles. A research project has been commissioned to support this process and de-risk outcomes.

Restoration of the site will require significant reprofiling of the landform and incorporation of approximately 3million m^3 of tunnel arisings. The proposals aim to replicate the existing character of dry valleys and ridges to provide a contextually appropriate solution and in turn create flow paths for surface water which are broadly akin to the existing drainage pattern. Variations in the ground profile have been used to recreate the sunken character of Tilehouse Lane; to provide noise mitigation; and to create areas of wetland habitat.

The management of the land after it is restored is also critical and measures (including key infrastructure) have been built into the design to facilitate a future management approach which is predicated on low maintenance and free roaming cattle grazing. Work will continue (supported by expert advisors as necessary) to finesse the management approach.

The CVWS is already connected into its surroundings by an existing footpath network. The masterplan will introduce approximately 4km of new footpaths, bridleways and cycle routes alongside upgrades to existing paths. These routes have been designed to meet specific user requirements and will form part of a wider series of routes provided by HS2 in the C1 Section. In addition, 'feature' areas have been created in strategic locations to allow visitors to view the railway. Future land art commissions are being progressed to further enrich the visitor experience.

The site supports key built structures including the Chiltern Tunnel south portal which is a Key Design Element. The portals adopt a simple sculptural form which is expressive of function and fully integrated within its landscape setting. There is commonality in design and materiality with nearby structures including the Tilehouse Lane overbridge and the Colne Valley Viaduct.

Image credit: Charles J Sharp, CC BY-SA via Wikimedia Commons

Fig.9.1_ Photograph - Chalkhill blue butterfly *Polyommatus coridon*

9.1.2 Design conclusion

The proposed design for the CVWS achieves the briefing criteria set out in Section 3 of this DAS; including the HS2 core design principles and goals, a host of demanding technical and operational requirements, the environmental requirements, and commitments set out in the HS2 Act.

The design is predicated on a compelling narrative about landscape scale change which when implemented will contribute positively to much broader challenges including climate change and biodiversity resilience; sustainable use of natural resources; health and well-being; importance of place, community and identity; and working with nature and natural processes to craft a landscape which will endure. The design is fully grounded in the practicalities of delivery and long term management and strikes a balance between public amenity, operational requirements for the railway and protection of nature.

The design has been developed in close collaboration with stakeholders including Buckinghamshire Council, Three Rivers District Council and Hertfordshire County Council, as well as Natural England and the Hertfordshire and Middlesex Wildlife Trust.

The proposed CVWS design, in a form ready for Schedule 17 submission, was presented to the HS2 IDP on 10 June 2020 and their subsequent report is included in Appendices Section 10.1. The report states that the HS2 IDP welcomes the design team's overall approach and the focus on delivering public access and ecological gain. It is excited by the potential of the proposed reintroduction of calcareous grassland and while acknowledging inherent risks in the preparation of soils (using construction aggregates as necessary), considers the risk is worth taking, especially as the team has alternative strategies in place. The ecological benefit, it notes, would be significant, and rewilding the area would represent an important achievement for which the IDP congratulates Align and HS2 Ltd on this innovative approach.

The panel also found much to admire in the designs for the portal structures and the portal building, and supports their proposed form, materials and detailing, which it considers meet the requirements of the HS2 Design Vision and the Sustainability Approach.

The IDP made several recommendations and these have been adopted in the final design where practicable and achievable. A summary of the recommendations and the designer's response is as follows:

Recommendation 1:

Consideration should be given to extending ecological connectivity across the railway (including the potential for a green bridge).

Designer's response:

The design provides an appropriate level of ecological connectivity across the railway without the need for a green bridge. This includes connected grassland and woodland habitat across the top of the Chiltern Tunnels southern portal and beneath the viaduct at the southern end of the site. A mammal shelf has also been designed into the culvert beneath the railway to provide a safe crossing point. Details are provided in Section 5.4 of the DAS.

Recommendation 2:

Opportunities are explored to combine drainage systems.

Designer's response:

The drainage systems are required by HS2 Technical Standards to be separated. If these were combined into a single location (by way of a departure) the size of the combined basins would be of a significant scale and incongruous with the overall design intent to create gentle slope profiles and shallow subtle valleys.

Recommendation 3:

A high quality design approach is maintained for the ATS building (which will come forward in future submissions) demonstrating integration with the portal buildings.

Designer's response:

Noted; this approach and intent will be incorporated into subsequent submissions.

Recommendation 4:

The earthworks design is presented in the context of the wider landscape using visualisations to illustrate this.

