

Lower Thames Crossing Design Principles

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Lower Thames Crossing

Design Principles

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Covering Note

This document is a draft of one of a series of Control Documents that will form part of our planned DCO application. Following this consultation we will carefully consider your feedback as we finalise the documents for our planned submission of the DCO application for the Lower Thames Crossing later this year.

The Design Principles set out guidance that underpins the design measures that integrate the new road into the local landscape. This captures mitigation measures and establishes parameters that must be met in the final design of the road.

The following contains a draft copy of this document to provide an example of how mitigation and commitments would be secured within the DCO application when it is submitted.

The Design Principles reflect the changes to the design described in this consultation. Updates may be made to this document to reflect feedback received from stakeholders ahead of submitting the document as part of the DCO application.

As this is a draft control document, there will be references to the upcoming Development Consent Order (DCO). Any documents referenced that will form the DCO will be mentioned with a (REF TBC).

1 Introduction

1.1 Scope of this report

- 1.1.1 This report describes the Design Principles that underpin the design and integration of the A122 Lower Thames Crossing (the Project) into its context. They are written to capture the key principles (documented in the Project Design Report (REF TBC) that have shaped the design thus far, and to make a commitment that these will be maintained and developed in the future detailed design and delivery phases of the Project in accordance with National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) requirements for ‘good design’.
- 1.1.2 The Design Principles are very much a ‘forward-looking’ document whereas the Project Design Report is a ‘backwards-looking’ document illustrating the process whereby the Preliminary Design was achieved.
- 1.1.3 Clauses 4.28-4.35 of the NPSNN set out the criteria for ‘good design’ for national networks noting that design shall be an integral consideration from the outset. It states:
- ‘4.29 Visual appearance should be a key factor in considering the design of new infrastructure, as well as functionality, fitness for purpose, sustainability and cost. Applying “good design” to national network projects should therefore produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction, matched by an appearance that demonstrates good aesthetics as far as possible.’*
- 1.1.4 Highways England (the Applicant) has published The Road to Good Design (Highways England, 2018). This document provides a framework for the application of this requirement within the NPSNN, to the strategic road network.
- 1.1.5 For more information on how the Project has been developed to comply with the NPSNN criteria for good design please see the Accordance Table within the Planning Statement (REF TBC) and the Project Design Report (REF TBC).
- 1.1.6 Achieving compliance with the NPSNN requires a high level of coordination across design, engineering, and environmental specialisms as well as consultation with external stakeholders. The design principles apply to the Project’s permanent physical structures (including highways, tunnels and buildings) and landscape works; they do not apply to the temporary works, utilities diversions and/or methods of construction, nor do they describe in detail how the works will be operated and maintained.
- 1.1.7 The Design Principles are submitted for approval as part of the application for development consent. As such, the Design Principles are commitments that will be secured through the Development Consent Order (DCO) and is certified in Schedule 16. Requirement 3 of the DCO states:
- ‘The authorised development must be designed in detail and carried out in accordance with the design principles document and the preliminary scheme design shown on the engineering drawings and sections, and the general arrangement drawings, unless otherwise agreed in writing by the Secretary of State following consultation by the undertaker with the relevant planning*

authority on matters related to its functions, provided that the Secretary of State is satisfied that any amendments to those documents showing departures from the preliminary scheme design would not give rise to any materially new or materially different environmental effects in comparison with those reported in the environmental statement.'

- 1.1.8 The Design Principles are one of a suite of documents that capture the Project's design and environmental commitments. These documents include:
- a. The Environmental Statement (REF TBC), including:
 - i. The Environmental Masterplan (REF TBC) which defines the spatial layout of physical mitigation proposals.
 - ii. The Register of Environmental Actions and Commitments (REAC) which defines commitments on the processes that need to be used in the delivery, management, monitoring and maintenance of the works.
 - b. The Code of Construction Practice (CoCP) which covers commitments pertaining to the processes of construction only.
- 1.1.9 The principles reflect the commitments of the Applicant in relation to the Project and consider its clear and overriding need. They are intended to set out a unified approach to design and capture the collective knowledge of the Project team at the time of application for development consent. The design principles therefore create an overarching, shared resource which give clarity to stakeholders over the required design outcomes. They give more detail on design intent and objectives to be achieved, but still provide some flexibility for the detailed designs to be developed.
- 1.1.10 A project design narrative was produced for Supplementary Consultation, which describes the Project context and proposed possible approaches to be adopted throughout the design. The project design narrative broke the Project down into eight 'character areas'. Each character area was then divided into regional areas, which include the broad regional policies that inform the design and the overarching multi-discipline design development. Each regional area is further broken down into 'local' areas that describe the local context (e.g. local features and not the character, which is covered earlier). Each local area has a summary of the design constraints and opportunities.
- 1.1.11 The project design narrative was issued to statutory stakeholders as part of ongoing engagement in 2018. The feedback received was grouped together by area and similarity of issues raised. These were then used to develop the Project-wide Design Principles and also area-specific Design Principles as set out in Section 4 of this document.
- 1.1.12 The principles serve a number of functions:
- a. Along with the Environmental Masterplan (REF TBC), they capture the embedded mitigation that has informed the Environmental Statement.
 - b. They set a consistent set of parameters for the detailed design of the Project.
 - c. In discharging Requirement 3 of the DCO, the Applicant will need to demonstrate accordance with the Design Principles.

- d. In conjunction with the Project Design Report and Consultation Report the Design Principles illustrate how Highways England has responded to public consultation feedback in relation to design.
- e. They illustrate how the Applicant has taken account of the criteria for good design set out in the NPSNN (Department for Transport, 2014) in order to ensure that the development is as sustainable and as aesthetically sensitive, durable, adaptable and resilient as it can reasonably be.
- f. They capture the results of feedback from independent design reviews conducted by the Design Council on behalf of the Applicant.

1.1.13 This report is structured as follows:

- a. Section 2 outlines the high-level design objectives and vision for the Project. These are Highways England's overarching objectives for the design of permanent works.
- b. Section 3 sets out the Project-wide principles. However, they must be read in conjunction with the area-specific principles as they are not always appropriate to each character area. For example, lighting design principles do not apply where there is no lighting. A table at the beginning of each area section lists the generic principles that do not apply to that area.
- c. Section 4 details the area-specific commitments. These are contextual principles that are unique to each area or that elaborate on the Project-wide principles.

1.2 Project description

1.2.1 The A122 Lower Thames Crossing (the Project) would provide a connection between the A2 and M2 in Kent, east of Gravesend, crossing under the River Thames through a tunnel, before joining the M25 south of junction 29. The Project route is presented in Plate 1.1.

1.2.2 The A122 road would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13 and junction 29 of the M25. The tunnel entrances would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side.

1.2.3 Junctions are proposed at the following locations:

- a. New junction with the A2 to the south-east of Gravesend
- b. Modified junction with the A13/A1089 in Thurrock
- c. New junction with the M25 between junctions 29 and 30

1.2.4 The Project route would be three lanes in both directions, except for:

- a. link roads
- b. stretches of the carriageway through junctions
- c. the southbound carriageway from the M25 to the junction with the A13/A1089, which would be two lanes

- 1.2.5 In common with other A-roads, the A122 would operate with no hard shoulder but would feature a 1m hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. Our A122 road design outside of the tunnel includes emergency areas spaced at intervals between 800 metres and 1.6km (less than one mile). The tunnel would include a range of enhanced systems and response measures instead of emergency areas.
- 1.2.6 The A122 would be classified as an ‘all-purpose trunk road’ with green signs. For the benefit of safety, walkers, cyclists, horse-riders and slow-moving vehicles would be prohibited from using it.

Junction modifications

- 1.2.7 Widening works would be required to both the M25 at the northern limits of the route and on the A2 at the southern end, to manage the traffic volumes. The existing A13/A1089 junction would also require modifications to connect to the Project route.

Vertical alignment

- 1.2.8 The new A122 road would be at varying heights along the route, with approximately 80% in a cutting, false cutting or tunnel. The A2 would remain at its current level, with the junction between the A2 and the A122 road requiring some link roads at ground level, on embankments and structures such as bridges. As it approaches the southern tunnel entrance, the A122 road would be at ground level before descending into a deep cutting. To the north, the A122 road would be lowered as much as practicable to reduce its impact on the landscape. Where the road crosses the Tilbury floodplain, railway lines, and the Mardyke floodplain, it would be elevated.

Side roads

- 1.2.9 The Project would include adjustment to a number of side roads. Most existing side roads affected by the Project route would be reconnected or designed to provide alternative provision. In most locations, the affected side roads would cross over the Project route.

Tunnel

- 1.2.10 It is currently proposed that two tunnel boring machines (TBMs) would be used to construct the tunnel, one for each bore.
- 1.2.11 Emergency access and vehicle turn-around facilities would be provided at the tunnel entrances. Cross-passages providing a connection between the two bores would be provided for emergency incident response and tunnel user evacuation. Tunnel portal structures would accommodate service buildings for control operations, mechanical and electrical equipment, drainage and maintenance operations.

Highway structures

- 1.2.12 Approximately 60 new structures would be required, including road bridges, underpasses, green bridges and footbridges. In addition, widening and other modification of existing structures would be required.

Highway drainage

- 1.2.13 South of the River Thames, drainage systems would discharge to soakaways. North of the river, drainage systems would generally be piped systems, discharging through outfalls into watercourses.

Safety and security

- 1.2.14 The Project route would include the following:
- a. Modern safety measures and construction standards with technology to manage traffic and provide better information to drivers
 - b. Variable Message Signs to display variable speed limits, travel information, hazard warnings and both advisory and mandatory signage to drivers
 - c. CCTV cameras and detection equipment to monitor and manage network usage, for alerting and investigating incidents (e.g. stopped vehicles); for maintenance and asset protection; and for detection of crime
 - d. Above-ground traffic detection to control automatic traffic management systems (e.g. variable speed limits) and to collect data on traffic flows
 - e. Free-flow road user charging infrastructure
 - f. Equipment within the tunnel to monitor and control the tunnel environment during normal and emergency operations

Road User charging

- 1.2.15 In December 2014, the Government stated in the National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) that the '*Government will consider tolling as a means of funding new road capacity on the SRN. River and estuarial crossings will normally be funded by tolls or road user charges*'.
- 1.2.16 To align with NPSNN policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied. Vehicles would be charged for using the new tunnel.

Walkers, cyclists and horse riders

- 1.2.17 Walkers, cyclists and horse-riders, as well as slow-moving vehicles, would be prohibited from using the A122 road. Where the Project affects existing Public Rights of Way, these would be reinstated with provision of under- or overbridges, or a suitable alternative provision would be made. The Project proposes a number of new, diverted, upgraded and reinstated routes for walkers, cyclists and horse riders.

Environmental design

- 1.2.18 The Project has been developed to avoid or minimise significant effects on the environment, and during the design process further measures have been incorporated into the Project to mitigate adverse impacts that would arise and that cannot be avoided. Some of the measures adopted include landscaping, noise mitigation measures, and the provision of green infrastructure along the Project route including a number of green bridges. The Project would create a number of new areas of ecological habitat, providing mitigation or compensation for the impacts on existing areas. Two new parks would be created including Tilbury Fields to the west of the northern tunnel entrance, and Chalk Park, to the south of the River Thames.

Construction compounds and utility logistics hubs

- 1.2.19 While the Project is being built, construction compounds would be located along the Project route. Larger compounds would be required at the northern and southern tunnel entrances to allow for tunnelling operations and materials management. Utility logistics hubs would be needed for specific utility works.

Haulage routes and construction traffic management

- 1.2.20 Where there is no direct access from the strategic road network, suitable local roads would initially be used to access and establish construction compounds. Traffic management measures would be used to control the impacts of construction on the local and strategic road network.
- 1.2.21 Haul roads designed for heavy or bulk transfer of materials would be constructed alongside the Project route and connect to the existing strategic road network to minimise construction impacts on the local road network where practicable.

Services and utility installations and diversions

- 1.2.22 To accommodate the construction and operation of the Lower Thames Crossing, it will be necessary to install and divert multiple utilities which would otherwise be affected by the Project route. This would involve the installation and diversion of overhead high voltage electricity transmission and distribution lines, high-pressure gas mains and other utilities and associated infrastructure including cabinets, substations and maintenance compounds.

Land required

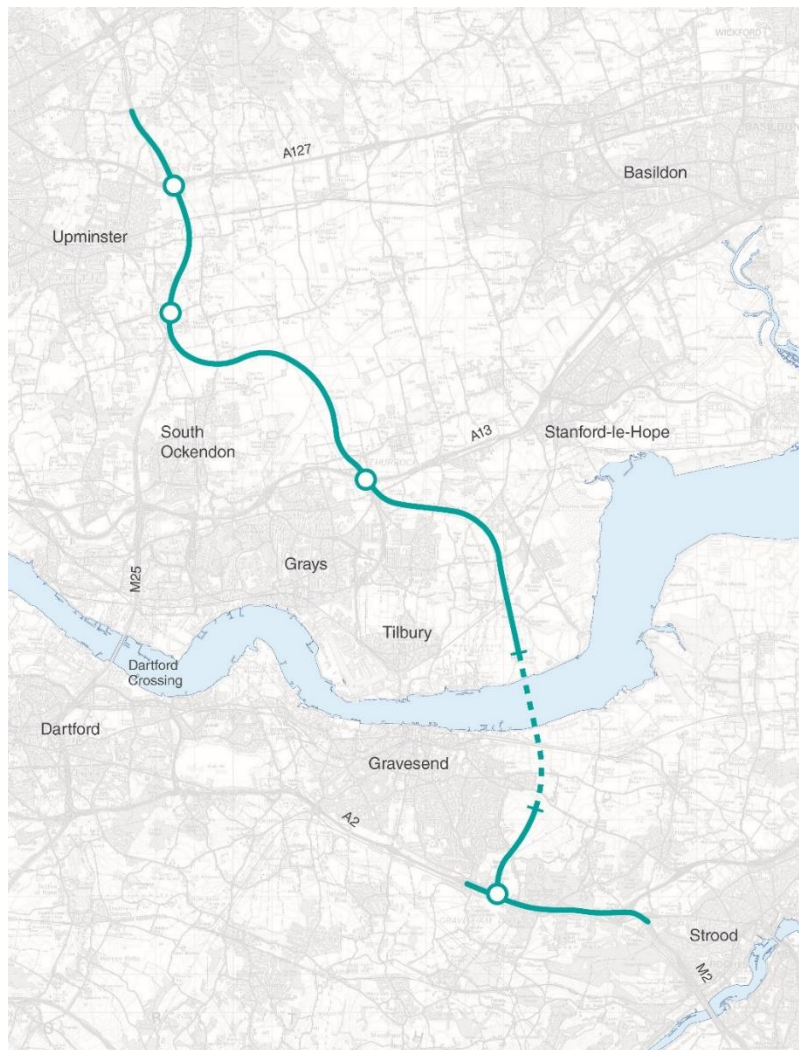
- 1.2.23 The Project would require land on a permanent basis for the road and tunnel, along with other operational infrastructure, and ecological mitigation and compensation. On a temporary basis, land would be required for construction compounds, logistics areas and other construction activities. The utility installations and diversions, some environmental mitigation and flood compensation requirements would require land to be taken on a temporary basis, and for permanent rights to be acquired for the operation and maintenance of any utility infrastructure, and to secure the environmental mitigation and flood compensation.

- 1.2.24 The Project also requires both permanent acquisition and temporary use of areas of special category land, which includes common land and public open space. Replacement land would be provided for some of this special category land. In other cases, in accordance with the Planning Act 2008, replacement land has not been included, for example because the use of this land would be temporary, or because it is only proposed to install and divert utilities through the land. This means that its previous use can continue once the works are finished.
- 1.2.25 Consultation with relevant landowners, occupiers and agents remains an ongoing focus through the development of the Project. Compensation for affected parties follows the statutory Compensation Code.

Operations and maintenance

- 1.2.26 Following completion, the A122 road would be part of the strategic road network.
- 1.2.27 To carry out inspection, certain specified maintenance activities in the tunnel and periodic emergency exercises, a periodic full closure of the relevant bore(s) would be required. These would be planned to minimise disruption, and where feasible lane closures would be used instead.

