national highways

Lower Thames Crossing

7.5 Design Principles (Clean version)

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1 Executive summary

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 (Application Document 7.4) that have shaped the design thus far, and to make a commitment that these will be maintained and developed in the future detail 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 'backward-looking' document illustrating the process whereby the Preliminary Design was achieved.

1.1.3 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 that are certified in Schedule 16.

2 Introduction

2.1 Scope of this report

2.1.1 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 (Application Document 7.4) that have shaped the design thus far, and to make a commitment that these will be maintained and developed in the future detail 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'.

2.1.2 The Design Principles are very much a 'forward-looking' document whereas the Project Design Report is a 'backward-looking' document illustrating the process whereby the Preliminary Design was achieved.

2.1.3 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.'

2.1.4 National Highways (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.

2.1.5 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 (Application Document 7.2) and the Project Design Report (Application Document 7.4).

2.1.6 Achieving compliance with the NPSNN requires a high level of coordination across design, (including engineering and environmental specialisms) as well as engagement 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, temporary utilities diversions and connections and/or methods of construction, nor do they describe in detail how the works will be operated and maintained.

2.1.7 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 that are 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.'

The Design Principles are also secured by Requirement 5 (landscape and ecology):

'Each part of the authorised development must be landscaped in accordance with a LEMP [Landscape and Ecology Management Plan] which sets out details of all proposed hard and soft landscaping works for that part and which has been submitted to and approved in writing by the Secretary of State prior to the opening of that part, following consultation by the undertaker with [the bodies listed in the outline LEMP] on matters related to their respective functions.'

2.1.8 The Design Principles (document) is one of a suite of documents that capture the Project's design and environmental commitments. These documents include:

a. The Environmental Statement (Application Documents 6.1, 6.2 and 6.3), including:

   i. The Environmental Masterplan (Application Document 6.2, Figure 2.4) which defines the spatial layout of physical mitigation proposals.

   ii. The Register of Environmental Actions and Commitments (REAC) (Chapter 7 of the Code of Construction Practice (CoCP)) which defines commitments on the processes that need to be used in the delivery, management, monitoring and maintenance of the works.

b. The CoCP (Application Document 6.3, Appendix 2.2) which covers commitments pertaining to the processes of construction only.

c. The engineering drawings and sections, and the general arrangement drawings, which show the preliminary scheme design.

2.1.9 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 detail designs to be developed.

2.1.10 A project design narrative was produced 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.

2.1.11 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 5 of this document.

2.1.12 The principles serve a number of functions:

a. Along with the Environmental Masterplan (Application Document 6.2, Figure 2.4), they capture the embedded mitigation that has informed the Environmental Statement (Application Documents 6.1, 6.2 and 6.3).

b. They set a consistent set of parameters for the detail 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 the Applicant 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.

g. They enhance the preliminary scheme design shown on the engineering drawings and sections, and the general arrangement drawings.

2.1.13 This report is structured as follows:

a. Section 3 outlines the high-level design objectives and vision for the Project. These are Applicant's overarching objectives for the design of permanent works.

b. Section 4 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.

c. Section 5 details the area-specific principles. These are contextual principles that are unique to each area or that elaborate on the Project-wide principles.

2.2 Project route

2.2.1 The A122 Lower Thames Crossing (the Project) would provide a connection between the A2 and M2 in Kent and the M25 south of junction 29, crossing

under the River Thames through a tunnel. The Project route is presented in Plate 2.1.

2.2.2 The A122 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, M25 junction 29 and the M25 south of junction 29. The tunnel portals 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.

2.2.3 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

2.2.4 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

2.2.5 In common with most 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. The A122 design outside the tunnel would include emergency areas. The tunnel would include a range of enhanced systems and response measures instead of emergency areas.

2.2.6 The A122 would be classified as an ‘all-purpose trunk road’ with green signs. For safety reasons, walkers, cyclists, horse riders and slow-moving vehicles would be prohibited from using it.

2.3 Junction modifications

2.3.1 Alterations would be required to both the M25 at the northern limits of the route and on the A2 at the southern end. The existing A13/A1089 junction would also require modifications to connect to the Project route.

2.4 Vertical alignment

2.4.1 The new A122 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 requiring some link roads at or below ground level, on embankments and structures such as bridges. As it approaches the southern tunnel portal, the A122 would be at ground level before descending into a deep cutting. To the north of the River Thames, the A122 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.

2.5 Local roads

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

2.6 Tunnel

2.6.1 It is currently proposed that two tunnel boring machines (TBMs) would be used to construct the tunnel, one for each bore.

2.6.2 Emergency access and vehicle turn-around facilities would be provided at the tunnel portals. Cross-passages providing a connection between the two tunnels 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.

2.7 Highway crossings

2.7.1 Approximately 50 new highway crossings would be required, comprising road bridges, underpasses, green bridges and footbridges. In addition, widening and other modification of existing highway crossings would be required.

2.8 Highway drainage

2.8.1 South of the River Thames, the highway drainage system would discharge into vegetated drainage comprising infiltration basins with lined sediment forebays, ditches and swales. The intention is that these would outfall from the drainage systems to ground.

2.8.2 North of the River Thames, the highway drainage system would discharge into vegetated drainage comprising wetland-type retention ponds with sediment forebays, ditches and swales within an infiltration basin at the A13 junction. Existing dry retention ponds located along the M25 would be upgraded to wetland-type retention ponds with sediment forebays. The outfall from these ponds would discharge into watercourses and ditches.

2.9 Safety and security

2.9.1 The A122 would include the following:

a. Modern safety measures and design 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

2.10 Road user charging

2.10.1 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*'.

2.10.2 To align with NPSNN policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied in line with the Dartford Crossing. Vehicles would be charged for using the new tunnel.

2.11 Walkers, cyclists and horse riders

2.11.1 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.

2.12 Environmental design

2.12.1 The Project has been developed to avoid or minimise significant effects on the environment, and during the design process further measures have been incorporated 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 portal, and Chalk Park, to the south of the River Thames.

2.13 Construction compounds and utility logistic hubs

2.13.1 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 portals to allow for tunnelling operations and materials management. Utility logistic hubs would be needed for specific utility works.

2.14 Haulage routes and construction traffic management

2.14.1 Where there is no direct access from the strategic road network, suitable local roads would initially be used to access the construction worksites and compounds. Following this, temporary haul routes would be constructed off the strategic road network early in the programme where possible to access the construction worksites and compounds and further reduce usage of the local road network. In some instances, the temporary haul roads may need to connect to the existing local road network. Traffic management measures would

be used to control the impacts of construction on the local and strategic road network.

2.15 Services and utility installations and diversions

2.15.1 To accommodate the construction and operation of the Project, it would be necessary to install and divert multiple utilities including overhead electricity powerlines, high-pressure gas pipelines and other utility networks and their associated infrastructure including cabinets, substations and maintenance compounds. New utility connections would be installed to the compounds and to the tunnels.

2.16 Land required

2.16.1 The Project would require land on a permanent basis for the road and tunnel, along with other operational infrastructure, and environmental mitigation and compensation.

2.16.2 On a temporary basis, land would be required for construction compounds, logistics areas and other construction activities. The utility installations and diversions, some environmental works 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 environmental works and flood compensation.

2.16.3 The full land requirement for the Project is shown on the Land Plans (Application Document 2.2) and set out in the Statement of Reasons (Application Document 4.1).

2.16.4 The Project would also require 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 it is only proposed to install and divert utilities through the land and the land would not be permanently impacted. This means that its previous use can continue once the works are finished.

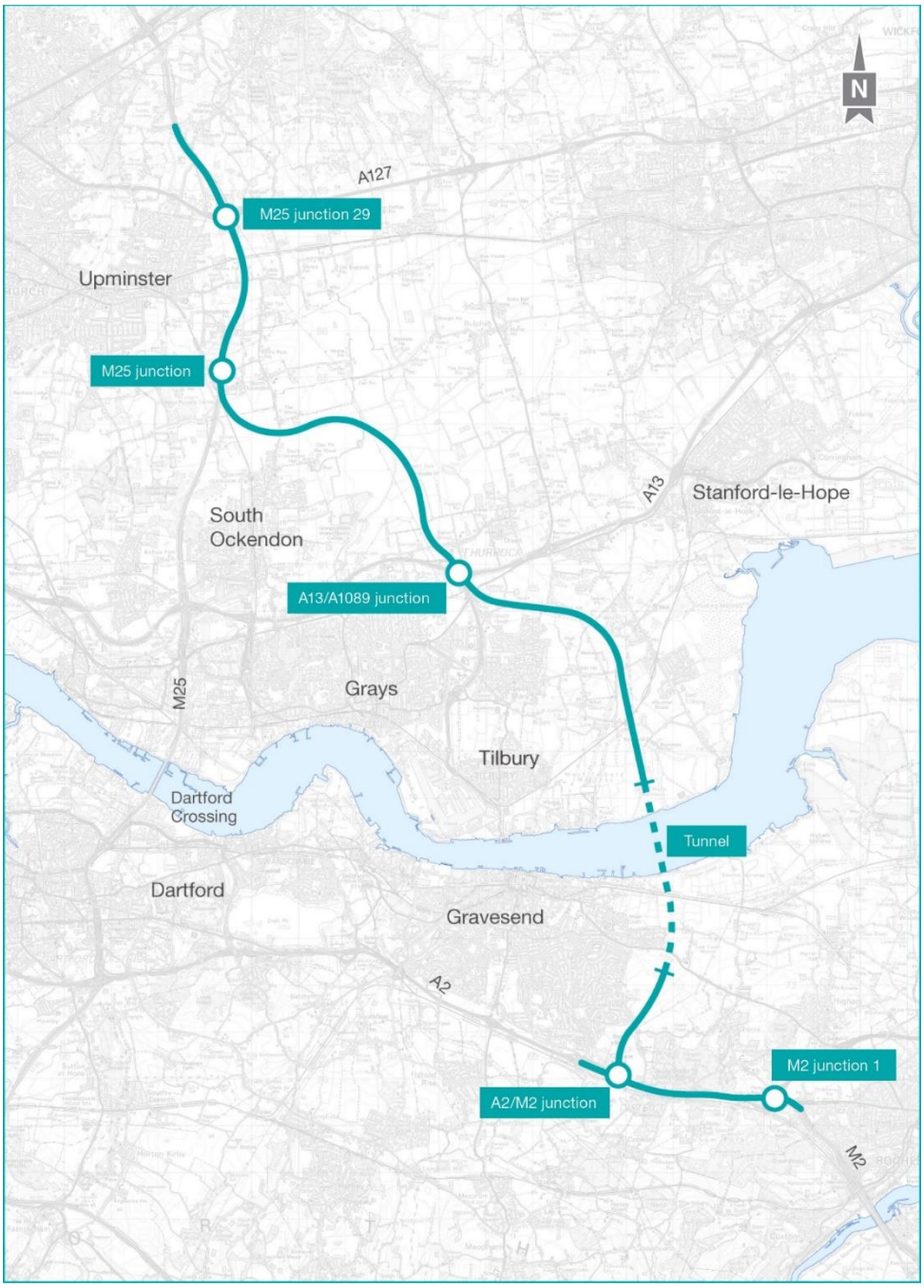
2.16.5 Consultation with relevant landowners, occupiers and agents remains an ongoing focus through the development of the Project. Compensation for affected parties follows the statutory Compensation Code.

2.17 Operations and maintenance

2.17.1 Following completion, the A122 would be part of the strategic road network.

2.17.2 To carry out inspection, certain specified maintenance activities in the tunnel and periodic emergency exercises, a periodic full closure of the relevant tunnel(s) would be required. These would be planned to minimise disruption, and where feasible lane closures would be used instead.

Plate 2.1 Lower Thames Crossing route



2.18 Setting the Scheme Objectives

2.18.1 The various issues which give rise to the need for the Project, as set out above, form the basis for the identification of the Scheme Objectives.

2.18.2 These objectives, which comprise three principal categories of Transport, Community and Environment, and Economic, were developed by the Applicant and endorsed by the Department for Transport, after the Government commissioned the Applicant to identify and assess options for a new road crossing in the Lower Thames area in 2014. The objectives are shown in Table 2.1.

Table 2.1 Scheme Objectives

Scheme Objectives	
Transport	• To relieve the congested Dartford Crossing and approach roads and improve their performance by providing free-flowing north-south capacity • To improve the resilience of the Thames crossings and the major road network • To improve safety
Community and Environment	• To minimise adverse impacts on health and the environment
Economic	• To support sustainable local development and regional economic growth in the medium to long term • To be affordable to government and users • To achieve value for money

2.18.3 As well as the Scheme Objectives, the Lower Thames Crossing is being developed in line with the NPSNN (Department for Transport, 2014), which sets out government policies for Nationally Significant Infrastructure Projects (NSIPs) for England (also refer to the Planning Statement (Application Document 7.2). As the Project includes both gas pipeline and overhead line NSIPs, the Overarching National Policy Statement for Energy (EN-1) Department of Energy and Climate Change (2011a), National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Department of Energy and Climate Change (2011b), and National Policy Statement for Electricity Networks Infrastructure (EN-5) (Department of Energy and Climate Change (2011c) are being considered. This is defined further within the Planning Statement (Application Document 7.2).

3 Overarching design vision

3.1 Vision

3.1.1 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.

3.1.2 The Scheme Objectives are listed in Section 2.18, above.

3.1.3 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 its operation, management and maintenance as easy as reasonably practicable, and meet safety targets in order to achieve the Applicant'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 PRoWs 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.

b. *'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 achieved 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.

c. *'Connecting processes: A successful outcome focussed 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. Design and engineering proposals will be developed to consider opportunities to enhance rather than detract from the local environment.

4 Project-wide design principles

4.1 Introduction

4.1.1 The Project-wide design principles have been broken down against the tenets laid out in The Road to Good Design (Highways England, 2018): 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.

Terminology

4.1.2 Various abbreviations 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.

4.1.3 Emergency services refers to Kent Police, Kent Fire and Rescue, Essex Police, Essex Ambulance, Essex County Fire and Rescue, South East Coast Ambulance Service, Metropolitan Police, London Fire Brigade and London Ambulance Service.

4.2 Connecting people

4.2.1 '*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*'.

4.2.2 The principles in Table 4.1 apply to all areas unless stated otherwise.

Table 4.1 Project-wide design principles: Connecting people

Clause no.	Design principle name	Design principle
PEO.01	Walking, cycling and horse riding (WCH)	All PRoWs crossing the Project route shall have a detail 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 where appropriate.
PEO.02	WCH user experience	In order to allow users to recognise and appreciate their whereabouts, WCH routes across and adjacent to the Project within the Order Limits shall include appropriate clear and informative signage to provide wayfinding for the users.
PEO.03	WCH detail 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	WCH detail design standards	WCH routes shall be designed in accordance with the following standards: • DMRB standard CD 143 Designing for walking, cycling and horse-riding (Highways England, 2021a) • DMRB standard CD 195 Designing for cycle traffic (Highways England, 2021b) • Local Transport Note 1/20 Cycle infrastructure design (Department for Transport, 2020) In addition to the above, WCH routes should consider the following guidance (up to the DCO submission date): • Local Cycling and Walking Infrastructure Plans - Technical Guidance for Local Authorities (Department for Transport, 2017) • Sustrans Design Manual – Handbook for cycle-friendly design (2014) and • British Horse Society advice notes

Clause no.	Design principle name	Design principle
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 the use of robust design elements to prevent and mitigate the potential for misuse of the WCH network by unauthorised vehicles and to prevent and deter anti-social behaviour and unauthorised access to third-party land.
PEO.07	WCH: heritage interpretation	To identify and document local heritage and connection to the landscape, the Project during the detail 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	-
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, Sheets 5 and 6 of Figure 2.4: Environmental Masterplan (Application Document 6.2). 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 green bridge north (Work No. 3B).
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 horse riders through Design Principle specific Sections S11, S12, S13 and S14 (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 (as per the Rights of Way & Access Plans, Application Document 2.7). 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.