Designer's response:

Noted; this has been adopted and presented in visualisations and plans throughout the DAS.

Recommendation 5:

Aspects of the design of the viewing areas be explored, including the potential for involvement of an artist.

Designer's response:

Noted; the detailing of the viewing areas has been considered further and the potential for involvement of artists is set out Section 5.8 of the DAS.

Recommendation 6:

The Arts Strategy commission forms an inherent part of the overall design approach.

Designer's response:

Noted; details are provided in Section 5.8 of the DAS.

Recommendation 7:

Further information is provided to assess the landscape proposals against the requirements of the HS2 Sustainability Approach.

Designer's response:

Noted; details are provided in Section 7.0 of the DAS.

To summarise our ALIGN JV wishes to thank all stakeholders, the LPAs, members of the community, the wider general public and the HS2 IDP for their views, ideas and feedback, and look forward to continuing to work closely with them on the future stages of the project.

Fig.9.2_ Photograph_Calcareous grassland

Fig.9.3_ Visualisation (14)

Fig.9.6_ Visualisation (2)

Fig.9.9_ Visualisation (11)

Fig.9.4_ Visualisation (3)

Fig.9.7_ Visualisation (4)

Fig.9.10_ Visualisation (7)

Fig.9.5_ Visualisation (5)

Fig.9.8_ Visualisation (6)

Fig.9.11_ Visualisation (12)

Fig.9.12_ Visualisation (1)

10.0 Appendices

This section comprises the IDP Report; the list of Schedule 17 request for approvals Reference documents and drawings; and a list of the Figures included in the Design and Access Statement

HS2 Independent Design Panel Report

10.1.1 HS2 IDP report

the following section sets out the full transcript of the IDP report, dated 10 June 2020.

HS2 INDEPENDENT DESIGN PANEL

REPORT

HS2 Design Panel Meeting to discuss the Schedule 17 stage designs for Chiltern Tunnel south portal (western valley slopes)

14.00 – 16.00 Wednesday 10 June 2020
Via Microsoft Teams

HS2 Independent Design Panel

Tony Burton (chair)
Harbinder Birdi
Kathryn Moore
Martin Stockley

Attendees

Steve Austin	Town Planning Manager, HS2 Ltd
Mark Clapp	Senior Project Manager Area Central, HS2 Ltd
James Dearing	Design Manager, HS2 Ltd
Blake Edmunds	Senior Environment Manager, HS2 Ltd
James Glynn	Senior Town Planning Manager Central, HS2 Ltd
Robert Howard	Landscape Design Manager Central, HS2 Ltd
Kevin Roberts	Lead Senior Project Engineer, HS2 Ltd
Tom Podd	Town Planning Manager, HS2 Ltd
Alan Price	Design Director, Align JV
Leigh Crowhurst	Landscape Architect, Align JV
Matt Hobbs	Align JV
Diane Metcalfe	Architect, Align JV
Chris Patience	Architect, Align JV
Simon Railton	Landscape Architect, Align JV
Ben Benatt	Align JV
David Costello	Align JV
Chris Chantler	Align JV
Ben Northover	Align JV
Jo Cullis	Associate Director, Align JV
John Woodhouse	Senior Planning Consultant, Align JV
Jenny Foster	Hertfordshire County Council
Jennifer Owen	Hertfordshire County Council
Saeed Mahmood	Buckinghamshire Council
Richard Hannay	Landscape consultant, Buckinghamshire Council

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Delivered by Frame Projects

Edward Bailey	Frame Projects
Tom Bolton	Frame Projects

Apologies / copied to

Adam Ralton	Three Rivers District Council
Martin Short	Lead Architect, HS2 Ltd
Kay Hughes	Design Director, HS2 Ltd
Billy Ahluwalia	Senior Project Manager, HS2 Ltd
Matt Dormer	Town Planning Lead Phase One, HS2 Ltd
Bernadette Hurd	Head of Benefits, HS2 Ltd
Chelsea Evans	Apprentice Project Manager, HS2 Ltd
Clive Green	Senior Communications Manager, HS2 Ltd
Giles Thomas	Phase One Engineering Director, HS2 Ltd
Nicole Linney	PA to Design Director, HS2 Ltd
Paul Gilfedder	Head of Town Planning, HS2 Ltd
Zoe Stewart	Lead Design Manager, HS2 Ltd
Design Inbox	HS2 Ltd

Note on Design Panel process

The HS2 Independent Design Panel was established in 2015 at the request of the Department for Transport, to help ensure that, through great design, HS2 delivers real economic, social and environmental benefits for the whole country.