Plate 1.1 Lower Thames Crossing route



1.3 Scheme Objectives

- 1.3.1 The Applicant has worked with the Department for Transport (DfT) to agree the following objectives that the Lower Thames Crossing should achieve:
- a. To support sustainable local development and regional economic growth in the medium to long term.
 - b. To be affordable to government and users.
 - c. To achieve value for money.
 - d. To minimise adverse impacts on health and the environment.
 - e. To relieve the congested Dartford Crossing and approach roads, and improve their performance by providing free-flowing, north-south capacity.
 - f. To improve resilience of the Thames crossings and the major road network.
 - g. To improve safety.
- 1.3.2 As well as the Scheme Objectives above, the Lower Thames Crossing is being developed in line with the NPSNN, which sets out government policies for Nationally Significant Infrastructure Projects (NSIPs) for England (also refer to

the Planning Statement (REF TBC). As the Project includes both gas pipeline and overhead line NSIPs, the Overarching National Policy Statement for Energy (EN-1), National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4), and National Policy Statement for Electricity Networks Infrastructure (EN-5) are being considered. This is defined further with the Planning Statement (REF TBC).

2 Overarching design vision

2.1 Vision

- 2.1.1 The Project is part of the biggest investment in the country's road network for a generation and an essential component in the UK's future transport infrastructure. It will boost local, regional and national economies, while offering new connections, better journeys and fewer delays.
- 2.1.2 The Scheme Objectives are listed in Section 1.3, above.
- 2.1.3 There are several ways that the design and integration of the road can contribute to achieving the Scheme Objectives. The section below sets out the overarching tenets of the Road to Good Design (Highways England, 2018), and how the Project engages those tenets:
- a. *'Connecting people: People are at the heart of our design work, making good roads safe and useful, inclusive and understandable. Good road design reflects users' needs, engages with communities and works intuitively for all'.*
 - i. Its scale means that the Project will be experienced by large numbers of people in many different ways, including people travelling along the route, those living in the towns and villages close to it, those who make recreational use of the landscape through which it passes, and those who will be employed in its operation. It has been, and will continue to be, designed to respond to the needs of each of these groups.
 - ii. To serve its strategic transport objectives, the Project has been designed, and will continue to be designed, and built to make the operation, management and maintenance as easy as reasonably practicable and meet safety targets in order to achieve Highways England's 2041 strategic goals on safety. It will be designed to be resilient to flood risk and climate change and be robust, attractive and durable.
 - iii. The Project interacts with many Public Rights of Way (PRoW) and is designed to minimise severance within the existing PRoW network. Furthermore, the Project shall enhance the existing network by forming new connections to encourage active travel within areas local to the route.
 - g. *'Connecting places: Good road design demands a deep understanding and response to place, to create a quality aesthetic experience for the user and wider community. This is restrained and environmentally sustainable design, in fitting with the context'.*

- i. The majority of the Project sits within the green belt, as well as within some landscapes of exceptional value and variety. Therefore, it shall be as green and sympathetic (forming a positive response) to its context as reasonably practicable. Tailoring the design of the road and new landscape works to their context will make it fit more harmoniously within it. The design of all architectural elements, such as overbridges, portals and operational buildings, shall reflect the nature of their character area, while being recognisable as part of the wider Project.
 - ii. A common design language announces the Project to users. For all the different people using and impacted by the Project, the route will be characterised with enhanced structures and landscaping through the varied landscape, made coherent by an underlying narrative which draws from its context and function. This is through enhancement to structures at Thames Chase and Thong Lane to celebrate arrival onto the Project. In addition, the River Thames and the two portal thresholds in the north and south will form a key threshold. The design will be enhanced to differentiate and draw attention to these key moments of transition and threshold that emphasise the response to landscape to give people a sense of location on the Project. Enabling road users to experience this range of landscapes will help them to enjoy their journey.
- h. 'Connecting processes: A successful outcome focused on people and places requires good design processes. These are collaborative, thorough and innovative, generating long-lasting outcomes that are of benefit to users and the wider community'.*
- i. The Project strives and will continue to strive, for the best approach to integrated design. Among other things, this means working collaboratively to design elements of the Project that address multiple functional requirements. Design measures shall meet a variety of compatible environmental needs and be embedded into the engineering design wherever reasonably practicable. Engineering proposals will be developed to consider opportunities to enhance rather than detract from the local environment.

3 Project-wide design principles

3.1 Introduction

- 3.1.1 The Project-wide design principles have been broken down against the tenets laid out in the Road to good design (Highways England, 2018)¹: Connecting people, Connecting places and Connecting processes. After this, there are also separate sections specific to discipline/type of asset for structures, lighting, signage and technology, and landscape.

3.2 Connecting people

- 3.2.1 *‘People are at the heart of our design work, making good roads safe and useful, inclusive and understandable. Good road design reflects users’ needs, engages with communities and works intuitively for all’.*

Terminology

- 3.2.2 Various acronyms exist across policy and guidance documents to describe those who travel without some type of car, van/lorry, or motorbike. Historically, the most common is NMU (for ‘Non-Motorised User’) but other terms are in circulation also; WCH for ‘walking, cycling and horse riding’ is sometimes used within the Design Manual for Roads and Bridges (DMRB) (Highways England, 2019), as is the term PCE for ‘Pedestrians Cyclists and Equestrians’. WCH has been chosen for this document as it is the term most frequently used within DMRB, however, the other terms may be used interchangeably across the broader application.
- 3.2.3 The principles in Table 3.1 apply to all areas unless stated otherwise.

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672822/Good_road_design_Jan_18.pdf

Table 3.1 Project-wide design principles: Connecting people

Reference	Design principle name	Design principle
PEO.01	Walking, Cycling and Horse Riding (WCH)	All Public Rights of Way (PRoWs) crossing the Project route shall have a detailed design that is safe and considers the convenience of the users and appropriateness to the context of the adjacent landscape character, with changes in level minimised.
PEO.02	WCH user experience	In order to allow users to recognise and appreciate their whereabouts, WCH routes across and adjacent the Project within the Order Limits shall include appropriate clear and informative signage to provide wayfinding for the users.
PEO.03	WCH detailed design	Surfacing, signage, boundary treatments and access controls shall be designed with the intent of being efficient and integrated, appropriate to the type of usage permitted and appropriate to its surrounding context as much as is reasonably practicable.
PEO.04	Not used	-
PEO.05	WCH hubs	Certain points of access into the PRoW network shall be designated as WCH hubs. Facilities that make the PRoWs accessible and visible shall be provided here, such as suitable wayfinding, placemaking/design features and where appropriate facilities such as seating and parking for WCH users wishing to access the network.
PEO.06	WCH: accessibility	To improve access to the existing PRoW network and for travel and outdoor recreation, the design of new WCH routes shall maximise access for users (including those with limited mobility) through good design while considering and mitigating the potential impacts from misuse and anti-social behaviour associated with unauthorised vehicles.
PEO.07	WCH: heritage interpretation	To identify and document local heritage and connection to the landscape, the Project during the detailed design phase shall consider and implement an approach for signage and wayfinding for the PRoW network that includes interpretation of relevant historic features in and of the landscape and their role in the development of that place/area.
PEO.08	Not used	-

Reference	Design principle name	Design principle
PEO.09	WCHs south of the Thames	The Project shall provide and enable recreational looping routes around the new junction and the South Portal, linking with routes between Shorne Woods Country Park, Ashenbank Wood and Jeskyns Community Woodland, and linked with existing routes from Gravesend illustrated on Section 2 Sheet 5 and 6 of Figure 2.4 of The Environmental Masterplan (REF TBC). These new routes shall also compensate for the loss of direct routes through what shall become a junction/portal. These shall intersect at Thong Lane over Lower Thames Crossing Overbridge.
PEO.10	WCHs north of the Thames: recreational loop	To support local strategies to improve access to and enjoyment of the PRow network, such as Thurrock Greengrid, Thames Chase Forest Circle (loop) and Mardyke River link, the Project shall enable recreation loops for pedestrians, cyclists and equestrians through sections 11-14 (A13 junction, Ockendon link and M25 junctions). This shall be achieved by improving existing PRowS and forming new connections between existing PRowS within the Order Limits (REF TBC) This is in order to create a cohesive network of paths that help increase access to green space and promote active travel for local residents. By making use of these and other connections, it shall provide a north-south link enabling travel from Thames Chase Forest Centre through to Orsett Showground, across the A13 at Rectory Road, through to Muckingford Road where users can connect to Coalhouse Fort using the existing PRow network.
PEO.11	WCHs north of the Thames: east-west connectivity	The Project shall address access to employment, education and services where distances are suitable for travel by foot or cycle. Specifically, shared tracks, segregated from the carriageway, shall be provided to promote east-west inter-urban connectivity along Muckingford Road, and the existing shared use tracks alongside Stifford Clays Road and the A1013 shall be improved.
PEO.12	Not used	-
PEO.13	Not used	-

3.3 Connecting places

- 3.3.1 'Good road design demands a deep understanding and response to place, to create a quality aesthetic experience for the user and wider community. This is sustainable design, which is unobtrusive and environmentally fitting within its context.' (Highways England, 2018).
- 3.3.2 The principles in Table 3.2 apply to all areas unless stated otherwise.

Table 3.2 Project-wide design principles: Connecting places

Clause no.	Design principle name	Design principle
PLA.01	Smarter design	Architecture, landscape and engineering design shall be efficient in its use of resources and multifunctional wherever reasonably practicable. For example, gantries will be designed to accommodate multiple functions including signage and automatic number plate recognition cameras.
PLA.02	Highways environment	To avoid visual clutter, the amount of roadside furniture and signage shall be reduced (or combined) as far as reasonably practicable (including any necessary departures from Highways England standards), while promoting safety requirements/targets through its location, mounting and lighting.
PLA.03	Common design language	The design shall be developed according to a common design language, which shall be locally differentiated where appropriate to respond to its context, with the common design language adapted/developed for specific structures (e.g. portals) where appropriate.
PLA.05	Habitat connectivity	Design proposals shall prioritise improving connectivity between existing habitats wherever reasonably practicable, as defined within the Environmental Masterplan (REF TBC). Fragmentation of habitats shall be reduced as far as reasonably practicable by avoiding unnecessary barriers to movement and, where necessary, including design features which allow safe passage of animals, and colonisation by plants to enhance biodiversity.

3.4 Connecting processes

3.4.1 ‘A successful outcome focused on people and places requires good design processes. These are collaborative, thorough and innovative, generating long-lasting outcomes that are of benefit to users and the wider community’ (Highways England, 2018).

3.4.2 The principles in Table 3.3 apply to all areas unless stated otherwise:

Table 3.3 Project-wide design principles: Connecting processes

Clause no.	Design principle name	Design principle
PRO.01	Design review	The Project will engage with the Highways England Design Review Panel (HEDRP) on the development of the detailed design. The design proposals shall be developed with regard to comments raised by the HEDRP.
PRO.02	Integrated design	The detailed design shall be developed through a multi-disciplinary collaborative design process such that all features of the highway, maintenance access, its integration with the surroundings, and environmental mitigation are coordinated as a cohesive project. For example, access tracks shall be multiple use (for Statutory Undertakers’ access to utilities, WCHs, highway maintenance and farm access tracks) wherever reasonably practicable.
PRO.03	Carbon reduction	All design proposals shall be developed in accordance with Publicly Available Specification (PAS 2080): Carbon Management in Infrastructure, to support the Project’s aim of achieving a reduction in carbon emissions compared to the figure calculated in the Project’s carbon baseline (REF TBC). Low-carbon materials, energy supply and construction processes (e.g. Design for Manufacture and Assembly (DfMA)) shall be specified wherever reasonably practicable and economic within the Project life cycle.
PRO.04	Biodiversity net gain	The detailed design of structures, buildings and landscape shall be developed with the goal of maximising biodiversity value where reasonably practicable, within the constraints of the DCO.

3.5 Structures

3.5.1 This section relates to specific requirements for bridges and portals across this Project. Though it references Project Enhanced Structures it does not supersede the requirements of the DMRB for careful consideration in the design and appearance of all structures:

‘Aesthetic impact is not limited to higher profile, landmark structures that stand out as a result of their scale, location or role within their local cultural vernacular, but also to structures that are regarded as commonplace, widespread and therefore highly visible elements within the highway network’ (Highways England, 2020).

3.5.2 The principles in Table 3.4 apply to all areas unless stated otherwise:

Table 3.4 Project-wide design principles: Structures

Clause no.	Design principle name	Design principle
STR.01	General structures	The design is to be led by the existing landscape, incorporating, and integrating the structures and buildings, so they appear as fully and seamlessly integrated components within the landscape. Therefore, the Project shall aim to achieve high-quality structures along the Project route, incorporating Design for Manufacture and Assembly (e.g. prefabricated components) and integration of architecture and structural designs. The goal of the design shall be to have structures that are not overbearing or obtrusive in the landscape, thereby reducing impact on the local character and environment.
STR.02	Project Enhanced Structures: Portal design	The design of Project Enhanced Structures shall be coherent and distinctive with a recognisable design language and consistent material palette. It shall be developed to reflect the nature of their context and integrated positively with the landscape works. Specifically, this design principle shall apply to the following structures: <ul style="list-style-type: none"> • The South Portal including ramp and tunnel approach retaining walls, the Tunnel Services Building and ancillary buildings. • The North Portal including tunnel approach retaining walls and the Tunnel Services Building. Further information on these structures is given in STR.01, STR.09, STR.12, Section 4.3 Gravesend link and 4.5 Tilbury Marshes and North Portal.
STR.03	Project Enhanced Structures: Bridge design	The design of Project Enhanced Structures shall be coherent and distinctive with a recognisable design language and consistent material palette. It shall be developed to reflect the nature of their context and integrated positively with the landscape works. Specifically, this design principle shall apply to the following structure (The Kent Downs Area of Outstanding Natural Beauty (AONB) bridge): <ul style="list-style-type: none"> • Thong Lane over Lower Thames Crossing Overbridge (Works No. 3B ii) Further specific requirements for this structure are given in STR.01, STR.06, STR.07, STR.08, STR.11, STR.12 and Section 4.3 Gravesend link.

Clause no.	Design principle name	Design principle
STR.04	Project Enhanced Structures: Bridge design	<p>The design of Project Enhanced Structures shall be coherent and distinctive with a recognisable design language and consistent material palette. It shall be developed to reflect the nature of their context and integrated positively with the landscape works.</p> <p>Specifically, this design principle shall apply to the following structures (the viaducts):</p> <ul style="list-style-type: none"> • Orsett Fen Viaduct (Works No. 8B i) • Mardyke Viaduct (Works No. 8B ii) <p>Further specific requirements for these structures is given below in STR.01, STR.06, STR.07, STR.12 and Section 4.8 Ockendon link.</p>
STR.05	Project Enhanced Structures: Bridge design	<p>The design of Project Enhanced Structures shall be coherent and distinctive with a recognisable design language and consistent material palette. It shall be developed to reflect the nature of their context and integrated positively with the landscape works.</p> <p>Specifically, this design principle shall apply to the following structure:</p> <ul style="list-style-type: none"> • Thames Chase Community Forest Bridge (Works No. 90 i) <p>Further specific requirements for this structure are given in STR.01, STR.06, STR.07, STR.12 and Section 4.9 M25 junctions.</p>

<p>STR.06</p>	<p>Project Enhanced Structures: Consistent design approach</p>	<p>Project Enhanced Structures (ref. STR.01-05 and STR.08) shall share a consistent design approach where:</p> <ul style="list-style-type: none"> • A consistent material palette shall be used for all structures. • The surrounding landscape, earthworks and bridge abutments will provide a coordinated integrated solution resulting in a site-led coordinated engineered landscape. • Bridge pier material and form will be distinctive and consistent across the Project and avoid large expanses of flat concrete surfaces at the abutments. • Within and close to the Kent Downs AONB, materials will be self-finished, minimising maintenance while being consistent and appropriate to the colour palette required in the Kent Downs AONB. • Parapet material and form (e.g. weathering steel) will be distinctive and consistent across the Project. Parapets and acoustic barriers shall be combined where reasonably practicable. • The natural light under bridge structures will be maximised as much as is reasonably practicable. • Components will be limited in variety and consistent in form of construction and of high quality by maximising standard components replicable through DfMA. • A sense of place and pride of asset will be promoted through the application of placemaking features, where the name of each bridge and/or graphics will be incorporated permanently into the deck or parapet so it can be seen by users of the Project (Thames Chase footbridges, Project bridges and AONB bridges) and/or WCH users (viaducts) as they approach. • Bridge-supporting structures such as earth-retaining structures and parapets will seamlessly integrate within the landscape, avoiding the need for exposed wing walls and concrete retaining structures where reasonably practicable. • Where exposed engineered structures are required, these will be designed and constructed to support the principles of a landscape-led approach and mitigate the impact on the existing green infrastructure. • Different access requirements, including for maintenance, will be coordinated where practicable to avoid duplication. Where access structures (e.g. galleries) are required, these will be integrated within the Project rather than added on. • A typical graphic illustrating a Project Enhanced Structure is provided in Appendix B.
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Clause no.	Design principle name	Design principle
STR.07	Bridge structures	<p>All bridges not subject to the requirements of Project Enhanced Structures shall share a consistent design approach with the Project Enhanced Structures in the following respects:</p> <ul style="list-style-type: none"> • A consistent material palette shall be used for all structures. • The surrounding landscape, earthworks and bridge abutments will provide a coordinated integrated solution resulting in a site-led coordinated engineered landscape. • The natural light under bridge structures will be maximised as much as is reasonably practicable. • Components will be limited in variety and consistent in form of construction and of high quality by maximising standard components replicable through DfMA. • Parapets and acoustic barriers shall be combined where reasonably practicable. • Bridge-supporting structures such as earth-retaining structures and parapets will seamlessly integrate within the landscape, avoiding the need for exposed wing walls and concrete retaining structures where reasonably practicable. • Where exposed engineered structures are required, these will be designed and constructed to support the principles of a landscape-led approach and mitigate the impact on the existing green infrastructure. • Different access requirements, including for maintenance, will be coordinated where practicable to avoid duplication. Where access structures (e.g. galleries) are required, these will be integrated within the Project rather than added on.