Clause no.	Design principle name	Design principle
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	Landowner access tracks	Where provided, access tracks shall be appropriately constructed and surfaced for their intended use (e.g., for farm vehicles).
PEO.13	Not used	-

4.3 Connecting places

4.3.1 '*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 restrained and environmentally sustainable design, in fitting with the context.*' (Highways England, 2018).

4.3.2 The principles in Table 4.2 apply to all areas unless stated otherwise.

Table 4.2 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 National Highways standards), while promoting safety requirements/targets through its location, mounting and lighting.
PLA.03	Common design language	The Project 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.04	Not used.	-

Clause no.	Design principle name	Design principle
PLA.05	Habitat connectivity	Design proposals shall prioritise improving connectivity between existing habitats wherever reasonably practicable, as defined within the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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.

4.4 Connecting processes

4.4.1 '*A successful outcome focussed 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).

4.4.2 The principles in Table 4.3 apply to all areas unless stated otherwise.

Table 4.3 Project-wide design principles: Connecting processes

Clause no.	Design principle name	Design principle
PRO.01	Design review	The Project shall engage with the National Highways Design Review Panel (NHDRP) on the development of the detail design. The design proposals shall be developed with regard to comments raised by the NHDRP.
PRO.02	Integrated design	The detail 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 (Carbon and Energy Management Plan, Application Document 7.19). Efficient, low carbon-emission designs, low-carbon materials, energy supply and construction processes (e.g., Design for Manufacture and Assembly (DfMA)) shall be specified wherever reasonably practicable and economical within the Project life cycle.

Clause no.	Design principle name	Design principle
PRO.04	Biodiversity	The detail 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.
PRO.05	Design champion	In accordance with the National Infrastructure Strategy (2020) a Project-wide design champion shall be designated by National Highways to protect and promote good design and these Project Design Principles throughout the detail design and delivery phases of the Project.
PRO.06	Suicide prevention	The detailed design process for the highways forming part of the strategic road network or local road network must consider the incorporation of measures, such as enhanced parapets on high-risk structures, so far as is reasonably practicable to reduce the risk of suicides in accordance with the National Highways (2022) Suicide Prevention Strategy (or any substituted version of that strategy published by National Highways). The emergency services will be consulted on the proposed measures as part of the detailed design process.

4.5 Structures

4.5.1 This section relates to specific requirements for bridges and tunnel portals across the Project. Though it references Project Enhanced Structures it does not supersede the requirements of DMRB CD 351 (Highways England, 2020a) 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’.*

4.5.2 The principles in Table 4.4 apply to all areas unless stated otherwise.

Table 4.4 Project-wide design principles: Structures

Clause no.	Design principle name	Design principle
STR.01	General structures	The design shall 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 design shall achieve structures that are not overbearing or obtrusive in the landscape, thereby reducing impact on the local character and environment.
STR.02	Project Enhanced Structures: South Portal (Work No. 3C) and North Portal (Work No. 5A)	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. • The South Portal, including the cutting, short tunnel approach ramp and retaining walls, and the South Portal Tunnel Services Building incorporated within the cut and cover tunnel structure. • The North Portal, including the tunnel approach ramp and retaining walls, and the North Portal Tunnel Services Building above the cut and cover tunnel structure. • The materials, colour and finishes shall be consistent. • The Tunnel Services Building(s) shall have a green/ brown roof. • The Tunnel Services Building(s) shall be designed to achieve a BREEAM level of 'Excellent'. Natural light, passive ventilation and climate control for the staff welfare facilities shall be incorporated as part of the overall building design. • Passive provision for, and installation of renewable energy systems for the operation of the Tunnel Services Buildings, shall be investigated and implemented so far as reasonably practicable to do so. Where this gives rise to materially new or materially different environmental effects, and cannot be delivered under the terms of the DCO, the Contractors shall investigate alternative delivery mechanisms so far as is reasonably practicable. Further requirements for these structures is given in STR.01, STR.06, STR.09, STR.12, Section 5.3 Gravesend link and Section 5.5 Tilbury Marshes and North Portal.

Clause no.	Design principle name	Design principle
STR.03	Project Enhanced Structures: Thong Lane green bridge north (Work No. 3B)	The design 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. • There shall be no primary structure above the apex of the parapet. • The bridge parapet colour and finish shall match the North and South Portal tunnel entrance thresholds, and the parapets of the North Portal operational access bridge. Further specific requirements for this structure are given in STR.01, STR.06, STR.07, STR.08, STR.11, STR.12 and Section 5.3 Gravesend link.
STR.04	Project Enhanced Structures: Orsett Fen viaduct (Work No. 8B), Mardyke viaduct (Work No. 8B)	The design 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. • The form, materials, colour and finishes of the two viaducts shall be consistent. • The viaducts' design shall minimise structural members above the A122 road levels subject to noise barriers and parapet requirements. • Smooth curved and haunched beam soffit profiles shall be used, whilst optimising spans to minimise the number of piers required to maximise the views under the viaduct. Further specific requirements for these structures are given below in STR.01, STR.06, STR.07, STR.12 and Section 5.8 Ockendon link.

Clause no.	Design principle name	Design principle
STR.05	Project Enhanced Structures: Thames Chase WCH bridge (Work No. 9O)	The design 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. • The bridge shall be sympathetic to the local topography and span between the tops of and across the cutting slopes so as not to visually constrain the view along the M25 cutting. • There shall be no primary structure above the apex of the parapet. • The structural depth shall be minimised by combining the main structures with the parapets (e.g. in a through girder form). • The structure shall be designed to include safety refuges and seating points at each pier. Any utility requirements shall be integrated within the structural outline (e.g., not hung and exposed). Further specific requirements for this structure are given in STR.01, STR.06, STR.07, STR.12 and Section 5.9 M25 junctions.

Clause no.	Design principle name	Design principle
STR.06	Project Enhanced Structures: consistent design approach	Project Enhanced Structures (ref. STR.01-05, STR.08 and STR.15) shall share the following consistent design approach: • A consistent material palette shall be used for all Project Enhanced Structures. • The surrounding landscape, earthworks and bridge abutments will provide an integrated solution resulting in a Project-wide fully coordinated design and engineered landscape. • Bridge pier material and form shall be distinctive and consistent across the Project and avoid large expanses of planar surfaces at the abutments and adjacent landforms. • Materials shall be self-finished, (as far as technically practicable whilst complying with DMRB standards) minimising maintenance while being consistent and appropriate to the colour palette required in the Kent Downs AONB. • Parapet material and form shall be distinctive and consistent across the Project. Parapets and acoustic barriers shall be combined where reasonably practicable. • The natural light under bridge structures shall be maximised as much as is reasonably practicable. • Components shall be limited in variety, consistent in form and of high-quality, maximising standard components replicable through DfMA. • A sense of place and pride of asset shall 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. • Structures such as earth-retaining walls, abutments, piers and parapets shall seamlessly integrate within the landscape, avoiding exposed wing walls and visible concrete retaining structures where reasonably practicable. • Where exposed engineered structures are required, these shall be designed and constructed to support the principles of a landscape-led approach and mitigate the impact on the existing green infrastructure. • Access requirements, including for maintenance, shall be coordinated where practicable to avoid duplication. Where access structures (e.g., galleries) are required, these shall be integrated within the Project rather than added on. • A typical graphic illustrating a Project Enhanced Structure is provided in Appendix B.

Clause no.	Design principle name	Design principle
STR.07	Bridge structures	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: • 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. • Project overbridges (not including those at junctions) shall incorporate the name of the road, PRoW or WCH carried over the bridge onto the structure or parapet as a recognisable graphic (e.g., perforated steel parapet, etc). • Any utility requirements shall be integrated within the structural outline (e.g., not hung and exposed).

Clause no.	Design principle name	Design principle
STR.08	Green bridges	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 detail 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. The following bridges shall be green bridges: • Brewers Road green bridge (Work No. 1D) • Thong Lane green bridge south (Work No. 1H) • Thong Lane green bridge north (Work No. 3B) • Muckingford Road green bridge (Work No. 6B) • Hoford Road green bridge (Work No. 6C) • Green Lane green bridge (Work No. 7M) • North Road green bridge (Work No. 8D) Subject always to the constraints set out in the DCO, the design of green bridges shall be developed to support the successful establishment of the planting typologies as shown on the Environmental Masterplan (Application Document 6.2, Figure 2.4) and as defined in the outline Landscape and Ecology Management Plan (oLEMP) (Application Document 6.7), and shall consider the guidance set out in the Summary of Findings within the Natural England (2015) report, Green Bridges: A Literature Review (NECR181). Green bridge planting shall be designed to be set back from the bridge parapet edge to reduce the chance of landscape planting falling onto the operational highway below. Any utility requirements shall be integrated within the structural outline (e.g., not hung and exposed). The minimum widths of planting zones are defined in the bridge-specific principles below.
STR.09	Barriers and fences	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.

Clause no.	Design principle name	Design principle
STR.10	Noise barriers and tranquillity	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. Required noise mitigation structures shall be designed and (where reasonably practicable) screened with planting to minimise the perception of the urbanisation in rural areas. 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).
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, instead of, or combined with structural parapets), VRSs shall be a timber National Highways certified system for the level of use identified, unless agreed otherwise.
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.
STR.13	Planting in utility corridors	Planting proposed within the proximity of underground and overhead utilities shall adhere to the relevant Statutory Undertaker and asset owner's planting policies, guidelines and easement considerations Planting within utility corridors shall avoid appearing as 'notches' in long distance views and shall be designed to transition into the adjacent planting in a naturalistic manner.

Clause no.	Design principle name	Design principle
STR.14	Telecommunications ducts within bridge structures	The following new bridge structures shall include spare ducts to provide for all necessary communications infrastructure by others, providing sufficient capacity to meet both current and likely future fibre, phone and cabling needs: • Muckingford Road bridge (Work No. 6B) • Brentwood Road overbridge (Work No. 6D) • A1013 over A1089 overbridge (Work No. 7D) • A1013 over A122 Lower Thames Crossing overbridge (Work No. 7D) • Rectory Road overbridge (Work No. 7J) • Stifford Clays Road over A122 Lower Thames Crossing overbridge (Work No. 7L) • Stifford Clays Road over A122 Lower Thames Crossing northbound overbridge (Work No. 7L) • Green Lane bridge (Work No. 7M) • Farm track and footpath 136 (Work No. 8C) • North Road bridge (Work No. 8D) • Brewers Road green bridge (Work No. 1D) • Thong Lane green bridge south (Work No. 1H) • Thong Lane green bridge north (Work No. 8D)
STR.15	Project Enhanced Structures: North Portal operational access bridge (Work No. 5E)	The design 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. • There shall be no primary structure above the apex of the parapet. • The bridge parapet colour and finish shall match the North and South Portal tunnel entrance thresholds, and the parapets of the Thong Lane Green bridge north.
STR.16	Bridge structures: WCH design	Further to the requirements of principle PEO.04, WCH provision on bridge structures shall be designed in accordance with the following standards: • DMRB standard CD 353 Design criteria for footbridges (Highways England, 2020b) The minimum widths for WCH provision are defined in the bridge-specific principles.

Clause no.	Design principle name	Design principle
STR.17	Above-ground utilities infrastructure	Integrate any above-ground infrastructure required for the operation and maintenance of the utility networks into the setting of the area, or screen by landscaping, where practicable and compliant with the requirements of the utility owner.

4.6 Lighting, signage and technology

4.6.1 The principles in Table 4.5 apply to all areas unless stated otherwise.

Table 4.5 Project-wide design principles: Lighting, signage and 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 (including the A2/M2 Corridor) and to maintain dark corridors for wildlife, 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 and to maintain dark corridors for wildlife, (such as at the portals) shall be controllable, directional and as low-level as is practicable and safe (floodlighting shall be avoided).

4.7 Landscape

4.7.1 The principles in Table 4.6 apply to all areas unless stated otherwise.

Table 4.6 Project-wide design principles: Landscape

Clause no.	Design principle name	Design principle
LSP.01	Retention of existing vegetation	All existing vegetation shall be retained as far as reasonably practicable in order to: • preserve its intrinsic ecological value • preserve the existing woodland character and pattern • preserve its function as a natural screen to the works • preserve the natural enclosed woodland settings for existing adjacent properties. Minimum areas of retained woodland and hedges are shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4). However, even outside these areas, existing vegetation shall be retained as far as reasonably practicable. Measures for the protection of retained vegetation during site clearance works are provided for in REAC item LV028 (Application Document 6.3, Appendix 2.2). Details relating to root protection for veteran or ancient trees are defined within the REAC document, item LV030.
LSP.02	Planting strategy	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. Planting shall be designed to link into retained and existing habitats, strengthening connectivity across the wider landscape. The species mix and pattern shall take into account the historic landscape, underlying geology, aspect, level of disturbance/potential for remediation, and other local character features to ensure it will be suitable within its environs. 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. It shall comprise only 'plant healthy' accredited stock where reasonably practicable.

Clause no.	Design principle name	Design principle
LSP.03	Landscape integration features for visual screening	The detail design shall use planting to soften the edge of the earthworks and integrate the Project as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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 landscape within the Order Limits adjacent to the receptor to mitigate the loss of visual screening.
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 (Application Document 6.2, Figure 2.4).
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 reasonably 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 detail 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, the new landscape design shall take account of local landscape character, respect historic features and reference historic land use, landforms, field 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	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. 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 (Application Document 6.2, Figure 2.4). Exceptions are where land has been identified as to be returned to agriculture, where slopes shall be slackened to a minimum 1:10 gradient. Where minimising the land required for the Project, to avoid additional impacts, slopes shall be designed no steeper than 1:3 gradient, unless agreed otherwise.
LSP.10	Junction planting	Given the complexity of the junctions at the M2/A2/A122 Lower Thames Crossing, A13 and M25, the landscape shall primarily be woodland planting, as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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.
LSP.11	Planting palettes	Planting shall be provided in accordance with the palettes in Appendix A.
LSP.12	New, diverted and reinstated watercourses	Additional diversions of watercourses to those currently defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4) and the Works Plans (Application Document 2.6) shall be undertaken as a last resort unless they would afford benefits such as a more natural alignment.
LSP.13	Hedgerow reinstatement: field and roadside boundaries	To protect the historic character of the landscape, provide additional screening and enhance biodiversity, reinstated field boundaries shall be demarcated with hedgerows. 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 of local provenance and, where appropriate, include hedgerow trees.