The HS2 Design Vision sets out nine principles grouped around three themes: People; Place; and Time. The design uses this framework to help the HS2 Ltd leadership, project teams and other partners to make the right design choices – and this also informs its advice on designs that are to be submitted under Schedule 17 of the High Speed Rail (London – West Midlands) Act 2017.

The panel plays an advisory role, providing impartial and objective advice, to support the design process. At a pre-application stage it is for HS2 Ltd to decide what weight to place on the panel's comments balanced with other considerations. Once a Schedule 17 application is submitted, the panel's advice may inform the local planning authority's decision making process.

Further details of panel membership and process are available at:
https://www.gov.uk/government/publications/hs2-design-panel

The HS2 Design Vision is available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/607020/HS2_Design_Vision_Booklet.pdf

The HS2 Independent Design Panel comments below follow on from four pre-application reviews of the Chiltern Tunnel South Portal.

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Timing of Schedule 17 meeting

This meeting took place in advance of a Schedule 17 submission for the Chiltern Tunnel South Portal. Align intends to submit one Schedule 17 request for approval incorporating the Western Valley Slopes landscaping earthworks, the Chiltern Tunnel south portal and building, and the Tilehouse Lane Realignment to be submitted in Autumn 2020 to Three Rivers District Council (TRDC). Due to the proposals extending over two local authorities (TRDC and Buckinghamshire Council), a separate Schedule 17 request for approval for the portion of the landscaping earthworks within Buckinghamshire Council will also be made at this time.

A future schedule 17 submission will be made regarding the mitigation proposals and detailed landscape design, these will be formalised in later 'site restoration' and 'bringing into use' submissions.

The ATS building, to be located adjacent to the portal building, forms part of a separate contract and approval process.

HS2 Ltd indicates that it is satisfied that the proposal would meet the aspirations of the HS2 Design Vision and the Sustainability Approach.

[Post meeting note: HS2 Ltd have advised that the intention is to hold an additional Schedule 17 stage design panel meeting prior to the Schedule 17 submission being made in Autumn 2020.]

Local planning authority views

Three Rivers District Council (TRDC) is the consenting authority for the Key Design Element (KDE) Chiltern Tunnel south portal, the portal building, and for the majority of the area known as the Western Valley Slopes. TRDC has worked with Hertfordshire County Council (HCC) on all matters relating to HS2-related Schedule 17 consents.

The councils have been involved throughout in discussions with HS2 Ltd, the Colne Valley Regional Park Panel (CVRPP) and the neighbouring authorities (now amalgamated as Buckinghamshire Council). TRDC and HCC consider the proposed designs to be exciting and positive. As some material presented is illustrative, they ask for assurance on the delivery of proposed approach, including identification of guiding masterplanning principles. They also ask for more information on the nature of the viewing points presented, to understand whether they are accurate and the nature of the view they offer is realistic, and on the view from the train. They would like clarity on the status of the portal building visualisations, and ask that the design of the Tilehouse Lane overbridge and the ATS building are of the same quality.

The councils support plans to create new calcareous grassland, delivering huge ecological gain, although they have concerns over whether it can be delivered. They feel that more attention should be given to the relationship of the landscape design to the wider landscape context, including the Colne Valley Regional Park. They hope that the

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final Schedule 17 submission will include a detailed landscape narrative, demonstrating how the materials and landscape on the site are integrated with their surroundings and confidence that visualisations provide an accurate picture of this context. They would welcome future detail on how the landscape strategy will approach place-making, and establishment and maintenance of landscape, and designing out of crime. Both councils look forward to continuing to work with HS2 and Align on the evolving design.

HS2 Independent Design Panel's views

Summary

The panel considers that the Schedule 17 stage proposals for the Chiltern Tunnel south portal building, and landscape earthworks meet the aspirations of the HS2 Design Vision - subject to the design quality presented being maintained through detailed design and construction. The panel supports the team's intention to include indicative information on the landscape as part of the Schedule 17 submission. It welcomes the design team's overall approach and the focus on delivering public access and ecological gain. The extension of landscape design work to include the Western Valley Slopes is also positive. The panel supports the proposals to embrace a long-term management approach, and to rewild the area as calcareous grassland. It suggests this ambition could be expanded in two areas: by extending ecological connectivity between the two sides of the railway, and by exploring opportunities to combine the two separate drainage systems proposed. It will be important that the Schedule 17 submission clearly shows how the landform of the site relates to the wider Colne Valley Regional Park setting. The panel finds much to admire in designs for the portal structures and the portal building, which it considers meet the requirements of the HS2 Design Vision and the Sustainability Approach. The panel understands that the ATS building will form part of a separate contract, but highlights the importance of this being integrated with the design for the portal building, and also meeting the same design quality standards. The ambition to create public access to the site, and to introduce viewing platforms is also strongly supported. The panel does not yet consider it has received sufficient information to assess the landscape proposals against the requirements of the HS2 Sustainability Approach. These comments are expanded below.