Clause no.	Design principle name	Design principle
STR.08	Green bridges	<p>Green bridges are required mitigation for the severance and fragmentation of habitat due to the Project. Planting on green bridges shall tie in with the broader landscape to ensure this connectivity. The design of these green bridges shall be further developed during detailed design to also provide an enhanced user experience for those using the crossing and living in the immediate area of the Project (including WCH) and to retain the character of the local roads and routes.</p> <p>The following bridges shall be green bridges:</p> <ul style="list-style-type: none"> • Brewers Road Overbridge (BRN000001) • Thong Lane over M2 Overbridge (BRN000002) • Thong Lane over Lower Thames Crossing Overbridge (BRN0000014) • Muckingford Road Bridge (BRN0000030) • Hoford Road Bridge (BRN0000031) • Green Lane Bridge (BRN0000059) • North Road Bridge (BRN0000073) <p>Subject always to the constraints set out in the DCO, the design of green bridges shall be developed to be compatible with the guidance set out in the Summary of Findings within the Natural England (2015) report, Green Bridges: A Literature Review (NECR181).</p>
STR.09	Barriers and fences	<p>In order to avoid duplication leading to the creation of visual clutter, environmental, acoustic, boundary fences and security barriers shall be combined into a single structure as much as is reasonably practicable. Materiality and appearance shall be designed with consideration of the surrounding context of the landscape (e.g. weathering steel, timber, etc).</p>
STR.10	Noise barriers and tranquillity	<p>Proposals shall balance mitigation requirements for noise and visual impact in such a way as to minimise the negative impact on tranquillity and landscape character.</p> <p>Required noise mitigation structures shall be designed and (where reasonably practicable) screened with planting to minimise the perception of the urbanisation in rural areas.</p> <p>Where screening is not reasonably practicable, the materiality and appearance of the barrier shall be designed with respect to the surrounding context of the landscape (e.g. weathering steel, timber).</p>

Clause no.	Design principle name	Design principle
STR.11	Green Bridge Vehicle restraint systems (VRS)	To help maintain the rural lane character of the landscape over green bridges, where it is identified that VRSs are required (in addition to structural parapets), VRSs shall be a timber Highways England certified system for the level of use identified.
STR.12	Materials and durability	Material selection shall be optimised in all areas to balance capital and maintenance cost, to reduce the frequency of maintenance and replacement.

3.6 Lighting, signage & technology

3.6.1 The principles in Table 3.5 apply to all areas unless stated otherwise:

Table 3.5 Project-wide design principles: Lighting, signage & technology

Clause no.	Design principle name	Design principle
LST.01	Highways furniture	To avoid visual clutter, the amount of roadside furniture and signage shall be reduced (or combined) as far as reasonably practicable, while promoting safety requirements/targets through its location, mounting and lighting. Materiality and appearance shall be designed with consideration of the surrounding context of the landscape.
LST.02	Minimised lighting (main alignment)	To preserve the rural and historic nocturnal character of the landscape along the Project route, only junctions and approaches to the portals shall be lit. Lighting will be minimised wherever it is reasonably practicable and safe to do so, but shall remain in accordance with relevant standards.
LST.03	Minimised lighting (off-line)	To preserve local nocturnal character and habitats, lighting required at 'off-line' operational areas (such as at the portals) shall be controllable, directional and as low-level as is practicable and safe (floodlighting shall be avoided).

3.7 Landscape

3.7.1 The principles in Table 3.6 apply to all areas unless stated otherwise.

Table 3.6 Project-wide design principles: Landscape

Clause no.	Design principle name	Design principle
LSP.01	Retention of existing vegetation	<p>All existing vegetation shall be retained as far as reasonably practicable in order to:</p> <ul style="list-style-type: none"> • Preserve its intrinsic ecological value. • Preserve its function as a natural screen to the works. • Preserve the natural enclosed woodland settings for existing adjacent properties. <p>Minimum areas of retained vegetation are shown in the Environmental Masterplan (REF TBC). Measures for the protection of retained vegetation during site clearance works are provided for in REAC item LV028 (REF TBC). Details relating to root protection for veteran or ancient trees are defined within the REAC document, item LV030.</p>
LSP.02	Planting Strategy	<p>The planting strategy for the Project including species selection and planting pattern shall be developed with consideration of context, of local provenance and be appropriate to its locality. The species mix and pattern shall take into account the underlying geology, aspect, level of disturbance/potential for remediation, and other local character features to ensure it will be suitable within its environs.</p> <p>The planting species mix shall be as diverse as reasonably practicable to ensure resilience against potential future diseases. It will include native species of local provenance and will also consider the inclusion of a small percentage of non-native species, where appropriate, in response to forecasted impacts of climate change.</p>
LSP.03	Landscape integration features for visual screening	<p>The detailed design shall use planting to soften the edge of the earthworks and integrate the Project as defined in the Environmental Masterplan (REF TBC). The earthworks shall be graded into the wider landscape as appropriate for its context and shall respect the local topography and landscape character where reasonably practicable. Where this is not reasonably practicable, the design shall provide additional landscaping adjacent to the receptor to mitigate the loss of visual screening within the Order Limits.</p>

Clause no.	Design principle name	Design principle
LSP.04	Landscape: planting	In order to minimise the visual impact of the Project, the landscaping design shall include planting to integrate the road into the adjacent landscape as defined within the Environmental Masterplan (REF TBC).
LSP.05	Landscape reinstatement	To retain the character of the landscape, where land is utilised during construction, it shall be reinstated to its original use as far as technically practicable or in line with landowner agreements. If required for environmental mitigation, appropriate ecological and visual screening shall be placed on land used temporarily for construction.
LSP.06	Landscape legacy	Where large scale landscape mitigation is required, the design of this shall be developed to maximise the Project's legacy for local communities, landowners, whilst considering existing land use. Where compatible with mitigation proposals the Project shall provide, within the Order Limits, enhanced access, amenities and green infrastructure. Where there is alignment between the Project and other existing or planned green infrastructure schemes identified by local authorities and other relevant stakeholders, the Project's detailed design will be developed to integrate with the delivery of green infrastructure by others.
LSP.07	Respecting historic landscape	To protect views across historic landscape and topography, the new landscape design will take account of local landscape character, respect historic features and reference historic land use, patterns and boundaries.
LSP.08	Landscape earthworks: flood risk	To reduce the loss of existing flood storage capacity, no landscape earthworks for visual mitigation shall be provided in flood plains.

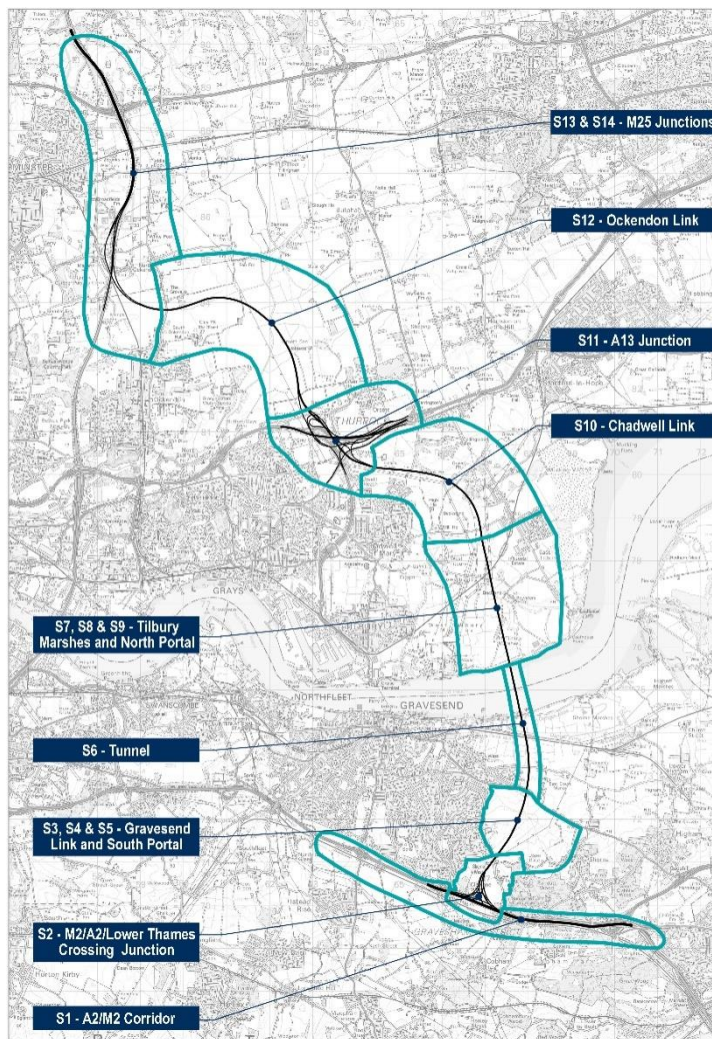
Clause no.	Design principle name	Design principle
LSP.09	Landscape earthworks: false cuttings	<p>All false cuttings shall have rounded crest tops and where reasonably practicable, slackened outward-facing slopes to allow for agriculture and/or planting as appropriate to the surrounding landscape character and use. Any fences or other structures required will be set down from the top of the slopes to reduce visibility from the wider landscape with the exception of acoustic barriers where required for acoustic mitigation. Appropriate soft landscaping shall be planted to integrate and soften the interface of the earthworks to the existing landscape and shall reflect the existing character, land use and pattern. To this end planting shall extend a minimum of 5m beyond the outside toe of the earthworks.</p> <p>Outward-facing slopes shall be slackened to a minimum of 1:4 gradient to allow for woodland planting in suitable locations (as defined within the Environmental Masterplan (REF TBC). Exceptions are where land has been identified as to be returned to agriculture, where slopes shall be slackened to a minimum 1:10 gradient.</p> <p>Where minimising the land required for the Project becomes the overriding concern, slopes shall be designed to a minimum of 1:3 gradient.</p>
LSP.10	Junction planting	<p>Given the complexity of the junctions at the A2, A13 and M25, the landscaping shall focus on woodland planting (as defined in the Environmental Masterplan (REF TBC). This will screen the structures required within the junction (such as bridges and overpasses) from the wider landscape. It will also limit views out so drivers will be more focused on navigating the junction.</p>
LSP.11	Planting palettes	<p>Planting shall be provided in accordance with the palettes in the Appendix A.</p>
LSP.12	New, diverted and reinstated watercourses	<p>Additional diversions of watercourses to those currently defined in the Environmental Masterplan (REF TBC) shall be regarded as a last resort unless it would afford benefits such as a more natural alignment.</p>
LSP.13	Hedgerow reinstatement: field and roadside boundaries	<p>To protect the historic character of the landscape, provide additional screening and enhance biodiversity, reinstated field boundaries shall be demarcated with hedgerows where agreement with the landowner has been reached. Species-diverse hedgerow planting shall be designed to form part of a matrix of biodiverse habitats aiding wildlife movement through areas of intensive arable land. Hedgerow planting shall comprise a diverse mix of native species and, where appropriate, include hedgerow trees.</p>

Clause no.	Design principle name	Design principle
LSP.14	Hedgerows: highways boundaries	Where appropriate, and in keeping with existing landscape character, hedgerow planting is to be planted at the toe of engineered earthworks or beyond proposed Project assets such as drainage ditches and swales. This shall soften the appearance of the engineered earthworks into the existing landscape, provide a boundary to highways assets and integrate any fencing required at the highway's boundary. Exceptions are where land can be returned to agriculture and earthworks have been slackened to accommodate this function.
LSP.15	Planting densities	Planting shall be developed to comply with environmental functions as set out in the Environmental Masterplan (REF TBC).
LSP.16	Surfacing to hard landscape and operational areas	Drainage to operational areas on greenfield sites shall be designed to ensure that post-development surface water runoff rates do not exceed existing rates. To this end permeable paving that is suited to context (e.g. cellular grass paving systems), shall be used wherever practicable.
LSP.17	Pond integration	Drainage attenuation ponds shall be designed to appear as naturalistic elements within the wider setting that take account of existing topography, gradients and field boundaries. Planting shall be provided to soften edges where this is appropriate to the context.
LSP.18	Chalk cuttings	To prevent views of the edges of the exposed chalk cutting across the landscape and create valuable habitat, the top of the cuttings in chalk shall be graded back to allow for the establishment of chalk grassland.
LSP.19	Ancient woodland compensation	The ancient woodland compensation planting strategy will be defined to achieve the most ecologically beneficial woodland habitat and be in accordance with REAC reference TB28 and as shown on the Environmental Masterplan (REF TBC) using the code E3.2.

Clause no.	Design principle name	Design principle
LSP.20	Wildflower planting on earthworks	Grassland on roadside verges and earthworks including embankments, cuttings and false cuts shall be planted to become species-rich grassland and include wildflowers, suitable to underlying soil and subsoil type. Species-rich grassland shall be the default grass type and established where reasonably practicable along the road network to provide biodiversity benefit and visual amenity for road users. Grass verges shall be formed avoiding the use of fertile topsoil and be sown on clean subsoil, with a suitable titre, to encourage establishment of a sustainable diverse plant community. Soil materials used and methods of reinstatement shall be in accordance with the prescribed soil handling requirements in BS 3882:2015 (British Standards Institute, 2015). Seed mixes shall be of British origin, locally sourced and appropriate for the subsoil within the locality.
LSP.21	Blending of earthworks	Where false cuttings and embankments associated with the Project route meet other landscape earthworks or landscape features, the earthworks shall be designed with the aim to integrate and terminate them in a naturalistic way. Earthworks shall maintain a consistent level of screening if appropriate to the location.
LSP.22	Approach to Open Mosaic Habitat (OMH)	<p>Areas of OMH (as defined in the Environmental Masterplan (REF TBC)) shall be a dynamic habitat, the value of which is generated by regular disturbance which prevents habitat succession and retains habitat and structural diversity.</p> <p>The final distribution of habitats will be as follows:</p> <ul style="list-style-type: none"> • Scrub – no greater than 10% coverage • Bare ground – approximately 10% coverage • Rough grassland – approximately 30% coverage • Low nutrient, free-drainage grassland – approximately 50% <p>Pulverised fuel ash (PFA) and sands and gravels generated by the construction works shall be used to provide approximately 10% of overall area of the OMH substrate to mimic the substrate in areas where the habitat is currently found within the Order Limits.</p>
LSP.23	Early planting	Where reasonably practicable planting should be undertaken early in the construction programme to maximise the maturity of the planting scheme at road opening.

