Lower Thames Crossing

6.1 Environmental Statement Chapter 2 - Project Description

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Lower Thames Crossing

6.1 Environmental Statement
Chapter 2 – Project Description

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2 Project description

2.1 Introduction

2.1.1 This chapter provides a description of the A122 Lower Thames Crossing, hereafter referred to as 'the Project', which has informed the assessments undertaken in this Environmental Statement (ES).

2.1.2 This chapter provides information about the Project including the route, tunnel construction and supporting works such as environmental mitigation, site preparation work and construction compounds. Information is also provided about how environmental considerations have informed the evolution of the design, although this is covered in greater detail within ES Chapter 3: Assessment of Reasonable Alternatives, the Planning Statement (Application Document 7.2) and the Project Design Report (Application Document 7.4).

2.1.3 The proposed Project route, and the area that would be needed for the development, is shown on Figure 2.1: Route Alignment and Order Limits (Application Document 6.2). Figure 2.2: Project Proposals (Application Document 6.2) shows a high-level view of the Project design. Further detail, including permanent and temporary land-take, land for utilities works, temporary works and environmental mitigation is shown in detail in the Land Plans (Application Document 2.2), Works Plans (Application Document 2.6), and on Figure 2.4: Environmental Masterplan (Application Document 6.2). Figure 2.5: Construction Information (Application Document 6.2) provides a high-level view of the construction phase including construction worksites, compounds and access routes, with further detail available in the Temporary Works Plans (Application Document 2.17).

2.1.4 The Development Consent Order (DCO) application has been developed on the basis of a 2030 opening year. This assumes consent is granted in 2024. Following the DCO Grant there would be preparatory works, referred to in the draft DCO as preliminary works taking place in 2024. The main construction period for the Lower Thames Crossing would start in early 2025, with the road being open for traffic in late 2030. Construction may take up to six years, but as with all large projects there is a level of uncertainty over the construction programme, which will be refined once contractors are appointed and as the detailed design is developed. The 2030 opening year has been selected as the basis for the assessments and is representative of the reasonable worst-case scenario. This has been used consistently across the environmental assessments, transport assessments and the economic appraisal of the Project.

Need for the Project

2.1.5 For over 58 years the Dartford Crossing has provided the only significant road crossing of the River Thames to the east of London. It is a critical part of the country's road network, connecting communities and businesses and providing a vital link for the nearby major ports. However, traffic flows on the Dartford Crossing are consistently in excess of the design capacity of the road which results in frequent congestion and poor journey time reliability, making it one of the least reliable sections of the strategic road network. The current operational

challenges have significant negative impacts on users and non-users in terms of economic productivity and trade, social and user experience, and environmental impacts. For more information on the need case refer to the Need for the Project (Application Document 7.1).

Scheme Objectives

2.1.6 The various issues set out above give rise to the need for the Project and form the basis for the identification of the Scheme Objectives, as agreed with the Department for Transport, which are shown in Table 2.1.

Table 2.1 Scheme Objectives

Scheme Objectives	
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
Community and environment	• To minimise adverse impacts on health and the environment
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

Project location and surrounding area

2.1.7 The Project would be located in a highly populated part of the country near urban areas including, but not limited to, Gravesend, Grays and Tilbury. The relevant wards through which the Project passes are shown in Figure 2.1: Route Alignment and Order Limits (Application Document 6.2). While located within close proximity to these urban areas, the route passes mostly through rural areas within a designated Green Belt, with an alignment which seeks to reduce impact on environmental assets and communities. There are a large number of footpaths, bridleways, National Cycle Routes, local cycle routes and trails within the area to provide walkers, cyclists and horse riders (WCH) with access and connectivity to surrounding areas.

2.1.8 The environmental features of the area are shown on Figure 2.3: Environmental Constraints Plan (Application Document 6.2). Areas of the physical environment around the Project are designated for their important ecological, cultural heritage, geological, and landscape features. South of the River Thames, and close to the A2, there are a number of areas of nationally important ancient woodland, Sites of Special Scientific Interest (SSSIs) and sites of local biodiversity importance. On the south bank of the River Thames to the east of Gravesend and north-east of Chalk are the Thames Estuary and Marshes Ramsar Site, and the South Thames Estuary and Marshes SSSI, with the land further east also being designated as a Special Protection Area (SPA). There are a number of Local Wildlife Sites (LWSs) located north of the River Thames, as well as other areas of ancient woodland and sites of ecological and local biodiversity importance.

2.1.9 The land between the villages of Thong and Shorne and to the south of the A2 forms part of the Kent Downs Area of Outstanding Natural Beauty (AONB). In addition, the Cobham Hall Registered Park and Garden lies to the south of the A2. The villages of Shorne and Cobham are also designated as Conservation Areas. North of the River Thames the settlements of East and West Tilbury are designated as Conservation Areas. Both south and north of the River Thames there are a number of listed buildings of all grades, particularly Grades II and II*. Other heritage features of note are scheduled monuments including New Tavern Fort and Cliffe Fort on the southern bank of the River Thames and Coalhouse Fort battery and artillery defences and Tilbury Fort on the northern bank of the River Thames, as well as a cropmark complex at Orsett next to the A13.

2.1.10 The Project will traverse floodplains associated with the River Thames, the Mardyke and West Tilbury Main. The Mardyke lies to the north of the River Thames in Thurrock and flows into the Thames via Purfleet sluice. West Tilbury Main also lies to the north of the River Thames in Thurrock and flows into the Thames via Bowaters sluice. Some of the floodplain areas benefit from flood defences. Numerous ordinary watercourses traverse the Project, particularly to the north of the River Thames.

2.1.11 There are a number of Air Quality Management Areas (AQMAs) designated by Gravesham Borough Council, Thurrock Council and the London Borough of Havering, which demonstrate the existing air quality issues in these areas. There is also an AQMA at the Dartford Crossing designated by Dartford Borough Council.

2.1.12 A number of Noise Important Areas are designated south of Gravesend along parts of the A2, as well as along the A13 and the M25. These are shown on Figure 2.3: Environmental Constraints Plan (Application Document 6.2).

2.1.13 Further details about the local environment are provided in the topic-specific chapters of this ES (Chapters 5 to 15).

Contents of this chapter

2.1.14 This chapter is structured as follows:

a. Section 2.1: Introduction – provides an introduction to the Project, its objectives and location.

b. Section 2.2: Project design process – provides a summary of key design standards, principles and considerations that have influenced the Project design. This section also describes how the potential impacts identified through the assessment process have shaped the design and will be managed as the Project progresses.

c. Section 2.3: Project sections – provides detailed descriptions of the permanent changes proposed within each of the nine identified operational sections of the Project, including changes to highway infrastructure, drainage, watercourses, WCH, utilities, special category land and private recreational facilities, together with a summary of the environmental

mitigation and compensation measures proposed to reduce and offset adverse environmental effects of the Project.

d. Section 2.4: Description of the Project – provides a general description of the individual elements which make up the Project supplementing the section specific information provided in Section 2.3, together with a description of the environmental mitigation and compensation proposals that have been embedded into the Project design.

e. Section 2.5: Construction – provides an introduction to the construction phase and a description of the construction activities that are anticipated to be involved in the construction of the Project. This section also includes a summary of the construction design and management process.

f. Section 2.6: Construction sections – provides detailed descriptions of the construction works proposed within each of the four construction sections of the Project, including a description of construction compounds.

g. Section 2.7: Construction description – provides details on the specific construction techniques, methods and general approaches to construction required for each construction activity across the Project.

h. Section 2.8: Operations, maintenance and management – provides a summary of the post-construction activities to be undertaken throughout the handover, maintenance and operational phases of the Project, and how they would be managed.

i. Section 2.9: Benefits and outcomes – provides an introduction to the legacy projects being developed to provide further benefits for communities.

2.2 Project design process

2.2.1 This Project description is based on the preliminary design of the Project at the time the DCO application is submitted. The final detailed design would be further finessed prior to construction. The detailed design would be in accordance with the extent of the defined limits of deviation (LOD) provided in the draft DCO, the constraints set by the Rochdale Envelope (see Section 2.2 of this chapter) set out within the ES and any approval required under the requirements set out in Schedule 2 to the draft DCO (Application Document 3.1)

National Policy Statements (NPSs)

2.2.2 The following relevant National Policy Statements have influenced the development of the design, construction and operation of the Project:

a. National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014)

b. Overarching National Policy Statement for Energy (EN-1) (Department of Energy and Climate Change, 2011a)

c. National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Department of Energy and Climate Change, 2011b)

d. National Policy Statement for Electricity Networks Infrastructure (EN-5) (Department of Energy and Climate Change, 2011c)

2.2.3 Further details on this can be found in Chapter 1: Introduction, Chapter 3: Assessment of Reasonable Alternatives, Chapter 4: EIA Methodology, the topic chapters (Chapters 5 to 15) of this ES, and Appendix A of the Planning Statement (Application Document 7.2) submitted with the application.

Design standards

2.2.4 The Project is designed having regard for the design standards in the Design Manual for Roads and Bridges (DMRB). As the DMRB standards are updated on a frequent basis, it is normal for highways schemes to be based upon the DMRB standards which were current at the point of conclusion of the preliminary design, for the purpose of seeking consent and undertaking procurement. Once consent has been granted, the design will be progressed to detailed design, which will based upon the DMRB standards current at that point in time, while maintaining compliance with the requirements set out within the DCO and the control documents making up the control plan, as explained in the Introduction to the Application (Application Document 1.3). Should it be necessary to accommodate changes to the DMRB, further approval would be sought in accordance with the framework set out in Schedule 2 of the DCO, or in certain circumstances, the Applicant may choose to depart from the DMRB standard. These outcomes are considered unlikely at this stage.

2.2.5 The DMRB standards have been used to inform the horizontal and vertical alignment of the road and its cross-sections, junction layouts and road type (including the number of lanes). The DMRB standards inform the design principles required for highway structures including the tunnel, bridges, geotechnical structures and earthworks. They also define requirements for environmental design, drainage, lighting, road signs and markings, traffic control technology and provision for WCH.

2.2.6 The design for the Project has been developed having regard for the design parameters set out in the DMRB standards. The standards include a three-stage process for situations where the required design parameters cannot be achieved. The first two stages are relaxations which can be used at the discretion of the designer. The final stage is a departure which must be submitted to the Applicant's design specialists and approved before inclusion in the design to ensure the safety of the Project.

2.2.7 The DMRB standards have been supplemented, where appropriate, with other documents and good practice guidance including the Manual of Contract Documents for Highways Works (Highways England, 2020a) and British and European (Eurocodes) Standards (British Standards Institution, n.d.).

2.2.8 Where the Project would require utilities assets to be diverted or protected, this has been designed to be compliant with industry codes of practice, standards, legislative requirements and the utilities providers' specific standards and guidance.

Design Principles

2.2.9 The Design Principles (Application Document 7.5) create an overarching, shared resource which gives clarity to stakeholders over expected design outcomes by establishing parameters that must be met in the final detailed design of the Project.

2.2.10 The Design Principles apply to the Project's physical highways structures (including highways, tunnels, bridges and buildings) and landscape works; they do not apply to the temporary works, utilities works or methods of construction, nor do they describe in detail how the works would be operated and maintained.

2.2.11 A 'Project Design Narrative' was issued in 2019 as part of the wider Project stakeholder engagement including local authorities, amenity groups and the public. The feedback received was grouped together by location and similarity of issues raised. These were then used to develop the overarching Design Principles and for geographical area-specific design principles.

2.2.12 The Design 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 this ES.

b. They set a consistent set of parameters for the detailed designs to be prepared by the Contractors.

c. They help to illustrate how the Applicant responded to public consultation feedback in relation to design.

d. They illustrate how the Applicant has taken account of the criteria for good design set out in the NPSNN to ensure that the development is as sustainable and as aesthetically sensitive, durable, adaptable and resilient as it can reasonably be.

e. They capture the results of feedback from independent design reviews conducted by the Design Council on behalf of the Applicant.

2.2.13 Detailed design would need to be compliant with the Design Principles. In discharging Requirement 3 of Schedule 2 of the draft DCO (Application Document 3.1), the Applicant would need to demonstrate compliance with the Design Principles.

2.2.14 The Project Design Narrative and Design Principles were then developed into the Project Design Report (Application Document 7.4) which describes the Preliminary Design and integration of the Project into its surrounding landscape and context.

Rochdale Envelope

2.2.15 This ES chapter provides an illustrative design and envisaged construction methodology. It is recognised that parts of the Project design and construction methodology, as consented, may be subject to further refinement and optimisation prior to and during construction.

2.2.16 The Rochdale Envelope approach is an established principle that allows a development project to be broadly defined within a series of parameters.

2.2.17 The Planning Inspectorate's (2018) Advice Note Nine: Rochdale Envelope provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008. The adoption of the Rochdale Envelope approach allows meaningful Environmental Impact Assessment (EIA) to be undertaken by defining a reasonable worst-case scenario that decision-makers can consider when determining the acceptability of the environmental effects of a development project. This approach reflects the need for the Project design to evolve over time following the established principle set out in the case of R v Rochdale Metropolitan Borough Council ex parte Milne (2000) and R v Rochdale Metropolitan Borough Council ex parte Tew (1999).

2.2.18 In line with the Rochdale Envelope approach, parameters have been established across the Project to manage uncertainty, accommodate design flexibility and ensure that reasonable worst-case scenarios are assessed. These parameters are described within the description of the Project and its construction and operation within this chapter, and include the defined reasonable worst-case scenario. Any changes to the Project within such parameters will not result in any likely significant effects not previously identified and assessed in this ES.

Limits of Deviation

2.2.19 The limits of deviation (LOD) for the Project represent an 'envelope' within which the Project would be constructed. The LOD define the maximum extent to which the main elements of the Project can deviate spatially, both horizontally (in plan) and vertically (in elevation). The LOD provide the required degree of flexibility necessary to accommodate the final detailed design of the Project, in line with the Rochdale Envelope approach.

2.2.20 The extents of land that need to be acquired to enable the Project to be constructed, operated and maintained are known as the Order Limits. These have been identified taking into consideration the LOD, the envisaged construction methodology and any ancillary works, such as required environmental mitigation. This ensures that the DCO application has identified sufficient permanent and temporary land requirements for the safe construction, operation and maintenance activities involved in the Project.

2.2.21 This ES and the assessments within it are based on the works proposed in the DCO application and the Order Limits (i.e. the maximum area of land anticipated as likely to be required, taking into account the LOD proposed for the Project and the flexibility of detailed design provided for in the DCO).

2.2.22 The Order Limits, which take into account the extents of the LOD, are shown on the Works Plans (Application Document 2.6) and Figure 2.1: Route Alignment and Order Limits (Application Document 6.2). The LOD proposed for the Project are defined in article 6 (Limits of deviation) of the draft DCO (Application Document 3.1). Horizontal LOD are shown on the Works Plans (Application Document 2.6), with vertical LOD described in article 6 of the draft DCO (Application Document 3.1) and related to the levels shown on the Engineering Drawings and Sections (Application Document 2.9). Horizontal and vertical LOD for the tunnel are shown on the Tunnel Limits of Deviation Plans (Application Document 2.15).

Environmental considerations

2.2.23 The Highways England Licence (Department for Transport, 2015a) sets out the Secretary of State's statutory directions and guidance to National Highways (formerly Highways England). It sets out what is expected of National Highways and how it must behave when discharging its duties delivering the vision and plans for the network, set out in the Road Investment Strategy 2015/16 – 2019/20 (Department for Transport, 2015b) and the Road Investment Strategy 2: 2020–2025 (Department for Transport, 2020).

2.2.24 Section 4.2(g) of the licence states that National Highways, when exercising its functions and complying with its legal duties, must act in a manner which it considers best calculated to '*minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment*'. This requirement is further outlined in Section 5.23 of the licence.

2.2.25 Effective design is an iterative process informed by the EIA process. The environmental, architecture and engineering designs have been developed concurrently, with close collaboration between the design and environmental disciplines as part of the iterative design process. As an overarching principle, the Project development team and design process actively sought to prevent, avoid, reduce or offset significant adverse environmental effects on environmental receptors, and to seek beneficial effects. A full description of the Project design principles can be found in the Design Principles (Application Document 7.5) and the Project Design Report (Application Document 7.4), and further information regarding the consideration of alternatives as part of the iterative design process is provided in Chapter 3: Assessment of Reasonable Alternatives. Details of how climate change resilience considerations and the Project's commitment to carbon reduction have also influenced the design process are discussed below in this section of the Chapter.

2.2.26 Relevant design measures, as set out in the DMRB, have been incorporated within the Project design, where appropriate, to mitigate impacts arising from the Project that cannot be avoided.

2.2.27 The detailed design of the Project's structures, buildings and landscape would be developed with the goal of further increasing biodiversity value where reasonably practicable through the Project.

Environmental mitigation

2.2.28 Environmental considerations have influenced the Project throughout the design development process, from early route options assessment through to refinement of the Project design. An iterative process has facilitated design updates and improvements, informed by environmental assessment and input from the Project design teams, stakeholders and public consultation.

2.2.29 The environmental assessment process has identified the potential for the Project to result in a significant environmental impacts at each phase of the Project, in the context of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations. These adverse effects would require mitigation, as documented within the topic chapters (Chapters 5 to 15) of this ES. The identified potential impacts, arising during each phase of the Project, would be managed by the mitigation route map, also known as the control plan.

2.2.30 The control plan is the framework for mitigating, monitoring and controlling the effects of the Project. It is made up of a series of 'control documents' which present the mitigation measures identified in the application that must be implemented during design, construction and operation to reduce the adverse effects of the Project. Further explanation of the control plan and the documents which it comprises is provided in the Introduction to the Application (Application Document 1.3).

2.2.31 The Project proposals include a range of environmental mitigation commitments. These commitments fall within the following categories, and each topic chapter of the ES identifies those that are relevant to the topic assessment:

a. Embedded mitigation: measures that form part of the Project design, developed through the iterative design process.

b. Good practice: standard approaches and actions commonly used on infrastructure development projects to avoid or reduce environmental impacts, typically applicable across the whole Project.

c. Essential mitigation: any additional Project-specific measures needed to avoid, reduce or offset potential impacts that could otherwise result in effects considered significant. These additional measures have been identified by environmental topic specialists, taking into account the effect of embedded mitigation and good practice commitments.

2.2.32 Embedded mitigation is included within the Design Principles (Application Document 7.5) and is also identified on the General Arrangement drawings (Application Document 2.5). Figure 2.4 illustrates the Environmental Masterplan for the Project (Application Document 6.2). The Design Principles and Environmental Masterplan form part of the control plan.

2.2.33 The following are examples of embedded mitigation measures incorporated into the Project design:

a. The landscape design has been developed to integrate the Project with the local character of the surrounding landscape and soften the visual impact. The landscape design aims to maintain local vegetation patterns and landform.

b. The Project design has considered biodiversity and opportunities have been explored to identify suitable areas for potential habitat creation where significant effects on designated areas and protected species have been identified. This has informed the design process so that linkages between habitats and new wildlife corridors are incorporated within the Project design. For example, the proposed green structures on the A2 corridor and Project route aim to connect new and existing habitats north–south and east–west.

c. The Project design includes the provision of green bridges in seven locations to reduce habitat fragmentation.

d. The Project design includes re-linking of severed Public Rights of Ways (PRoWs), cycle routes and bridleways and provision of new routes to improve access to the existing networks.

e. The Project design includes flood alleviation measures (mitigation, protection and resilience) to ensure that the Project is safe for its users and does not result in an increase in flood risk elsewhere.

2.2.34 The Project has been designed to be sympathetic to its context, the majority of which is designated Green Belt (as discussed in the Planning Statement (Application Document 7.2)); and to fit harmoniously into the landscapes through which it passes. As a result, the design of the architectural elements of the Project, such as overbridges, portals and operational buildings, are intended to reflect the nature of their surrounding environs/setting, while also being recognisable as part of the wider Project. Thirty-two route-wide landscape design principles were established to guide the design process for the Project.

2.2.35 These landscape design principles are listed below, with further detail provided in the Design Principles (Application Document 7.5) and the Project Design Report (Application Document 7.4):

a. Retention of existing vegetation

b. Planting strategy

c. Landscape integration features for visual screening

d. Landscape planting

e. Landscape reinstatement

f. Landscape legacy

g. Respecting historic landscape

h. Landscape earthworks: flood risk

i. Landscape earthworks: false cuttings

j. Junction planting

k. Planting palettes

l. New, diverted and reinstated watercourses

m. Hedgerow reinstatement: field and roadside boundaries

n. Hedgerows: highways boundaries

o. Planting densities

p. Surfacing to hard landscape and operational areas

q. Integration of infiltration basins, detention basins and retention ponds

r. Chalk cuttings

s. Ancient woodland compensation

t. Wildflower seeding on earthworks

u. Blending of earthworks

v. Approach to Open Mosaic Habitat

w. Early planting

x. Planting: key views/vistas

y. Planting: openness

z. Planting: screening

aa. Nitrogen deposition compensation sites

bb. Drainage design

cc. Drainage strategy: south

dd. Drainage strategy: north

ee. Wildlife pond provision

ff. Public safety in publicly accessible land.

2.2.36 While the Project is committed to providing high-quality design solutions for all structures across the project, six of the proposed structures along the Project route have been identified as 'Project Enhanced Structures' embedded into the design. The design and appearance of these structures is particularly important to their specific locations along the route, due to the wider impact on connectivity benefits they offer within the surrounding environment and landscape. These Project Enhanced Structures have been designed to enhance the aesthetic quality of the road and its relationship with the places it passes through. Further information on the design of these Project Enhanced Structures is provided in the Project Design Report (Application Document 7.4).

2.2.37 A summary of all the good practice and essential mitigation presented in the ES is provided in the Register of Environmental Actions and Commitments (REAC) which forms part of the Code of Construction Practice (CoCP) (Application Document 6.3, Appendix 2.2). The CoCP provides a framework to manage construction and operational activities. The CoCP ensures that environmental mitigation commitments are met and necessary consents and licences are obtained. The CoCP is a control plan document.

2.2.38 Examples of good practice mitigation measures are as follows:

a. The first five years of vegetation establishment would be overseen by an Environmental Clerk of Works. Vegetation that has failed to establish would be replaced as soon as identified within the next available planting season. At the end of the establishment period, subsequent landscape management would be undertaken in accordance with the Landscape and Ecology Management Plan (LEMP) (REAC Ref. LV003).

b. Where guards are used to protect seedlings and whips, the use of plastic tree guards would be avoided in favour of biodegradable options where available. In the event that plastic guards are used, these will be removed within five years of installation (REAC Ref. LV004).

c. Noise and vibration levels would be controlled in accordance with BS 5228: Code of practice for noise and vibration control on construction and open sites, to reduce disturbance to the environment and communities in the vicinity of the construction works, including Thames Estuary and Marshes SPA/Ramsar and associated functionally linked land (REAC Ref. NV001).

d. Work site drainage systems would be inspected and maintained to ensure they continue to operate to their design standard, safeguarding surface and groundwater quality (REAC Ref. RDWE002).

2.2.39 Examples of essential mitigation measures are as follows:

a. Erection of noise attenuation measures at the boundaries of compounds identified in REAC Ref. HR004 will be carried out in April, May, June and July only to avoid disturbance of birds in the passage and winter period (REAC Ref. HR006).

b. A minimum of 30 individual specimen trees would be planted as replacement for 10 lost veteran trees (REAC Ref. LV032).

c. All required Natural England licences and associated working practices and method statements would be in place prior to any related construction works starting in areas where licensable species occur (REAC Ref. TB014)

d. Where below ground utilities diversions are required, watercourses would be crossed using trenchless techniques in order to avoid disturbance to channel form, flow regimes and riparian habitats and species, unless other techniques are agreed with the Environment Agency or Lead Local Flood Authority (LLFA), where relevant (REAC Ref. RDWE008).

e. Bankside vegetation reinstatement and planting at the entrances to the West Tilbury Main culvert would be designed to ensure no sharp light/dark interface to encourage continued fish passage. This would be achieved by planting with a scrub mix that will include alder. Root barriers would be installed to protect structural integrity of the bank as appropriate (REAC Ref. RDWE021).

Consultation and engagement

2.2.40 Consultation and engagement have been an important influence on the development of the Project proposals. The Planning Statement (Application Document 7.2) and ES Chapter 3: Assessment of Reasonable Alternatives provide further details on the route selection process and the development of the Project design.

2.2.41 Since the preferred route was announced in 2017, five public consultations have been held, as listed below. The feedback received from these has guided the development of the Project design and the construction proposals.

a. Statutory Consultation – October to December 2018

b. Supplementary Consultation – January to March 2020

c. Design Refinement Consultation – July to August 2020

d. Community Impacts Consultation – July to September 2021

e. Local Refinement Consultation – May 2022 to June 2022.

2.2.42 A summary of consultation is provided within Chapter 1: Introduction of the ES and further detail is provided within the Consultation Report (Application Document 5.1) including information on the evolution of the design in response to feedback. Alongside public consultation, the Applicant has continued to engage with stakeholders to refine and develop the Project proposals. The Statement of Engagement (Application Document 5.2) sets out National Highways' approach to engagement with stakeholders and the Statement of Commonality (Application Document 5.3) identifies where there are common issues being discussed between different stakeholders.

Safety

2.2.43 The safety implications of the Project have been given due consideration at each stage of design development. This would continue as the Project develops from preliminary design through to detailed design and handover into operation.

2.2.44 The design adopts the latest applicable safety standards for construction methods, and uses technology to effectively manage traffic, provide better information to drivers and to support the management of incidents.

2.2.45 The Emergency Services and Safety Partners Steering Group (ESSPSG) has been established to review and consult on the design of the tunnel as it develops. The ESSPSG currently includes the remit of the Tunnel Design and Safety Consultation Group (TDSCG), as required by the DMRB, and includes members of the Project Team, National Highways tunnel specialists, National Highways Operations Directorate, the emergency services, adjacent local highway authorities and environmental bodies. The ESSPSG and / or TDSCG will continue to be consulted on matters of safety and operational readiness throughout the development of the design and construction.

2.2.46 Safety of the operational phase of the Project has influenced the design processes to date. Examples of safety considerations include the following:

a. The use of variable mandatory speed limits (VMSL) to manage traffic during all operating states

b. A traffic signal and barrier arrangement on each tunnel bore approach to allow the tunnel to be closed in the event of a significant incident

c. Technology improvements to detect incidents on highway links and in the tunnel, to activate control measures

d. Comprehensive closed-circuit television (CCTV) coverage

Security

2.2.47 Security implications of the Project have been given due consideration at each stage of design development. This would continue as the Project develops from the preliminary design through to detailed design and handover into operation of the built asset. Security also forms part of the remit of the ESSPSG / TDSCG which has been established to review and consult on security considerations as the Project develops.

2.2.48 The design for the built asset has been informed by guidance provided by the UK Government's Centre for the Protection of National Infrastructure (CPNI). Guidance provided by the UK Police official security initiative 'Secured by Design' has also been considered, as have Crime Prevention Through Environmental Design (CPTED) principles.

2.2.49 The design and specification of physical security measures will consider the impact on wildlife, public access, light and noise pollution, nuisance to neighbouring properties and visual impact, and the Project's carbon reduction commitments. This will include sensitive routing of security fencing to reduce visual impacts, and the use of modern technology to reduce or eliminate lighting requirements, whilst maintaining the desired security required.

Climate change resilience

2.2.50 An assessment of the vulnerability of the Project to the impacts of climate change during the construction and operational phases has been undertaken and is presented in Chapter 15: Climate.

2.2.51 Climate projections for the Project area are set out in Appendix 15.2 (Application Document 6.3) using the latest data from the United Kingdom Climate Projections 18 (UKCP18) resources. At this design stage, as presented in the DCO, the principal climate change considerations are related to material deterioration, flood risk and highway drainage.

2.2.52 Measures to mitigate the effects of climate change have been incorporated into the Project.

2.2.53 The Environment Agency's current guidance on climate change allowances for flood risk assessments (2022) has been used to analyse flood risk and to determine a suite of flood alleviation measures. Climate change allowances for flood risk are detailed in the Flood Risk Assessment (Application Document 6.3, Appendix 14.6).

2.2.54 Due to the extensive resilience mitigation proposed within the design, Chapter 15: Climate concludes that the Project would be capable of withstanding the climate change likely to occur during the design life.

2.2.55 Consideration of the capacity for the Project design to be resilient to climate change will continue as the Project develops through detailed design. The Contractors would design the permanent works in accordance with the design standards identified in Appendix 15.3: Climate Resilience Impacts and Effects (Application Document 6.3) and use construction materials and products that would be resilient to the effects of projected future climate change, as set out in the REAC which forms part of the CoCP (Application Document 6.3, Appendix 2.2).

Carbon reduction in design

2.2.56 The outline design of the Project has been influenced by an assessment of the likely effects of the Project on greenhouse gas (GHG) emissions during construction and operation. This is explained in detail in Chapter 15: Climate.

2.2.57 The Project is committed to reducing GHG emissions from Project activities by implementing the hierarchy for GHG emissions (avoid and/or prevent, reduce, remediate). As a first step to minimising GHG emissions, the Project has quantified likely emissions across both the construction and operational phases of the Project, as set out within the Carbon and Energy Management Plan (Application Document 7.19). This hierarchy has been applied throughout the design process and has informed the measures proposed to mitigate the effects of the Project on climate.

2.2.58 The Project has focused its carbon reduction effort in areas that it can control during the construction phase and influence during the future operation and maintenance.

2.2.59 The Project has identified the following four types of carbon reduction opportunities:

a. Opportunities that have been included in the carbon calculation

b. Opportunities that would be pursued through the procurement process

c. Opportunities that Contractors can consider during detailed design

d. Opportunities that the Applicant can consider during the operational phase

2.2.60 Building on this, the outline design process has sought to identify and incorporate opportunities for carbon reduction through design, incorporating current, commercially available low carbon technology and adopting best practice. Opportunities available to the Contractors and included in the Project's carbon model are:

a. Lower carbon concrete – Concrete, one of the main construction materials, has a relatively high carbon footprint and would be one of the main emission sources for the new road. It has been calculated to account for approximately 15% of all embodied carbon from construction materials.

b. The use of steel fibre reinforced concrete (SFRC) in the tunnel lining for most of the concrete segments in the bored tunnels. SFRC has lower carbon emissions than traditional steel bar reinforced concrete.

c. The use of a low-carbon cement replacements across the Project. Cement accounts for 10% of the embodied carbon from construction materials

d. Reuse of material onsite – Reusing topsoil, vegetation and excavated material onsite reduces carbon emissions associated with transport and waste treatment.

e. Provision for WCH within the design – The design includes features that provide alternatives to road travel for WCH, such as the creation of green bridges and new routes to improve provisions and enhance connectivity for WCH. This could also have a beneficial impact in reducing GHG emissions associated to the Project, as it provides alternatives to car travel.

f. Planting – Trees, shrubs and hedgerows planted as part of the landscape design offer the opportunity to offset a proportion of the Project's GHG emissions associated with land use change and the subsequent loss of carbon sink.

g. Low energy and renewable energy use during operation – Electricity used for operation of the Project is to be procured from renewable electricity suppliers. In addition to this, as part of the design development there is a commitment for low energy light sources to be used within the Project lighting systems to reduce energy consumption during operation and offer a more readily recyclable product at the end of life compared to traditional lighting.

2.2.61 These measures represent examples of numerous possible pathways that the Contractors could take to match the low carbon position presented in the Carbon and Energy Management Plan (Application Document 7.19).

2.2.62 In addition to the above, the Carbon and Energy Management Plan sets out the mechanisms to allow the Project to support and incentivise its Contractors to further reduce Project emissions during the detailed design and construction phase, through best practice carbon management, contractor collaboration and innovations.

2.2.63 Through carrying out a quantification of the likely emissions, the Carbon and Energy Management Plan has identified key contributors (carbon hotspots) within the design. This can help to focus the Project's future emission reduction effort most effectively.

2.2.64 Carbon hotspots are identified as:

a. Steel

b. Cement

c. Diesel

d. Asphalt.

2.2.65 A series of opportunities for reducing GHG emissions associated with these hotspots during detailed design and construction are provided in the Carbon and Energy Management Plan. Chapter 15: Climate concludes that the GHG impact of the Project would not have a material impact on the carbon reduction targets set by the UK Government. Section 2.5 of this chapter further describes the role of the Carbon and Energy Management Plan (Application Document 7.19).

Sustainability

2.2.66 In addition to the carbon emission reduction considerations outlined above, sustainability considerations have informed the design development. The Project has identified the following sustainable development outcomes, giving regard to the goals of sustainability themes outlined in Section E/1 of DMRB GG 103 (Highways England, 2019a). These outcomes are described further in the Sustainability Statement (Application Document 7.11).

a. Improve the health, safety and wellbeing of those affected by road infrastructure – including various health, safety and wellbeing related issues affected by the design of the Project, flood risk, drainage issues and noise management.

b. Improve Land, water and air quality – including how the design of the Project has considered land contamination, preserving and improving the quality of surface and groundwater and minimising the consumption of groundwater, together with the incorporation of air quality improvements into the design.

c. Serve to support a sustainable economy – including how the Project would support local, regional and economic objectives whilst reducing disturbance to the local economy from issues such as severance or environmental impacts.

d. Represent good whole-life value across the design life of road infrastructure – including how whole-life value has been incorporated into design decisions, analysis of pay back periods, the costs and benefits of innovations and the impacts this can have on network availability from reduced maintenance.

e. Embrace Innovation – including examples of where design, technology or behavioural innovations have enhanced the Project's sustainable development outcomes.

f. Reduce inequalities and ensure access for all – including the design aspects that have addressed the needs of users with protected characteristics or who are affected by socio-economic disadvantage; and transport connectivity.

g. Use responsibly sourced materials that minimise adverse impacts on people and the environment – including consideration of National Highways' strategy for responsible sourcing and how this is addressed in the design.

h. Be resource efficient and reflect a circular approach to the use of materials – including an explanation of where the design promotes material reuse and minimising waste and where this would be encouraged during construction.

i. Minimise GHG emissions – including how the Project is tackling the challenge of reducing GHG emissions from the construction and operation of the Project.

j. Be resilient to future climate change – including the attention paid to climate change resilience during design.

k. Protect and, where possible, enhance the surrounding environmental and cultural context – including how the design has considered the surrounding natural, built and historic environment, as well as where it promotes biodiversity and avoids light pollution.

l. Be shaped by the opinions of communities and road users – including a summary of discussions with stakeholders that have shaped the approach taken to sustainability on the Project.

2.2.67 Sustainability considerations have been incorporated into the Project through inclusion of relevant concepts in the design; direct specification; and by encouraging carbon emission reduction through the procurement process.

2.2.68 During the detailed design and construction phases the Contractors would work with National Highways and stakeholders to further identify and create sustainable outcomes for the Project, in a manner that satisfies the requirements of DMRB GG 103 (Highways England, 2019a) and Highways England's (2017) Sustainable Development Strategy.

Traffic modelling

2.2.69 Traffic modelling has been undertaken to assess the impacts of additional road capacity across the River Thames, east of London, and the impact that the Project would have on the road network. A simulation of the transport system in the Lower Thames area, a transport model called the Lower Thames Area Model (LTAM), was developed, in accordance with the NPSNN paragraph 4.6 (Department for Transport, 2014). The transport model contains a detailed representation of the road network in the area, and information on where people travelled to and from. This model was validated against real-world data, to provide a baseline reflecting an average month (March 2016). This baseline has then been used to develop forecasts to inform the environmental assessment.

2.2.70 More detail on how the transport model was built and what it predicts can be found in the Combined Modelling and Appraisal Report (ComMA) (Application Document 7.7), the Traffic Forecasts Non-Technical Summary (Application Document 7.8) and the Transport Assessment (Application Document 7.9).

2.2.71 The transport model shows the number of people choosing to travel by road and rail, the route they use now, and the route they are forecast to use in the future. This enables predictions to be made of how many vehicles would be using each part of the road network in the future and how long it would take to complete a journey.

2.2.72 The Do Minimum (without the Project) scenario has been modelled, where the Project is not built but where changes to the road network and planned development that is forecast to go ahead (whether the Project is built or not) are included. The transport model also predicts the use of both the Project and other parts of the road network if the Project is built (the Do Something scenario). It predicts the following for the same years as the Do Minimum situation:

a. How people would react to the changes in the time and cost of their journeys

b. The routes they would use as a result of the Project.

2.2.73 The transport model is used to predict traffic conditions on the road network in the following years:

a. 2030 – the Project's opening year

b. 2037 – an interim year used in the economic appraisal

c. 2045 – the Project's design year being 15 years after opening

d. 2051 – the final forecast year. This is the furthest year into the future for which the Department for Transport publishes traffic growth forecasts for use in transport models.

2.2.74 The transport model uses the busiest times of the day on the strategic road network (SRN) in the area: 07:00 to 08:00 (the morning peak) and 17:00 to 18:00 (the evening peak). An hour in the middle of the day is also modelled (the inter-peak), reflecting the period between 09:00 and 15:00.

2.2.75 The changes in journey times and costs for all traffic in the area, including for those who would not use the Project but have their journey times affected by changes in traffic patterns, form the basis for assessing the economic impact of building the Project. The transport model provides data on forecast traffic flows and speeds. This data is used to consider the environmental impacts of the forecast changes to traffic, accident levels and changes in journey time reliability, and to demonstrate the economic benefits of the Project.

2.2.76 The transport model has been used to inform the design of the new road and its junctions so that it is suitable for the predicted traffic levels. The model has been assessed by an independent assessor from National Highways who has confirmed that the model is suitable to assess the impact of the Project on the transport network. The traffic modelling results have been used to develop the junction layouts and to establish how many lanes would be needed in order to comply with National Highways design standards. Micro simulation modelling was also carried out to further assess the performance of the Project's junctions and to ensure that the new road would operate satisfactorily.

2.2.77 Transport modelling of the construction phase of the Project has been undertaken, considering the combined impacts of:

a. the additional construction traffic on the network

b. traffic management measures associated with the construction works

2.2.78 Outputs from the construction and operational transport modelling and the Transport Assessment (Application Document 7.9) have been used to inform the assessments presented in the relevant ES chapters.

Other Nationally Significant Infrastructure Projects (NSIPs) and major developments

2.2.79 There are a number of other NSIPs and major developments currently proposed, or in development, near the Project. These include the following:

a. The London Resort

b. Tilbury2

c. Thurrock Flexible Generation Plant

d. Thames Freeport

e. Tilbury Link Road

f. East Anglia Green

g. DP World London Gateway

h. Brentwood Enterprise Park

i. Hole Farm

j. M25 junction 28

2.2.80 The development of the Project design and construction methodologies has sought to design out and control project interfaces, where necessary, to avoid prejudicing the successful delivery of other projects. This has included adjusting the Project's Order Limits and careful programming of construction activities where there is potential for overlap with other construction programmes. Extensive engagement has been undertaken to date with the various landowners and key stakeholders for these other Projects to inform the design development process. The relationship between the Project and the revenant other projects will be ongoing as they continue to be developed.

2.2.81 Detailed information on the other projects is provided within the Interrelationships with other Nationally Significant Infrastructure Projects and Major Development Schemes (Application Document 7.17). The cumulative effects of the Project in combination with the other developments is discussed in Chapter 16: Cumulative Effects Assessment.

Detailed design

2.2.82 Following successful grant of the DCO, the Contractors would develop the preliminary design presented in the DCO application into a detailed design for construction. The detailed design would be produced in accordance with the control plan documents presented in the DCO application, as amended during examination where relevant. The detailed design would be developed in accordance with the relevant design standards current at that time.

2.2.83 Where the Contractors propose a change to the design of the Project under article 6 or Requirements 3 or 8 of the draft DCO (Application Document 3.1), they must follow the process set out below in considering whether the proposed change would result in a 'materially new or materially different' effect as compared with the ES. The Contractors would engage a competent environmental specialist to consider the effects of the change and whether it would give rise to:

a. an effect that is 'materially new' – this is an effect that is significant in EIA terms and does not fall within the envelope of the scope of the environmental assessment contained in the ES certified by the Secretary of State.

b. an effect that is 'materially different' – this is an effect that was reported in the ES but in respect of which there is an adverse material change in the significance attributed to the effect from that reported in the ES.

2.2.84 If the Contractors determine the proposed change does give rise to materially new or materially different effect, the change cannot be progressed under the terms of the DCO. If the Contractors determine the proposed change does not give rise to a materially new or materially different effect, they will notify National Highways. Once National Highways is satisfied the proposed change should be the subject of an application, the Contractors would prepare an application for the proposed change. Prior to submission of an application to approve a proposed change by the Secretary of State, the Contractors would engage with the relevant bodies under article 6 or Requirement 3 of the draft DCO (Application Document 3.1). The Contractors will be expected to provide information on how any application complies with the requirements of article 6 or Requirement 3 as part of that engagement.

2.2.85 The Contractors will comply with paragraph 20 of Schedule 2 to the draft DCO (Application Document 3.1), which sets out further information about the process in connection with an application to the Secretary of State.

2.2.86 If the proposed change does not give rise to a materially new or materially different effect, the relevant control plan documents would be amended to reflect the change, where required.

2.3 Project sections

2.3.1 The Project would provide a connection between the A2 and M2 in Kent, to the east of Gravesend, and the M25 south of junction 29. It would cross underneath the River Thames via two bored tunnels.

2.3.2 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.

2.3.3 The Project would also include modifications to the existing A2/M2, A13/A1089 and M25 as described in the following paragraphs.

2.3.4 The Project proposals are shown on Figure 2.2 (Application Document 6.2), and plates are included in this chapter to aid understanding of each section and junction arrangements. Full details of the works proposed are set out in Schedule 1 of the draft DCO (Application Document 3.1) and are shown on the Works Plans (Application Document 2.6).

2.3.5 The operational Project is broken down geographically into nine sections, as outlined in Table 2.2. Further detail for each can been seen in the General Arrangement drawings (Application Document 2.5). Each section is broken down into individual work elements and given an individual Work Number. It should be noted that these Work Numbers do not always reflect the start and end point of works to an entire length of road, but reflect the approach taken in preparing Schedule 1. For example the works on the A2 extend through both Sections 1 and 2, and Works Numbers have been allocated accordingly.

Table 2.2 Project description – operational sections

Section	Name	Description
1	A2/M2 corridor	Alteration of the A2 from junction 1 of the M2 running west under Thong Lane green bridge south, towards the M2/A2/A122 Lower Thames Crossing junction.
2	M2/A2/A122 Lower Thames Crossing junction	Alteration of the A2 and construction of the new junction with the Project continuing north to a point directly south of the new Thong Lane green bridge north over the A122.
3	M2/A2/A122 Lower Thames Crossing junction to South Portal	Construction of the Project road between the M2/A2/A122 Lower Thames Crossing junction, directly south of the new Thong Lane green bridge north over the A122, running north beyond the South Portal until Rochester Road. Section 3 includes construction of the portal structure and infrastructure associated with the tunnel.
4	A122 Lower Thames Crossing Tunnel	Construction of the tunnels and the A122 through the tunnels between the South Portal and North Portal.
5	North Portal to northern end of Tilbury Viaduct	Construction of the A122 at the North Portal to the northern end of the Tilbury Viaduct. Section 5 includes construction of the portal structure and infrastructure associated with the tunnel and its maintenance access.

Section	Name	Description
6	Chadwell St Mary link	Construction of the A122 between the Tilbury Viaduct and the A13/A1089/A122 Lower Thames Crossing junction.
7	A13/A1089/A122 Lower Thames Crossing junction	Alteration of the existing A13/A1089 junction, and construction of the new A13/A1089/A122 Lower Thames Crossing junction.
8	LTC Ockendon Link	Construction of the highway between the junction with the A13 and the M25.
9	A122 Lower Thames Crossing/M25 junction	Construction of the A122 Lower Thames Crossing/M25 junction, and alteration of the M25 including junction 29.

2.3.6 The horizontal and vertical alignments of the Project route are discussed below and have been designed to the DMRB standards as published in 2019 (Highways England, 2020b) as discussed in Section 2.2 of this chapter. The design speed for the mainline would be 120kph (74.6mph), with a 70mph (112.7kph) speed limit.

2.3.7 Junctions are proposed at the following locations and are described in the relevant sections below:

a. A new junction with the A2 to the south-east of Gravesend (Section 2)

b. A modified junction with the A13/A1089 in Thurrock (Section 7)

c. A new junction with the M25 between junctions 29 and 30 (Section 9)

2.3.8 The Project Design Report (Application Document 7.4) and Figure 2.4: Environmental Masterplan (Application Document 6.2) provide further details about the design of the Project and the proposed planting and landscaping.

2.3.9 The following subsections of this chapter describe the main features of the Project, Section by Section as outlined previously in Table 2.2. The main features of each Section are described, including the proposed environmental mitigation measures that have been identified to date.

2.3.10 Figure 2.2 (Application Document 6.2) displays the operational proposals for the Project whilst Figure 2.5 (Application Document 6.2) displays the land required for construction alongside any associated construction infrastructure (e.g. compound locations and haul roads and access routes).

2.3.11 In general, features are described from south to north and east to west for features that cross the Project centreline, unless otherwise stated.

2.3.12 It should be noted that all dimensions provided are approximates, and where a feature straddles multiple Sections it is reported only in the first Section.

2.3.13 The Project description should be read alongside the Rights of Way and Access Plans (Application Document 2.7) which have been submitted as part of the DCO application.

Section 1: A2/M2 corridor

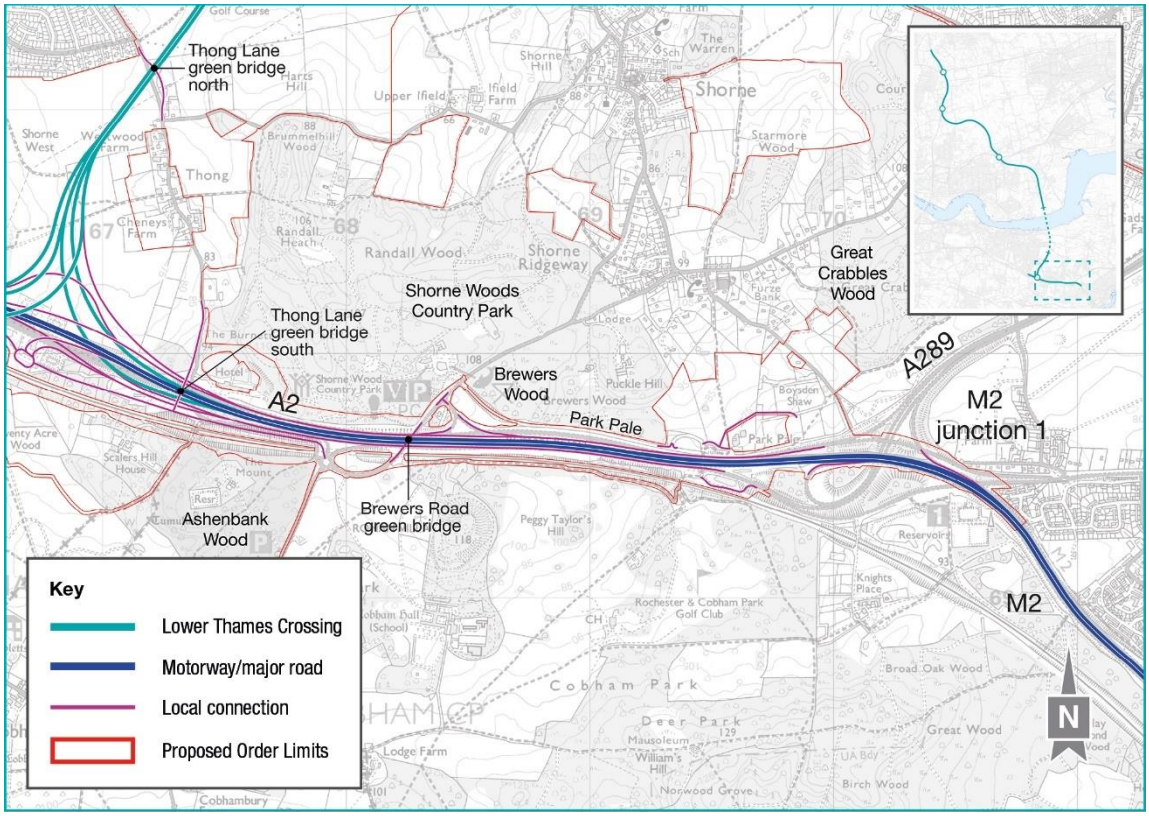
2.3.14 Section 1 would be located within the wards of Shorne, Cobham and Luddesdown, and Higham. Highway works in Section 1 begin at M2 junction 1 with the A289 Hasted Road, west of Strood, and would retain four lanes each way along the A2. Parallel link roads provide two lanes in each direction between the M2/A2/A122 Lower Thames Crossing junction and M2 junction 1. Section 1 ends directly west of the Thong Lane green bridge south over the A2 (where Section 2 starts).

2.3.15 The alterations to the A2/M2 and the provision of the link roads would ensure that all existing movements (with the exception of Brewers Road to the M2 eastbound) to and from the local road network would be provided.

2.3.16 A schematic layout of Section 1 is provided in Plate 2.1.

2.3.17 The construction of Section 1 would be managed as part of Construction Section A, as described in Section 2.6 of this chapter.

Plate 2.1 Operational Section 1 schematic



Key work elements

2.3.18 The key components of works in Section 1 would be the provision of an improved section of the existing M2 and improvement works to the A2, including the construction of a new A2 eastbound link road. This includes widening of both the existing three-lane southbound (over a length of approximately 1,115m) and three-lane northbound (over a length of approximately 835m) carriageways of the M2, to four-lane carriageways. Together with improvement works to lengths of approximately 2,460m along both the eastbound and westbound carriageways of the existing A2 mainline, (Work number 1A). Intermittent hard shoulders would be provided along the altered alignment through this Section.

2.3.19 A new section of highway would be created between the westbound carriageway of the improved A2 mainline and the northbound carriageway of the A122 new link road (approximately 500m in length), together with a further new section of highway between the southbound carriageway of the A122 and the eastbound carriageway of the improved A2 (approximately 515m in length). Both of these new sections would provide two-lane link roads connecting the improved A2 to the A122 new link road (Work number 1A).

2.3.20 Improvement works to lengths of the southbound (approximately 245m) and northbound (approximately 255m) M2 single-lane slip roads between the existing A289 and the improved M2 would also be undertaken (Work number 1B).

2.3.21 A new two-lane eastbound link road would be constructed between the existing eastbound carriageway of the A2 mainline and the northbound carriageway of the existing A289. This new section of highway would be approximately 3,880m in length (Work number 1C). A new section of single carriageway local road, approximately 75m in length would also be constructed; together with a new private means of access to Park Pale business park (Work number 1C).

2.3.22 A new two-lane westbound link road would also be constructed between the westbound carriageway of the existing A2 mainline and the southbound carriageway of the existing A289. This new section of highway would be approximately 3,140m in length (Work number 1F). These parallel link roads would not have hard shoulders but 1m-wide hard strips on the edge of the carriageways.

2.3.23 A new single-lane A122 link road (Work number 1G), approximately 550m in length, would also be constructed between the new A2 westbound link road (Work number 1F above) and the new link road between the westbound carriageway of the improved A2 mainline and the northbound carriageway of the A122 (Work number 2A discussed below under Section 2).

2.3.24 A new single-lane section of local road, approximately 645m in length, would also be constructed between the realigned Brewers Road and the new A2 eastbound link road (Work number 1M), together with a new single-lane section of local road, approximately 265m in length, between the new A2 eastbound link road and the realigned Brewers Road (Work number 1M).

2.3.25 Improvement works would also include realignment of Brewers Road, over a length of approximately 275m (Work number 1D). Thong Lane would also be realigned for approximately 420m in length (Work number 1H) and a new section of single-carriageway local road would be constructed between the existing Halfpence Lane roundabout and Thong Lane green bridge south, approximately 670m in length (Work number 1E).

2.3.26 Other key design features of Section 1 would include the following as shown on the Works Plans (Application Document 2.6):

a. Construction of a new Public Right of Way (PRoW) between Park Pale and Shorne Woods (Work number 1C).

b. Demolition of the existing Brewers Road bridge (Structure Ref. BRE009123) over the existing A2 (Work number 1D).

c. Provision of a new Brewers Road green bridge (Structure Ref. BRN0000001) to carry the realigned Brewers Road over both carriageways of the improved A2 mainline and both carriageways of the new eastbound and westbound A2 link roads. The new Brewers Road green bridge would be approximately 104m in length, 32m in width and 8.6m above ground level (AGL) above the A2 and located in the same position as the existing bridge (Work number 1D).

d. Construction of a new PRoW from Brewers Road to the Halfpence Lane roundabout (Work number 1D).

e. Construction of a section of a new PRoW from Halfpence Lane roundabout to Thong Lane and the construction of a new permissive path from the Halfpence Lane roundabout leading to Scalers Hill House (Work number 1E).

f. Demolition of the existing Thong Lane bridge (Structure Ref. BRE0025747) over the existing A2 mainline (Work number 1H).

g. Construction of a new green bridge (Structure Ref. BRN0000002), approximately 55m west of the existing bridge, to carry the realigned Thong Lane over the widened section of the A2 mainline and the existing and proposed highways at this location. The new Thong Lane green bridge south, would be approximately 153m in length, 41m in width and 10.5m AGL. A new single carriageway local road would be provided over Thong Lane green bridge south, approximately 420m in length (Work number 1H), connecting to a new local link road providing access to Henhurst Road in the west.

h. Construction of a new access road from the new Thong Lane green bridge south to The Inn on the Lake (Work number 1H).

i. Construction of a new PRoW along the verge of the realigned Thong Lane and construction of a new PRoW in the access from Thong Lane (Work number 1H).

j. Construction of a gravity highway drainage network incorporating new infiltration basin (Pond Ref. POS01-001). The basin would be located to the north of the Project road at M2 junction 1 and be constructed as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the basin via Park Pale (Work number 1I).

k. Construction of a gravity highway drainage network incorporating an existing infiltration basin (Pond Ref. EXPOS01-001). The basin is located to the south of the Project road at M2 junction 1 and would be fully refurbished and include a lined sediment forebay (Work number 1J).

l. A new PRoW from the drainage pond (Work number 1J above) to the improved PRoW south of the improved A2 mainline would be constructed; together with improvement works to the existing PRoW along footpath NS179. A new public right of way would be constructed from the improved footpath to the improved Brewers Road (Work number 1K).

m. Construction of a new PRoW, to include improvement works to a section of the existing PRoW between Halfpence Lane roundabout to Jeskyns Community Woodland, and the construction of a new permissive path between the improved PRoW and Jeskyns Community Woodland (Work number 1L).

n. Construction of a section of the new local road between the improved A2 and the realigned Brewers Road with rectified turning radii, approximately 70m in length (Work number 1N).

o. Construction of a new PRoW between Pale Park and the existing footpath NS161 (Work number 1O).

p. Construction of a new car park to the west of the realigned Thong Lane over the A2 mainline, north of the new Thong Lane green bridge south. This would provide parking and access to Shorne Woods Country Park (Work number 1P). Construction of a private means of access to the new car is proposed as part of Work number 1H.