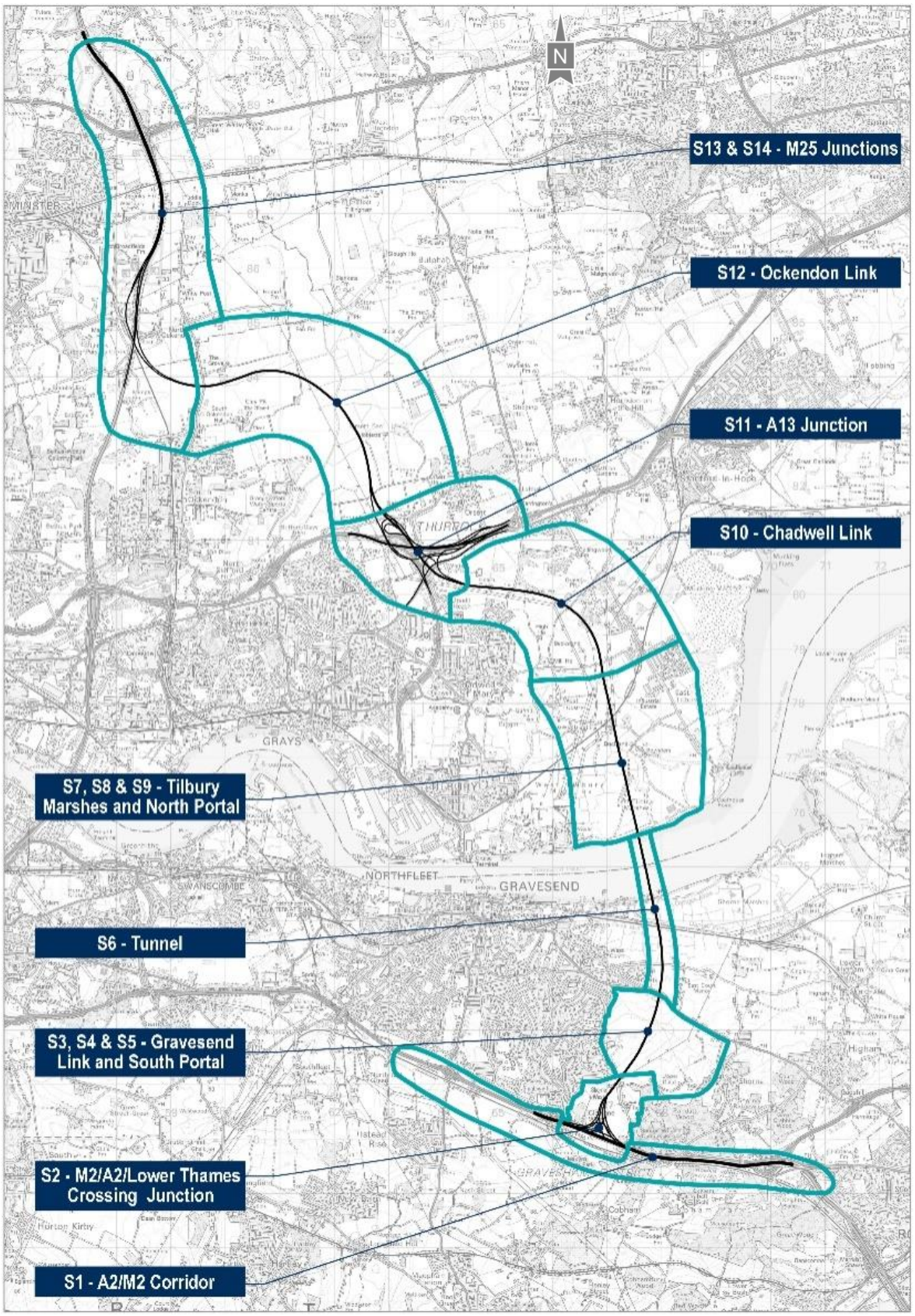
Clause no.	Design principle name	Design principle
LSP.14	Hedgerows: highways boundaries	Where appropriate, and in keeping with existing landscape character, hedgerow planting shall be planted at the toe of engineered earthworks or beyond proposed Project assets such as drainage ditches and swales. This will 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 densities shall be developed to comply with environmental functions as set out in the Environmental Masterplan (Application Document 6.2, Figure 2.4).
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 so far as is possible and reasonably practicable. To this end permeable paving that is suited to context (e.g., cellular grass paving systems), shall be used wherever practicable.
LSP.17	Integration of infiltration basins and retention ponds	Infiltration basins and retention ponds shall not appear utilitarian or urban and 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. The drainage design shall incorporate Sustainable Drainage Systems (SuDS) that provide for runoff treatment and reduce the risk of flooding in local catchments by providing storage and attenuation. Attenuation features are shown on the Environmental Masterplan (Application Document 6.2, Figure 2.4) and the Works Plans (Application Document 2.6). Where this attenuation is provided via retention and infiltration basins, the basins shall be designed to appear as naturalistic elements within the wider setting, with planting provided to soften edges where this is appropriate. Conveyance of runoff would be by means of drainage ditches and pipes, and drainage ditches would be used wherever practicable.
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 designed to achieve the most ecologically beneficial woodland habitat and be in accordance with REAC reference TB28 and as shown on the Environmental Masterplan (Application Document 6.2, Figure 2.4) using the code LE8.2.

Clause no.	Design principle name	Design principle
LSP.20	Wildflower seeding on earthworks	Grassland on roadside verges and earthworks including embankments, cuttings and false cuts shall be seeded to become species-rich grassland and include wildflowers, suitable to underlying soil and subsoil type. Wildflower mixes shall include yellow rattle to help suppress the growth of grass. 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 tilth, 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 Institution, 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 to integrate and terminate them in a naturalistic way. Earthworks shall maintain a consistent level of screening with no gaps, and not appear stepped or terraced, unless appropriate to the location.
LSP.22	Approach to Open Mosaic Habitat (OMH)	Areas of OMH (as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4)) shall be a dynamic habitat, the value of which is generated by regular disturbance which prevents habitat succession and retains habitat and structural diversity. The final distribution of habitats will be as follows: • Scrub – no greater than 10% coverage • Bare ground – approximately 10% coverage • Rough grassland – approximately 30% coverage • Low nutrient, free-drainage grassland – approximately 50% Pulverised fuel ash to provide a minimum 20% overall area substrate, together with sands and gravels generated by the construction work, shall be used to mimic the substrate in areas where the habitat is currently found, and left to regenerate naturally. Planting mixes shall aim to extend the flowering season to support a range of pollinator species such as shrill carder bee.
LSP.23	Early planting	Where reasonably practicable, planting shall be undertaken early in the construction programme to maximise the maturity of the planting scheme at road opening.

Clause no.	Design principle name	Design principle
LSP.24	Planting – Key views/vistas	The detail design of planting mitigation and planting compensation areas shall aim to maintain the key views/vistas identified in the area-specific design principles.
LSP.25	Planting – Openness	Where reasonably practicable, the planting of larger tree and/or shrub species shall be set back from WCH routes and residential properties to maintain a sense of openness, as well as avoiding the obstruction of views.
LSP.26	Planting – Screening	Opportunities shall be sought in the detail design of planting to screen or soften the visual appearance of any existing visual detractors featuring in views, for example, overhead power lines.
LSP.27	Nitrogen deposition compensation sites – retention of key vistas	Landscape design principles for habitat creation on the nitrogen deposition compensation sites are set out in the oLEMP (Application Document 6.7). Principles for retention of key vistas are included in the sections on area-specific principles.
LSP.28	Drainage design	Conveyance of runoff would be by means of drainage ditches / swales and pipes. Drainage ditches / swales would be used wherever safe and practicable. The use of gully pots within the drainage design shall be avoided where a viable alternative is available. Gully pots present a risk of trapping various species, most notably great crested newts.
LSP.29	Drainage strategy – south	To the south of the River Thames, the drainage strategy would be based primarily on the use of gravity drainage networks that outfall to infiltration basins. Pumping stations would only be incorporated into the highway drainage system where gravity networks are not viable.
LSP.30	Drainage strategy – north	To the north of the River Thames, the drainage strategy would be based primarily on the use of gravity drainage networks that outfall to retention ponds prior to discharge to watercourses. Pumping stations would only be incorporated into the highway drainage system where gravity networks are not viable.
LSP.31	Wildlife pond provision	Where any pond is lost this shall be replaced on a one-for-one basis with a new pond of similar area to those lost. Where ponds have been identified as supporting great crested newts, two new ponds shall be created for each great crested newt pond lost. The design of all ponds shall follow the guidance given in the Great Crested Newt Conservation Handbook (Langton *et al*, 2001).
LSP.32	Public safety in publicly accessible land	New public open spaces, common land and replacement open space shall be designed in accordance with the principles and practice outlined in Managing Visitor Safety in the Countryside (Visitor Safety Group, 2011). Designs shall achieve an appropriate balance between the risks and benefits of providing recreational access to these spaces.

5 Area-specific design principles

Plate 5.1 Project route as Sections



5.1 S1 – A2/M2 Corridor

Plate 5.2 Section 1 – A2/M2 Corridor

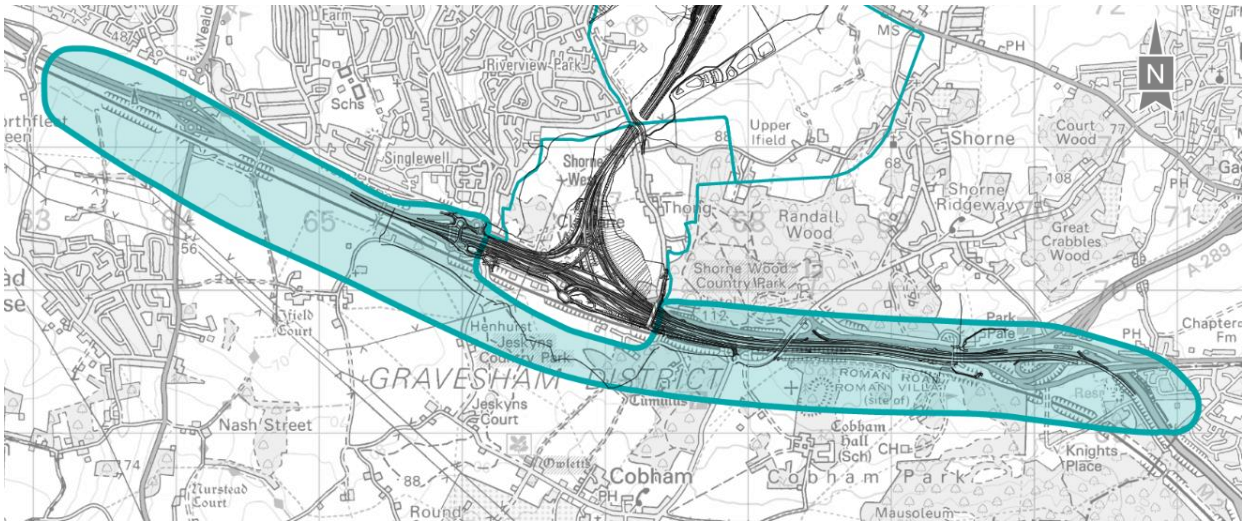
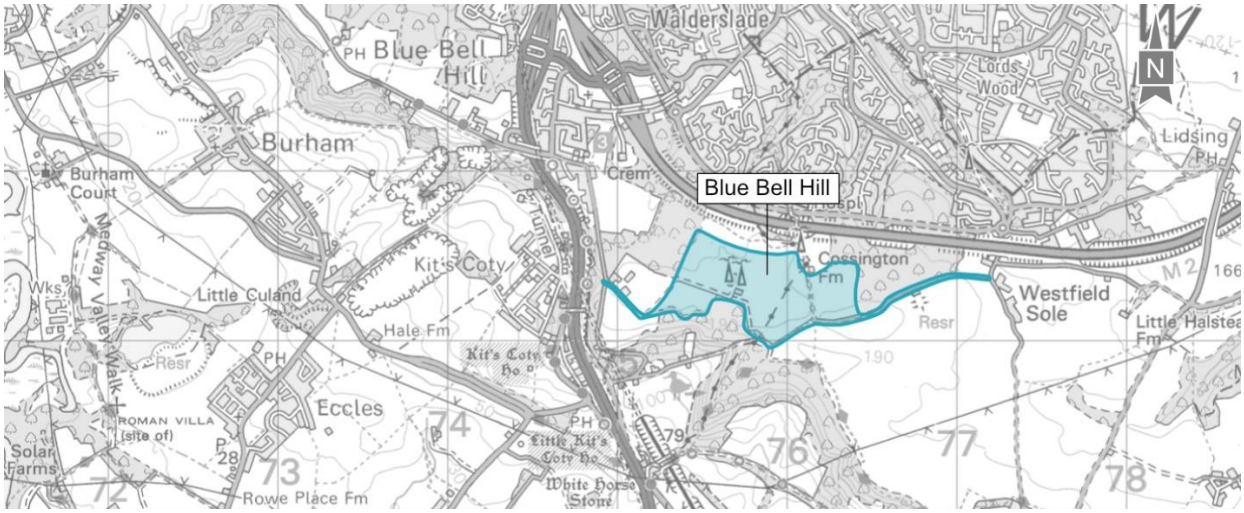


Plate 5.3 Section 1 – Blue Bell Hill Nitrogen Deposition Compensation site (south-east of A2/M2 Corridor)



5.1.1 The principles in Table 5.1 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4), and are shown approximately by the teal area in Plate 5.2 and Plate 5.3 above for reference, subject to the Order Limits.

Table 5.1 Section-specific principles: Section 1 – A2/M2 Corridor

Clause no.	Design principle name	Design principle
S1.01	Woodland north of the A2/M2 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 (Application Document 6.2, Figure 2.4).
S1.02	Planting to the south of the A2/M2 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 (Application Document 6.2, Figure 2.4).
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 reduce the width of the A2 corridor footprint as far as reasonably practicable. The detail 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 green bridge (Work No. 1D) and Thong Lane green bridge south (Work No. 1H)	The bridges shall be designed to meet the following criteria: • 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 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 reasonably practicable. • To act as local landmarks and to signal entry into the Kent Downs AONB for drivers, the vegetation on the bridges shall be visible on the horizon on their approach to the area from the east for Brewers Road green bridge, and from the west for Thong Lane green bridge south. • To provide a bridge with soil depth suitable to establish appropriate shrubs and intermittent tree species, reflective of the surrounding character and species makeup of the Kent Downs AONB. Variations in soil depth on the bridge can provide diversity in planting species and heights.

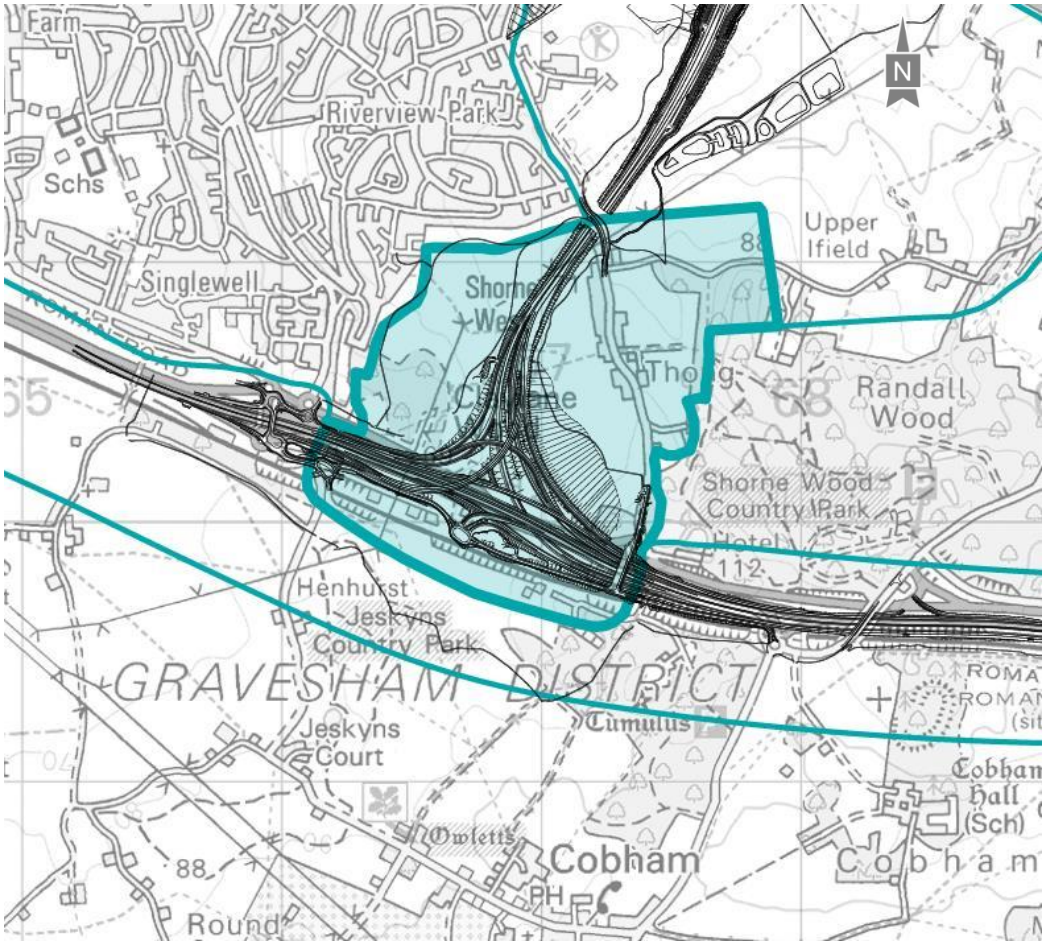
Clause no.	Design principle name	Design principle
		• To provide a high-quality experience for users crossing the bridge through vegetation and woodland planting. The green bridge shall improve recreation access across the A2/M2/Lower Thames Crossing corridor. • To provide planting on the green bridge that links into woodland planting to the edge of Gravesend in the west and the gateway to Shorne Woods Country Park in the east as part of a wider 'wooded circle' connecting Shorne Woods and Claylane Wood.
S1.05	NCR177 Realignment	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 A2 carriageway. Connections across HS1 and the A2 carriageway between recreational areas north and south shall be made at Gravesend East, and at Thong Lane green bridge south, Brewers Road green bridge and Park Pale bridge. The realigned route shall be surfaced to maintain the rural character of the setting while providing a robust enough surface for frequent cycle use. During construction, the NCR177 shall be temporarily diverted through Ashenbank Wood and Jeskyns Community Woodland. Existing tracks shall be temporarily resurfaced appropriately for road cycle use. The surface through Ashenbank Wood shall be removed once the permanent route is complete, and the quality of the existing track shall be restored.
S1.06	Reflect surrounding landscape character	The detail design of the landscape and mitigation shall take account of the extensive deciduous woodlands adjoining large arable fields, thick deciduous shaws and hedgerows to ensure they complement and strengthen the existing character of the Kent Downs AONB and local landscape character assessments and the Kent Downs AONB Landscape Design Handbook (Kent Downs AONB Joint Advisory Committee, 2018). 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.
S1.07	Planting palette within the Kent Downs AONB and its setting	Further to Design Principle LSP.11, a diverse palette of native shrub and tree species characteristic of the local landscape character area and of local provenance shall be used in the area, in accordance with the Kent Downs AONB Landscape Design Handbook (Kent Downs AONB Joint Advisory Committee, 2018). Planting palette to consider suitable species to be reintroduced as identified from archaeological data (from field data) as far as reasonably practicable.