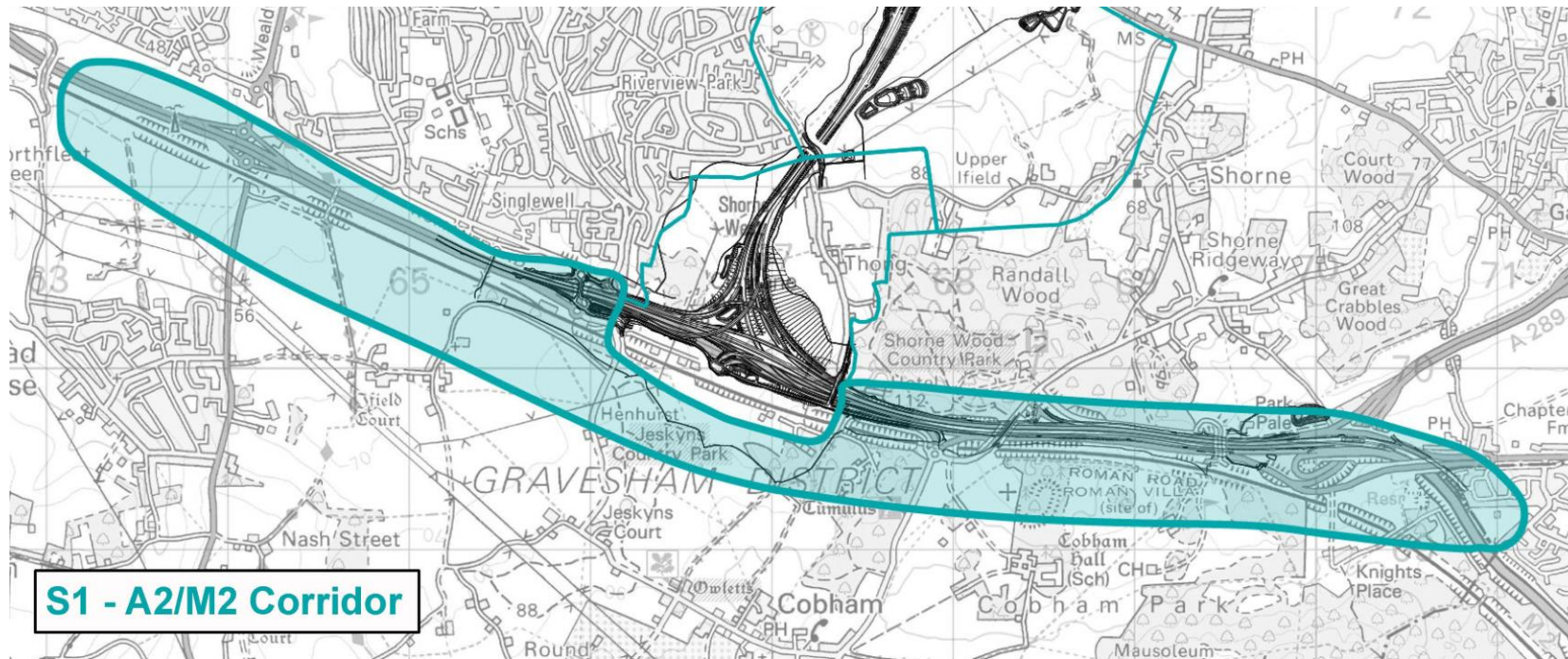
4 Area-specific design principles

Plate 4.1 Project route as Sections



4.1 S1 – A2/M2 Corridor

Plate 4.2 Section 1 – A2/M2 Corridor



4.1.1 The principles in Table 4.1 apply to all works in the Environmental Masterplan (REF TBC), and shown approximately by the teal area in Plate 4.2 above for reference, subject to the Order Limits.

Table 4.1 Section specific principles: Section 1 – A2/M2 Corridor

Clause no.	Design principle name	Design principle
S1.01	Woodland north of the A2 Corridor	To retain the historic woodland landscape character within the Kent Downs AONB and to screen the Project from users of Shorne Woods Country Park (including users of Park Pale), existing planting along the northern edge of the A2 corridor shall be retained as far as reasonably practicable. Where tree loss is unavoidable, landscape proposals shall maximise reinstatement of woodland within the A2 corridor as defined in the Environmental Masterplan (REF TBC)
S1.02	Planting to the south of the A2 Corridor	To reduce the visual impact of the Project on users of Cobham Hall, woodland adjacent to and within Cobham Park shall be retained as far as practicable. Furthermore, in order to mitigate loss of woodland and screen the works within the AONB, trees shall be planted on new earthworks along the southern sides of the A2 as far as practicable. As shown in the Environmental Masterplan (REF TBC)
S1.03	Associated works in the A2/M2 Corridor	To reduce the impact on the Kent Downs AONB, the preliminary design has been developed to minimise the width of the A2 corridor footprint as far as reasonably practicable. The detailed design shall be developed to minimise the footprint of the works associated with the Project and diverted utilities in order to maximise the areas available for woodland planting. For example, steep planted engineered embankments shall be used, and asset maintenance accesses, PRoWs and utilities easements shall be combined to make as efficient use of land as is safe and practicable.
S1.04	Brewers Road and Thong Lane Over A2 Overbridges	<p>To provide connectivity of habitats for species including dormice, badgers, reptiles, bats and Great crested newts between Shorne Woods and Ashenbank Woods, Jeskyns and Cobham Park, and to strengthen the woodland character, new green bridges shall be provided for the replacement of Thong Lane (Old) and Brewers Road crossings. Landscape shall be designed to provide continuity of habitat between the bridges along the main highway’s corridor as far as practicable.</p> <p>To act as local landmarks and to signal entry into the Kent Downs AONB for drivers, the tree-line on the bridges shall be visible on the horizon on their approach to the area from the east and west.</p>

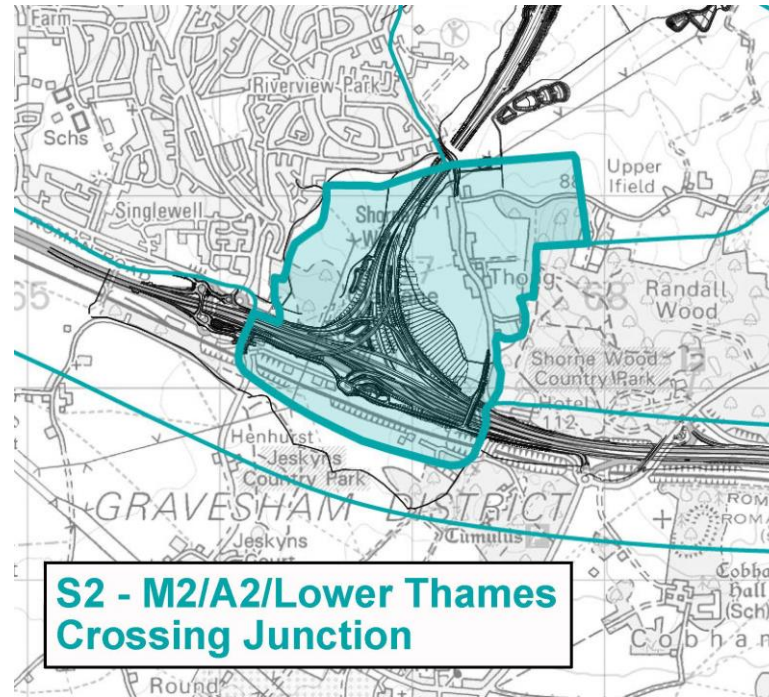
Clause no.	Design principle name	Design principle
S1.05	NCR 177 Realignment	<p>To improve the user experience, maintain east-west connectivity as both a recreational and commuter route for cyclists, and avoid the requirement for crossings through the new junction, National Cycle Route (NCR) 177 shall be permanently realigned south of the High Speed 1 rail line (HS1) away from its current position adjacent to the A2 carriageway. Connections across HS1 and the A2 corridor between recreational areas north and south of the A2 corridor shall be made at the Hares Bridge, East Gravesend, and at Thong Lane, Brewers Road and Park Pale bridges.</p> <p>The realigned route shall be surfaced to maintain the rural character of the setting while providing a robust enough surface for frequent cycle use.</p>
S1.06	Reflect surrounding landscape character	<p>The design of the landscape and mitigation proposals shall take account of the extensive deciduous woodlands surrounding large arable fields, thick deciduous shaws and hedgerows to ensure they complement and strengthen the existing character. A diverse palette of local provenance native shrub and tree species will be reflective of the key characteristics of the West Kent Downs Character Area.</p>
S1.07	Planting Palette within the AONB and its setting	<p>Further to Design Principle LSP.11, a diverse palette of native shrub and tree species characteristic of the local character area and of local provenance shall be used in the area.</p>
S1.08	New woodland east of Shorne Woods Country Park.	<p>New woodland east of Shorne Woods Country Park shall be provided to link Shorne Woods with Great Crabbles Woods. The design shall be developed through collaboration and engagement with Shorne Woods Country Park and relevant local stakeholders, subject to their requirements being compatible with mitigation requirements as defined in the Environmental Masterplan (REF TBC)</p> <p>The design of woodland shall retain key views from the upper slopes of the new woodland across to the Darnley Mausoleum.</p>

Clause no.	Design principle name	Design principle
S1.09	Park Pale screening	A new acoustic barrier constructed from or faced with materials appropriate to the context along the southern edge of the lane between Park Pale bridge, continuing to the Inn on the Lake. This barrier shall replace vegetation lost to the creation of new earthworks and utility diversions, it shall provide screening for users travelling along Park Pale and recreational users on the southern edge of Shorne Woods Country Park. The design shall be developed through collaboration and engagement with Kent Downs AONB unit subject to their requirements being compatible with mitigation requirements as defined in the Environmental Masterplan (REF TBC). The acoustic barrier shall be a minimum of 2m high and positioned to maximise visual screening through placement on elevated ground where reasonably practicable.
S1.10	Old Watling Street screening	To provide screening for residents of Old Watling Street and to replace lost landscaping features, new hedgerow and trees shall be planted along the northern (eastbound) edge of the A2/M2, east of M2 junction 1.
S1.11	Switching station screening	The replacement switching station adjacent to the A2 shall be screened by planting from users of Thong Lane.
S1.12	Reinstatement planting to the west of A2 junction	Where vegetation is removed as a result of utilities work along the former A2 corridor west of the junction with the Project, appropriate reinstatement and planting using suitable species is to take place along the utility route as far as reasonably practicable.
S1.13	Planting of NCR177	To reduce the urbanising impact of the Project on Shorne Woods Country Park, the existing alignment of NCR 177 (to be re-routed) shall be planted where the path is not required for connection into other WCH routes.
S1.14	Planting adjacent to Thong Lane	To integrate the realigned Thong Lane into the surrounding landscape, replace features lost during construction and to re-establish the woodland edge along the road which provides screening for the Inn on the Lake, woodland planting shall be provided adjacent to Shorne Woods along both sides of Thong Lane.
S1.15	The Mount	To integrate reinstated raised earthworks around The Mount into the existing landscape, the new earthworks and retaining structures on the green bridge crossing HS1 shall be designed to match the remaining structure. WCH routes provided across Project infrastructure shall be merged with existing provision here.

Clause no.	Design principle name	Design principle
S1.16	Landforms around the Project	In order to integrate the Project into the surrounding landscape and provide screening to improve the setting of Cobham Hall, new landforms shall avoid the appearance of unnatural valleys between the Project and HS1. Where reasonably practicable, the land required and vegetation removed, shall be reduced between the Project and HS1.

4.2 S2 – M2/A2/Lower Thames Crossing Junction

Plate 4.3 Section 2 – M2/A2/Lower Thames Crossing Junction



- 4.2.1 The principles in Table 4.2 apply to all works in the Environmental Masterplan (REF TBC), and shown approximately by the teal area in Plate 4.3 above for reference subject to the Order Limits.

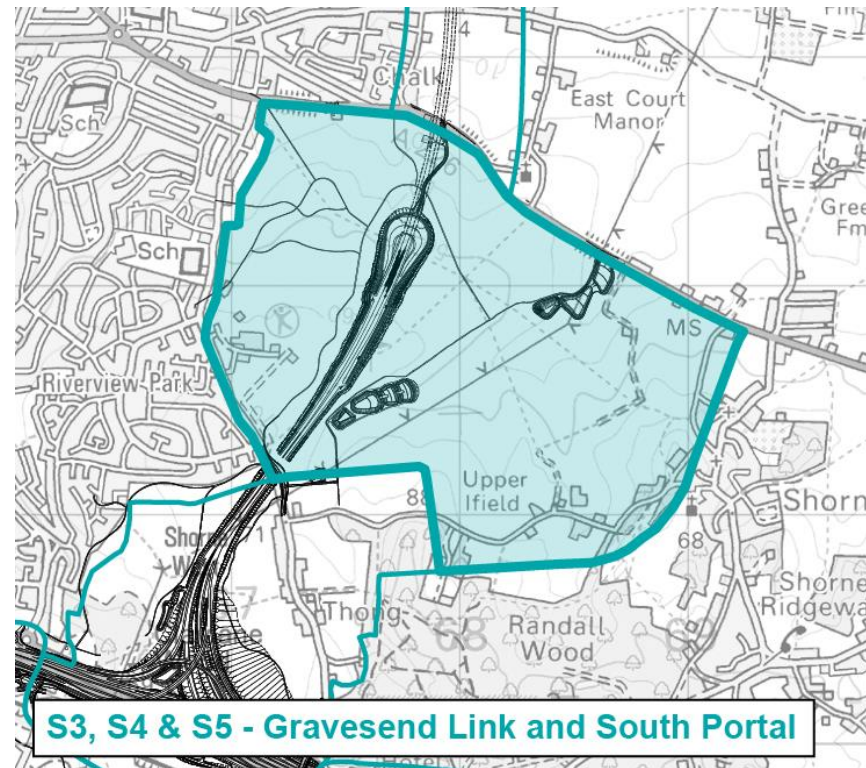
Table 4.2 Section specific principles: Section 2 – M2/A2/Lower Thames Crossing Junction

Clause no.	Design principle name	Design principle
S2.01	Wooded circle around Thong	<p>To retain the open rural setting of the village of Thong, the landscape shall retain an open aspect around the village by use of species-rich grassland and wildflower meadow planting. The open aspect will be enhanced by the contrast created by increased woodland planting along the eastern edge of Gravesend which will form part of a circular wooded habitat corridor linking Claylane Wood and Shorne Woods, and screen the Project from the residents of Gravesend East.</p> <p>Within the open grassland, wildflower meadow planting shall reference the historic layout and runways of RAF Gravesend as shown in the Environmental Masterplan (REF TBC)</p>
S2.02	Circular walks connecting recreational areas	<p>In order to restore PRowS severed by the Project and to create an enhanced user experience, PRowS NS167 and NS169 shall be integrated into the new circular WCH route connecting around the A2 junction. Between Claylane Wood and Shorne Woods Country Park, this shall be via the new green bridge at Thong Lane. NS167 shall not cross the junction.</p>
S2.03	Woodland planting around slip roads	<p>To integrate the Project into the surrounding landscape character, the planting and landscape design shall incorporate woodland planting within the junction and around slip roads, shown on Section 2, Sheet 2 and 5 of the Environmental Masterplan (REF TBC)</p>
S2.04	Thong Lane North green bridge	<p>To connect woodland habitat, lessen the visual impact of the M2/A2/Lower Thames Crossing junction, enhance the user experience and maintain east-west connectivity between Gravesend and Thong/Shorne Woods Country Park, the crossing at Thong Lane North shall be a new green bridge. The landscape across the bridge shall be designed to maintain the character of a well-vegetated lane and to provide a habitat corridor for mammals.</p> <p>The bridge shall provide off-road routes for cyclists and pedestrians away from the main road. Appropriate crossings shall be provided north and south of the bridge to facilitate north-south movement.</p> <p>Design principles for the Project Enhanced Structures shall apply to this bridge.</p>

Clause no.	Design principle name	Design principle
S2.06	Minimise impact on Claylane ancient woodland	<p>To limit the loss of ancient woodland as far as reasonably practicable, the earthworks along the western edge of the A2 junction will be kept to a minimum and no false cut provided. Woodland planting shall be provided on the earthworks slopes to provide visual mitigation and landscape integration.</p> <p>Planting beneath overhead power lines and above underground utilities, between Claylane Wood and the A2 junction, including drainage basins, will be in accordance with LSP.02. Planting will be in suitable locations and of suitable species and heights in agreement with utilities operators who maintain an easement to their assets, but shall provide some cover for small mammals.</p>
S2.07	Retained vegetation	<p>In order to preserve landscape character and to reduce visibility towards the M2/A2/Lower Thames Crossing junction, existing vegetation along and around the junction shall be retained as far as practicable.</p>
S2.08	A2 junction ponds	<p>Where reasonably practicable, central islands within the A2 junction shall be utilised for the drainage and attenuation ponds required, so that the outer edges of the junction can be woodland planted, enclosing the junction and providing visual screening. Ponds shall be appropriately designed within islands to allow planting and landscape integration. Ancillary elements such as fencing and surfacing of access roads shall be appropriate to the context to avoid urbanising the junction.</p>
S2.09	Planting adjacent to Thong Lane	<p>To integrate the new realigned Thong Lane into the surrounding landscape, replace features lost during construction and to re-establish the woodland edge along the road which provides screening for the Inn on the Lake, woodland planting shall be provided adjacent to Shorne Woods along both sides of Thong Lane.</p>
S2.10	Retaining wall materials	<p>To integrate the retaining structures at the junction within the AONB, into the wider landscape, either green walls/earth banks or use of materials or cladding, reflective of the local vernacular (such as flint or ragstone) shall be used.</p>

4.3 S3, S4 & S5 – Gravesend link & South Portal

Plate 4.4 Section 3, 4 & 5 – Gravesend link & South Portal



- 4.3.1 The principles in Table 4.3 apply to all works in the Environmental Masterplan (REF TBC), and shown approximately by the teal area in Plate 4.4 above for reference subject to the Order Limits.