2.3.27 Where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available. In most locations, the affected local roads would go over the Project road and would generally need alterations to the horizontal alignment to enable the new local roads to be constructed offline of the existing roads. This would enable traffic to continue to use the roads during construction.

Utilities works

2.3.28 Permanent diversions of the utility networks would be required within Section 1 as listed below. Further information on all utility network diversions, including temporary diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. Diversion of approximately 5.4km length of Southern Gas Network medium-pressure gas pipeline (Work number G1a approximate length of 2.4km and Work number G1b approximate length of 3km) and associated assets. Work number G1b extends into Section 2.

b. Multi-utility corridors including UK Power Networks (UKPN) electricity networks, Southern Water foul sewers and water mains, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU1 to MU12). This includes the installation of three new substations: one to the west of Harlex Haulage Services Ltd. (SS1) and two located within the Shorne Woods Country Park car park (SS2 and SS3). Work number MU9 extends into Section 2.

Special category land

2.3.29 Where the proposed Project road and its construction results in permanent impacts on common land and open space sites, the Applicant would provide replacement open space and common land parcels within the Order Limits in accordance with the requirements of sections 131 and 132 of the Planning Act 2008. For Section 1, this includes replacement land in response to the permanent acquisition of land and rights over the designated open space land at Shorne Woods Country Park, immediately to the north of the A2 with access off Brewers Road (Work number OSC1).

2.3.30 The replacement land would be located immediately to the east of Brewers Wood (which also forms part of Shorne Woods Country Park). The area would be designed to complement the existing site with woodland planting and provide a connection between currently fragmented parcels of woodland, by providing a link between Shorne Woods Country Park, Brewers Wood and Great Crabbles Wood.

2.3.31 This area would be landscaped to complement the existing site with woodland planting, allowing for the spaces to link together and function as one. The new area of woodland to the east of Brewers Wood would link Shorne Woods with Great Crabbles Wood and would create new recreational areas. The replacement land comprises approximately 19,100m^2 (compared with the approximately 15,000m^2 that is proposed to be acquired, or be subject to rights).

Private recreational facilities

2.3.32 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.33 For Section 1, a small northern corner of Cobham Hall (a school, but also used for swimming classes, fishery and guided tours) is within the Order Limits. Part of this land would be required temporarily for improvement works to an existing section of bridleway and part would be required permanently for the construction of a new section of bridleway.

2.3.34 The northern section of Rochester and Cobham Park Golf Club is within the Order Limits. Temporary possession of this land would be required for the improvement of an existing bridleway. Appendix D of the Planning Statement (Application Document 7.2) provides further information on impacts to Rochester and Cobham Park Golf Club.

Section 2: M2/A2/A122 Lower Thames Crossing junction

2.3.35 Section 2 comprises two components and would be located within the wards of Northfleet South; Shorne, Cobham and Luddesdown; Istead Rise; Painters Ash; Woodlands; Singlewell; Riverview; and Westcourt.

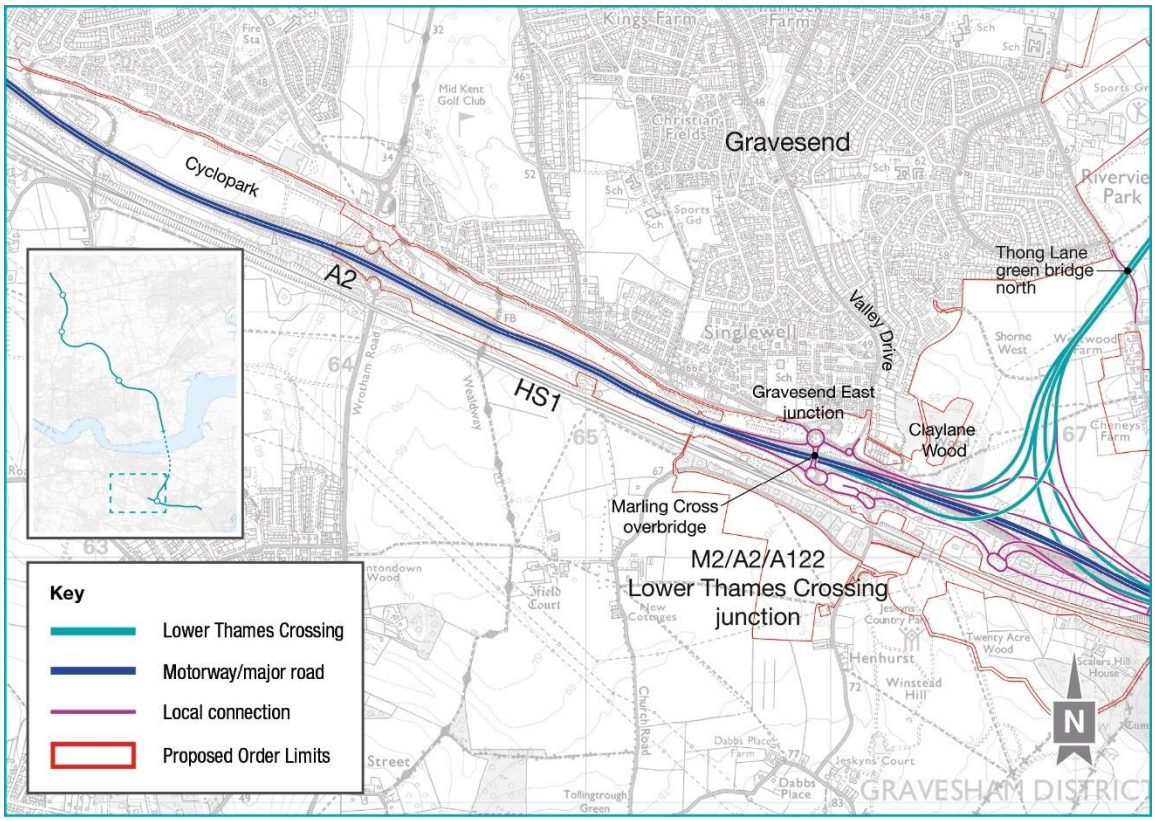
2.3.36 The first component would broadly follow the alignment of the existing A2 and would continue on from the works along the A2/M2 corridor (Section 1), directly west of the new Thong Lane green bridge south over the A2. This A2 component of Section 2 would end near the A227 junction, south of Gravesham. Four lanes would be retained each way (reducing to two lanes eastbound and three lanes westbound through the new M2/A2/A122 Lower Thames Crossing junction) along the A2.

2.3.37 The second component of Section 2 would divert northwards offline from the proposed junction, towards the River Thames. This offline component of Section 2 would end directly south of the new Thong Lane green bridge north over the A122, south of the Southern Valley Golf Course, where the M2/A2/A122 Lower Thames Crossing junction to Tunnel South Portal Section begins (Section 3).

2.3.38 A schematic layout of Section 2 is provided in Plate 2.2.

2.3.39 The construction of Section 2 would be managed as part of Construction Section A as described in Section 2.6 of this chapter.

Plate 2.2 Operational Section 2 schematic



Key work elements

2.3.40 The key components of works in Section 2 would be the continuation of the widening along the existing A2 and provision of a new junction immediately to the east of Claylane Wood. The new junction arrangement would provide a series of connections with the highway network at this location, including eastbound and westbound connections between the A122 and the existing A2 and M2. This can be seen on the General Arrangement drawings (Application Document 2.5). As the A122 heads northwards between Gravesend and Thong, it would descend into a cutting and pass under the proposed new Thong Lane green bridge north, which would be approximately 10.8m above the A122.

2.3.41 A new three-lane link road, approximately 1,685m in length, between the westbound carriageway of the improved A2 mainline (Work number 1A above) and the northbound carriageway of the A122 (Work number 3A below) would be constructed. A new two-lane link road, approximately 1,255m in length, between the eastbound carriageway of the improved A2 mainline and the southbound carriageway of the A122 would also be constructed (Work number 2A).

2.3.42 A new two-lane link road, approximately 1,365m in length, between the eastbound carriageway of the improved A2 mainline and the new A2 eastbound link road (Work number 1C above) would be constructed (Work number 2B), providing access to the A2 east of M2 junction 1, and to the A289.

2.3.43 A new single-lane A122 link road, approximately 915m in length, between the southbound carriageway of the A122 and the eastbound carriageway of the new A2 link road (Work number 1C above) would be constructed (Work number 2C), providing access to the A2 and the A289.

2.3.44 A new two-lane single carriageway link road, approximately 870m in length, between the new westbound A2 link road (Work number 1F above) and the westbound carriageway of the improved A2 mainline (Work number 2S below) would be constructed (Work number 2D). A new single-lane link road, approximately 325m in length, between the new westbound A2 link road (Work number 1F above) and the new Cobham roundabout (Work number 2U below) would also be constructed (Work number 2D).

2.3.45 The current A2/M2 connection would be maintained eastbound and westbound. Sections of the eastbound and westbound carriageway of the existing A2 would be improved, for approximately 1,800m and 2,310m in length respectively (Work number 2S).

2.3.46 Eastbound traffic from Valley Drive and Gravesend East junction would be able to connect directly onto the A2/M2 eastbound. Traffic from Valley Drive and Gravesend East junction would also be provided with a direct link onto the A122 northbound.

2.3.47 Other key design features of Section 2 would include the following as shown on the Works Plans (Application Document 2.6):

a. Provision of a new A2 underbridge (Structure Ref. BRN0000004), approximately 156m in length, to carry the new link road between the northbound carriageway of the improved M2 and the northbound carriageway of the A122, under both the eastbound and westbound carriageways of the improved A2 mainline and the new link road between the westbound carriageway of the improved A2 and the new Cobham roundabout (Work number 2A).

b. Provision of a new overbridge (Structure Ref. BRN0000003), approximately 193m in length, to carry the new link road between the eastbound carriageway of the improved A2 mainline and the new A2 eastbound link road over both the new link road between southbound carriageway of the A122 and the eastbound carriageway of the improved A2 mainline, and over the new Gravesend junction link road to the eastbound carriageway of the improved A2 mainline (Work number 2B).

c. Provision of a new overbridge (Structure Ref. BRN0000007), approximately 43m in length, to carry the new link road between the eastbound carriageway of the improved A2 mainline and the new A2 eastbound link road over the link road between the westbound carriageway of the improved A2 mainline and the northbound carriageway of the A122 (Work number 2B).

d. Construction of a new roundabout, Cobham roundabout, located to the south of the Project. A new section of single carriageway local road, approximately 590m in length, would be constructed between the Thong Lane green bridge south and the new Cobham roundabout (Work number 2U).

e. Provision of a new underbridge (Structure Ref. BRN0000005), approximately 86m in length, to carry the new link road between the westbound carriageway of the new A2 link road and the westbound carriageway of the improved A2 mainline under the new link road between the westbound carriageway of the improved A2 mainline and the new Cobham roundabout (Work number 2D).

f. Construction of a new roundabout, Henhurst roundabout, located to the south of the Project and the construction of three new local accesses. A new section of single carriageway local road, approximately 535m in length, would be constructed between the new Cobham roundabout and the new Henhurst roundabout (Work number 2E).

g. Provision of a new viaduct (Structure Ref. BRN0000020), approximately 96m in length and 10m AGL, to carry the new road between the new Cobham roundabout and the Henhurst roundabout over the existing High Speed 1 (HS1) infiltration pond (Work number 2E).

h. Construction of a new single-lane collector road, approximately 350m in length, between the westbound carriageway of the improved A2 mainline and the new Cobham roundabout (Work number 2T).

i. Modification of the existing Marling Cross overbridge (Structure Ref. BRE0025748) to carry the road between the Gravesend East junction south and the Gravesend East junction north over both carriageways of the improved A2 mainline. The eastern edge of the existing bridge deck would be removed prior to widening works to create the proposed wider bridge deck (Work number 2F).

j. Construction of an improved four-lane section of new road (two lanes in each direction), approximately 80m in length, between Gravesend East junction south and the Gravesend East junction north, including modification of the existing roundabout at the Gravesend East junction south of the improved A2 mainline; and modification of the roundabout at the Gravesend East junction north of the improved A2 mainline (Work number 2F).

k. Construction of a new single carriageway between the new link road (Work number 2W below) and the existing Valley Drive roundabout, approximately 280m in length (Work number 2F).

l. Construction of a new PRoW from the Gravesend East junction south to the Gravesend East junction north (Work number 2F).

m. Provision of a new viaduct (Structure Ref. BRN0000019), approximately 557m in length and 16.5m AGL, to carry the new link road between the southbound carriageway of the A122 and the westbound carriageway of the improved A2. The new 'Project road southbound to A2 westbound viaduct' would cross over the multiple link roads associated with both the A2 carriageways (both the new and the improved links) and the A122 carriageways at this location. The vertical profile of the link would provide a minimum headroom of 5.3m to the roads below. A maintenance access track alongside the Project would be provided to the new viaduct (Work number 2G).

n. Construction of a new two-lane A122 link road, approximately 1,460m in length, between the southbound carriageway of the A122 and the westbound carriageway of the improved A2 mainline (Work number 2G).

o. Construction of a new single-lane A122 link road, approximately 540m in length, between the eastbound carriageway of the improved A2 mainline and the northbound carriageway of the A122 (Work number 2H); and provision of a new viaduct (Structure Ref. BRN0000017), approximately 312m in length and 8m AGL, to carry the new link road between the existing Valley Drive roundabout and the A122 southbound link road. The new viaduct would cross over the multiple link roads associated with both the A2 carriageways (both the new and the improved links) and the A122 carriageways at this location. The viaduct would pass under the Project road southbound to the A2 westbound viaduct. The vertical profile of the link would provide a minimum headroom of 5.3m to the roads below. A maintenance access track alongside the Project would be provided to the new viaduct (Work number 2I).

p. Construction of a new single-lane link road approximately 1,000m in length, between the Gravesend East junction and the northbound carriageway of the A122 (Work number 2I). Together with the construction of a new single-lane link road approximately 1,100m in length, including the viaduct extent mentioned above, between the Gravesend East junction and the A122 southbound to A2 eastbound link road (Work number 2I).

q. Construction of a new single-lane link road (widened to three lanes approaching the roundabout) near the site of Cobham service station, approximately 420m in length, between the new link road between the southbound carriageway of the A122 and the westbound carriageway of the improved A2 mainline and the Gravesend East junction south (Work number 2W).

r. Construction of a new multi-lane carriageway local road, approximately 155m in length, between the new Henhurst roundabout and the modified Gravesend East junction south (Work number 2X); construction of a new single-lane link road, approximately 420m in length, between the Gravesend East junction south and the improved A2 mainline; and the construction of a new single carriageway link road, approximately 314m in length, between the Gravesend East junction north and the improved A2 mainline (Work number 2Y).

s. Improvement of the existing Hever Court Road west from Gravesend East junction north, for approximately 155m in length; and improvement of the existing Hever Court Road east, from Gravesend East junction north roundabout to Valley Drive roundabout, for approximately 140m in length. In addition, the improvement of the existing Valley Drive from Valley Drive roundabout, for approximately 70m in length (Work number 2Z).

t. Construction of a gravity highway drainage network incorporating an existing infiltration basin (Pond Ref. EXPOS02-005). The basin is located to the south of the M2/A2/A122 Lower Thames Crossing junction directly east of Cobham petrol filling station and would be reconfigured as a vegetated drainage system with a vortex grit separator (pollution control device). A private means of access would be constructed for the basin from the new link road between the existing Halfpence Lane roundabout and the new Cobham roundabout (Work number 2J).

u. Construction of a gravity highway drainage network incorporating a new infiltration basin (Pond Ref. POS02-004). The basin would be located within the M2/A2/A122 Lower Thames Crossing junction and be constructed as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the basin from the new link road between the eastbound carriageway of the improved A2 mainline and the new A2 eastbound link road (Work number 2K).

v. Construction of a gravity highway drainage network incorporating a new infiltration basin (Pond Ref. POS02-001). The basin would be located to the south of the improved A2 mainline, north of Henhurst Road and be constructed as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the basin from the new Henhurst roundabout (Work number 2L).

w. Construction of a gravity highway drainage network incorporating an existing infiltration basin (Pond Ref. EXPOS02-001). The basin is be located to the north of the A2, and would be reconfigured as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the basin from the modified Gravesend East junction north.(Work number 2M).

x. Construction of a gravity highway drainage network incorporating a new infiltration basin (Pond Ref. POS02-002). The basin would be located to west of the M2/A2/A122 Lower Thames Crossing junction and be constructed as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the basin from the new link road between the Gravesend East junction and the northbound carriageway of the A122 (Work number 2N).

y. Construction of a new PRoW connecting Thong Lane green bridge south over the improved A2 mainline, to Thong Lane green bridge north over the A122 (Work number 2O).

z. Construction of a new section of the PRoW from Jeskyns Community Woodland to Church Road, and improvement works to a section of the existing PRoW from Church Road to the existing PRoW footpath NS175 (Work number 2P).

aa. Construction of a new PRoW from the new M2/A2/A122 Lower Thames Crossing junction to the new Thong Lane green bridge north; together with improvements to a section of the existing PRoW footpath NS169 and the construction of a new PRoW from Valley Drive to the existing PRoW footpath NS174 (Work number 2Q).

bb. Construction of a new PRoW from the existing footpath NS174, to the north-west of the new M2/A2/A122 Lower Thames Crossing junction, towards the new Thong Lane green bridge north, from Claylane Wood (Work number 2R).

cc. Construction of a section of a new PRoW from the Thong Lane green bridge south to the Henhurst roundabout (Work number 2V).

dd. Construction of a new PRoW from Hever Court Road to Valley Drive (Work number 2Z).

2.3.48 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

Utilities works

2.3.49 Permanent diversions of the utility networks would be required within Section 2 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. The permanent diversion of 495m horizontally within a length of approximately 1.8km of modified National Grid Electricity Transmission (NGET) 400kV overhead power line network (Work number OH1) including the construction of four new pylons and restringing of approximately 3km of overhead power line. The works also include the removal of four existing pylons. These diversion works extend into Section 3.

b. Removal of approximately 2.8km of an existing UKPN 33kV overhead power line and associated poles (Work number OH2). These works extend into Section 3 and Section 4.

c. National Grid (NG) high-pressure gas pipelines (Work numbers G2 to G4). The approximate lengths of the diversions are 0.12km (Work number G2), 1.6km (Work number G3) and 2.7km (Work number G4). These three gas pipeline works are considered likely to have a significant effect on the environment for the purposes of section 20(3) of the Planning Act 2008 and are therefore considered NSIPs. Further information is available in Appendix 1.3: Assessment of proposed gas pipeline works for the purposes of section 20 of the Planning Act 2008 (Application Document 6.3). Work numbers G3 and G4 extend into Section 3.

d. Diversion of approximately 5.4km length of Southern Gas Network medium-pressure gas pipeline (Work number G1a approximate length of 2.4km and Work number G1b approximate length of 3km) and associated assets. These diversion works extend into Section 1.

e. Installation of approximately 8.6km of new permanent power supplies for the South Portal (Work numbers MU15 and MU17). MU17 extends into Section 3.

f. Multi-utility corridors including UKPN electricity networks, Southern Water foul sewers and water mains, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU9 (continuing from Section 1) and MU13 to MU17). This includes the installation of three electrical substations east of Henhurst Road (SS4, SS5 and SS6). MU17 continues into Section 3.

Special category land

2.3.50 As outlined for Section 1, where the proposed Project road and its construction results in permanent impacts on common land and open space sites, the Applicant would provide replacement open space and common land parcels within the Order Limits in accordance with the requirements of sections 131 and 132 of the Planning Act 2008. For Section 2 this also includes replacement land in response to the permanent acquisition of land and rights over the designated open space land at Shorne Woods Country Park, immediately to the north of the A2 with access off Brewers Road, as described above for Section 1.

2.3.51 There are also six other public open spaces in Section 2: Ashenbank Wood; Jeskyns Community Woodland; Claylane Wood; open space at Roman Road; Cyclopark; and Michael Gardens Play Area.

2.3.52 To the south of the A2, the Project would create a temporary permissive path through Ashenbank Wood to divert WCH traffic during construction, with the temporary surfacing material to be removed once construction has finished. There would be no acquisition of land or rights over land, so the Project would not provide any replacement land.

2.3.53 The Project would create a temporary permissive path through Jeskyns Community Woodland to divert WCH traffic during construction. There would be no acquisition of land or rights over land related to this temporary permissive path, so the Project would not provide any replacement land.

2.3.54 The Project would upgrade the existing utilities at Jeskyns Community Woodland and translocate protected species. The Project proposes to acquire rights over land to enable these works, but the Project would not provide any replacement land as the relevant land would be no less advantageous than before.

2.3.55 The Project proposes to acquire land and rights over land at Claylane Wood to enable the construction of new roads and associated utilities diversion. The Project would provide replacement land to the north of Claylane Wood (Work numbers OSC2 and OSC3). The Project proposes to treat Claylane Wood as a public open space on a precautionary basis in the event that the Secretary of State considers it to be a public open space. Appendix D of the Planning Statement (Application Document 7.2) provides further information.

2.3.56 The Project proposes to acquire land and rights over open space land at Roman Road open space. This is for the enlargement of the existing infiltration basin and diversion of underground utilities. The Project would not provide any replacement land as the drainage requirement is exempted from replacement and the subject land would be no less advantageous than before.

2.3.57 The Project proposes to acquire rights over land at Cyclopark to enable the diversion of underground utilities. The Project would not provide any replacement land as the subject land would be no less advantageous than before.

2.3.58 The Project would resurface an existing path at Michael Gardens Play Area, to the west of the A122. There would be no acquisition of land or rights over land, so the Project would not provide any replacement land.

Private recreational facilities

2.3.59 There are no private recreational facilities affected in Section 2.

Section 3: M2/A2/A122 Lower Thames Crossing junction to Tunnel South Portal

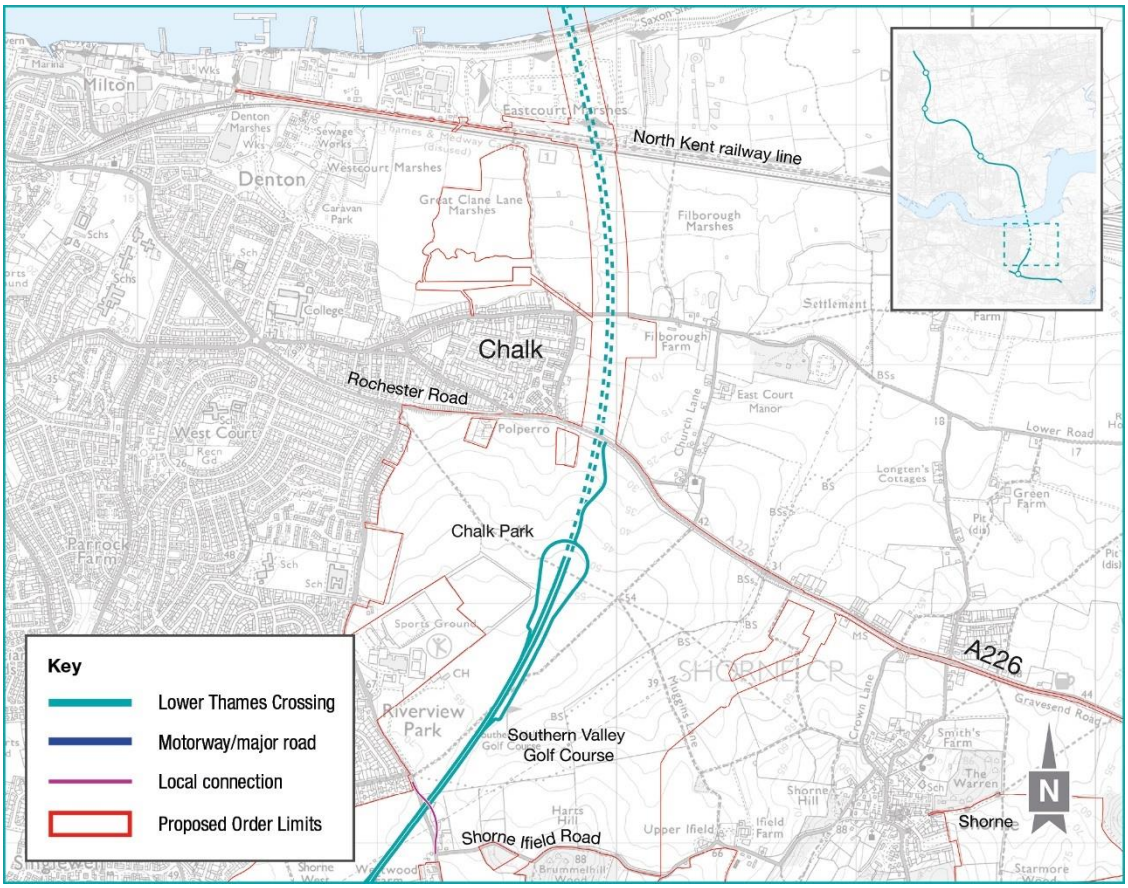
2.3.60 The Project road through Section 3 would be approximately 2km in length and would serve as the southern entry/exit to the A122 Lower Thames Crossing Tunnel. Section 3 would be located within the wards of Shorne, Cobham and Luddesdown; Riverview; and Westcourt. Section 3 would start directly south of the new Thong Lane green bridge north over the A122 (where Section 2 ends) and would continue north towards and beyond the start of the proposed tunnel.

2.3.61 At this location, Sections 3 and 4 overlap for a short distance with Section 3 works continuing above ground until Rochester Road and the Section 4 works starting south of this where the underground works begin for the A122 Lower Thames Crossing Tunnel Section.

2.3.62 A schematic layout of Section 3 is provided in Plate 2.3.

2.3.63 The construction of Section 3 would be managed as part of Construction Section A as described in Section 2.6 of this chapter.

Plate 2.3 Operational Section 3 schematic



Key work elements

2.3.64 The key components of works in Section 3 would be the continuation of the A122 within a cutting leading to a cut and cover section, and the provision of a Tunnel Service Building (TSB). This can be seen on the General Arrangement drawings (Application Document 2.5).

2.3.65 The cutting would extend across the site of the Southern Valley Golf Course to a maximum depth of 28m below the existing ground level, before descending into the tunnel portal approximately 500m south of the A226.

2.3.66 At the South Portal and tunnel approach, there would be a cut and cover section of tunnel, cross-passages, a TSB and an emergency area. A new three-lane dual carriageway (all purpose trunk road), approximately 130m in length, and an anti-recirculation wall between the southbound and northbound carriageways of the A122 would also be constructed at this location (Work Number 3C). The TSB would be located above the cut and cover section of the tunnel to accommodate the mechanical and electrical equipment and plant required to support safe operation of the road tunnel, local tunnel control facilities (for use during maintenance activities, emergency incident response or communications failures with Regional Operations Centre) and welfare facilities for tunnel operational staff and incident responders. TSBs are discussed in Section 2.4 of this chapter. The construction of the A122 in Section 3 would include the construction of a new three-lane dual carriageway, approximately 1,420m in length (Work number 3A).

2.3.67 The cut and cover section of the tunnel, which is similar to that also provided as part of the Tunnel North Portal Section, has at either end a short open ramp section. The tunnel portal is where the traffic enters/exits the tunnel which is at the interface with the approach ramp.

2.3.68 The central reservation along the A122 would be widened as the Project road approaches the tunnel portal to align with the tunnel separation. A crossover between the carriageways would be provided on the tunnel approach, to allow for management of traffic in the event of closure.

2.3.69 An access road would also be constructed around the South Portal to link the southbound carriageway of the A122, to the northbound carriageway of the A122. This would form a South Portal emergency loop road, which passes over the tunnel to the north of the tunnel portal (Work number 3G). A new private means of emergency and maintenance access from the South Portal emergency loop road from the existing A226 (Work number 3G) for the A122 Lower Thames Crossing tunnel would also be constructed. These roads would provide access for emergency services and maintenance vehicles only.

2.3.70 The South Portal would comprise a bowl-shaped excavation and a concrete headwall that would function as a reception point for the tunnel boring machinery during construction. A rock trap and fence would be required at the back of the verge along the main cutting and around the portal area to protect the road from debris that may fall out of the cutting from time to time due 333to weathering.

2.3.71 Other key design features of Section 3 would include the following as shown on the Works Plans (Application Document 2.6):

a. Construction and installation of new gantries and new charging infrastructure (Work number 3A).

b. Provision of a new green bridge (Structure Ref. BRN0000014), approximately 35m north of the existing Thong Lane, to carry the realigned Thong Lane over the southbound and northbound carriageways of the A122. The new Thong Lane green bridge north over the A122 would be approximately 60m in length, 86m in width and 2m AGL with a minimum clearance of 5.3m above the A122 carriageway. Improvement works would be undertaken to a section of the existing Thong Lane, approximately 330m in length, and a new PRoW along the southern verge of the new Thong Lane green bridge north would be provided, together with the construction of a new PRoW between the northern verge of the Thong Lane green bridge north and the new PRoW described in Work number 2Q (Work Number 3B).

c. Construction of a gravity highway drainage network incorporating a new cascading infiltration basin (Pond Ref. POS02-003). The basin would be located to the south east of the South Portal. It would comprise three compartments and a lined sediment forebay, and would be constructed as a vegetated drainage system. A private means of access would be constructed for the basin from the realigned Thong Lane (Work number 3D).

d. Construction of a highway drainage network incorporating a new cascading infiltration basin (Pond Ref. POS04-001). Collected runoff would gravitate to the basin where possible. At the base of the ramp down to the South Portal, where a gravity connection is not possible, a pumping station will be constructed to pump flows to the basin. The basin would be located to the south-east of the South Portal. It would comprise two compartments and a lined sediment forebay, and would be constructed as a vegetated drainage system. A private means of access would be constructed for the basin from the existing A226. The pumping station would be located close to the South Portal (Work number 3E).

e. Construction of a new rendezvous point for the South Portal (Work number 3F).

f. Construction of a new PRoW along the northern verge of the Thong Lane green bridge north over the A122, to the existing footpath NG7 on the west of the South Portal (Work number 3H). A further new PRoW would also be constructed from the existing Thong Lane to this new PRoW (Work number 3L), together with a new PRoW between these two new PRoWs (Work number 3K).

g. Construction of a new PRoW from the Thong Lane green bridge north over the A122, to Shorne Ifield Road, together with the construction of a new PRoW from Shorne Ifield Road to the new private means of access for the new infiltration basin directly north of Shorne Ifield Road (Work number 3I).

h. Construction of a PRoW (Work number 3J) between the new private means of access from the new drainage structure (Work number 3D above), to the existing A226, along the new infiltration basin (Work number 3E above). A new PRoW along the verge of the existing A226 would also be constructed (Work number 3J).

i. Construction of a new PRoW (Work number 3M) between the existing Thong Lane and Work number 3L above.

j. Construction of a new PRoW (Work number 3N), to include the upgrade of a section of the existing footpath NG7 from Work number 3L above and Thong Lane at its junction with the existing A226, north-west of the South Portal.

k. Construction of a new PRoW between the new PRoW from Thong Lane green bridge north over the A122 to NG7 (Work number 3H above) and the existing A226, directly north of the South Portal (Work number 3O).

l. Construction of a PRoW (Work number 3P), to include the upgrade of a section of existing footpath NG8 between the new PRoW from Thong Lane green bridge north over the A122 to NG7 (Work number 3H above) and the A226, north-east of the South Portal.

m. Construction of new landforms for public use and associated landscaping referred to as Chalk Park (Work number OSC4) to the east of Gravesend, around the South Portal. This new landscaped recreational area would cover approximately 45 ha and include areas of woodland and species-rich grassland planting typical of the local area. The proposed Chalk Park would feature a distinctive new wooded hilltop landform (13m to 17m above existing ground level based on the application of the LOD) between the South Portal and the edge of Gravesend and Chalk.

2.3.72 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

Utilities works

2.3.73 Permanent diversions of the utility networks would be required within Section 3 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. The permanent diversion of 495m horizontally within a length of approximately 1.8km of modified National Grid Electricity Transmission (NGET) 400kV overhead power line network (Work number OH1) including the construction of four new pylons and restringing of approximately 3km of overhead power line. The works also include the removal of four existing pylons. These diversion works extend into Section 2.

b. Removal of approximately 2.8km of an existing UKPN 33kV overhead power line and associated poles (Work number OH2). These works extend into Section 2 and Section 4.

c. National Grid (NG) high-pressure gas pipelines (Work numbers G3 and G4). The approximate lengths of the diversions are 1.6km (Work number G3) and 2.7km (Work number G4). These gas pipeline works are considered likely to have a significant effect on the environment for the purposes of section 20(3) of the Planning Act 2008 and are therefore considered NSIPs. Further information is available in Appendix 1.3: Assessment of proposed gas pipeline works for the purposes of section 20 of the Planning Act 2008 (Application Document 6.3). Work numbers G3 and G4 extend into Section 2, and G4 into Section 4.

d. Installation of approximately 8.6km of new permanent power supplies for the South Portal (Work numbers MU17 and MU19). MU17 extends into Section 2, and MU19 into Section 4.

e. Multi-utility corridors including UKPN electricity networks, Southern Water foul sewers and water mains, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU18).

Special category land

2.3.74 No special category land would be affected in Section 3 and no replacement land is proposed.

Private recreational facilities

2.3.75 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.76 For Section 3, the Project would permanently acquire the entirety of Southern Valley Golf Club for the new road, earthworks, and the creation of a new area of open space at Chalk Park. The Project is not proposing to replace the golf club. Instead, it proposes to create a new parkland area (Chalk Park) on part of the site that would be open to the public after construction.

2.3.77 The Project would also permanently acquire the nine-hole par 3 golf course, 32 bay driving range and shop at Gravesend Golf Centre. This is to create the working area for the South Portal, for the landscaping associated with the South Portal once constructed, and the creation of Chalk Park following construction. The Project would provide a replacement golf facility to the south of the adjacent Cascades Leisure Centre. However, the Project recognises that there are broader proposals for the redevelopment of the Cascades Leisure Centre and that Gravesham Borough Council which owns the site has been exploring the feasibility of alternative locations for the relocated golf facility in order to maximise the future potential of the site. The Project is engaging with Gravesham Borough Council in this regard, and is willing to support it in relation to any feasibility work. If an alternative location for the relocated golf facility were identified and progressed as a result, it would be delivered separately to the Project.

Section 4: A122 Lower Thames Crossing Tunnel

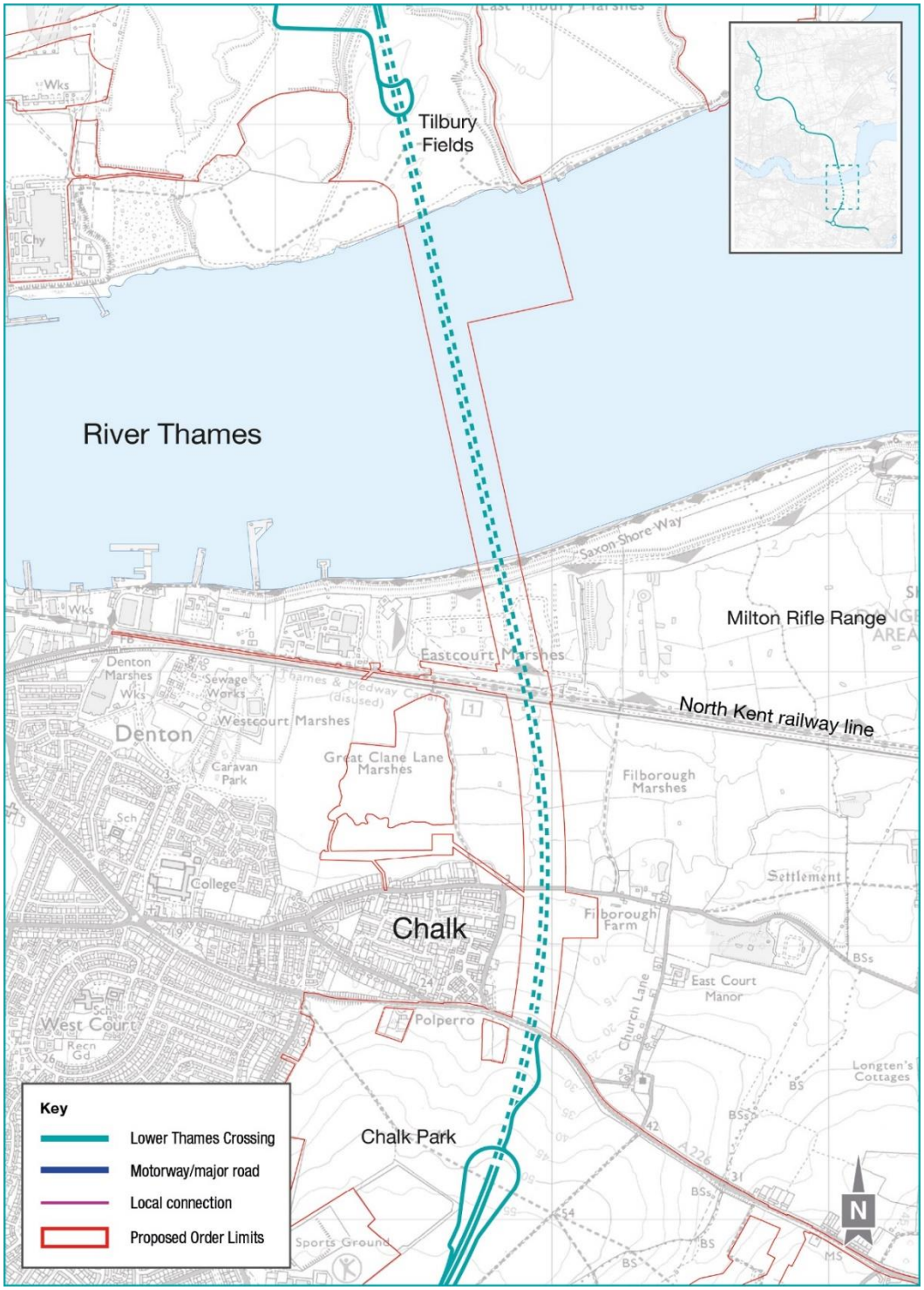
2.3.78 The Project road through the A122 Lower Thames Crossing Tunnel Section would be approximately 4.25km in length and would pass underneath the River Thames connecting the South and North Portals. Section 4 would be located within the wards of Westcourt; Chalk; Riverside; East Tilbury; and Tilbury Riverside and Thurrock Park. Section 4 would continue from the M2/A2/A122 Lower Thames Crossing junction to Tunnel South Portal Section (Section 3) and end at the start of the North Portal to northern end of Tilbury Viaduct Section (Section 5).

2.3.79 As outlined above, Section 4 would start where the underground works for the tunnel begin, approximately 500m south of the A226, to the south-east of the village of Chalk on the south of the River Thames. It would then pass under the River Thames and continue north to the end of the underground work extents approximately 675m to the north of the River Thames, south-east of Tilbury. The tunnel would pass under the North Kent railway line, Thames and Medway Canal, the Thames Estuary and Marshes Ramsar site, South Thames Estuary and Marshes SSSI, and the Milton Rifle Range. Section 4 would overlap for a short distance with both Section 3 and Section 5, with Section 4 comprising the underground works and Sections 3 and 5 comprising the above ground works through these areas of overlap.

2.3.80 A schematic layout of Section 4 is provided in Plate 2.4.

2.3.81 The construction of Section 4 would be managed as part of Construction Section B as described in Section 2.6 of this chapter.

Plate 2.4 Operational Section 4 schematic



Key work elements

2.3.82 The key component of work in Section 4 would be the construction of the twin tunnel bores (Work number 4A), approximately 3.9km in length, one for northbound traffic and one for southbound traffic. A three-lane dual carriageway in each direction would be provided between the tunnel portals. Cross-passages connecting the two bores would be constructed and associated tunnelling works would be undertaken (Work number 4A).

2.3.83 A new ground protection tunnel and access shafts would be constructed, to facilitate ground treatment works above the A122 Lower Thames Crossing tunnel under the Ramsar site (Work number 4B).

2.3.84 The tunnel portals to the north and south are described under the headings for Operational Sections 3 and 5. This can be seen on the General Arrangement drawings (Application Document 2.5).

2.3.85 The tunnel itself would be approximately 4.25km in length in total, approximately 372m of which would be cut and cover. The internal diameter would be approximately 15m, while the external diameter of each tunnel bore would be approximately 16.5m. It is anticipated that the top of the tunnel would be approximately 18m below the riverbed of the River Thames. The twin bores would be horizontally spaced at between 0.5 and 1 times the tunnel diameter, as reflected in the LOD for tunnels.

2.3.86 From south to north, there would be a maximum approach gradient of 4% into the tunnel as far as its crossing under Lower Higham Road, at which point it would reduce to up to 1.6%. This gradient would continue to approximately the centre of the river where the road level would be around 30m below the riverbed. From the centre of the tunnel continuing north, there would be a maximum gradient of 3% as the tunnel rises northwards towards ground level.

2.3.87 The tunnel would contain mechanical and electrical, operational and safety systems. Further information regarding the tunnel design in relation to drainage, lighting, ventilation and emergency arrangements during operation is provided in Section 2.4 of this chapter.

2.3.88 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

Utilities works

2.3.89 Permanent diversions of the utility networks would be required within Section 4 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. Diversion of 2.68km in length of NG high-pressure gas pipeline (Work number G4), which is one of the three gas pipeline works that are considered likely to have a significant effect on the environment for the purposes of section 20(3) of the Planning Act 2008 and are therefore considered NSIPs. Further information is available in Appendix 1.3: Assessment of proposed gas pipeline works for the purposes of section 20 of the Planning Act 2008 (Application Document 6.3). Work number G4 extends into Section 2 and Section 3.

b. Removal of approximately 2.8km of an existing UKPN 33kV overhead power line and associated poles (Work number OH2). These works extend into Section 2 and Section 3.

c. Installation of utilities supplies for the South Portal and tunnel including installation of approximately 8.6km of new power supplies (Work numbers MU19 (extending into Section 3) and MU20), including the installation of a new primary substation and switchgear equipment adjacent to the A226 (Work number MU21).

d. Multi-utility corridors including UKPN electricity networks, Southern Water foul sewers and water mains, Openreach and other utility companies' strategic telecommunication cable routes, to divert assets affected by potential ground settlement resulting from the construction of the tunnel and access to the South Portal (Work numbers MU22 to MU26).

Special category land

2.3.90 No special category land would be affected in Section 4 and no replacement land is proposed.

Private recreational facilities

2.3.91 There are no private recreational facilities affected in Section 4.

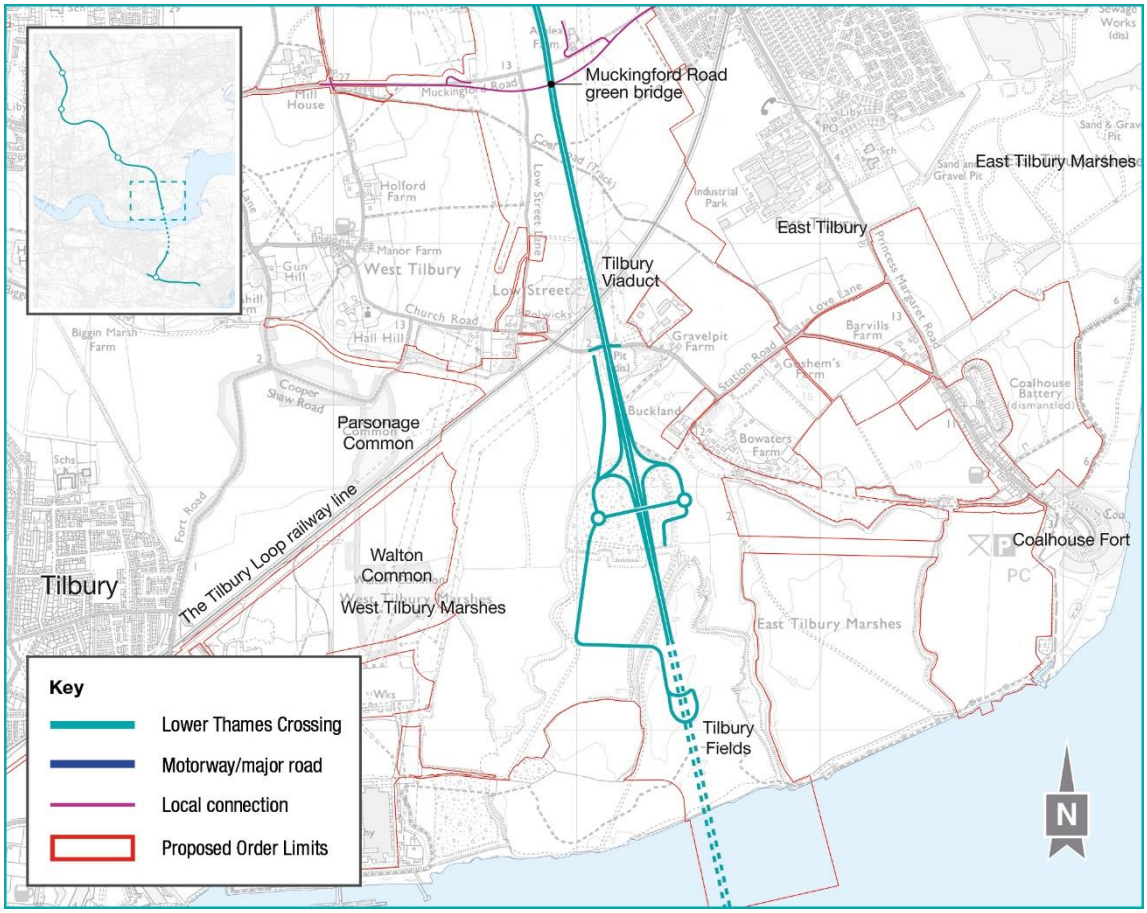
Section 5: North Portal to northern end of Tilbury Viaduct

2.3.92 The Project road through Section 5 would serve as the northern entry/exit to the A122 Lower Thames Crossing Tunnel. Section 5 would be located within the wards of Tilbury Riverside and Thurrock Park; and East Tilbury. Section 5 would start directly north of the River Thames, to the south-east of Tilbury, and would continue north over the Tilbury Loop railway line. Section 5 would finish at the northern end of the new Tilbury Viaduct, south of Muckingford Road, at the point where the Chadwell St Mary link Section (Section 6) starts, between East and West Tilbury. As outlined above, in the south of Section 5 there would be an overlap with the extents of Section 4 which would continue underground for approximately 675m north of the River Thames, overlapping with the above ground Section 5 works at this location.

2.3.93 A schematic layout of Section 5 is provided in Plate 2.5.

2.3.94 The construction of Section 5 would be managed as part of Construction Section C as described in Section 2.6 of this chapter.

Plate 2.5 Operational Section 5 schematic



Key work elements

2.3.95 The key components of works in Section 5 would be the continuation of the A122 from the northern side of the tunnel onto the Tilbury Viaduct, a cut and cover section of tunnel, the provision of a tunnel maintenance access and the construction of a new area of open space for Tilbury Fields. This can be seen on the General Arrangement drawings (Application Document 2.5).

2.3.96 The tunnel would rise to the north of the River Thames. The bored tunnel would end at a headwall and at this point the road would be at a depth of approximately 22m below ground level. The A122 would then continue through a short section of cut and cover up to 300m in length before exiting into an open retained structure open cutting.

2.3.97 At the North Portal and tunnel approach, there would be an approach ramp, retaining structures and associated works for the A122; construction of a cut and cover section of tunnel, cross-passages, a TSB, flood protection for the tunnel, a drainage outfall from the North Portal to the River Thames; and an emergency area. A new three-lane dual carriageway, approximately 740m in length, and an anti-recirculation wall between the southbound and northbound carriageways of the A122 would also be constructed at this location (Work number 5A). A TSB would be located outside of the tunnel, above the cut and cover section of tunnel, to accommodate the mechanical and electrical plant, drainage pumps and maintenance operations. TSBs are discussed in Section 2.4 of this chapter.

2.3.98 Due to the ground conditions at the North Portal location, a concrete box structure would be required both to provide the launch point for the tunnel boring machinery during construction and to support the approach road during operation. This is further discussed in Sections 2.6 and 2.7 of this chapter.

2.3.99 The TSB buildings sit above the reinforced concrete, below ground level cut and cover structure. The above ground TSB would be single storey, utilising some of the below-ground space of the cut and cover for services. The ramp structures are concrete retaining walls that blend into the surrounding formed land levels with earth embankments.

2.3.100 From the cut and cover section, the A122 would become elevated, rising on an embankment to Tilbury Viaduct. A tunnel operational maintenance access, north of the tunnel entrance and south of the Tilbury Loop railway line, would provide operational access for emergency service and maintenance vehicles to the tunnel and A122.

2.3.101 Two new private means of access roundabouts would be constructed on the eastern and western side of the A122, and a North Portal operational access bridge carrying a new private means of access road would be built to allow National Highways' operational vehicles and emergency service vehicles to cross over the A122 at this location, between the two roundabouts (Work number 5E). This access arrangement would also provide sufficient flexibility for emergency services to turn vehicles around in the event of an incident further north or south on the A122. A new private means of access from the new eastern roundabout would be constructed. There would be no access for public traffic on or off the A122 at this location.

2.3.102 A new private means of access would also be constructed, to provide a turnaround facility and emergency and maintenance access from the new operational maintenance access (Work number 5E above) to the North Portal and for access to the TSB (Work number 5D).

2.3.103 A new three-lane dual carriageway, approximately 1.4km in length, would be constructed northwards through Section 5 (Work number 5B).

2.3.104 A new private means of access road would be constructed between the northbound carriageway of the A122 at this location, and the new operational access, through the western roundabout (Work number 5E above), together with a new private means of access road between the southbound carriageway of the A122 and the new operational access (Work number 5F).

2.3.105 A new 'Tilbury Viaduct' (Structure Ref. BRN0000025), approximately 660m in length, would be constructed to carry the A122 over Tilbury Loop railway line, at a maximum height of 13.8m AGL. The new viaduct would also cross the existing Station Road and Coal Road (Work number 5C). The vertical profile of the viaduct has been designed to ensure appropriate headroom above Station Road, the railway line and over the permanent Coal Road diversion. The viaduct has been designed at the lowest practicable height to reduce its visual impact on the surrounding area. A maintenance access track alongside the Project would be provided to the new viaduct (Work number 5V). This can be seen on the General Arrangement drawings (Application Document 2.5). Station Road would remain at its existing location and level, with the A122 passing overhead on the Tilbury Viaduct. The headroom provided over the

Tilbury Loop railway line would require alteration to the railway overhead electric equipment, which would require restringing underneath the viaduct.

2.3.106 Other key design features of Section 5 would include the following as shown on the Works Plans (Application Document 2.6):

a. Construction of new landforms for public use and associated landscaping, to include the environmental mitigation and the landscape for Tilbury Fields (Work number OSC5). Sculptural landscaping mounding is proposed at Tilbury Fields, which will range from 13m to 17m above existing ground level (based on the application of LOD) to the south and east of the North Portal. It is proposed that the largest mound, at the south-east corner of Tilbury Fields, would feature a star-shaped area 22m to 24m above ordnance datum, which would act as a focal and destination point.

b. Construction of two new private means of access roads between the northbound and southbound carriageway of the A122, and the new operational access. A new private means of access between the operational access and the existing Station Road would also be constructed (Work number 5F).

c. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS08-003). The pond would be located to the north west of the North Portal, adjacent to the operational access road, and discharge to West Tilbury Main via the gravity outfall. The pond would be constructed as a vegetated drainage system with a vortex grit separator, and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. A private means of access would be constructed for the pond from the new North Portal emergency and maintenance access road (Work number 5G).

d. Construction of a gravity highway drainage network incorporating a new attenuation pond, a gravity outfall (Pond Ref. POS08-001). Collected runoff would gravitate to the pond where possible. At the base of the ramp down to the North Portal, where a gravity connection is not possible, a pumping station will be constructed to pump flows to the pond. The pond would be located to the west of the Project road, within the footprint of the new operational access road and discharge to West Tilbury Main via the gravity outfall. The pond would be constructed as a vegetated drainage system with a lined sediment forebay, and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. The pumping station would be located near the North portal. A private means of access would be constructed for the pond from the new operational access (Work number 5H).

e. Construction of a gravity highway drainage network incorporating a new retention pond and a gravity outfall (Pond Ref. POS08-002). The pond

would be located to the east of the Project road, within the footprint of the new operational access road, and discharge to POS08-001 via the gravity outfall. The pond would be constructed as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the pond from the new operational access (Work number 5I).

f. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS09-001). The basin would be located at the junction between the operational access road and Station Road, and discharge to West Tilbury Main via the gravity outfall. The pond would be constructed as a vegetated drainage system (with a vortex grit separator (pollution control device), and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. A private means of access would be constructed for the basin from the new link road from the operational access roads to the south (Work number 5J).

g. The modification of an existing irrigation reservoir, located north of the Tilbury Loop railway line, both east and west of the Project. This would include the diversion and modification of irrigation infrastructure, including the provision of a new groundwater abstraction well (Work number 5K). A new private means of access for maintenance access to the new irrigation reservoir would also be constructed (Work Number 5V).

h. Realignment of the West Tilbury Main, via a new culvert under the A122, as it emerges from the North Portal (Work number 5L).

i. Diversion to West Tilbury Main over a stretch of approximately 20m to the east of the Project road (Ref. D-EFR-2-02) and diversion to West Tilbury Main over a stretch of approximately 100m upstream of the culvert under the Project road (Ref. D-EFR-2-03) (Work number 5L).

j. Diversion an unnamed ordinary watercourse over a stretch of approximately 378m running west to east across the Project road, including 11m via a new culvert were it would cross the operational access road; this watercourse would pass under Tilbury Viaduct (Ref. D-EFR-2-2-04) (Work number 5M).

k. Diversion of existing ordinary watercourse via a new culvert under the new link road between Station Road and the operational access road (Work number 5N).

l. Construction a new PRoW along the existing footpath FP146 (Work number 5O).

m. Construction of a new PRoW across the new Tilbury Fields public space (Work number 5P).

n. Construction of a new PRoW and new permissive paths across the new Tilbury Fields public space (Work number 5Q).

o. Construction of a new PRoW, including along the eastern section of FP200, between Coalhouse Fort and FP200, and between the improved section of FP200 and Station Road (Work number 5R).

p. Construction of new permissive paths, including between Princess Margaret Road and the new PRoW described in Work number 5R above, adjacent to the East Tilbury Battery, and between the existing footpath FP147 and Princess Margaret Road (Work number 5S).

q. Construction of a new PRoW along the verge of the existing Station Road (Work number 5T).

r. Construction of a new PRoW as replacement for the existing FP200 at this location (Work number 5U).

s. Diversion of the existing PRoW BR58 Coal Road underneath the new Tilbury Viaduct (Work number 5V).

t. Construction of a new PRoW between the PRoW described in Work number 5V above and footpath FP61 (Work number 5W).

u. Construction of a new water inlet with self-regulating valve (Work number 5X).

v. Provision of a flow retention type compensatory flood storage area (CFSA). This CFSA would be located under Tilbury Viaduct and would extend eastward and westward across the footprint of the Project road (Ref. Tilbury-CFSA-1). It would intercept flows from upstream catchments before they reach the floodplain. The flow entering the CFSA would cascade downstream through four compartments. At the downstream end of the CFSA, retained flows would be discharged to West Tilbury Main at a controlled rate (Work number FCA1).