Portal structures, portal building and Tilehouse Lane Bridge

The panel finds much to admire in the designs for the portal structures and the portal building, and supports their proposed form, materials and detailing.

The panel saw limited information on the designs for Tilehouse Lane Bridge. It is not clear the extent to which this will form a part of the Schedule 17 submission. The panel suggests the team explore opportunities for the bridge to contribute to ecological connectivity, for example as a green bridge. *[Post meeting note: HS2 Ltd have advised that the Schedule 17 proposals for Tilehouse Lane Bridge have been approved as part of an earlier submission to the local planning authority].*

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ATS building

The panel appreciates that the ATS building lies outside Align's remit and scope of this Schedule 17 submission. However, it will be important that it is integrated with the design approach taken for the other structures, south portal and portal building, and that it matches their design quality. This structure is prominent in views of the portal and will have a huge influence on the ultimate success of these proposals, and the panel asks for reassurance on how Align and HS2 Ltd will work together to achieve this.

Landscape approach

The panel is excited by the potential of the proposed reintroduction of calcareous grassland as the site restoration strategy. It acknowledges the inherent risk in applying an unusual approach, using chalk cake made from stabilised chalk slurry extracted during tunnelling, but considers the risk is worth taking, especially as the team has alternative strategies in place. The ecological benefit would be significant, and rewilding the area would represent an important achievement. The panel congratulates Align and HS2 Ltd on this innovative approach.

The initiative to extend the landscape design to include the Western Valley Slopes is significant and welcome. The panel suggests that this expansion increases the need for ecological connectivity across the railway. It suggests the design team explores whether there opportunities such as the potential of utilising the Tilehouse Lane Bridge as a green bridge.

The relationship between the landform being created through the project and the wider landscape setting will be important to its success. Visualisations showing the new landform in its wider context, could provide reassurance that different elements within the project come cohesively, and sit well in the context of the Colne Valley Regional Park.

The panel welcomes the team's efforts to minimise fencing. It questions the need for vegetation to end short of the security fences, and asks whether it can be extended closer to the barriers and railway.

Viewing points

The panel strongly supports the introduction of multiple public viewing points to see the railway. As detailed design work progresses, it suggests exploring different materials that could make the viewing points feel more tactile and inviting. They could be made more welcoming, creating informal places to sit and to lean. An artist could also potentially be involved in developing these designs further.

The panel also suggests that further cross-sections are produced to demonstrate why these particular locations have been chosen for the viewing points, how they fit into the landscape contours, and what views they will provide.

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HS2 Independent Design Panel Report

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Art strategy

The panel notes that there is ongoing work with BOP Consulting to explore opportunities for land art at the site, as part of the HS2 Art Strategy. While it supports the Art Strategy, it cautions against introducing a further, separate element into the landscape and considers it important that any commission forms an inherent part of the overall design approach, such as the viewing points, landform or the portal buildings.

Community engagement

The panel supports engagement with the local wildlife trust over the future of the site, and suggests that there are many other organisations that would want to be involved in such an exciting project, as well as local communities. It encourages the design team to expand engagement to ensure its ambitions can be achieved.

Water management

The panel notes that separate drainage systems are proposed for track and landscape drainage, guided by HS2 design standards. There is some debate over whether or not this is an HS2 Ltd requirement, and the panel feels that combining the two systems could benefit the landscape design. It asks the design team to explore how any appearance of engineered railway retention ponds can be avoided, and the need for two drainage systems challenged.

It will be important that drawings and supporting information submitted as part of the Schedule 17 submission give an accurate picture of the landscape, including the proposed drainage systems. If, for example, retention ponds will predominately appear as low recesses of grassland, then this should be clearly communicated.

Sustainability approach

The panel welcomes the information on sustainable design, and notes the design team's intention to comply with HS2 Ltd requirements by achieving BREEAM Infrastructure Level 2 certification.