Table 4.3 Section specific principles: Section 3, 4 & 5 – Gravesend Link and South Portal

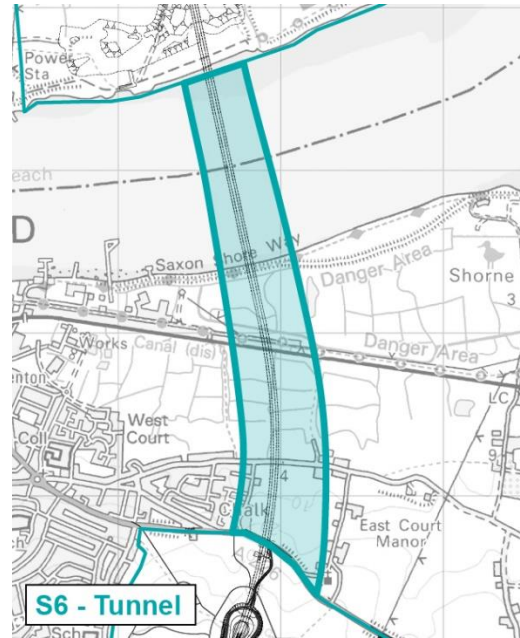
Clause no.	Design principle name	Design principle
S3.01	Retain open views	Open views across the landscape north of Thong Lane shall be maintained as far as reasonably practicable. Where the road is in cutting, fencing, signage, gantries and lighting columns shall be positioned within the cutting to reduce their visual impact on views across the wider landscape as far as reasonably practicable.
S3.02	Mask cutting route	So as not to emphasise the linear nature of the Project route north of Thong Lane Green Bridge, the top of the cutting shall not be edged with fencing and/or hedgerow planting. Where reasonably practicable, fencing shall be incorporated into the cutting slope and hidden from view. Where not reasonably practicable, localised earthworks planting in blocks and not in a continuous linear form adjacent to the alignment (in keeping with the surrounding context) shall be provided to limit its visual impact and to mask the linearity of the cutting.
S3.03	Transition to the South Portal	The profile of the cuttings between the A2 junction and the South Portal shall be considered as a single visually consistent engineered solution developing the profile and levels defined at the tunnel portal and incorporating the bridge abutments at the new Thong Lane bridge seamlessly. To maintain a sense of openness and light for users of the Project as they enter the tunnel, structural concrete walls required near to the South Portal shall be kept at a minimal height with earth embankments above, so far as structural performance constraints will allow.
S3.04	Chalk Park	In order to provide an enhanced amenity for local residents, recreational areas of over 35 hectares shall be provided to the west of the South Portal and approach cutting. Excavated material from the cutting shall be used to integrate the open space into the existing topography. A wooded hilltop shall be provided in a manner characteristic of the setting of nearby settlements at Thong and Shorne to soften the exposed urban edge of Gravesend, as defined in the Environmental Masterplan (REF TBC).
S3.05	Reinstatement of construction compounds	To keep the human-influenced rural character of the area, where practicable the construction compounds east of the cutting shall not result in disturbance of the boundary hedgerows and landform changes associated with the historic parish boundary. Land covered by construction compounds shall be reinstated to reflect existing field patterns and the surrounding landscape character. The landscape proposals will include no engineered features, e.g. fencing.

Clause no.	Design principle name	Design principle
S3.06	Cascading drainage attenuation ponds	To enhance the landscape character around the area of the South Portal, naturalistic drainage ponds whose location and design respond to existing topographical features shall be located adjacent to the A226 Gravesend Road and on the eastern side of the Project route, within the boundary of the existing Southern Valley Golf Course.
S3.07	Screening to residents of Riverview	To provide screening of the Project for residents of Gravesend and to replace lost woodland features, native woodland shall be planted north-west of the Thong Lane green bridge.
S3.08	Chalk & scrub grassland	Areas around the portal cutting shall consist of species-rich grassland. However, to increase nature conservation and biodiversity in the area, and to aid landscape integration of the Project, blocks of scrub and woodland shall be planted at appropriate locations following the existing field pattern.
S3.09	Historic hedgerow reinstatement	New hedgerows will reference historic field boundaries, reversing field aggregation and linking remnant hedgerow trees. Field boundaries to the west shall be planted with hedgerows to reverse the appearance of field aggregation and to screen the Project.
S3.10	Integration of portal facilities	To further integrate the portal into the surrounding landscape and reduce visibility of operational equipment and vehicles to residents of Chalk and Gravesend, localised raised earthworks shall be created around the northern end of the portal structure and bolstered with small blocks of woodland planting. In order to screen portal operations from users of the surrounding PRowS, the access road shall be set at a lower elevation than the surrounding topography.
S3.11	Integration of portal building	The South Portal structure and building shall have a green roof and be designed to sit within the cutting and to blend into the surrounding landscape topography as far as reasonably practicable through the use or similar grassland species to the adjacent chalk grassland. The building shall be earth banded. The earthworks shall be profiled to merge seamlessly with surrounding ground profiling.
S3.12	Portal maintenance and emergency access	To ensure 24 hour operational and emergency access to the portal, access shall be provided via the A226 and the Project. Vehicular access onto this road shall be controlled. Pedestrians, cyclists and equestrians shall be able to cross the access road in an east-west direction with suitable measures in place, such as fencing that is in keeping with the local context, to avoid public and animals straying onto the Project.

Clause no.	Design principle name	Design principle
S3.13	NG7 diversions	To maintain an inclusive and naturalistic route for the user and avoid unnecessary structures, a recreational loop that connects Gravesend with Shorne Woods Country Park shall be created for NG7. This will be re-routed north around the South Portal and will link to routes going further south at Thong Lane green bridge. The recreational loop will cross the Project access road north of the portal structure, but access across the road shall be maintained at all times.
S3.14	Portal control room	The design of portal control rooms shall maximise natural light, ventilation and passive surveillance, and shall be located to provide views overlooking the highway operations.
S3.15	Woodland planting north of Brummelhill Wood	To replace existing ancient woodland lost, a new area of woodland (Planting Appendix LE2.11 – Woodland with non-native species) shall be planted north-east of Thong on the upper slopes adjacent to the AONB boundary/Brummelhill Wood. The woodland planting shall follow the contours of the landscape and tie into existing field/hedge line boundaries.
S3.16	Substation	A new substation shall be surrounded by bunding and retain access to/from the adjacent farm building across Chalk Park to the reinstated agricultural field.

4.4 S6 – Tunnel

Plate 4.5 Section 6 – Tunnel



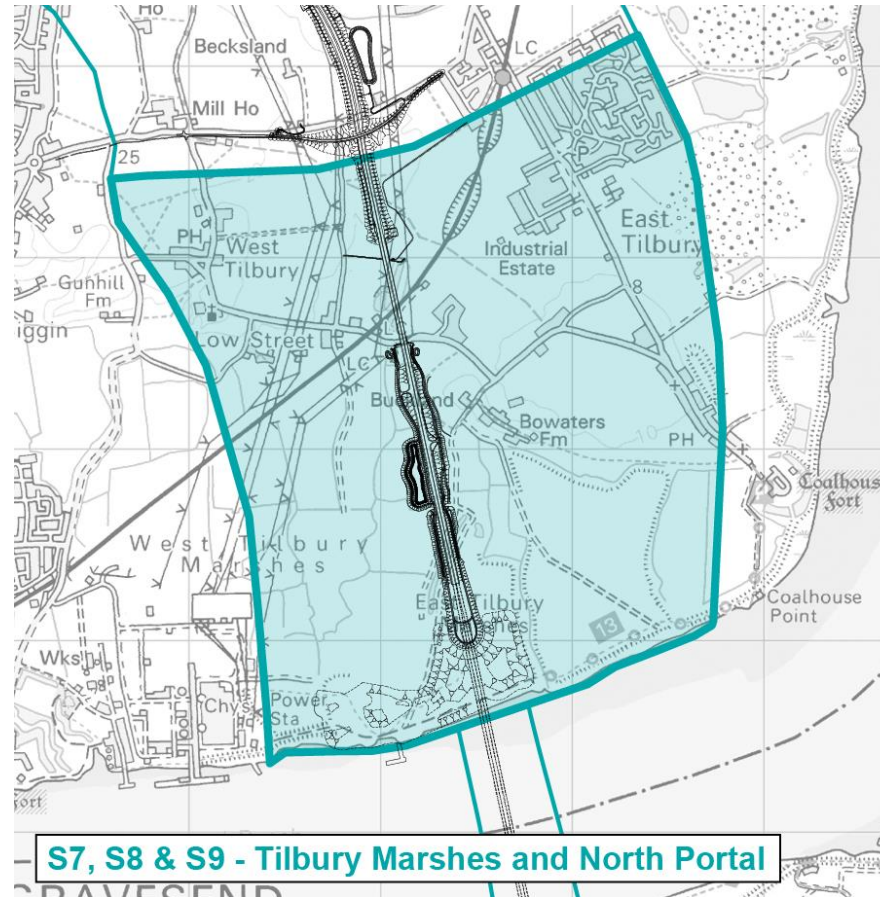
4.4.1 The Project route will be within a twin bored tunnel within this sector. The principles in Table 4.4 apply to all works in the Environmental Masterplan (REF TBC), and shown approximately by the teal area in Plate 4.5 above for reference subject to the Order Limits.

Table 4.4 Section specific principles: Section 6 – Tunnel

Clause no.	Design principle name	Design principle
S6.01	Not used	-
S6.02	Not used	-

4.5 S7, S8 & S9 – Tilbury Marshes and North Portal

Plate 4.6 Section 7, 8 & 9 – Tilbury Marshes and North Portal



4.5.1 The principles in Table 4.5 apply to all works in the Environmental Masterplan (REF TBC), and shown approximately by the teal area in Plate 4.6 above for reference subject to the Order Limits.

Table 4.5 Section specific principles: Section 7, 8 & 9 – Tilbury Marshes and North Portal

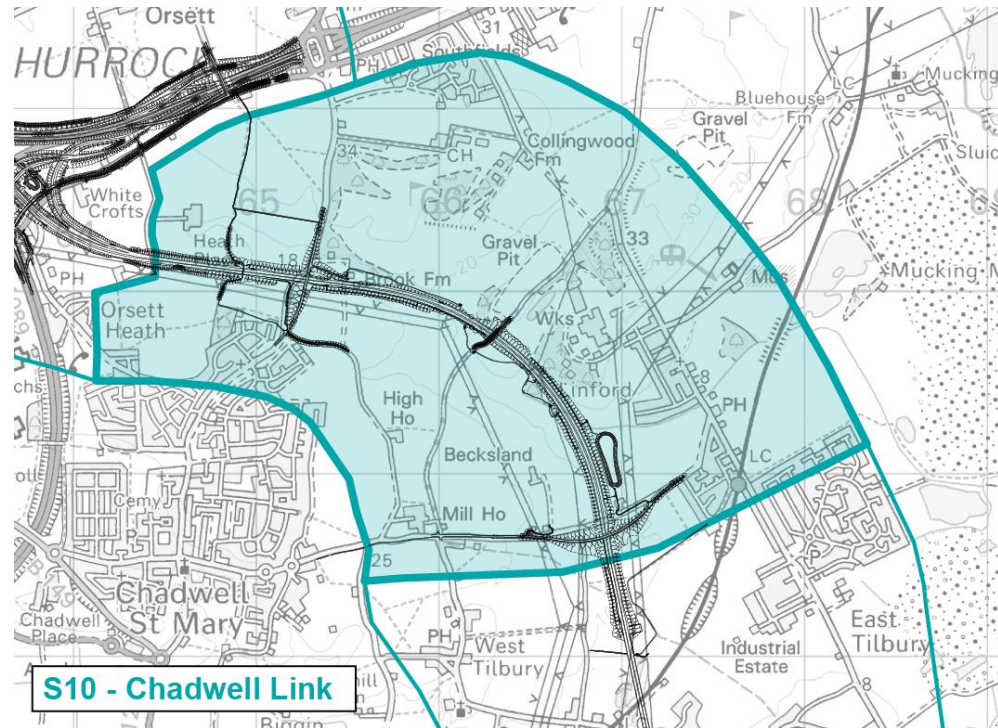
Clause no.	Design principle name	Design principle
S9.01	Approach to marshland landscape	In order to distinguish new landscape proposals from the original (no longer present) marshland character of the area, landscape designs shall avoid design approaches that seek to blend artificial features into the landscape. Where it is possible to recognise the original landscape character, open views across the flat landscape north of the portal shall be maintained.
S9.02	Tilbury Fields	<p>New sculptural landscape earthworks of over 35 hectares on Goshems Farm shall be designed with elevated areas to create vistas (above the surrounding landfill) across the Thames Estuary and guide views to features such as Tilbury Fort and Coalhouse Fort that reflect the military history of the Thames.</p> <p>The earthworks shall be designed to be capable of a return to pastoral agriculture with suitable gradients. They shall be publicly accessible, via the Two Forts Way, from informal footpaths through the landforms that shall follow historic routes and allow users to reach the elevated areas. Placemaking features shall be located at the top of the earthworks, to create a focal point and landmark.</p>
S9.03	Portal security structures	All fencing and other safety measures required for the Project for the safety of pedestrians in publicly accessible areas around the portal and its associated structures shall be integrated into the wider landscape.
S9.05	Heritage interpretation along Two Forts Way	Interpretation boards and signage, coordinated with those for Tilbury Fields, shall be provided along Two Forts Way, highlighting the local heritage features and directions to the new placemaking features. No other enhancement shall be carried out to Two Forts Way.
S9.06	Integration of tunnel control facilities	To minimise the impact on the landscape of required tunnel operations and facilities buildings, the portal shall be designed to integrate all required buildings/uses into the portal structure shown in the Environmental Masterplan (REF TBC) and a single building as far as reasonably practicable.

Clause no.	Design principle name	Design principle
S9.07	Flood protection of tunnels & buildings	Protective earthworks shall be provided between the Project and the access road and Tunnel Services Buildings at a level that protects against a flood event (including provision for the impact of future climate change) to ensure the tunnel and associated buildings are protected and emergency access can be maintained.. At the approach to the North Portal, flood protection (for example, in the form of a bund with an integral cut-off wall or a clay core) would flank both sides of the Project, starting where the ground level around the portal meets the design protection level and extending north until the road level reaches the design protection level.
S9.08	Transition to the portal	To maintain a sense of openness and light for users of the Project, the structural concrete walls required for the cutting shall be kept at a minimal height and the earth embankments of the cutting shall be tapered away from the road.
S9.09	Access roads	To minimise the land required north of the portal and the length of the Tilbury Main culvert, the detailed design of the operational access roads shall be kept as close to the Project route as reasonably practicable subject to the constraints of the powers in the DCO (REF TBC).
S9.10	Watercourses	Culverting of the Tilbury Main shall be reduced as far as practicable to minimise detrimental effects on the channel biodiversity. The culvert shall be designed to allow natural 'bed' features to form and provide a ledge to allow mammal passage. Where appropriate, new watercourses and diversions shall be naturalised and follow historic ditch patterns. Scattered wetland trees and scrub are to be reinstated along the existing watercourse network and to connect into existing features and patterns.
S9.11	Strengthen wooded ridgeline	Woodland planting shall follow the existing wooded ridge and shall not follow the Project route. Within lower-lying areas to the south of the ridge, wet woodland shall be planted following watercourse alignments and link into existing features and connect into woodland planting on the earthworks adjacent to the Project. Where possible, existing vegetation shall be retained as far as reasonably practicable on the wooded ridge.
S9.12	Protective earthworks	Earthworks to the mainline carriageway shall be designed to provide appropriate flood resilience to support the functioning of the tunnel. The earthworks shall be protected by additional earthworks designed to allow Ingrebourne Valley Ltd to resume its spoil placement activities following the completion of the Project, without any impact on the Project's earthworks.