2.3.107 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

Utilities works

2.3.108 Permanent diversions of the utility networks would be required within Section 5 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. Undergrounding of approximately 2.2km of UKPN existing 132kv overhead powerline network (Work number OH3) via the installation of a 2.37km underground cable (Work number MU28). The works include removal of eight existing pylons, the modification of an existing pylon and the

demolition of another existing pylon to be replaced via the construction of a new terminal pylon in the same location north of Muckingford Road. A temporary diversion of 0.6km length and requiring the construction of a temporary pylon is required (Work No OHT3) to maintain network continuity during the works. These works extend into Section 6.

b. The permanent diversion of 890m horizontally within a length of approximately 2km of NGET 400kv overhead powerline network (Work number OH4) including the construction of five new pylons and restringing of approximately 3.6km of overhead powerline network. The work also involves the removal of three existing pylons. These works continue to Section 6.

c. Permanent provision of utilities to the North Portal, including approximately 6.6km of new electricity supply and 2.9km of water pipeline (Work number MU27 and MU29) and reconfiguration of existing local utility networks within multi-utility corridors including UKPN electricity networks, Anglian Water foul sewers, Essex and Suffolk Water water mains, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU28, MU30 to MU33). This includes the installation of a new substation north-east of the reservoir (SS7).

d. Diversion of the proposed Thurrock Flexible Generation Plant high pressure gas pipeline for a length of approximately 0.3km to run perpendicular to the route of the A122 between the Tilbury Viaduct abutment and the subsequent viaduct, avoiding conflict between the proposals for the two projects (Work number TFGP1).

Special category land

2.3.109 As outlined for Section 1, where the proposed Project road and its construction results in permanent impacts on common land and open space sites, the Applicant would provide replacement open space and common land parcels within the Order Limits in accordance with the requirements of sections 131 and 132 of the Planning Act 2008. For Section 5, this includes replacement land in response to the permanent acquisition of common land at Tilbury Green, east of the Project (Work number OSC5). Tilbury Green, while registered as common land, partly comprises a footpath (FP200) (rather than a 'green' as the name suggests). An alternative route for FP200 is proposed that links the new open space at Tilbury Fields to the network of footpaths in the area, providing improved access to the riverfront. The replacement land would be designated as common land so that they allow the public to enjoy the same rights as the affected parts of the existing FP200.

2.3.110 The footpath would be upgraded to a bridleway so it can also be used by horse riders as well as pedestrians. The replacement land comprises approximately 12,800m^2 (compared with approximately 12,500m^2 which is proposed to be acquired, or be subject to rights).

2.3.111 In addition, acquisition of rights over the common land at Walton Common, west of the Project, would be required for utilities diversion. No replacement land is proposed in this regard as the subject land would be no less advantageous than before.

Private recreational facilities

2.3.112 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.113 For Section 5, a small southern corner of Condovers Scout Activity Centre would be within the Order Limits and is needed temporarily to install a water connection. The works would not adversely affect the existing use of the activity centre.

2.3.114 The Project would reshape the Low Street Lane Reservoir (crop irrigation reservoir, but also used by farm staff, friends and family for fishing) to align it with supports for the viaduct above to ensure the landowner has the same volume of water available for irrigation (and fishing).

2.3.115 The entirety of Thames View Camping site is within the Order Limits for permanent acquisition to create an area of environmental mitigation (open mosaic habitat) to provide habitat for reptiles and terrestrial invertebrates displaced by the Project. The Project is not proposing to replace the camping site.

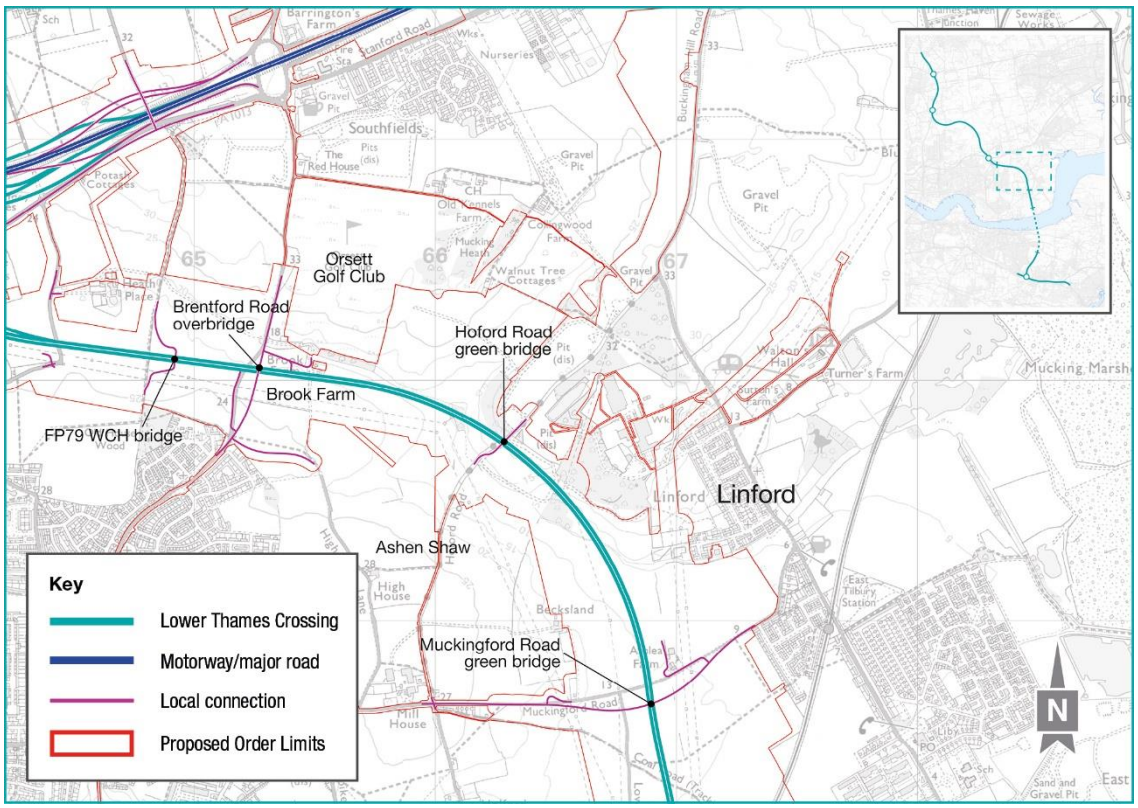
Section 6: Chadwell St Mary link

2.3.116 Section 6 would be located within the wards of East Tilbury; Chadwell St Mary; and Orsett. Section 6 would start at the northern end of the new Tilbury Viaduct, south of Muckingford Road, between East and West Tilbury (where Section 5 ends) and would continue north-west around Chadwell St Mary towards the A1089. Section 6 would end directly west of Brentwood Road, south-west of Orsett Golf Course (where Section 7 starts).

2.3.117 A schematic layout of Section 6 is provided in Plate 2.6.

2.3.118 The construction of Section 6 would be managed as part of Construction Section C as described in Section 2.6 of this chapter.

Plate 2.6 Operational Section 6 schematic



Key work elements

2.3.119 The key components of works in Section 6 would be the continuation of the Project road beyond the Tilbury Viaduct (Structure Ref. BRN0000025) and the provision of the Muckingford Road green bridge over an approximate 550m long embankment. A new three-lane dual carriageway, approximately 2.9km in length, would be constructed through Section 6 (Work number 6A).

2.3.120 North of the Tilbury Viaduct, the Project road would approach at grade, and pass beneath the realigned Muckingford Road green bridge (Structure Ref. BRN0000030), which would be approximately 73m in length and 9m above the proposed Project road. The Project road would then pass an existing pond, located to the west of Linford, prior to descending into a cutting for approximately 400m which would pass underneath the new Hoford Road green bridge (Structure Ref. BRN0000031).

2.3.121 The Project road would continue on embankment for approximately 500m and approach the existing ground level before Brentwood Road, passing underneath the new Brentwood Road overbridge (Structure Ref. BRN0000032) (9m above the Project road) and Footpath 79 (8.5m above the Project road), to then descend into a cutting as it approaches the Section 7.

2.3.122 Throughout the Chadwell St Mary link, the Project road would be in a false cutting 4m high, which is designed to mitigate noise and visual impacts. At Brentwood Road, a new private means of access to the Project would be provided for local emergency services' and maintenance use, with access both on and off the Project road in both directions (Work number 6A).

2.3.123 Other key design features of Section 6 would include the following as shown on the Works Plans (Application Document 2.6):

a. Provision of a new green bridge (Structure Ref. BRN0000030) to carry the realigned Muckingford Road over the A122, approximately 80m south of the existing route (Work Number 6B). This would include the construction of a new road, with a single carriageway in both directions, approximately 1,500m in length; together with the provision of a new single carriageway local side road to the east, approximately 240m in length, and a further new local side road to the west, approximately 140m in length. A new private means of access, from the local side road to the new drainage structure (Work number 6E below) would be constructed. (Work number 6B). The proposed bridge design is inspired by the local area and incorporates hedgerow planting, paved areas and open grassland.

b. Construction of a new PRoW in the verge of the realigned Muckingford Road and the existing Linford Road (Work number 6B).

c. Provision of a new green bridge (Structure Ref. BRN0000031) to carry the realigned Hoford Road over the A122, approximately 20m south of the existing route. The Hoford Road green bridge would be approximately 81m in length and approximately 2m above ground level. The realigned section of Hoford Road would be approximately 290m in length. A new private means of access for maintenance access from the realigned Hoford Road would be constructed. A new private means of access would also be constructed (Work number 6C) to the existing drainage pond located south-west of the Project road, which would be remodelled as describe under Work number 6K below.

d. Provision of a new bridge (Structure Ref. BRN0000032), approximately 35m in length, to carry the realigned Brentwood Road over the A122, approximately 80m east of the existing route. The realigned Brentwood Road would be approximately 805m in length and elevated by up to 11m AGL to cross over the A122. New private means of access would be provided between Brentwood Road and both the northbound and southbound carriageways of the A122 (Work number 6D). The design of Brentwood Road would draw upon the existing landscape by expanding the woodland associated with Orsett Golf Club.

e. Construction of a 3m high reflective acoustic barrier next to Brook Farm (Work number 6D).

f. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS10-001). The pond would be located to the east of the Project Road, near Linford, and discharge to Gobions Sewer via the gravity outfall. The pond would be constructed as a vegetated drainage system with a sediment forebay. The

forebay and main part of the pond would be lined. A private means of access would be constructed for the pond to the north of the new pond (Work number 6E).

g. Diversion of Gobions Sewer over a stretch of approximately 290m (Ref. D-EFR-2-05) including 178m via a new culvert where it would cross under the A122 (Ref. X-EFR-2-04) (Work number 6F).

h. Diversion of an unnamed watercourse over a stretch of approximately 565m (Ref. D-EFR-2-06) including 20m via a new culvert where it would cross under Hoford Road (Ref. X-EFR-2-05) (Work number 6G).

i. Diversion of an unnamed watercourse over a stretch of approximately 565m (Ref. D-EFR-2-06) including 20m via a new culvert where it would cross north of Hoford Road (Ref. X-EFR-2-05) (Work number 6H). A new private means of access to Brook Farm and to the culvert would also be constructed (Work number 6D).

j. Diversion of an existing watercourse, via a new culvert east of A122 and under the earthworks for the realigned Muckingford Road (Work number 6B above). The new culvert would be approximately 180m in length (Work number 6I).

k. Diversion of an existing watercourse, via a new culvert under west of A122 and under the earthworks for the realigned Muckingford Road (Work number 6B). The new culvert would be approximately 180m in length (Work number 6J).

l. Remodelling of an existing drainage pond located to the south-west of the Project road (Work number 6K).

m. Construction of a new PRoW from the realigned Brentwood Road, south-east of the A122 (Work number 6L). High House Lane would be stopped up where it crosses the A122. The section to the south of the A122 would be diverted to the west for approximately 300m to join Brentwood Road via a new private means of access.

n. Construction of a new PRoW from the realigned Brentwood Road, south-west of the A122 (Work number 6M).

2.3.124 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

Utilities works

2.3.125 Permanent diversions of the utility networks would be required within Section 6 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. Undergrounding of approximately 2.2km of UKPN existing 132kV overhead powerline network (Work number OH3) via the installation of a 2.37km underground cable (Work number MU28). The works include removal of eight existing pylons, the modification of an existing pylon and the demolition of another existing pylon to be replaced via the construction of a new terminal pylon in the same location north of Muckingford Road. These works extend into Section 5.

b. The permanent diversion of 890m horizontally within a length of approximately 2km of NGET 400kv overhead powerline network (Work number OH4) including the construction of five new pylons and restringing of approximately 3.6km of overhead powerline network. The work also involves the removal of three existing pylons. These works continue to Section 5.

c. Diversion of 1.45km horizontally of UKPN 132kV overhead powerline network including the construction of five new pylons, removal of four existing pylons and restringing of approximately 1.7km of overhead line network (Work number OH5).

d. The permanent diversion of 1.2km horizontally within a length of approximately 1.7km of NGET 400kV overhead powerline network including the construction of four new pylons, removal of four existing pylons and restringing of approximately 4.8km of overhead powerline network (Work number OH6). These works extend into Section 7 and Section 8.

e. The permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction. A further area of works of approximately 0.7km at the Mardyke is required. The works include the construction of 10 new pylons, removal of nine existing pylons and restringing of approximately 8.4km of overhead line network (Work number OH7). This overhead line diversion has been screened against criteria for replacement lines set out in section 16(3) of the Planning Act 2008 and is therefore considered as an NSIP. Further information on this screening is available in Annex 2 of the Explanatory Memorandum (Application Document 3.2). These works extend into Sections 7 and 8.

f. Multi-utility corridors for the diversion of assets including UKPN electricity networks, Anglian Water foul sewers, Essex and Suffolk Water water mains, Cadent gas pipelines, Openreach and other utility companies' strategic

telecommunication cable routes, to divert assets (Work numbers MU34 to MU41). This includes works at Muckingford Road, Hoford Road and Brentwood Road (Work numbers MU40 and MU41 extend into Section 7). New substations would be installed at Muckingford Road (SS8) and west of Brook Farm (SS9).

Special category land

2.3.126 No special category land would be affected in Section 6 and no replacement land is proposed.

Private recreational facilities

2.3.127 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.128 For Section 6, an area of vegetation in the south-west of Orsett Golf Club would be required permanently to construct the Brentwood Road bridge. Temporary possession of the south-west corner of the site would be required to install the diversion of utilities with permanent rights for maintenance. Furthermore, two areas of woodland within the golf course would be needed for the erection of bat boxes. These works would not adversely affect the existing use.

2.3.129 The Project would require the temporary possession of Linford Allotments (private allotment which does not fall within the definition of Special Category Land), with permanent rights for re-stringing operations to divert the existing overhead electricity lines onto a temporary alignment during construction of the Project, before returning to their original position following the completion of works. Permanent rights would be acquired for operation and maintenance. These works would not change the existing situation onsite on completion of the works, as it is already subject to existing overhead lines that cross the allotments.

2.3.130 The western corner of the East Tilbury and Linford Gun Club site is included within the Order Limits to access existing overhead power lines for inspection, restringing and earthing. This temporary possession with permanent rights for maintenance would not adversely affect the existing use.

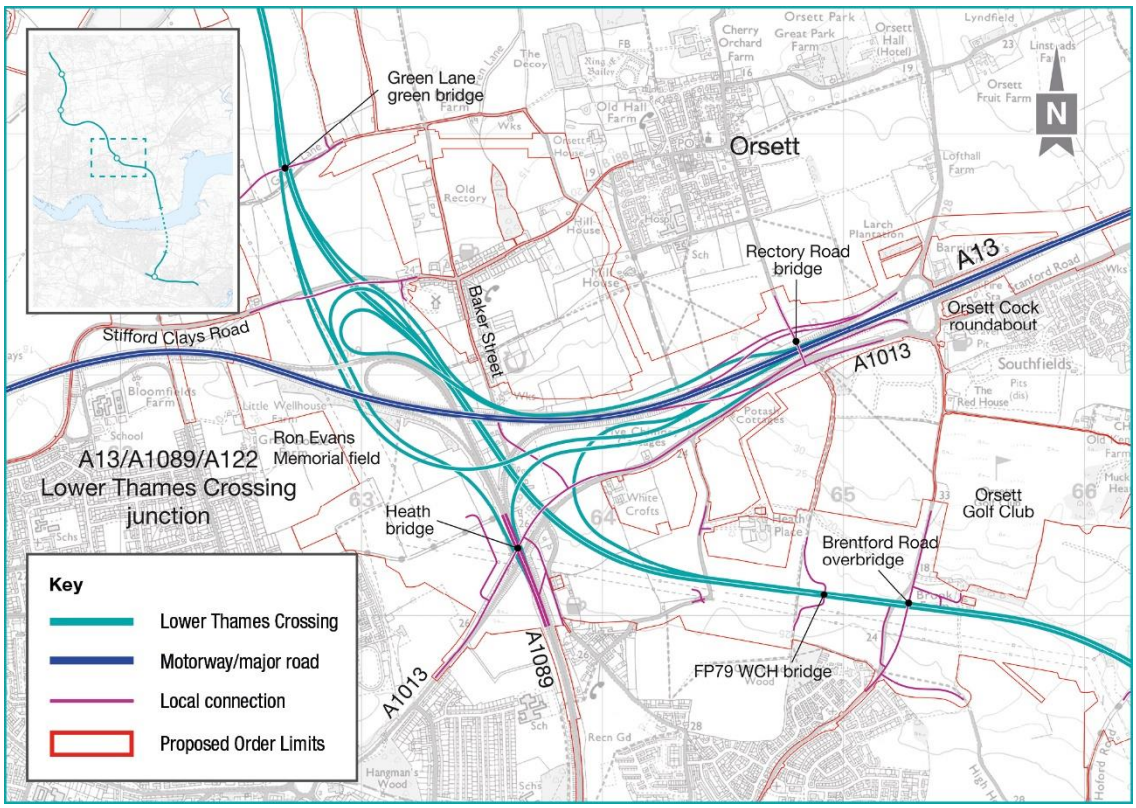
Section 7: A13/A1089/A122 Lower Thames Crossing junction

2.3.131 The Project road through Section 7 would be approximately 3.5km in length from south to north. It should be noted that there is an approximate 1.9km length of Section 7 which extends to the east along the existing A13. Section 7 would be located within the wards of Orsett; Little Thurrock Blackshots; and Stifford Clays. Section 7 would continue from Section 6 directly west of Brentwood Road, towards the existing A1089. From the A1089 it extends north through the A1089 junction with the A13 and Baker Street, until a point approximately 190m north of the realigned Green Lane, Orsett (where Section 8 starts).

2.3.132 A schematic layout of Section 7 is provided in Plate 2.7.

2.3.133 The construction of Section 7 would be managed as part of Construction Section C as described in Section 2.6 of this chapter.

Plate 2.7 Operational Section 7 schematic



Key work elements

2.3.134 The key components of works in Section 7 would be the continuous highway for the Project road northwards towards the M25 and a modified junction which would be constructed to connect the Project road with the A13 and the A1089. In this location the Project road would be two lanes in both directions through the new junction, along which hard shoulders would be provided. This can be seen on the General Arrangement drawings (Application Document 2.5).

2.3.135 The modified junction with the A13 and A1089 would be located at the site of the existing junction between these roads to the west of Orsett (10m below the existing A13 level). The Project road would pass under the A13 to the east of the existing A1089 bridge through a new structure.

2.3.136 The A13 westbound would remain on the current alignment to London, and the A13 eastbound would remain on the current alignment towards Southend-on-Sea. The A1089 northbound to A13 westbound and eastbound links would also remain on the current alignment, as would the A13 eastbound to A1089 southbound link.

2.3.137 The A13 eastbound to the Orsett Cock junction would be replaced on a modified alignment. A link road from the Orsett Cock junction would connect the A13 westbound onto the A1089 southbound. New direct links would be provided onto the Orsett Cock junction (A128) from the A122 northbound and southbound.

2.3.138 New links would be provided from the A122 northbound and southbound, to connect directly onto the A13 in the eastbound direction. Link roads would be provided to directly connect the A13 westbound to the A122 northbound and

southbound. Link roads would also be provided to connect the A1089 northbound to the A122 northbound and southbound via the Orsett Cock junction.

2.3.139 The A1013 would be realigned between the A1089 and the Orsett Cock junction to accommodate the proposed Project slip roads, providing new junctions with Baker Street and Rectory Road which would include a new structure over the existing A13 and the proposed junction link roads. The Orsett Cock junction would remain in its current location.

2.3.140 The A122 through the A13 junction would be in cutting, with an average level of 4m below the existing ground level. The A122 through Section 7 would include a new three-lane dual carriageway, approximately 3,590m in length (Work number 7A).

2.3.141 Junction slip roads, apart from bridge crossings, would be in false cutting between 2m and 4m above the road levels to reduce noise and/or visual impacts.

2.3.142 To the north of the A13/A1089/A122 Lower Thames Crossing junction, Stifford Clays Road would be realigned (12m above the A122) to align with the new slip roads layout. The Project road would be in cutting at variable depth from 5m to 2m for approximately 750m, passing under Green Lane (12m above the A122).

2.3.143 No connections would be provided from the A122 to the A13 westbound or from the A13 eastbound to the A122.

2.3.144 Other key design features of Section 7 would include the following as shown on the Works Plans (Application Document 2.6):

a. Construction of a new PRoW, to include the realignment of existing footpath FP79 and the provision of a new FP79 WCH bridge (Structure Ref. BRN0000033), approximately 36m in length and 8.5m AGL, to carry the new PRoW over the A122. A new private means of access from the A128 Brentwood Road would also be constructed at this location (Work number 7B).

b. Provision of a new 94m long overbridge (Structure Ref. BRN0000048) to carry the A122 under the existing A13 highway. This would include the construction of a new overbridge to carry the improved section of the A13 dual carriageway over the A122 (Work number 7C).

c. Construction of a realigned section of the existing A1013, approximately 2,425m in length and elevated slightly, from the Orsett Cock junction westwards, to accommodate the realigned Orsett Cock westbound on-slip and the replacement Rectory Road bridge over the A13. This would also include the construction of a new PRoW along the verge of this realigned section of the A1013. A new bridge (Structure Ref. BRN0000042), approximately 77m in length and 9m AGL, would also be constructed to carry the realigned A1013 over the existing and improved A1089 and the multiple proposed highways at this location (Work number 7D).

d. Demolition of the existing Heath Road bridge (Structure Ref. BRE0012829) over the existing westbound carriageway of A13 to the existing southbound carriageway of A1089 (Work number 7D).

e. Provision of a new overbridge (Structure Ref. BRN0000043), approximately 77m in length and 3m AGL, to carry the realigned A1013 over the A122; together with the construction of a new overbridge (Structure Ref. BRN0000044), approximately 29m in length and at approximately existing ground level, to carry the realigned A1013 over the new link road between the westbound carriageway of the improved A13 and the southbound carriageway of the A122 (Work number 7D).

f. Construction of a new two-lane link road, approximately 1,745m in length, between the westbound carriageway of the improved A13 and the southbound carriageway of the improved A1089. This is through the Orsett Cock junction. This new link would allow traffic to access the A1089 southbound from the A13 and Orsett Cock junction. A new overbridge (Structure Ref. BRN0000045), approximately 178m in length and up to 9m AGL, would be constructed to carry this new link road over the A122 and the improved Baker Street (Work number 7E).

g. Construction of a new two-lane link road, approximately 2,625m in length, between the westbound carriageway of the improved A13 and a new link road from the A1089 connecting onto the A122 (Work number 7E).

h. Provision of a new viaduct (Structure Ref. BRN0000046), 470m in length and maximum height of 9.5m AGL, to carry the new link road between the westbound carriageway of the improved A13 and the northbound carriageway of the A122. The new bridge/'A13 westbound to Project road northbound viaduct' would cross over the improved Baker Street, the new A122, the existing A1089 and the new link road between the northbound carriageway of the improved A1089 and the northbound carriageway of the A122. The vertical profile of the link would provide a minimum headroom of 5.3m to Baker Street and the A122, and minimum 5.6m headroom provided to allow for a high vehicle route on the A1089. A maintenance access track alongside the Project would be provided to the new viaduct (Work number 7E).

i. Provision of a new bridge (Structure Ref. BRN0000047), approximately 42m in length and 7m AGL, to carry the new link road between Orsett Cock junction and the southbound carriageway of the improved A1089, over the new link road between the improved A13 and the southbound carriageway of the A122 (Work number 7E).

j. Provision of a new bridge (Structure Ref. BRN0000091), approximately 62m in length and 5.5m AGL, to carry the new link road between the westbound

carriageway of the improved A13 and the northbound carriageway of the A122, over the new link road between the improved A13 and the southbound carriageway of the A122 (Work number 7E).

k. The demolition of the existing bridge (Structure Ref. BRE0012829, approximately 15m in length) on the redundant A1089 slip road over the existing Baker Street (Work number 7E).

l. Provision of a new overbridge (Structure Ref. BRN0000049), approximately 94m in length and 10m above the Project road, to carry the existing A13 over the multiple proposed highways at this location. Approximately 4,300m in length of improvement works to the existing A13 dual carriageway would be undertaken, together with improvements to the Orsett Cock junction. A new PRoW would be constructed from Long Lane to the south of the A13 (Work number 7F).

m. Construction of a new link road, approximately 2,500m in length, between the southbound carriageway of the A122 and the improved Orsett Cock junction. A new link road, approximately 450m in length, would be constructed between this new link road and the eastbound carriageway of the improved A13(Work number 7G).

n. A new link road, approximately 2,500m in length, would be constructed between the northbound carriageway of the A122 and the eastbound carriageway of the improved A13, together with the construction of a new link road, approximately 600m in length, between the A122 and the Orsett Cock junction. A new overbridge (Structure Ref. BRN0000050), approximately 23m in length and 10m AGL, would be constructed to carry these new link roads between the A122 and the eastbound carriageway of the improved A13 over the existing Baker Street (Work number 7G).

o. Provision of a new overbridge (Structure Ref. BRN0000054), approximately 215m in length and 8.5m AGL, to carry the new link road between the northbound carriageway of the A122 and the eastbound carriageway of the improved A13 over the A122 trunk road (Work number 7G).

p. Construction of a new two-lane link road, approximately 1,200m in length, between the improved Orsett Cock junction and the westbound carriageway of the improved A13. A new bridge (BRN0000051), approximately 157m in length and 8m AGL, would be constructed to carry this new link road over the new link road between the westbound carriageway of A13 and the A122 (Work number 7H).

q. Construction of a new two-lane link road, approximately 1,005m in length, between the eastbound carriageway of the improved A13 and the new link road between the A122 and the improved Orsett Cock roundabout. A new

bridge (Structure Ref. BRN0000052), approximately 62m in length and 8m AGL, would be constructed to carry this new link road over the new link roads of the A122 to the improved A13 (Work number 7I).

r. Construction of a realigned section of Rectory Road, including approximately 350m of improvement works to the existing Rectory Road and the construction of two new PRoWs along the verge of the improved Rectory Road. The existing Rectory Road bridge (Structure Ref. BRE0000N20), which carries the existing Rectory Road over the existing A13, would be demolished and a new bridge, approximately 160m in length and 9.5m above the existing A13, would be constructed on the alignment of the existing Rectory Road. The new Rectory Road bridge (Structure Ref. BRN0000053) would be elevated by 23m to carry the realigned Rectory Road over the multiple realigned slip roads at this location. A new PRoW between Woolings Close and Rectory Road would be constructed, together with the construction of a new private means of access, including the new access to Woolings Close and Baker Street from the new PRoW (Work number 7J).

s. Construction of a new single-lane link road, approximately 685m in length, between the existing A1089 and the southbound carriageway of the A122. A new bridge (Structure Ref. BRN0000056), approximately 130m in length and maximum 6m AGL, would be constructed to carry a new link road between the existing A1089 and the northbound carriageway of the A122, over the northbound A122 (Work number 7K).

t. A new overbridge (Structure Ref. BRN0000057), approximately 38m in length and elevated by approximately 4m above the existing ground level, would be constructed to carry the realigned Stifford Clays Road over the new northbound link road from the A1089 connecting onto the northbound carriageway of the A122, and the dual carriageway westbound of the improved A13 (Work number 7L).

u. Construction of a realigned section of Stifford Clays Road to the south of the existing route, including approximately 710m of improvement works to the existing Stifford Clays Road and the construction of a new PRoW along the verge of the improved Stifford Clays Road. A new bridge (Structure Ref. BRN0000058), approximately 92m in length and elevated by approximately 7m above the existing ground level, would be constructed to carry the realigned Stifford Clays Road over the A122 and the new link road between the southbound carriageway of the A122 and the eastbound carriageway of the improved A13. A new private means of access from Stifford Clays Road to the west, from the A122, would also be constructed (Work number 7L).

v. Construction of a realigned section of Green Lane to the north of the existing route, including the construction of a new PRoW as the improved Green Lane. A new Green Lane green bridge (Structure Ref. BRN0000059), approximately 80m in length and elevated by up to approximately 11m above existing ground level, would be constructed to carry the realigned Green Lane over the A122 and the new link road between the westbound carriageway of the improved A13 and the northbound carriageway of the A122. Together with the construction of a new PRoW between Green Lane and the improved Stifford Clays Road (Work number 7M).

w. Provision of a new overbridge (Structure Ref. BRN0000055), approximately 56m in length, to carry the existing eastbound link road between the improved A13 and the existing southbound carriageway of A1089 over multiple proposed highways at this location (Work number 7N).

x. Construction of a gravity highway drainage network incorporating a new infiltration basin (Pond Ref. POS11-003). The basin would be located within the A13/A1089/A122 Lower Thames Crossing junction. It would constructed as a vegetated drainage system (DMRB CD 532) with a vortex grit separator (pollution control device). A private means of access would be constructed for the basin from Baker Street (Work number 7O).

y. Diversion of an existing watercourse, via a new culvert west of A122 and under the earthworks for the realigned Green Lane (Work number 7M above). The new culvert would be approximately 180m in length (Work number 7P).

z. Diversion of an existing watercourse, via a new culvert east of A122 and under the earthworks for the realigned Green Lane (Work number 7M above). The new culvert would be approximately 175m in length (Work number 7Q).

aa. Re-provision of the Gammonfields Way travellers' site and associated landscaping west of the A13/A1089/A122 Lower Thames Crossing junction (Work number 7R).

bb. Hornsby Lane would be closed where it would otherwise cross the A122. Two new turning heads to the north and to the south of the A122 would be constructed to enable vehicles to make turnaround manoeuvres. This would include improvement to approximately 125m of Hornsby Lane in the north and approximately 80m in the south. A new private means of access from the new Hornsby Lane turning head north of the A122 to Heath Place would be constructed, together with the construction of two new private means of access from Hornsby Lane turning head south off the A122 (Work number 7S).

cc. Improvement works to approximately 480m of the existing A1089 (Work number 7T).

dd. Construction of a realigned section of the existing Gammonfields Way, approximately 80m west of the existing route and for a length of approximately 390m, to join the A1013 west of its bridge over the A1089. A new PRoW along the verge of the realigned Gammonfields Way would be constructed (Work number 7U).

ee. Construction of a realigned section of Baker Street, approximately 410m in length, to run on the east side of the A122, north from a new junction with the A1013 (east of the A1013 bridge over the Project road). This would include the construction of a new PRoW along the verge of the realigned Baker Street, and the construction of two new private means of access for maintenance access from the realigned section of Baker Street (Work number 7V).

ff. Construction of a realigned section of the existing Heath Road, approximately 95m west of the existing route for a length of approximately 240m, to join the realigned A1013 east of its crossing of the A1089. Three new private means of access would also be constructed at this location (Work number 7W).

gg. Construction of a new PRoW between the new bridge to carry the new PRoW over the A122 (Work number 7B above) and the realigned Rectory Road (Work number 7X).

hh. Construction of a new two-lane link road, approximately 2,045m in length, between the westbound carriageway of the improved A13 and the southbound carriageway of the A122 (Work number 7Y).

ii. Construction of a new two-lane link road, approximately 1,265m in length, between the existing A1089 northbound and the new link road to the southbound carriageway of the A122. A new multi-lane link road, approximately 1,100m in length, starting from the fork to the A122 southbound and heading towards the A122 northbound would also be constructed (Work number 7Z).

2.3.145 As discussed for Section 1, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

2.3.146 In addition to the above works, the Project includes the provision of additional landscaping with planting around the A13/A1089/A122 Lower Thames Crossing junction. This landscaping includes the construction of six landscape mounds, using material generated from other parts of the Project's construction. These features would help integrate the new junction into the surrounding landscape and provide noise attenuation and soften views of the junction for the surrounding communities.

2.3.147 The northernmost of these landscape mounds would be located directly north of Stifford Clays Road, directly west of the A122. It is proposed that this feature would extend 2m in height above Stifford Clays Road and 15m above the A122 road.

2.3.148 Three landscape mounds are proposed within the A13/A1089/A122 Lower Thames Crossing junction, to the east of the A122 and Baker Street. The largest would abut the westbound A13 and would extend up to 9m in height above the A13 and up to 17m above Baker Street. Directly south of this, a smaller landscape mound would extend up to 11m in height above Baker Street. The third landscape mound to the east of the A122 would be located directly south of the A1013 and would extend 9m in height above the existing ground level, directly west of the Whitecroft care home, with the intention of reducing the visibility of the new road and A13/A1089/A122 Lower Thames Crossing junction to the residents of this care home.

2.3.149 To the west of the A122 and the A1089, two further landscape mounds would be constructed south of the A13. The southernmost would abut the northbound A1089 to A122 northbound link and would extend approximately up to 11m in height above the existing ground level. Directly north of this and to the east of the same link, a new landscape mound extending up to 10m in height above the existing ground level is proposed.

2.3.150 In addition to these landscaping features, landscape screening around the relocated Gammonfields Way traveller's site is proposed to the south-west of this junction.

2.3.151 The heights of these landforms can vary within the extents defined in the LOD for highways, summarised in the Works Plans (Application Document 2.6). This allows flexibility for the ongoing design development and construction of the Project to respond to design improvements and unforeseen constraints.

2.3.152 These proposed landscaped areas are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2).

Utilities works

2.3.153 Permanent diversions of the utility networks would be required within Section 7 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. The permanent diversion of 1.2km horizontally within a length of approximately 1.7km of NGET 400kV overhead powerline network including the construction of four new pylons, removal of four existing pylons and restringing of approximately 4.8km of overhead powerline network (Work number OH6). These works extend into Section 6 and Section 8.

b. The permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction. A further area of works of approximately 0.7km at the Mardyke is required. The works include the construction of 10 new pylons, removal of nine existing pylons and restringing of approximately 8.4km of overhead line network (Work number OH7). This overhead line

diversion has been screened against criteria for replacement lines set out in section 16(3) of the Planning Act 2008 and is therefore considered as an NSIP. Further information on this screening is available in Annex 2 of the Explanatory Memorandum (Application Document 3.2). These works extend into Sections 6 and 8.

c. Diversion of approximately 0.27km of Cadent high-pressure gas pipeline east of Brentwood Road (Work number G5).

d. Diversion of approximately 5.23km of Cadent high-pressure gas pipeline around the A13/A1089/A122 Lower Thames Crossing junction (Work number G6), and construction of a new gas compound and permanent access along Stanford Road (Work number G6a).

e. Diversion of approximately 0.34km of Cadent high-pressure gas pipeline north of Green Lane (Work number G7).

f. Installation of multi-utility corridors of assets including UKPN electricity networks, Anglian Water foul sewers, Essex and Suffolk Water water mains, Cadent gas pipelines, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU40 to MU60). Work numbers MU40 and MU41 extend into Section 6. New substations would be installed at Heath Place (SS10), Hornsby Lane (SS11), Heath Place (SS12), Baker Street (SS13), Stanford Road (SS14) and Rectory Road (SS15).

Special category land

2.3.154 As outlined for Section 1, where the proposed Project road and its construction results in permanent impacts on common land and open space sites, the Applicant would provide replacement open space and common land parcels within the Order Limits in accordance with the requirements of sections 131 and 132 of the Planning Act 2008. For Section 7, this includes replacement land in response to the permanent acquisition of land and rights over the public open space Ron Evans Memorial Field, to the west of the A13/A1089/A122 Lower Thames Crossing junction (Work numbers OSC6 and OSC7). The replacement land would be located immediately next to (south and west) the existing memorial field, split into two areas that, combined, are greater in size than the land required permanently for the new road.

2.3.155 This replacement land would be designated as open space and have landscaping to match the existing retained field. Informal paths would connect the replacement and retained memorial field with an adjacent area of proposed environmental mitigation to the north of Long Lane to function as one coherent space. The site would be accessed by existing routes from Long Lane and Fairfield Way. The replacement land comprises approximately 92,200m^2 (compared with approximately 82,700m^2 which is proposed to be acquired, or be subject to rights).

2.3.156 Replacement land is proposed in response to the permanent acquisition of land and rights over the common land at Orsett Fen, north of the A13/A1089/A122 Lower Thames Crossing junction (Work numbers OSC8 and OSC9). The replacement land is split in two areas to the north and south of the existing common land. This replacement land would be designated as common land, allowing the public to enjoy the same rights that they have currently. The replacement land comprises approximately 619,600m^2 (compared with approximately 534,600m^2 which is proposed to be acquired).

2.3.157 In addition, temporary possession of some land at King George's Field, south of the existing A13 junction, would be required to provide a working area for utilities works. No replacement land is proposed in this regard as the subject land would be no less advantageous than before following the completion of works.

Private recreational facilities

2.3.158 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.159 For Section 7, a small area in the north-east of Thurrock Rugby Football Club is within the Order Limits for the construction of new overhead electricity lines. Temporary possession of the land would be needed to undertake the works, with permanent rights acquired for operation and maintenance. The works would not adversely affect the existing use.

2.3.160 An area to the south of Orsett Showground (events venue) is required permanently for the new link roads to the Orsett Cock junction and the A13. Temporary possession and permanent rights for maintenance are also required in the south of the site for the diversion of a gas pipeline and temporary multi-utility works. The landowner has confirmed that the existing use would continue for commercial event hire despite the works to the south of the site, and as such, the existing use would continue.

2.3.161 The Foxhound Riding School itself is not within the Order Limits and not directly impacted by the Project. However, the school leases a field to the south of their site from Thurrock Council. A small southern part of this field, alongside the A13, would be required permanently for highway works. The Project is not proposing to replace this loss of field.

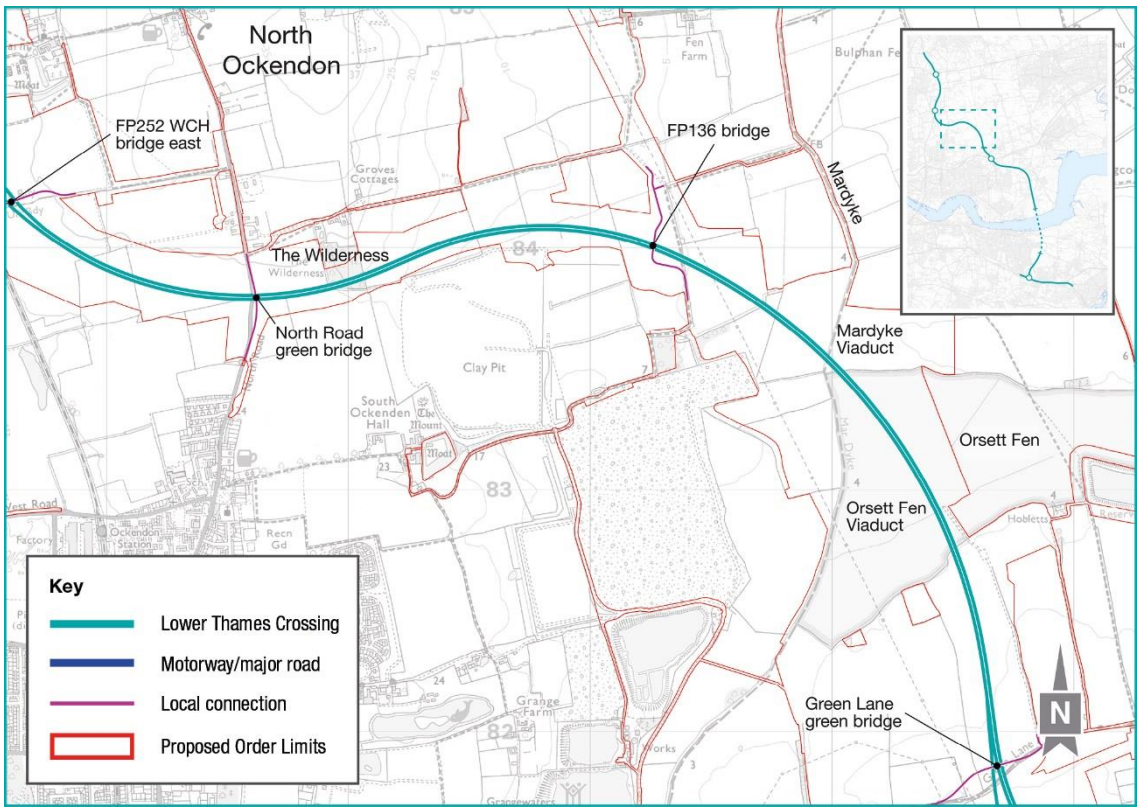
Section 8: Ockendon link

2.3.162 The Project road through Section 8 would be approximately 4.8km in length from south to north. Section 8 would be located within the wards of Orsett; and Ockendon. Section 8 would continue north from Section 7 approximately 190m north of the new realigned Green Lane green bridge, before heading north-west around South Ockendon, towards the M25. Section 8 would end approximately 550m west of the existing B186 North Road, north of South Ockendon (where Section 9 starts).

2.3.163 A schematic layout of Section 8 is provided in Plate 2.8.

2.3.164 The construction of Section 8 would be managed as part of Construction Section D as described in Section 2.6 of this chapter.

Plate 2.8 Operational Section 8 schematic



Key work elements

2.3.165 The key components of works in Section 8 would be the mixture of embankments and viaducts, which would cross the Mardyke floodplain.

2.3.166 As the Project road passes through Section 8 to the north of the A13, the northbound carriageway would return to three lanes, while the southbound would remain at two lanes. The A122 through Section 8 would be approximately 4,810m in length (Work number 8A). The alignment would pass to the west of Orsett and then turn to the west passing north of South Ockendon. This can be seen on the General Arrangement drawings (Application Document 2.5).

2.3.167 The Project road would cross the Mardyke floodplain for 1.7km with approximately 500m of embankment rising to an elevation of approximately 7.2m above existing ground level, then passing over a viaduct across Orsett Fen Sewer with a 500m embankment 6.2m above ground, followed by a second viaduct across the Golden Bridge Sewer and the Mardyke.

2.3.168 West of the Mardyke, where the Project road would run to the north of the Ockendon landfill site, it approaches grade underneath the diverted Footpath 136 (9.5m AGL), to then descend into a 0.8m cutting past the landfill site, before entering a 5.5m (below ground level) cutting for approximately 2.4km between The Wilderness woodland and the landfill site and underneath the diverted North Road green bridge.

2.3.169 North of Green Lane, a 2m high (relative to the road surface) false cutting would be provided on both sides of the main carriageway up to the first viaduct. A 2m false cutting (relative to the road surface) would then run along the southbound carriageway between Footpath 136 and North Road. West of North Road for a

length of 300m there would be a 5m (relative to the road surface) false cutting along the northbound carriageway providing noise and visual mitigation for South Ockendon. A 5m false cutting (relative to the road surface) would run along the southbound carriageway between the M25 and North Road to provide mitigation for North Ockendon.

2.3.170 Key design features of Section 8 would include the following as shown on the Works Plans (Application Document 2.6):

a. Provision of a new 'Orsett Fen Viaduct' (Structure Ref. BRN0000070), approximately 200m in length, to carry the A122, whilst accommodating access between fields and Orsett Fen. The viaduct would cross Orsett Fen Sewer and a minor watercourse with provisions for access for river maintenance beneath the structure. Provision would also be made for farm vehicles to cross underneath. At the northern end of the structure, a minimum 5.3m headroom would be provided for continued agricultural use of the land either side of the Project. A maintenance access track alongside the Project would be provided to the new viaduct (Work number 8B).

b. Provision of a new 'Mardyke Viaduct' (Structure Ref. BRN0000071), approximately 352m in length, to carry the A122. The viaduct would cross the River Mardyke and the Golden Bridge Sewer with a minimum 5.3m headroom over the water features and a minimum 5.3m headroom for the southern end of the structure to accommodate farm vehicles crossing underneath. A maintenance access track alongside the Project would be provided to the new viaduct (Work number 8B).

c. Provision of a new accommodation bridge (Structure Ref. BRN0000072), approximately 40m in length and up to 9.5m AGL, to carry the new PRoW (the realigned footpath FP136) over the A122. A new PRoW over the A122 would be constructed at this location, together with a new private means of access across the new bridge (Work number 8C).

d. Provision of a new green bridge (Structure Ref. BRN0000073), approximately 66m in length and up to 3.5m AGL, to carry the realigned B186 North Road over the A122, including improvement works to approximately 450m of B186 North Road, the construction of a new PRoW in the verge of the improved B186 North Road, and the construction of two new private means of access from the southern side of the new North Road green bridge to the A122 and the construction of a new private means of access from the northern side of the new North Road green bridge to the A122. A new PRoW from the realigned North Road to the new PRoW to Church Lane would be constructed, as would a new private means of access from the southern side of the new North Road green bridge, along the A122 earthworks to the new bridge (Structure Ref. BRN0000073) (Work number 8D). The B186 North Road would be realigned approximately 20m

to the east of the existing North Road and elevated by up to 3.5m AGL to cross over the A122.

e. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS11-002). The pond would be located to the west of the A122, north of Green Lane, and discharge to Orsett Fen Sewer via the gravity outfall. The pond would be constructed as a vegetated drainage system with a lined sediment forebay, and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. A private means of access would be constructed for the pond (Work number 8E).

f. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS11-001). The pond would be located to the east of the Project road, north of Green Lane, and discharge to Orsett Fen Sewer via the gravity outfall. The pond would be constructed as a vegetated drainage system with a lined sediment forebay, and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. A private means of access would be constructed for the pond (Work number 8F).

g. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS12-001). The pond would be located east of the Project road, between the two viaducts, and discharge to a local watercourse via the gravity outfall. The pond would be constructed as a vegetated drainage system with a lined sediment forebay, and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. A private means of access would be constructed for the pond (Work number 8G).

h. Construction of a gravity highway drainage network incorporating a new attenuation pond and a gravity outfall (Pond Ref. POS12-002). The pond would be located at the south of the Project road, east of the Wilderness and discharge to the Mardyke via the gravity outfall. The pond would be constructed as a vegetated drainage system with a lined sediment forebay, and flow controls to regulate the rate of discharge and to staunch flows in the event of a pollution incident. A private means of access would be constructed for the pond (Work number 8H).

i. Construction of a new private means of access for maintenance of the new drainage ponds (Work numbers 8F and 8G above) from the realigned Green Lane (Work number 8K).

j. Modification of an existing infiltration basin located to the south of the Project road, east of The Wilderness (Work number 8I).

k. Construction of a new PRoW between the realigned Green Lane and the private means of access to the new drainage pond (Work number 8E above), together with the construction of a new PRoW and new private means of access along the Mardyke channel from this private means of access (Work number 8J).

l. Construction of a new PRoW along the Mardyke channel, between the new PRoW described in Work number 8M below, and south of the new Mardyke Viaduct (Work number 8J).

m. Construction of a new PRoW between the Mardyke channel and the realigned footpath FP136, including the construction of a new PRoW between the new PRoW described in Work number 8J above and the realigned section of footpath FP136 (Work number 8C above), together with the construction of a new private means of access between these two PRoW. A new private means of access would be provided around the earthworks of the A122 at this location (Work number 8L).

n. Construction of a new PRoW between the new PRoW described in Work number 8J above and the new bridge to carry the realigned footpath FP136 over the A122; together with the construction of a new PRoW between the new PRoW between the same new bridge, and the new bridge to carry the realigned North Road over the A122 (Work number 8M).

o. Construction of a new PRoW between the new PRoW described in Work number 8D above, and Church Lane (Work number 8N).

p. Diversion of an unnamed watercourse over a stretch of approximately 199m (Ref. D-EFR-4-01) including 82m via a new culvert where it would cross under the A122, south-east of the new FP136 bridge (Ref. X-EFR-4-06)(Work number 8O).

q. Diversion of an unnamed watercourse via a new culvert under A122, over a stretch of approximately 1074m (Ref. D-EFR-4-02) (Work number 8P).

r. Diversion of an unnamed watercourse via a new culvert to the south of the Project road and under the earthworks of the realigned North Road, over a stretch of approximately 618m (Ref. D-EFR-4-03) (Work number 8Q).

s. Diversion of an unnamed watercourse to the north of the project road, over a stretch of approximately 924m (Ref. D-EFR-4-04) including 57m via a new culvert where it would cross under the realigned North Road (Work number 8R).

t. Construction of a 77m long culvert to carry an unnamed watercourse under the private means of access to the drainage pond (Work number 8F above) (Ref. X-EFR-4-05). (Works number 8S).

u. Construction of a 15m long culvert to carry an unnamed watercourse under the new private means of access (Work number 8K above) (Work number 8T).

v. Construction of a 12m long culvert to carry an unnamed watercourse under the new PRoW (Work number 8L above) (Work number 8U).

w. Provision of compensatory flood storage to offset the loss of storge volume in the Mardyke floodplain (Ref. Mardyke-CFSA-1). The compensatory storage areas would be located in the area to the north of the point where the Project road crosses the Mardyke. The compensation would comprise two scrapes with a combined area of approximately 1.0ha and with depths ranging from 0.1m to 0.5m. The two scrapes would only provide part of the compensatory flood storage required; the residual would be provided in the Mardyke wetland (Work number FCA2, FCA3 and FCA4).

2.3.171 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

Utilities works

2.3.172 Permanent diversions of the utility networks would be required within Section 8 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. The permanent diversion of 1.2km horizontally within a length of approximately 1.7km of NGET 400kV overhead powerline network including the construction of four new pylons, removal of four existing pylons and restringing of approximately 4.8km of overhead powerline network (Work number OH6). These works extend into Section 6 and Section 7.

b. The permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction. A further area of works of approximately 0.7km at the Mardyke is required. The works include the construction of 10 new pylons, removal of nine existing pylons and restringing of approximately 8.4km of overhead line network (Work number OH7). This overhead line diversion has been screened against criteria for replacement lines set out in section 16(3) of the Planning Act 2008 and is therefore considered as an NSIP. Further information on this screening is available in Annex 2 of the Explanatory Memorandum (Application Document 3.2). These works extend into Sections 6 and 7.

c. Capping and removal of two sections of the ex-Barking Power Station high-pressure gas pipeline (Work numbers G8 and G9). Work number G8 is up to approximately 1.58km of the pipeline to be removed and Work number G9 1.15km. Work number G9 extends into Section 9.

d. Installation of multi-utility corridors of assets including UK Power Networks electricity networks, Essex and Suffolk Water water mains, Cadent gas pipelines, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU61 to MU71). Work number MU71 extends into Section 9.

Special category land

2.3.173 As outlined for Section 1, where the proposed Project road and its construction results in permanent impacts on common land and open space sites, the Applicant would provide replacement open space and common land parcels within the Order Limits in accordance with the requirements of sections 131 and 132 of the Planning Act 2008. For Section 8 this also includes replacement land in response to the permanent acquisition of common land at Orsett Fen, north of the A13/A1089/A122 Lower Thames Crossing junction, as described above for Section 7. No further replacement land is proposed for Section 8.