It is confident that the buildings and structures will meet the ambitions of the HS2 Sustainability Approach.

However, it has not received sufficient information to assess the landscape proposals against the requirements of the HS2 Sustainability Approach, and asks for additional details to demonstrate how the project will meet these.

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Next steps

The panel feels that the Chiltern Tunnel south portal, portal building, landscaping earthworks meet the aspirations of the HS2 Design Vision at Schedule 17 stage - subject to the design quality presented being maintained through detailed design and construction.

The panel supports the team's intention to include indicative information on the landscape as part of the Schedule 17 submission. As part of this, it suggests the team give careful consideration to how it communicates the relationship with the wider landscape setting of the Colne Valley Regional Park.

The landscape design will play a fundamental role in the success of these proposals. The panel therefore asks for an opportunity to be involved in commenting on this at 'bringing into use' and site restoration stages, once Schedule 17 decisions have been made. This would allow for further information to be provided on whether the landscape proposals meet the requirements of the HS2 Sustainability Approach.

Once a Railway Systems contractor is in place it urges HS2 Ltd and Align to ensure that the ATS Building is integrated as part of the design, matching the design quality of the south portal and portal building.

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References

10.2.1 Document list

This DAS should be read in conjunction with the documents and drawings listed below, submitted as part of these Schedule 17 requests. These documents also form a part of the concurrent consultation on Indicative Mitigation Details, as set out in the document (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000009).

Drawings marked with * are for part approval only - refer to Written Statement (ref: 1MC05-ALJ-TP-REP-CS02_CL03-000007) for details.

10.2.2 For Approval

Earthworks Plans

- 1MC05-ALJ-TP-DPL-CS01_CL02-219141 - 219148: Colne Valley Western Slopes Proposed Contours Plan Sheets 1 - 8
- 1MC05-ALJ-TP-DSE-CS01_CL02-219201 - 219210*: Colne Valley Western Slopes Site Wide Sections Sheets 1 - 10

Softworks Drawings

- 1MC05-ALJ-TP-DPL-CS01_CL02-219150*: Colne Valley Western Slopes Tree Retention and Removal Plan

Boundaries and Interfaces Drawings

- 1MC05-ALJ-TP-DPL-CS01_CL02-219171: Colne Valley Western Slopes Fencing Plan Overview
- 1MC05-ALJ-TP-DDE-CS01_CL02-219401 - 219403: Colne Valley Western Slopes Fencing Gate and Barrier Details Sheets 1 - 3
- 1MC05-ALJ-TP-DDE-CS01_CL02-219411: Colne Valley Western Slopes Landscape Security Features

Access and Highways Drawings

- 1MC05-ALJ-TP-DGA-CS01_CL02-211711 - 211714*: Tilehouse Lane Proposed General Arrangement Sheets 1 - 4
- 1MC05-ALJ-TP-DSE-CS01_CL02-211751 - 211753*: Tilehouse Lane Proposed Works Cross Section Sheets 1 - 3

Detail Area Plan Drawings

- 1MC05-ALJ-TP-DDE-CS01_CL02-219421 - 219423*: Colne Valley Western Slopes Viewing Areas Sheets 1 - 3
- 1MC05-ALJ-TP-DDE-CS01_CL02-219431*: Colne Valley Western Slopes Waterbodies

Drainage Drawings

- 1MC05-ALJ-DR-DGA-CS01_CL02-212111 - 212112*: Tilehouse Lane Cutting Railway Drainage Attenuation Layout Sheets 1 and 2
- 1MC05-ALJ-DR-DGA-CS01_CL02-212131 - 212134*: Colne Valley Western Slopes Land Drainage Layout (North East) Sheets 1 – 4
- 1MC05-ALJ-DR-DGA-CS01_CL02-212121*: Colne Valley Western Slopes Land Drainage Attenuation Layout
- 1MC05-ALJ-DR-DDE-CS01_CL02-212481 - 212482*: Colne Valley Western Slopes Quarry Road Drainage Details Sheets 1 – 2
- 1MC05-ALJ-DR-DPL-CS01_CL02-232101 - 232104*: Tilehouse Lane Drainage Layout Sheets 1 – 4
- 1MC05-ALJ-DR-DDE-CS01_CL02-232401*: Tilehouse Lane Drainage Details
- 1MC05-ALJ-DR-DSH-CS01_CL02-232411*: Tilehouse Lane Drainage Schedules
- 1MC05-ALJ-DR-DGA-CS01_CL02-232111*: Tilehouse Lane Drainage Highway Attenuation Layout
- 1MC05-ALJ-DR-DDE-CS01_CL02-232421*: Tilehouse Lane Drainage Highway Attenuation Details
- 1MC05-ALJ-DR-DGA-CS02_CL03-262101*: Chiltern Tunnel South Cutting Land Drainage Layout
- 1MC05-ALJ-DR-DGA-CS02_CL03-262121*: Chiltern Tunnel South Cutting Drainage Attenuation Basin 1 Layout
- 1MC05-ALJ-DR-DGA-CS02_CL03-262131*: Chiltern Tunnel South Cutting Drainage Attenuation Basin 2 Layout
- 1MC05-ALJ-DR-DDE-C001-202411: Sector C1 Land Drainage Details Sheets 1 – 2