Clause no.	Design principle name	Design principle
S9.13	Water vole habitat	The land parcel adjacent to Coalhouse Fort shall be used for water vole mitigation in the form of new watercourse creation. New watercourses shall follow historic ditch patterns and remaining land is to be managed as wet grassland habitat (Planting Palette Appendix – LE6.4 Wet Grassland).
S9.14	Drainage attenuation pond form	Drainage attenuation ponds will be designed in a long linear pattern along the Project route to take account of the existing landscape character.
S9.15	Views from the Tilbury Viaduct	To promote a sense of place on their journey, views towards West Tilbury Church and the chalk escarpment shall be retained for northbound users of the Project. Similarly, open views across the marshes towards the River Thames for southbound users of the Project shall be provided as far as practicable.
S9.16	Tilbury Viaduct design	The form and structure of the Tilbury Viaduct shall be designed, so far as reasonably practicable and within the limits of the DCO powers, to maximise views through the viaduct structure and to minimise its intrusion into the wider landscape and visual impact on surrounding properties. Landscape earthworks and planting shall be used adjacent to the abutments and shall aid their integration into the landscape. The positioning of gantries and other infrastructure on the viaduct shall be designed to avoid accentuating the height and massing of the viaduct so far as reasonably practicable. The viaduct shall not be lit.
S9.17	Diversion of FP200	The existing alignment of FP200 is through common land and the re-aligned route shall be through replacement common land. The quality of the route shall not be inferior to the existing route, and areas of tree planting will screen this route from the road. The area of common land will not be diminished.

4.6 S10 – Chadwell Link

Plate 4.7 Section 10 – Chadwell Link



4.6.1 The principles in Table 4.6 apply to all works in the Environmental Masterplan (REF TBC), and shown approximately by the teal area in Plate 4.7 above for reference subject to the Order Limits.

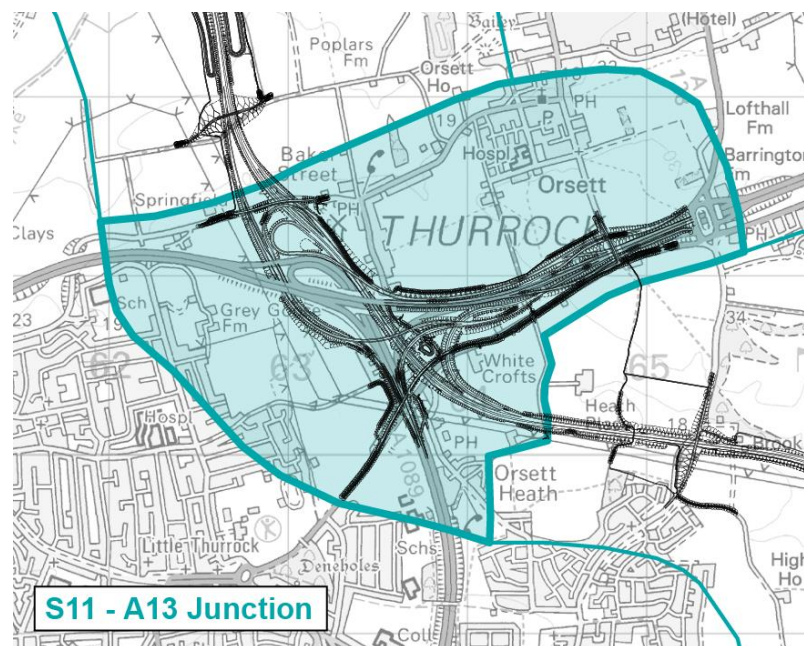
Table 4.6 Section specific principles: Section 10 – Chadwell Link

Clause no.	Design principle name	Design principle
S10.01	Landscape integration of Muckingford Road green bridge	<p>Continuous hedgerow shall be planted along the alignment of Muckingford Road Bridge (Ref. BRN0000030) to connect landscape either side of the Project route and to maintain existing character.</p> <p>In order to counter the isolation of Linford and East Tilbury, the east-west inter-urban connectivity for access to employment and services shall be improved for WCHs.</p> <p>There shall be a new shared track parallel to Muckingford Road to provide a better connection between residential areas and areas of employment. Where the realignment of Muckingford Road is necessary, this track shall be adjacent to the road. Where Muckingford Road is not realigned, this track shall avoid impacting on hedgerows as far as is reasonably practicable and shall be behind hedgerows if the existing verge width does not allow its construction without impacting trees and hedgerows. Earthwork slopes to bridges shall also incorporate shaping around the existing pylon to achieve the required clearance zones.</p>
S10.02	Planting to natural valley	In accordance with the local landscape character and to make the Project route less prominent, woodland planting and grassland shall follow the natural valley topography rather than Project. Woodland shall be planted on top of earthworks to follow the current pattern and connect into existing features.
S10.03	Landscape integration of Hoford Road green bridge	The approaches to Hoford Road Bridge shall be retained as far as practicable along its existing route. Where vegetation is to be removed along the route, it shall be reinstated with hedgerow and tree planting where reasonably practicable to retain the historic character of a protected lane. Where Hoford Road crosses the Project, the green bridge shall be designed to be integrated within the landscape. It will reflect the existing character of the protected land, with a sunken lane character, and appropriate hedgerow and tree planting.
S10.04	Screening planting	Woodland planting shall link Hoford Road and Brentwood Road to provide visual mitigation for users of the golf course and footpath networks to the north, in the absence of false cut earthworks. Where appropriate and within the Order Limits, existing hedgerows shall be replanted and strengthened.
S10.05	Acoustic mitigation to Brooks Farm	Appropriate noise mitigation barriers are to be provided adjacent to Brooks Farm. The landscaping shall be planted to soften the visual impact of the noise mitigation proposals.

Clause no.	Design principle name	Design principle
S10.06	Setting of the scheduled monument (causewayed enclosure and Anglo-Saxon cemetery)	Impacts on the scheduled monuments shall be avoided as far as reasonably practicable.
S10.07	Impact on Rainbow Shaw Local Wildlife Site	Vegetation removal within Rainbow Shaw Local Wildlife Site shall be kept to a minimum, and an area of land contiguous with the site (to its north) will be planted to offset woodland loss as defined in the Environmental Masterplan (REF TBC).
S10.08	CH Cole Irrigation reservoir	The existing reservoir and the associated bankside vegetation shall be remodelled and vegetation retained as far as practicable.
S10.09	WCH requirements	A bridleway connection shall be made between the A1013 and High House Lane by the re-designation of Footpath 79 to bridleway, the re-designation of the stretch of Footpath 95 between Footpath 79 and Brentwood Road and the designation of the realigned Footpath 78 between Brentwood Road and High House Lane as bridleway. This route shall be surfaced with an appropriate material for all permitted users and be appropriate to context. The existing route of FP79 shall be maintained up until bridge earthworks force it to be diverted in order to prevent impacts on existing hedgerows.

4.7 S11 – A13 Junction

Plate 4.8 Section 11 – A13 Junction



- 4.7.1 The principles in Table 4.7 apply to all works in the Environmental Masterplan (REF TBC) Section 11 sheets 1-22, and shown approximately by the teal area in Plate 4.8 above for reference subject to the Order Limits.

Table 4.7 Section specific principles: Section 11 – A13 Junction

Clause no.	Design principle name	Design principle
S11.01	Planted earthworks within the Junction	All areas within the A13 junction are to be woodland planted to create a wooded character and enclose views in accordance with the overarching design principle. Within the islands of the A13 junction, earthworks shall be softened and modulated to appear more naturalistic and integrated into the landscape. Hard engineered edges to earthworks shall be avoided and softened and planted with woodland. Exceptions shall be made where woodland planting and/or earthworks impact on visibility splays within the highway. Land parcels between Project slip roads that cannot be easily accessed for return to agriculture shall be grassland planted with linear belts of trees and scrub to reflect the historic landscape character.
S11.02	Not used	-
S11.03	Reducing light pollution	The design of the lighting on the elevated slip roads shall seek to minimise light pollution, subject to relevant standards.
S11.04	Scheduled monument (Crop mark complex, Orsett)	The detailed design of structures in the junction and the landscape scheme shall seek to minimise as far as reasonably practicable the impact on buried archaeology, specifically the scheduled monument.
S11.05	Baker Street and Orsett conservation area	Earthworks associated with A13 southbound slip road shall be carefully planted to reduce visual impacts on the Baker Street and Orsett conservation area and integrate the design of acoustic fencing on the embankment, acoustic screens on the bridge and the reinforced acoustic bund adjacent to the windmill as far as is reasonably practicable.
S11.06	Ron Evans Memorial Community Field	The Ron Evans Memorial Field (Blackshots Nature Reserve) and its vegetation shall be retained as far as reasonably practicable. To integrate new areas of planting into its setting, scrub and species-rich grassland shall be planted on the earthworks slopes and within islands of the A13 junction within the existing boundary of Blackshots Nature Reserve. Replacement open space shall be designed to be of the same character and planting as Blackshots Nature Reserve.
S11.07	Hornsby Lane	Scattered trees and scrub planting shall be planted along the former alignment of Hornsby Lane, including on Project earthworks to connect the existing vegetation along the retained sections of Hornsby Lane.

Clause no.	Design principle name	Design principle
S11.08	Landscape under overhead lines	Further to LSP.10, where woodland planting around the junction conflicts with overhead utilities (both existing and diverted), scrub planting of suitable species shall be planted to connect areas of woodland and provide a diversity of planting palettes. Any such planting will need to be agreed with the utility provider in accordance with LSP.02.
S11.09	Baker Street Mills	To limit the land required near the windmill on Baker Street, an earth bund shall be designed to provide visual and noise mitigation without impacting on access. Woodland planting shall be provided where reasonably practicable on the outward slope.
S11.11	Green Lane Bridge landscape integration	Green Lane Bridge is to have continuous hedgerow planting across the extents of the bridge to ensure continuity of route for bats, and appropriate grassland planting to connect habitats either side of the bridge.
S11.12	Gammonfield Travellers' site	<p>The residents of Gammonfield Travellers' site shall be relocated to a new purpose-built site nearby. The design of this replacement site shall be developed to meet current guidance including Designing Gypsy and Traveller Sites – Good Practice Guide (Department for Communities and Local Government, 2008).</p> <p>The residents shall be consulted regarding the design and layout of the site and on the process for relocating to the new site. Consultation shall meet the guidance laid out in Designing Gypsy and Traveller Sites – Good Practice Guide (Department for Communities and Local Government, 2008). See also Requirement 12 of the DCO (REF TBC).</p> <p>The new travellers' site shall be constructed in accordance with an indicative plan which will be consulted on with Thurrock Council and traveller representatives.</p> <p>Specifically, the new site shall include 21 pitches with associated hard standing and amenity blocks, a site manager's office and associated utilities. The current three groupings of pitches around separate accesses shall be maintained as far as practicable in the new site. The new site design shall be developed according to the principles of Secured by Design. The new travellers' site shall be constructed in accordance with a subsequently agreed indicative plan and developed by the Contractor with Thurrock Council and traveller representatives.</p>
S11.13	Stifford Clays Road shared walking/cycle track	In order to better connect the Baker Street area to William Edwards School, the existing shared walking/cycling track adjacent to Stifford Clays Road shall be extended from its present end at Springfield Farm as far as 6 Stifford Clays Road. This extended track shall be 3.5m wide and be separated from the highway by a strip of planting. The surface will be appropriate to cycle and pedestrian use.

Clause no.	Design principle name	Design principle
S11.14	A1013 shared walking/cycling route	The A1013 is a relatively busy cycle commuter route. There is an existing shared pedestrian-cycle route adjacent to it. In order to improve the cycle connection along the A1013, this facility shall be re-established where the A1013 is realigned, and replaced where it is not, with a 3.5m wide shared use facility. This new/replacement facility shall extend between Orsett Cock roundabout to 44 Stanford Road. There shall be a 2m separation between this track and the highway. A Pegasus crossing shall be provided in order to allow safe crossing from the south side of the A1013 to Rectory Road. Between this crossing and Footpath 79, a separate equestrian track shall also be provided parallel to the pedestrian-cycle track. The surface of the new shared route shall be asphalt. The adjacent equestrian track shall have a construction and surface finish appropriate to equestrian use.
S11.15	Baker Street shared walking/cycle track	Baker Street is a frequently used cycle route. In order to promote active travel where it is being realigned between the A1013 and the A13 underpass, a shared use pedestrian/cycle route shall be provided adjacent to the highway. This shared use facility shall have an asphalt finish.

Table 4.8 Section specific principles: Section 12 – Ockendon Link

Clause no.	Design principle name	Design principle
S12.01	Mardyke Valley landscape approach	Given the landscape character of limited tree and hedgerow cover and flat topography, the footprint of earthworks shall be reduced in this area so far as reasonably practicable. Where earthworks cannot be avoided, woodland planting and creation of wetland shall be used to integrate the earthworks into the wider landscape of fenland character to soften their appearance.
S12.02	Woodland block planting	Planting of woodland blocks shall be provided to help break up long-distance views across the fenland and views of the embankments and viaducts. It shall follow historic and existing landscape patterns and be rectangular in nature or follow existing field boundaries. Woodland planting shall be positioned at the base of the earthworks and encroach up the earthwork slopes. Species at the base of earthworks and near watercourses and drainage ditches shall be suitable for wetland habitats and be reflective of the fenland character.
S12.03	Mardyke and Orsett Fen Viaduct design	The form and structure of Mardyke and Orsett Fen Viaducts shall be designed, so far as reasonably practicable and within the limits of the DCO powers, to maximise habitat and landscape connectivity, to minimise intrusion into the wider landscape and to maximise views through the viaduct structure that maintain the expansive views across the open, flat landscape. The positioning of gantries and other infrastructure on the viaduct shall be designed to avoid accentuating the height and massing of the viaduct so far as reasonably practicable. The viaduct shall not be lit.
S12.04	BR219: Mardyke Trail under the viaduct	To minimise the impact on users of BR219 and retain the open views across the fen, the viaduct shall be designed to seek to maximise space and clearance underneath.
S12.05	Height of the Mardyke and Orsett Fen Viaducts	Flood resilience shall be provided at the viaducts in Orsett Fen by elevating their soffits to a level that exceeds the potential flood level plus freeboard. To allow for easy movement of farm equipment, the Mardyke Viaduct shall be designed to be a suitable height to allow vehicles to pass safely underneath with adequate clearance. Where the Project crosses the statutory main rivers Mardyke, Orsett Fen Sewer and Golden Bridge Sewer, to protect river banks and facilitate access by the Environment Agency to these watercourses to undertake maintenance activities, a bankside access track would be incorporated into the design of the crossings, the width of which would be subject to consultation with the Environment Agency.

Clause no.	Design principle name	Design principle
S12.06	Wetland habitat creation	Subject to the constraints of the DCO, land between the Mardyke and the viaduct shall be restored to suitable wetland habitat to integrate the built structure into the wider fenland landscape.
S12.07	Watercourse enhancements	Where reasonably practicable, vegetation shall be retained along the Mardyke, and along tributary watercourses and ditches, to maintain the existing fenland landscape character.
S12.08	North Road WCH Route	A segregated pedestrian, cycle and equestrian track shall be provided parallel to North Road between eastern end of Footpath 151 and the junction of Wilsman Road and North Road in South Ockendon. This shared track shall be to the east of North Road and connect Footpath 151 with Footpath 135 and with South Ockendon in order to facilitate east-west WCH links that are prevented by the level of traffic on North Road. By linking the western end of Footpath 135 to South Ockendon, and the creation of a link between Footpaths 135 and 136, a circular route shall be formed. In conjunction with other improvements, this track shall further improve access to the PROW network for the residents of South Ockendon by providing access to Thames Chase Forest Centre via Footpath 151. A Pegasus crossing shall be provided where Footpath 151 terminates at North Road in order to allow PROW users to safely cross North Road directly onto this new track. This track shall be 3.5m wide, although local narrowing may be necessary at The Grove. Due to the frequent use of North Road by cyclists, the surface shall be an appropriate material, suitable for all users.
S12.09	Mardyke River Link	The Project shall include enhancements to surfaces and signage of Mardyke trail within the Order Limits and its connection into the PROW network, in accordance with 3.07 of The Thames Chase Plan (Thames Chase Trust, 2014).
S12.10	Linear woodland adjacent landfill site	North of the Mardyke Valley, woodland shall be planted along the Project route and the existing landfill, following the route of the existing and diverted watercourse.
S12.11	Hedgerow screening north of Project	Hedgerows shall be planted at the top of the cutting slopes between The Wilderness and the embankment to the FP136 Overbridge, screening the cutting and creating a link between the two. Slopes shall be seeded with species-rich grassland.