Private recreational facilities

2.3.174 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.175 For Section 8, the Project is proposing to restring the existing overhead pylons at the eastern end of Top Meadow Golf Club. The temporary possession with permanent rights is required for the works and ongoing maintenance. The works would not adversely affect the existing use.

2.3.176 The Poplars Reservoir (crop irrigation reservoir, but also used by a private fishing club for fishing) is just outside of the Order Limits and no direct works are proposed to affect existing fishing. However, the Applicant is proposing to translocate protected species on land that surrounds the reservoir by creating open mosaic habitat. This open mosaic habitat creation would not adversely affect the operation of the reservoir or affect the fishing.

2.3.177 The Wild Thyme Outdoors at the Wilderness (foraging and outdoor lifestyle educational services) would be affected permanently as the Applicant is proposing to build a new road and undertake utility diversion at the southern end of the site. The Applicant is not proposing to replace this facility.

2.3.178 A small number of car parking bays of Grangewaters Outdoor Education Centre would be temporarily affected by the Project due to the construction of water connection works. The Project is seeking to connect a temporary water supply for a construction compound needed during the construction phase. These works would not adversely affect the existing use.

2.3.179 The Thurrock Model Flying Club is just outside of the Order Limits and no direct works are proposed to affect existing flying club use. However, the Project is seeking to construct a temporary water supply on the adjacent access road. The access to and from the flying club would be maintained at all times.

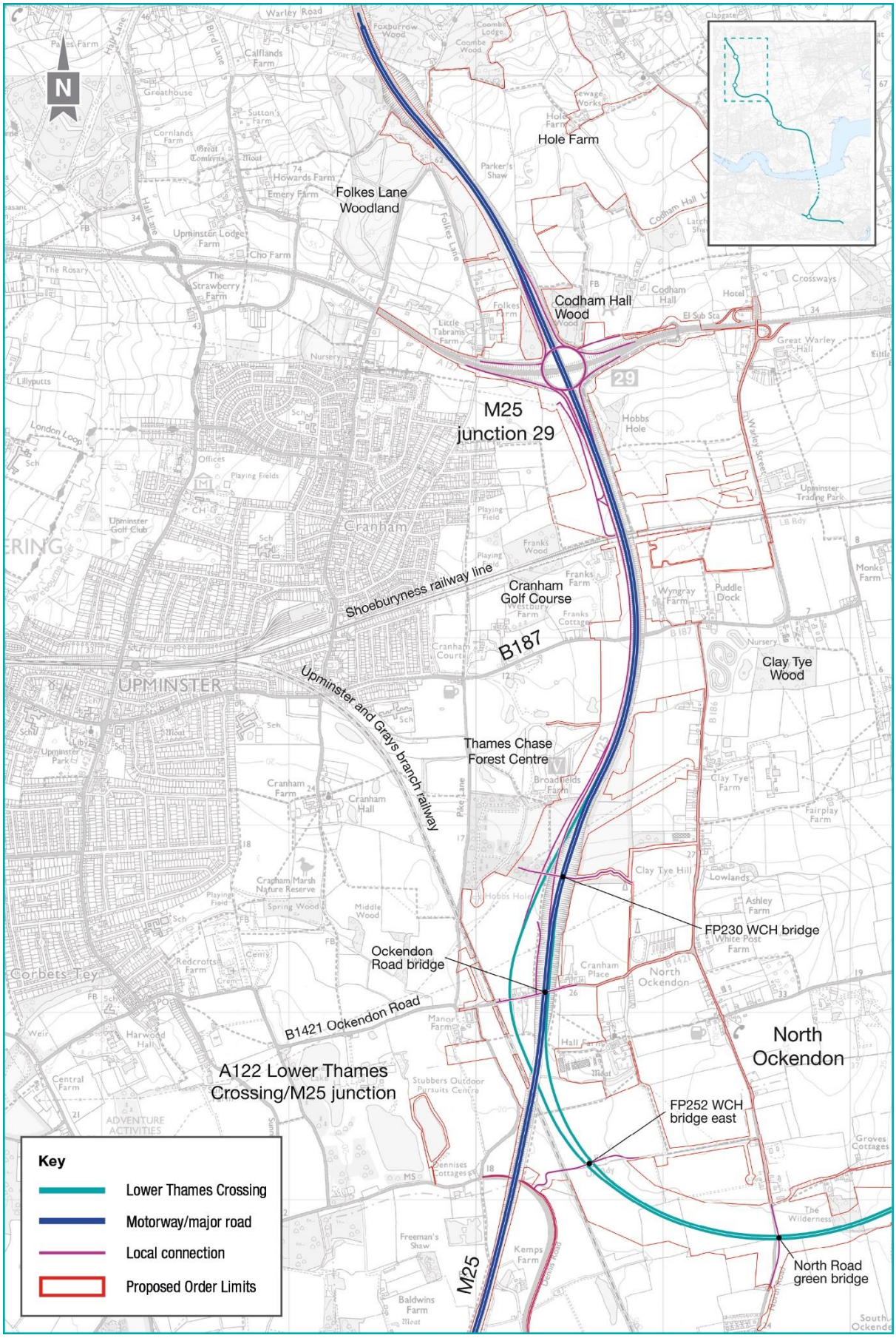
Section 9: A122 Lower Thames Crossing/M25 junction

2.3.180 The Project road through Section 9 would be approximately 9.1km in length from south to north. Section 9 would be located within the wards of Ockendon; Upminster; Warley; Cranham; Harold Wood; and South Weald. Section 9 would continue from Section 8, approximately 550m west of the existing B186 North Road, north of South Ockendon, and would end at the northernmost extent of the Order Limits, immediately south of M25 junction 28.

2.3.181 A schematic layout of Section 9 is provided in Plate 2.9.

2.3.182 The construction of Section 9 would be managed as part of Construction Section D as described in Section 2.6 of this chapter.

Plate 2.9 Operational Section 9 schematic



Key work elements

2.3.183 The key components of works in Section 9 would be the A122 Lower Thames Crossing/M25 junction between M25 junctions 29 and 30, multiple cuttings and multiple bridge structures.

2.3.184 The Project would connect with the M25 between junctions 29 and 30 via a new junction, which would be located approximately 3km south of M25 junction 29, near Ockendon Road. It would have north-facing slip roads for northbound traffic on the A122 to join the M25 and for southbound M25 traffic to join the A122. A two-lane parallel link road would be constructed to the west of the existing M25, providing a direct connection from the A122 to the M25 junction 29. Access to the A122 southbound would be at grade via a new on-slip from the existing M25, north of Ockendon Road. Ockendon Road would remain at its current elevation over the M25 and raised by up to 1m AGL where crossing over the proposed A122 northbound link road. This can be seen on the General Arrangement drawings (Application Document 2.5).

2.3.185 As the A122 approaches the existing M25 from the east the A122 would be in cutting, and to the west of North Road the northbound and southbound carriageways would divide underneath the diverted FP252 bridge (up to 8.5m AGL). The northbound carriageway would descend into a deeper cutting passing under the M25 just to the north of its crossing of the Upminster and Grays branch railway line. East of the railway line it would remain in cutting to pass under a realigned Ockendon Road. The depth of the cutting through this 1.5km section of the A122, between the M25 and North Ockendon, would be approximately 9.8m below existing ground level. Approximately 400m north of Ockendon Road, the northbound slip road would divide, with two lanes continuing to connect to the M25 northbound and the third lane connecting to M25 junction 29 which merges with the parallel link road as described above.

2.3.186 Where the Project link roads pass through Thames Chase Forest Centre, improvement works and widening would also be undertaken along this stretch of the M25, up to and including junction 29. Modification works would also be carried out on the M25 between its junction with the Project and to the north of junction 29. The M25 would be reduced to three lanes locally between the diverge of the connection to the junction 29 parallel link road and the merge from the A122 northbound. North of the connection from the A122, the M25 northbound would revert to its existing four lanes with hard shoulder as far as the disconnected junction 29 northbound off-slip.

2.3.187 In the southbound direction, the M25 would be widened from four lanes with a hard shoulder to five lanes with a hard shoulder between the M25 junction 29 southbound on-slip and A122 southbound off-slip.

2.3.188 Through M25 junction 29, the existing M25 would be widened from three lanes each way with hard shoulder to four lanes each way with hard shoulder in both directions. This would involve the widening of the existing viaduct structure over the existing roundabout and A127.

2.3.189 North of M25 junction 29, the connections of the north-facing slip roads would be modified because of the widening of the M25 through the junction. The northbound on-slip would be modified from a lane gain arrangement to an extended auxiliary lane extending appropriately 2,340m north. In the

southbound direction, a two-lane auxiliary lane parallel diverge would be provided in place of the existing lane drop. These auxiliary lanes would be approximately 580m long.

2.3.190 The M25 southbound would remain on the current alignment with an additional lane between M25 junction 29 and the A122 Lower Thames Crossing/M25 junction. The M25 northbound would also remain on the current alignment, with an additional lane north of the A122 Lower Thames Crossing/M25 junction.

2.3.191 The A127 eastbound and westbound would remain on their current alignment to Southend-on-Sea and London respectively. The current links from the A127 eastbound and westbound to the M25 via junction 29 would also remain.

2.3.192 Key design features of Section 9 would include the following as shown on the Works Plans (Application Document 2.6):

a. Provision of a new underbridge (Structure Ref. BRN0000081), approximately 127m in length and about 10m above the Project road, to carry the A122 northbound link road under an improved section of the M25. A new overbridge (Structure Ref. BRN0000084), approximately 147m in length and 8m above the Project road, would also be constructed to carry the A122 northbound link road under the proposed link road between M25 northbound and M25 junction 29. A new section of A122 three-lane single carriageway, approximately 2,680m in length, would be constructed through Section 9 (Work number 9A).

b. Construction of the A122 southbound link road from the M25 southbound, with a two-lane carriageway in one direction, approximately 1,865m in length (Work number 9B).

c. Construction of the new single-lane link road, between the new northbound link road and the M25 northbound to M25 junction 29 link road, approximately 885m in length (Work number 9C).

d. Construction of a new two-lane link road from the M25 northbound carriageway to the M25 junction 29 link road, approximately 3,510m in length. A new overbridge (Structure Ref. BRN0000085), approximately 17m in length and 2m AGL, would be constructed to carry the improved M25 northbound to M25 junction 29 link road over the West Mardyke. A new overbridge (Structure Ref. BRN0000086), approximately 18m in length and 6m AGL, would also be constructed to carry the improved M25 northbound to M25 junction 29 link road over the B187 St Marys Lane. A further new overbridge (Structure Ref. BRN0000087), approximately 37m in length and up to 8.5m AGL, would be constructed to carry the improved M25 northbound to M25 junction 29 link road over the Shoeburyness railway line (Work number 9D).

e. A new private means of access between the new PRoW (Work number 9P below) and the existing M25 junction 29 roundabout would also be constructed (Work number 9D).

f. Construction of an improved section of the M25, including the improvement of the existing M25 northbound for approximately 9,610m in length, and the improvement of the existing M25 southbound for approximately 9,010m in length (Work number 9E).

g. Modification of the Mardyke West Tributary culvert (Structure Ref. BRE0013569) to carry the improved M25 southbound over the Mardyke West, modification of the underbridge (Structure Ref. BRE0013568) to carry the improved M25 southbound over B187 St Marys Lane, modification of the bridge (Structure Ref. BRE0013562) to carry the improved M25 southbound over Shoeburyness railway line, and modification of Codham Hall viaduct (Structure Ref. BRE0013567) to carry the improved M25 over the M25 junction 29 roundabout and the A127 road (Work number 9E).

h. Construction of an improved link road (improved section of the existing A127), approximately 690m in length, between the A127 westbound carriageway and the improved southbound carriageway of the M25 link road (Work number 9F).

i. Improvements to the existing M25 junction 29 roundabout. Full signalisation would be provided in place of the current partial signalisation, and segregated left-turn lanes would be provided from the A127 westbound off-slip to M25 southbound on-slip and from the northbound parallel link road to the A127 westbound on-slip. A new PRoW would be constructed in the verge of the improved M25 junction 29 roundabout (Work number 9G).

j. Improvements to the existing two-lane link road between the A127 eastbound and the M25 junction 29 roundabout for approximately 335m in length (Work number 9H).

k. Improvements to the existing two-lane link road between the M25 junction 29 roundabout and the eastbound link road to the A127, for approximately 325m in length. The existing private means of access between the improved M25 junction 29 roundabout and Codham Hall Lane would also be improved (Work number 9I).

l. Improvements to a section of the existing A127 two-lane dual carriageway, approximately 1,850m in length (Work number 9J).

m. Improvements to the existing two-lane link road between the M25 junction 29 roundabout and the M25 northbound link for approximately 1,295m in length (Work number 9K).

n. Improvements to the existing two-lane link road between the M25 southbound link and the M25 junction 29 roundabout for approximately 1,295m in length (Work number 9L).

o. Construction of a new PRoW over the A122, east of Dennises Lane, from the junction with Pea Lane; provision of a new FP252 WCH bridge east (Structure Ref. BRN0000080), approximately 80m in length and up to 8.5m AGL, to carry the new PRoW over the A122 northbound and southbound carriageways (Work number 9M); provision of a new FP252 WCH bridge west (Structure Ref. BRN0000082), approximately 32m in length and up to 9m AGL, to carry the new PRoW over the existing Upminster and Grays branch railway line. A new PRoW would also be constructed from West Road to Pea Lane (Work number 9M).

p. Improvements to the existing B1421 Ockendon Road, for approximately 480m in length, with modifications to an existing bridge (Structure Ref. BRE0013570) to carry the improved B1421 Ockendon Road over an improved section of the M25. Ockendon Road would be realigned to the south of its existing route and elevated by 1m for the new structure. A new bridge (Structure Ref. BRN0000083), approximately 30m in length and approximately at existing ground level, would be constructed to carry the B1421 Ockendon Road over the A122 northbound link to M25. A new PRoW would be constructed along the edge of the embankment associated with the A122 southbound link road to M25 southbound (Work number 9N).

q. Where the Project link roads pass through Thames Chase Forest Centre, a new PRoW would be constructed from the west of the A122 to Clay Tye Road in the east and Ockendon Road in the south. A new PRoW over the A122 and the improved section of the M25 would be constructed. A new FP230 Thames Chase WCH bridge (Structure Ref. BRN0000088), approximately 163m in length (16m above the Project road northbound link to the M25 and 13.5m above the M25), would be constructed to carry the PRoW from FP232 to FP230 over the multiple existing and proposed highways at this location. This new footbridge would provide access to the east and west of the woodland. A new PRoW would also be constructed from the new Thames Chase WCH bridge to the existing FP230, together with the construction of a new PRoW from Thames Chase Forest Centre and a further new PRoW to the new culvert described below under Work number 9X (Work number 9O).

r. Construction of a new PRoW under the A122, between the existing footpath FP176 and Warley Street. A new private means of access would also be constructed between the new drainage attenuation pond (Work number 9U below) and the existing B186 (Work number 9P).

s. Construction of a gravity highway drainage network incorporating a new attenuation pond and gravity outfall (Pond Ref. POS13-002). The pond would be located between the M25 and the Project road (M25 on slip), and would outfall to the West Mardyke via the gravity outfall. The pond would constructed as a vegetated drainage system with a lined sediment forebay. A private means of access would be constructed for the pond (Work number 9Q).

t. Construction of a gravity highway drainage network incorporating an existing attenuation pond with a new gravity outfall (Pond Ref. POS13-001). The pond is located adjacent to the southbound carriageway of the M25, immediately to the south of the West Mardyke. The pond would be enlarged and reconfigured as a vegetated drainage system with a lined sediment forebay. The pond would outfall to West Tilbury Main via the new gravity outfall. A private means of access would be constructed for the pond (Work number 9R).

u. Construction of a gravity highway drainage network incorporating an existing attenuation pond with a new gravity outfall (Pond Ref. POS14-001). The pond is located adjacent to the southbound carriageway of the M25, immediately to the north of the West Mardyke. The pond would be enlarged and reconfigured as a vegetated drainage system with a lined sediment forebay. The pond would outfall to West Tilbury Main via the new gravity outfall. A private means of access would be constructed for the pond (Work number 9S).

v. Construction of a gravity highway drainage network incorporating a new attenuation pond and gravity outfall (Pond Ref. POS14-002). The pond would be located immediately to the north of the B187 St Marys Lane and adjacent to the northbound carriageway of the M25. The pond would constructed as a vegetated drainage system with a lined sediment forebay. The pond would outfall to local watercourse via the new gravity outfall. A private means of access would be constructed for the pond (Work number 9T).

w. Construction of a gravity highway drainage network incorporating an existing attenuation pond with a new gravity outfall (Pond Ref. POS14-003). The pond is located adjacent to the southbound carriageway of the M25, immediately to north of the Shoeburyness railway line. The pond would be enlarged and reconfigured as a vegetated drainage system with a lined sediment forebay. The pond would outfall to local watercourse via the new gravity outfall. A private means of access would be constructed for the pond (Work number 9U).

x. Construction of a gravity highway drainage network incorporating an existing attenuation pond with a new gravity outfall (Pond Ref. POS14-005).

The pond is located adjacent to the southbound carriageway of the M25, immediately to the north of M25 junction 29. The pond would be enlarged and reconfigured as a vegetated drainage system with a lined sediment forebay. The pond would outfall to local watercourse via the new gravity outfall. A private means of access would be constructed for the pond (Work number 9V).

y. Diversion of an unnamed watercourse over a stretch of approximately 1,089m (Ref. D-EFR-5-01) including 558m via a new culvert. The part of the watercourse in culvert includes an 87m section that crosses under the proposed northbound link road between the Project road and the M25 (Ref X-EFR-5-01) (Work number 9W). A new private means of access to the culvert would also be constructed (Work number 9M).

z. Diversion of an existing watercourse, via a new culvert under the improved section of the M25 (Work number 9E above). The new culvert would be approximately 100m in length (Work number 9X).

aa. Construction of a new PRoW over the improved A127, west of the existing M25 junction 29; together with the construction of a new WCH bridge referred to as the A127 WCH bridge west (Structure Ref. BRN0000090), to carry the new PRoW at this location. The new combined pedestrian, cyclist and equestrian use bridge would be approximately 70m in length, with an additional approximately 270m of ramps (Work number 9Y).

bb. Construction of a new PRoW over the improved A127, east of the existing M25 junction 29; together with the construction of a new WCH bridge, referred to as the A127 WCH bridge east (Structure Ref. BRN0000089) to carry the new PRoW at this location. The new combined pedestrian, cyclist and equestrian use bridge would be approximately 55m in length, with an additional approximately 370m of ramps (Work number 9Z).

cc. Provision of compensatory flood storage to offset the loss of storge volume in the Mardyke floodplain (Ref. M25-CFSA-1). The compensatory storage area would be formed by widening the West Mardyke by 4m over a stretch of 75m, immediately upstream of the point where is passes under the M25 (Work number FCA5).

dd. Provision of compensatory flood storage to offset the loss of storge volume in the Mardyke floodplain (Ref. M25-CFSA-2). The compensatory storage area would be located adjacent to the northbound carriageway of the M25 and immediately north of the West Mardyke. The compensatory flood storage would comprise a 0.10m to 0.20m deep scrape over an area of approximately 0.3ha.(Work number FCA6 and FCA7).

2.3.193 As discussed for Section 1 above, where existing local roads would be affected by the Project, provision has been made to reconnect the roads or a reasonable alternative route would be available.

2.3.194 In addition to the above works, the Project includes the provision of additional landscaping with planting around the new A122 Lower Thames Crossing/M25 junction, between North Road and Ockendon Road, North Ockendon. This landscaping includes the construction of three landforms/landscape features, using material generated from elsewhere during the construction of the Project, to help integrate the Project route into the surrounding landscape and to provide noise buffers and visual screening of the new road for the surrounding communities.

2.3.195 The southernmost of these landforms would abut the northbound carriageway of the A122, between North Road and the Upminster and Grays branch railway line. It is proposed that this feature would extend 6m in height above the existing ground level and 5m above the A122, which would be constructed below ground level in cutting at this location.

2.3.196 The other two landscape features would be constructed between the northbound A122 and the M25, either side of Ockendon Road. The northernmost of these would extend up to 13.5m in height above the A122 and 10m above the M25 at its highest point, sloping down 13.5m from Ockendon Road to the A122. The middle landscape feature would extend 15m in height above the A122 and 10m above the M25 at its highest point.

2.3.197 The heights of these landforms can vary within the extents defined in the LOD for highways, summarised in Section 2.2 of this chapter. This enables the ongoing design development and construction of the Project the flexibility to respond to design improvements and unforeseen constraints.

2.3.198 These proposed landscaped areas are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2).

Utilities works

2.3.199 Permanent diversions of the utility networks would be required within Section 9 as listed below. Further information on all utilities diversions, including temporary utilities diversions, is provided in Sections 2.6 and 2.7 of this chapter.

a. Diversion of approximately 1km of UKPN 132kv overhead powerline network including the construction of two new pylons, the removal of two existing pylons and restringing of approximately 1.3km of overhead line network (Work number OH8).

b. Capping and removal of a section of the ex-Barking Power Station high-pressure gas pipeline (Work number G9). Work number G9 is up to approximately 1.15km of the pipeline to be removed. Work number G9 extends into Section 8.

c. Diversion of approximately 0.63km of Cadent high-pressure gas pipeline north of M25 junction 29 (Work number G10).

d. Diversion of approximately 3.12km of Essex and Suffolk Water trunk water main (Work number MU72).

e. Installation of multi-utility corridors of assets including UKPN electricity networks, Anglian Water and Thames Water foul sewers, Essex and Suffolk Water water mains, Cadent gas pipelines, Openreach and other utility companies' strategic telecommunication cable routes (Work numbers MU71 to MU92). Work number MU71 extends into Section 8. Work number MU87 requires the installation of new poles and pole-mounted transformer equipment.

Special category land

2.3.200 As outlined for Section 1, where the proposed Project road and its construction results in permanent impacts on common land and open space sites, the Applicant would provide replacement open space and common land parcels within the Order Limits in accordance with the requirements of sections 131 and 132 of the Planning Act 2008. For Section 9, this includes replacement land in response to the permanent acquisition of land and rights over the designated open space land at Thames Chase Forest Centre, located to the north of Ockendon, straddling this section of the M25 (Work numbers OSC10, OSC11 and OSC12). The replacement land for this site would be split into two parts: one area to the south and one area to the north of the forest, on the western side of the M25. The land would be accessed through the existing site and footpath network.

2.3.201 The land would be designed to match the existing forest and is being developed in collaboration with stakeholders. There would be additional access from the proposed new footbridge over the M25, connecting the forest to the Land of the Fanns, a low-lying area made up of the northern Thames-side marshes, fens and fanns, and the wider environment. There would also be further opportunities to provide access to the north of the site from St Marys Lane.

2.3.202 This replacement land comprises approximately 156,100m^2 (compared with approximately 141,300m^2 which is proposed to be acquired, or be subject to rights).

2.3.203 In addition to this, replacement land is also proposed in exchange for the permanent acquisition of land and rights over it at Folkes Lane Woodland (an area that forms part of the wider Thames Chase Community Forest network of woodlands), located to the north of M25 junction 29 on the western side of the M25. The replacement open space land would be provided on the eastern side of the M25, within a new area of woodland planting at Hole Farm. This area will be linked to the current area by the existing bridge over the M25. The landscaping would complement the existing site and allow the spaces to link together.

2.3.204 This replacement land comprises approximately 29,200m^2 (compared with approximately 17,800m^2 which is proposed to be acquired, or be subject to rights).

Private recreational facilities

2.3.205 In addition to public open space and common land sites, the Project would also affect a number of private recreational facilities either temporarily or permanently.

2.3.206 For Section 9, the Manor Farm Fishing Lake is just outside of the Order Limits, but the Applicant is proposing to install bat boxes on the lakeside trees surrounding the lake. This would not adversely affect the operation of the lake for fishing purposes and no direct works are proposed to the lake.

2.3.207 The Hobb's Hole Fishing Lake is just outside of the Order Limits and the Applicant is not proposing any direct works to the lake itself and the operation of the lake for fishing purposes could continue. However, the land surrounding the lake would be replacement open space (Thames Chase Forest Centre) as a result of the Project. As such, the access arrangements to the fishing lake would be changed.

2.3.208 The Moat Lake Fishing Lake is just outside of the Order Limits and no direct works are proposed to the lake. The operation of the lake for fishing purposes could therefore continue. The Applicant is however proposing to improve and upgrade the route used to access the lake.

2.3.209 The InFitness Gym at Franks Farm is located just outside of the Order Limits. The Applicant is proposing utilities diversion works to the south and to the north of the gym. However, these works would not adversely affect the existing use.

2.3.210 The Applicant is proposing to use a small area of Cranham Golf Course along an existing watercourse for flood mitigation works. This work would not adversely affect the operation of the golf course.

Environmental mitigation and compensation

2.3.211 As part of the Project, design, mitigation and compensation measures are proposed to reduce and offset adverse environmental effects. These include some of the key features described above under key works elements for each section of the Project. These measures include green bridges, flood compensation areas, PRoW improvements, replacement special category land and acoustic measures.

2.3.212 The key principles that will underpin the design for the mitigation measures and the integration of the Project into the landscape are described within the Design Principles (Application Document 7.5). The location of environmental mitigation and compensation features embedded within the Project design are shown within Figure 2.4: Environmental Masterplan (Application Document 6.2). The oLEMP also outlines the proposed management of the landscape and ecological elements.

2.3.213 In addition to the key features described above, the following ecological mitigation and compensation measures are proposed for the Project. These are not set out by individual Project Section as many areas of mitigation/compensation are distanced from the A122 carriageway and its connections with the existing highway network.

a. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located south-east of M2 junction 3, between Kit's Coty and

Westfield Sole (Work number E1). This area of nitrogen deposition compensation planting (Site Reference: Blue Bell Hill) is located remotely from the Project road, approximately 9km south-east of Section 1, and comprises approximately 72.2ha of habitat creation, primarily of woodland.

b. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located south-west of M2 junction 3, north-west of Kit's Coty (Work number E2). This area of nitrogen deposition compensation planting (Site Reference: Burham) is located remotely from the Project road, approximately 8km south-east of Section 1, and comprises approximately 9.7ha of habitat creation, primarily of woodland.

c. Provision for ancient woodland planting compensation, located north of Park Pale, north-west of M2 junction 1 (Work number E3), including the construction of a new bat barn structure (BBr1). This area of mitigation is located near Project Section 1 and has been identified to offset the loss of ancient woodland.

d. Provision for a receptor site for protected species located north of the improved A2 corridor, between Brewers Road and Thong Lane (Work number E4). This area of mitigation is located near Project Section 1.

e. Provision for a receptor site for protected species located south of the improved A2 corridor and the HS1 railway line, west of Brewers Road (Work number E5). This area of mitigation is located near Project Section 1.

f. Provision for a receptor site for protected species, including the construction of a new bat barn structure (BBr4) and new ecological ponds, located north-east of Thong Lane (Work number E6). This area of mitigation is located near Project Section 2.

g. Provision for a receptor site for protected species, including the construction of a new bat barn structure (BBr2), located south of the improved A2 corridor and the HS1 railway line, west of Henhurst Road (Work number E7). This area of mitigation is located near Project Section 2.

h. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located directly west of Henhurst Road (Work number E8). This area of nitrogen deposition compensation planting (Site Reference: Henhurst Hill) is located near Project Section 2 and comprises approximately 9.1ha of habitat creation, primarily of woodland.

i. Provision for a site for ancient woodland planting compensation located north-west of the new M2/A2/A122 Lower Thames Crossing junction, north of Claylane Wood (Work number E9). This area of mitigation is located near Project Section 2 and has been identified to offset the loss of ancient woodland.

j. Provision for a site for ancient woodland planting compensation located east of the new Thong Lane green bridge north over the A122 (Work number E10), including the construction of a new bat barn structure (BBr3). This area of mitigation is located near Project Section 3 and has been identified to offset the loss of ancient woodland.

k. Provision for a site for ancient woodland planting compensation located south-west of Shorne, south of Shorne Ifield Road (Work number E11). This area of mitigation is located near Project Section 3 and has been identified to offset the loss of ancient woodland.

l. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located south of Shorne, west of Woodlands Lane (Work number E12). This area of nitrogen deposition compensation planting (Site Reference: Fenn Wood) is located near Project Section 1 and comprises approximately 5.8ha of habitat creation, primarily of woodland.

m. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located south-east of Shorne and Swiller's Lane (Work number E13). This area of nitrogen deposition compensation planting (Site Reference: Court Wood) is located near Project Section 1 and comprises approximately 27.7ha of habitat creation, primarily of woodland.

n. Provision for a receptor site for protected species around the North Portal (Work number E14). This area of mitigation is located near Project Section 5.

o. Provision for a receptor site for protected species at East Tilbury Marshes, west of Coalhouse Fort Park (Work number E15). This area of mitigation is located near Project Section 5.

p. Provision for a receptor site for protected species, including the construction of new ecological ponds located north of Coalhouse Fort Park (Work number E16). This area of mitigation is located near Project Section 5.

q. Provision for a receptor site for protected species, including the construction of a new bat barn structure (BBr5) located west of Princess Margaret Road, north-west of Coalhouse Fort Park (Work number E17). This area of mitigation is located near Project Section 5.

r. Provision for a receptor site for protected species, located south of Church Road, west of the Tilbury Loop railway line (Work number E18). This area of mitigation is located near Project Section 5.

s. Provision for a receptor site for protected species, located north-east of the Tilbury Viaduct, south of the Muckingford Road green bridge (Work number E19). This area of mitigation is located near Project Section 5.

t. Provision for a receptor site for protected species, located north-east of the Muckingford Road green bridge (Work number E20). This area of mitigation is located near Project Section 6.

u. Provision for a receptor site for protected species, located west of Hoford Road (Work number E21). This area of mitigation is located near Project Section 6.

v. Provision for a receptor site for protected species, located south-west of Collingwood Farm, west of Hoford Road (Work number E22). This area of mitigation is located near Project Section 6.

w. Provision for a receptor site for protected species, located north-west of Hoford Road green bridge (Work number E23). This area of mitigation is located near Project Section 6.

x. Provision for a site for ancient woodland planting compensation, located north-west of Hoford Road green bridge (Work number E24), including the construction of a new bat barn structure (BBr6). This area of mitigation is located near Project Section 6 and has been identified to offset the loss of ancient woodland.

y. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located north of the A122, west of Hoford Road (Work number E25). This area of nitrogen deposition compensation planting (Site Reference: Hoford Road) is located near Project Section 6 and comprises approximately 21.6ha of habitat creation, primarily of woodland.

z. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located directly west of Buckingham Hill Road (Work number E26). This area of nitrogen deposition compensation planting (Site Reference: Buckingham Hill) is located near Project Section 6 and comprises approximately 24.4ha of habitat creation, primarily of woodland.

aa. Provision for a site for protected species, including the construction of at least one new ecological pond, located north of the A122, east of Hornsby Lane (Work number E27). This area of mitigation is located near Project Section 7.

bb. Provision for a receptor site for protected species, including the construction of at least one new ecological pond, located north of the A122, west of Hornsby Lane (Work number E28). This area of mitigation is located near Project Section 7.

cc. Provision for a receptor site for protected species, including the construction of at least one new ecological pond, located west of the A13/A1089/A122

Lower Thames Crossing junction, directly north of Long Lane (Work number E29). This area of mitigation is located near Project Section 7.

dd. Provision for a receptor site for protected species, including the construction of at least one new ecological pond, located west of the A13/A1089/A122 Lower Thames Crossing junction, directly south of the A13 (Work number E30). This area of mitigation is located near Project Section 7.

ee. Provision for a receptor site for protected species located west of the A13/A1089/A122 Lower Thames Crossing junction, directly south of the A13 (Work number E31). This area of mitigation is located near Project Section 7.

ff. Provision for a receptor site for protected species, located north-east of the A13/A1089/A122 Lower Thames Crossing junction, north of High Road (Work number E32). This area of mitigation is located near Project Section 7.

gg. Provision for a receptor site for protected species, located north of the A13/A1089/A122 Lower Thames Crossing junction, directly west of Fen Lane (Work number E33). This area of mitigation is located near Project Section 7.

hh. Provision for a receptor site for protected species, located north of the A13/A1089/A122 Lower Thames Crossing junction, directly west of Fen Lane (Work number E34). This area of mitigation is located near Project Section 7.

ii. Provision for a receptor site for protected species, including the construction of a new bat barn structure (BBr7), located east of the A122, around the existing reservoir at Orsett Fen (Work number E35). This area of mitigation is located near Project Section 8.

jj. Provision for a receptor site for protected species, including the construction of a new bat barn structure (BBr8) and at least one new ecological pond, located either side the A122 at Orsett Fen (Work number E36). This area of mitigation is located near Project Section 8.

kk. Provision for a receptor site for protected species, located east of the A122, west of Parker's Farm Road (Work number E37). This area of mitigation is located near Project Section 8.

ll. Provision for a receptor site for protected species, located east of South Ockendon Hall (Work number E38). This area of mitigation is located near Project Section 8.

mm. Provision for a receptor site for protected species, located east of the A122, west of Parker's Farm Road (Work number E39). This area of mitigation is located near Project Section 8.

nn. Provision for a receptor site for protected species, located west of the Mardyke Viaduct (Work number E40). This area of mitigation is located near Project Section 8.

oo. Provision for a receptor site for protected species including the construction of at least one new ecological pond, east of the footbridges over the A122 and Upminster and Grays branch railway line (Work number E41). This area of mitigation is located near Project Section 9.

pp. Provision for a receptor site for protected species, located south of Top Meadow Golf Course (Work number E42). This area of mitigation is located near Project Section 9.

qq. Provision for a receptor site for protected species, located west of the M25, north of Dennises Lane (Work number E43). This area of mitigation is located near Project Section 9.

rr. Provision for a receptor site for protected species, located west of the M25, east of Pea Lane (Work number E44). This area of mitigation is located near Project Section 9.

ss. Provision for a receptor site for protected species, including the construction of a new bat barn structure (BBr9), located west of the M25, east of Pike Lane (Work number E45). This area of mitigation is located near Project Section 9.

tt. Provision for a receptor site for protected species located west of the M25, north-east of Thames Chase Forest Centre (Work number E46). This area of mitigation is located near Project Section 9.

uu. Provision for a receptor site for protected species, including the construction of at least one new ecological pond, located directly west of the B186 and south of the B187 St Marys Lane (Work number E47). This area of mitigation is located near Project Section 9.

vv. Provision for a receptor site for protected species, including the construction of at least one new ecological pond, located west of the M25 and south of the B187 St Marys Lane (Work number E48). This area of mitigation is located near Project Section 9.

ww. Provision for a site for ancient woodland planting compensation, located directly north-west of M25 junction 29 (Work number E49). This area of mitigation is located near Project Section 9 and has been identified to offset the loss of ancient woodland.

xx. Provision for a site for ancient woodland planting compensation, including the construction of at least one new ecological pond (Work number E50). This is located north-east of M25 junction 29 and Codham Hall Wood and is part of the proposals for Hole Farm. This area of compensation is located near Project Section 9 and has been identified to offset the loss of ancient woodland. It is anticipated that the woodland planting as part of the Hole Farm proposals will start in winter 2022/2023 and will have begun to become established prior to the commencement of construction of the Project.

yy. Provision for a receptor site for protected species, including the construction of at least one new ecological pond, located west of the M25, north of Folkes Lane Woodland (Work number E51). This area of mitigation is located near Project Section 9.

zz. Creation of compensatory habitat to compensate for the effects of nitrogen deposition, located east of the M25 at Hole Farm (Work number E52). This area of nitrogen deposition compensation planting (Site Reference: Hole Farm East) is located near Project Section 9, approximately 750m north of M25 junction 29 and comprises approximately 75.2ha of habitat creation, primarily of woodland. It is anticipated that the habitat creation as part of the Hole Farm proposals would start in winter 2022/2023 and will have started to become established before the start of the Project's construction.

aaa. Provision of an area of temporary ecological habitat creation south of the River Thames (Work number ET1). This area of temporary habitat creation is located near Project Section 4.

2.4 Description of the Project

2.4.1 This section of the chapter provides a general description of the Project and its design, supplementing the Section-specific information provided in Section 2.3 of this chapter.

Highways design

Highways alignment

2.4.2 The highways alignment of the A122, altered existing roads, local roads, junctions and associated slip roads are shown on the General Arrangement drawings (Application Document 2.5). The highways alignments are described in Section 2.3 of this chapter for each of the Project Sections.

2.4.3 The alignments of the highways can vary within the extents defined in the LOD, as identified in article 6 of the draft DCO (Application Document 3.1) and summarised in Section 2.2 of this chapter. This enables the ongoing design development and construction of the Project to have the flexibility to respond to design improvements and unforeseen constraints.

Design speed

2.4.4 A key parameter for the design of a highway is the design speed. This determines the geometry and layout of the road and junctions.

2.4.5 The design speed for the A122 and the improved sections of A2/M2 and M25 is 120kph (74.6mph), with a 70mph (112.7kph) speed limit.

2.4.6 In accordance with the requirements of DMRB TD 22/06 Layout of Grade Separated Junctions (Highways Agency, 2006) the design speeds of connector roads (a collective term for interchange link, slip roads and link roads) are:

a. Interchange links (free-flow links within an interchange): 85kph (52.8mph)

b. Slip roads: 70kph (43.5mph)

c. Link roads (one-way connector roads adjacent to but separate from the A122): 120kph (74.6mph) or 100kph (62.1mph)

2.4.7 Notwithstanding the different design speeds, the signed speed limit within the grade-separated junctions (such as connector roads) is proposed to be 70mph (112.7kph), as is standard practice.

Highways cross-sections

2.4.8 A122 lane widths would be in accordance with the appropriate design standards. The main three-lane roads would be approximately 11m wide with 1m-wide hard strips on each side. From the M25 to the A13, where the road is two-lanes southbound the width would be 7.3m with a 1m wide hard strip. The widths of the central reserve and verge would vary with widening being provided either for sight lines or to accommodate items such as signs and drainage. The minimum central reserve width would be approximately 4.5m (including hard strips). The minimum verge width would be approximately 5.4m (including hard strips) except at structures.

2.4.9 Emergency areas would be provided on the A122 outside the tunnel at regular intervals no greater than 1,600m. These would be 4.6m-wide places of relative safety (a facility where road users may stop in an emergency) which would be a minimum of 100m long (including tapers). Some of the emergency areas would be combined with maintenance hardstandings which would generally be at the locations of features and equipment such as variable message signs (VMSs), CCTV cameras and communications cabinets.

2.4.10 Slip road cross-sections would vary. Two-lane slip roads would generally have 7.3m-wide carriageways with 1m-wide hard strips, and one-lane slip roads would have a 3.7m-wide running lane and a 3.3m-wide hard shoulder nearside. The two-lane parallel link roads at the A2 would be 7.3m wide with 1m-wide hard strips on the edge of the carriageway. The northbound two-lane parallel link road at the M25 would be 7.3m wide with a 3.3m-wide hard shoulder.

Road pavement and road surfacing

2.4.11 The road pavement design has been based on the DMRB standards as published in 2019 (which were current at the point of concluding the preliminary design), as discussed in Section 2.2 of this chapter. However, during the

detailed design stage, updated DMRB standards would be incorporated to reflect the current DMRB standards at that point in time.

2.4.12 New pavement is designed to have an operational lifespan of 40 years; the construction thickness and material choice would be influenced by traffic flows and may vary throughout. Three pavement options would be considered, including rigid, flexible and flexible composite, for whole-life cost analysis.

2.4.13 Existing pavements which are affected by the Project would be investigated, and maintenance design options would be provided to ensure a maintenance-free period of five years following construction.

2.4.14 A Thin Surface Course System (TSCS) has been assumed for all new and altered highways associated with the Project, which is a low noise surface that generates lower road traffic noise levels than a standard hot rolled asphalt pavement surface. Further information on location-specific provision for low noise surfacing is described in Chapter 12: Noise and Vibration and shown on Figure 12.6: Operational Road Traffic Noise Mitigation, of this ES (Application Document 6.2).

Highways earthworks

2.4.15 The earthworks required by the Project comprise cuttings, embankments, bunding, retaining walls and landscaping. These elements are detailed in Table 2.3 Where suitable, material obtained from onsite excavations would be reused for the construction of embankments and false cuttings. This mitigation measure, which is discussed further in Chapter 11: Material Assets and Waste, would reduce adverse impacts associated with waste disposal and transport movements.

2.4.16 Earthworks associated with highways works fall under the LOD defined for highways in the draft DCO (Application Document 3.1).

Table 2.3 Earthwork elements

Section	Element	Height
Sections 2 / 3	False cutting along M2/A2/A122 Lower Thames Crossing junction slip road	4m above slip roads/visual mitigation
Section 3	Tunnel approach cutting	Up to 28m Below Ground Level (BGL)
Section 5	The North Portal operational access road has been designed to sit above flood level. Two sections of the mainline in this section would be vulnerable to overtopping during a tidal flood event and would need to be protected. The first vulnerable section would be a 265m long stretch that straddles West Tilbury Main. The protection would comprise a retaining wall with an earth mound behind it, rising to the design flood level (7.83mAOD). The protection would be keyed into the high ground around the North Portal and tie-in	7.83m Above Ordnance Datum (AOD) earth bund rising to 9m AOD in future fill by Ingrebourne Valley Limited (IVL).

Section	Element	Height
	with the earthworks for the operational access road. The second vulnerable section would be along parts of the slip roads between the mainline and the operational access road. The protection would be incorporated as bunds within the earthworks for the slip roads.	
	A122 in tunnel approach structure	Up to 12.8m BGL
Section 6	A122 at Hoford Road in cutting	Up to 8.5m BGL
	False cuttings along Chadwell St Mary link both sides of the Project	4m above the A122/noise mitigation
	Muckingford Road slackened slopes to blend landscaping in with green bridge	Up to 7m AGL
Section 7	False cutting along junction slip roads	Either 2m or 4m above slip roads/visual or noise mitigation
	A122 in cutting	Between 2m and 5m BGL
	Engineered earth slope between A13 slip road and A1013 to soften slope	10m AGL
Section 8	False cuttings along Ockendon link both sides of the A122 south of the floodplain and along the southbound carriageway between FP136 and The Wilderness	2m above the A122/visual mitigation
	A122 on embankment in in the floodplain between viaducts	6.2m AGL
	Retaining walls either side of the Project between the landfill and The Wilderness	5.5m BGL
	False cuttings between North Road and the M25	5m above the A122/noise and visual mitigation
	Green Lane slackened slopes to blend landscaping in with green bridge	Up to 12m AGL
	North Road slackened slopes to blend landscaping in with green bridge	Up to 3m AGL
Section 9	False cuttings between North Road and the M25	5m above the A122/noise and visual mitigation
	False cutting to slip roads bordering Thames Chase Forest Centre with slackened slope for planting	2m above the A122/visual mitigation
	Slip road slackened slope between Ockendon Road and the M25 for agriculture	13.5m in height above the A122 and 10m above the M25 at its highest point
Project-wide – Local roads	Embankments and cutting where not landscaped	Varies throughout Project route

Highways structures

2.4.17 The Project includes 50 new highway and pedestrian bridge structures, including overbridges, underpasses, viaducts and footbridges. Other ancillary structures including field bridges, retaining walls and culverts would also be required. Nine new viaducts are included within the Project to provide crossings where required and provided with a maintenance access track where required. In addition, widening and other modifications of existing structures are required. These can be seen on the General Arrangement drawings (Application Document 2.5), Engineering Drawings and Section (Application Document 2.9) and the Structures Plans (Application Document 2.13).

2.4.18 The Project would also require the demolition of nine existing bridges, comprising five road bridges and four field bridges. The proposed new highways structures, together with those existing structures to be impacted by the Project, are described in Section 2.3 of this chapter for each of the Project Sections. In addition to the above highway structures, modifications to existing retaining walls, bridges and culvert structures along the Project route would be undertaken as required during the detailed design.

2.4.19 The Project design has incorporated existing bridges where practicable; there are four existing bridges on the A2, three on the A13 and five on the M25, some of which will require widening to accommodate additional lanes or layout upgrades. The highway structures included in the Project are shown on the Structures Plans (Application Document 2.13).

2.4.20 Seven green bridges would be included in the Project to mitigate the severance and fragmentation of habitat resulting from the Project. Green bridges are described further under the 'Environmental mitigation and compensation' subheading below. Further information on the design of the green bridges is also available in the Design Principles (Application Document 7.5) and Project Design Report (Application Document 7.4).

2.4.21 As described in Section 2.2 of this chapter, Project Enhanced Structures would be included in the Project to enhance the aesthetic quality of the road and its relationship with the places it passes through. As described in detail in the Project Design Report (Application Document 7.4), the Project Enhanced Structures are as follows:

a. Thong Lane green bridge north

b. South Portal (including tunnel approach ramp and retaining walls, and the TSB)

c. North Portal (including tunnel approach ramp and retaining walls, and the TSB)

d. North Portal operational access bridge

e. Mardyke and Orsett Fen Viaducts

f. Thames Chase WCH bridge

2.4.22 The LOD for structures are as defined for highways in the draft DCO (Application Document 3.1). Horizontal LOD are as shown in the Works Plans (Applicational Document 2.6), and additional LOD for structures are shown where these fall outside of the highways LOD.

Highways lighting

2.4.23 This section describes lighting on roads outside of the Tunnel. Lighting within the Tunnel is described in the next subsection on Tunnel design under the 'Tunnel Lighting' heading.

2.4.24 The road lighting for the Project, has been designed in accordance with current standards and requirements. The sections of the Project road that would be lit are as follows:

a. All highway areas from the South Portal southwards to the southern end of the Project at the M2

b. From the North Portal 200m northwards

c. The A13/A1089/A122 Lower Thames Crossing junction

d. All areas of the M25 involved in the Project

e. All of the All Purpose Trunk Roads (APTRs) tying into existing APTR sections with existing lighting

2.4.25 Any highway underbridge longer than 35m would be provided with night-time lighting as a minimum (subject to the relevant adopting highway authorities' lighting strategies/policies).

2.4.26 Environmental impact has been considered in the lighting design in the following ways:

a. Column heights have been kept as low as practicable while still providing a compliant lighting design. Column heights used would vary between 5m and 15m.

b. Luminaires have been selected which would emit no light above the horizontal to reduce skyglow and ensure light is only projected to where it is needed.

c. Light Emitting Diode (LED) light sources would be used to reduce energy consumption and offer a more readily recyclable product at the end of life, compared to traditional light source lamps and luminaires.

d. As LED light sources require less energy to operate, they require smaller cables, which reduces the amount of copper required for the installation.

e. Lighting levels can be linked to the live traffic flow, so that during quiet periods the lighting is dimmed to reduce energy consumption.

f. The lighting columns would be placed in the verges projecting towards the central reserve wherever practicable to reduce light spill into adjacent areas.

g. The unlit sections of the Project road would provide 'dark corridors' for photosensitive species such as bats to cross or feed near the highway.

h. Luminaires have been selected with warm white (3,000K) LEDs to reduce the impact on wildlife of any light spill, as research has shown insects and bats, for example, are less attracted to warm white compared to cool white light due to the reduced UV emissions. Also, ongoing research shows that warm white light reduces 'white line loss' on wet highways when compared to cool white (i.e. warm white light gives a better contrast between the road surface and road markings on a wet road).

Technology, gantries and signage

2.4.27 The technology assets that would be provided by the Project include the following:

a. Variable message signs (VMSs)

b. Lane control signals

c. Entry slip signals

d. Emergency roadside telephones

e. Closed-circuit television (CCTV)

f. Traffic detection equipment

g. Stopped vehicle detection

h. Weather monitoring equipment

i. Traffic management technology at the tunnel portals

j. Road user charging infrastructure as appropriate

k. Equipment cabinets

l. Tunnel specific technology, including provision of emergency/incident management technology

2.4.28 VMSs and emergency areas would be provided along the Project route based on National Highways guidance. These signs would be used by the existing National Highways Regional Operations Centre to display travel information, hazard warnings and both advisory and mandatory signage to drivers. The signs would be a standard National Highways design and mounted on gantries located in the verge. Where practical, the signs would be co-located with gantry-mounted direction signage to reduce the number of gantries on the road.

2.4.29 On each approach to the tunnel, LED matrix lane control signals would be mounted on cantilever gantries above each lane. These would allow National Highways to manage traffic before entering the tunnel, applying any lane closures or speed restrictions in advance, to allow traffic to flow freely through the tunnel. Where practical, the signals would be located on gantries provided for other purposes.

2.4.30 CCTV masts would typically also be sited at emergency areas, with additional masts installed if necessary, to avoid blind-spots and provide surveillance coverage of the whole road. Standard CCTV mast height is between 10m and 15m above ground level.

2.4.31 Traffic detectors would be mounted on poles in the verge at approximately 500m spacing, co-located with emergency areas or other accessible locations wherever practicable. The detectors are needed to control automatic traffic management systems (for example variable speed limits) and to collect data on traffic flows. The poles are up to 8m high. Stopped vehicle detectors would be mounted on gantry legs wherever possible, or otherwise on poles approximately 4.5m high, up to 500m apart and co-located with other technology equipment sites.

2.4.32 Wherever practicable, equipment cabinets would be co-located with emergency areas or clustered at locations that offer safe maintenance access, such as from adjacent land.

2.4.33 The need for any additional VMSs on the roads approaching the A122 (including but not limited to the A2, A13 and M25) would be considered as part of the future Project development such as during the detailed design stage. It is possible that limited additional VMSs could be needed as the approach roads are already equipped with highway communications equipment. However, it may be necessary to move or add signage to enable drivers to be advised of alternative routes when either the Project or Dartford Crossing is congested or closed. It is expected that VMSs for strategic diversions would be mounted on cantilever structures, providing a display matrix.

2.4.34 In conjunction with the requirements for technology, highways signs would be included in the design. This could include both gantry and roadside mounted signs. Where large advanced directional signs (ADS) are needed, their height would be kept to a minimum using reduced letter heights where standards permit.

Existing roads

2.4.35 The A2 between M2 junction 1 and the M2/A2/A122 Lower Thames Crossing junction would be an APTR but would have additional vehicle restrictions imposed and managed through signage. Pedestrians, low-powered motorcycles, cyclists, horse riders and agricultural vehicles would be prohibited, and technology would be provided according to the latest standards.

2.4.36 The technology design for the M25 would support Variable Mandatory Speed Limits (VMSL). VMSL would also be provided on the improved A2 and M2 on each link approaching the M2/A2/A122 Lower Thames Crossing junction. Lane control signals would be provided on the A2 and M2 on each link downstream from the M2/A2/A122 Lower Thames Crossing junction.

Gantries

2.4.37 Gantries supporting the technology assets listed above along the Project road would be positioned to reduce the construction footprint and environmental impact. This would be achieved by co-locating ADS, VMSs and lane signals (advanced motorway indicators (AMI)) where feasible.

2.4.38 National Highways guidance on the selection of gantry types has been followed. Gantries would have a clear headroom beneath the gantry arm of at least 5.7m. The proposed gantry types are summarised as follows:

a. MS4 cantilever – single-leg structure in verge with VMS straddling a single lane. These gantries would be located throughout the Project.

b. Cantilever – single-leg structure in verge with ADS/VMS/AMI straddling a single carriageway. These gantries would be located throughout the Project.

c. Super portal – full span straddling both carriageways or full width of a single carriageway, for example slips or connector roads, with two legs in both carriageway verges. These gantries are proposed on the improved A2, improved A13, improved M25, the A122 and potentially on the M2 if existing gantry positions do not suit the revised road layout.

2.4.39 Gantries carrying technology would generally be equipped with caged ladders and walkways for maintenance access.

2.4.40 The gantry positions are shown on the General Arrangement drawings (Application Document 2.5). Gantries are also shown in the Structures Plans (Application Document 2.13).

2.4.41 Additional signage elements include countdown markers, marker posts, driver location signs and emergency area signing.

Direction signs

2.4.42 Where practicable, direction signs along the Project route would be positioned to reduce the construction footprint and environmental impact by co-locating with technology, for example on gantries.

2.4.43 Many of the existing direction signs along roads within the Order Limits (A2, M2, A13 and M25) would need to be changed to include the new destinations available but will be retained where there is no change necessary.

Highways drainage

2.4.44 The drainage design has been developed in accordance with current standards and the requirements of the Environment Agency and Lead Local Flood Authorities (LLFA) where applicable. Assessments, including the Flood Risk Assessment (Application Document 6.3, Appendix 14.6) and the Water Framework Directive Assessment (Application Document 6.3, Appendix 14.7), have informed the development of the drainage design. The drainage strategy is described in detail within Part 7 of the Flood Risk Assessment and shown on the Drainage Plans (Application Document 2.16).

2.4.45 The proposed drainage system has been designed to rapidly remove water from the carriageway and to manage water quality. The drainage design considers ease of access for maintenance interventions, the effects of climate change and the environmental setting of the catchment.

2.4.46 The design includes the provision of both infiltration basins and attenuation ponds. The differences between the two are outlined below.

2.4.47 Infiltration basin are shallow depressions that detain storm water flows as temporary storage and allow water to percolate through a permeable base. The water may be directed to a surface water outfall, or it may continue to percolate through to groundwater.

2.4.48 Attenuation ponds are ponds designed primarily to attenuate highway runoff. These ponds generally always retain some water.

2.4.49 Tunnel drainage is discussed separately in the next subsection on 'Tunnel design'.

2.4.50 The LOD for drainage are as defined for highways in the draft DCO (Application Document 3.1). Horizontal LOD are as shown in the Works Plans (Application Document 2.6), and additional LOD for drainage are shown where these fall outside of the highways LOD.

South of the River Thames (Project Sections 1 to 3)

2.4.51 Highway runoff would be collected by means of one of the edge of pavement details specified in the DMRB CD 524 (Highways England, 2021). Disposal of surface water runoff from all the drainage catchments south of the River Thames would be via infiltration ponds.

2.4.52 Three existing infiltration basins within the Order Limits would be retained and upgraded as part of the Project and six new infiltration basins would be constructed, two of which comprises multiple cascading infiltration basin features. These basins would serve catchments including both new and existing carriageway surfaces.