Clause no.	Design principle name	Design principle
S1.08	New woodland east of Shorne Woods Country Park	New woodland east of Shorne Woods Country Park shall be provided to link Shorne Woods with Great Crabbles Wood. The design shall be developed through collaboration and engagement with Shorne Woods Country Park, Natural England, Kent Downs AONB and relevant local stakeholders, subject to their requirements being compatible with mitigation requirements as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). Defensive understorey planting shall be planted to the boundary of adjacent private land to prevent public access. The design of woodland shall retain key views from the upper slopes of the new woodland across to the Darnley Mausoleum and views to the wider Kent Downs AONB.
S1.09	Retaining structures and bridge abutments	Retaining structures and bridge abutments within the Kent Downs AONB and its setting, shall be either green walls, earth banks, or clad with hard materials in accordance with the Kent Downs AONB Landscape Design Handbook (Kent Downs AONB Joint Advisory Committee, 2018), to be reflective of the local vernacular.
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 woodland 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 NCR177 (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 and hedgerow planting shall be provided adjacent to Shorne Woods along both sides of Thong Lane where practicable and in accordance with the requirements of the utility companies.
S1.15	Not used	-

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. Further to LSP.01, where reasonably practicable, the vegetation removed, shall be reduced between the Project and HS1.
S1.17	Brewers Road green bridge (Work No. 1D)	The following minimum widths shall apply in accordance with STR.08 and STR.16: • A 10m planting zone on the east. • A 1.5m planting zone on the west. • WCH provision, comprising a 3m shared pedestrian/ cycle route and a 3.5m horse riding route.
S1.18	Not used	-
S1.19	Retention of vista near Representative Viewpoint S-02	The detail design of ancient woodland compensation planting shall retain a framed long-range view south-west from footpath NS160 on the south-west edge of Great Crabbles Wood, towards woodland within Cobham Hall Grade II* Registered Park and Garden. Refer to Viewpoint S-02 location on Figure 7.16 (Application Document 6.2).
S1.20	Retention of vista near Representative Viewpoint N-Dep-RV-03	The detail design of nitrogen deposition compensation planting shall retain a view south-east from Swiller's Lane and east from residential properties along Barndale Court and Warren View in Shorne village, over undulating landscape framed by skyline woodland at Court Wood, Cole Wood and Starmore Wood. Refer to Viewpoint N-Dep-RV-03 location on Figure 7.16 (Application Document 6.2).
S1.21	Retention of vista near Representative Viewpoint N-Dep-RV-04	The detail design of nitrogen deposition compensation planting shall retain a view south from footpath KT/NS/159 and footpath KT/NS/156, towards backdrop woodland at Court Wood, Cole Wood and Starmore Wood. Refer to Viewpoint N-Dep-RV-04 location on Figure 7.16 (Application Document 6.2).
S1.22	Not used	-
S1.23	Brewers Road green bridge: Habitat connectivity	A mammal culvert shall be provided at the north side of the bridge, between the existing and new bridge abutments. The culvert shall be designed to allow mammal passage and adequate space for maintenance and inspection. The culvert structure shall be designed to integrate into the surrounding landscape.

5.2 S2 – M2/A2/A122 Lower Thames Crossing junction

Plate 5.4 Section 2 – M2/A2/A122 Lower Thames Crossing junction



5.2.1 The principles in Table 5.2 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4), and shown approximately by the teal area in Plate 5.4 above for reference, subject to the Order Limits.

Table 5.2 Section-specific principles: Section 2 – M2/A2/A122 Lower Thames Crossing junction

Clause no.	Design principle name	Design principle
S2.01	Wooded circle around Thong	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. Within the open grassland, wildflower meadow planting shall reference the historic layout and runways of RAF Gravesend as shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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. The detailed specification of planting adjacent to the properties of Gravesend East shall be developed to avoid overshadowing and consider appropriate planting treatment to deter anti-social behaviour.
S2.02	Looping walks connecting recreational areas	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 looping WCH route connecting around the M2/A2/A122 Lower Thames Crossing junction. Between Claylane Wood and Shorne Woods Country Park, this shall be via the Thong Lane green bridge north (Work No: 3B). NS167 shall not cross the junction.
S2.03	Woodland planting around slip roads	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 (Application Document 6.2, Figure 2.4).
S2.04	Thong Lane green bridge north (Work No. 3B)	To connect woodland habitat, lessen the visual impact of the M2/A2/A122 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 green bridge north shall be a new green bridge. The landscape across the bridge shall be designed to extend the character of the well-vegetated Thong Lane and connect woodland to the east and west to provide a habitat corridor for mammals. The bridge shall provide off-road routes for walkers, cyclists and horse riders away from the main road. Appropriate crossings shall be provided north and south of the bridge to facilitate north-south movement. Design Principles for the Project Enhanced Structures shall apply to this bridge. Woodland shall be designed to retain a sense of openness and intervisibility at eye level to make people feel safe when crossing the bridge, and not fully enclosed. The bridge shall provide a high-quality experience for users crossing the bridge using vegetation and woodland planting.

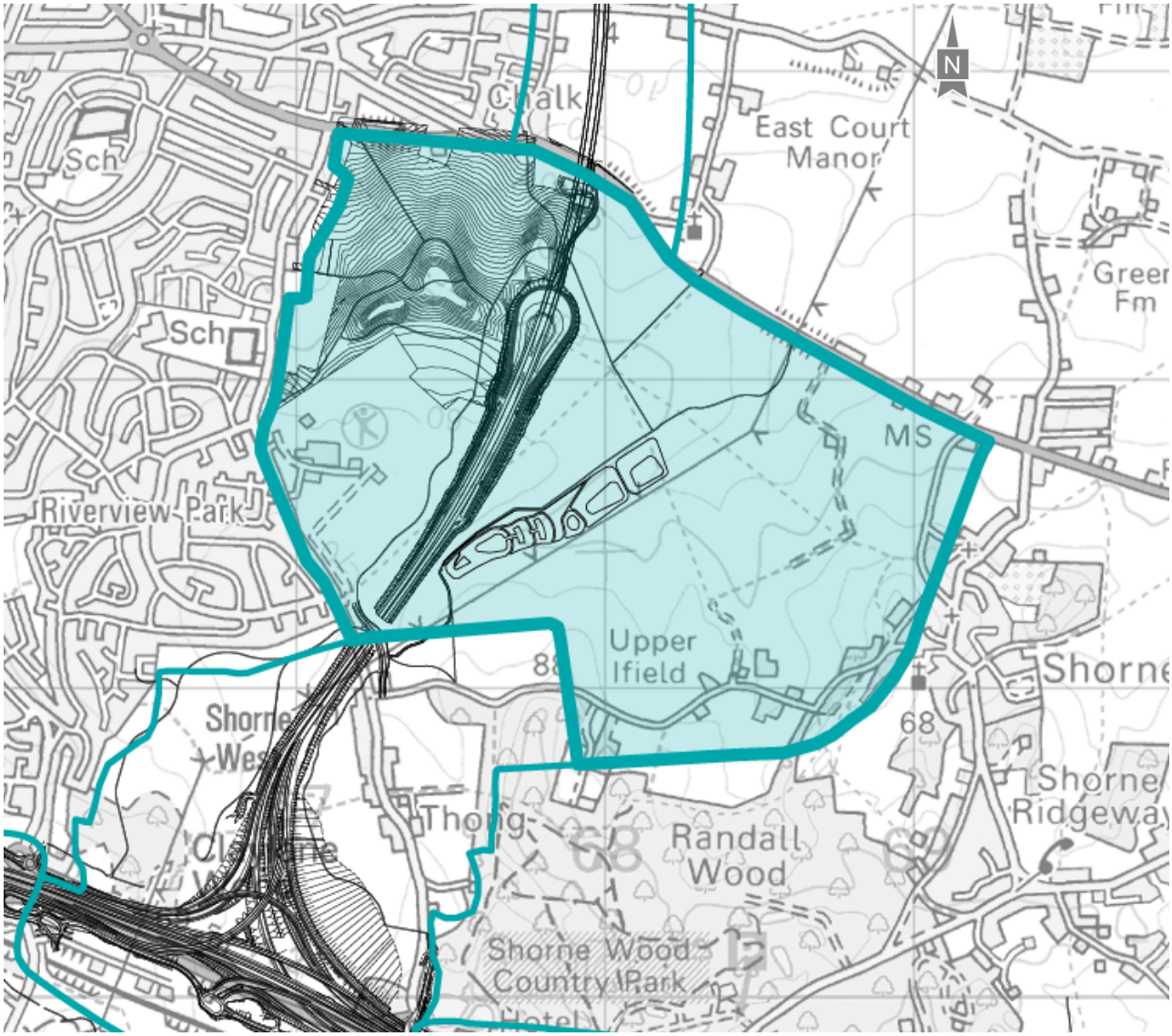
Clause no.	Design principle name	Design principle
		The soil depth on the bridge shall be suitable to establish appropriate woodland and woodland edge species, reflective of the surrounding character and species make up of the Kent Downs AONB. Variations in soil depth on the bridge can provide diversity in planting species and heights.
S2.06	Minimise impact on Claylane ancient woodland	The earthworks along the western edge of the M2/A2/A122 Lower Thames Crossing junction will be kept to a minimum and no false cut provided to limit the loss of ancient woodland as far as reasonably practicable. Woodland planting shall be provided on the earthwork slopes to provide visual mitigation and landscape integration. Planting in proximity to overhead power lines and underground utilities, between Claylane Wood and the M2/A2/A122 Lower Tames Crossing junction, including infiltration 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.
S2.07	Retained vegetation	In order to preserve landscape character and to reduce visibility towards the M2/A2/A122 Lower Thames Crossing junction, existing vegetation along and around the junction shall be retained as far as reasonably practicable.
S2.08	Infiltration basins at M2/A2/A122 Lower Thames Crossing junction (Work Nos. 2J, 2K, 2L, 2M, 2N)	Infiltration basins shall be located within the central islands of the M2/A2/A122 Lower Thames Crossing junction where reasonably practicable, so that the outer edges of the junction can be woodland planted, enclosing the junction and providing visual screening. Infiltration basins 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.
S2.09	Planting adjacent to Thong Lane	Design Principle S1.14 applies here also.
S2.10	Retaining wall materials	Design Principle S1.09 applies here also.

Clause no.	Design principle name	Design principle
S2.11	Thong Lane Car park (Work No. 1P)	A car park area shall be provided to the west of Thong Lane to provide recreational access to the PRoW network and open spaces within the wider area. The car park area shall repurpose hardstanding as a base for new surfacing and utility connections from the construction phase of the Project as far as reasonably practicable. Provision shall be made for facilities such as buildings (including a kiosk, toilets, changing and storage facility), and an area for cycle hire and cycle washing. The car park area shall also include provision for horsebox parking with suitable surfaced parking for 10-12 horseboxes, located away from the main car park circulation. A wooded buffer shall be provided along Thong Lane between the car park within the constraints of proposed utilities and highway visibility splays to the car park entrance. Planting shall be designed to the north of the car park to screen views from the village of Thong. Boundary planting shall be provided to integrate the car park into the surrounding landscape. Substations shall be appropriately sited and designed (materials and colour) to integrate with the car park and surrounding landscape.
S2.12	Thong Lane green bridge south (Work No. 1H)	The following minimum widths shall apply in accordance with STR.08 and STR.16: • A 20m planting zone on the west • A 1.5m planting zone on the east • WCH provision, comprising a 3m shared pedestrian/cycle route and a 3.5m horse riding route
S2.13	Retention of vista near Representative Viewpoint N-Dep-RV-01	The detail design of ancient woodland and nitrogen deposition compensation planting shall retain a long-range vista west from footpath KT/NS/176 and footpath KT/NS/175, across the landscape towards St Margaret's Church. Refer to Viewpoint N-Dep-RV-01 location on Figure 7.16 (Application Document 6.2).
S2.14	Retention of glimpsed views – Gravesend	The detail design of ancient woodland compensation planting adjoining residential properties on the eastern edge of Gravesend (Davy's Place, Fairfields, Astra Drive, Gazelle Glade, Glenrosa Gardens and Genesta Glade) shall aim to balance the need to visually screen views of the new road and provide ecological mitigation, with the aim of avoiding the obstruction of views and overshadowing of gardens, and shall have regard to residential security, for example, by maintaining good natural surveillance.

Clause no.	Design principle name	Design principle
S2.15	Thong Lane green bridge south: Habitat connectivity	A mammal culvert shall be provided south-west of the bridge, under the southern connector road. The culvert shall be designed to allow mammal passage and adequate space for maintenance and inspection. The culvert structure shall be designed to integrate into the surrounding landscape.

5.3 S3, S4 & S5 – Gravesend link and South Portal

Plate 5.5 Section 3, 4 & 5 – Gravesend link and South Portal



5.3.1 The principles in Table 5.3 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4), and shown approximately by the teal area in Plate 5.5 above for reference, subject to the Order Limits.

Table 5.3 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 north, 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 and 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 (Work No. 3C)	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 green bridge north, 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 (Work No. OSC4)	In order to provide an enhanced amenity for local residents, a new recreational site 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 (Application Document 6.2, Figure 2.4).
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 infiltration basins adjacent to the South portal (Works nos. 3D and 3E)	To enhance the landscape character around the area of the South Portal, naturalistic infiltration basins whose location and design respond to existing topographical features shall be located on the eastern side of the Project route.
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 north (Work No. 3B) where appropriate.
S3.08	Chalk and 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 of the South Portal shall be planted with hedgerows to reverse the appearance of field aggregation and to screen the Project as far as reasonably practicable.
S3.10	Integration of portal facilities	To further integrate the South Portal (Work No. 3C) 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 Tunnel Services Building (Work No. 3C) shall have a green/brown 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 of similar grassland species to the adjacent chalk grassland. The building shall be earth bunded. The earthworks shall be profiled to merge seamlessly with surrounding ground profiling.
S3.12	South Portal (Work No. 3C) maintenance and emergency access	To ensure 24 hour operational and emergency access to the portal, access (Work No. 3G) shall be provided via the A226 and the Project route. 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 route.