Clause no.	Design principle name	Design principle
S12.12	Wilderness vegetation retention	Existing woodland planting at The Wilderness shall be retained as far as practicable and the construction of retaining walls and watercourse diversions shall be optimised to reduce tree loss. New woodland will be provided adjacent to the retaining walls north and south of the Project route within the boundaries of the existing wood. Suitable set back distances shall be provided between the replanted woodland and the edge of the retaining wall for safe maintenance and to avoid trees falling onto the Project route.
S12.13	Landscape Integration of North Road green bridge	Hedgerows shall be planted to the top of the cutting between The Wilderness and North Road, connecting into hedgerow planting over North Road green bridge. Slopes to be grassland-planted with suitable buffer at top of slope for habitat connectivity.
S12.14	Landscape integration of FP136 Overbridge	Earthworks to the proposed FP136 Overbridge shall be woodland and scrub-planted and integrated into the surrounding planting to maintain ecological connectivity.

4.9.1 The principles in Table 4.9 apply to all works in the Environmental Masterplan (REF TBC) Section 13 sheets 1-14 and Section 14 sheets 1-14, and shown approximately by the teal area in Plate 4.10 above for reference subject to the Order Limits.

Table 4.9 Section specific principles: Section 13 & 14 – M25 Junctions

Clause no.	Design principle name	Design principle
S14.01	Woodland planting to junction	In accordance with LSP.10, existing woodland within islands created by the Project junction with the M25 shall be retained and infilled with woodland planting where indicated on the Environmental Masterplan (REF TBC), whilst maintaining visibility splays at all times. Further, woodland shall also be planted in parcels of land between the Project and the railway line, which cannot be meaningfully returned to previous land use.
S14.02	Woodland planting to field boundaries	Between FP151 and the B186, new woodland planting shall be provided along existing field boundaries as shown in the Environmental Masterplan (REF TBC) to strengthen the local rectilinear field pattern and to break up wider views.
S14.03	Planting to Thames Chase Community Forest	Where reasonably practicable, planting shall be undertaken early during the construction phase on the boundary with the Thames Chase Community Forest to screen the Project.
S14.04	Thames Chase Community Forest bridge	In order to meet the vision of Thames Chase Trust to create a connected network of links and accessible vibrant green spaces, the Project shall connect the Thames Chase Community Forest across the M25 with a new foot, cycle and equestrian bridge. The bridge shall be sympathetic to the local topography, it shall be approximately 220m long and span between the tops of the cutting so as not to visually constrain the view along the M25 cutting.
S14.05	Community engagement at Thames Chase Community Forest	The design of new areas of woodland planting south of the Thames Chase Community Forest, shall be developed in collaboration with Thames Chase Trust.
S14.06	Earthworks within Thames Chase Community Forest	Tree removal will be kept to a minimum within the Thames Chase Community Forest unless to create false cut earthworks for noise mitigation. To minimise tree loss adjacent to the visitor centre and close to existing Thames Chase assets, outward slopes are to be 1:4 to allow for woodland planting.
S14.07	Planting north of Ockendon Road	North of Ockenden Road, in the island created between the Project northbound and the M25, access shall be returned to the landowner to continue cultivation of the remaining field. The land shall be profiled at gradients suitable for a return to agricultural use, except around the existing pylon. In accordance with design principle LSP.10 of giving junctions a wooded character, appropriate woodland planting around the edge of the retained field shall be provided.

Clause no.	Design principle name	Design principle
S14.08	Path/water main diversion	The water main diversion shall be located to minimise the amount of vegetation removal within the Thames Chase Community Forest. A bridleway shall be designed over the top of the water main diversion, with suitable planting provided within the easement of the utilities corridor.
S14.09	Franks Farm retaining wall	To limit the land required adjacent to the Listed Franks Farm and the property of St Mary's Lane, a retaining wall rather than earthworks shall be provided. Either soft landscaping shall be provided to soften the visual impact of the structures or planted green walls shall be provided.
S14.10	A127 WCH route	A new WCH bridge over the A127 to the east of junction 29 of the M25 shall allow users of the A127 footway to cross between the north and south sides of the A127 in order to use new at-grade crossings through the north side of the junction. Combined with use of the existing at grade crossing at the junction of Front Lane and the A127, this will maintain connectivity. This new bridge shall be suitable for cyclists and pedestrians, with ramps at appropriate gradients. Where the existing roadside route is interrupted by the new slips to the south-east of the junction, this route will turn to the south to connect with an existing bridleway. This shall be diverted to follow the bottom of earthworks to the slips until it can resume on its existing alignment to the north of the rail line. Where this route diverges from the A127, the surface shall be appropriate for equestrian use.
S14.11	Dennis Road WCH track	Dennis Road is a frequently used cycle route with no existing WCH provision. A shared track for WCH shall be introduced to the north of Dennises Lane and Dennis Road from the junction of Pea Lane and Dennises Lane to the junction of Arisdale Ave and West Road in South Ockendon. This new route shall connect residents of South Ockendon to Little Belhus Country Park, a new country park. In conjunction with other improvements, this route shall also link Little Belhus Country Park to the Thames Chase Forest Centre. This track shall largely be behind an existing treeline/hedgerow along the field boundaries. It shall be surfaced in material appropriate for the rural character of the setting, whilst providing a robust enough surface for frequent cycle use.
S14.12	Open space and woodland compensation	The quantity and quality of the site, shown on the Environmental Masterplan (REF TBC shall match the existing land and existing use within the designated open space.

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Appendix A Planting Palettes

Planting Palette

LE1.3 SPECIES RICH GRASSLAND

Earth movement will form a large part of the works. This disturbance and stockpiling of materials gives the opportunity to create favourable conditions for species diverse wildflower grassland. Over the last 90 years 97% of wildflower habitat in the UK has been lost, often through a decision by landowners to increase soil fertility, which increases the land's productivity but also results in reduced biodiversity. Stress tolerant wildflowers are able to survive alongside competitive grass species providing the competitor species do not have the resources they need to dominate. A low fertility soil and an appropriate maintenance regime will facilitate this aim, creating a linear habitat that facilitates the movement of declining pollinators.



Achillea millefolium



Agrimonia eupatoria



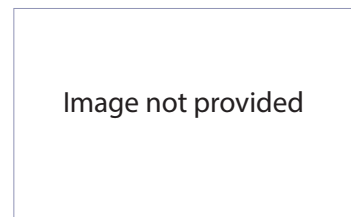
Anthyllis vulneraria



Centaurea nigra



Centaurea scabiosa



Cruciata laevipes



Daucus carota



Filipendula vulgaris



Galium verum



Knautia arvensis



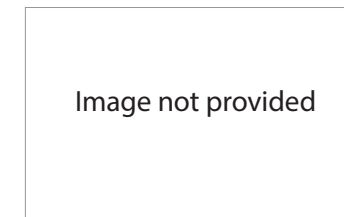
Leontodon hispidus



Leucanthemum vulgare



Malva moschata



Ononis spinosa



Origanum vulgare



Plantago media



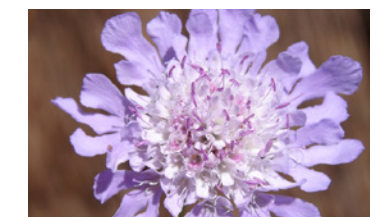
Poterium sanguisorba



Primula veris



Prunella vulgaris



Scabiosa columbaria



Briza media



Carex flacca



Cynosurus cristatus



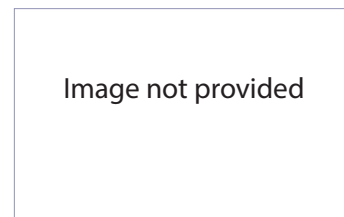
Festuca ovina



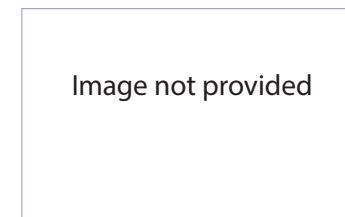
Festuca rubra



Koeleria macrantha



Phleum bertolonii



Trisetum flavescens

Planting Palette

LE1.3 SPECIES RICH - CHALK



Achillea millefolium



Agrimonia eupatoria



Centaurea nigra



Galium album



Galium verum



Geranium pratense



Knautia arvensis



Leontodon hispidus



Leucanthemum vulgare



Malva moschata



Plantago lanceolata



Primula veris



Prunella vulgaris



Ranunculus acris



Ranunculus bulbosus



Rhinanthus minor



Rumex acetosa



Silene vulgaris



Taraxacum officinale



Vicia sativa ssp. segetalis



Agrostis capillaris



Anthoxanthum odoratum



Briza media



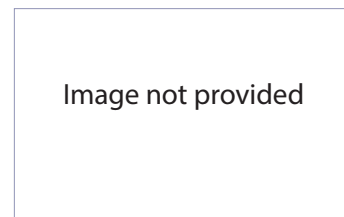
Cynosurus cristatus



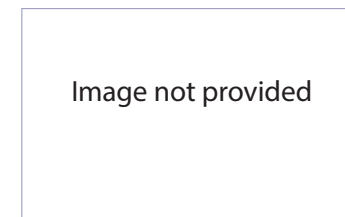
Festuca ovina



Festuca rubra



Phleum bertolonii



Trisetum flavescens

Planting Palette

LE 2.1 Woodland Innerstand

The planting of whips aims to accelerate the creation of woodland, by skipping the earlier phases of natural regeneration that would be experienced under natural colonisation. With appropriate management, the whips are able to fuse a low canopy that will help to suppress the germination and development of species that would have dominated the plantation in earlier phases of natural regeneration. The species include:-

- Nurse species: Fast growing pioneer trees that will start to form a taller canopy whilst offering a level of protection to slower growing species and in some instances improve soil productivity. A small proportion of Italian Alder (*Alnus cordata*) is included to help improve soil productivity and strengthen the resilience of the plantation against climate change through increased diversity. Can be gradually thinned to quicken the succession process.
- Ultimate canopy: Species that will form the dominant canopy of the mature woodland.
- Sub dominant canopy: Species that will form a layer just below the ultimate canopy of the mature woodland. The naturalised species, Sweet Chestnut (*Castanea sativa*) is included to mirror what is a prominent element within the adjacent ancient woodlands and to strengthen the resilience of the plantation against climate change through increased diversity. The native Wild Service Tree (*Sorbus torminalis*) has been included for its broad native range to the south, stretching into North Africa.
- Understorey shrubs: Shrub species that will be prominent in the early years when light exclusion is limited and will continue to form a lower storey within the developing woodland.

South

Nurse species



Alnus cordata 7.5%



Betula pendula 12.5%

Ultimate canopy



Fagus sylvatica 7.5%



Quercus robur 12.5%

Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.

Sub dominant canopy



Carpinus betulus 4%



Castanea sativa 7%



Prunus avium 4%

Smaller trees



Acer campestre 3%



Sorbus torminalis 4%



Taxus baccata 3%

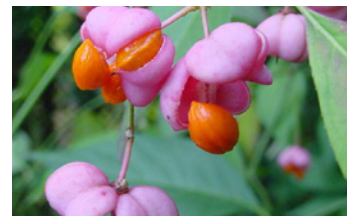
Understorey shrubs



Corylus avellana 15%



Crataegus monogyna 7.5%



Euonymus europaeus 2.5%



Ilex aquifolium 5%



Sambucus nigra 5%

Planting Palette

LE 2.1 Woodland - inc Non-native Species Innerstand

The species include:-

- Nurse species: Fast growing pioneer trees that will start to form a taller canopy whilst offering a level of protection to slower growing species and in some instances improve soil productivity. A proportion of Italian Alder (*Alnus cordata*) is included to help improve soil productivity and strengthen the resilience of the plantation against climate change through increased diversity. Can be gradually thinned to quicken the succession process.
- Ultimate canopy: Species that will form the dominant canopy of the mature woodland. Small proportions of Silver Lime (*Tilia tomentosa*) and Black Pine (*Pinus nigra*) are included to strengthen the resilience of the plantation against climate change through increased diversity.
- Sub dominant canopy: Species that will form a layer just below the ultimate canopy of the mature woodland. The native Wild Service Tree (*Sorbus torminalis*) has been included for its broad native range to the south, stretching into North Africa, which should help the tree adapt to the UK's changing climate.
- Understorey shrubs: Shrub species that will be prominent in the early years when light exclusion is limited and will continue to form a lower storey within the developing woodland.

South

Nurse species



Alnus cordata 7.5%



Betula pendula 12.5%

Ultimate canopy



Fagus sylvatica 12%



Quercus robur 7%



Tilia tomentosa 5%

Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.

Sub dominant canopy



Carpinus betulus 5%



Prunus avium 5%

Smaller trees



Acer campestre 4%



Sorbus torminalis 4%



Taxus baccata 3%

Understorey shrubs



Corylus avellana 15%



Crataegus monogyna 7%



Euonymus europaeus 3%



Ilex aquifolium 5%



Sambucus nigra 5%

Planting Palette

LE 2.1 Woodland - inc Non-native Species Innerstand (cont)

North

Nurse species



Alnus cordata 7.5%



Betula pendula 12.5%

Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.

Ultimate canopy



Fagus sylvatica 7.5%



Quercus robur 7.5%



Tilia tomentosa 5%

Sub dominant canopy



Carpinus betulus 5%



Pinus nigra 5%



Prunus avium 5%

Smaller trees



Acer campestre 3%



Sorbus torminalis 4%



Taxus baccata 3%

Understorey shrubs



Corylus avellana 15%



Crataegus monogyna 7.5%



Euonymus europaeus 2.5%



Ilex aquifolium 5%



Sambucus nigra 5%

Planting Palette

LE 2.1 Woodland - inc Non-native Species Land that has been heavily impacted by construction. i.e. construction compounds, embankment earthworks inc. false cuttings

The species include:-

- Nurse species: The nurse species make up 45-50% of the species composition within this mix. The development of mature woodland on poorer land can take much longer. A large proportion of nurse species that can more easily deal with the poor conditions will help to provide woodland cover sooner, whilst improving the soil condition which will improve growing conditions for other species. A large proportion of Italian Alder (*Alnus cordata*) is included to help improve soil productivity and strengthen the resilience of the plantation against climate change through increased diversity.
- Ultimate canopy: Species that will form the dominant canopy of the mature woodland. The species have been selected for their ability to adapt to poor soil conditions and a changing climate, rather than for their relationship to nearby woodlands. Small leaved Lime (*Tilia cordata*), Silver Lime (*Tilia tomentosa*), Black Pine (*Pinus nigra*) and Norway Maple (*Acer platanoides*) make up this group.
- Sub dominant canopy: Species that will form a layer just below the ultimate canopy of the mature woodland. The native Wild Service Tree (*Sorbus torminalis*) has been included for its broad native range to the south, stretching into North Africa, which should help the tree adapt to the UK's changing climate.
- Understorey shrubs: Shrub species that will be prominent in the early years when light exclusion is limited and will continue to form a lower storey within the developing woodland.

South				
Nurse species	Ultimate canopy	Sub dominant canopy	Smaller trees	Understorey shrubs
 <i>Alnus cordata</i> 35%	 <i>Acer platanoides</i> 4%	 <i>Prunus avium</i> 5%	 <i>Acer campestre</i> 3%	 <i>Corylus avellana</i> 13%
 <i>Betula pendula</i> 5%	 <i>Tilia cordata</i> 6%		 <i>Sorbus aucuparia</i> 3%	 <i>Crataegus monogyna</i> 5%
	 <i>Tilia tomentosa</i> 4%		 <i>Sorbus torminalis</i> 3%	 <i>Ilex aquifolium</i> 5%
			 <i>Taxus baccata</i> 4%	 <i>Sambucus nigra</i> 5%

Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.

Planting Palette

LE 2.1 Woodland - inc Non-native Species
 Land that has been heavily impacted by construction. i.e. construction compounds, embankment earthworks inc. false cuttings (cont)

North				
Nurse species	Ultimate canopy	Sub dominant canopy	Smaller trees	Understorey shrubs
 Alnus cordata 40%	 Acer platanoides 3.5%	 Pinus nigra 5%	 Acer campestre 2.5%	 Corylus avellana 10%
 Betula pendula 10%	 Tilia cordata 3.5%	 Prunus avium 2.5%	 Sorbus torminalis 2.5%	 Crataegus monogyna 5%
<p>Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.</p>	 Tilia tomentosa 3.5%		 Sorbus aucuparia 2%	 Ilex aquifolium 5%
				 Sambucus nigra 5%

Planting Palette

LE 2.1 Woodland - inc Non-native Species Green bridges

Only used on Thong Lane Heavyweight Green Bridge

All the green bridge mixes have been built around plants capable of withstanding a higher level of water stress that will be created by the bridge's limited soil depth and raised soil level as well as climate change. The general arrangement over Thong Lane Heavyweight Green Bridge aims to create a woodland corridor across the bridge that also creates a sense of separation between LTC and local road and active travel routes. The shrub mix has been selected to continue the feeling of woodland across green bridge. The shrub mix will limit plantation height and their multi-stemmed structure is less susceptible to wind blow, a potentially serious issue on a narrow bridge. Where space allows, this taller mix will be specified on Thong Lane Heavyweight Green Bridge, with 25% tree species it will emphasise the feeling that the woodland is continuous. As the planting mix develops, its height will help to reduce people's perception of crossing a bridge.