10.1.2 For Approval (continued)

Architectural Drawings

- 1MC05-ALJ-TP-DPL-CS02_CL03-279152: Colne Valley Western Slopes Chiltern Tunnel South Portal Building General Arrangement Plan
- 1MC05-ALJ-TP-DEL-CS02_CL03-279731: Chiltern Tunnel South Portal General Arrangement Long Elevation
- 1MC05-ALJ-TP-DPL-CS02_CL03-279153: Colne Valley Western Slopes Chiltern Tunnel South Portal Building Floor Plan
- 1MC05-ALJ-TP-DPL-CS02_CL03-279154: Colne Valley Western Slopes Chiltern Tunnel South Portal Building Roof Plan
- 1MC05-ALJ-TP-DEL-CS02_CL03-279351 – 279352: Colne Valley Western Slopes Chiltern Tunnel South Portal Building Elevations Sheets 1 – 2
- 1MC05-ALJ-TP-DSE-CS02_CL03-279251: Colne Valley Western Slopes Chiltern Tunnel South Portal Building Sections
- 1MC05-ALJ-TP-DEL-CS02_CL03-279353 -279354: Colne Valley Western Slopes Chiltern Tunnel South Portal Elevations Sheets 1 - 2
- 1MC05-ALJ-TP-DDE-CS02_CL03-279451: Colne Valley Western Slopes Chiltern Tunnel South Portal Architectural Finishes
- 1MC05-ALJ-TP-DDE-CS01_CL02-219106: Colne Valley Western Slopes Noise Barrier Elevations Details

Geotechnical Drawings

- 1MC05-ALJ-GT-DDE-CS01_CL02-213411: Colne Valley Western Slopes Hostile Vehicle Bunds Standard Details
- 1MC05-ALJ-GT-DDE-CS01_CL02-213412: Colne Valley Western Slopes Hostile Vehicle Bunds Crossing Point Standard Details

References

10.2

10.2.3 For Information

Documents

- 1MC05-ALJ-TP-REP-CS02_CL03-000007: Written Statement
- 1MC05-ALJ-TP-REP-CS02_CL03-000008: Design and Access Statement
- 1MC05-ALJ-TP-REP-CS02_CL03-000009: Indicative Mitigation Details
- 1MC05-ALJ-EV-REP-CS02_CL03-000088: Operational Noise Assessment Report
- 1MC05-ALJ-EV-REP-CS01_CL01-000015: Operational Noise Assessment Report for the Colne Valley Viaduct

Softworks Drawings

- 1MC05-ALJ-TP-DPL-CS01_CL02-219111: Colne Valley Western Slopes Site Location Plan
- 1MC05-ALJ-TP-DPL-CS01_CL02-219112: Colne Valley Western Slopes Existing Site Plan
- 1MC05-ALJ-TP-DPL-CS01_CL02-219120: Colne Valley Western Slopes Landscape and Environmental Master Plan
- 1MC05-ALJ-TP-DPL-CS01_CL02-219121 - 219128: Colne Valley Western Slopes Landscape and Environmental Plan Sheets 1 - 8
- 1MC05-ALJ-TP-DPL-CS01_CL02-219131 - 219138: Colne Valley Western Slopes Existing Contours Plan Sheets 1 - 8
- 1MC05-ALJ-TP-DPL-CS01_CL02-219151 - 219158: Colne Valley Western Slopes Landscape Planting Plan Sheets 1 - 8
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- 1MC05-ALJ-TP-DEL-CS01_CL02-211741 - 211748: Tilehouse Lane Longitudinal Profile Sheets 1 - 8
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- 1MC05-ALJ-TP-DPL-CS01_CL02-219191: Colne Valley Western Slopes Post Settlement Contours
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10.3.1 Figure List

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