2.4.53 Drainage infiltration basins would be designed as vegetated drainage systems in accordance with the relevant provisions of DMRB CD 352 (Highways England, 2020d) and will incorporate a lined sediment forebay with sufficient capacity to accommodate the first flush. Where sediment forebays cannot be accommodated, a vortex grit separator shall be installed upstream of the basin inlet for pollution control.

2.4.54 Infiltration basins would accommodate runoff from the Project road for all events up to and including the 1% annual exceedance probability (AEP) rainfall event with climate change.

2.4.55 One new pumping station would be included to convey flows from the foot of the South Portal ramp to one of the proposed infiltration basins.

North of the River Thames (Project Sections 5 to 8)

2.4.56 Highway runoff would be collected by means of one of the edge of pavement details specified in DMRB CD 524 (Highways England, 2021).

2.4.57 Surface water runoff from highways would be by positive drainage networks that would drain to ponds and a basin, before discharge to watercourses or an existing irrigation reservoir which would be modified.

2.4.58 At the A13, where ground conditions are favourable, Sustainable Drainage (SuDS) features incorporating infiltration techniques would be used for disposal of highway runoff from small, isolated catchments (an infiltration pond and several swales).

2.4.59 Eight new drainage attenuation ponds, one retention pond and one new infiltration basin would be created. An existing infiltration basin would also be retained and modified as part of the Project.

2.4.60 New ponds and the basin would be designed as vegetated drainage systems in accordance with the relevant provisions of DMRB CD 352 (Highways England, 2020d) and would incorporate a lined sediment forebay with sufficient capacity to accommodate the first flush.

2.4.61 The capacity and discharge rates from new ponds would be agreed in conjunction with the Environment Agency (main rivers) or LLFA (ordinary watercourses), subject to a minimum discharge rate of 1l/s.

2.4.62 One new pumping station would be included to convey flows from the foot of the North Portal ramp to one of the proposed attenuation ponds.

A122 Lower Thames Crossing/M25 junction and M25 (Project Section 9)

2.4.63 Several existing drainage catchments along the M25 would be affected by the Project. These catchments discharge to the West Mardyke and ordinary watercourses. Four existing drainage attenuation ponds within the Order Limits would be retained and enlarged as part of the Project. Two new drainage attenuation ponds would also be created.

2.4.64 The proposed surface water drainage systems for this section of the Project route are a combination of existing drainage networks (where it is feasible to retain or upgrade them) and new drainage networks. New road edge collection systems would generally be in the form of concrete surface water channels or combined surface and sub-surface drains when the Project road is in cutting.

2.4.65 Surface water runoff from highways would be by positive drainage networks that drain to ponds before ultimate discharge to watercourses. The capacity and discharge rates from new ponds would be agreed in conjunction with the Environment Agency (main rivers) or LLFA (ordinary watercourses), subject to a minimum discharge rate of 1l/s. The capacity of new ponds would also be agreed in conjunction with the Environment Agency (main rivers) or LLFA (ordinary watercourses) but discharge rates would be reduced by at least 50% on existing discharge rates.

Watercourse crossings and diversions

2.4.66 The Project would involve the crossing and diversion of main rivers and ordinary watercourses. Watercourse crossings and diversions are described in detail in the Flood Risk Assessment (Application Document 6.3, Appendix 14.6) and shown on the General Arrangement drawings (Application Document 2.5).

2.4.67 The Project would cross six main rivers and nine ordinary watercourses. To carry the highway across watercourses, the Project would incorporate viaducts, bridges, culverts and a tunnel to cross the River Thames.

2.4.68 Diversion of watercourses is regarded as a last resort and would be avoided where practicable. The reasons for watercourse diversions are as follows:

a. Where a watercourse alignment coincides with the alignment of the Project road

b. Where watercourses cut across the Project road at an oblique angle

c. Where the vertical alignment of the Project road is below existing watercourses

2.4.69 The Project would involve the diversion of West Tilbury Main (main river) in three locations and of ordinary watercourses in 10 locations. In addition, a number of minor diversions would be undertaken to enable watercourses to be aligned with culvert inlets and outlets.

2.4.70 The culverts would maintain the natural channel width at normal flow levels and would replicate the current hydraulic conditions of the existing watercourse through the proposed culvert, so far as is practicable.

2.4.71 It is proposed that the invert level of the culverts is positioned 150mm below the natural bed of the watercourse. This would allow for any future regrading of the watercourse and allows sedimentation to promote the formation of a more natural bed through the culvert (which helps to maintain ecological continuity).

2.4.72 Mammal ledges would be provided along the length of the culverts for wildlife to migrate along the watercourses. If mammal passage is required for pipe culverts, an additional dedicated pipe (overpass) would be provided. Culvert designs would be developed to reduce effects on fish passage where appropriate.

2.4.73 The Project would include the introduction of four watercourse control structures. One of these structures is a two-stage flow control structure on West Tilbury Main. This structure forms an integral part of the flood alleviation measures. The other control structures would manage the level of watercourses in the proposed wetland areas. These level control structures would ensure that water is retained in the wetland.

2.4.74 The net gain in the length of watercourse in channel that would be realised as a result of undertaking the proposed diversions would be approximately 1.7km. Furthermore, approximately 3.2km of watercourse in channel would be realised by formation of the proposed Mardyke Wetland.

Permanent fencing

2.4.75 The fencing required to denote the permanent highway boundary would generally be a timber post and four-rail fence up to a height of 1.4m. This would, however, be complemented or substituted with fencing to an alternative specification to meet other objectives (for example to deter wildlife from reaching the highway) where necessary and appropriate.

Tunnel design

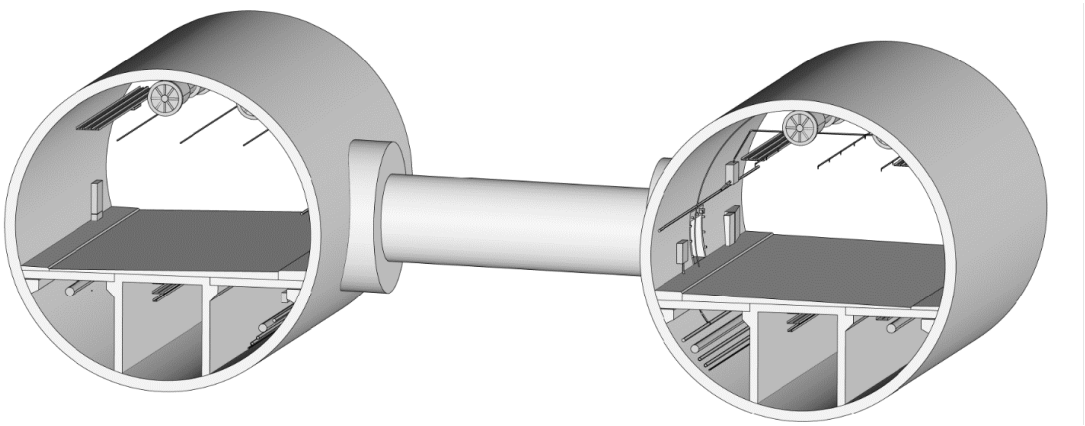
2.4.76 The Project would include twin bored tunnels approximately 4.25km in length, with a cut and cover section of tunnel at either end and a short open ramp section. The tunnel portal is where the traffic enters/exits the tunnel which is at the interface with the approach ramp.

2.4.77 The size of the twin tunnels would be able to accommodate three lanes of traffic, and the external diameter of each tunnel bore would be approximately 16.5m with a maximum road gradient of 4% within the tunnel. The twin bores would typically be horizontally spaced at between 0.5 and 1 times the tunnel diameter.

2.4.78 Cross-passages connecting each tunnel would be provided for emergency evacuation, emergency incident responder access, as well as maintenance works. Connecting cross-passages provided between the tunnel bores would be regularly spaced at approximately 150m intervals.

2.4.79 An indicative cross-section of the tunnels is shown in Plate 2.10.

Plate 2.10 Indicative tunnel cross-section



2.4.80 The vertical tunnel alignment has been developed to achieve appropriate cover beneath the River Thames, as well as critical assets above, and has considered current and historical bathymetric data, likely future navigation channel depths and potential scour of the riverbed. The tunnel is approximately 16.5m diameter and would be constructed approximately 20m below the riverbed at mid-river.

2.4.81 The tunnel has been designed in accordance with current standards and would achieve the safety requirements for tunnels on the trans-European road network. The tunnel bores would have enough headroom to accommodate all vehicles capable of using the normal road network. Therefore, it is not necessary to provide for overheight vehicle detection systems on approach to the tunnel portals.

2.4.82 The design includes stop barriers on the approach to both tunnels, with space provided in the central reserve for vehicles to be turned around onto the opposing carriageway in the event of an unplanned tunnel closure. Emergency vehicle and maintenance vehicle access would be provided from the local road network to the TSBs located at either end of the tunnel, and from these buildings to the carriageway in both directions.

2.4.83 The alignments of the tunnels and associated portal structures, approach ramps, TSBs and ground protection tunnel can vary within the extents defined in the LOD, summarised in Section 2.2 of this chapter and as presented in the Tunnel Limits of Deviation Plans (Application Document 2.15). This flexibility enables the Contractor to identify the best value, lowest carbon and safest option during the development of the detailed design. It would allow consideration of any new or changed information on ground conditions and groundwater and the influence that this might have on design and construction methods.

Tunnel drainage

2.4.84 The tunnel drainage design includes capacity to deal with tunnel wall wash-down water, firefighting water, runoff from vehicles entering from wet weather outside the tunnel, and for any seepage through the segmental lining joints. Water collected within the tunnel would be channelled to a low point sump in each bore and pumped from that location to the North Portal for discharge via an outfall to the River Thames. Contaminated discharge from major incidents, firefighting and maintenance activities would be pumped to an impounding sump at the North Portal for specialist disposal. Routine runoff, for example runoff from vehicles entering during wet weather and from background seepage, would be pumped to an impounding sump, which would then go through a treatment process, such as tanks and pollution control devices complying with the DMRB CG 501 (Highways England, 2020), before it outfalls to the River Thames. Discharge to the River Thames would only occur at high tide.

2.4.85 Surface water runoff on the tunnel approaches would be collected in a separate sump such that it does not enter the tunnel. Each sump, one at the North Portal and one at the South Portal, would have pumps installed to discharge the collected water. The surface water runoff which is collected at the northbound sump would be pumped to an underground storage tank proposed to be located beneath the parking to the North Portal building and finally discharging by a pumping main into the River Thames. The surface water runoff collected at the southbound sump would be pumped to an infiltration basin. The tunnel portals and approach structures have been designed to exclude groundwater, hence avoiding it entering the drainage system.

Tunnel lighting

2.4.86 Tunnel lighting during operation would be provided to ensure visibility during day and night. The lighting design would ensure a transition in luminance on entry and exit from the tunnel. Additionally, entry level lighting at each end of the bores would also facilitate traffic flows opposite to the normal direction of flow to accommodate any bi-directional running (e.g. during an extended closure of one bore).

2.4.87 Safety lighting would be provided to allow visibility for tunnel users to evacuate the tunnel in their vehicles in the event of a power supply failure.

2.4.88 Evacuation lighting, such as evacuation marker lights, would be provided to guide tunnel users evacuating the tunnel on foot in emergency conditions.

Tunnel ventilation

2.4.89 A longitudinal mechanical ventilation system would be employed at the tunnel. The system would use banks of jet fans located at discrete intervals along the entire length of each of the tunnel bores.

2.4.90 Ventilation during normal operation would generally be via the natural piston/drag effect of the unidirectional traffic. However, in some circumstances a mechanical ventilation system may also need to be used to supplement the natural ventilation, as described above. The tunnel's control system would operate the fans automatically during normal day-to-day operation to maintain acceptable air quality levels within the tunnel.

2.4.91 In the event of a fire, the ventilation system in the incident bore would maintain safe conditions (cool, clean air) on the upstream side (in relation to direction of travel in the bore) of the incident site by forcing smoke movement towards the tunnel exit portal. In the non-incident (adjacent) bore, the ventilation system would operate to prevent recirculation of incident smoke at the tunnel portal as well as to prevent smoke ingress into the cross-passages when emergency doors are opened.

Emergency arrangements (operation)

2.4.92 Emergency vehicle access would be provided between the local road network, the A122 and the TSBs. This would allow responders from either side of the crossing to access both the incident and non-incident bores on their respective sides, irrespective of their initial starting point. Rendezvous points would also be provided at either end of the tunnel.

2.4.93 The proposed tunnel operational maintenance access, located north of the tunnel entrance, would provide operational access for emergency service and maintenance vehicles to the tunnel and A122. A loop road would also be provided behind the TSB at the South Portal. This access arrangement has been designed to provide sufficient flexibility for emergency services to turn vehicles around in the event of an incident further north or south on the A122. A bridge would be built to allow National Highways operational vehicles and emergency service vehicles to cross over the A122 at this location.

2.4.94 Cross-passages connecting each tunnel would be provided for emergency evacuation, emergency incident responder access as well as maintenance works.

Tunnel Services Building (TSB)

2.4.95 A TSB would be constructed above the cut and cover sections at each end of the tunnel, extending to one storey above ground level, to accommodate mechanical and electrical plant, drainage pumps and maintenance operations. Each TSB is expected to include an office, pump rooms, water storage for firefighting, power supply equipment and provision for local control of the tunnel.

2.4.96 The local tunnel control facility at the TSB would allow for local tunnel control during tunnel maintenance activities as well as serving a backup role in case remote control from the National Highways Regional Control Centre is unavailable for any reason.

2.4.97 The TSB would be accessed from the local road network using the same access roads provided for emergency vehicles. Parking provision would also be made available for personnel visiting the TSB.

Flood alleviation design

2.4.98 A suite of flood alleviation measures have been developed to ensure that the Project shall:

a. Remain operational and safe for users in times of flood

b. Result in no net loss of floodplain storage

c. Not impede water flows and not increase flood risk elsewhere

2.4.99 Further details on flood alleviation are presented in the Flood Risk Assessment (Application Document 6.3, Appendix 14.6).

2.4.100 The design of all flood alleviation measures would include allowances for projected climate change in accordance with Environment Agency requirements (Environment Agency 2022).

2.4.101 Two forms of Compensatory Flood Storage Areas (CFSA) would be employed by the Project. The more common are areas that allow flood water to freely flow in and out of them (conventional CFSA). The other form of CFSA are areas where flood water is temporarily retained (flow retention CFSA). Areas within the Order Limits identified for provision of compensatory flood storage are larger than the areas that are needed in order to allow the required flexibility in the future development of the design.

2.4.102 Proposed flood alleviation measures are detailed with Section 2.3 of this chapter by Project Section and are summarised under the ‘Environmental mitigation and compensation’ subheading below.

Utilities works

2.4.103 The DCO application includes the diversion or alteration of several overhead high-voltage electricity transmission and distribution powerlines that are required as part of the Project. In addition, there are high-pressure gas pipelines that would need diversion. Three of these gas pipeline works (Work numbers G2, G3 and G4 located in Project Section 2) are considered likely to have a significant effect on the environment for the purposes of section 20(3) of the Planning Act 2008 and are therefore considered NSIPs. Further information is available in Appendix 1.3: Assessment of proposed gas pipeline works for the purposes of section 20 of the Planning Act 2008 (Application Document 6.3). One of the overhead line diversions (Work number OH7, located within Project Section 6, Section 7 and Section 8) has been screened against criteria for replacement lines set out in section 16(3) of the Planning Act 2008 and is therefore considered as an NSIP. Further information on this screening is available in Annex 2 of the Explanatory Memorandum (Application Document 3.2).

2.4.104 There are many other complex utilities works including intermediate, medium and low-pressure gas distribution mains, trunk water mains, foul sewers, underground high voltage electricity distribution cables and a range of telecommunications cables including fibre optic cables and their associated

infrastructure such as substations and cabinets. In addition, there are low-voltage electricity cables, smaller water mains and other utilities that would need diversion or protection works.

2.4.105 The design of the utilities works has been developed within the context of the landscape, visual appearance and the potential impacts of the Project. The utility diversions have been developed with regard to potential impacts on residential areas and the further use of the land post construction. In particular, this has influenced decision making on whether existing overhead powerlines should be 'undergrounded'. The proposals have sought to strike a balance between the needs of the Project and the asset owner by ensuring customer supply is maintained and that the utility network owner does not adopt an asset where its operation and maintenance would be less efficient or more onerous than at present. The design development has sought to strike a balance between the potential impacts from the proposals, and the impacts from the construction activities which may themselves have adverse impacts and also the feasibility and costs.

2.4.106 The proposed utility diversions are shown in the Works Plans (Application Document 2.6). Overhead powerline diversions, including proposed heights, are included in the Engineering Drawings and Sections (Application Document 2.9).

2.4.107 The utilities work falls into the following categories:

a. Diversion of existing utilities to reduce the impact to customers of each network from construction, operation and maintenance of the road and the utility networks

b. Protection of existing utilities from Project works without the need to divert the asset

c. Temporary supplies to compounds to facilitate construction of the Project and to ensure network connectivity during the works

d. Permanent supplies required for the operation of the newly constructed highway and tunnel assets

e. Stopping-up and removal of parts of the redundant network in agreement with the asset owner

2.4.108 The utilities diversion works are split into two classifications:

a. Non-contestable utilities works which can only be undertaken by the utilities providers and their contractors. This includes network design, connections to their network and strategic asset diversions.

b. Contestable utilities works which do not have to be undertaken by the utilities providers and can be undertaken by the Applicant's accredited Contractor, or which would be undertaken by utility companies if it is agreed this would be better value for money, or in the interests of the.

2.4.109 The Works Plans (Application Document 2.6) show works to overhead powerlines (OH Works), high-pressure gas pipelines or those with a diameter of 800mm or greater (G Works) and multi-utility corridors (MU Works) and associated infrastructure such as substations or permanent compounds. Multi-utility corridors include assets such as water pipelines, foul sewers and telecommunication networks and include those parts of the gas and underground electricity networks that have not met the threshold to be promoted as individual overhead powerline or gas pipeline works. Across all nine Project Sections, described in Table 2.2, both non-contestable and contestable utilities diversions would be needed, and an indication of the diversions required for each Project Section is provided in Section 2.3 of this chapter. Further information on the construction of the utilities works is provided in Section 2.6 of this chapter.

2.4.110 LOD have been identified within the design for the utility diversion works to allow flexibility during the construction phase, for example to address unforeseen ground conditions or other constraints. The LOD are summarised in Section 2.2 of this chapter and in the draft DCO (Application Document 3.1) and are shown on the Works Plans (Application Document 2.6) and Figure 2.1 (Application Document 6.2). The overhead powerline works and gas pipeline works have been identified in liaison with the relevant statutory undertakers and vary according to known constraints and available working areas. The high voltage overhead line diversions include large LOD (40m either side), which account for the swing of the outer conductor resulting from movement of a pylon. The multi-utility corridors have had LOD of varying widths applied, to accommodate the number, or size, of assets expected within the corridor. The LOD width has also taken into account the required separations during operation and construction and standard configurations of these assets in each scenario, including the anticipated utility owner's legal easements and how these vary in highways, footpaths and fields.

Traffic impacts

2.4.111 Information on the traffic modelling undertaken for the Project is provided in Section 2.2 of this chapter. Information about how the Project's transport model has been built is set out in detail in the Combined Modelling and Appraisal Report (Application Document 7.7). The Traffic Forecasts Non-Technical Summary (Application Document 7.8) provides a summary of how the model was built as well as an overview of the forecast changes in traffic as a result of the Project. The Transport Assessment (Application Document 7.9) provides detailed information on the forecast changes in traffic and associated impacts as a result of the Project.

2.4.112 The impacts from the Project on traffic on the strategic and local road networks could result in effects on receptors within the surrounding environment. These effects have been assessed in the environmental topic chapters within this ES using the specific data outputs from the Project's transport model required for the modelling and quantitative assessments.

2.4.113 The predicted operational phase impacts shown in the transport model indicate that there would be changes in traffic flows across the region, and the impact on some roads and junctions would be noticeable.

2.4.114 The Transport Assessment (Application Document 7.9) uses a scoring system, which uses information on the change in traffic volume based on the capacity of the road. It is forecast that there would be widespread changes in traffic flows across the region and the impact on some links would be noticeable. The largest adverse impacts would occur on the major routes leading to the Project such as the sections of the A13 from the east. There would be a moderate adverse impact on the M25 north of the Project.

2.4.115 South of the River Thames, the main adverse impacts are at junctions, such as M2 junctions 1, 2 and 3 and M20 junction 6, which forms part of the link between the two motorways.

2.4.116 The forecast shows a major beneficial impact on the Dartford Crossing, which aligns with one of the Scheme Objectives. The A13 between the Project and the M25, and the A2 between the Project and the M25, also see a reduction in traffic and an improvement in the performance of the road network.

2.4.117 If the Project is not built (the Do Minimum scenario), it is expected that the volume of traffic using the Dartford Crossing would continue to increase compared to current conditions. As the Dartford Crossing is already operating above capacity, this would lead to further increases in journey times and a higher number of incidents. Due to the increased traffic, this would also lead to more days where traffic conditions on both the Dartford Crossing and the approach roads would impact significantly on both people travelling on the road network and communities living in the impacted areas.

Provision for walkers, cyclists and horse riders (WCH)

2.4.118 For safety reasons, pedestrians, low-powered motorcycles, cyclists, horse riders and agricultural vehicles would be prohibited through signage, from using the A122.

2.4.119 The Project would result in changes to the network of routes used by WCH. Where the Project may directly affect an existing WCH route following completion of the construction works, such as footpaths, shared use routes for pedestrians/cyclists and existing bridleways, provision would be made to enable the routes to remain open. This may be through provision of underbridges or overbridges or, where a direct connection is not feasible, alternative routes using suitable diversions.

2.4.120 Some footpaths, shared use routes for pedestrians/cyclists, and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network. Existing WCH routes that would be affected by the Project are shown on the Rights of Way and Access Plans (Application Document 2.7).

2.4.121 Proposals for permanent changes to WCH routes are set out for each Project Section within Section 2.3 of this chapter. A full description of the Project proposals for each affected WCH route is provided in Part E of the Project Design Report (Application Document 7.4). The routes are also indicated in Figure 2.2: Project Proposals (Application Document 6.2)

2.4.122 Overall, the proposals for WCH include more than 62km of extended, diverted, upgraded or new footpaths, bridleways and cycle routes. These would provide much improved connectivity across the Project.

2.4.123 The construction of permanent and temporary WCH works is described in Section 2.7 of this chapter.

Environmental mitigation and compensation

2.4.124 As set out in Section 2.2 of this chapter, to mitigate adverse impacts arising from the Project on the environment and surrounding communities, a number of measures have been embedded into the Project design. Section 2.3 of this chapter sets out where such mitigation measures have been incorporated into each of the Project Sections.

2.4.125 Embedded mitigation is enshrined within the Design Principles (Application Document 7.5). The Project Design Report (Application Document 7.4), Chapter 7 of this ES and Figure 2.4: Environmental Masterplan (Application Document 6.2) also provide details about the design of the Project and the planting and landscaping proposed to mitigate impacts arising from the Project and to compensate for those that cannot be avoided. The outline Landscape and Ecology Management Plan (oLEMP) (Application Document 6.7) provides further information including an outline of the proposed management of the landscape and ecological elements.

2.4.126 The Project has been designed to enhance biodiversity as discussed in Chapter 8: Terrestrial Biodiversity. The detailed design of the Project's structures, buildings and landscape would be developed in accordance with Design Principle PRO.04 (Application Document 7.5), to maximise biodiversity value where reasonably practicable.

2.4.127 The following paragraphs summarise the environmental mitigation measures proposed for the completed Project. Mitigation measures associated with the underground elements of the tunnel are discussed within the tunnel information provided above in Section 2.4 of this chapter.

2.4.128 The environmental assessments reported in this ES have considered the potential environmental effects that could arise from the inclusion of these mitigation measures within the Project proposals.

Green bridges

2.4.129 Green bridges are built over infrastructure such as roads or railways to provide landscape and habitat connectivity, helping wildlife to move safely across the new infrastructure once it's built, avoiding habitat fragmentation. They usually include features to encourage use by native species and can create an attractive environment for use by pedestrians, cyclists and horse riders.

2.4.130 Seven green bridges would be included in the Project to mitigate the severance and fragmentation of habitat resulting from the Project. These aim to maintain habitat connectivity for a range of species including reptiles, amphibians, bats and other small mammals such as dormice. Green bridges would incorporate planting such as native hedgerow, scrub and species-rich grassland, and on heavier-weight bridges may include tree planting. These provide shelter and

foraging resource for a range a wildlife. Further information on the design of the green bridges is available in the Design Principles (Application Document 7.5).

Acoustic measures

2.4.131 The road surfacing on new and altered trunk roads and slip roads associated with the Project would be designed to meet the acoustic performance levels set out in item NV013 of the REAC (Application Document 6.3, Appendix 2.2), to reduce the potential effects from road traffic noise.

2.4.132 The design of the new road and tunnel entrance and exit levels have been kept at a low height to also help mitigate noise levels.

2.4.133 Acoustic barriers would be installed at the locations identified on Figure 12.6: Operational Road Traffic Noise Mitigation (Application Document 6.2), to mitigate the potential noise impacts of the completed Project on nearby properties and recreational spaces in accordance with item NV013 of the REAC (Application Document 6.3, Appendix 2.2).

Flood alleviation measures

2.4.134 Seven flood storage compensation areas are proposed as part of the Project to compensate for the loss of storage in the floodplain, arising as a result of the Project. An overview of the flood alleviation measures is presented below.

2.4.135 Flow through West Tilbury Main would be enhanced to offset the loss of a flow path running east to west across East Tilbury Marshes (Section 5). The enhancement would comprise the enlargement of one existing culvert, removal of two existing culverts and provision of a two-stage flow control structure.

2.4.136 Two sections of the A122 between the North Portal and the Tilbury Viaduct would be vulnerable to overtopping during a tidal flood event and would need to be protected. The first vulnerable section would be a 265m long stretch that straddles West Tilbury Main. The second vulnerable section would be along parts of the slip roads between the mainline and the operational access road. The form of construction of the first vulnerable section would comprise a retaining wall with an earth mound behind. The protection for the second section would be incorporated into the on-slip and off-slip earthworks. The flood protection level is 7.83 m AOD; this is based on the 0.1% AEP with a 1.0m residual uncertainties allowance and a lifetime of at least 100 years.

2.4.137 Compensatory flood storage areas (CFSA) would be provided in three areas to offset the floodplain storge lost to the Project (Section 5, 8 and 9). The CFSAs are as follows:

a. A flow retention type CFSA would be provided in Section 5. This CFSA would be located to the north of Tilbury loop and intercept flows from upstream catchments before they reach the floodplain. The flow entering the CFSA would cascade downstream through four compartments. At the downstream end of the CFSA, retained flows would be discharged to West Tilbury Main at a controlled rate.

b. Conventional CFSAs would be provided in Section 8 and Section 9. The compensatory flood storage requirements in Section 8 would, in part, be provided by the proposed wetland in Orsett Fen (Mardyke Wetland).

2.4.138 The embankment supporting part of the A122 would intercept an overland flow path across the Mardyke floodplain. To ensure that connectivity is retained across the floodplain, a flood relief channel would be formed immediately to the west of the Mardyke at the point it crosses under the proposed viaduct. The channel would be approximately 10m wide and run for approximately 180m. The depth would vary and would be approximately 0.6m at its deepest.

2.4.139 The restoration of the Mardyke wetland and creation of the water vole habitat may result in the formation of a new flow path between Golden Bridge Sewer and the Mardyke during some storm events. To prevent the formation of a new flow path and maintain the local flow path between Golden Bridge Sewer and the Mardyke, a bund would be formed on the eastern side of the wetland. The bund would be approximately 185m long and would have a maximum elevation of approximately 3.64m AOD.

Drainage and water environment measures

2.4.140 Provision of a highway drainage system is an embedded Design Principle.

2.4.141 The highway drainage design includes construction of ten new drainage attenuation ponds, one retention pond and seven new infiltration basins, to contain and manage stormwater flows and highway runoff. In addition, four existing drainage attenuation ponds and four existing infiltration basins would be retained and reconfigures as part of the Project. Although their principal function is for flood storage, the attenuation ponds would all be designed to include marsh and wetland grassland edges for the benefit of biodiversity.

2.4.142 An existing irrigation reservoir at Low Street would be modified to ensure continuity of water supply for irrigation is maintained for the landowner.

Hedgerow creation

2.4.143 Hedgerow habitat lost during construction of the Project would be compensated for through the creation of new hedgerows, using native species of local provenance. The hedgerow planting proposals are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2). Hedgerow planting would be designed to provide foraging opportunities and shelter for wildlife, and would link up existing habitats such as woodlands, providing green corridors along which animals can move safely.

2.4.144 Environmental mitigation measures would also include maintaining and improving hedgerows in areas adjacent to the proposed green bridges, so the planting across the bridges ties in with the adjacent habitat and wider landscape.

Ancient woodland compensation

2.4.145 New compensatory areas of ancient woodland, as shown on Figure 2.4: Environmental Masterplan (Application Document 6.2), would be planted to offset the loss of ancient woodland arising from the Project. The design of this planting would link up areas of retained woodland, not only creating more woodland habitat, but also strengthening the resilience of the habitat network within the area and enabling animals to move freely between woodland blocks.

2.4.146 Where practicable, suitable soils from existing ancient woodland sites that would otherwise be disturbed by the construction activities, would be salvaged

and used as a planting medium in areas identified for ancient woodland compensatory planting, to aid the establishment of ancient woodland ground flora.

Woodland and grassland planting

2.4.147 New areas of woodland and grassland would be planted to offset the woodland and grassland habitat loss arising from the Project. This would increase the overall extent of woodland within the area and provide strong connections between existing habitats such as Claylane Wood and Shorne Woods. Brewers Wood and Great Crabbles Wood would also be connected via an area of woodland habitat creation north of Park Pale bridge, forming part of a larger compensatory package for ancient woodland.

2.4.148 The existing A2/M2 is within a sensitive wooded landscape, so the planting proposals for this part of the Project have been designed to be primarily woodland.

2.4.149 There would also be woodland planting south of the A2, near the young woodland planted by HS1 and Jeskyns Community Woodland. The woodland would be set back away from St Margaret's Church to preserve its setting.

2.4.150 It is proposed that around 110ha of new woodland would be planted to the South of the River Thames, linking existing areas of woodland habitat. This woodland creation would provide additional habitat for a range of species, notably dormice.

2.4.151 A minimum of 15 individual specimen trees would be planted to the south of the River Thames and 15 to the north of the River Thames, to reflect the equal split of lost veteran trees on either side of the river. The location, stock size and species selection would be agreed with the Secretary of State following consultation with the relevant local planning authorities.

Protected species receptor sites and habitat creation and enhancement

2.4.152 Retained habitats including areas of existing woodland, trees and hedges would be utilised as receptor sites for protected and notable species translocated from the construction worksites. These receptor sites would provide alternate habitats for species being disturbed by the Project, including dormice, bats, nesting birds, badgers, reptiles and amphibians.

2.4.153 Where appropriate, dormouse boxes and bat boxes would be installed to offset the loss of natural nest features. The locations of these boxes are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2).

2.4.154 Bird nest boxes would be provided within areas of retained woodland trees and hedges shown on Figure 2.4: Environmental Masterplan (Application Document 6.2) to supplement the habitat creation by offsetting the loss of nesting opportunities while newly created habitats establish. A ratio of 10 assorted small nest boxes and one medium open fronted nest box per hectare of lost woodland/scrub would be adopted, where it is reasonably practical to erect this number of nest boxes. For hedgerows, a ratio of 10 assorted small nest boxes per kilometre of hedgerow would be adopted, where it is reasonably practicable to erect these numbers within retained vegetation. The Project includes provision for alternative barn owl breeding sites (nest boxes) to be located in appropriate settings, to mitigate for those that would be lost.

2.4.155 Where terrestrial and aquatic habitat that supports great crested newts would be lost due to the Project, suitable receptor areas of high quality habitat for any displaced animals would be maintained or created to translocate animals into. This habitat would also provide suitable receptor sites for reptiles affected by the Project. Locations of these areas are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2).

2.4.156 Extensive areas of habitat creation, notably around Tilbury Fields and Coalhouse Fort, would provide optimum habitat for a range of invertebrate assemblages affected by the Project. These habitats would contain a diverse mosaic of woodland, scrub, grassland and bare earth to provide a range of structure and food sources for these species. Locations of these areas are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2).

2.4.157 Where known bat roosts would be lost or heavily disturbed by the Project, alternative roosting structures, in the form of nine bat barns, would be provided in areas as indicated on Figure 2.4: Environmental Masterplan (Application Document 6.2).

2.4.158 An air raid bunker containing a hibernation bat roost would be disturbed as a result of the Project. A replica bunker would be constructed, in line with European Protected Species mitigation licence requirements, prior to demolition of the existing structure, to provide a compensatory roosting site for bats within land between Shorne Woods and Great Crabbles Wood.

2.4.159 Where the Project would result in the closure of any main badger setts that do not have an existing suitable naturally occurring alternative sett, an artificial sett would be constructed in a suitable location, in accordance with a licence from Natural England.

2.4.160 If a habitat affected by the Project has valuable features that are also moveable (for example, dead-wood features for terrestrial invertebrates), these would be translocated, where appropriate, to protected species receptor sites.

2.4.161 The soils from an area of acid grassland in Low Street Pit, approximately 1ha in area, would be salvaged and translocated to a receptor site as shown on Figure 2.4: Environmental Masterplan (Application Document 6.2). The receptor site is an area of grassland located between the sea wall and the Parish Church of St. Catherine, approximately 100m to the north of Coalhouse Fort.

2.4.162 The land parcel within and adjacent to the south of the Milton Rifle Range would be reinstated, following its use for the Milton compound, for habitat enhancement. The land will be reinstated to create additional slow-flowing ditch, pond and grassland with scrub habitats for use by species such as water vole and great crested newt as well as providing suitable bird foraging and nesting habitat.

2.4.163 The Project would require the permanent diversion of a number of watercourses, as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). The new watercourses would be planted to ensure they have a greater floral diversity than the existing watercourses, to benefit a wider range of species.

2.4.164 Water voles displaced by the loss of ditch habitat would be translocated to offsite receptor areas along the River Blackwater in Essex. National Highways is working with the Essex Wildlife Trust to facilitate this translocation work.

Marsh and wet grassland

2.4.165 Marsh and wet grassland would be created to maintain the functionality of land associated with the Thames Estuary and Marshes SPA and Ramsar, immediately west and south-west of Coalhouse Fort. A series of ditches and shallow scrape habitats would also be created to the west of Coalhouse Fort.

2.4.166 A water inlet with self-regulating valve or equivalent structure would be constructed within the existing flood defence at Coalhouse Point to secure a water supply for this area of habitat creation.

2.4.167 It is proposed that a mosaic of wet grassland, dry grassland, marginal and aquatic planting areas, alongside a series of ditches and water bodies, would be created within Orsett Fen.

Water vole habitat creation

2.4.168 Watercourses to the south of the Tilbury Loop railway line would be reinstated to their former alignment with appropriate bank and ditch vegetation, including wetland trees and scrub. Bank profiles, and bankside and marginal planting, would be designed to provide suitable water vole habitat.

2.4.169 It is proposed that approximately 3km of new watercourses and water bodies suitable for water vole mitigation would be created within the old area of Orsett Fen.

Fish passage

2.4.170 The West Tilbury Main culvert would integrate a fish pass aid designed for eels and elvers, to assist their migration.

2.4.171 To encourage continued fish passage, bankside vegetation reinstatement and planting at the entrances to the West Tilbury Main culvert would be designed to ensure no sharp light/dark interface. The base of the culverts would be set below the bed of West Tilbury Main, and a substrate would be provided along the culvert which mirrored the natural substrate.

2.4.172 This culvert and others across the Project would include mammal ledges or passages to allow safe passage through them for non-aquatic species or at times of high water/flood conditions.

Landscape measures

2.4.173 Landscape planting will be required to mitigate the impacts of the Project in the form of habitat creation, visual screening, integration of the highways into the surrounding landscape, or a combination of the above. The Project's landscaping proposals have been designed to be reflective of the existing ecology in these areas, to mitigate against potential adverse ecological effects. The landscaping proposals are shown on Figure 2.4: Environmental Masterplan (Application Document 6.2).

2.4.174 The M2/A2/A122 Lower Thames Crossing junction in Section 2 would be primarily landscaped with woodland and species-rich grassland.

2.4.175 To provide screening of the Project for residents of Gravesend and to replace lost woodland features, woodland with non-native species would be planted north-east of the new Thong Lane green bridge north in Section 3.

2.4.176 Excavated materials from the construction of the tunnel and South Portal would be used to create the proposed new Chalk Park landscape, featuring a distinctive new wooded hilltop landform between the South Portal and the edge of Gravesend and Chalk. Chalk Park would include areas of woodland and species-rich grassland planting typical of the local area, to further integrate the features into the landscape. The area would be planted to provide biodiversity benefits, while enhancing the visual experience for users of the local WCH network with enhanced panoramic views to the Kent Downs AONB and the River Thames.

2.4.177 Small blocks of woodland planting would also be provided in order to screen portal operations from users of the surrounding WCH routes. The access road would be set at a lower elevation than the surrounding topography.

2.4.178 The landscaping along the new road corridor has been designed to reduce visibility of the new road and traffic. To reduce the noise and visual disturbance of traffic to local communities, a number of cuttings and false cuttings are proposed, including north of the North Portal, throughout the Chadwell St Mary link, for some of the new roads that form the new A13/A1089/A122 Lower Thames Crossing junction, and west of North Road.

2.4.179 Excavated materials from the construction of the tunnel and North Portal would be used to create new sculptural landscape mounding at Tilbury Fields, which draws on the heritage of the local area. The design reflects the circular nature of Coalhouse Fort and the gun embankments of Tilbury Fort. Several place-making landforms are proposed around the North Portal. These would provide a visual separation between East Tilbury and the more industrial emerging development in the local area. These landforms would also offer far-reaching views of the Thames Estuary and nearby heritage features, such as Coalhouse Fort, Cliffe Fort and Shornemead Fort. The largest mound, at the south-east corner of Tilbury Fields, would feature a star-shaped area that would act as a focal and destination point.

2.4.180 Tilbury Fields would provide improved recreational amenities, within the riverside space acting as a local and regional landmark. A total area of approximately 45ha of open mosaic habitat is proposed within Tilbury Fields. The landscape design for Tilbury Fields, along with the existing area of habitat to the west, would improve habitat connectivity. New areas of habitat creation within Tilbury Fields would link established ecological habitats to the west of Tilbury Fields with new habitats further to the east at Mucking Flats and Marshes landfill restoration and the Thameside Nature Reserve. The proposal would also introduce a new link to other new habitats proposed at Linford to the north.

2.4.181 An area of land near the junction of East Tilbury Road and Muckingford Road would be landscaped as open mosaic habitat. Two areas of land to the north-west and north of Coalhouse Fort would be also landscaped as open mosaic habitat.

2.4.182 Riparian planting along the existing watercourse that runs from the wetland area to the west of Linford, to the pond west of Linford, would be reinstated on completion of construction, including woodland edge scrub along its banks.

2.4.183 The landscape along the A122 route from the North Portal to the A13/A1089/A122 Lower Thames Crossing junction would be landscaped to mitigate the loss of habitats arising from the Project. False cuttings would also be provided to mitigate the visual impact of the Project road.

2.4.184 The area around the A13/A1089/A122 Lower Thames Crossing junction would also be landscaped with planting running along the roads and the edges of the junction to woodland edges. North of the A13/A1089/A122 Lower Thames Crossing junction towards the M25, the new road would be landscaped with limited species-rich grassland and with woodland including non-native species to reflect the open character of the former fenland landscape.

2.4.185 As described in Section 2.3 of this chapter, the Project includes the provision of additional landscaping features with extensive woodland planting around the A13/A1089/A122 Lower Thames Crossing junction and the A122 Lower Thames Crossing/M25 junction, North Ockendon. These landscape mounding features have been designed to help integrate the new junctions into the surrounding landscape and provide acoustic and visual screening for nearby communities.

2.4.186 An example of the provision of landscape mounding for screening is that proposed around the relocated Gammonfields Way traveller's site to the south-west of the A13/A1089/A122 Lower Thames Crossing junction.

2.4.187 The planting mix for these landscaped areas will be consistent with the habitat typologies described in the oLEMP (Application Document 6.7) based on the indicative planting palettes included within the Design Principles (Application Document 7.5).

2.4.188 Wet and species-rich grassland is proposed as part of the landscape design between the A122 and Mardyke River to help integrate the viaduct and embankment into the wider former fenland landscape. These areas would also form receptor sites for translocated species.

2.4.189 Areas of woodland planting alongside the A122 route and to the south of Thames Chase Forest Centre are proposed to replace trees removed as part of the Project, complement the community woodland.

2.4.190 Ancient woodland compensation planting provided at Hole Farm would help integrate the Project road into the surrounding landscape. This planting forms part of the proposals at Hole Farm discussed below and in Section 2.9 of this chapter.

2.4.191 To preserve the rural and historic character of the landscape, road lighting would be minimised where it is safe and practicable to do so but remain in accordance with relevant standards.

2.4.192 The planting design would take into account National Highways' required minimum planting distances from the carriageway. The planting areas would maintain safe sightlines at road bends and junctions and would avoid obscuring signs and signals. Tall-growing species would not be planted under power lines,

and tree and shrub planting would generally avoid underground services. Plant stock would be preferably of local or regional provenance.

Nitrogen deposition compensation areas

2.4.193 Changes to traffic flows arising from the operation of the Project have the potential to result in the deposition of nitrogen on nearby habitats, including sites designated for ecological conservation.

2.4.194 Mitigation measures have been identified to reduce the amount of nitrogen emitted from the Project, where necessary and practicable, including the installation of speed enforcement cameras on the M2 between junctions 3 and 4 to encourage motorists to obey existing speed limits.

2.4.195 Where it has not been feasible to identify appropriate mitigation measures to reduce potential significant effects from nitrogen deposition, compensation measures have instead been identified. These compensation measures have been designed to offset significant effects of nitrogen deposition once the Project is operational, by planting new compensatory habitats and enhancing existing ones.

2.4.196 As set out in Section 2.3 of this chapter and identified on Figure 2.4: Environmental Masterplan (Application Document 6.2), eight sites have been identified for the provision of compensatory habitat planting for the effects of nitrogen deposition on designated habitats, equating to approximately 246ha in total. These sites are referred to as follows:

a. Hole Farm East

b. Buckingham Hill

c. Hoford Road

d. Henhurst Hill

e. Fenn Wood

f. Court Wood site

g. Blue Bell Hill

h. Burham

2.4.197 It is proposed that these compensation sites would have a woodland-dominated mosaic of habitats created through planting and natural regeneration, including woodland, grassland and scrub; providing new wildlife-rich habitats, linked to existing habitats and improving biodiversity. Additional benefits would include opportunities for increasing public access to the countryside and local landscape improvements through planting.

2.4.198 The Application Documents have not specified the detailed design and future management regime for the habitat creation sites proposed as compensation for the effects of nitrogen deposition. The design and management regimes for these locations will be developed as part of the detailed design, in accordance with the control plan documents (which are secured by the DCO) including the

oLEMP (Application Document 6.7), Design Principles (Application Document 7.5) and the Environmental Masterplan (Application Document 6.2, Figure 2.4).

2.4.199 The environmental assessments of these compensation measures reported in the ES have been based on the available design information. Where assumptions have been made, these have reflected a reasonable worst case, for both construction and operational phases. Relevant assumptions are set out in the topic chapters of the ES (Chapters 5 to 15).

Hole Farm

2.4.200 It is proposed that the Hole Farm site would be utilised to offer multiple benefits, including as a nitrogen deposition compensation site and as an ancient woodland compensation site. The proposals at Hole Farm also include development as a community woodland as further discussed under the 'Benefits and outcomes' section of this chapter (Section 2.9) and the Benefits and Outcomes Document (Application Document 7.20).

2.4.201 Approximately 75.2ha of a woodland-dominated mosaic of habitats would be created at Hole Farm to offset significant effects of nitrogen deposition once the Project is operational.

2.4.202 In addition to the above nitrogen deposition compensation, approximately 26ha of woodland creation would be provided at Hole Farm, to compensate for ancient woodland lost due to construction and to integrate the Project road into the surrounding landscape, while at the same time respecting existing key views.

Replacement land

2.4.203 Replacement land is proposed in compensation for special category land and private recreational facilities affected by the construction and operation of the Project. This is discussed further in Section 2.4 of this chapter under the 'Land required' heading below and in each Project Section description in Section 2.3 of this chapter.

Land required

Residential and commercial properties

a. The Applicant would acquire land permanently and take temporary possession of land. Land would be required permanently for the road and tunnel along with other operational infrastructure and some areas of environmental mitigation. The area of land to be permanently acquired is 1,487 hectares.

b. Land would be required temporarily for construction working areas, compounds and stockpiling areas. This area would total 420 hectares.

c. Temporary possession of land and permanent acquisition of rights would be required for utility diversions, some areas of environmental mitigation and flood compensation. This area would total 440 hectares.

2.4.204 The land required by the Project would be kept to a minimum. Compensation would be payable in accordance with the Compensation Code. Consultation with landowners, occupiers and agents would continue as the Project develops to manage and reduce impact on property owners as far as practicable.

2.4.205 South of the River Thames, there are 10 residential properties and six commercial properties located within the Order Limits. Four of the residential properties and four of the commercial properties would require demolition as a result of the Project.

2.4.206 North of the River Thames, there are 61 residential properties within the Order Limits, of which 26 would require demolition. There are seven commercial properties within the Order Limits north of the river, one of which would require demolition.

2.4.207 Permanent acquisition of the Cobham service station on the A2 westbound to the south-west of Thong is required for the Project and the Applicant is progressing a voluntary acquisition agreement with the owner. National Highways recognises that the service station is well-used and there would not be a direct replacement for it as part of the Project. However, if development consent for the Project is granted, the Applicant would work with roadside service facility operators, the haulage industry and road user groups to consider the need for roadside service facilities and the most appropriate locations on the SRN. Any new roadside facility would require planning consent from the appropriate local authority.

2.4.208 Along the Project route, approximately 1,077ha of agricultural land would be permanently affected, with approximately 727ha of land associated with agricultural landholdings required for construction being returned to agricultural use by the end of the construction phase. All agricultural land temporarily affected during the construction of the Project will be restored to the reasonable satisfaction of the owners of the land in accordance with article 35(5) of the draft DCO.

2.4.209 The property demolition and land use requirements for the Project are shown on the General Arrangement drawings (Application Document 2.5). The Statement of Reasons (Application Document 4.1) provides a detailed description of each plot of land required as part of the Project.

Travellers site

2.4.210 The creation of a new slip road at the A13/A1089/A122 Lower Thames Crossing junction connecting the A1089 to the A122 northbound would require the permanent acquisition of land occupied by the Gammonfields Way travellers' site. An alternative site would be provided next to its current location, with access off Gammonfields Way and would include appropriate landscaping. Noise mitigation and visual screening would also be provided.

Special category land

2.4.211 Areas of special category land relating to common and open space would be impacted as a result of the construction and operation of the Project. Common, fuel or field garden allotment, and open space are defined in the Acquisition of Land Act 1981 to include the following designated areas:

a. ‘Common’ includes any land subject to be enclosed under the Inclosure Acts 1845 to 1882, and any town or village green.

b. ‘Fuel or field garden allotment’ means any allotment set out as a fuel allotment, or a field garden allotment, under an Inclosure Act.

c. ‘Open space’ means any land laid out as a public garden, or used for the purposes of public recreation, or land being a disused burial ground.

2.4.212 No fuel or field garden allotment sites would be affected by the Project.

2.4.213 Special category land affected by the Project would be subject to compulsory acquisition, either permanent acquisition or the acquisition of rights over the land, or would be subject to temporary possession to construct the new road.

2.4.214 The Project’s construction will have both temporary and permanent impacts on 11 open space sites and three common land sites. The Applicant is proposing the acquisition of seven areas of land in order to provide replacement open space and common land within the Order Limits; in accordance with the requirements of sections 131 and 132 of the Planning Act 2008 and the NPSNN (DfT, 2014). In accordance with the Planning Act 2008, replacement land has not been included in all cases, for example because the acquisition of this land would be for a temporary but possibly long-lived process, or because it is only proposed to install and divert utilities through the land and would not affect its advantageousness once the rights were imposed. This means that its previous use can continue once the works are finished.

2.4.215 For the purposes of this DCO application, replacement land is defined as ‘*land which is not less in area than the Order land and which is no less advantageous to the persons, if any, entitled to rights of common or other rights, and to the public*.’

2.4.216 A summary of the specific replacement land proposals for each Project Section is provided within Section 2.3 of this chapter, with further detail provided in Appendix D of the Planning Statement (Application Document 7.2).

Private recreational facilities

2.4.217 In addition to affecting special category land, the Project would also affect a number of private recreational facilities, such as sports clubs and fishing lakes. It is proposed that the Applicant will either acquire all or part of these sites (or rights over these sites) or use these areas temporarily during construction of the Project. There are also private recreational sites which may not directly be affected by the Project but are located immediately outside of the Order Limits.

2.4.218 A summary of the site-specific impacts and land requirements is provided for all private recreational facilities within Section 2.3 of this chapter, and further details are available in Appendix D of the Planning Statement (Application Document 7.2) submitted as part of the DCO application.

2.5 Construction

Introduction

2.5.1 This section provides an outline description of the activities that are anticipated to be involved in the construction of the Project. The construction activities

described in this section provide the basis for the assessment presented in this ES. The approach to construction described is indicative but it is representative of the likely approach to be adopted.

2.5.2 Similar to how the operational Project has been divided into nine operational sections to aid description of the as-built proposals, the Project construction site has been split into four construction sections (Sections A to D). Construction Sections A to D have then been further divided into activities for the purposes of managing the construction process. The locations of the four construction sections as listed below are presented in Figure 2.5 (Application Document 6.2). Section 2.6 of this chapter provides detailed descriptions of the construction works proposed within each of these sections.

a. Section A: South of the River Thames: Covering the area of the A2/M2 corridor, the proposed M2/A2/A122 Lower Thames Crossing junction and highways up to, and including, the proposed Thong Lane green bridge north over the A122.

b. Section B: A122 Lower Thames Crossing Tunnel: Covering the area from north of the Thong Lane green bridge north to the southern end of the proposed Tilbury Viaduct structure. This includes the areas required for above and below ground construction of the tunnel.

c. Section C: North of the River Thames: Covering the area from the southern end of, and including, the proposed Tilbury Viaduct up to, and including, Green Lane, north of the proposed A13/A1089/A122 Lower Thames Crossing junction.

d. Section D: North of the River Thames: Covering works north of Green Lane to the M25 corridor, extending beyond M25 junction 29.

Construction design and management

Construction design

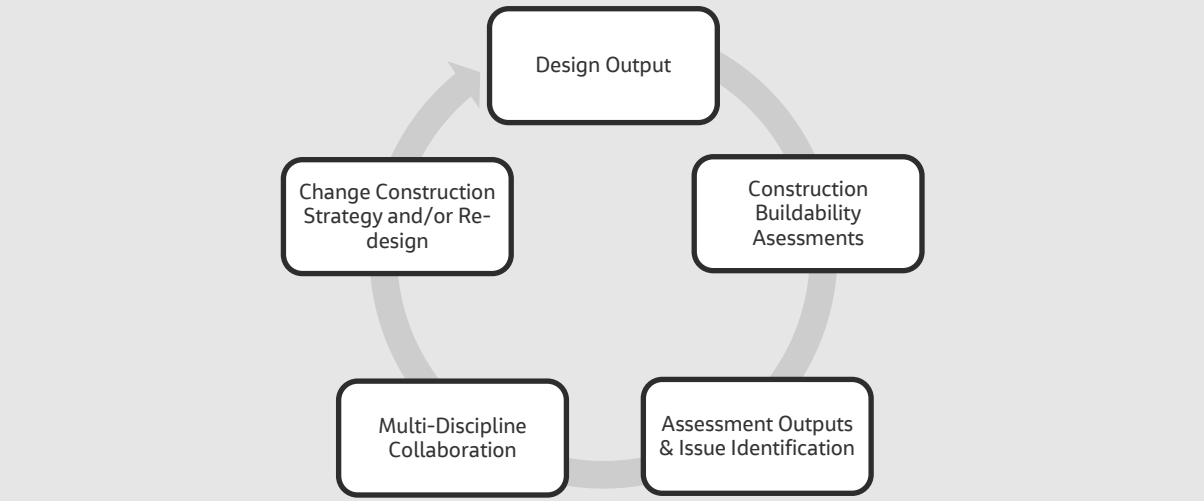
2.5.3 The proposed approach for construction has been developed as a collaborative and iterative process, taking into account the various constraints and opportunities associated with the Project, its location and surroundings. This has included information and input provided by the Project Team and stakeholders and obtained through Project consultation and technical engagement. The construction proposals have sought to manage potential conflict with other nearby developments as discussed in Section 2.2 of this chapter and the Interrelationships with other Nationally Significant Infrastructure Projects and Major Development Schemes (Application Document 7.17).

2.5.4 During the preliminary design stage, several construction buildability assessments were carried out, which included input from environmental specialists. The aim of the assessments was to improve the future construction scenario by identifying issues and eliminating or mitigating them early through the proposed construction approach and design development. The overall objective was planning the construction phase to be more efficient and safer (in line with the Construction (Design and Management) Regulations 2015) while

ensuring all other objectives, including function and environmental, were met. Through collaboration with several key disciplines during the construction assessments, a balanced approach was achieved.

2.5.5 This process was repeated on an iterative basis with the aim of optimising the strategy and design and de-risking the construction phase by reducing further redesign requirements (including onsite redesign). Plate 2.11 illustrates this iterative process.

Plate 2.11 Iterative process for design development



2.5.6 Table 2.4 highlights the key buildability assessment workstreams, the outputs from assessments undertaken to date including identification of issues, the actions taken to resolve or de-risk issues as well as highlighting the associated improvements as a result.