Species



Acer negundo 2.5%



Betula pendula 7.5%



Castanea sativa 2.5%



Cornus sanguinea 15%



Corylus avellana 10%



Crataegus monogyna 25%



Ilex aquifolium 5%



Quercus petraea 10%



Rhamnus cathartica 10%



Taxus baccata 2.5%



Viburnum lantana 10%

Planting Palette

LE2.2 Woodland edge

In addition to a light demanding edge for woodland, woodland edge species have also been used over wider areas where a lower level plantation is required (ie. under overhead power lines) that still gives the impression of woodland when viewed from outside the plantation. Ongoing maintenance will need to limit the development of taller tree species, which may self seed and start to colonise the plantation.

South



Buxus sempervirens 10%



Corylus avellana 10%



Crataegus monogyna 35%



Euonymus europaeus 5%



Ilex aquifolium 10%



Ligustrum vulgare 5%



Malus Sylvestris 5%



Sambucus nigra 10%



Viburnum opulus 10%

Planting Palette

LE2.2 Woodland edge (cont)

North



Corylus avellana 10%



Crataegus monogyna 20%



Euonymus europaeus 5%



Ilex aquifolium 5%



Prunus cerasifera 10%



Prunus spinosa 15%



Rosa arvensis 5%



Rosa canina 15%



Sambucus nigra 10%



Ulex europaeus 5%

Planting Palette

LE 2.2 Woodland Edge - Low LE 2.8 Scrub

This mix includes low growing species typically found in a woodland edge. It has been composed to fulfill an aesthetic function, capable of softening the appearance of engineered earthworks without highlighting the alignment of the route from the surrounding landscape. These low growing pioneer species have a higher stress tolerance and will better suited to deal with the growing conditions on a partially compacted steep bank, especially on a false cutting. Therefore these species may be most appropriate to the growing conditions along much of the route even if they are not a dominant species growing within the more natural soil profiles surrounding the route.

North



Cornus sanguinea 27.5%



Ilex aquifolium 5%



Malus Sylvestris 2.5%



Prunus spinosa 35%



Rosa arvensis 15%



Rosa canina 15%

Planting Palette

LE.2.2 Woodland Edge - Use on Green bridges

The green bridge low mix has been selected to continue the feeling of woodland and/or untrimmed hedgerows (depending on planting area) across green bridges. The low mix will limit plantation height and their multi-stemmed structure is less susceptible to wind blow, a potentially serious issue on a narrow bridge. As the planting mix develops, its dense edge will help to reduce people's perception of crossing a bridge.

Species



Cornus sanguinea 15%



Corylus avellana 12.5%



Crataegus monogyna 30%



Euonymus europaeus 5%



Ilex aquifolium 7.5%



Prunus spinosa 10%



Rhamnus cathartica 7.5%



Ulex europaeus 5%



Viburnum lantana 7.5%

Planting Palette

LE 2.2 Woodland Edge - Scrub

Scrub woodland aims to replicate the early stages of scrub transitioning into woodland. It is an effective way of establishing woodland on more challenging sites over a longer period. It includes pioneer tree species and other tree species that would typically form part of a sub dominant canopy layer in mature woodland. Slow growing ultimate canopy trees are not included within the mix at time of planting.

South



Acer campestre 5%



Cornus sanguinea 25%



Corylus avellana 5%



Crataegus monogyna 20%



Ilex aquifolium 5%



Juniperus communis 15%



Ligustrum vulgare 5%



Prunus avium 5%



Sambucus nigra 5%



Viburnum lantana 5%



Viburnum opulus 5%

Planting Palette

LE 2.2 Woodland Edge - Scrub (cont)

North



Acer campestre 5%



Betula pendula 2.5%



Corylus avellana 5%



Crataegus monogyna 20%



Ilex aquifolium 5%



Prunus avium 5%



Prunus cerasifera 10%



Prunus spinosa 15%



Rosa arvensis 5%



Rosa canina 15%



Sambucus nigra 5%


















Sorbus aucuparia 2.5%



Ulex europaeus 5%

















Planting Palette

LE 2.4 Linear Belt Of Shrubs And Trees

South				
Nurse species	Ultimate canopy	Sub dominant canopy	Smaller trees	Understorey shrubs
 Alnus cordata 7.5%	 Fagus sylvatica 12%	 Carpinus betulus 5%	 Acer campestre 4%	 Corylus avellana 15%
 Betula pendula 12.5%	 Quercus robur 7%	 Prunus avium 5%	 Sorbus torminalis 4%	 Crataegus monogyna 7%
<p>Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.</p>	 Tilia tomentosa 5%		 Taxus baccata 3%	 Euonymus europaeus 3%
				 Ilex aquifolium 5%
				 Sambucus nigra 5%

Planting Palette

LE 2.4 Linear Belt Of Shrubs And Trees (cont)

North				
Nurse species	Ultimate canopy	Sub dominant canopy	Smaller trees	Understorey shrubs
 <p><i>Alnus cordata</i> 7.5%</p>	 <p><i>Fagus sylvatica</i> 7.5%</p>	 <p><i>Carpinus betulus</i> 5%</p>	 <p><i>Acer campestre</i> 3%</p>	 <p><i>Corylus avellana</i> 15%</p>
 <p><i>Betula pendula</i> 12.5%</p>	 <p><i>Quercus robur</i> 7.5%</p>	 <p><i>Pinus nigra</i> 5%</p>	 <p><i>Sorbus torminalis</i> 4%</p>	 <p><i>Crataegus monogyna</i> 7.5%</p>
<p>Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.</p>	 <p><i>Tilia tomentosa</i> 5%</p>	 <p><i>Prunus avium</i> 5%</p>	 <p><i>Taxus baccata</i> 3%</p>	 <p><i>Euonymus europaeus</i> 2.5%</p>
				 <p><i>Ilex aquifolium</i> 5%</p>
				 <p><i>Sambucus nigra</i> 5%</p>

Planting Palette

LE 2.5 Shrubs With Intermittent Trees

South



Acer campestre 5%



Cornus sanguinea 25%



Corylus avellana 5%



Crataegus monogyna 20%



Ilex aquifolium 5%



Juniperus communis 15%



Ligustrum vulgare 5%



Prunus avium 5%



Sambucus nigra 5%



Viburnum lantana 5%



Viburnum opulus 5%

Planting Palette

LE 2.5 Shrubs With Intermittent Trees (cont)

North



Acer campestre 5%



Betula pendula 2.5%



Corylus avellana 5%



Crataegus monogyna 20%



Ilex aquifolium 5%



Prunus avium 5%



Prunus cerasifera 10%



Prunus spinosa 15%



Rosa arvensis 5%



Rosa canina 15%



Sambucus nigra 5%



Sorbus aucuparia 2.5%



Ulex europaeus 5%

Planting Palette

LE 2.7 Scattered Trees

South



Carpinus betulus 25%



Fagus sylvatica 15%



Prunus avium 20%



Quercus robur 15%



Sorbus torminalis 10%



Tilia tomentosa 15%

Planting Palette

LE 2.8 Scrub



Cornus sanguinea 27.5%



Ilex aquifolium 5%



Malus sylvestris 2.5%



Prunus spinosa 35%



Rosa arvensis 15%



Rosa canina 15%

Planting Palette

LE 4.2 Native Species Hedge (trimmed)

LE 4.3 Native Species Hedge (untrimmed)

LE 4.4 Native Hedgerow With Trees

The hedge composition will be influenced by species present in the local vicinity and diversified where required with appropriate species that are capable of contributing to a strong dense hedge whilst providing resilience through diversity, a central theme to all the mixes. The climate change resilience of the north mix is further diversified by the inclusion of a small proportion of the naturalised species Cherry Plum (*Prunus cerasifera*). With the aim of creating a dense strong hedge, hedges will be planted in a trench with a triple staggered lines offset by 0.5m at 0.3m centres.

South



Carpinus betulus 15%



Cornus sanguinea 10%



Crataegus monogyna 35%



Ilex aquifolium 10%



Ligustrum vulgare 5%



Malus sylvestris 5%



Taxus baccata 5%



Viburnum lantana 15%

North



Acer campestre 15%



Carpinus betulus 15%



Crataegus monogyna 35%



Ilex aquifolium 10%



Malus sylvestris 5%



Prunus cerasifera 5%



Prunus spinosa 10%



Rosa canina 5%

Planting Palette

LE 4.2 Native Species Hedge (trimmed)

LE 4.3 Native Species Hedge (untrimmed)

LE 4.4 Native Hedgerow With Trees

Land that has been heavily impacted by construction. i.e. construction compounds, embankment earthworks inc. false cuttings

On poor land, the hedge composition will still be influenced by species present in the local vicinity. Species that have been found to tolerate poorer growing conditions have been introduced to the mix or make up a greater proportion of the mix in comparison with the standard hedge mix. As with the standard north hedge mix this mix includes a small proportion of the naturalised species Cherry Plum (*Prunus cerasifera*) to increase climate change resilience through diversity.

South



Acer campestre 35%



Cornus sanguinea 10%



Crataegus monogyna 25%



Ilex aquifolium 10%



Malus sylvestris 5%



Prunus cerasifera 5%



Viburnum lantana 10%

North



Acer campestre 35%



Crataegus monogyna 15%



Ilex aquifolium 10%



Prunus cerasifera 5%



Prunus spinosa 10%



Rosa canina 5%



Sorbus aucuparia 20%

Planting Palette

LE 4.2 Native Species Hedge (trimmed) Green bridges

The proposed green bridge hedgerow plant mix has been influenced by vegetation found in the surrounding area. However the mix and proportions have been altered to take account of the higher water stress created by the limited soil depth and raised soil profiling on the green bridge. The mix and proportions favour:-

- Drought tolerant plants
- Ability to contribute to a dense hedge with good form
- Fruiting species as a valuable food source for small mammals
- Presence in the local landscape

Species



Cornus sanguinea 20%



Corylus avellana 10%



Crataegus monogyna 45%



Ilex aquifolium 5%



Prunus spinosa 10%



Rhamnus cathartica 5%



Viburnum lantana 5%

Planting Palette

LE 6.2 Banks And Ditches

Expected flows and capacity usage through the year will help influence where these mixes, suited to wetter conditions are deployed. Seeding a broad range of species, many of which have a broad tolerance, will allow species to find appropriate growing conditions as part of a semi stable plant community requiring annual maintenance.

Banks and ditches



Achillea ptarmica



Angelica sylvestris



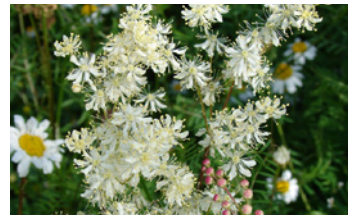
Caltha palustris



Centaurea nigra



Eupatorium cannabinum



Filipendula ulmaria



Geum rivale



Hypericum tetrapterum



Iris pseudacorus



Lotus pedunculatus



Lycopus europaeus



Lythrum salicaria



Mentha aquatica



Pulicaria dysenterica



Ranunculus acris



Sanguisorba officinalis



Silene flos-cuculi



Succisa pratensis



Vicia cracca



Agrostis capillaris



Alopecurus pratensis



Anthoxanthum odoratum



Briza media



Cynosurus cristatus



Deschampsia cespitosa



Festuca rubra



Hordeum secalinum

Planting Palette

LE 6.2 Banks And Ditches

Expected flows and capacity usage through the year will help influence where these mixes, suited to wetter conditions are deployed. Seeding a broad range of species, many of which have a broad tolerance, will allow species to find appropriate growing conditions as part of a semi stable plant community requiring annual maintenance.

Detention basin bases



Achillea millefolium



Achillea ptarmica



Betonica officinalis



Centaurea nigra



Filipendula ulmaria



Galium verum



Geranium pratense



Leontodon hispidus



Leucanthemum vulgare



Lotus pedunculatus



Plantago lanceolata



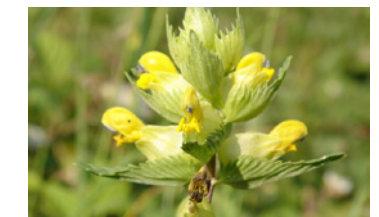
Primula veris



Prunella vulgaris



Ranunculus acris



Rhinanthus minor



Rumex acetosa



Sanguisorba officinalis



Silaum silaus



Taraxacum officinale



Vicia cracca



Agrostis capillaris



Alopecurus pratensis



Anthoxanthum odoratum



Briza media



Cynosurus cristatus



Deschampsia cespitosa



Festuca rubra



Hordeum secalinum

Appendix B Project Enhanced structures, Bridge Diagram

Project Enhanced Structures

1. Integrated abutments

- terraced gabion baskets using local stone

2. Common material palette

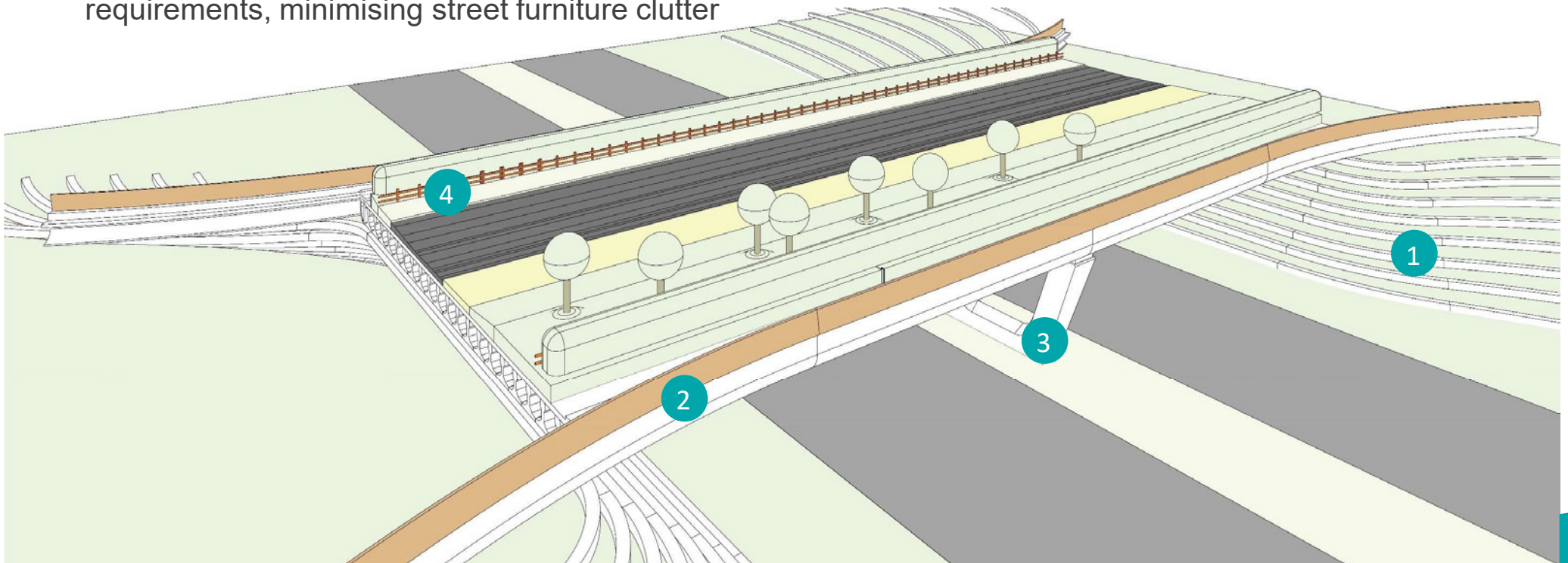
- use of weathered steel, consistent with tunnel portal design

3. Elegant structural forms

- use of equal spans, consistent deck depth, minimising pier and beam profiles, flared approaches

4. Design sympathetic to setting

- vehicle restraint system appropriate to context, coordinated with parapet and acoustic barrier requirements, minimising street furniture clutter



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