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 (Works No. 3H, 3K, 3L, 3M, 3N, 3O and 3P) that connects Gravesend with Shorne Woods Country Park shall be created for NG7. This will be re-routed north around the South Portal (Work No. 3C) and will link to routes going further south at Thong Lane green bridge north (Work No. 3B). 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 and Randall Wood	To replace existing ancient woodland lost in the south, a new area of woodland shall be planted north-east of Thong on the upper slopes adjacent to the AONB boundary/ Brummelhill Wood and north of Randall Wood as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). The woodland planting shall follow the contours of the landscape and tie into existing field/hedge line boundaries.
S3.16	South Substation (Work No. MU21)	A new substation shall be surrounded by bunding and retain access to and from the adjacent farm building across Chalk Park to the reinstated agricultural field.
S3.17	Replacement recreation ground for Gravesham Borough Council	A replacement recreational area shall be provided adjacent to Cascades leisure centre and shall be developed in coordination with Gravesham Borough Council.
S3.18	Thong Lane green bridge north (Work No. 3B)	The following minimum widths shall apply in accordance with STR.08 and STR.16: • The planting green zones shall be maximised. Their width shall vary across the length of the bridge but shall have a 7m minimum width at pinch points. The WCH routes may be located within the planting zones. • WCH provision on the west side within the planting zone, comprising a 3m shared pedestrian/cycle route and a 3.5m horse riding route. • WCH provision on the east side within the planting zone, comprising a 3m shared pedestrian/cycle route and a 3.5m horse riding route. A WCH crossing shall be provided on the bridge between the east and west WCH routes.

Clause no.	Design principle name	Design principle
S3.19	Retention of vista near Representative Viewpoint S-29	The detail design of ancient woodland compensation planting shall retain a long-range view north from Shorne Ifield Road bordering Shorne Woods Country Park within the Kent Downs AONB, over the River Thames towards distant hills near Thorndon Country Park. Refer to Viewpoint S-29 location on Figure 7.16 (Application Document 6.2).
S3.20	Emergency Services Rendezvous Point (RVP)	An Emergency Services Rendezvous Point (RVP) area shall be provided. The detailed design and layout of the RVP will be developed in consultation with the emergency services.
S3.21	Helicopter landing area	An area suitable (flat, unobstructed, stable) for landing a helicopter (air ambulance or similar) shall be identified in the vicinity of the tunnel portal inside of the Order Limits. The location of the landing area will be determined in consultation with the emergency services.
S3.22	Emergency muster points	Points suitable for initial mustering of tunnel evacuees, including safe access routes, shall be identified in the vicinity of the tunnel portal inside of the Order Limits. The detailed design and layout of the muster point will be developed in consultation with the emergency services.

5.4 S6 – Tunnel

Plate 5.6 Section 6 – Tunnel

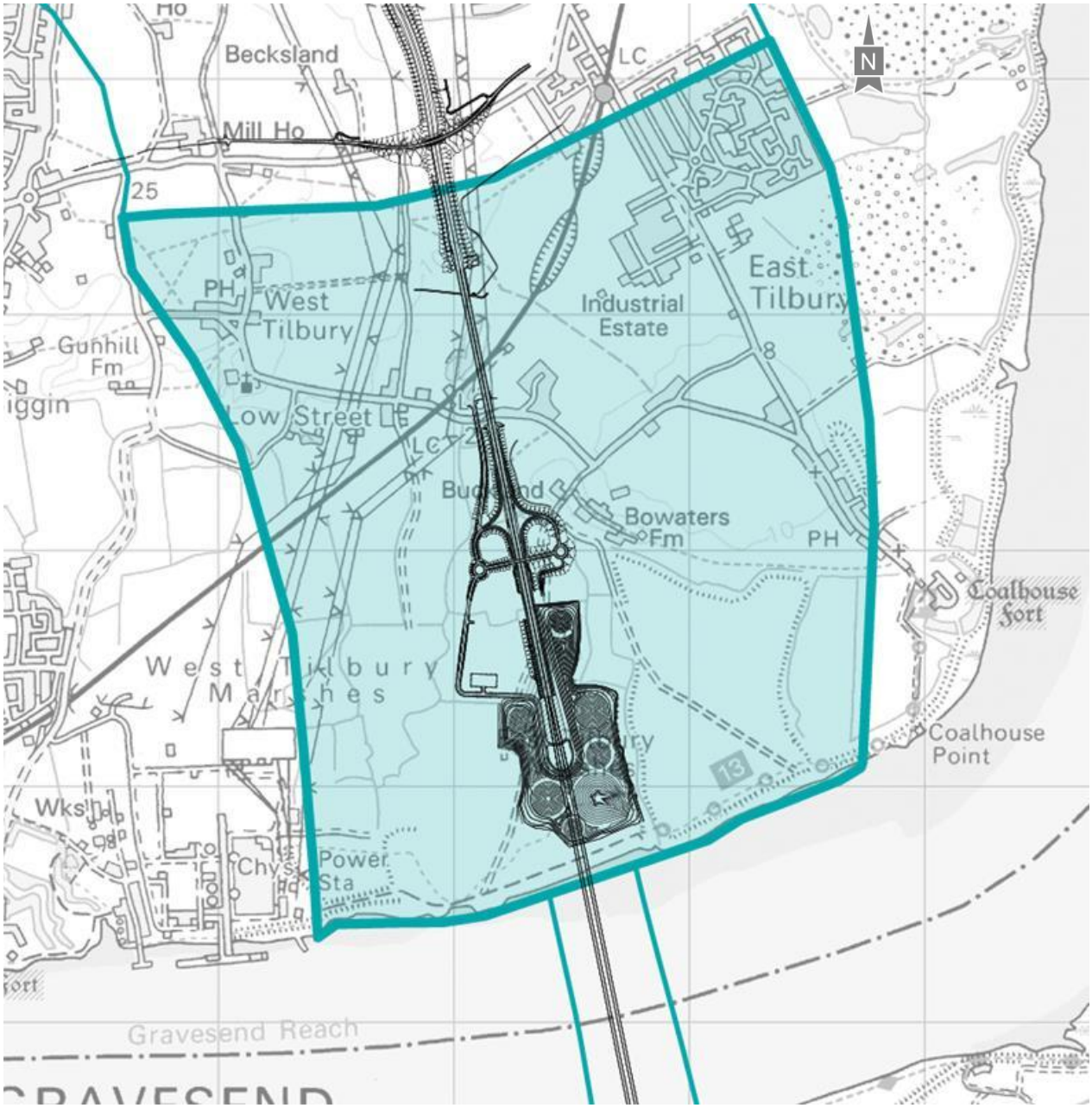
5.4.1 The Project route will be within a twin-bored tunnel within this sector. The principles in Table 5.4 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4), and shown approximately by the teal area in Plate 5.6 above for reference, subject to the Order Limits.

Table 5.4 Section-specific principles: Section 6 – Tunnel

Clause no.	Design principle name	Design principle
S6.01	Spacing of tunnel cross-passages	The preliminary scheme design has a 150m maximum spacing between cross-passage centre lines. The spacing between tunnel cross-passages will be in accordance with DMRB CD 352 Design of road tunnels (Highways England, 2020c), and supported by risk assessment, The emergency services shall be consulted on the risk assessment and determination of cross-passage spacing. To support cross-passage spacing greater than 100m between centre lines, a Fixed Fire-Fighting System (FFFS) will be deployed within the tunnel bore. There shall be engagement with the emergency services on the type and specification of the FFFS.
S6.02	Not used	-

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

Plate 5.7 Section 7, 8 & 9 – Tilbury Marshes and North Portal



5.5.1 The principles in Table 5.5 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4), and shown approximately by the teal area in Plate 5.7 above for reference, subject to the Order Limits.

Table 5.5 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 from the original (no longer present) marshland character of the area, landscape designs shall avoid design approaches that seek to blend artificial features (e.g. earth bunding) into the existing natural landscape and instead shall create a distinction between the two. 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 (Work No. OSC5)	A new recreational site shall be provided at Goshems Farm. The recreational space of over 35 hectares shall primarily incorporate Open Mosaic Habitats. It shall be designed for maximum biodiversity benefit to link existing habitat areas along the Thames Estuary, to proposed habitat creation further north of the Tilbury Loop line, extending to the new Open Mosaic Habitat creation at Linford. The design of the new recreational site shall incorporate sculptural earthworks up to a maximum +24.0m AOD and 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, Cliffe Fort and Coalhouse Fort that reflect the military history of the Thames. The new recreational site shall be publicly accessible, via the Two Forts Way in the south and from FP200 in the north. It shall incorporate accessible permissive routes through the landforms 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. The landscape shall be designed (in consultation with Natural England) so that public access to the informal footpaths and viewing points would be appropriately screened to prevent significant visual intrusion to waterbirds using the Thames Estuary.
S9.03	Portal security structures	All fencing and other safety measures required by 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 (Work No. OSR5), shall be provided along Two Forts Way, highlighting the local heritage features and directions to the new placemaking features.

Clause no.	Design principle name	Design principle
S9.06	Integration of tunnel control facilities	To minimise the impact on the landscape of required tunnel operations and Tunnel Services Building, the portal shall be designed to integrate all required buildings/uses into the portal structure shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4) and a single building as far as reasonably practicable.
S9.07	Flood protection of tunnels, approach ramp, operational access and Tunnel Services Building	Protective earthworks (for example, in the form of a bund with an integral cut-off wall or a clay core) shall be provided at the design protection level that safeguards against a flood event (including provision for the impact of future climate change) to ensure the tunnels, associated Tunnel Services Building, north portal approach ramp and operational access roads are protected and emergency access can be maintained. For further information, refer to the Flood Risk Assessment (Application Document 6.3, Appendix 14.6).
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/landforms of the cutting shall be tapered away from the road.
S9.09	Not used	-
S9.10	Watercourses	Culverting of the Tilbury Main shall be reduced as far as reasonably 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 as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4).
S9.11	Strengthen wooded ridgeline	Woodland planting shall follow the existing wooded ridge and shall not follow the Project route as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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.

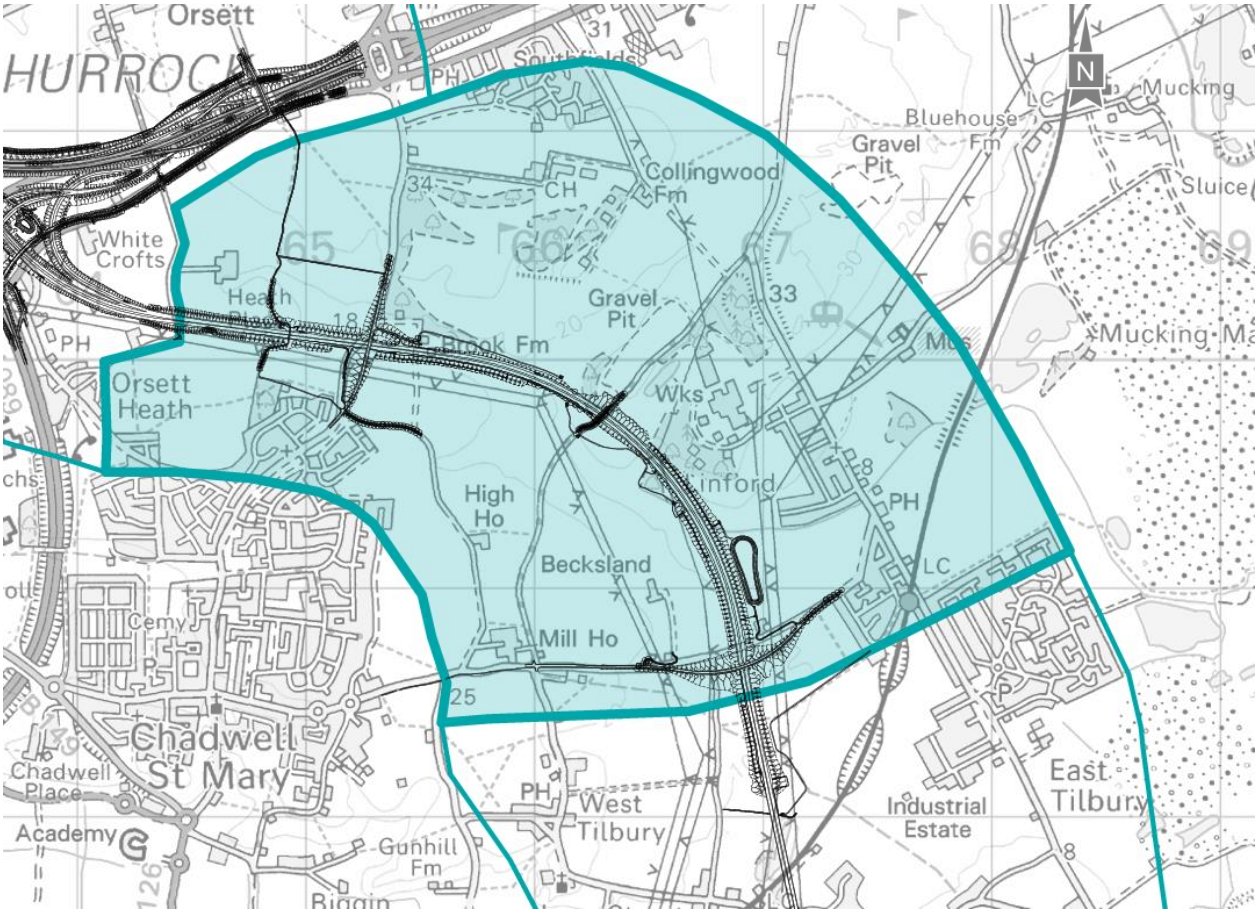
Clause no.	Design principle name	Design principle
S9.12	Protective earthworks	Earthworks to the mainline carriageway shall be designed to provide appropriate flood resilience to support the functioning of the tunnel. Flood defence earthworks shall be protected by additional earthworks designed to allow Ingrebourne Valley Ltd to resume its spoil placement activities following the completion of the Project, without any impact on the Project's earthworks.
S9.13	SPA/Ramsar bird habitat	The land parcel at Coalhouse Point shall be used for habitat enhancement to maintain baseline functionality of functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar. The land will be used to create a series of shallow scrape habitats, high tide roost features and coastal grazing marsh habitat suitable for use by the qualifying features of the SPA/Ramsar (LE6.2 Banks and ditches, LE6.1 Water bodies and associated plants, LE6.4 Marsh and wet grassland).
S9.14	Drainage attenuation pond form (Work Nos. 5G, 5H, 5I and 5J)	Drainage attenuation ponds shall be designed to be integrated within the operational access junction and shall include woodland and scrub planting to the periphery where reasonably practicable and to not obscure visibility splays.
S9.15	Not used	-
S9.16	Tilbury Viaduct design (Work No. 5C)	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 realigned 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.

Clause no.	Design principle name	Design principle
S9.18	Tilbury Interpretation Boards	Along footpaths and publicly accessible areas, interpretation boards shall be provided to explain the heritage of the area and the importance of the Thames Estuary for bird and nature conservation. Incorporated into the design of the new recreational site will be viewing points and interpretation boards to draw the users attention to the following: • The various forts, batteries and block houses on this stretch of the Thames Estuary which, from the Tudor period onwards, have served as Britain's defensive front line against attack and invasion and their relationship to remarkable and noteworthy periods and events in history. • The importance and sensitivities of the Thames Estuary for nature, including wetland habitats which support internationally important assemblages of birds during winter months, bare earth and wildflowers that support nationally important groups of insects, and a ditch network that is home to water voles.
S9.19	Two Forts Way	The existing route will be upgraded to be appropriate for pedestrians and cyclists. Designs shall be developed in coordination with the Port of Tilbury and Thurrock Council. From the Two Forts Way, there will be secondary and tertiary paths within Tilbury Fields.
S9.20	Routes between heritage assets	Permissive footpaths shall be provided across Open Mosaic Habitat that connect Coalhouse Fort with East Tilbury Battery, Bowaters Farm Battery and FP200.
S9.21	Emergency Services Rendezvous Point (RVP)	An Emergency Services Rendezvous Point (RVP) area shall be provided. The detailed design and layout of the RVP will be developed in consultation with the emergency services.
S9.22	Open Mosaic Habitat connectivity	An area of Open Mosaic Habitat shall be provided east of the Project route and south of Muckingford Road green bridge as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). This is to provide habitat connectivity between Tilbury Fields and Linford Open Mosaic Habitat areas.
S9.23	Helicopter landing area	An area suitable (flat, unobstructed, stable) for landing a helicopter (air ambulance or similar) shall be identified in the vicinity of the tunnel portal inside of the Order Limits. The location of the landing area will be determined in consultation with the emergency services.