Table 2.4 Key buildability assessment outputs

Buildability assessment	Identified issues	Construction and design response to identified issues
Construction Programme	• Interfaces with third parties • Identification of constraints • Environmental receptors and potential effects	• Workshops with stakeholders to manage interfaces • Redesign to optimise buildability, remove constraints and need for temporary works where practicable • Develop understanding of work packages thereby reducing onsite reactive rework as well as reducing requirement for temporary works
Construction Methodology	• Method of construction • Space requirements • Environmental receptors and potential effects	• Redesign to allow alternative methodology to be used • Include temporary land-take within Order Limits to allow sufficient space

Buildability assessment	Identified issues	Construction and design response to identified issues
Construction Logistics	• Access arrangements and construction routes • Compound locations • Temporary haul route provision • Environmental receptors and potential effects • Potential for interface between construction activities and the public • Forecast of construction traffic (Heavy Goods Vehicle (HGV) & Workforce)	• Site visits to determine suitable locations for accesses and construction routes • Reduce the use of the local road network for construction traffic • Include certain routes within Order Limits where mitigation measures (for example temporary widening) may be required • Amendments to construction compound layouts to avoid environmental constraints where practicable, for example heritage assets • Optimised plant layout within compounds to reduce noise, landscape and visual impact during the construction phase • Forecast of construction traffic has informed the construction traffic modelling which has provided a basis to understand the impact on the road network and where mitigation would be required. • Workforce forecast has informed the Framework Construction Travel Plan (Application Document 7.13) which sets out measures to reduce adverse local disruption or traffic impacts on the highway network from worker and visitor travel to and from construction worksites
Temporary Traffic Management	• Proposed traffic management restrictions • Road closures and diversion routes • Effects on strategic and local traffic	• Change construction proposals where practicable • Redesign to eliminate or reduce the need to implement traffic management measures • Traffic modelling of construction scenarios to enable identification of potential effects and relevant mitigation
Earthworks	• Earthworks strategy including balance of cut and fill, material make up, reusability, movement of material	• Redesign of earthworks including landscaping proposals • Reduce construction movements using the public road network and thereby reducing interface between construction and public

Buildability assessment	Identified issues	Construction and design response to identified issues
Waste Management	• Generation of waste and need for offsite disposal	• Reduce demolition requirements • Reuse of materials onsite • Redesign to reduce the width of the carriageway while maintaining safe driving conditions • Maximise the use of cut and fill to reduce the volume of excavated materials being moved offsite

Construction safety

2.5.7 The outline approach to construction for the Project set out in this chapter has been developed to protect employee wellbeing. The construction approach has been developed taking into account the following requirements:

a. Legislation and legal requirements

b. Approved Codes of Practice (ACoPs) and guidance documents

c. National Highways standards and procedures

d. Industry Common Intent and Raising the Bar guidance documents

2.5.8 The Project approach to Health, Safety and Wellbeing (HSW) will continue to influence the development of the construction methodologies and proposals through future stages of the Project. The Project HSW approach expects communication, collaboration, cooperation and coordination between all parties at all times while they are delivering the Project.

2.5.9 The Project is fully aligned to the National Highways ambition to make sure that everyone gets home, safe and well, every day (Highways England, 2019b). The Project aims to lead the industry when it comes to HSW and deliver a step change in HSW performance that can be carried forwards into future projects and programmes, both for National Highways and the construction industry as a whole.

2.5.10 The HSW vision is to protect those working on the Project, road users, and local communities, avoiding fatalities and serious injuries, while guarding against illness and psychological harm. This will be achieved as follows:

a. Setting new HSW standards: driving continuous improvement on the Project and other projects and programmes in the future using the past experiences of National Highways and other major UK programmes.

b. Recognising the role of mental health and wellbeing: keeping individuals safe through a shared understanding of how mental health and wellbeing can have a significant impact on safety. This would include building on the work of other major programmes in this area to drive improvement, now and in the future.

Security

2.5.11 Security implications of the Project during construction have been given due consideration at each stage of the development and are incorporated into Project's Code of Construction Practice (CoCP) (Application Document 6.3, Appendix 2.2).

2.5.12 Security planning for the construction phase has been informed by guidance published by the UK Government's Centre for the Protection of National Infrastructure (CPNI). Guidance provided by the UK Police official security initiative 'Secured by Design' has also been considered, as have Crime Prevention Through Environmental Design (CPTED) principles. This includes the Secured by Design (2021) document Construction Site Security Guide 2021.

2.5.13 The Applicant has adopted a risk-based approach for the Project based on experience from other major infrastructure projects and proven crime prevention principles that are known to reduce criminal opportunity by creating safer, more secure, and sustainable environments.

2.5.14 Site-specific security risk assessments will be carried out to determine the required type of security measures and will consider the impact on wildlife, public access, light and noise pollution, nuisance to neighbouring properties and visual impact, and the Project's carbon reduction commitments. This will include the use of a mixture of temporary and semi-permanent measures, such as temporary access control, boundary fencing and the use of modern technology to reduce or eliminate lighting requirements.

Risk assessment

2.5.15 A risk-based approach has been used in developing the proposed construction approach, this would continue prior to and during construction. Generally risk assessments would be required where notable interfaces exist, such as when carrying out works close to other infrastructure, when setting out traffic management, when determining the level of segregation required between the works and public (e.g. fencing and security).

2.5.16 The contractor would have the duty to identify hazards, assess risks and consider means to control the risk exposure. This would include consideration of potential hazards associated with safety and the performance and operation of other infrastructure, such as roads, railways and utility networks.

2.5.17 Risk assessments would be carried out prior to specific works where required. Risk assessments would be carried out to determine the construction methodology of an activity, and to determine and implement a suitable mitigation measure as required.

Construction phase control documents

2.5.18 As fully explained in the Introduction to the Application (Application Document 1.3), potential adverse effects arising during the construction phase of the Project would be managed by a series of control documents, included in the Project control plan. The control documents would be secured by the DCO. Table 2.5 identifies the control documents that are relevant to the construction phase of the Project.

Table 2.5 Construction phase control documents

Application Documents that control construction impacts
• Code of Construction Practice (CoCP) • Register of Environmental Actions and Commitments (REAC) • Outline Site Waste Management Plan (oSWMP) • Outline Materials Handling Plan (oMHP) • Outline Traffic Management Plan for Construction (oTMPfC) • Framework Construction Travel Plan (FCTP) • Draft Archaeological Mitigation Strategy – Outline Written Scheme of Investigation (Draft AMS-OWSI) • Carbon and Energy Management Plan • Preliminary Navigational Risk Assessment (pNRA) • Stakeholder Actions and Commitments Register

2.5.19 These documents contain measures to be implemented by the Contractors prior to, during and following construction of the Project to ensure that the different phases of the Project are appropriately managed to reduce the adverse effects of the Project.

2.5.20 The Project Contractors would update the outline plans included as part of the DCO application, for implementation during construction in accordance with Requirement 4 of Schedule 2 (Part 1) of the draft DCO (Application Document 3.1). These updated plans will be submitted to the Secretary of State for approval in consultation with the relevant statutory bodies prior to commencement of construction works.

2.5.21 The control documents which are relevant to the management of the environmental effects of the Project during construction are described below.

Code of Construction Practice (CoCP)

2.5.22 The CoCP (Application Document 6.3, Appendix 2.2) provides a framework to manage construction and operational activities. The REAC forms part of the CoCP.

2.5.23 Before the commencement of construction, the Contractors would develop a Second Iteration Environmental Management Plan (EMP2) for each phase, which must be consistent with the CoCP. The EMP2 for each phase would be specific to the Contractor, the scope of works to be undertaken and the location. Each EMP2 would follow appropriate industry-standard good practice and reflect the mitigation measures set out in the REAC.

Register of Environmental Actions and Commitments (REAC)

2.5.24 The REAC presents the essential mitigation commitments that need to be implemented in the delivery, management, monitoring and maintenance of the Project, and acts as a securing mechanism for the essential mitigation measures identified in the ES.

Outline Site Waste Management Plan (oSWMP)

2.5.25 The oSWMP (Application Document 6.3, Appendix 2.2, Annex A) sets out the overarching principles and procedures for managing waste during the construction phase. The plan also defines specific roles and responsibilities to ensure waste is managed effectively and covers all works within the Order Limits during construction. The Contractor would produce a Site Waste Management Plan (SWMP) in accordance with the oSWMP, and this would be appended to the EMP2.

Outline Materials Handling Plan (oMHP)

2.5.26 The oMHP (Application Document 6.3, Appendix 2.2, Annex B) sets out the approach and high-level principles for handling construction materials and waste, both inside and outside the Order Limits. The Contractor would produce a plan for the management of materials, substantially in accordance with the oMHP, once appointed and more detail is known. This would be part of the EMP2.

Outline Traffic Management Plan for Construction (oTMPfC)

2.5.27 The oTMPfC (Application Document 7.14) outlines the approach to carrying out temporary traffic management for the safe construction of the new road. It also explains measures available to the Contractor to reduce the impact on the local community (including journey time reliability, access, severance and safety). The oTMPfC has been produced following work with relevant local authorities, businesses and emergency services. Once appointed, the Contractors would produce a plan for managing construction traffic in accordance with the oTMPfC for implementation during construction.

Framework Construction Travel Plan (FCTP)

2.5.28 The FCTP (Application Document 7.13) sets out a framework to reduce the impact of the Project's construction workforce on the road network as a result of travel to and from construction worksites, compounds and Utilities Logistics Hubs (ULHs). The FCTP sets out proposed measures, including reducing single occupancy vehicle trips and encouraging sustainable and active travel. Prior to the start of construction, the Contractors would develop Site Specific Travel Plans (SSTPs) in accordance with the FCTP, following the latest policy advice and best practice documents. This would apply to individual compounds or ULHs, or several where they are closely located with similar levels of accessibility.

Draft Archaeological Mitigation Strategy – Outline Written Scheme of Investigation (Draft AMS-OWSI)

2.5.29 The Draft AMS-OWSI document (Application Document 6.3, Appendix 6.9) sets out the strategy for essential mitigation for heritage assets. It describes the embedded and good practice mitigation measures relevant to cultural heritage. Written Schemes of Investigation (WSIs) would be prepared for areas of archaeological interest provisionally identified as requiring mitigation in this AMS-OWSI. The Contractor would produce a plan in accordance with the Draft AMS-OWSI, once appointed and more detail is known.

Carbon and Energy Management Plan

2.5.30 The Carbon and Energy Management Plan (Application Document 7.19) sets out proposals for how the Project would minimise its carbon impact during construction and operation. To achieve this, the Project has reduced its carbon emissions during the development of the preliminary design through the use of current, commercially available low carbon solutions and technology. This has set the Project's low carbon position when compared to business as usual. The plan describes the carbon commitments that the Project is making, which are focused around setting a challenging carbon baseline and establishing a best practice approach to carbon management and the adoption of the PAS2080 Carbon Management in Infrastructure standard. The Carbon and Energy Management Plan provides details of the mechanisms which the Project and its contractors will use to further reduce carbon emissions over the lifetime of the Project by continuing to drive low carbon innovation and continued improvements.

2.5.31 Before construction starts, a Second Iteration of the Carbon and Energy Management Plan would need to be submitted to and approved by the Secretary of State following consultation with the stakeholders identified in the First Iteration. The Second Iteration must be substantially in accordance with the First Iteration submitted as part of the DCO application.

Preliminary Navigational Risk Assessment

2.5.32 The Preliminary Navigational Risk Assessment (pNRA) (Application Document 7.15) assesses and quantifies the navigation risk posed by the Project during construction and operation. The draft DCO seeks a range of powers necessary to undertake the Project, including powers in relation to construction of temporary and permanent structures, discharge of water and survey of the River Thames and adjoining land.

2.5.33 The requirement for a Navigational Risk Assessment, is secured in the protective provisions for the Port of London Authority (PLA) in the draft DCO. The protective provisions require a navigational risk assessment to be submitted to the PLA that must be in all material respects in accordance with the pNRA, and should include where relevant, the incorporation of risk controls identified in the pNRA.

Stakeholder Actions and Commitments Register

2.5.34 The Stakeholder Actions and Commitments Register (Application Document 7.21) provides a list of construction, design and operational phase related commitments given to stakeholders that are secured within the DCO and are not included in other documents or agreements such as side agreements (agreed with specific stakeholders outside of the DCO), environmental mitigation (as secured in the REAC) or measures required within the outline management plans. The intention of the document is to reduce the need for legal agreements by providing a mechanism to provide legally secured commitments which has the effect of assisting stakeholders by obviating time and expense associated with legal agreements and speeding up resolution of issues during examination.

Sustainable construction

2.5.35 As outlined in Section 2.2 of this chapter, sustainability considerations have been incorporated into the Project through inclusion of relevant concepts in the design, direct specification and by encouraging carbon emission reduction through the procurement process. As a result, a series of opportunities have been identified for the Project to promote sustainable construction practices and, specifically, reducing the GHG emissions generated throughout the construction phase. These include opportunities for the following measures:

a. Maximising the use of hybrid or electric plant – The use of hybrid and electric equipment where feasible has been assumed for the construction phase to reduce GHG emissions as set out in the Sustainability Statement (Application Document 7.11).

b. Reuse of material onsite – Reusing topsoil, vegetation and excavated material onsite during the construction phase reduces carbon emissions associated with transport and waste treatment.

c. Lower carbon concrete – Concrete, one of the main construction materials, has a relatively high carbon footprint and would be one of the main emission sources for the new road. As outlined in Section 2.2 of this chapter, the Project therefore includes for the use of steel fibre reinforced concrete (SFRC) which has lower carbon emissions than traditional steel bar reinforced concrete. In addition, the use of a low-carbon cement replacement is proposed across the Project.

d. Renewable energy for construction – The Project Contractors would be obliged to procure electricity used at compounds during the construction phase (including for the tunnel boring machinery and concrete plant) from renewable electricity suppliers.

e. Environmental product declarations – In addition to carbon emission reduction processes, the Project Contractors would need to identify their top 10 emissions-producing materials and provide environmental product declarations for them. These declarations set out the environmental performance or impact of any product or material over its lifetime.

f. Carbon management – The Project Contractors will be required to reduce their emissions beyond the carbon modelled and reported in this ES. Carbon reduction would be one of the evaluation criteria used during the Contractor procurement process. The selected Contractors would need to specify a challenging reduction target that would then become a contractual commitment.

g. The Contractors will be required to adhere to the approved standard for carbon management in infrastructure (British Standards Institution, 2016). They would develop a detailed plan of how reductions in GHG emissions

would be identified, prioritised, implemented and monitored throughout the supply chain. As early action is critical in minimising carbon emissions, Contractors must present their plan for approval within three months of appointment and these plans will be reviewed annually.

2.5.36 Further details on the sustainable construction opportunities considered during construction planning for the Project can be found in the Sustainability Statement (Application Document 7.11). ES Chapter 15: Climate concludes that the GHG impact of the Project would not have a material adverse impact on carbon reduction targets as set by the UK Government.

Construction monitoring

2.5.37 The Project would include various types of monitoring during the construction phase and during an appropriate period of the operational phase. The control plan documents identifies the monitoring required by the Project, as well as appropriate time spans. The following are examples of the monitoring that would be undertaken for the Project:

a. Noise and vibration monitoring to ensure that the mitigation measures are working effectively (identified in the REAC (Application Document 6.3, Appendix 2.2))

b. Regular onsite and offsite inspections to monitor dust (identified in the REAC)

c. Monitoring of protected species during construction (identified in the REAC)

d. Live monitoring of traffic on the road network (identified in the oTMPfC (Application Document 7.14)

2.5.38 Contractors would monitor greenhouse gas emissions from all construction activities and report these quarterly to the Applicant in line with the requirements of PAS 2080 Carbon Management in Infrastructure and the Contractors' Carbon and Energy Management Plans, which will be approved by the Secretary of State prior to construction.

Construction overview

2.5.39 Following the DCO Grant there would be preparatory works, referred to in the draft DCO (Application Document 3.1) as preliminary works taking place in 2024. The main construction period for the Project would start in early 2025, with the road being open for traffic in late 2030.

2.5.40 The construction of the Project has been split into three contracts in order to best serve the Project’s requirements and programme. National Highways’ contracting approach is outlined below, along with a brief description of each contract's purpose:

a. Kent Roads Contract: This is a design and build contract that would deliver the Project from approximately 100m north of Thong Lane green bridge north to the M2/A2/A122 Lower Thames Crossing junction. This contract would include the diversion and protection of existing utilities. This contract covers the works to deliver the Project within construction Section A.

b. Tunnels and Approaches Package: This is a design and build contract that would deliver the crossing under the River Thames , the approach ramp on the north side and approach in cutting on the south side. This contract would include the diversion and protection of existing utilities. This contract covers the works to deliver the crossing and the sections of highway within construction Section B.

c. Roads North of the Thames Contract: This is a design and build contract that would deliver the Project from the proposed Tilbury Viaduct (which starts just south of the Tilbury Loop railway line) up to and including the proposed works to the M25. This contract would include the diversion and protection of existing utilities. This contract covers the works to deliver the Project within construction Sections C and D.

2.5.41 Contractors would be employed via the three contracts described above to deliver the construction phase following the approval of the DCO application. Construction would take place following commencement, as defined in the draft DCO (Application Document 3.1). The following construction activities would be required to deliver the Project:

a. Initial works in preparation for construction, including setting up of construction compounds, utility connections for services and early stages of ecological mitigation

b. Utility diversions, protections and provision of temporary connections for construction of the Project and permanent connections for the operation of the Project

c. New junctions and associated slip roads on the A2, A13 and M25

d. New carriageway, including that in cuttings, on embankments and viaducts

e. Multiple crossings of roads, railway lines and watercourses

f. Long tunnel approach structures

g. Bored tunnel crossing

h. Landscape planting

i. Environmental mitigation and compensation

j. Testing and commissioning

k. Demobilisation

2.5.42 Information on the works to be undertaken within each construction section and an outline of the programme for these works is provided within Section 2.6 of this chapter. Further information on the activities comprising the main works is provided in Section 2.7 of this chapter.

Preliminary works

2.5.43 Preliminary works would take place in the phase between the DCO being granted and the commencement of construction. The term 'commencement' is formally defined in the draft DCO (Application Document 3.1).

2.5.44 The preliminary works activities have been identified as those which may be carried out early in the construction programme and which would have negligible or relatively minor environmental impacts. These activities and the locations where they can be undertaken are set out in the CoCP (Application Document 6.3, Appendix 2.2), and only these activities can take place prior to commencement, as defined in the draft DCO. Further information on these activities is provided in Section 2.7 of this chapter.

2.5.45 Activities started as preliminary works would continue following the commencement of construction as part of the delivery of the Project.

2.5.46 Environmental mitigation measures applicable to preliminary works are presented in the Preliminary Works Environmental Management Plan (Application Document 6.3, Appendix 2.2, Annex C).

2.5.47 These controls would be in place on the date the DCO comes into force to provide appropriate environmental controls over preliminary works activities. Ecology mitigation activities would be subject to protected species licences, where relevant.

Post-completion activities

2.5.48 It is anticipated that all construction activities would be complete prior to road opening, but unforeseen delays may result in some minor works, such as demobilisation of construction compounds, continuing after this date. If this were to occur, all works would follow the requirements set out in the control plan documents, and it is not anticipated that there would be material changes in the environmental effects reported in this ES.

2.5.49 Handover and the maintenance and operation phases of the Project are described in Section 2.8 of this chapter.

2.6 Construction Sections

2.6.1 This section of the report provides a brief outline of the work activities by construction Section, inclusive of any utilities works that are required. The description for each construction Section builds on the construction overview set out above and provides indicative locations, timescales and levels of intensity for each section of works.

2.6.2 The boundaries between the construction Sections are indicative – works which take place near, or across, the boundaries between construction Sections are described within the relevant construction Section. Each of the four construction Sections A to D have been further divided into the activities which would take place in a specified location, together with initial works, utilities works and testing and commissioning activities that would take place across the construction Section.

2.6.3 Indicative timelines are provided for each of the activities in Plate 2.12 to Plate 2.15, including an indication of the intensity of the works to be undertaken.

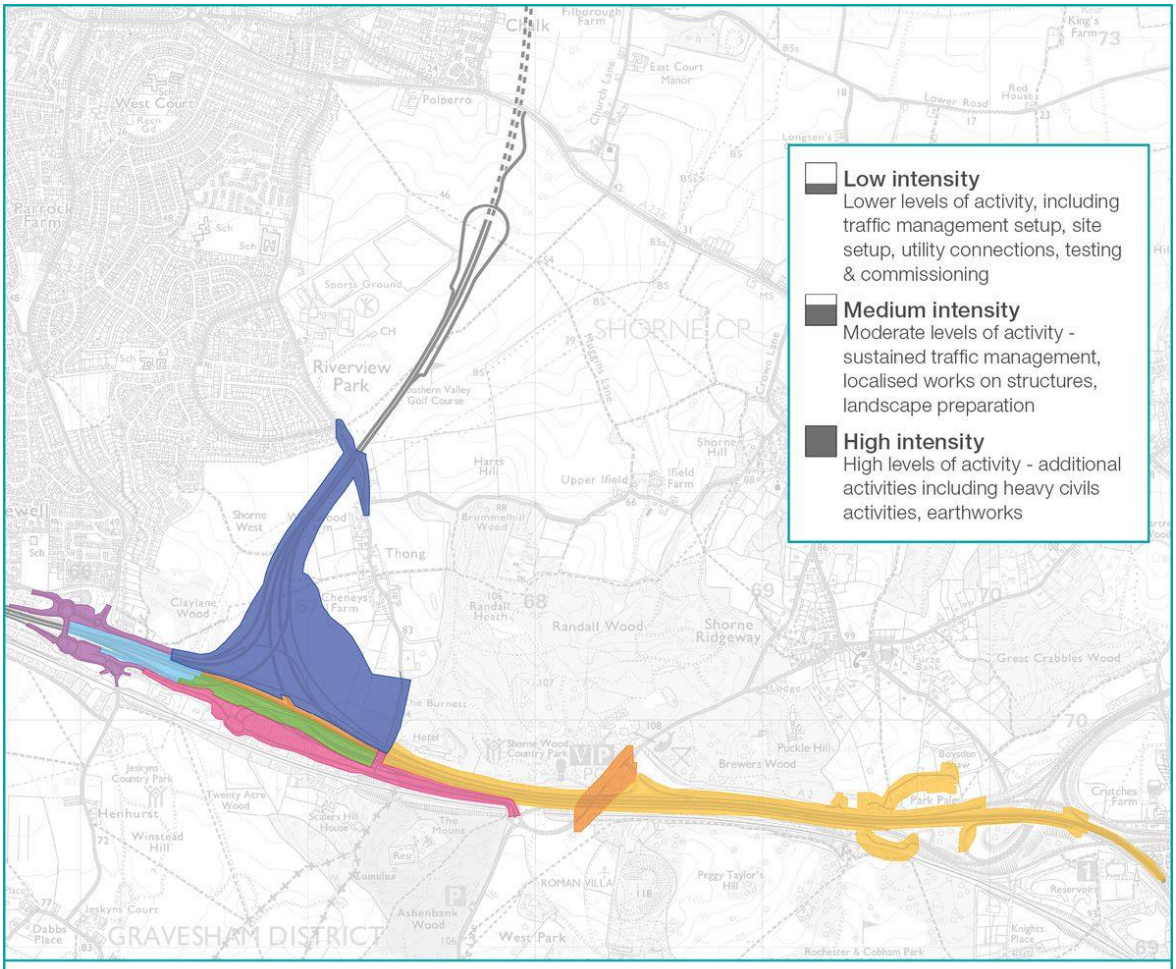
2.6.4 Details on the specific construction techniques, methods and general approaches to construction required for each construction activity are described in Section 2.7 of this chapter. Further information on working hours is provided in Section 2.7 of this chapter and in Appendix 2.2: Code of Construction Practice (Application Document 6.3), and the activities requiring extended hours are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3). Information on the traffic management associated with construction is provided under the 'Traffic management and construction traffic' heading for each Construction Section, with further detail provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Section A: South of the River Thames

2.6.5 Section A includes the area of the A2/M2 corridor, the proposed M2/A2/A122 Lower Thames Crossing junction and highways up to, and including, the proposed Thong Lane green bridge north over the A122.

2.6.6 Plate 2.12 illustrates the locations of the key construction activities for Section A, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 2.12 Section A construction activities and timeline



	2025				2026				2027				2028				2029				2030		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Initial works																							
Utility works																							
Gravesend East junction																							
Offline works north of A2/M2																							
Connector roads around the A2/M2																							
A2/M2 corridor works																							
A2/M2 corridor works																							
A2/M2 corridor works																							
A2/M2 corridor works																							
Testing & commissioning																							

2.6.7 Section A has been divided into the following activities, which are discussed below and relate to the information presented in Plate 2.12. It should be noted that Plate 2.12 does not identify all activities listed below. Where the activities take place throughout Section A, these are not identified on the mapping in Plate 2.12.

a. Preliminary works

b. Initial works

c. Walkers, cyclists and horse riders

d. Utilities works

e. Offline works north of the A2/M2

f. Gravesend East junction

g. Connector roads around the A2/M2

h. A2/M2 corridor works

i. Reinstatement and planting

j. Testing and commissioning

k. Compounds

l. Traffic management and construction traffic

2.6.8 A summary of the works undertaken as part of each activity identified in Plate 2.12 is provided below. Further detail on construction methods associated with these activities is provided in Section 2.7. Information related to compounds, access routes and construction traffic in Section A is also provided below. Additional information on extended working hours and construction traffic is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The Transport Assessment (Application Document 7.9) provides details on the forecast impacts from construction traffic.

Preliminary works

2.6.9 Preliminary works are those activities that would take place in the phase between the DCO being granted and the commencement of construction, as defined in the draft DCO (Application Document 3.1). In many cases, activities started as preliminary works, prior to the commencement of construction, would continue in later stages of construction. Most of the preliminary works activities within Section A are anticipated to start in late in 2024.

2.6.10 A general description of preliminary works is provided in Section 2.7 of this chapter.

Initial works

2.6.11 Initial works would take place following the commencement of construction, and are those activities that prepare the site and the compounds for the main construction activities. Initial works activities within Section A are anticipated to last around one year, with construction due to begin early in 2025.

2.6.12 A general description of initial works is provided in Section 2.7 of this chapter. Initial works in Section A would include the following activities:

a. Securing the site, including diverting or closing temporary public rights of way

b. Setting up the construction compounds including utility diversions and connections. Where ULHs are required early in the construction programme, these would be established as part of initial works. Construction compounds within Section A are as follows:

i. Marling Cross compound

ii. A2 compound

c. Establishing haul roads

Walkers, cyclists and horse riders (WCH)

2.6.13 The construction of the Project would result in changes to the network of routes used by WCH, including footpaths, shared use routes for pedestrians/cyclists and existing bridleways. Some routes within construction working areas would require temporary closure during construction to ensure the safety of users of the route. Temporary and permanent diversions would be provided for some routes to maintain connectivity during construction, while those that are unable to be diverted would be closed for as short a time as feasible to reduce the impact on the local public right of way network.

2.6.14 Some footpaths, shared use routes for pedestrians/cyclists and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network.

2.6.15 A full description of the Project proposals for each affected WCH route is provided in Part E of the Project Design Report (Application Document 7.4). The routes are also indicated in Figure 2.2: Project Proposals (Application Document 6.2) and presented in more detail on the Rights of Way and Access Plans (Application Document 2.7).

2.6.16 Section 2.7 of this chapter describes the construction of the permanent WCH routes and the temporary impacts on WCH routes resulting from the construction of the Project.

2.6.17 WCH routes temporarily diverted or closed during the works would be reinstated on completion of construction activities once it is safe for public.

Utilities works

2.6.18 The construction of the Project would require permanent diversion or protection of utilities, as described in Sections 2.3 and 2.4 of this chapter. These include overhead power lines and underground utilities such as gas and water pipelines, electricity and telecommunications cables, and the associated infrastructure such as cabinets, chambers and maintenance compounds.

2.6.19 Three of the utilities works required in Section A meet the relevant criteria for them to be defined as NSIPs in their own right due to the anticipated significant environmental effects associated with their diversion. These are Work numbers G2, G3 and G4.

2.6.20 Temporary utilities connections are also required to connect the compounds to the utility networks, providing communications, water, electricity and wastewater. Where practicable, these works would take place at the same time as other highway works or permanent utility diversions to reduce the impact on local communities. These connections would be removed at a later date as part of the compound demobilisation.

2.6.21 Overall, utilities works are anticipated to begin at the start of construction at the start of 2025 for Section A and would continue for up to five years. Most works would not take the full five-year duration, and this would not be in a single location. The most intensive works would take place from the start of 2026 until mid-2027. Temporary connections would be removed towards the end of the construction period during 2028, and where appropriate, the land would be reinstated to its previous condition.

2.6.22 In addition to the construction compounds, four temporary ULHs would be required south of the River Thames. Further information is provided in Table 2.6, and they are shown on Figure 2.5: Construction Information (Application Document 6.2). An indicative ULH layout is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The ULHs would be constructed for specific utilities works to be completed by the relevant utility company. These would be set up according to the timescales for which they would be operational; not all would be required at the start of construction in 2025. Where required, the Section A construction compounds would also support the major utility diversions undertaken south of the River Thames.

Table 2.6 ULHs in Section A

ULH	Utility company	Works	Approximate area (m^2)	Access	Approximate duration
Park Pale Lane ULH	Southern Gas Networks	Gas pipeline diversions (Work number G1a)	9,400	Park Pale	27 months
A2 East ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH1 and OHT1)	15,600	A2	16 months
A2 West ULH	National Grid Gas	Gas pipeline diversions (Work numbers G2, G3 and G4)	52,700	A2	24 months
Shorne Ifield Road ULH (this ULH is located in Construction Section B but facilitates utilities works that are also within Section A)	National Grid Gas	Gas pipeline diversions (Work numbers G3 and G4)	60,800	A226 Gravesend Road	14 months

2.6.23 It is anticipated that some of the utilities works would require working outside of standard working hours (referred to as extended working hours), including but not limited to tunnelling work for Work numbers G1b, G3 and G4; restringing of overhead lines for Work number OH1; and trenchless installation under the A2

for Work number MU2. Further information on working hours is provided in Section 2.7 of this chapter and in Appendix 2.2: Code of Construction Practice (Application Document 6.3), and the activities requiring extended working hours are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

National Grid gas diversions near the A2/M2

2.6.24 Two National Grid gas transmission pipelines would need to be diverted. One of the pipelines would be diverted in two separate locations. These would consist of approximately 0.12km in length at the Claylane Wood area (Work number G2) and 2.7km from the west of Thong Lane to the A226 (Work number G4). Work number G4 extends into construction Section B.

2.6.25 The other pipeline diversion would be approximately 1.6km in length and run from the east of Claylane Wood to Shorne Ifield Road, passing beneath Thong Lane and the A122 (Work number G3).

2.6.26 The majority of the pipeline diversions would be installed using normal open cut trenching techniques. However, due to the small footprint of land to the west of Thong Lane and the depth of the pipelines relative to the existing ground level, each of the pipelines (Work numbers G3 and G4) would be installed under the A122 by the construction of two shafts (approximately 17–20m in depth) and a joining tunnel (approximately 200m in length). The section under Thong Lane will be installed using trenchless techniques at a shallower depth of approximately 3–6m. To construct the tunnels, extended working hours would be required.

2.6.27 These three gas pipeline works (Work numbers G2, G3 and G4) would be NSIPs. The NSIP test has multiple criteria, but these works meet the criteria for significant environmental impacts in section 20(3) of the Planning Act 2008 and are therefore considered NSIPs. Further information is available in Appendix 1.3: Assessment of proposed gas pipeline works for the purposes of section 20 of the Planning Act 2008 (Application Document 6.3).

Diversion of National Grid power line at Thong Lane and the A2/M2

2.6.28 The permanent diversion of 495m horizontally within a length of approximately 1.8km of NGET 400kV overhead power line network (Work number OH1). This would include construction of a 75m high pylon north of the A2 at Claylane Wood west of the M2/A2/A122 Lower Thames Crossing junction, and three new pylons to cross the route and Thong Lane, and removal of four existing pylons. Temporary diversions of the power line (Work number OHT1) of approximately 1.8km length on four temporary pylons would be needed to maintain electricity supply while the new pylons are installed. To complete the restringing of the overhead power line, the working area would need to include the existing pylons from the south of High Speed 1 (HS1) through to the A226, a distance of around 3km. Restringing of the overhead powerlines is expected to be completed outside of core working hours. These works extend into Section B.

UK Power Networks (UKPN) proposals

2.6.29 A new electricity compound containing a new electricity substation and switchgear equipment would be constructed near the A226 (Work number MU21). This substation would be connected to the existing Northfleet grid

substation at the B262 Hall Road via a cable approximately 8.6km in length (Work numbers MU15 to MU17 and MU19), to be installed as part of the Project along the A2 Roman Road, Hever Court Road and then north heading along the WCH routes on the western side of the A122 to the A226. The A226 substation would provide permanent power for building and operating the new tunnels and South Portal, and provide temporary power to the A226 Gravesend Road compound and Milton compound located within Section B, to complete the associated works.

2.6.30 Working with UKPN, the Project proposals include reconfiguration of the local network to supply the required electricity north of the A226 from the new substation. This would remove approximately 2.8km of existing overhead power lines and poles between Gravelhill Wood and the A226 (Work number OH2). These works extend into Section B.

2.6.31 The construction of six substations is also proposed throughout Section A as part of the diversion works, as listed below:

a. SS1 - to the west of Harlex haulage

b. SS2 and SS3 - linked to the proposed Shorne Woods Country Park car park off Thong Lane

c. SS4 and SS5 - to the east of the HS1 National Grid compound

d. SS6 - to the south-east of the new Henhurst Road roundabout at the HS1 crossing

Diversion of Southern Gas Networks pipeline

2.6.32 A gas pipeline that follows the A2/M2 near Shorne Woods Country Park would need to be diverted to allow for the widening of the A2/M2 (Work numbers G1a and G1b). The total diversion length from Marling Cross to Park Pale is approximately 5.4km (Work number G1a approximate length of 2.4km and Work number G1b approximate length of 3km). The route has been selected to reduce the impact on the existing vegetation and lessen the impact on existing open space at Shorne Woods Country Park. The 1.5km section of the pipeline from Brewers Road to Park Pale (Work number G1a) would be located within the Brewers Road and Park Pale carriageway to avoid adverse effects on ancient woodland.

2.6.33 The majority of the pipeline diversion would be installed using normal open cut trenching techniques. However, due to the small footprint of land to the west of Thong Lane and the depth of the pipelines relative to the existing ground level, these would be installed under the Project road by the construction of two shafts (approximately 12–15m in depth) and a joining tunnel (approximately 180m in length). The section under Thong Lane and Valley Drive would be installed using trenchless techniques at a shallower depth of approximately 3–6m. To construct the tunnels, extended working hours would be required.

Diversion of other utilities networks

2.6.34 To ensure customer supplies are not adversely affected and can be operated and maintained safely while the new road is built and when it is open, it is necessary to complete multiple diversions of the network of utilities in Section A. The works required would involve the installation of multi-utility corridors for Work numbers MU1 to MU18. Specific additional information is provided for the Work numbers identified below, as relevant. Where no additional information is provided, the utilities works would be undertaken using standard trenching techniques during normal working hours.

a. Work number MU1 includes the installation of a new substation (SS1) to the west of Harlex haulage. It has been assumed that trenchless installation would be required under the A289.

b. Work number MU2 would require trenchless installation under the A2 at the Park Pale overbridge, and extended working hours.

c. It is anticipated that Work number MU10 would require installation using trenchless methods at Thong Lane.

d. Work number MU11 includes the installation of two new substations (SS2 and SS3) which would be linked to the proposed Shorne Woods Country Park car park off Thong Lane.

e. Work number MU13 includes the installation of two new substations (SS4 and SS5) which would be required to the east of the HS1 National Grid compound.

f. Work number MU14 includes the installation of a new substation (SS6) which would be required to the south-east of the new Henhurst Road roundabout at the HS1 crossing.

g. It is anticipated that Work number MU16 would be installed as a mix of open cut and trenchless construction methods.

Permanent multi-utility corridors

2.6.35 Multi-utility corridors would be required to divert assets affected by potential tunnel settlement, for the establishment and operation of the southern tunnel entrance compound and to enable the UKPN reconfiguration of the local network (Work numbers MU22 to MU26).

Temporary utilities works

2.6.36 Temporary supplies of power, water, foul water and communications connections would be required for the A2 compound (Work numbers MUT1). These supplies may be left in place for use by the proposed car park.

2.6.37 A temporary network connection would be required along Thong Lane to the west to existing Shorne Wood Switching Station while new routes are constructed (Work number MUT2).

2.6.38 Four temporary pylons and approximately 1.8km of overhead powerlines would be required as part of the diversion of National Grid power line at Thong Lane and the A2/M2 (Work number OHT1). These pylons and associated powerlines would be removed as part of the permanent works (Work number OH1). Extended working hours would be required for OHT1 and OH1.

2.6.39 The assessments presented in this ES have assumed that temporary utilities would be removed as part of the demobilisation works, which represents a reasonable worst-case. These may, however, be left *in situ*, which would require the development of proposals with relevant stakeholders, landowners and other developers.

Offline works north of the A2/M2

2.6.40 This activity relates to the construction of the Project between the A2/M2 junction and the Thong Lane green bridge north.

2.6.41 The construction of these works would be expected to take five years, beginning in early 2025 and lasting until early 2030.

Earthworks

2.6.42 A significant amount of this activity involves earthworks associated with the deep cutting between the proposed M2/A2/A122 Lower Thames Crossing junction and the South Portal. There would also be a false cutting along the M2/A2/A122 Lower Thames Crossing junction slip roads near Thong village.

2.6.43 Construction of Section A extends to the Thong Lane green bridge north, where the cutting would be excavated to a depth of 8m and around 80m wide.

2.6.44 The ground to be excavated south of the River Thames is mostly chalk, covered by a layer of topsoil around 0.25m in depth. The topsoil layer would be removed, stored and reused within the Project, for example to provide a top layer on nearby embankments for seeding with vegetation. The majority of the excavated chalk would be reused around the South Portal for the new landscaped area, Chalk Park (see Section 2.7 for further information).

M2/A2/A122 Lower Thames Crossing junction

2.6.45 The M2/A2/A122 Lower Thames Crossing junction would require the construction of two viaducts: Gravesend East to the M2 eastbound viaduct and the A122 southbound to the A2 westbound viaduct. The general approach to constructing viaducts is set out in Section 2.7 of this chapter.

2.6.46 Ecological work, including the moving of species, would take place at the start of construction as initial works, while some landscaping and environmental mitigation would happen towards the end of the programme.

2.6.47 Additional works would be required for building the parts of the proposed M2/A2/A122 Lower Thames Crossing junction that intersect with the existing A2/M2. The A2/M2 would remain open for most of the works, although overnight closures and extended working hours are likely towards the end of the programme when the new roads and structures are tied into the existing road network. Traffic management would be used and adapted along the A2/M2 as construction progresses, with narrow lanes and 60mph speed limits likely to be used.

Thong Lane green bridge north

2.6.48 A new green bridge would be constructed to allow Thong Lane to pass over the new A122, connecting woodland planting and providing a connection for WCH via the proposed bridleway. Its construction would require Thong Lane to be moved northwards so the road could remain open while the bridge is being built, with the exception of occasional overnight and/or weekend closures and extended working hours. It is anticipated that the construction would use similar techniques to a standard bridge, for example piling, building the supports and piers, and installing the deck.

Gravesend East junction

2.6.49 At the Gravesend East junction, construction works would include modifications to the junction, including an upgrade to the existing roundabout, widening an existing bridge, and changes to existing utilities in the area.

2.6.50 The works would be scheduled to begin early in the construction of Section A with an initial construction period of around one year starting in early 2025. The works would be completed towards the end of the overall construction phase, towards the end of 2029.

2.6.51 The works to upgrade the roundabouts would involve building retaining walls, carrying out earthworks, widening roads and upgrading lighting.

2.6.52 The junction would remain open throughout the work needed to upgrade the existing roundabouts, although there would be periods of traffic management such as reduced capacity and lane closures. It is anticipated that the works would require limited overnight or weekend closures and extended working hours.

Connector roads around the A2/M2

2.6.53 These works would include modifications to existing roads and the construction of new connector roads and bridges.

2.6.54 These works would take place throughout the construction of Section A, beginning in mid-2025 and ending in mid-2029.

Thong Lane green bridge south

2.6.55 A new green bridge is proposed over the A2/M2 at Thong Lane. As the new bridge has been designed on a different alignment to the existing one, the existing bridge would not require demolition until the new structure is in place. It is anticipated that the new bridge supports would be built onsite and the completed bridge deck brought in by road. The green bridge would be assembled overnight requiring closures of the A2/M2 while this takes place, with extended working hours.

Brewers Road green bridge

2.6.56 The new Brewers Road green bridge would be built on the same alignment as the existing bridge as this would need to connect directly to the existing HS1 green bridge immediately to the south. This alignment would maintain the wildlife corridor across the HS1 bridge, which would be further improved by the new green bridge linking habitats to the north of the A2/M2 with those south of HS1.

2.6.57 A long-term closure of Brewers Road (approximately 19 months) would be necessary to demolish the existing structure and build the replacement bridge. The durations of road closures are identified in the oTMPfC (Application Document 7.14). Although the existing bridge would be closed while the new green bridge is built, the A2/M2 would be kept open for the majority of the time, with only occasional overnight or weekend closures, and extended working hours. The A2 slip roads and the HS1 bridge would also remain open.

2.6.58 The first activity would be demolition of the existing bridge, requiring closure of the A2/M2 over a weekend. During this time, the entire bridge deck would be removed. The existing piers (bridge supports) would then be removed while the A2/M2 is running under temporary traffic management.

2.6.59 It is anticipated that the construction of the replacement bridge would take approximately 19 months. These works would take place alongside the A2/M2 widening works, described later in this section. Construction of the new, wider bridge would also involve replacing the northern supports, repositioning the piers, and partially rebuilding the southern supports. During this work, the A2/M2 would be subject to traffic management measures, including narrow lanes, a 60mph speed limit and some overnight or weekend closures.

2.6.60 Once the green bridges at Thong Lane and Brewers Road are built, features such as planting would be added to make them more likely to be used by wildlife, as would features appropriate for PRoW. Hedgerows close to the proposed green bridges would be improved and maintained to strengthen the wildlife corridors.

Other works, including Halfpence Lane

2.6.61 Other works associated with the connector roads around the A2/M2 would include the link roads between the new A122 and the A2 westbound, local roads between Henhurst Road roundabout and Thong Lane and Brewers Road roundabout, and sections of the Thong Lane green bridge south, and the Brewers Road bridge. None of these roads, apart from Brewers Road bridge, would be expected to close during construction, with the exception of occasional nights and weekends.

2.6.62 Works would be necessary on Halfpence Lane to divert a foul water main. The road would remain open to traffic apart from occasional short-term closures at night or weekends. It is anticipated that traffic management would involve a rolling contraflow where, rather than having the entire length of road under contraflow conditions, shorter 200m sections would be used and then relocated as the works progress. The contraflow is expected to be in place for approximately six months.

Cobham service station

2.6.63 Cobham service station would be closed early in the construction programme. Some decontamination activities may be needed, but this would not be confirmed until the tanks under the concrete have been checked for leaks or seepage. Once assessed, the tanks would be removed. Works would then begin to build a new roundabout involving the demolition of the existing petrol station, vegetation clearance, earthworks, new retaining walls and a bridge. New utilities would also be diverted into this area.

A2/M2 corridor works

2.6.64 The A2/M2 would be widened adjacent to the proposed M2/A2/A122 Lower Thames Crossing junction. This would include adding a fourth lane of the M2 through junction 1, and additional lanes in both directions running parallel to the A2 to provide connections to the A289 and the A2.

2.6.65 These works would take place throughout the construction of Section A, as shown in Plate 2.12, with work beginning in early 2025 and lasting until late 2029.

2.6.66 The widening works would use standard construction methods, and the new sections of highway would be built alongside the existing road and then joined together at the end. The A2/M2 widening works would take place in phases to align with the aforementioned construction of Brewers Road bridge.

2.6.67 It is proposed that the A2/M2 would remain open for the duration of the construction phase, apart from occasional overnight or weekend closures, with associated extended working hours.

2.6.68 The traffic management for these widening works would involve the introduction of narrow lanes and a 60mph maximum speed limit on the main A2/M2 carriageway in both directions between the Gravesend East junction and M2 junction 1. The hard shoulder would also be removed. Introducing narrow lanes on the main carriageway would also lead to changes at the merge and diverge locations. Traffic management on the A2 would be required for approximately two years during the construction phase.

2.6.69 Woodland edge planting would be established where woodland was removed to allow construction to take place.

Reinstatement and planting

2.6.70 Land temporarily utilised during the construction phase, including construction working areas, construction compounds and ULHs, would be reinstated on completion of the construction activities in accordance with the REAC (Application Document 6.3, Appendix 2.2).

2.6.71 Planting and landscaping would be undertaken as necessary in accordance with the oLEMP (Application Document 6.7) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.

2.6.72 Fences and other mitigation measures installed to protect environmentally sensitive areas from construction works would be removed on completion of construction activities.

2.6.73 Further information on reinstatement and planting activities is provided in Section 2.7 of this chapter.

Testing and commissioning

2.6.74 During the final part of the construction phase, testing would take place to ensure that the road (including all electrical and mechanical systems), structures, earthworks, drainage, public rights of way and other elements are complete and function to the required standards.

2.6.75 The individual parts of the new road, including its structures, gantries, drainage and other supporting infrastructure, would be tested as they reach completion. Testing would include adherence to the design specifications for each section of the road. The safety checks would vary according to the different functions and specifications of the element being tested. When construction of the Project road is complete, it would be tested in its entirety. The final testing and commissioning is scheduled to take place from late-2029 to mid-2030.

2.6.76 Commissioning refers to the completion of the testing phase, at which point the new road would be brought into public use.

Compounds

2.6.77 Each compound in Construction Section A is described in detail below. All dates and durations of activities are indicative. All compounds would require initial site set-up works and, at the end of their use, finalisation works including site reinstatement, landscaping and planting (as necessary). Compound locations are shown on Figure 2.5: Construction Information (Application Document 6.2), and indicative internal layouts are provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.6.78 The ULHs which support the utilities works within Construction Section A are discussed above, under the ‘Utilities works’ sub-heading.

Marling Cross compound

2.6.79 The Marling Cross compound is situated on land owned by National Highways near the Gravesend East junction. The compound is approximately 0.3ha in size and already exists, having been used as a base for personnel carrying out pre-construction investigative works for the Project, such as archaeological and environmental surveys. The compound’s facilities would be repurposed during initial works in 2025 to accommodate more staff and provide additional space. The existing utility connections from Valley Drive, which include a small substation on the edge of the compound, would be adequate for the construction works.

2.6.80 The compound would be used to support the works needed to build the Gravesend East junction. The site has fencing and access control security measures implemented, and this will be re-assessed to ensure the measures are effective at each phase. The existing access via Hever Court Road would remain during construction. This compound would have hardstanding with a tarmac surface throughout. Space would be provided for car parking, offices and welfare facilities, as well as storage for equipment and materials. It would be visually shielded from nearby properties by existing vegetation, and no noisy activities (such as piling) are anticipated to take place here. As a result, additional noise mitigation features have not been proposed.

2.6.81 The Marling Cross compound would be accessed via the Gravesend East junction and Valley Drive.

A2 compound

2.6.82 This compound would be used for the main construction work for Section A, except for the Gravesend East junction works (see ‘Marling Cross compound’, above). The compound would be approximately 5ha in size and would provide a

hub for deliveries and logistics, as well as checking and storing materials and equipment. The compound would be established during initial works in 2025 and would remain in place for the duration of the construction of Section A, which is planned to last around five years.

2.6.83 The compound would require electricity, communications, water and sewerage connections to existing utilities located near the Inn on the Lake. This would include the provision of a temporary electricity substation to provide power. The temporary utilities works associated with provision of supplies to the compounds are discussed further under the 'Utilities works' heading, above, for Section A.

2.6.84 An indicative layout of the compound is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). Within the compound there would be areas used for car parking, materials and equipment storage, offices and welfare facilities, and workshops. The remainder would be used for soil storage. Any construction compound facilities greater than 6m in height would be located as far as reasonably practicable away from nearby residential properties on Thong Lane and from the Kent Downs AONB. The Contractors would be required to carry out a risk assessment to establish whether the area set aside for soil storage should be fenced or not.

2.6.85 To reduce the visual and noise impacts on nearby Thong village, a 3m high bund, or barrier, would be constructed along the north-east boundary of the compound. This would remain while the compound is operational.

2.6.86 The main access to the site for works vehicles, including HGVs, would be via the eastbound A2. From here, vehicles would use an 8m wide, two-way haul road. Existing access on the north side of the A2, which used to be part of the former Esso petrol station, would be adapted.

2.6.87 There would be a secondary access on Thong Lane. HGVs would use the A2 as their primary access rather than driving through Thong village. Thong Lane would, however, be available to worker traffic which would mostly consist of cars and vans.

2.6.88 To create the secondary access for staff to the compound, works would be needed along Thong Lane and a rolling contraflow would be put in place. Instead of the entire length of road being under contraflow conditions, shorter 200m sections would be used and relocated as the works progress. It is anticipated that the contraflow system would be in place for one month, which would also assist with the utility connections to the compound.

2.6.89 The access points to the A2 compound are shown in the indicative layout in Appendix 2.1: Construction Supporting Information (Application Document 6.3). There would also be a haul road crossing Thong Lane, close to the south-eastern limit of Riverview Park, where temporary traffic lights would be needed.

2.6.90 It is proposed that, following the completion of construction, the A2 compound would be reused as a car park to allow the public to access the network of WCH routes and connections into Chalk Park, Shorne Woods Country Park and Jeskyns Community Woodland (via Thong Lane green bridge north). The Applicant would develop proposals with stakeholders, landowners and other developers to retain as much of the required compound infrastructure *in situ* as practicable, to reduce adverse environmental and traffic related effects during

the creation of the car park. The assessments presented in this ES have assumed that temporary utilities would be removed and the compound reinstated, reflective of a reasonable worst-case.

Traffic management and construction traffic

2.6.91 The access routes for each of the construction compounds are described above. The outline Traffic Management Plan for Construction (oTMPfC) (Application Document 7.14) presents the approach that would be followed when undertaking temporary traffic management during the construction phase. It includes further information on proposed construction routes, on roads where restrictions would be in place for use by HGVs associated with the Project, and proposed traffic management measures to facilitate the construction works.

2.6.92 In order to mitigate the construction traffic impacts on the surrounding road network, a decision has been made to restrict the use of HGVs delivering materials and moving excavated material for the Project on the local roads within Section A listed below. This ban would not affect other HGVs using these roads.

a. Brewers Road from Park Pale to the A226 Gravesend Road, including the Ridgeway and Peartree Lane.

b. Thong Lane between the A2 compound access and the A226

c. The Street, Cobham

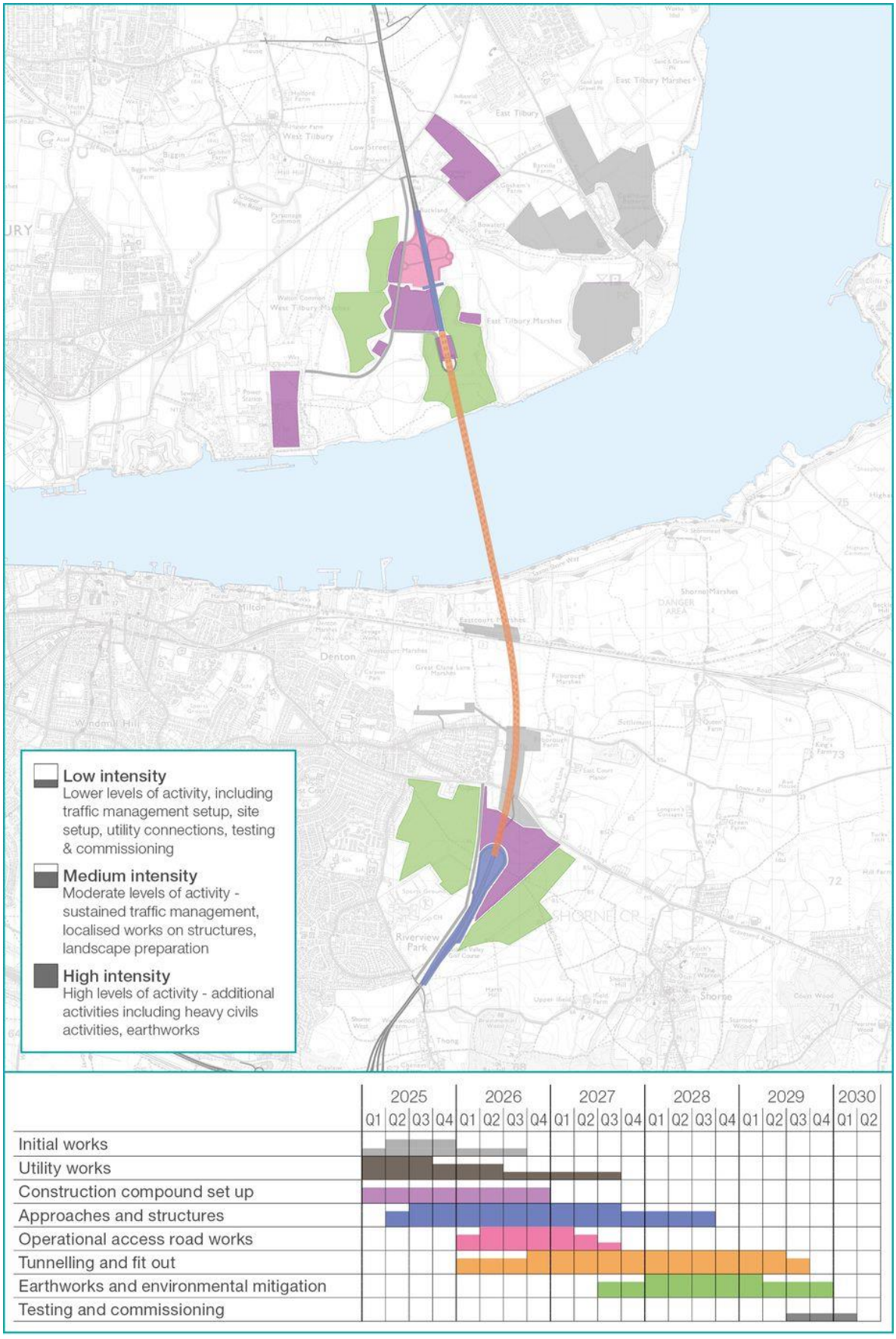
2.6.93 Proposed traffic management measures that could be implemented throughout the construction phase are outlined within Section 2.7 of this chapter, with further detail provided in the oTMPfC (Application Document 7.14). The indicative traffic management measures and road closures associated with the construction works and utilities works are detailed in the oTMPfC (Application Document 7.14). Further information on the effects of construction on the local road network is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Section B: A122 Lower Thames Crossing Tunnel

2.6.94 Section B covers the area between the proposed Thong Lane green bridge north and the proposed Tilbury Viaduct. This includes the work needed to construct the tunnels and their approach roads, south and north of the River Thames. A ground protection tunnel would run from south of Lower Higham Road to north of the Medway Canal and North Kent railway line.

2.6.95 Plate 2.13 illustrates the locations of the key construction infrastructure and locational activities for Section B, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 2.13 Section B construction activities and timeline



2.6.96 Section B has been divided into the following activities, which are discussed below and relate to the information presented in Plate 2.13. It should be noted that Plate 2.13 does not identify all activities listed below. Where the activities take place throughout Section B, these are not identified on the mapping in Plate 2.13.

2.6.97 The works with Section B are discussed under the following sub-headings:

a. Preliminary works

b. Initial works

c. Construction compound set-up

d. Walkers, cyclists and horse riders

e. Utilities works

f. Approaches and structures

g. Operational access road works

h. Tunnelling and fit-out

i. Earthworks and environmental mitigation

j. Reinstatement and planting

k. Testing and commissioning

l. Compounds

m. Traffic management and construction traffic.

2.6.98 A summary of the works undertaken as part of each activity identified in Plate 2.13 is provided below. Further detail on construction methods associated with these activities is provided in Section 2.7. Information related to compounds, access routes and construction traffic in Section B is also provided below. Additional information on extended working hours and construction traffic is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The Transport Assessment (Application Document 7.9) provides details on the impacts from construction traffic.

Preliminary works

2.6.99 Preliminary works are those activities that would take place in the phase between the DCO being granted and the commencement of construction, as defined in the draft DCO (Application Document 3.1). In many cases, activities started as preliminary works, prior to the commencement of construction, would continue into later stages of construction. Most of the preliminary works activities within Section B are anticipated to take place in late 2024.

2.6.100 A general description of preliminary works is provided in Section 2.7 of this chapter.

Initial works

2.6.101 Initial works would take place following the commencement of construction, and are those activities that prepare the site and the compounds for the main construction activities. Initial works activities within Section B are anticipated to begin early in 2025 and be complete at the end of 2025.

2.6.102 A general description of initial works is provided in Section 2.7 of this chapter. Initial works in Section B would include the following activities:

a. Securing the site, including diverting or closing temporary public rights of way.

b. Setting up the construction compounds including utility diversions and connections. Where ULHs are required early in the construction programme, these would be established as part of initial works. Construction compounds within Section B are as follows:

   i. Southern tunnel entrance compound

   ii. A226 Gravesend Road compound

   iii. Milton compound

   iv. Northern tunnel entrance compound

c. Establishing haul roads

d. Ground treatment.

Ground treatment

2.6.103 Due to the ground conditions at both the South Portal and North Portal locations, ground treatment would be required before heavy construction activities can begin. Initial works would prepare the ground so that it can be strengthened to support the heavy loads that would be placed upon it through use of the construction compound and as part of the construction of the approaches, structures and tunnels. This would be done using a number of different techniques, including stabilising the ground by mixing with grout and cement. Where there are particularly heavy loads, for example underneath fixed crane positions, more ground improvement would be carried out or deeper foundations would be constructed.

2.6.104 South of the River Thames, the bored tunnels would pass beneath the Thames Estuary and Marshes SPA and Ramsar site, through material that includes Alluvium, Chalk and River Terrace Deposits. These varying ground conditions and the potential for instability would require the ground to be strengthened for two purposes:

a. To allow the tunnel boring machinery to pass through this area without causing any excessive settlement, including under the North Kent railway line.

b. To allow for safe construction of cross-passages between the two bored tunnels.

2.6.105 These works would take place over approximately 12 months, beginning in mid-2025.

2.6.106 A number of ground treatment measures would be required as part of the tunnel works. It is anticipated that the Contractors would need to install grout blocks at critical locations in advance of the arrival of the tunnel boring machinery to site. Further information on the methods for ground treatment is provided in Section 2.7.

2.6.107 Works to allow ground treatment beneath the Thames Estuary and Marshes SPA and Ramsar site would involve constructing a ground protection tunnel with an outside diameter of approximately 5.8m.

2.6.108 It would start from a shaft located south of Lower Higham Road, and travel to a shaft north of the North Kent railway line. This tunnel would then be used to access the areas above which the main road tunnels would pass and where ground treatment is needed.

2.6.109 Once the ground strengthening works are completed, both the shafts and ground protection tunnel would be backfilled, and the ground would be reinstated to its original condition.

2.6.110 It is assumed that the ground protection tunnelling would be needed, although the Contractors would be allowed to carry out further detailed ground investigations and these may conclude that the work can be avoided. The assessments presented in this ES have assumed that the ground protection tunnel is required, as the reasonable worse case.

2.6.111 It is anticipated that deep soil mixing would be required to strengthen the ground beneath the haul roads throughout the northern tunnel entrance compound. Shallow soil mixing is anticipated to be required more widely within the compound areas used for the construction of the approaches and structures.

Construction compound set-up

2.6.112 There are four proposed construction compounds in Section B: three to the south of the River Thames (southern tunnel entrance compound, the A226 Gravesend Road compound and the Milton compound) and one to the north (northern tunnel entrance compound). These are shown in Figure 2.5 (Application Document 6.2) and described further under the ‘Compounds’ subheading, below, in this section.

2.6.113 Alongside the initial works described above, to facilitate the tunnelling, the northern tunnel entrance compound would be established next to the North Portal site, along with relevant accesses from the local road network. Due to the large size of this compound and the complex nature of the works undertaken the compound set up would extend from early 2025 until the end of 2026.

2.6.114 Site facilities would be established adjacent to the North Portal prior to the start of tunnelling activities. The compound would include a precast facility for tunnel lining production and storage, a separation plant for processing excavated material, a water treatment plant, hyperbaric facilities and other plant to support

tunnel construction. The Project would require the construction of a temporary substation to provide power from the existing network to the tunnel boring machinery constructing the tunnels and all the support functions listed above.

2.6.115 Prior to the start of works at the northern tunnel entrance compound, environmental mitigation works adjacent to Coalhouse Point would need to be completed. These works would involve creation of wet grassland habitat. The water inlet with self-regulating valve associated with the habitat creation area would also need to be installed and operational prior to the start of works at the northern tunnel entrance compound. These works would involve working within the intertidal zone from a suitable vessel to install piles and excavate and install the valve structure.

2.6.116 Additional details on the set up of the northern tunnel entrance compound are provided under the 'Compounds' subheading, below, within this section.

Walkers, cyclists and horse riders (WCH)

2.6.117 The construction of the Project would result in changes to the network of routes used by WCH, including footpaths, shared use routes for pedestrians/cyclists and existing bridleways. Some routes within construction working areas would require temporary closure during construction to ensure the safety of users of the route. Temporary and permanent diversions would be provided for some routes to maintain connectivity during construction, while those that are unable to be diverted would be closed for as short a time as feasible to reduce the impact on the local public right of way network.

2.6.118 Some footpaths, shared use routes for pedestrians/cyclists and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network.

2.6.119 A full description of the Project proposals for each affected WCH route is provided in Part E of the Project Design Report (Application Document 7.4). The routes are also indicated in Figure 2.2: Project Proposals (Application Document 6.2) and presented in more detail on the Rights of Way and Access Plans (Application Document 2.7).

2.6.120 Section 2.7 of this chapter describes the construction of the permanent WCH works and the temporary impacts on WCH works resulting from the construction of the Project.

2.6.121 WCH routes temporarily diverted or closed during the works would be reinstated on completion of construction activities once it is safe for public.

Utilities works

2.6.122 The construction of the Project would require permanent diversion or protection of utilities, as described in Sections 2.3 and 2.4 of this chapter. These include overhead power lines and underground utilities such as gas and water pipelines, electricity and telecommunications cables, and the associated infrastructure such as cabinets, chambers and maintenance compounds.

2.6.123 Temporary utilities connections are required to connect the compounds to the utility networks, providing communications, water, electricity, gas and

wastewater. Where practicable, these works would take place at the same time as other highway works or permanent utility diversions to reduce the impact on the local communities. These connections would be removed at a later date as part of the compound demobilisation.

2.6.124 Utilities works would begin at the start of construction for Section B, and would continue for up to three years. Temporary connections would be removed towards the end of the construction period during 2028, and where appropriate, the land would be reinstated to its previous condition.

2.6.125 In addition to the construction compounds, the Shorne Ifield ULH would be located within Construction Section B. Further information on this ULH is provided in Table 2.7, and it is shown on Figure 2.5: Construction Information (Application Document 6.2). An indicative ULH layout is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The ULHs would be constructed for specific utilities works to be completed by the relevant utility company. These would be set up according to the timescales for which they would be operational; not all would be required immediately, at the start of construction in 2025. Where required, the Section B construction compounds would also support the delivery of the major utilities works.

Table 2.7 ULHs in Section B

ULH	Utility company	Works	Approximate area (m^2)	Access	Approximate Duration
Shorne Ifield Road ULH (This ULH is located in Construction Section B but facilitates utilities works that are also within Section A)	National Grid Gas	Gas pipeline diversions Work numbers G3 and G4	60,800	A226 Gravesend Road	14 months

2.6.126 It is anticipated that some of the utilities works would require working outside of standard working hours (referred to as extended working hours), for example where trenchless crossings are required beneath roads or railways, or for restringing works. Further information on working hours is provided in Section 2.7 of this chapter and in Appendix 2.2: Code of Construction Practice (Application Document 6.3), and the activities requiring extended working hours are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

South of the River Thames

National Grid gas diversions near the A226

2.6.127 One National Grid gas transmission pipeline would need to be diverted via the construction of an approximately 2.7km pipeline, extending from the west of Thong Lane to the A226 (Work number G4). Work number G4 extends into construction Section A.

2.6.128 This gas pipeline works (Work numbers G4) would be an NSIP. The NSIP test has multiple criteria, but these works meet the criteria for significant environmental impacts in section 20(3) of the Planning Act 2008 and are therefore considered NSIPs. Further information is available in Appendix 1.3: Assessment of proposed gas pipeline works for the purposes of section 20 of the Planning Act 2008 (Application Document 6.3).

Diversion of National Grid power line at Thong Lane and the A2/M2

2.6.129 The permanent diversion of 495m horizontally within a length of approximately 1.8km of NGET 400kV overhead power line network (Work number OH1). This would include construction of a 75m high pylon north of the A2 at Claylane Wood west of the A2 A122 junction, and three new pylons to cross the route and Thong Lane, and removal of four existing pylons. Temporary diversions of the power line (Work number OHT1) of approximately 1.8km length on four temporary pylons would be needed to maintain electricity supply while the new pylons are installed. To complete the restringing of the overhead power line, the working area would need to include the existing pylons from the south of HS1 through to the A226, a distance of around 3km. Restringing of the overhead powerlines is expected to be completed outside of core working hours. These works extend into Section A.

UK Power Networks (UKPN) proposals

2.6.130 A new electricity substation would be constructed in the area near the A226 (Work number MU21). This substation would be connected to the existing Northfleet grid substation at the B262 Hall Road via a cable approximately 8.6km in length to be installed as part of the Project. This includes Work numbers MU19 in Section B and Work numbers MU15 to MU17 in Section A (see Section A for further information). The A226 substation would provide permanent power for building and operating the new tunnels and South Portal (Work number MU20) and provide temporary power to the A226 Gravesend Road compound and Milton compound located within Section B, to complete the associated works.

2.6.131 Working with UKPN, the Project proposals include reconfiguration of the local network to supply the required electricity north of the A226 from the new substation. This would promote removing 2.8km of existing overhead power lines and poles between Gravelhill Wood and the A226 (Work number OH2). These works extend into Section A.

Permanent multi-utility corridors

2.6.132 Permanent utility connections would be for the operation of the A122, TSB and the tunnels. This includes the power supply from Northfleet Grid Site (MU15, MU16, MU17, MU19, MU21 (Primary Substation) for power) (MU20 (from the A226) for multi utility (comms, power, water, foul) and to enable the reconfiguration of the local networks).

2.6.133 Diversion of other utility networks would be required to the local gas, water, communications and power networks to support the construction of the Project (Work numbers MU22 to MU26).

Temporary utilities works

2.6.134 In addition to the UKPN connections described above, temporary supplies of power, water, foul water and communications would be required for the southern tunnel entrance compound, the A226 Gravesend Road compound and the Milton compound (Work number MUT3). The assessments presented in this ES have assumed that temporary utilities would be removed as part of the demobilisation works, which represents a reasonable worst-case. These may be left *in situ* in the A226 and along the substation access road once works are completed. This would require the development of proposals with relevant stakeholders, landowners and other developers.

North of the River Thames

Diversion of overhead power lines

2.6.135 The diversion of overhead power lines (Work numbers OH3, OH4 and MU28) also fall within Construction Section C. Detailed descriptions of these diversions are provided for Construction Section C. These works would require extended working hours.

Thurrock Flexible Generation Plant (TFGP) high-pressure gas pipeline

2.6.136 The TFGP DCO application identified the diversion of a high pressure gas pipeline. The route of the diversion proposed would conflict with the Project proposals, rendering the pipeline alignment non-compliant with gas industry standards. This has therefore been amended in the Project proposals to run perpendicular to the Project route rather than crossing it diagonally. The revised diversion route runs beneath the Tilbury Viaduct, adjacent to the proposed watercourse diversion. On the western side of the Project route, the pipeline would be located between the maintenance access road and watercourse diversion where it links up south of Footpath 200 with the existing pipeline. The revised diversion would be installed as part of the construction of the Project (Work number TFGP1) and would require approximately 0.3km of pipeline diversion. It is anticipated that the diversion would be installed using open cut techniques except where trenchless methods would be used to cross watercourses.

Permanent multi-utility corridors

2.6.137 Permanent utilities connections for the North Portal would extend from Construction Section C as part of the reconfiguring of local networks (Work numbers MU27 and MU29). It is assumed that Work number MU29 would require trenchless installation under the railway and extended working hours.

Temporary utilities works

2.6.138 Temporary supplies of power, water, foul water, gas and communications connections would be required for the northern tunnel entrance compound (Work numbers MUT4 to MUT11). The assets would be removed as part of the demobilisation of the compound, unless identified below. Specific additional information is provided for the Work numbers identified below, as relevant. Where no additional information is provided, the utilities works would be undertaken using standard trenching techniques during normal working hours.

a. Work number MUT4 would require the installation of cables connected to the existing 132kV overhead powerline network and the Tilbury Substation to Work number MUT5. Work number MUT5 would require the installation of a 60MVA substation. These works are to provide electricity supply to the tunnel boring machinery.

b. Work number MUT6 is an approximately 3.18km installation of water supply from Linford Borehole to the point of distribution for the tunnel boring machinery. It would require trenchless installation beneath the London, Tilbury and Southend railway line. It is proposed that this section would not be removed following construction, but would be left in situ. The remaining length would be removed. It is assumed that installation of the pipeline would require extended working hours.

c. Work number MUT8 is an approximately 0.5km installation of a foul water connection and would require trenchless installation beneath the London, Tilbury and Southend railway line. It is proposed that this section would not be removed following construction, but would be left *in situ* as agreed with relevant stakeholders. The remaining length would be removed. It is assumed that installation of the pipeline would require extended working hours.

2.6.139 The assessments presented in this ES have assumed that temporary utilities would be removed as part of the demobilisation works, which represents a reasonable worst-case, but these may be left *in situ*. This would require the development of proposals with relevant stakeholders, landowners and other developers.

Approaches and structures

2.6.140 To connect the deep bored tunnel to the surface-level highway, approach ramps would be constructed. The construction of the approaches and structures would take place from approximately mid-2025 to mid-2028.

2.6.141 At the North Portal, the deeper part of the approach ramp would be excavated first so that the tunnel boring machinery can be lowered into the excavation to start tunnelling. Following this, the cut and cover section would be constructed, through construction of a structure to form a section of tunnel which is then buried. As the cut and cover section rises to meet ground level, the excavation is left open and formed into a cutting. The road would continue to rise following the ramp, becoming shallower until it eventually meets ground level.

2.6.142 The launch structure at the North Portal would be a large excavation, with a concrete base and walls, supported by steel props. This box structure would provide a solid base on which to assemble the tunnel boring machinery, and a firm support against which pressure would be applied to push the tunnel boring machinery forwards. The box structure would be open during tunnelling activities and then incorporated into the cut and cover tunnel.

2.6.143 Structures would be built at the North Portal site for launching and servicing the tunnel boring machinery for their tunnel drives.

2.6.144 At the South Portal, the tunnel would emerge into a deep cutting that leads southwards towards the M2/A2/A122 Lower Thames Crossing junction. The cutting work at the South Portal would involve the excavation of mostly chalk material. A deep excavation would be needed to build the section of road between the new M2/A2/A122 Lower Thames Crossing junction and the tunnel.

2.6.145 The excavation works associated with the construction of approaches at both the North and South Portals would produce a significant amount of excavated material. The excavated material would be processed, temporarily stored and used in the earthworks and landscaping activities such as creating the Tilbury Fields and Chalk Park landscape features.

2.6.146 A detailed description of the methodologies associated with the construction of the tunnel approaches and structures, and earthworks and landscaping, is provided in Section 2.7 of this chapter.

Operational access road works

2.6.147 The operational access roads providing emergency access at the North Portal would be constructed making use of the haul roads used during the construction phase. Construction of the operational access roads would take place from early 2026 until mid-2027.

2.6.148 This would include construction of an overbridge and on and off slip roads providing emergency access to both the north and south along the new road. These works would involve the construction of an overbridge over the A122 and highways works associated with the creation of roundabouts, access road and associated on- and off-slips. This would include the upgrade of the haul road used during construction to an operational access road. The works would include earthworks associated with the approach to the Tilbury Viaduct and the construction of the emergency access overbridge. The works would also include the construction the highway drainage networks.

Tunnelling and fit-out

2.6.149 Our assessments have been based on a scenario where two tunnel boring machines (TBMs) are working to construct the tunnels, working from north to south. It has been assumed for assessment purposes that each tunnel would be excavated by a single TBM and lined with precast concrete segments. These segments would be produced in a batching facility located within the hardstanding area which was formerly part of the Tilbury Power Station. These segments would be assembled once the tunnel boring machinery has passed through that area. Once the bored tunnels under the River Thames have been made by the TBMs, they would then be strengthened and prepared for use as public roads.

2.6.150 The tunnelling and fit-out activities would take place throughout the second half of the construction of Section B, beginning in 2026 and continuing until mid-2029.

2.6.151 On average, the tunnel boring machinery would advance at a rate of 50m per week, depending on the model of machine selected by the Contractors and geology that the tunnel boring machinery passes through. Site activities on the surface would need to support the tunnel boring machinery and this would take place 24 hours a day, seven days a week. The works at the northern tunnel

entrance compound would be lit at all times and measures would be taken to limit any disturbance caused. For example, lighting would not be directed towards residential areas.

2.6.152 Once the tunnel boring machinery has finished a section of the tunnel, the internal road deck would be installed sequentially, as large precast units within the tunnel. Due to their size and weight, it is anticipated that these units are likely to be produced onsite.

2.6.153 The twin road tunnels would be connected at regular intervals by cross-passages. These are short, smaller diameter tunnels that provide emergency escape routes for pedestrians to move from one tunnel to the other. Our assessment is based on a scenario in which these would be constructed behind the tunnel boring machinery as it progresses, after the second TBM starts in mid-2027.

2.6.154 All materials and equipment required for tunnel construction would be supplied from the northern tunnel entrance compound. Contractors would work on rotating shifts operating on a 24-hour basis to crew the tunnel boring machinery, install the deck, and cross-passages, and carry out associated surface activities.

2.6.155 Some non-technical works, such as the installation of support brackets and cable-trays, may take place as the tunnel progresses. However, the bulk of the installation of the more sensitive mechanical, electrical and communication equipment would need to take place in a clean environment, after the main civil engineering works have been completed, and so would happen once the tunnel boring work is complete and the tunnel boring machinery removed from the tunnels. This would be on a 24-hour basis from both the North and South Portals.

2.6.156 The tunnel boring machinery would produce a large volume of excavated material that would emerge at the North Portal where it would be processed, temporarily stored and then spread as fill to create the finished landscape, including the Tilbury Fields landscape feature.

Earthworks and environmental mitigation

2.6.157 Earthworks activities for Section B involving the movement, processing and placement of excavated material would continue throughout the construction activities described above, such as the excavation of approaches and structures and boring of the tunnels.

2.6.158 The material excavated from the approaches and structures and tunnelling work would be temporarily stored within the construction compounds until placed in the permanent locations at Chalk Park, adjacent to the South Portal, and at Tilbury Fields, adjacent to the North Portal, with surplus material placed at Ashfields. These earthworks activities would take place throughout the second half of the construction of Section B, starting in mid-2027.

2.6.159 Following the placement of the excavated material, the associated landscaping works would be undertaken to create the ecological and landscape features, including woodland planting, species-rich grassland and open mosaic habitat. The creation of Chalk Park and Tilbury Fields forms part of the environmental

mitigation proposals for the Project. These works would conclude at the end of 2029.

Reinstatement and planting

2.6.160 Land temporarily utilised during the construction phase, including construction working areas, construction compounds and ULHs, would be reinstated on completion of the construction activities in accordance with the REAC (Application Document 6.3, Appendix 2.2).

2.6.161 Planting and landscaping would be undertaken as necessary in accordance with the oLEMP (Application Document 6.7) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.

2.6.162 Fences and other mitigation measures installed to protect environmentally sensitive areas from construction works would be removed on completion of construction activities.

2.6.163 Further information on reinstatement and planting activities is provided in Section 2.7 of this chapter.

Testing and commissioning

2.6.164 Following the completion of construction activities, testing would take place to ensure that the tunnel and road (including all electrical and mechanical systems), structures, earthworks, drainage, public rights of way and other elements are complete and function to the required standards.

2.6.165 Testing would be ongoing throughout construction as activities are completed. When construction of the Project road is complete, it would be tested in its entirety. The final testing and commissioning is scheduled to take place from mid-2029 to late-2029.

2.6.166 The individual elements of the tunnel and new road, including the TSB, structures, gantries, drainage and other supporting infrastructure, would be tested as they reach completion. Testing would include adherence to the design specifications for each section of the road and tunnel. The safety checks would vary according to the different function and specifications of the element being tested.

2.6.167 Commissioning refers to the completion of the testing phase, at which point the tunnels and associated work elements would be brought into public use.

Compounds

2.6.168 Each compound within Construction Section B is described in detail below. All dates and durations of activities are indicative. All compounds would require initial site set-up works and, at the end of their use, finalisation works including site reinstatement, landscaping and planting (as necessary). Compound locations are shown on Figure 2.5: Construction Information (Application Document 6.2), and indicative internal layouts are provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.6.169 The ULHs which support the utilities works within Section B are discussed above, under the ‘Utilities works’ sub-heading.

Timing

2.6.170 The setting up of compounds would take place over roughly two years, during 2025 and 2026. This period includes all the access roads and ground improvement works, in addition to the time needed to set up offices and welfare facilities. This would start within the first three months of the construction process for Section B. The compounds would be in use throughout the period of construction works for Section B.

Southern tunnel entrance compound

2.6.171 The southern tunnel entrance compound would support the construction of the South Portal and approach structures and the tunnelling activities at this location. This would be a large site of around 163ha in size, located to the south of the Ramsar site, with no direct connection to the River Thames as shown in Figure 2.5: Construction Information (Application Document 6.2).

2.6.172 The main route into the southern tunnel entrance compound would be via the A2, the A289 and then the A226, with the entrance and exit being on the southern side of the A226 in Chalk ward, between Castle Lane and Church Lane.

2.6.173 A one-way internal access road would be built off the A226 to provide access for construction materials, equipment, personnel and for emergency services. This would be temporary, lasting for the duration that the compound is operational. The access road would be built to limit disruption to other road users and in line with standards required for HGVs. Generally, the road surface in the compound would be at ground level, but cuttings or raised embankments would be used to even-out the route.

2.6.174 Construction vehicle movements would be planned to ensure the compound operates efficiently and that unnecessary journeys and congestion are avoided. Speed limits in the compound would apply to improve safety and suppress dust emissions, and pedestrians would be separated from vehicles. Security and traffic management would be in place at access points off the public road. The shift patterns at this compound would include standard shifts, extended shifts and, in some periods, shifts across whole 24-hour days.

2.6.175 Within this compound, there would be internal haul roads for the distribution of people, materials, plant and equipment, and excavated material to where it is placed in permanent earthworks. These haul roads would not be for public use and only used by construction vehicles and equipment.

2.6.176 An indicative layout for the southern tunnel entrance compound is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3), which shows the locations of earthworks storage, materials storage, offices and welfare facilities, parking and internal haul routes.

A226 Gravesend Road compound

2.6.177 Local ground conditions mean a number of ground treatment measures would be needed as part of the Project tunnel works. To treat the ground beneath the Thames Estuary and Marshes SPA and Ramsar site, a ground protection tunnel is proposed.

2.6.178 Two compounds would be required to support the works associated with the ground protection tunnel and the ground treatment works. These are the A226

Gravesend Road compound and the Milton compound. Further information on the proposed works is provided in Section 2.7. An indicative layout of the A226 Gravesend Road compound, which would be approximately 5.6ha in size, is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.6.179 There would be three main phases of work at the compound, including the excavation of a ground protection tunnel:

a. Mobilisation, site set-up and the excavation of a vertical shaft from which to launch the tunnel boring machinery for the ground protection tunnel

b. tunnel boring machinery assembly, launch and tunnelling

c. Ground treatment and site take-down

2.6.180 While the construction compound is being established, access would be provided from Gravesend along Lower Higham Road. Access to the compound for HGVs would be from the A226 Gravesend Road from the east. From here, a dedicated access road would also be built across the field from the A226 to the south for the delivery of the ground protection tunnel boring machinery components and larger HGV loads.

Milton compound

2.6.181 The Milton compound is a satellite compound which would be approximately 3.2ha in size and mainly used for the reception and removal of the ground protection tunnel boring machinery, and to manage the settlement of the ground above the main bored tunnels. The site set-up would include cabin installation, delivery of a super-silenced generator and the preparation of the ground for use by heavy machinery. A gantry crane would be used to support tunnelling operations. An indicative layout of the compound is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.6.182 The Milton compound would also be accessed via the A226 Gravesend Road/Rochester Road, via Milton Road, Prospect Grove, Norfolk Road and Mark Lane, and the road alongside the Thames and Medway Canal. These roads would remain open to the public throughout the construction phase. Access to the Milton compound for HGVs would be along the A226 from the A289.

2.6.183 As the compound is located next to the Milton Rifle Range, it would have bullet-proof barriers and secure hoardings installed around the perimeter. Topsoil would be stripped and stored onsite so that the land could later be restored to its former condition once the works are complete.

Northern tunnel entrance compound

2.6.184 A construction compound of approximately 155ha in size would be set up near the River Thames to support the tunnel boring activity. The compound would be next to the North Portal, west of East Tilbury and Coalhouse Fort, with access from the local road network as shown in Figure 2.5: Construction Information (Application Document 6.2). The northern tunnel entrance compound includes sites previously used as part of the former Tilbury Power Station and former coal yard which already have a hardstanding surface.

2.6.185 Tunnelling and supporting operations on the surface would require the installation of temporary infrastructure, including a haul road through the site for the delivery of materials. Work within the northern tunnel entrance compound associated with tunnelling activities would be carried out 24 hours per day, seven days per week.

2.6.186 Before tunnel construction begins, essential site facilities would be set up next to the North Portal. In addition to the usual compound arrangements of offices, welfare, parking and areas for material to be delivered and stored, this site would include temporary facilities such as the following:

a. Concrete batching facilities, including a precast facility for tunnel lining production and storage: one for general concrete works and one for sprayed concrete

b. A Slurry Treatment Plant (STP) for processing excavated material

c. An area to manage and store excavated spoil including lagoons and pumps to clean and manage rainwater falling on the spoil stockpiles

d. A water treatment plant

e. Hyperbaric facilities, allowing specialist workers to remain in high pressure compressed air environments, which would be necessary for certain tunnelling activities

f. Sleeping accommodation for construction workers

g. A helipad for use by emergency services

h. Other equipment to support tunnel construction such as cranes and special vehicles to carry segments into the tunnel

i. Offices and worker welfare buildings

2.6.187 Within this compound, there would be internal haul roads for the distribution of people, materials, plant and equipment and excavated material to where it is placed in permanent earthworks. These haul roads would not be for public use and only used by construction vehicles and equipment.

2.6.188 It has been assumed that two conveyors would be used within the northern tunnel entrance compound for transporting materials. One would be used to transport excavated material following processing at the STP for storage at Shed Marsh. The other would be located within a westward spur of the Order Limits to connect to the Tilbury2 Construction Materials and Aggregate Terminal (CMAT), allowing aggregate to be brought in via the River Thames without needing road transport from the port to the construction compound.

2.6.189 An indicative layout for the northern tunnel entrance compound is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3), which shows the locations of earthworks storage, materials storage, offices and welfare facilities, parking and internal haul routes.

2.6.190 The concrete batching facilities would be located as follows:

a. On the hardstanding area which was formerly part of the Tilbury Power Station

b. Within the plant storage area to the west of the North Portal

c. Within the material storage area at Goshems Farm

Access to the northern tunnel entrance compound

2.6.191 To reduce the overall number of road journeys, equipment and material would arrive at the northern tunnel entrance compound via the Port of Tilbury and its new terminal, Tilbury2. Some of this would also be delivered using the SRN, through Tilbury2 and along a new, dedicated access road. The movement of materials for construction, including the use of the River Thames, is further discussed under the 'Construction traffic' heading in Section 2.7 of this chapter.

2.6.192 Smaller deliveries, shuttlebuses for staff from local train stations and the Gravesend Ferry, together with cycles and cars, would use a smaller, dedicated road built from Station Road to the north-east of the site. Deliveries of larger items, for example those needed for the construction of the viaduct north of the River Thames, would also pass through the Port of Tilbury and Substation Road, before following internal haul roads.

2.6.193 The main access to this compound for most traffic, including HGVs, would be from the eastern end of the Port of Tilbury's Substation Road. The main access road would require ground treatment as it traverses several topographical levels and crosses poor ground. This would ensure that the road can withstand the loads and frequencies of HGVs that would be required. These heavy loads would include tunnel boring machinery components, substation components, and pre-cast viaduct components for works in Construction Section C.

2.6.194 Three further access points would be located off Station Road, East Tilbury. These would mainly be used by Project Contractors and small delivery vehicles. They would also allow access between the main compound and proposed workers accommodation, lay down area and car parks, on a north-east parcel of the site. These would link to internal east–west and north–south roads in the compound. It has been assumed that the Tilbury2 infrastructure corridor would be used as the primary access for the tunnelling compounds.

2.6.195 When construction starts, and subject to local road network restrictions, it may be necessary to allow some HGVs to access the compound via Station Road. This would only be for the first few months of the construction phase, until the haul road in from Substation Road has been constructed.

Traffic management and construction traffic

2.6.196 The access routes for each of the construction compounds are described above. The oTMPfC (Application Document 7.14) presents the approach that would be followed when undertaking temporary traffic management during the construction phase. It includes further information on proposed construction routes, on roads where restrictions would be in place for use by HGVs associated with the Project, and proposed traffic management measures to facilitate the construction works.

2.6.197 In order to mitigate the construction traffic impacts on the surrounding road network, a decision has been made to restrict the use of HGVs delivering materials and moving excavated material for the Project on the local roads within Section B listed below. This restriction would not affect other HGVs using these roads.

a. Castle Lane

b. Lower Higham Road

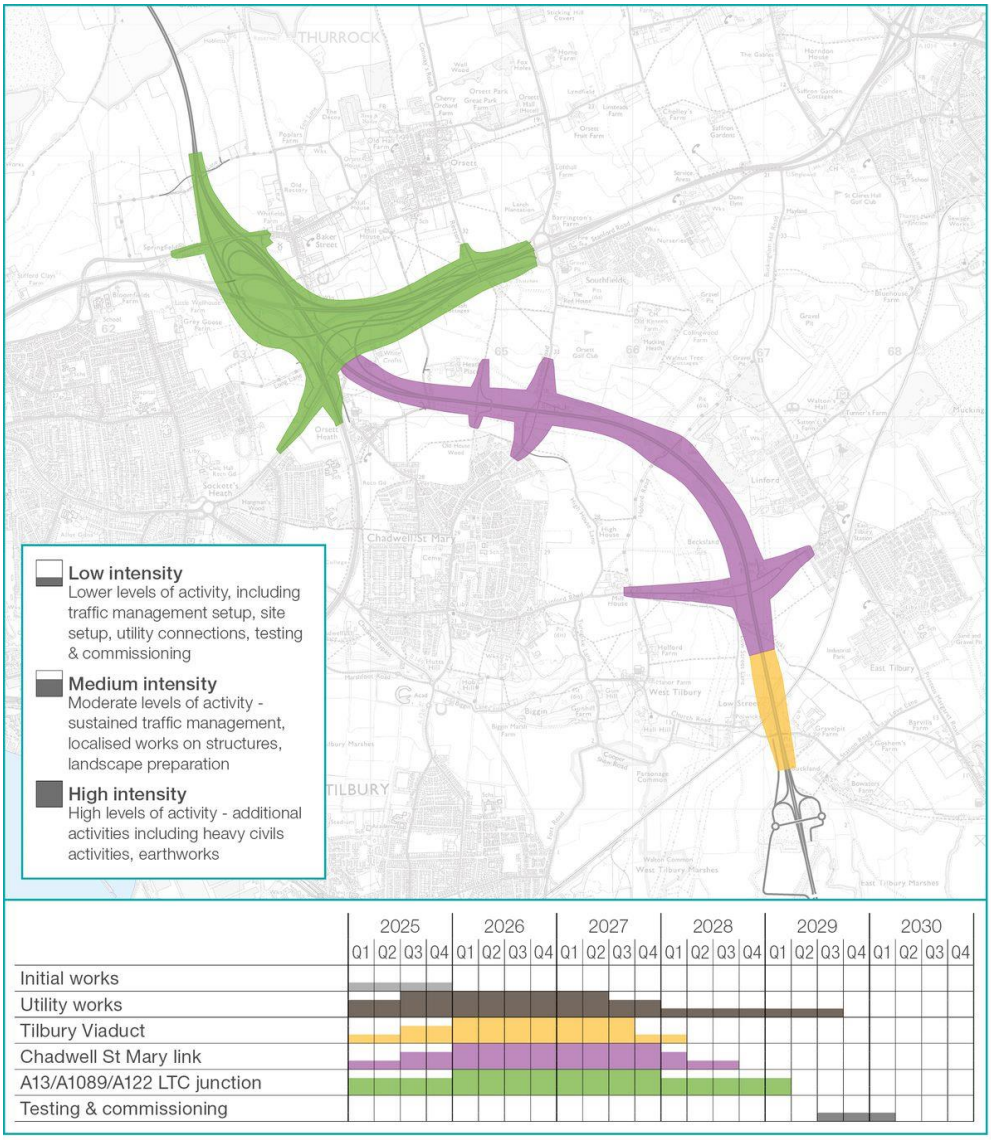
2.6.198 Proposed traffic management measures that could be implemented throughout the construction phase are outlined within Section 2.7 of this chapter, with further detail provided in the oTMPfC (Application Document 7.14). The indicative traffic management measures and road closures associated with the construction works and utilities works are detailed in the oTMPfC (Application Document 7.14). Further information on the effects of construction on the local road network is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Section C: North of the River Thames

2.6.199 Section C includes the area north of the River Thames between the proposed Tilbury Viaduct and Green Lane, north of the A13/A1089/A122 Lower Thames Crossing junction.

2.6.200 Plate 2.14 illustrates the locations of the key construction infrastructure and locational activities for Section C, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 2.14 Section C construction activities and timeline



2.6.201 Section C has been divided into the following activities, which are discussed below and relate to the information presented in Plate 2.14. It should be noted that Plate 2.14 does not identify all activities listed below. Where the activities take place throughout Section C, these are not identified on the mapping in Plate 2.14.

a. Preliminary works

b. Initial works

c. Walkers, cyclists and horse riders

d. Utilities works

e. Tilbury Viaduct

f. Chadwell St Mary link

g. A13/A1089/A122 Lower Thames Crossing junction

h. Reinstatement and planting

i. Testing and commissioning

j. Compounds

k. Traffic management and construction traffic

2.6.202 A summary of the works undertaken as part of each activity identified in Plate 2.14 is provided below. Further detail on construction methods associated with these activities is provided in Section 2.7. Information related to compounds, access routes and construction traffic in Section C is also provided below. Additional information on extended working hours and construction traffic is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The Transport Assessment (Application Document 7.9) provides details on the impacts from construction traffic.

Preliminary works

2.6.203 Preliminary works are those activities that would take place in the phase between the DCO being granted and the commencement of construction, as defined in the draft DCO (Application Document 3.1). In many cases, activities started as preliminary works, prior to the commencement of construction, would continue in later stages of construction. Most of the preliminary works activities within Section C are anticipated to take place in late 2024.

2.6.204 A general description of preliminary works is provided in Section 2.7 of this chapter.

Initial works

2.6.205 Initial works would take place following the commencement of construction, and are those activities that prepare the site and the compounds for the main construction activities. Initial works activities within Section C are anticipated to last around one year, with construction due to begin in early 2025.

2.6.206 A general description of initial works is provided in Section 2.7 of this chapter. Initial works in Section C would include the following activities:

a. Securing the site, including temporary diversions or closures to public rights of way.

b. Setting up the construction compounds including utility diversions and connections. Where ULHs are required early in the construction programme, these would be established as part of initial works. Construction compounds within Section C are as follows:

i. Station Road compound

ii. Brentwood Road compound

iii. Stanford Road compound

iv. Long Lane compound A

v. Long Lane compound B

vi. Stifford Clays Road compound West

vii. Stifford Clays Road compound East

c. Establishing haul roads

d. Relocating a travellers' site.

Relocating a travellers' site

2.6.207 The creation of a new slip road connecting the A1089 to the A122 northbound would require the land occupied by the Gammonfields Way travellers' site. Prior to the start of construction in this location an alternative site would be established next to its current location, with access off Gammonfields Way. The site would remain approximately 1.5ha in size, with an additional 1.5ha providing access, landscaping, noise mitigation and visual screening.

Walkers, cyclists and horse riders (WCH)

2.6.208 The construction of the Project would result in changes to the network of routes used by WCH, including footpaths, shared use routes for pedestrians/cyclists and existing bridleways. Some routes within construction working areas would require temporary closure during construction to ensure the safety of users of the route. Temporary and permanent diversions would be provided for some routes to maintain connectivity during construction, while those that are unable to be diverted would be closed for as short a time as feasible to reduce the impact on the local public right of way network.

2.6.209 Some footpaths, shared use routes for pedestrians/cyclists and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network.

2.6.210 A full description of the Project proposals for each affected WCH route is provided in Part E of the Project Design Report (Application Document 7.4). The routes are also indicated in Figure 2.2: Project Proposals (Application Document 6.2) and presented in more detail on the Rights of Way and Access Plans (Application Document 2.7).

2.6.211 Section 2.7 of this chapter describes the construction of the permanent WCH works and the temporary impacts on WCH works resulting from the construction of the Project.

2.6.212 WCH routes temporarily diverted or closed during the works would be reinstated on completion of construction activities once it is safe for public.

Utilities works

2.6.213 The construction of the Project would require permanent diversion or protection of utilities, as described in Sections 2.3 and 2.4 of this chapter. These include overhead power lines and underground utilities such as gas and water pipelines, electricity and telecommunications cables, and the associated infrastructure such as cabinets, chambers and maintenance compounds.

2.6.214 Permanent utilities connections would also be required from construction Section C into construction Section B to provide services to the North Portal TSB for the operation of the A122 and the tunnels.

2.6.215 Temporary utilities connections are also required to connect the compounds to the utility networks, providing communications, water, electricity and wastewater. Where practicable, these works would take place at the same time as other highway works or permanent utility diversions to reduce the impact on the local communities. These connections would be removed at a later date as part of the compound demobilisation.

2.6.216 Utilities works would begin at the start of construction for Section C and would continue for approximately five years, with the highest intensity activity from mid-2025 until mid-2027. Temporary connections would be removed towards the end of the construction phase during 2029, and where appropriate, the land would be reinstated to its previous condition.

2.6.217 In addition to the construction compounds, eight temporary ULHs would be required in Section C. Further information on these is provided in Table 2.8 and these are shown on Figure 2.5: Construction Information (Application Document 6.2). Each ULH would be set up by the relevant utility company undertaking the specific works that are required. Where required, the Section C construction compounds would also support the major utility diversions undertaken north of the River Thames.

Table 2.8 ULHs in Section C

ULH	Utility company	Works	Approximate area (m^2)	Access	Approximate duration
Low Street Lane ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH4 and OHT2)	14,300	Muckingford Road	14 months
Muckingford Road ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH4 and OHT2)	14,300	Muckingford Road	14 months
Brentwood Road ULH	Cadent	Gas pipeline diversion (Work number G5)	13,200	Brentwood Road	14 months
Hornsby Lane ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH6, OH7, OHT4, OHT5, OHT6, OHT7)	14,300	Hornsby Lane	33 months
Long Lane ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH6, OH7, OHT4, OHT5, OHT6, OHT7)	18,000	Long Lane	33 months
Stifford Clays Road ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH6, OH7, OHT4, OHT5, OHT6, OHT7)	13,300	Stifford Clays Road	33 months
Stanford Road ULH	Cadent	Gas pipeline diversion (Work numbers G6, G6a and G6b)	14,800	Stanford Road	27 months
Green Lane ULH	Cadent	Gas pipeline diversions (Work numbers G6 and G7)	13,200	Stifford Clays Road	27 months

2.6.218 It is anticipated that some of the utilities works would require working outside of standard working hours (referred to as extended working hours), for example where trenchless crossings are required beneath roads or railways, or for restringing works. Further information on working hours is provided in Section 2.7 of this chapter and in Appendix 2.2: Code of Construction Practice (Application Document 6.3), and the activities requiring extended working hours are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Diversion of National Grid power line at Tilbury to Linford

2.6.219 The works would require temporary and permanent modifications to an existing 400kV overhead power line, of which 890m of the approximate 2km length would be modified horizontally (Work number OH4). This would include the removal of three pylons and construction of five new pylons to cross the A122 and Tilbury Loop railway line. Two temporary diversions of approximately 0.25km and 1.2km length would be required, with the longer length requiring the construction of two temporary pylons to maintain network continuity during the works (Work No OHT2). To complete the approximately 4.2km of restringing of the overhead power lines, the working area will need to include the existing pylons from the south of the Tilbury Loop railway line through to the north of Walton's Hall Road. Restringing of the overhead powerlines is expected to be completed outside of core hours. These works extend into Section B.

Diversion of National Grid power lines from Chadwell St Mary to Stifford Clays Road

2.6.220 Temporary and permanent modifications would be required to two existing National Grid overhead power line networks. The first network to be diverted is a 400kV overhead line requiring a permanent diversion of 1.2km horizontally within a length of approximately 1.7km of the network (Work number OH6). It is located west of Hornsby Lane heading west of the A1089 and then north to the A13. These works would include building four new pylons and removing four existing ones. Two short-term diversions of approximately 0.57km and 0.4km (Work numbers OHT5 and OHT6 respectively) of the powerline on to two temporary pylons would be needed to maintain electricity supply while new pylons are installed. To complete the approximate 4.8km of re-stringing of the overhead power lines, the working area would need to include the existing pylons from the south of Hoford Road through to the north of Green Lane. Restringing of the overhead powerlines is expected to be completed outside of core hours.

2.6.221 The second network to be diverted, includes the permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction, located west of Hornsby Lane heading west of the A1089, then north over the A13 to Stifford Clays Road within Section C. A further area of works of approximately 0.7km is required, extending north across the Mardyke and the proposed A122 alignment which is located within Section D (Work number OH7). These works would include building 10 new pylons, of which nine are in Section C, and removing nine existing ones, of which eight are in Section C. Restringing of the overhead powerlines is expected to be completed outside of core hours. Three short-term diversions of 0.7.2km, 0.69km and 0.7km length, on three temporary pylons

would be needed to maintain electricity supply while the new pylons are installed (Work numbers OHT4, OHT7 and OHT8, respectively). To complete the re-stringing of the overhead power line, the working area would need to include the existing pylons from the south of Hoford Road through to the north of Fen Lane (approximately 8.4km). Restringing of the overhead powerlines is expected to be completed outside of core hours. These works continue into Construction Section D.

2.6.222 The overhead line diversion (Work number OH7) has been screened against criteria for replacement lines set out in section 16(3) of the Planning Act 2008 and has been identified as an NSIP. Further information on this screening is provided in Annex 2 of the Explanatory Memorandum (Application Document 3.2).

UKPN proposals

2.6.223 Construction works in Section C would affect two 132kV overhead line networks east of Tilbury (Work number OH3 and OH5). One, running from south of the Tilbury Loop railway line to north-west Linford, would require the undergrounding of approximately 2.2km of existing overhead powerline network (Work number OH3) via the installation of approximately 2.37km of underground cable (Work number MU28). The works include removal of eight existing pylons and modification of an existing pylon. A further existing pylon would be demolished, to be replaced by the construction of a new terminal pylon in the same location north of Muckingford Road. This would be completed by the construction of a temporary pylon and 0.6km of temporary overhead powerline (Work number OHT3) to maintain electricity supply while the new pylon is constructed. Restringing of approximately 0.4km of the overhead powerlines at Linford and the trenchless installation of Work number MU28 under the Tilbury Loop railway line are both expected to be completed outside of core hours. These works extend into Section B.

2.6.224 The other network would be on the western side of the Project route, starting south of Muckingford Road and heading north (Work number OH5). The works include the diversion of 1.45km of overhead powerline network, including the construction of five new pylons, removal of four existing pylons and restringing of approximately 1.7km of overhead powerline network. Restringing of the overhead powerlines is expected to be completed outside of core hours.

2.6.225 The construction of nine substations is also proposed throughout Section C as part of the diversion works, as listed below:

a. SS7 – to be installed north-east of the reservoir at Low Street

b. SS8 – at Muckingford Road

c. SS9 – west of Brook Farm

d. SS10 – at Heath Place

e. SS11 – at Hornsby Lane

f. SS12 – at Heath Place

g. SS13 – at Baker Street

h. SS14 – at Stanford Road

i. SS15 – at Rectory Road.

Diversion of Cadent high-pressure gas network

2.6.226 Works would be required in three separate locations for Cadent's high-pressure gas network and associated infrastructure.

2.6.227 An approximately 0.27km diversion of a high pressure pipeline would be required east of Brentwood Road at the western edge of Orsett Golf Club (Work number G5).

2.6.228 An approximately 5.23km diversion of a high-pressure pipeline would be required from Green Lane to Stanford Road. The pipeline is currently located south of the A13 from Green Lane to the Orsett Cock junction (Work number G6). The pipeline would be installed largely using open-cut methods, but the A122, A13 and other minor roads and water features would be crossed using trenchless installation methods of varying depth. The trenchless installation under the B188, the A13 and the A128 would require extended working hours. The works would make approximately 4.22km of pipeline redundant.

2.6.229 At the connection of the diversion for Work number G6 to the existing network at Stanford Road, a new gas valve compound (Work number G6a) would be required, approximately 30m by 30m in size secured by a 2.4m high fence. Permanent access from Stanford Road would be required for the ongoing operation and maintenance of the gas network.

2.6.230 To the east of the Orsett Cock junction, an approximately 15m section of pipeline would be modified to isolate it from the existing pipeline (Work number G6b). This would involve the installation of an isolation valve and removal of a section of redundant pipeline.

2.6.231 An approximately 0.34km diversion of a high pressure pipeline would be required to cross the Project route north of Green Lane (Work number G7). This diversion would be installed using trenchless construction methods.

Permanent connections for the Northern Portal

2.6.232 Permanent utilities connections for the North Portal would extend from Construction Section B as part of the reconfiguring of local networks (Work numbers MU27 and MU29). Work number MU29 would require trenchless installation under the railway and extended working hours.

Diversion of other utilities networks

2.6.233 To ensure customer supplies are not adversely affected and can be operated and maintained safely while the new road is built and when it is open, it is necessary to complete multiple diversions of the network of utilities in Section C. The works required would involve the installation of multi-utility corridors for Work numbers MU29 to MU60. Specific additional information is provided for the Work numbers identified below, as relevant. Where no additional information is provided, the utilities works would be undertaken using standard trenching techniques during normal working hours.

a. Work number MU30 would require trenchless installation at Station Road.

b. Work number MU33 would include the installation of a new substation (SS7) at the north-eastern corner of the reservoir.

c. Work number MU36 would include the installation of a new substation (SS8) at the junction of Muckingford Road with Ashlea Farm.

d. Work number MU41 would include the undergrounding of the existing electricity network and the installation of new substations (SS9 and SS10) to the west of Brook Farm and at Heath Place.

e. Work number MU43 would include the installation of a new substation (SS14) to the east of the recycling business on the A1013 Stanford Road.

f. Work number MU44 would require the installation of utilities networks through the new structures on the A1013 Stanford Road. It has been assumed that trenchless installation would be required for the network connections under Baker Street.

g. Work number MU45 would include the installation of a new substation (SS15) to the west of Rectory Road.

h. Work number MU46 would require trenchless installation under the A13, which would require extended working hours.

i. Work number MU47 would require trenchless installation at the A1089, requiring extended working hours.

j. Work number MU48 includes the installation of a new substation (SS11) to the west of Rose Cottage.

k. Work number MU49 includes the installation of a new substation (SS12) at Heath Road.

l. Work number MU51 would require trenchless installation beneath the A13 westbound to A1089 southbound slip road.

m. Work number MU52 includes the installation of a new substation (SS13) to the south-west of Baker Street.

n. Work number MU54 would require trenchless installation under the A1089.

o. Work number MU56 would require trenchless installation under the A13 requiring extended working hours.

p. Work number MU57 would require trenchless installation under the A13 requiring extended working hours.

q. Work number MU60 would require extended working hours.

Temporary utilities works

2.6.234 Temporary supplies of power, water, foul water and communications connections would be required for the compounds within Section C (Work numbers MUT12 to MUT18, and MUT20 to MUT24). The assets would be removed as part of the demobilisation of the compounds.

2.6.235 Supplies installed within the highway boundary from Marshfoot Road along Brentwood Road (Work number MUT14) may be left *in situ* for future use by interested parties, but the assessments presented in this ES have assumed their removal, which represents a reasonable worst-case. Where assets would be installed within infrastructure required for permanent works, the cabling would be retracted but ducting left *in situ*, such as at Brentwood Road (Work number MUT15) and Stifford Clays Road and High Road (Work number MUT21).

2.6.236 Work number MUT16 would require trenchless installation under the A1089, as would Work number MUT23 under the A13. These works would require extended working hours.

2.6.237 Temporary diversion of assets would be required during construction works at Rectory Road (Work number MUT19).

2.6.238 Temporary diversions of overhead lines and installation of temporary pylons would be required as part of the diversion of overhead lines, as identified below. These pylons and the associated powerlines would be removed as part of the permanent works.

a. OHT2 would require a temporary approximate 0.25km realignment of the line between two pylons (one existing and one new permanent pylon) and the installation of two temporary pylons and approximately 1.2km of overhead powerline. These temporary works are part of the diversion and modification of a permanent overhead line (Work number OH4).

b. OHT3 would require the installation of one pylon and approximately 0.6km of overhead powerline. These temporary works are part of the installation of a permanent overhead line diversion (Work numbers OH3 and MU28).

c. OHT4 would require the installation of one pylon and approximately 0.72km of overhead powerline. These temporary works are part of the diversion and modification of a permanent overhead line (Work number OH7).

d. OHT5 would require the installation of one pylon and approximately 0.6km of overhead powerline. These temporary works are part of the diversion and modification of a permanent overhead line (Work number OH6).

e. OHT6 would require the installation of one pylon and approximately 0.4km of overhead powerline. These temporary works are part of the diversion and modification of a permanent overhead line (Work number OH6).

f. OHT7 would require the installation of one pylon and approximately 0.68km of overhead powerline. These temporary works are part of the diversion and modification of a permanent overhead line (Work number OH7).

2.6.239 The assessments presented in this ES have assumed that temporary utilities would be removed as part of the demobilisation works which represents a reasonable worst-case, but these may be left *in situ*. This would require the development of proposals with relevant stakeholders, landowners and other developers.

Tilbury Viaduct

2.6.240 Tilbury Viaduct would be constructed to carry the new road over the Tilbury Loop railway line.

2.6.241 Construction of the Tilbury Viaduct is expected to begin in early in 2025 and to be completed in early 2028.

2.6.242 These works would be carried out offline of the existing transport network (outside of the footprint of the railway line, but within the Order Limits of the Project) and in agreement with Network Rail and would feature pre-cast concrete. See Section 2.7 for further information on the approach to viaduct construction).