Clause no.	Design principle name	Design principle
S9.24	Emergency muster points	Points suitable for initial mustering of tunnel evacuees, including safe access routes, shall be identified in the vicinity of the tunnel portal inside of the Order Limits. The detailed design and layout of the muster point will be developed in consultation with the emergency services.

5.6 S10 – Chadwell Link

Plate 5.8 Section 10 – Chadwell Link



5.6.1 The principles in Table 5.6 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4), and shown approximately by the teal area in Plate 5.8 above for reference, subject to the Order Limits.

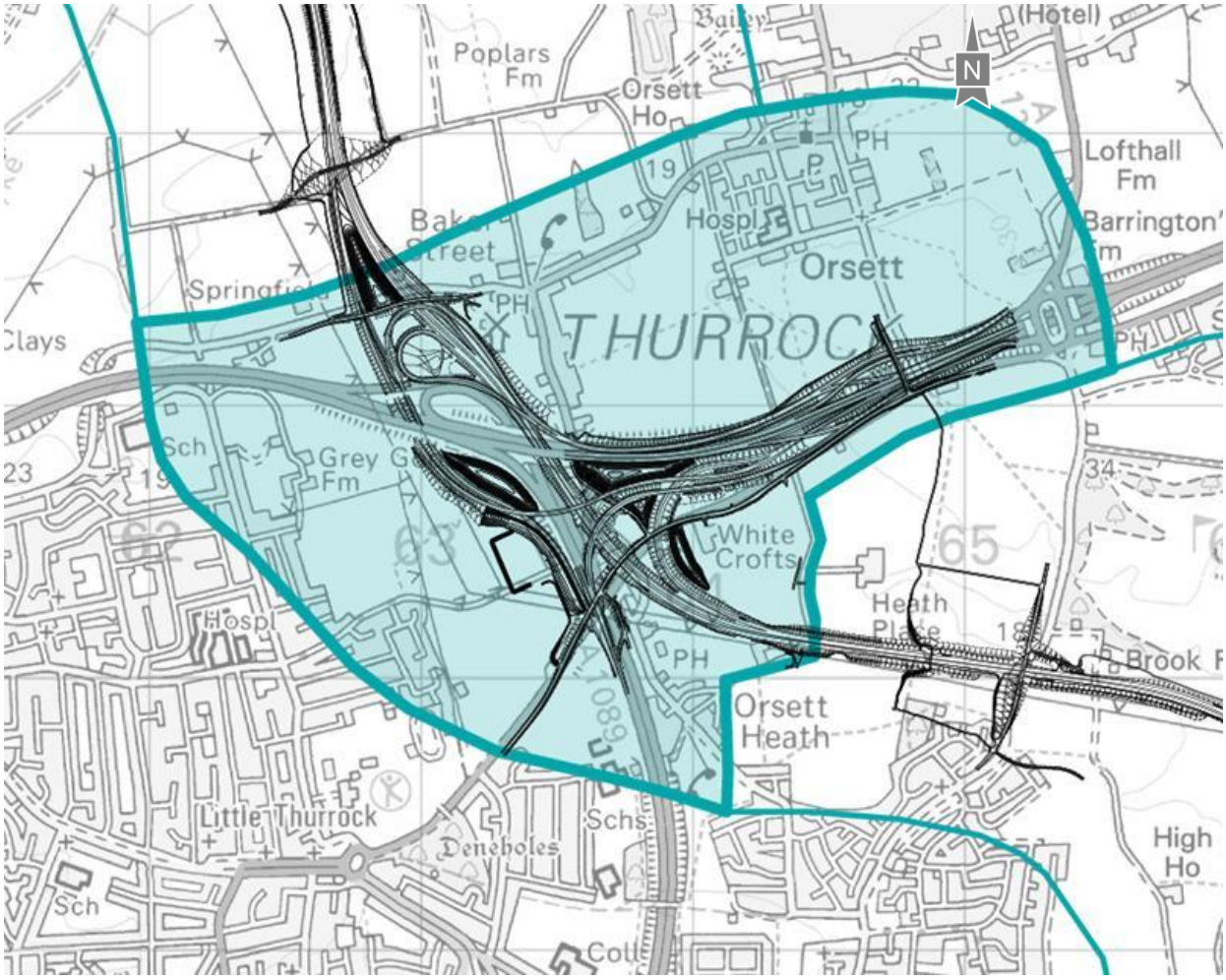
Table 5.6 Section-specific principles: Section 10 – Chadwell Link

Clause no.	Design principle name	Design principle
S10.01	Landscape integration of Muckingford Road green bridge (Work No. 6B)	Continuous hedgerows to the north and south shall be planted across Muckingford Road Bridge (Ref. BRN0000030) to connect landscape either side of the Project route and to maintain the existing character. Hedgerow planting shall provide suitable wildlife connectivity. Embankments and earthworks to the green bridge shall provide grassland and a suitable foraging habitat for terrestrial mammals, reptiles, amphibians, and bats. There shall be a new shared pedestrian cycle track parallel to Muckingford Road to provide a better connection between residential areas of Linford and East Tilbury and areas of employment. Where the realignment of Muckingford Road is necessary, this track shall be adjacent to the road.
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 the alignment of the Project as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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 (Work No. 6C)	The approaches to Hoford Road green bridge shall be retained as far as reasonably 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 lane, with a sunken lane character, and appropriate hedgerow and tree planting across the bridge. A continuous hedgerow and tree planting along both sides of the alignment of Hoford Road shall be provided to retain the existing character of the road (which is designated as a protected lane by Thurrock Council in their Local Plan). Hedgerow planting shall be provided to accommodate terrestrial mammals and as a bat commuting corridor from the woodlands to the north of the Project to foraging areas south of the Project.
S10.04	Screen planting	Woodland planting shall link Hoford Road (Work No. 6C) and Brentwood Road (Work No. 6D) 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 reinforced with additional hedgerow planting.

Clause no.	Design principle name	Design principle
S10.05	Acoustic mitigation to Brooks Farm (Work No. 6D)	Appropriate noise mitigation barriers shall be provided adjacent to Brooks Farm. The landscaping shall be planted to soften the visual impact of the noise mitigation proposals.
S10.06	Not used	-
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 Ancient Woodland compensation, contiguous with the site (to its north) will be planted to offset woodland loss as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4).
S10.08	CH Cole Irrigation reservoir (Work No. 5K)	The existing reservoir and the associated bankside vegetation shall be remodelled as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4) and vegetation retained as far as reasonably 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, part of FP95 (between FP79 and Brentwood Road) and the realigned Footpath 78, to bridleway. Where resurfacing existing routes, the existing alignment shall be followed to minimise impact on hedgerows.
S10.10	Muckingford Road Green bridge (Work No. 6B)	The following minimum widths shall apply in accordance with STR.08 and STR.16: • A 7m planting zone on the east • A 7m planting zone on the west • A combined pedestrian and cycling route, comprising a 2m wide pedestrian route and a 3m wide cycling route
S10.11	Hoford Road green bridge (Work No. 6C)	The following minimum widths shall apply for Hoford Road green bridge: • A 3.0m planting zone on the north • A 3.0m planting zone on the south
S10.13	FP79 WCH bridge (Work No. 7B)	The following minimum width shall apply in accordance with STR.08 and STR.16: • A combined pedestrian and cycling route 3.5m wide
S10.14	Retention of vista near Representative Viewpoint N-17	The detail design of nitrogen deposition compensation planting shall retain a framed long-range view south from footpath FP 45 within Orsett Golf Club, over the existing undulating landscape towards Chadwell St Mary. Refer to Viewpoint N-17 location on Figure 7.16 (Application Document 6.2).

5.7 S11 – A13 junction

Plate 5.9 Section 11 – A13 junction



5.7.1 The principles in Table 5.7 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4) Section 11 sheets 1-22, and shown approximately by the teal area in Plate 5.9 above for reference, subject to the Order Limits.

Table 5.7 Section-specific principles: Section 11 – A13 junction

Clause no.	Design principle name	Design principle
S11.01	Planted earthworks within the junction	Areas within the A13 junction as shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4) are to be woodland planted to create a wooded character and enclose views in accordance with the overarching Design Principle LSP.10. Within the islands of the A13 junction, earthworks shall be softened to appear more naturalistic and integrated into the landscape. Hard/ sharp edges to earthworks shall be avoided and softened by woodland planting as shown on the drawings. 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 and shall include linear belts of trees and scrub to reflect the historic landscape character. Woodland planting within the junction shall be designed to appear at a consistent height across the junction, to reinforce the wooded ridgeline character. In land parcels where earthworks are at a greater height, woodland planting shall be designed on the lower slopes, (at the same height as the surrounding woodland planting) with the upper slopes to be managed as scrub grassland as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4).
S11.02	Not used	-
S11.03	Reducing light pollution	The design of any necessary lighting on the elevated slip roads shall minimise light pollution, subject to relevant standards.
S11.04	Not used	Not used.
S11.05	Baker Street and Orsett conservation area	Planting on the earthworks associated with A13 southbound slip road shall be designed to reduce visual impacts on the Baker Street and Orsett conservation area and integrate the design of acoustic barriers on the embankment, acoustic barriers 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 earthwork 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. A new bridleway shall be provided through Blackshots Nature Reserve linking Long Lane in the south to an existing access track in the north-west.

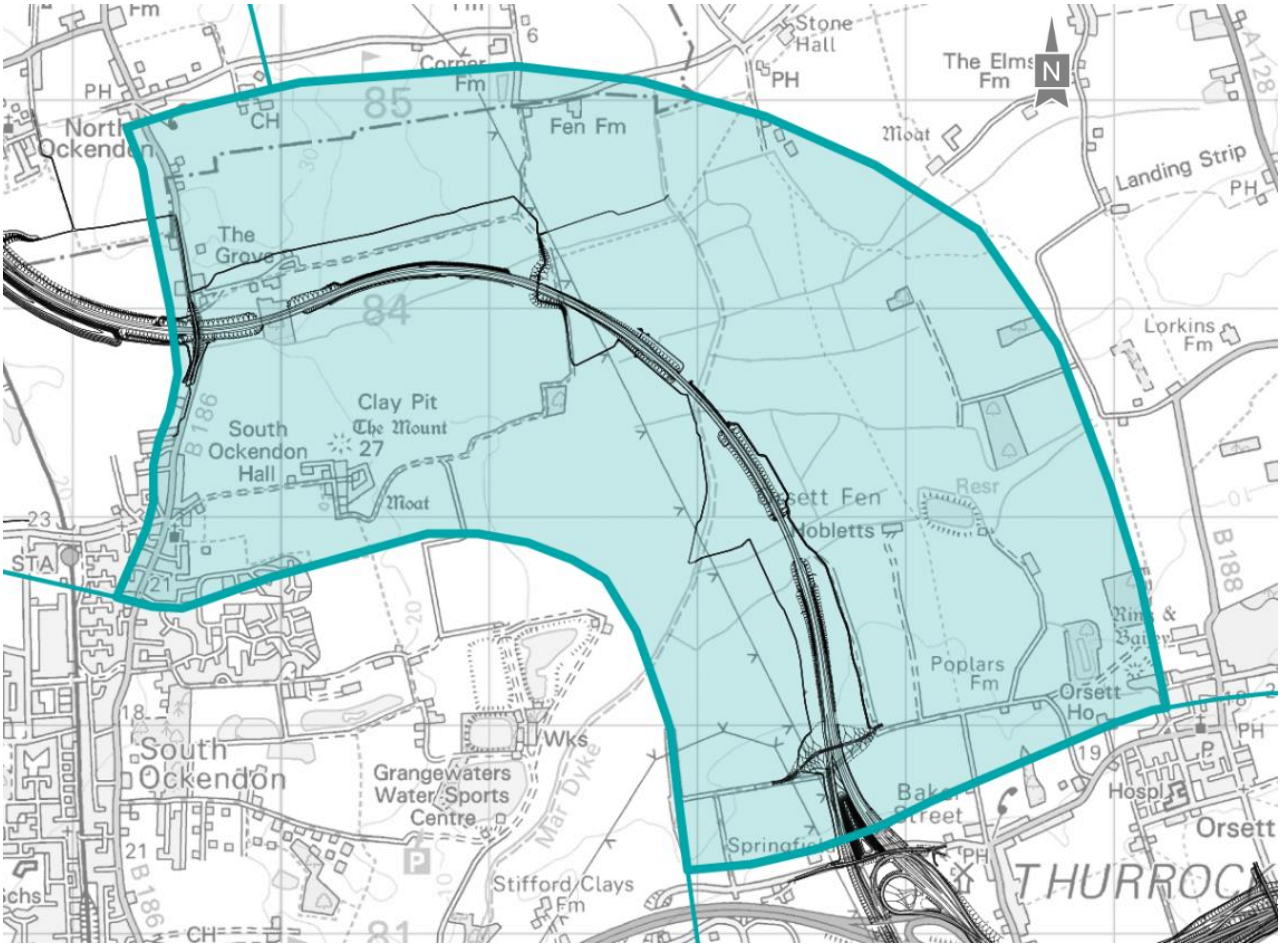
Clause no.	Design principle name	Design principle
S11.07	Hornsby Lane	Scattered trees and scrub planting shall be planted along the former alignment of Hornsby Lane, including on Project earthworks to connect the existing vegetation along the retained sections of Hornsby Lane.
S11.08	Landscape under 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	An earth bund shall be designed to provide visual and noise mitigation without impacting on access and view of the mill (which is a local landmark). Woodland planting shall be provided where reasonably practicable on the outward slope.
S11.11	Green Lane green bridge (Work No. 7M) landscape integration	Green Lane green 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. The alignment of Green Lane shall be designed to reflect the existing character of a rural lane. The following minimum widths shall apply for Green Lane green bridge: • A 3.0m planting zone on the east • A 3.0m planting zone on the west Shrubs and intermittent tree planting on the southern embankment slopes to the green bridge shall be provided for visual screening to gantries and infrastructure on the Project route from nearby receptors.

Clause no.	Design principle name	Design principle
S11.12	Gammon Field travellers' site (Work No. 7R)	The residents of Gammon Field travellers' Site shall be relocated to a new purpose-built site, located west of and adjacent to the current site. The design of this replacement site shall be developed to meet current building legislation and standards. 'Designing Gypsy and Traveller Sites: Good Practice Guide' (Department for Communities and Local Government, 2008) shall be used as guidance unless replaced by a new Government publication. See also Requirement 13 of Schedule 2 Part 1 of the draft DCO (Application Document 3.1). The new site shall include 21 residential pitches with associated hardstanding, landscaping and amenity blocks which reflect the local setting. The amenity blocks shall be of a standardised, fully accessible design, but shall be tailored to suit the individual accessibility needs of the users where identified by Thurrock Council. The current three groupings of pitches around separate accesses shall be retained in the new site, with a site manager's office and associated utility buildings located at the site entrance. The site landscaping shall be designed to mitigate the effects of the Project as far as reasonably practicable. Mains gas shall be provided to each of the 21 pitches on the site, with connections for static caravans/chalet bungalows. Each pitch shall be individually metered, with all meters located on the external southern perimeter of the site. The new site design shall be developed according to the principles of 'Designing Out Crime' (Essex Police) and constructed in accordance with the indicative plan (refer to Appendix C). The Applicant shall consult Thurrock Council and the travellers on the design and site layout in accordance with Requirement 13 of Schedule 2 Part 1 of the DCO (Application Document 3.1). Thereafter, the Applicants Contractors shall engage with Thurrock Council and the travellers' during the detail design phase of the replacement site.
S11.13	Stifford Clays Road shared walking/cycle track (Work No. 7L)	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 route shall follow the requisite design standards on width and separation from the highway. The surface will be appropriate for cycle and pedestrian use.
S11.14	A1013 shared walking/cycling route (Work No. 7D)	The existing adjacent shared pedestrian-cycle route facility shall be re-established where the A1013 is realigned, and replaced where it is not, following the requisite design standards on width and separation from the highway. This new/replacement facility shall extend between Orsett Cock roundabout and 44 Stanford Road. 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 route shall also be provided parallel to the pedestrian-cycle track on the A1013. The surface of the new shared pedestrian-cycle route and adjacent equestrian route shall be appropriate for the intended use.

Clause no.	Design principle name	Design principle
S11.15	Baker Street shared walking/ cycle track (Work No. 7E)	A shared use pedestrian-cycle route shall be provided on Baker Street adjacent to the highway where it is being realigned between the A1013 and the A13 underpass. This shared use facility shall have a finish appropriate for the intended use.
S11.16	Rectory Road bridge (Work No. 7J)	The following minimum widths shall apply in accordance with STR.16: • WCH provision, comprising a 2m pedestrian route, a 3m cycle route and 3.5m horse-riding route.
S11.17	A1013 bridges (Work No. 7D)	The following minimum widths shall apply in accordance with STR.16: • A combined pedestrian and cycling route, comprising a 2m pedestrian route and a 3m cycle route.
S11.18	Stifford Clays Road bridges (Work No. 7L)	The following minimum widths shall apply in accordance with STR.16: • A combined pedestrian and cycling route, comprising a 2m pedestrian route and a 3m cycle route.

5.8 S12 – Ockendon link

Plate 5.10 Section 12 – Ockendon link



5.8.1 The principles in Table 5.8 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4) Section 12 sheets 1-24, and shown approximately by the teal area in Plate 5.10 above for reference, subject to the Order Limits.

Table 5.8 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 as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4). 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 (Work No. 8B)	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 to 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 (Work No. 8J)	To minimise the impact on users of BR219 and retain the open views across the fen, the viaduct shall be designed to maximise space and clearance underneath.
S12.05	Height of the Mardyke and Orsett Fen Viaducts (Work No. 8B)	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 and maintenance 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 shall be incorporated into the design of the crossings, the width of which would be subject to consultation with the Environment Agency. For further information, refer to the Flood Risk Assessment (Application Document 6.3, Appendix 14.6).

Clause no.	Design principle name	Design principle
S12.06	Wetland habitat creation including water vole habitat (Work No. E36)	Subject to the constraints of the DCO, land between the Mardyke and the viaduct shall be restored to suitable wetland habitat to integrate the viaducts into the wider fenland landscape including Orsett Fen. The land parcel adjacent to the Mardyke viaduct shall be used for water vole mitigation in the form of new watercourse creation. New watercourses shall provide a minimum of 3km in length of water vole habitat and the remaining land is to be managed as a mosaic of wet grassland, species-rich grassland and ecological ponds as shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4).
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 (Work No. 8D)	A segregated WCH route shall be provided parallel to North Road and on the eastern side between the eastern end of FP151 and the junction of Wilsman Road and North Road in South Ockendon. A Pegasus crossing shall be provided where FP151 terminates at North Road in order to allow PRoW users to safely cross North Road directly onto this new route. The surface of this WCH route shall be an appropriate material, suitable for all users.
S12.09	Mardyke River Link	The Project shall include enhancements to surfaces and signage of the Mardyke Trail within the Order Limits and its connection into the PRoW network, in accordance with section 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.
S12.12	Wilderness vegetation retention	Existing woodland planting at The Wilderness shall be retained as far as reasonably 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.

Clause no.	Design principle name	Design principle
S12.13	Landscape integration of North Road green bridge (Work No. 8D)	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 seeded with suitable buffer at top of slope for habitat connectivity. The design of North Road green bridge shall reflect the existing character of a rural road by replicating hedgerow planting either side of the road and connecting to existing hedgerows.
S12.14	Landscape integration of FP136 Overbridge (Work No. 8C)	Earthworks to the proposed FP136 Overbridge shall be woodland and scrub-planted and integrated into the surrounding planting to maintain ecological connectivity.
S12.15	Mardyke Trail Interpretation	Interpretation boards shall be provided along the Mardyke Trail adjacent to both existing and proposed common land areas.
S12.16	Green Lane green bridge (Work No. 7M)	The following minimum widths shall apply in accordance with STR.08 and STR.16: • A 3m planting zone on the north • A 3m planting zone on the south • WCH provision, comprising a 4m wide WCH route shared with farm access.
S12.17	Farm track and FP136 bridge	The following minimum widths shall apply in accordance with STR.16: • WCH provision, comprising a 4m wide pedestrian route shared with farm access.
S12.18	North Road green bridge (Work No. 8D)	The following minimum widths shall apply in accordance with STR.08 and STR.16: • A 7m planting zone on the east • A 7m planting zone on the west • WCH provision, comprising a 2m pedestrian route and a 3m cycle route.
S12.19	Retaining wall and Watercourse diversion at ‘The Wilderness’ (Works Numbers 8A and 8V)	The earthworks, retaining wall and watercourse diversion in the vicinity of ‘The Wilderness’ shall be carefully coordinated and designed in such a way as to minimise the loss of vegetation and trees in The Wilderness as far as reasonably practical.

5.9 S13 & S14 – M25 junctions

Plate 5.11 Section 13 & 14 – M25 junctions

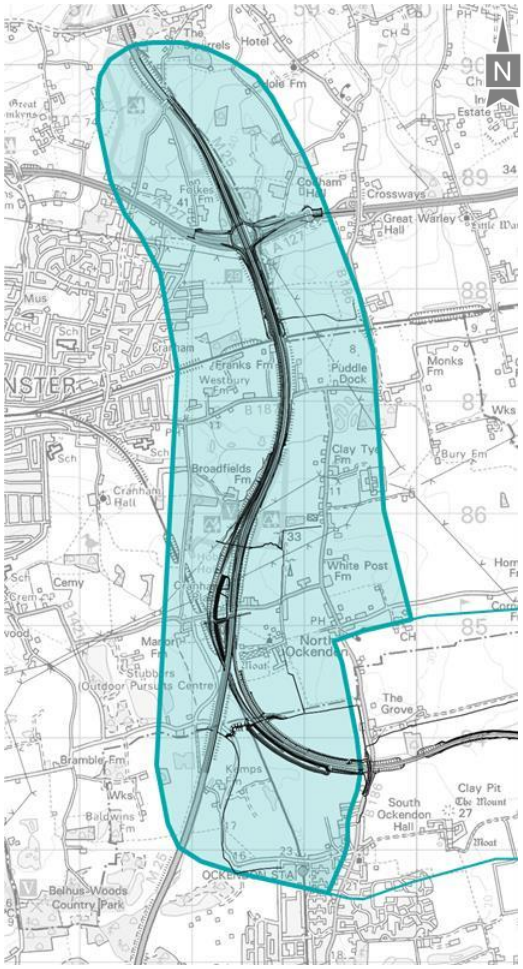
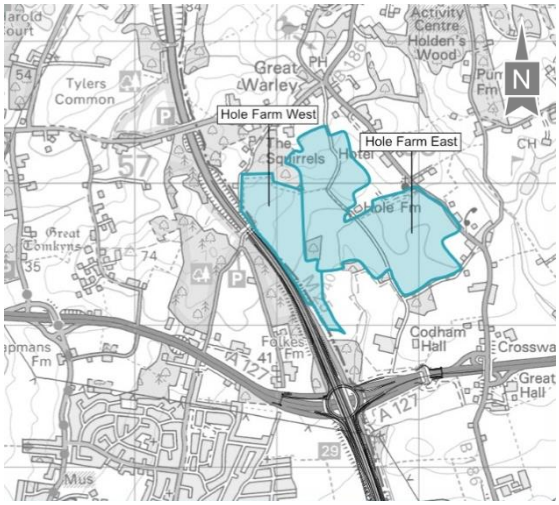


Plate 5.12 Hole Farm East and Hole Farm West



5.9.1 The principles in Table 5.9 apply to all works in the Environmental Masterplan (Application Document 6.2, Figure 2.4) Section 13 sheets 1-14 and Section 14 sheets 1-14, and shown approximately by the teal area in Plate 5.11 and Plate 5.12 above for reference, subject to the Order Limits.

Table 5.9 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 (Application Document 6.2, Figure 2.4), 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 within impacted field boundaries, west of North Road	Between FP151 and the B186 (North Road), new woodland planting shall be provided within existing field boundaries impacted by construction as shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4) to strengthen the local rectilinear field pattern and to break up wider views.
S14.03	Planting at 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 WCH bridge (Work No. 9O)	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 WCH 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	Thames Chase Community Forest woodland mitigation (Work No. E45)	The design of new areas of woodland planting south of the Thames Chase Community Forest, including the location of memorial tree planting and replacement of trees planted by the community, shall be developed in collaboration with Thames Chase Trust and Forestry England.
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 mitigate 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.

Clause no.	Design principle name	Design principle
S14.07	Planting north of Ockendon Road	North of Ockendon 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 gradient shall be retained or shall be profiled at gradients suitable for a return to agricultural use, except around the existing pylon. In accordance with the Design Principle LSP.10 of giving junctions a wooded character, appropriate woodland planting around the edge of the retained field shall be provided.
S14.08	Bridleway / water main diversion	The water main diversion (Work No. MU78) 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	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. Planting shall be provided to soften the visual impact of the structures. Planting on the embankment south of Franks Farm to include larger stock trees as part of the planting/woodland screening mix as defined in the Environmental Masterplan (Application Document 6.2, Figure 2.4).
S14.10	A127 WCH bridge east of M25 J29 (Work No. 9Z) and connections to BR183	A 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 junction 29. This bridge shall be suitable for walkers, cyclists and horse riders, with ramps at appropriate gradients. The following minimum widths shall apply in accordance with STR.16: • WCH provision, comprising a 3.5m shared WCH route, with ramps and steps to be provided Direct connections shall be made between the existing alignment of BR183 north and south across the WCH bridge independent of the A127 footways.
S14.11	Dennis Road WCH route	A shared track for WCH shall be provided to the north of Dennises Lane and Dennis Road from the junction of Pea Lane and Dennises Lane to the junction of Arisdale Avenue and West Road in South Ockendon. This route 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 (Application Document 6.2, Figure 2.4) shall match the existing land and existing use within the designated open space.

Clause no.	Design principle name	Design principle
S14.13	Hole Farm West	Ancient Woodland compensation planting shall be provided in Hole Farm West within the Order Limits. Woodland planting shall be provided to replace woodland lost due to construction and integrate the M25 and Project works into the surrounding landscape, without impeding existing key views. The design of new areas of woodland planting within the Order Limits, shall be developed in collaboration with Forestry England and Natural England.
S14.14	Hobbs Hole Fishing Lake	Dense shrub planting (within the Order Limits and near to this fishing lake) shall be provided to prevent members of the public approaching this private fishing lake.
S14.15	Earthworks within or adjacent to junctions	Earthworks shall be softened to appear more naturalistic and integrated into the landscape. Hard/sharp edges to earthworks shall be avoided and softened by woodland planting as shown on the drawings. Exceptions shall be made where woodland planting and/or earthworks impact on visibility splays within the highway.
S14.16	Retention of vista near Representative Viewpoint N-44	The detail design of ancient woodland and nitrogen deposition compensation planting shall retain a view east from residential properties along Beredens Lane and south-east from Beredens Lane and footpath 272_110 within Thames Chase, towards Langdon Hills Country Park. Refer to Viewpoint N-44 location on Figure 7.16 (Application Document 6.2).
S14.17	Retention of vistas near Representative Viewpoint N-Dep-RV-10	The detail design of nitrogen deposition compensation planting shall retain vistas from footpath 272_110 west of the B186 Great Warley Street above Hole Farm, towards distant hills within Kent AONB to the south-east and in the direction of Codham Hall Wood to the south-west. Refer to Viewpoint N-Dep-RV-10 location on Figure 7.16 (Application Document 6.2).
S14.18	Retention of vista near Representative Viewpoint N-Dep-RV-11	The detail design of nitrogen deposition compensation planting shall retain a view north-west from Codham Hall Lane, towards arable fields and woodland on rising ground near Beredens Lane, including Coombe Wood. Refer to Viewpoint N-Dep-RV-11 location on Figure 7.16 (Application Document 6.2).
S14.19	B186 temporary construction and permanent maintenance access (Work No. 9P)	In this design principle: • ‘BEP’ means Brentwood Enterprise Park. • ‘BEP Permission’ means any permission granted by Brentwood Borough Council for BEP as a result of planning application 22/00402/FUL, or a superseding application for an equivalent proposal. • 'Project B186 Access’ means a new private means of access and bellmouth from B186, comprising part of Work No. 9P in Schedule 1 to the Development Consent Order.

Clause no.	Design principle name	Design principle
		• 'BEP B186 Access' means the proposed access from the B186 opposite Upminster Trading Park to the proposed BEP site in the BEP Permission document 'Onsite Highway Works General Arrangement sheet 3 of 4' (drawing number BEP-ATK-HML-DR-CH-000003 rev C05), or subsequent plan providing an equivalent design. • 'Planned construction commencement date of the Project B186 Access' means the date identified by the undertaker for commencement of these works as part of the Project's wider delivery programme. The Project B186 Access shall be implemented observing the following two conditions: (1) The Project B186 Access shall be carried out such that it connects via a spur onto the BEP B186 Access, instead of a connection directly onto the B186, provided that all of the following conditions are met prior to the planned construction commencement date of the Project B186 Access: a. The BEP Permission has been granted. b. The BEP B186 Access has been designed to facilitate the construction of a connecting spur linking to the Project B186 Access. c. The BEP B186 Access has been constructed and is available for immediate lawful use by the Applicant. d. Required users of the Project B186 Access have been granted permanent rights of access to and from the B186 via the BEP B186 access and connecting spur. (2) Should the Project B186 Access be required prior to the BEP B186 Access being constructed and available for use in connection with the Project: a. The Project B186 Access shall be designed to facilitate the construction of a connecting spur linking onto the BEP B186 Access. b. The bellmouth onto the B186 forming part of the Project B186 Access would be stopped up and removed once the following conditions have been met: i. The BEP B186 Access and the connecting spur linking to the Project B186 Access have been constructed and are available for immediate lawful use by the Applicant. ii. The diversion of any affected utilities on such bellmouth has been completed. iii. Required users of the Project B186 Access have been granted permanent rights of access to and from the B186 via the BEP B186 access and connecting spur.

Clause no.	Design principle name	Design principle
S14.20	FP252 WCH bridges	The following minimum widths shall apply in accordance STR.16: • WCH provision, comprising a 3.5m shared WCH route
S14.21	Thames Chase WCH bridge (Work No. 9O)	The following minimum widths shall apply in accordance STR.16: • WCH provision, comprising a 3.5m shared WCH route • Localised widening with seating shall be provided at each structural column to both sides of the bridge structure, in order to provide a place for groups of WCH users to stand or sit, allowing other WCH users to safely pass.
S14.22	A127 East WCH bridge (Work No. 9Z)	In this design principle: • 'BEP' means Brentwood Enterprise Park. • 'BEP Permission' means any permission granted by Brentwood Borough Council for BEP as a result of planning application 22/00402/FUL, or a superseding application for an equivalent proposal. • 'BEP WCH Solution' means the vehicle and WCH access proposals for BEP which include a new connection for walkers and cyclists between the footway running along the southern side of the A127 and the existing bridleway as shown in the BEP Permission document 'Link Road Concept Design' (drawing number BEP-ATK-HML-DR-CH-000004 rev C06), or subsequent plan providing the same connectivity, and a dedicated Public Right of Way for WCH users over the existing accommodation bridge that spans the A127 connecting to Codham Hall Lane and to the footway running along the northern side of the A127. • 'Planned construction commencement date of the Project A127 East WCH Bridge' means the date identified by the undertaker for implementation of these works as part of the Project's wider delivery programme. • 'Project A127 East WCH Bridge' means Work No. 9Z in Schedule 1 to the Development Consent Order. The design and implementation of the Project A127 East WCH Bridge is dependent on the status of the proposed BEP. The undertaker shall observe the following conditions: (1) Notwithstanding the provisions of Design Principle S14.10 above, the authorised development shall be carried out excluding the Project A127 East WCH Bridge provided that all of the following conditions are met prior to the planned construction commencement date of the Project A127 East WCH Bridge: a. The BEP Permission has been granted.

Clause no.	Design principle name	Design principle
		b. The BEP Permission includes the BEP WCH Solution. c. The BEP WCH Solution is constructed and open for use by the public. (2) Notwithstanding provisions of Design Principle S14.10 above, the structures of the Project A127 East WCH Bridge shall be designed and constructed to align with the proposed BEP WCH Solution.
S14.23	A127 West WCH bridge (Work No. 9Y)	A new WCH bridge shall be provided across the A127 west of M25 junction 29, connecting Moor Lane in the south, to Folkes Lane in the north. The following minimum widths shall apply in accordance with STR.16: • WCH provision, comprising a 3.5m shared WCH route, ramps and steps shall be provided.

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Appendix A Planting Palette

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 such as the shrill carder bee. Flowering species specifically included in the planting palette to extend the flowering season are white and red dead-nettle, red clover, bird's-foot trefoil, vetches, knapweeds, creeping thistle and teasel. Red bartsia is included as a key foraging plant for shrill carder bee in the Thames estuary area.


Achillea millefolium


Agrimonia eupatoria


Anthyllis vulneraria


Centaurea nigra


Centaurea scabiosa

Image not provided
Cruciata laevipes


Daucus carota


Filipendula vulgaris


Galium verum


Knautia arvensis


Leontodon hispidus


Leucanthemum vulgare


Malva moschata

Image not provided
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

Image not provided
Phleum bertolonii

Image not provided
Trisetum flavescens

Planting Palette

LE1.31 SPECIES RICH - CHALK

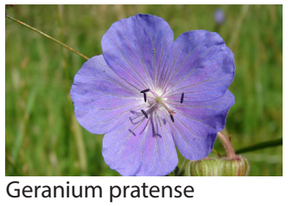

Achillea millefolium


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

Image not provided
Phleum bertolonii

Image not provided
Trisetum flavescens

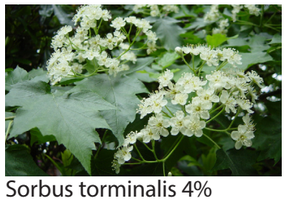
Planting Palette

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.
- Understory 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
 Alnus cordata 7.5%	 Fagus sylvatica 7.5%	 Carpinus betulus 4%	 Acer campestre 3%	 Corylus avellana 15%
 Betula pendula 12.5%	 Quercus robur 12.5%	 Castanea sativa 7%	 Sorbus torminalis 4%	 Crataegus monogyna 7.5%
		 Prunus avium 4%	 Taxus baccata 3%	 Euonymus europaeus 2.5%
				 Ilex aquifolium 5%
				 Sambucus nigra 5%

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

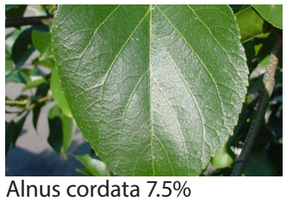
Planting Palette

LE 2.11 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.
- Understory 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.

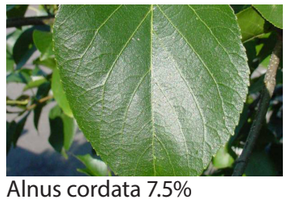
South

Nurse species	Ultimate canopy	Sub dominant canopy	Smaller trees	Understorey shrubs
 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%
Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.	 Tilia tomentosa 5%		 Taxus baccata 3%	 Euonymus europaeus 3%
				 Ilex aquifolium 5%
				 Sambucus nigra 5%

Planting Palette

LE 2.11 Woodland - inc Non-native Species Innerstand (cont)

North

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

Planting Palette

LE 2.11 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.
- Understory 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.

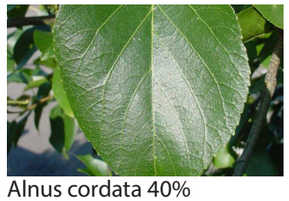
South

Nurse species	Ultimate canopy	Sub dominant canopy	Smaller trees	Understorey shrubs
 Alnus cordata 35%	 Acer platanoides 4%	 Prunus avium 5%	 Acer campestre 3%	 Corylus avellana 13%
 Betula pendula 5%	 Tilia cordata 6%		 Sorbus aucuparia 3%	 Crataegus monogyna 5%
Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.	 Tilia tomentosa 4%		 Sorbus torminalis 3%	 Ilex aquifolium 5%
			 Taxus baccata 4%	 Sambucus nigra 5%

Planting Palette

LE 2.11 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%
Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.	 Tilia tomentosa 3.5%		 Sorbus aucuparia 2%	 Ilex aquifolium 5%
				 Sambucus nigra 5%

Planting Palette

LE 2.11 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%

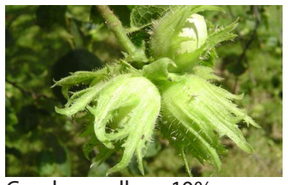

Sambucus nigra 10%


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 - 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 2.22 Scrub woodland

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 2.22 Scrub woodland (cont)

North


Acer campestre 5%


Betula pendula 2.5%

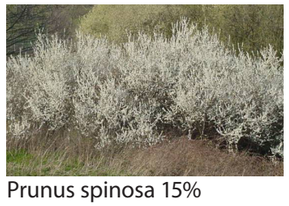

Corylus avellana 5%


Crataegus monogyna 20%


Ilex aquifolium 5%


Prunus avium 5%


Prunus cerasifera 10%


Prunus spinosa 15%


Rosa arvensis 5%


Rosa canina 15%


Sambucus nigra 5%

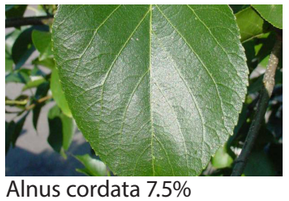

Sorbus aucuparia 2.5%


Ulex europaeus 5%

Planting Palette

LE 2.4 Linear Belt Of Shrubs And Trees

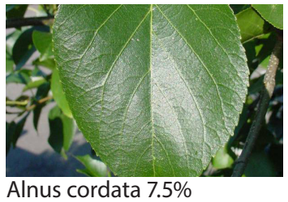
South

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%
Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.	 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
 Alnus cordata 7.5%	 Fagus sylvatica 7.5%	 Carpinus betulus 5%	 Acer campestre 3%	 Corylus avellana 15%
 Betula pendula 12.5%	 Quercus robur 7.5%	 Pinus nigra 5%	 Sorbus torminalis 4%	 Crataegus monogyna 7.5%
Offering soil conditioning and quickly established shelter. To be gradually reduced in number as the plantation matures.	 Tilia tomentosa 5%	 Prunus avium 5%	 Taxus baccata 3%	 Euonymus europaeus 2.5%
				 Ilex aquifolium 5%
				 Sambucus nigra 5%

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%

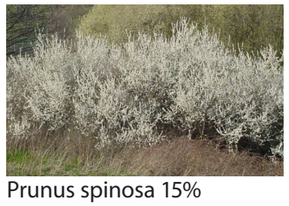

Corylus avellana 5%


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%

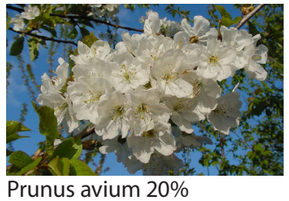
Planting Palette

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 / scattered 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 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 4.3 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 4.3 Native Species Hedge (untrimmed) 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

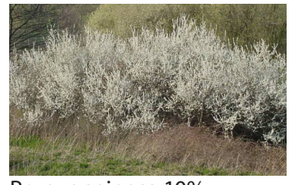
Species

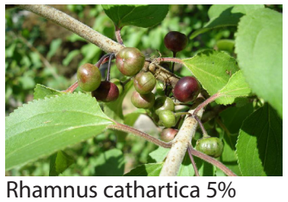

Cornus sanguinea 20%


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

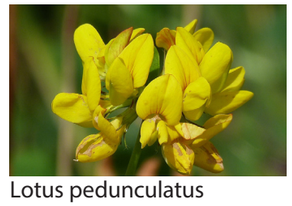

Eupatorium cannabinum


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

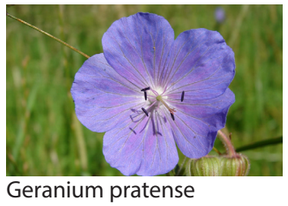

Achillea ptarmica


Betonica officinalis


Centaurea nigra

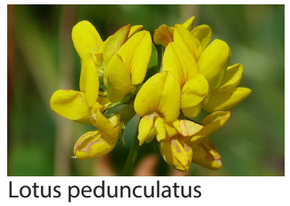

Filipendula ulmaria


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 – Bridges

Project Enhanced Structures – Bridges

1. Common material palette

– e.g. weathering steel, consistent with tunnel portal design

2. Design sympathetic to setting

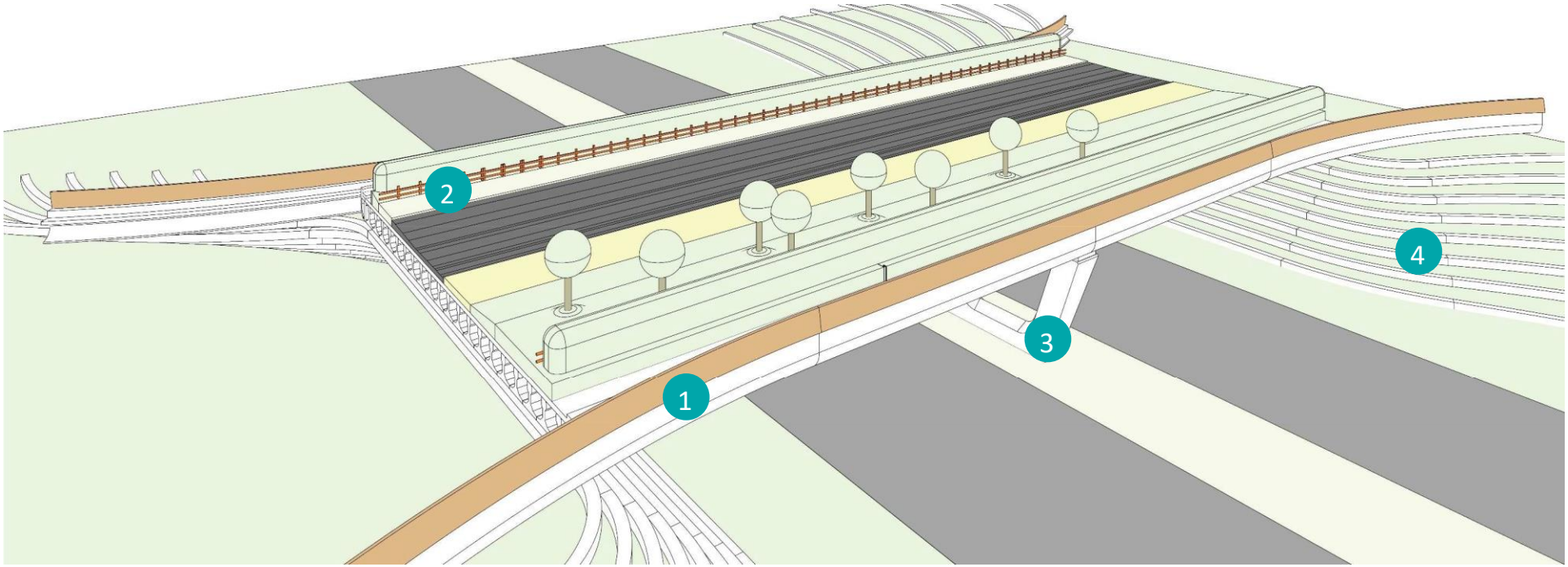
– e.g. structure subservient to landscape, minimising highway clutter, vehicle restraint system appropriate to context, coordinated with parapet and acoustic barrier requirements

3. Elegant structural forms

– e.g. careful integration of structural elements and use of equal spans, consistent deck depth, minimising pier and beam profiles, flared approaches (green bridges)

4 . Integrated Abutments

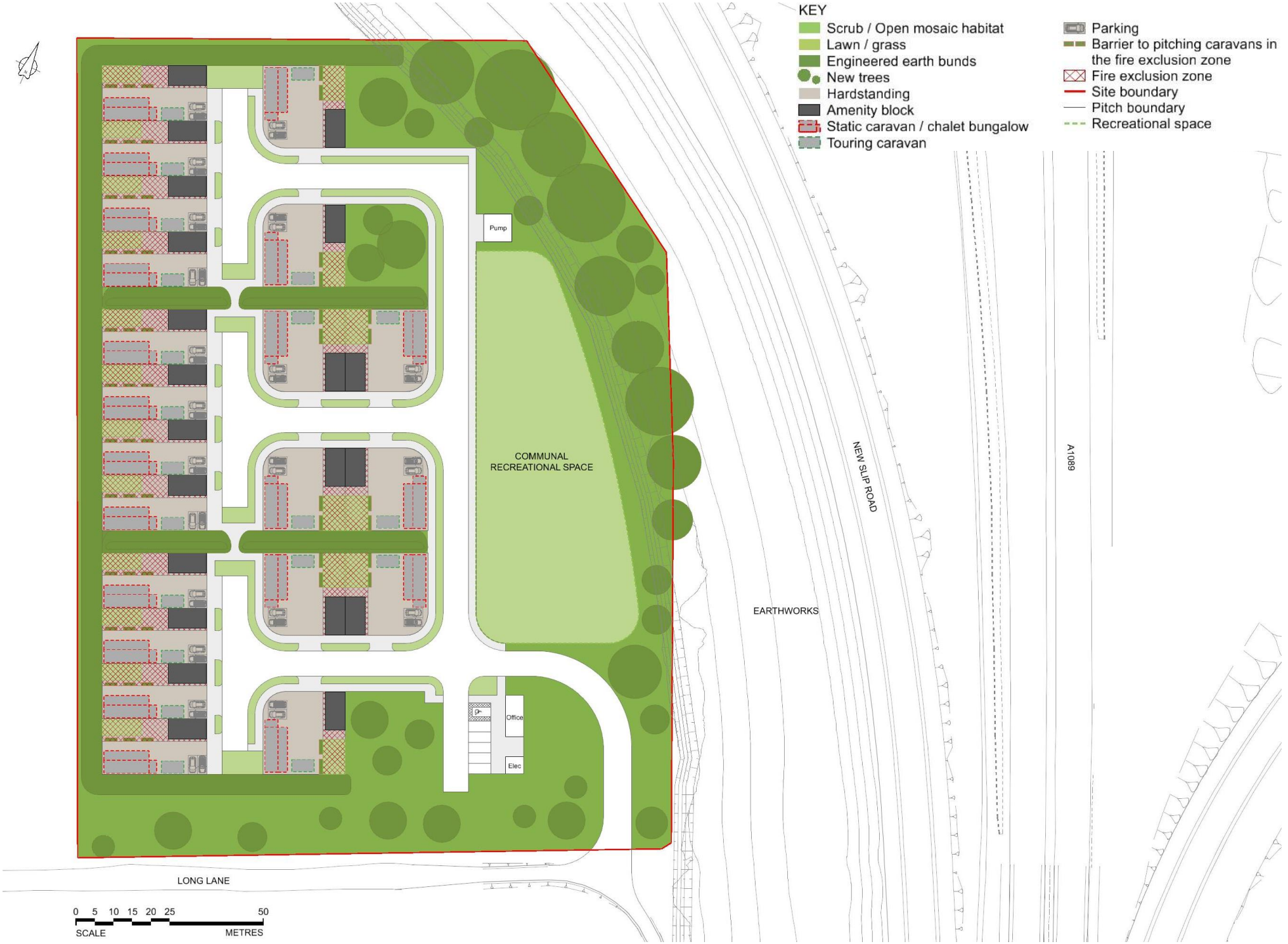
– e.g. structure seamlessly integrated into surrounding landscape treatment



For illustrative purposes only

Appendix C Travellers' Indicative Plan

Gammon Field travellers' – Indicative Site Plan



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