2.6.243 As the viaduct would need to be built over Station Road, a series of short-term closures would be necessary and a diversion would be put in place.

Chadwell St Mary link

2.6.244 Works to the south of the A13/A1089/A122 Lower Thames Crossing junction are described below. Work to construct this section of the Project route would begin early in 2025 and is expected to continue until mid-2028.

Main route, Tilbury Viaduct to south of the A13

2.6.245 These works would involve construction away from the existing road network, and would include major earthworks, preparation of the new road surface, drainage and finishing works from the A13 to the Tilbury Viaduct.

Muckingford Road green bridge

2.6.246 A new green bridge would be built to carry the realigned Muckingford Road over the new road, to maintain a habitat link for wildlife. It would take approximately 14 to 16 months to build, primarily offline. Some short-term temporary traffic management measures would be required to maintain through-traffic while the road is widened where the new bridge ties into the existing network. These works would require short-term overnight or weekend closures for tie-in works.

Brentwood Road bridge

2.6.247 A bridge would be installed at Brentwood Road, and the Brentwood Road would be realigned and raised to cross over the A122. Construction of the bridge would take place offline with some short-term overnight or weekend closures for tie-in works. These works are expected to take around 12 to 14 months.

Hoford Road green bridge

2.6.248 Hoford Road would be realigned, and a new green bridge is proposed to cross above the A122. The construction of the bridge would take place offline over 12 to 14 months.

A13/A1089/A122 Lower Thames Crossing junction

2.6.249 The proposed junction between the A122, the A13 and A1089 would require changes to the existing A13 junction as well as modifications to approach roads.

2.6.250 Work to build the A13/A1089/A122 Lower Thames Crossing junction and modify the approach roads would begin at the start of the construction phase in early 2025 and would take until early 2029.

Structures under the A13

2.6.251 As part of the initial works for the underpasses, a programme of earthworks would be required to allow construction to take place.

2.6.252 Construction of the A13 underpass east of the A1089 would take place early in the construction programme and would take 20 to 24 months. The underpass to the west would take between 18 and 22 months to build and would be constructed towards the end of construction, because existing overhead power lines need to be diverted first. Access to the worksite would be via Gammonfields Way.

2.6.253 The A13 would not need to close during these works, but temporary traffic management measures would be required throughout.

Rectory Road bridge

2.6.254 The bridge carrying Rectory Road over the A13 would be replaced and would need to close for approximately seven months.

2.6.255 Rectory Road and Baker Street would not be closed at the same time to make sure local access either side of the A13 is maintained. Construction traffic would only be permitted to use Rectory Road for specific works. Traffic management measures would be provided where a haul road would need to cross Rectory Road.

A1013 (Stanford Road) realignment and tie-in structures

2.6.256 The A1013 would be realigned as part of these works, which would include building three new bridges. This would involve construction activity including piling and earthworks.

2.6.257 The realignment of Stanford Road would take approximately 12 to 18 months. Some elements would take place towards the beginning of the construction programme. Most of this work, however, would need to be carried out after a gas main diversion in the area.

2.6.258 Works would be phased to make sure the A1013 remains open throughout construction, and traffic management measures would be required. This would change throughout the programme to allow construction vehicles and staff to access the works area. Signage would keep road users informed.

2.6.259 While the A1013 would remain open, overnight and weekend closures would be required for works to tie-in the A122 to the existing road network.

Orsett Heath Viaduct

2.6.260 This would be built over Baker Street and the A1089. These works would likely take 18 to 22 months and would happen after the diversion of a gas main in the area and during the closure of Baker Street.

Baker Street

2.6.261 The stretch of Baker Street between the A13 and A1013 would be closed for around nine months to allow the following works:

a. Existing bridge demolition

b. Bridge construction over Baker Street (carrying the A122)

c. Realignment of Baker Street.

2.6.262 The road south of the A13 would be realigned to its connection with the A1013. This would happen while it is closed.

2.6.263 Construction vehicles would use Baker Street for up to six months from the start of works for the site preparation. Baker Street south of the A13 would be closed to the general public and only used as a through-connection for construction traffic during the closure.

2.6.264 Crossing points would be needed on Baker Street to access works north of the A13 and to the east. Appropriate traffic management measures would be put in place. Additional overnight or weekend closures may be required to complete construction. While Baker Street is closed, Rectory Road would be open to maintain local access north and south of the A13.

Heath Road

2.6.265 This road would be realigned from the A1013 to 250m south of the A1013. This would require some earthworks and standard road construction.

2.6.266 Heath Road and its connection to the A1013 would be open for the duration of construction but some tie-in works would need overnight or weekend closures.

Works west of A1089

2.6.267 The existing Gammonfields Way travellers' site would be relocated to allow a new slip road to connect the A1089 northbound to the A122 northbound. This would involve earthworks and road construction.

2.6.268 Access to the works site would be via Gammonfields Way and a new haul road.

Realignment of Stifford Clays Road and bridge construction

2.6.269 Stifford Clays Road would need to be realigned and two bridges would be built to allow construction of the A122 underpass. These works would take approximately 12 to 14 months and Stifford Clays Road would remain open. Overnight or weekend closures would be required for tie-in works.

Realignment of Green Lane and bridge construction

2.6.270 Green Lane would be realigned, and a green bridge built with features that allow wildlife to pass over it. These works would take place mostly away from the existing road network and carried out over a period of 12 to 14 months. Some overnight or weekend closures would be needed for tie-in works.

Construction of the link roads north of the A13/A1089/A122 Lower Thames Crossing junction

2.6.271 A series of roads and bridges would need to be constructed to link the A122 to the A13 and the Orsett Cock junction. The majority of these works would take place away from the existing road network, towards the start of the construction programme. The works needed to connect the A122 with existing roads would be phased to reduce construction impacts.

Reinstatement and planting

2.6.272 Land temporarily utilised during the construction phase, including construction worksites, construction compounds and ULHs, would be reinstated on completion of the construction activities in accordance with the REAC (Application Document 6.3, Appendix 2.2).

2.6.273 Planting and landscaping would be undertaken as necessary in accordance with the oLEMP (Application Document 6.7) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.

2.6.274 Fences and other mitigation measures installed to protect environmentally sensitive areas from construction works would be removed on completion of construction activities.

2.6.275 Further information on reinstatement and planting activities is provided in Section 2.7 of this chapter.

Testing and commissioning

2.6.276 During the final part of the construction phase, testing would take place to ensure that the road (including all electrical and mechanical systems), structures, earthworks, drainage, public rights of way and other elements are complete and function to the required standards.

2.6.277 The individual parts of the new road, including its structures, gantries, drainage and other supporting infrastructure, would be tested as they reach completion. Testing would include adherence to the design specifications for each section of the road. The safety checks would vary according to the different functions and specifications of the element being tested. When construction of the Project road is complete, it would be tested in its entirety. The final testing and commissioning is scheduled to take place from mid-2029 to early-2030.

2.6.278 Commissioning refers to the completion of the testing phase, at which point the new road would be brought into public use.

Compounds

2.6.279 Each compound in Construction Section C is described in detail below. All dates and durations of activities are indicative. All compounds would require initial site set-up works and, at the end of their use, finalisation works including

site reinstatement, landscaping and planting (as necessary). Compound locations are shown on Figure 2.5: Construction Information (Application Document 6.2), and indicative internal layouts are provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.6.280 The ULHs which support the utilities works within Construction Section C are discussed above, under the 'Utilities works' sub-heading.

Station Road compound

2.6.281 This compound would be located near Station Road, next to the northern tunnel entrance compound, and would be approximately 4.5ha in size. Space would be allocated within the compound for stockpiling materials, workshops, offices, welfare facilities and parking.

2.6.282 This compound would support works at the Tilbury Viaduct and on connecting roads.

2.6.283 The compound would be accessed via an internal access road from the northern tunnel entrance compound.

Brentwood Road compound

2.6.284 This compound would be located on Brentwood Road near Heath Place and would be approximately 11ha in size. It would include space for car parking, offices and welfare facilities, as well as areas for storage of equipment and spoil.

2.6.285 The Brentwood Road compound would support works south of the A13 towards the Tilbury Loop railway line.

2.6.286 Where reasonably practicable, soil excavated and retained onsite temporarily would be stockpiled in bunds to use as screening for residential properties in Chadwell St Mary. Construction material stockpiles higher than 6m would, where practicable, be located at the southern end of the compound, away from these properties.

2.6.287 Construction traffic would use Brentwood Road, between the Orsett Cock junction and the A122, to access the Brentwood Road compound. These vehicles would not go further south than the proposed new Brentwood Road bridge and would not pass through the residential areas of Chadwell St Mary.

2.6.288 The Brentwood Road ULH would be located within the footprint of the Brentwood Road compound.

Stanford Road compound

2.6.289 The Stanford Road compound near Hornsby Lane near Stanford Road would be approximately 0.5ha in size and would support construction works affecting slip roads between the A13 and A1013.

2.6.290 Most of the compound would be used for storage, equipment and stockpiling. There would also be space for car parking, offices, welfare facilities and workshops. Bunding and/or fencing would be in place to provide noise and visual screening for nearby sensitive receptors.

2.6.291 The compound would be accessed via Hornsby Lane and an internal haul road.

Long Lane compound A

2.6.292 This compound would be located on the northern side of Long Lane and would be approximately 4.3ha in size. It would be used to support construction of the slip roads south of the A13 and west of the A1089, as well as the western underpass bridge below the A13 and the new proposed alignment of A1013, west of A1089.

2.6.293 Around half of Long Lane compound A would be for storage and equipment, and the other half for parking, offices and welfare facilities, workshops and earthworks stockpiling.

2.6.294 Access to this worksite would be via Long Lane.

Long Lane compound B

2.6.295 This compound would be located on the northern side of Long Lane and would be approximately 1.4ha in size. It would be used to support construction of the slip roads south of the A13 and west of the A1089, as well as the western underpass bridge below the A13 and the new proposed alignment of A1013, west of A1089.

2.6.296 Around half of the Long Lane compound B would be for storage and equipment, and the other half for parking, offices and welfare facilities, workshops and earthworks stockpiling. The compound is immediately adjacent to the Long Lane ULH. Bunding and/or fencing would be in place to provide noise and visual screening for nearby sensitive receptors.

2.6.297 Access to this worksite would be via a temporary access route from Long Lane.

Stifford Clays Road compound West

2.6.298 Stifford Clays Road compound West would be on the southern side of Stifford Clays Road to the west of the A122. It would be around 4ha in size and would be used for construction of the north-west section of the A13/A1089/A122 Lower Thames Crossing junction. Space would be allocated within the compound for stockpiling materials, workshops, offices, welfare facilities and parking. Fencing would be put in place to provide noise and visual screening to nearby sensitive receptors. This compound partially overlaps with the location of Stifford Clays Road ULH.

2.6.299 A temporary access haul road from Medebridge Road would be built. The haul road would be constructed within the first six to twelve months of construction starting. Before then, Stifford Clays Road would be used by construction traffic to access this compound and the Stifford Clays Road compound East. Once the temporary access road is open, Stifford Clays Road would only be used for specific works, including those to connect the new road to the existing road network.

2.6.300 However, Stifford Clays Road would be used as a crossing point, controlled by traffic signals to allow construction vehicles to access worksites between the A13 and Stifford Clays Road. Temporary traffic signals would be in place until the new Stifford Clays Road bridges are built and construction traffic can pass underneath.

Stifford Clays Road compound East

2.6.301 Stifford Clays Road compound East would be located north of Stifford Clays Road, east of the A122. It would be approximately 6.7ha in size, with space for car parking, offices, welfare facilities and storage. Around half of the site would be set aside for earthworks stockpiling. Fencing would be put in place to provide noise and visual screening to nearby sensitive receptors.

2.6.302 The compound would support the construction works for the A13/A1089/A122 Lower Thames Crossing junction slip roads and highways works north of the A13 towards the Mardyke, as well as the construction of the eastern underpass bridge below the A13. It would be in place throughout construction. Facilities higher than 6m, including offices and storage buildings, would be located as far as reasonably practicable away from residential properties on Stifford Clays Road and Fen Lane.

2.6.303 Access would be via Stifford Clays Road, until a temporary haul road for construction traffic is in place. The works to construct the temporary haul road are expected to complete within the first six months of the construction programme.

Traffic management and construction traffic

2.6.304 The access routes for each of the construction compounds are described above. The oTMPfC (Application Document 7.14) presents the approach that would be followed when undertaking temporary traffic management during the construction phase. It includes further information on proposed construction routes, on roads where restrictions would be in place for use by HGVs associated with the Project, and proposed traffic management measures to facilitate the construction works.

2.6.305 To access the road elements between the Tilbury Loop railway line and the River Thames, construction vehicles would access via Fort Road and an offline access (shared with tunnels works). A secondary access would be via Station Road, although this would mainly be for staff.

2.6.306 The main access route to the works between the Tilbury Loop railway line and the A13/A1089/A122 Lower Thames Crossing junction would be via the A13 and the Orsett Cock junction, along Brentwood Road and then onto the haul roads which would run adjacent to the alignment of the A122. The A1013 would also be required to access works around the A13/A1089/A122 Lower Thames Crossing junction (south of the A13).

2.6.307 To access the works north of the A13 in Section C, Stifford Clays Road would initially be used for site setup activities and to facilitate construction of an offline access. Once the offline access is in place, Stifford Clays roundabout and the offline access (as well as part of Green Lane) would be used to access the works. This would mitigate the need to use Stifford Clays Road (but staff and very specific works would still need access). Access routes and haul roads are shown on Figure 2.5: Construction Information (Application Document 6.2).

2.6.308 In order to mitigate the construction traffic impacts on the surrounding road network, a decision has been made to restrict the use of HGVs delivering materials and moving excavated material for the Project on the local roads within Section C listed below. This restriction would not affect other HGVs using these roads.

a. Rectory Road from School Lane to Prince Charles Avenue

b. School Lane from Mill Lane to Rectory Road

c. B188 High Road from Mill Lane to Rectory Road

d. Prince Charles Avenue from Rectory Road to the A128 Brentwood Road.

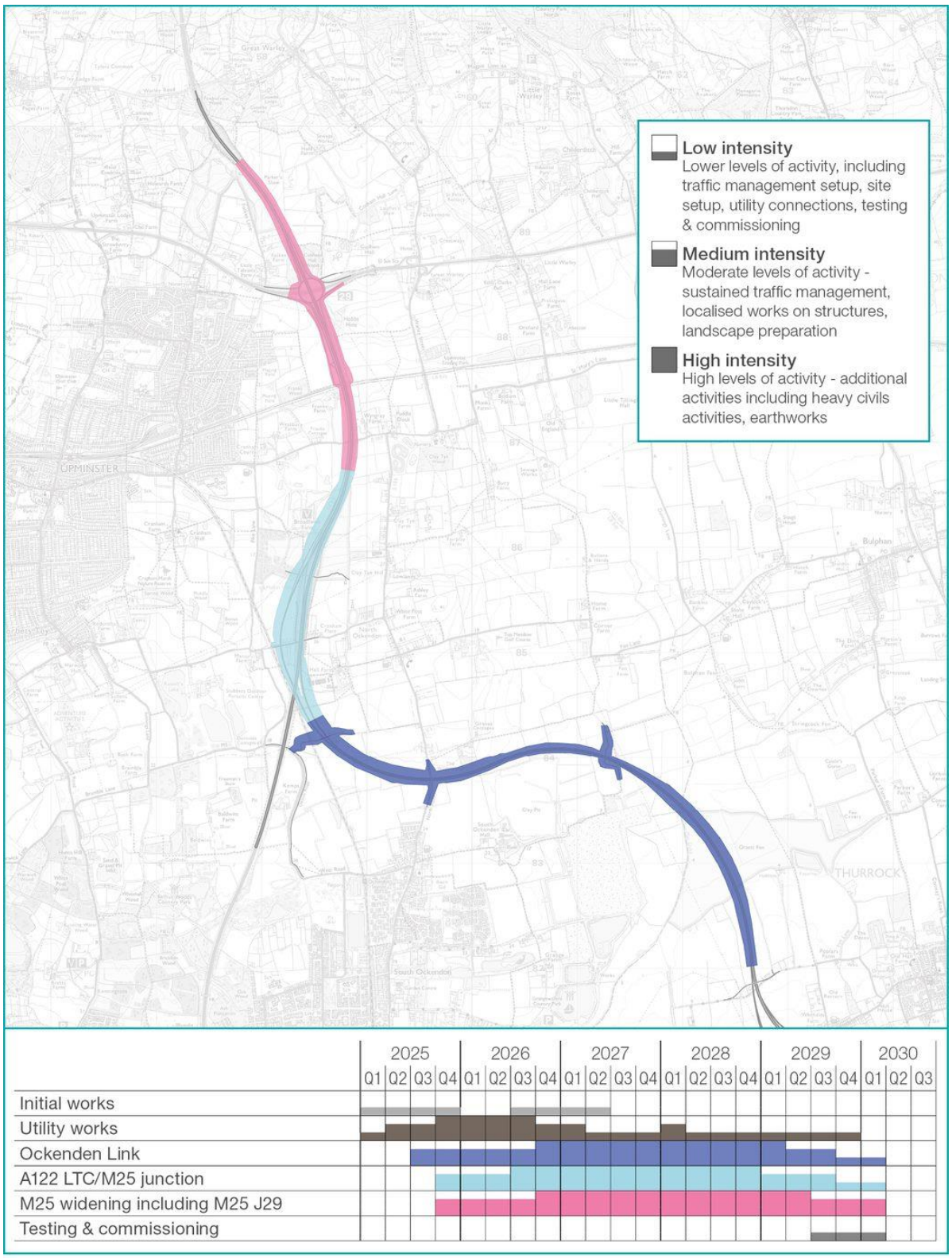
2.6.309 Proposed traffic management measures that could be implemented throughout the construction phase are outlined within Section 2.7 of this chapter, with further detail provided in the oTMPfC (Application Document 7.14). The indicative traffic management measures and road closures associated with the construction works and utilities works are detailed in the oTMPfC (Application Document 7.14). Further information on the effects of construction on the local road network is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Section D: North of the River Thames

2.6.310 Section D covers the northern extent of the Project, including the Ockendon link and the M25 junction 29.

2.6.311 Plate 2.15 illustrates the locations of the key construction activities for Section D, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 2.15 Section D construction activities and timeline



2.6.312 Section D has been divided into the following activities, which are discussed below and relate to the information presented in Plate 2.15. It should be noted that Plate 2.15 does not identify all activities listed below. Where the activities take place throughout Section D, these are not identified on the mapping in Plate 2.15.

a. Preliminary works
b. Initial works
c. Walkers, cyclists and horse riders
d. Utilities works
e. Ockendon link
f. A122 Lower Thames Crossing/M25 junction
g. M25 widening, including M25 junction 29
h. Reinstatement and planting
i. Testing and commissioning
j. Compounds
k. Traffic management and construction traffic

2.6.313 A summary of the works undertaken as part of each activity identified in Plate 2.15 is provided below. Further detail on construction methods associated with these activities is provided in Section 2.7. Information related to compounds, access routes and construction traffic in Section D is also provided below. Additional information on extended working hours and construction traffic effects is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The Transport Assessment (Application Document 7.9) provides details on the impacts from construction traffic.

Preliminary works

2.6.314 Preliminary works are those activities that would take place in the phase between the DCO being granted and the commencement of construction, as defined in the draft DCO (Application Document 3.1). In many cases, activities started as preliminary works, prior to the commencement of construction, would continue in later stages of construction. Most of the preliminary works activities within Section B are anticipated to take place in late 2024.

2.6.315 A general description of preliminary works is provided in Section 2.7 of this chapter.

Initial works

2.6.316 Initial works would take place following the commencement of construction, and are those activities that prepare the site and the compounds for the main construction activities. Most initial works activities within Section D are anticipated to take place over two periods of work: one from early 2025 until the end of that year, and the next beginning in the second half of 2026 and lasting for around one year.

2.6.317 A general description of initial works is provided in Section 2.7 of this chapter. Initial works in Section D would include the following activities:

a. Securing the site, including temporary public rights of way diversions or closures.

b. Setting up the construction compounds including utility diversions and connections. Where ULHs are required early in the construction programme, these would be established as part of initial works. Construction compounds within Section D are as follows:

   i. Mardyke compound

   ii. Medebridge compound

   iii. M25 compound

   iv. Ockendon Road compound

   v. Warley Street compound

c. Establishing haul roads.

Walkers, cyclists and horse riders (WCH)

2.6.318 The construction of the Project would result in changes to the network of routes used by WCH, including footpaths, shared use routes for pedestrians/cyclists and existing bridleways. Some routes within construction working areas would require temporary closure during construction to ensure the safety of users of the route. Temporary and permanent diversions would be provided for some routes to maintain connectivity during construction, while those that are unable to be diverted would be closed for as short a time as feasible to reduce the impact on the local public right of way network.

2.6.319 Some footpaths, shared use routes for pedestrians/cyclists and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network.

2.6.320 A full description of the Project proposals for each affected WCH route is provided in Part E of the Project Design Report (Application Document 7.4). The routes are also indicated in Figure 2.2: Project Proposals (Application Document 6.2) and presented in more detail on the Rights of Way and Access Plans (Application Document 2.7).

2.6.321 Section 2.7 of this chapter describes the construction of the permanent WCH works and the temporary impacts on WCH works resulting from the construction of the Project.

2.6.322 WCH routes temporarily diverted or closed during the works would be reinstated on completion of construction activities once it is safe for public.

Utilities works

2.6.323 The construction of the Project would require permanent diversion or protection of utilities, as described in Sections 2.3 and 2.4 of this chapter. These include overhead power lines and underground utilities such as gas and water pipelines, electricity and telecommunications cables, and the associated infrastructure such as cabinets, chambers and maintenance compounds.

2.6.324 Temporary utilities connections are also required to connect the compounds to the utility networks, providing communications, water, electricity and wastewater. Where practicable, these works would take place at the same time as other highway works or permanent utility diversions to reduce the impact on the local communities. These connections would be removed at a later date as part of the compound demobilisation.

2.6.325 Work affecting utilities is expected to take place throughout most of the construction phase for Section D, from the start of construction until the end of 2029. The highest levels of activity are expected from the end of 2025 for a period of approximately one year.

2.6.326 In addition to the construction compounds, three temporary ULHs would be required in Section D. Further information is provided in Table 2.9, and they are shown on Figure 2.5: Construction Information (Application Document 6.2). An indicative ULH layout is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The ULHs would be constructed for specific utilities works to be completed by the relevant utility company. These would be set up according to the timescales for which they would be operational; not all would be required immediately, at the start of construction in 2025. Where required, the Section D construction compounds would also support the major utility diversions undertaken north of the River Thames.

Table 2.9 ULHs in Section D

ULH	Utility company	Works	Approximate area (m^2)	Access	Approximate duration
Medebridge ULH	National Grid Electricity Transmission	Overhead electricity network modifications (Work numbers OH7 and OHT8)	14,300	Medebridge Road	33 months
Folkes Lane ULH	Cadent	Gas pipeline diversion (Work number G10)	2,100	Folkes Lane	13 months
Beredens Lane ULH	Cadent	Gas pipeline diversion (Work number G10)	13,200	Beredens Lane and the M25	13 months

2.6.327 It is anticipated that some of the utilities works would require working outside of standard working hours (referred to as extended working hours), for example where trenchless crossings are required beneath roads or railways, or for restringing works. Further information on working hours is provided in Section 2.7 of this chapter and in Appendix 2.2: Code of Construction Practice (Application Document 6.3), and the activities requiring extended working hours are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Diversion of National Grid power lines at the Mardyke

2.6.328 The works includes the permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction within Section C. A further area of works of approximately 0.7km at the Mardyke, within Section D, requires the construction of a replacement pylon 16m taller than the existing one, on the alignment of the current overhead powerlines (Work number OH7). These works would include building 10 new pylons, of which nine are in Section C, and removing nine existing ones, of which eight are in Section C. Restringing of the overhead powerlines is expected to be completed outside of core hours. Three short-term diversions of 0.7km, 0.68km and 0.7km length, on three temporary pylons would be needed to maintain electricity supply while the new pylons are installed (Work numbers OHT4, OHT7 and OHT8, respectively). To complete the re-stringing of the overhead power line, the working area would need to include the existing pylons from the south of Hoford Road through to the north of Fen Lane (approximately 8.4km). Restringing of the overhead powerlines is expected to be completed outside of core hours. These works continue into Construction Section C.

2.6.329 The overhead line diversion (Work number OH7) has been screened against criteria for replacement lines set out in section 16(3) of the Planning Act 2008 and has been identified as an NSIP. Further information on this screening is provided in Annex 2 of the Explanatory Memorandum(Application Document 3.2).

UK Power Networks (UKPN) proposals

2.6.330 Proposals have been developed with UKPN to divert approximately 1km of 132kV overhead powerline within the Thames Chase Forest Centre area (Work number OH8). The works would include the construction of two new pylons and the removal of two existing pylons. The restringing of approximately 1.3km of the overhead powerline would require extended working hours.

Diversion of Cadent gas high-pressure networks

2.6.331 Approximately 0.63km of high-pressure pipeline would be diverted to cross the M25 north-east of Folkes Lane (Work number G10). The works would include trenchless installation under the M25 and extended working hours.

Ex Barking Power Station pipeline

2.6.332 Two sections of the high pressure pipeline that was the feed for the now demolished Barking Power Station are to be removed as part of the proposals (Work numbers G8 and G9). This is to be completed through the interception of the pipeline at four locations outside of the highway alignment: for Work number

G8, this is east of the A122 at the Mardyke and east of the Wilderness; and for Work number G9, east of North Road and then west of the A122 at the A122 Lower Thames Crossing/M25 junction. At these locations, the pipeline would be capped and the adjoining sections of pipeline removed. Work number G8 would have a length up to approximately 1.58km and Work number G9 would have a length up to approximately 1.15km.

Essex and Suffolk Water trunk main

2.6.333 Approximately 2.7km of 900mm water trunk main would be diverted via a 3.12km installation of new pipeline (Work number MU72). Installation would require a trenchless crossing of the M25; the London, Tilbury and Southend railway line; and potentially Ockenden Road depending on phasing. Extended working hours would be required to complete these crossings.

Diversion of other utilities networks

2.6.334 To ensure supplies to customers are maintained during construction and afterwards, a number of utility diversions are required in Section D. The works required would involve the installation of multi-utility corridors for Work numbers MU61 to MU92. Specific additional information is provided for the Work numbers identified below, as relevant. Where no additional information is provided, the utilities works would be undertaken using standard trenching techniques during normal working hours.

a. Work number MU73 would require a trenchless crossing of the M25, the Upminster and Grays branch railway line and the Project route. These works would require extended working hours.

b. Work number MU75 would require a trenchless crossing of the London, Tilbury and Southend railway line and would require extended working hours.

c. Work number MU78 would require extended working hours.

d. Work number MU79 would require a trenchless crossing of the M25 and extended working hours.

e. Work number MU82 would require a trenchless crossing of the M25 to the south of St Marys Lane. These works would require extended working hours.

f. Work number MU83 would require a trenchless crossing of the M25 to the north of St Marys Lane. These works would require extended working hours.

g. Work number MU84 would require trenchless installation of assets under M25 to the south of the Shoeburyness railway line. These works would require extended working hours.

h. Work number MU87 would require a trenchless crossing of the M25 to the north of the Shoeburyness railway line. Two replacement poles and pole-mounted transformers would be required to the west of the existing ones These works would require extended working hours.

i. Work number MU88 would require the trenchless installation of utilities through M25 junction 29 connecting to the east and west of the A127. These works would require extended working hours.

j. Work number MU89 would require the trenchless installation of utilities through M25 junction 29. These works would require extended working hours.

k. Work number MU92 would require a trenchless crossing of the M25 to the north of M25 junction 29. One new pole-mounted transformer would be required on the existing overhead pole network to the west of the works. These works would require extended working hours.

Temporary utilities works

2.6.335 Temporary supplies would be provided to the compounds within Sections C and D. These would include power, water, foul water and communications connections, as required (Work numbers MUT23 to MUT29, MUT31 and MUT32). Assets installed under the A13 (MUT23) would not be removed.

2.6.336 Temporary diversion of assets would be required during construction works at Ockendon Road (Work number MUT30).

2.6.337 Temporary pylons and associated powerlines would be required as part of the diversion of overhead lines (Work number OH7). The temporary works in Section D (Work number OHT8) would require the temporary installation of one pylon and 0.7km of overhead powerline which would be removed as part of the permanent works.

2.6.338 The assessments presented in this ES have assumed that temporary utilities would be removed as part of the demobilisation works, which represents a reasonable worst-case, but these may be left *in situ*. This would require the development of proposals with relevant stakeholders, landowners and other developers.

Ockendon link

2.6.339 The Ockendon link is the 5km section of the A122 that extends between the A13 and M25. It includes construction of two viaducts, three embankments, earthworks cuttings, two footbridges and an overbridge to carry North Road (B186) over the A122.

2.6.340 Works are expected to begin in the second half of 2025 and continue throughout the construction phase for Section D, completing in early 2030.

Construction of the Mardyke Viaducts and embankments

2.6.341 Works would involve the construction of two viaducts in the Mardyke area between Green Lane and North Road to allow the A122 to pass over the Mardyke and associated floodplain.

2.6.342 It is expected that the construction of the Mardyke Viaduct and embankments would take around three years and take place away from the existing road network. This work would include taking excavated material from the west of the M25 to the east of the motorway to create embankments that support the viaduct.

Construction of North Road green bridge

2.6.343 North Road would be realigned temporarily to the west of the existing route to provide working space for construction, using standard bridge construction methods. These works would take around 18 to 22 months.

2.6.344 North Road would remain open, although temporary traffic management measures would be needed to divert traffic on to the temporary route and then subsequently on to the new bridge.

2.6.345 The new bridge at North Road has been designed as a green bridge to encourage habitat connection between The Wilderness and the woodland to the south of the A122.

2.6.346 Before North Road green bridge is built, a temporary junction with signals would need to be installed to allow construction traffic using the haul roads to cross North Road. Once the bridge is complete, haul roads in this area would be diverted under the new bridge. The temporary crossings at this location would then be removed as construction traffic would no longer need to cross this road.

2.6.347 It is anticipated that occasional overnight and/or weekend closures and extended working hours would be required for this construction activity.

A122 Lower Thames Crossing/M25 junction

2.6.348 This section of the Project includes the construction of new roads to form a junction between the new A122 and the M25. Works would include a cutting to take the A122 northbound below the existing ground level before passing under the existing M25 via a new underpass and joining the M25 northbound approximately 1km north of Ockendon Road. Access to the A122 southbound would be at grade via a new on-slip from the existing M25, north of Ockendon Road, passing under the Ockendon Road bridge.

2.6.349 This work would begin in late 2025 and would be expected to be complete early in 2030.

2.6.350 To reduce the number of construction vehicles using local roads, temporary slip roads would be built for direct access between the worksite and the M25. These temporary slip roads would be in the area around Ockendon Road and built within the first two years of construction.

M25 underpass

2.6.351 The A122 northbound would be built in an underpass beneath the M25.

2.6.352 It is intended that works would be carried out using the box jacking construction method. This method would avoid the need to close the M25, but some temporary traffic management measures may be necessary towards the end of the programme to connect the A122 to the existing network. Some traffic management measures would be needed, including lane narrowing and reduced speed limits, throughout construction, which would change as work progresses.

Proposed Ockendon Road bridge structure

2.6.353 A new overbridge would be needed to carry Ockendon Road over the northbound carriageway of the A122.

2.6.354 A section of Ockendon Road extending between the Upminster to Grays railway line and the M25 would need to be closed for approximately 19 months to allow for the construction of the new overbridge structure.

2.6.355 The closure to the east side of the M25 would be extended so that construction traffic could use the existing bridge that carries Ockendon Road over the M25 during the period of works to construct the new bridge. The purpose of this proposal would be to reduce the need for construction traffic to use the public road network during the period of closure.

2.6.356 A diversion via Dennis Road would be in place throughout the period of disruption.

M25 widening, including M25 junction 29

2.6.357 These works would take place south of M25 junction 29 to where the A122 connects to the M25 and would involve widening the M25 St Marys Lane bridge and the Shoeburyness railway line bridge.

2.6.358 These works would be expected to begin in late 2025 and continue until early 2030.

2.6.359 Northbound widening works would mostly take place away from the existing road network, to limit disruption to traffic, but the southbound widening works would need to happen on or very close to the existing road. These works have been designed to manage traffic flow on the M25, and traffic would need to be temporarily managed through lane reductions and reduced speed limits.

2.6.360 Some temporary crossing points would need to be installed to provide access for construction vehicles to carry out the widening of the M25 between the Shoeburyness railway line and St Marys Lane. These crossing points would link the proposed haul roads that run either side of the M25 and would be required for the duration of construction works.

2.6.361 Traffic signals would be added to manage both public and construction traffic on a 150m stretch of St Marys Lane.

Widening at St Marys Lane and Shoeburyness railway line bridge

2.6.362 Widening St Marys Lane and the Shoeburyness railway line bridge north of St Marys Lane would involve standard bridge construction techniques.

2.6.363 Works on the Shoeburyness railway line bridge would likely take place towards the end of the construction programme and take around 12 to 14 months. The works would be carried out with Network Rail’s agreement. The railway would

be closed, and the Contractor would undertake the engineering works in this location. Typically, these would be scheduled for a weekend or bank holiday to reduce disruption.

2.6.364 The works on St Marys Lane would take about the same time and begin after utilities works in the area are completed. Most works would take place without the need to close St Marys Lane. Access to the worksite would be provided by the haul roads running alongside the M25. However, specific works would need overnight or weekend closures.

M25 junction 29

2.6.365 At junction 29, the M25 main carriageway would be increased to four lanes. This would involve widening the Cobham Viaduct.

2.6.366 Works to widen this viaduct would make use of standard bridge construction methods. Where practicable, the works would be carried out offline, meaning no direct impacts on the road, though some online works would be necessary to widen the viaduct structure. Modifications to connections north of M25 junction 29 would be primarily offline and involve standard road construction and drainage works.

2.6.367 Some online works would be required to tie-in with the existing network. Some temporary traffic management measures on M25 junction 29, the M25 and A127 would be required, with narrow lanes or short-term lane closures for around approximately three to four years. A reduced speed limit would also be introduced. Further information is provided in the oTMPfC (Application Document 7.14).

Reinstatement and planting

2.6.368 Land temporarily utilised during the construction phase, including construction working areas, compound areas and ULHs, would be reinstated on completion of the construction activities in accordance with the REAC (Application Document 6.3, Appendix 2.2).

2.6.369 Planting and landscaping would be undertaken as necessary in accordance with the oLEMP (Application Document 6.7) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.

2.6.370 Fences and other mitigation measures installed to protect environmentally sensitive areas from construction works would be removed on completion of construction activities.

2.6.371 Further information on reinstatement and planting activities is provided in Section 2.7 of this chapter.

Testing and commissioning

2.6.372 During the final part of the construction phase, testing would take place to ensure that the road (including all electrical and mechanical systems), structures, earthworks, drainage, public rights of way and other elements are complete and function to the required standards.

2.6.373 The individual parts of the new road, including its structures, gantries, drainage and other supporting infrastructure, would be tested as they reach completion. Testing would include adherence to the design specifications for each section of the road. The safety checks would vary according to the different functions and specifications of the element being tested. When construction of the Project road is complete, it would be tested in its entirety. The final testing and commissioning is scheduled to take place from mid-2029 to early-2030.

2.6.374 Commissioning refers to the completion of the testing phase, at which point the new road would be brought into public use.

Compounds

2.6.375 Each compound in Construction Section D is described in detail below. All dates and durations of activities are indicative. All compounds would require initial site set-up works and, at the end of their use, finalisation works including site reinstatement, landscaping and planting (as necessary). Compound locations are shown on Figure 2.5: Construction Information (Application Document 6.2), and indicative internal layouts are provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.6.376 The ULHs which support the utilities works within Construction Section D are discussed above, under the ‘Utilities works’ sub-heading.

Mardyke compound

2.6.377 This compound would be on the eastern side of Green Lane and would be around 3ha in size. Space in the compound would be used for parking, welfare and office space, workshops, equipment and material storage.

2.6.378 Where soil is excavated and retained on site temporarily, it would be stockpiled in the form of earth bunds to facilitate screening for environmental receptors to the north-east.

2.6.379 This compound would support the construction works in the area surrounding Mardyke Viaduct but would not be in place for the duration of construction.

2.6.380 Initially, access would be via Green Lane until temporary haul roads are set up for construction traffic only. During the works, access would be required from Stifford Clays roundabout to these routes alongside the A122.

Medebridge compound

2.6.381 This compound would be located close to Fen Lane and North Road, east of North Ockendon. It would be around 4.2ha in size and would be used for the construction of the A122 between the M25 and the new Mardyke Viaduct. It would include a concrete mixing plant to supply the surrounding works.

2.6.382 Most of the space in the compound would be used for equipment and storage, with the remainder for parking, or offices and welfare facilities. Earthworks would need to be stockpiled and managed as per the requirements of the agreed Material Handling Plan. Fencing/bunding would be put in place to provide noise and visual screening to nearby sensitive receptors

2.6.383 Construction vehicles would need to use Fen Lane at the start of the programme, for a period of around nine months, to allow utilities works to be carried out. During this period traffic management measures would be required, with successive closures of up to approximately 300m sections of the road.

2.6.384 The access route for HGVs and most staff vehicles to Medebridge compound would be via the A127, Warley Street, St Marys Lane, Clay Tye Road and North Road for the first 12 to 24 months of the construction programme. For the remainder of the programme, access to the compound would be provided by the haul roads constructed from the A13 rather than these public roads.

M25 compound

2.6.385 This compound would be located near North Ockendon to the east of North Road and would be around 22.6ha in size. It would act as the main workforce compound for Section D and support construction of the Project between the A13 and M25, including earthworks and road construction, construction of an underpass beneath the M25, North Road green bridge and widening of the M25 southbound carriageway.

2.6.386 Most of the space in the compound would be used for equipment and storage, with the remainder for parking or offices and welfare facilities. Earth would need to be stockpiled and earthwork bunds of 2 to 3m would be created to provide noise and visual screening for nearby sensitive receptors. This compound is anticipated to contain a concrete mixing plant and a temporary pre-cast facility.

2.6.387 Construction vehicles and staff vehicles would need to use Clay Tye Road at the start of the works to access this site and the Ockendon Road compound. Temporary works access off the M25 would be created to allow construction vehicles to enter the construction worksites, at which point Clay Tye Road would only be used by workforce vehicles.

Ockendon Road compound

2.6.388 This compound would be located to the east of the junction of Ockendon Road and Pike Lane and would be around 3.3ha in size. It would offer space for parking, offices and welfare, as well as storage and equipment. Fencing/ bunding would be put in place to provide noise and visual screening to nearby sensitive receptors.

2.6.389 Where soil is excavated and retained onsite temporarily, it would be stockpiled in the form of earth bunds on the south and west boundaries of the compound, where required to facilitate screening for Ockendon Road and the nearest residential properties at the static caravan park.

2.6.390 The compound would support the earthworks to the west of the M25, the construction of a new bridge to carry Ockendon Road over the A122 northbound carriageway, and the widening of the M25 northbound carriageway.

Warley Street compound

2.6.391 The Warley Street compound would be located south-east of M25 junction 29, west of the B186 Warley Street. It would be around 2.4ha in size, with space for parking, offices and welfare, as well as storage and equipment.

2.6.392 It would be used as a supporting compound for the widening of the M25, mostly around M25 junction 29. Access would be via a temporary haul road from Warley Street.

2.6.393 Construction vehicles would need to use Warley Street between the A127 junction and the entrance of the compound (approximately 300m north of the bridge over the Shoeburyness railway line) throughout construction.

2.6.394 Vehicles turning into and out of Warley Street from the compound would be managed using temporary traffic signals.

Traffic management and construction traffic

2.6.395 The access routes for each of the construction compounds are described above. The oTMPfC (Application Document 7.14) presents the approach that would be followed when undertaking temporary traffic management during the construction phase. It includes further information on proposed construction routes, on roads where restrictions would be in place for use by HGVs associated with the Project, and proposed traffic management measures to facilitate the construction works.

2.6.396 To access the works east of the M25 (south of the Shoeburyness railway line), the initial access would be via the B186. Once the M25 southbound temporary accesses are available, the B186 would not be used by HGV construction traffic (other than for very specific works), except for the stretch of the B186 between the A127 and access to the Warley Street compound.

2.6.397 Similarly, to access the works west of the M25 (south of the Shoeburyness railway line), the B186 and Ockendon Road would initially be used. Once the temporary M25 accesses are constructed off the M25 northbound, the B186 would not be required. A section of Ockendon Road across the M25 would still be required and used throughout construction phase.

2.6.398 Offline access routes would run alongside the A122 and the M25 to allow construction access to the works. Access routes and haul roads are shown on Figure 2.5: Construction Information (Application Document 6.2).

2.6.399 Proposed traffic management measures that could be implemented throughout the construction phase are outlined within Section 2.7 of this chapter, with further detail provided in the oTMPfC (Application Document 7.14). The indicative traffic management measures and road closures associated with the construction works and utilities works are detailed in the oTMPfC (Application Document 7.14). Further information on the effects of construction on the local road network is provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

2.7 Construction description

2.7.1 This section describes the types of works and typical methodologies that are anticipated to be used during the construction works identified above for each Construction Section.

Preliminary works

2.7.2 Preliminary works would take place in the phase between the DCO being granted and the commencement of construction. Commencement is formally defined in the draft DCO (Application Document 3.1). A definitive list of the activities that could be undertaken during the preliminary works phase is provided in the CoCP (Application Document 6.3, Appendix 2.2).

Archaeological investigations

2.7.3 There is the need to investigate the archaeological resource to determine the significance, extent, survival and state of preservation of buried archaeology in line with the NPSNN (Department for Transport, 2014) and the guidance set out in the Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change, 2011a).

2.7.4 A series of desktop studies, geophysical surveys, and a programme of archaeological trial trenching (ATT) running from 2019 to 2021 was carried out across the Project.

2.7.5 Further investigation, which could include geophysical survey, digging specialist test pits, fieldwalking and ATT, is likely to be required in a small number of locations where access was not available during the ATT programme.

2.7.6 The findings of these further investigations would continue to inform the approach to archaeology, to ensure appropriate mitigation is in place. The scope of archaeology works has been developed in consultation with Historic England and the archaeological advisors to the local planning authorities and is discussed further in Chapter 6: Cultural Heritage. The final mitigation proposals would be agreed by the Secretary of State following consultation by the undertaker with the relevant planning authority and Historic England.

2.7.7 Where the partial or total loss of a heritage asset cannot be avoided archaeological excavation and recording will be carried out in line with the NPSNN (Department for Transport, 2014) and the guidance set out in the Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change, 2011a) to mitigate the loss of the heritage asset.

2.7.8 Those activities that take place as preliminary or initial works may require archaeological mitigation to take place prior to their starting.

2.7.9 All archaeological mitigation will be set out in the draft Archaeological Mitigation Strategy and Outline Written Scheme of Investigation (Application Document 6.3, Appendix 6.9).

2.7.10 Where ATT is required, trenches would typically be approximately 2m wide, between 20m and 50m in length and 1m deep. These trial trenches would initially be dug by mechanical excavator. Once the trench is open, the archaeologists would hand-excavate and collect archaeological finds. All finds would be described, photographed and drawn so that a full report can be prepared of everything that is discovered. The excavated trench would then be subsequently filled in once the archaeological investigation activities are complete.

Pre-construction ecological mitigation

2.7.11 Ecological mitigation works during preliminary works would include preparing habitats and moving existing species into the new habitats and suitable retained habitats.

2.7.12 The Contractors would determine which ecological mitigation works would be undertaken as preliminary works based on the development of the detailed programme, constraints on starting work and where commitments have been made for works starting prior to commencement.

2.7.13 Proposed ecological mitigation and compensation measures are described in Section 2.4 of this chapter and identified in the Environmental Masterplan (Application Document 6.2, Figure 2.4). The ecological mitigation activities that are anticipated to be started as preliminary works are as follows:

a. Preparation of ecological receiving site for reptiles

b. Preparation of ecological receiving site for great crested newts (GCN)

c. Translocation of protected species

d. Installation of bat boxes and hibernaculum

e. Installation of dormouse boxes

f. Installation of artificial badger setts

g. Installation of bird boxes

h. Closure of badger setts

i. Installation of ecological exclusion fencing

j. Vegetation clearance

Preparation for construction

2.7.14 Preliminary works activities would also include key activities associated with the preparation for construction, or as associated with other preliminary works activities. These activities are as follows:

a. Environmental surveys and monitoring, for example pre-construction noise monitoring

b. Investigations for the purpose of assessing and monitoring ground conditions and levels

c. Temporary fencing would be installed to define working areas for the construction phase, or to secure working areas for preliminary works

d. Plant and equipment would be delivered and erected on site at specific locations identified as advance compound areas. This activity would not include works to prepare the site for the plant and equipment, and so the plant and equipment could only be placed within suitable locations, for example where there is existing hard standing.

e. The diversion and laying of underground apparatus, including utilities supplies, could take place as preliminary works at the advance compound areas.

f. Vegetation clearance and construction of accesses for advance compound areas.

g. Temporary display of site notices or information

2.7.15 Advance compound areas, where preliminary works could take place, are as follows:

a. A2 compound

b. Southern tunnel entrance compound

c. Northern tunnel entrance compound

d. Brentwood Road compound

e. Stifford Clays Road compound East

f. M25 compound

Initial works

2.7.16 Initial works form part of the main construction works and would take place following the commencement of construction (as defined in the draft DCO (Application Document 3.1)). Initial works are those that prepare the site and the compounds for the main construction activity. These works would cover the following activities to allow construction to begin:

a. The early stages of ecological mitigation, such as preparing habitats and moving species (these works may start as part of preliminary works and would also continue through later phases of construction)

b. Securing the construction sites, including diverting or closing temporary public rights of way

c. Creation of haul roads

d. Establishing the construction compounds and ULHs, including utility diversions and connections

Securing the site, including public rights of way

2.7.17 During the initial works, security control measures would be implemented in areas within the Order Limits that may present a safety or security threat during construction. This may include working areas, compounds or sections of compounds in some cases. Environmentally sensitive areas that need to be separated from the public or construction works would also be controlled during this time.

2.7.18 Site-specific risk assessments would be carried out to identify potential security threats, and identify the most effective and aesthetically suitable security measures to be installed. This would ensure that if fencing or hoarding and other materials are used, they would be appropriate to the threat at that location and to the activities within the compound or area of works.

2.7.19 Fencing and hoarding requirements would follow the Manual of Contract Documents For Highway Works Volume 1 Specification For Highway Works Series 300 on Fencing (Highways Agency, 2008).

2.7.20 Any WCH routes, such as footpaths or bridleways, affected by works would be made safe. This would involve creating diversions or using temporary closures. Further information on routes used by WCH can be found under the 'WCH' heading later in this section.

Construction compound and ULH set-up

2.7.21 A number of proposed construction compounds and ULHs would be set up to serve the construction activities within each construction section. These are described further under the 'Construction compounds and ULHs' heading later in this section.

Haul roads

2.7.22 Where there is no direct access from the strategic road network, suitable local roads would initially be used to access the site. Following this, temporary haul routes (haul roads) would be constructed off the strategic road network early in the programme where possible to access the site 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.

2.7.23 Temporary haul roads would be constructed within the Order Limits for the movement of construction vehicles, including HGVs, around the construction site, between compounds and working areas. Haul roads are shown in Figure 2.5: Construction Information (Application Document 6.2) and the management of these routes is described under the 'Construction compounds and ULHs' heading later in this section.

Highways works

2.7.24 Construction methods typically associated with major infrastructure projects would be implemented to construct the proposed roads and highways, as detailed further in this section. Assumptions have been made on the methodologies used for construction, based on a reasonable worst case, and the assessments presented in this ES have reflected this. Construction methodologies and working areas have been developed reflecting the LOD set out in the draft DCO (Application Document 3.1) and the Works Plans (Application Document 2.6).

2.7.25 Specific works within existing highway and railway boundaries during night-time, weekends and bank holidays would be required, for safety reasons or to minimise disruption to the operation of the network. These works could include installation of bridge decks or gantries, surface tie-ins, installation of signage and technology, implementation of traffic management and road resurfacing. These specific works are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The environmental assessments presented in the ES have considered the requirements for extended working hours. Where extended working hours are not known, but there is likelihood they would be required, these longer hours have been assumed in the assessments, to reflect a reasonable worst case.

Topsoil removal

2.7.26 Topsoil removal is one of the first stages for construction, which involves stripping the top layer of soil, typically to a depth of 0.25m.

2.7.27 Its removal would be necessary from various areas, including:

a. the main construction worksites

b. utilities works sites

c. temporary construction site areas, including compounds and ULHs

d. temporary haul roads and temporary construction working areas.

2.7.28 Typically, at the end of each section of construction works, topsoil would be replaced and embankments and side slopes would be seeded. This would follow the completion of all main construction activities before the opening of the new road and would enable the subsoil to be sealed, preventing sediment runoff.

Temporary soil storage areas

2.7.29 Soil storage areas would be used to temporarily stockpile the fill material that would be either imported from an outside source or generated onsite through cutting operations. Prior to using these areas for storing the fill material, topsoil would be stripped off and transported to the designated topsoil storage areas. Soil storage areas would then be bounded by appropriate fencing where required.

2.7.30 It is anticipated that temporary soil stockpiling would be required along the Project route due to the sequential packaging of construction activities. Where reasonably practicable, the stockpiles themselves would be positioned to provide temporary noise and visual barriers screening sensitive receptors from the works.

2.7.31 Provision within the compounds has been made for temporary soil storage during construction. These stockpiles would also be used to screen compound facilities such as welfare facilities, offices and workshops where appropriate. The required size of stockpile areas would be determined by the Contractors during detailed design, but indicative sizes are shown in the compound layouts presented in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Temporary topsoil storage areas

2.7.32 Topsoil storage areas would be used to temporarily stockpile topsoil so that it can be reused. These areas would be created during site setup. Stockpiled topsoil would be used to reinstate temporary working areas, such as compounds and haul roads, when they are no longer required. It is also assumed that topsoil would be reused on the exposed side slopes of embankments and cuttings and also for additional landscaping purposes and habitat provision. Therefore, the topsoil storage areas would be required until landscaping activities have been completed.

2.7.33 Topsoil storage would follow appropriate best practice measures to ensure it is suitable for reuse, such as restricting the height of stockpiles to avoid compaction, protection from erosion and weed management. Topsoil storage piles would not exceed 2m in height and would be fenced appropriately.

2.7.34 Where feasible, topsoil would be stockpiled adjacent to the temporary working areas such as construction compounds and haul roads, to mitigate construction movements. Depending on their location and the heights required, the stockpiles may also act as temporary noise and visual barriers during the works. These have not been assessed as mitigation during the construction phase, and as such the assessment reflects a worst-case scenario. Once the temporary working areas are no longer required, they would be demobilised and removed, and the area reinstated using the stockpiled topsoil. Grass seeding would be carried out in accordance with the landscape design and/or landowner agreement if the land is being returned.

Earthworks

2.7.35 The construction of earthworks, such as cuttings and embankments, mostly involves filling (i.e. building up the ground level) and cutting (i.e. excavating). This would be carried out after stripping and storing the topsoil for reuse. The formation level of the pavement can then be built at the required level.

2.7.36 Soil and other material for embankments would be brought to the site using heavy machinery, and then added in layers and compacted. Cutting would involve excavating and shaping using excavators.

Filling

2.7.37 Construction of embankments by filling would involve sourcing and using fill material and raising the profile of the ground to the road formation level. This enables the construction of the design item, such as a road pavement or footpath, to be based on the embankment.

2.7.38 Construction of embankments would involve transporting suitable fill material using road wagons or dumpers, laying the fill material in layers using a bulldozer/grader and then compacting each layer of fill material using a suitable roller. The slope would typically have a slope ratio of 3:1, but this would depend on the ground conditions and design requirements. In some instances, this ratio could be altered by using a different fill material or by creating engineered slopes. For example, it is proposed to reuse site-won excavated material (such as sand, gravel and clay) in some instances to construct the road embankments. In such instances, the design of the slope ratios would depend on the quality of the excavated material and the ground conditions in the embankment areas.

Cutting

2.7.39 To construct a cutting, the ground is excavated to road formation level. This enables the construction of the design item, such as a road pavement or footpath, to be based within the cutting.

2.7.40 Construction of cuttings would involve excavating soil and shaping slopes using suitably sized excavators with hydraulic attachments. The slope would typically have a ratio of 3:1 but this would depend on the ground conditions, for example

in areas of chalk this may be 1:1 or 1:1.5. Where required, slopes would be engineered using methods such as soil nailing or rock bolting. Some excavations may encounter rock which would require ripping using a bulldozer with a blade attached or hydraulic breaker.

Management of spoil/excavated material and earthworks

2.7.41 As a result of excavating the tunnels and preparing the ground, the construction of the Project would generate a large amount of excavated material, such as earth and rock. Managing this excavated material, and reusing it for earthworks, would play a significant role in reducing the amount of construction traffic using the road network to transport this material to worksites at any given time.

2.7.42 Soil storage areas have been incorporated into the construction site layout to assist in managing spoil and fill supplies.

2.7.43 It is currently assumed that the majority of fill material can be sourced from material excavated from cutting works within the Order Limits of the Project; however, some fill material may need to be imported from external sources to meet the design requirements. The Project would give priority to sourcing aggregates from Kent, Essex and Greater London whenever the design specification permits, and supply is available. It is assumed that imported fill material would typically come from a supplier within a 50-mile radius of the Project location and that this supplementary material would be transported via the road network. At present, it is assumed that several suppliers would be required to meet the Project needs.

2.7.44 It has been assumed that some of the excavated and tunnelled ground materials could be used as fill material. This assumption takes into account the possibility of ground contamination and the geotechnical properties of the materials.

2.7.45 Some of the material obtained onsite from the cutting and tunnelling operations would require treatment so that it can be reused or safely disposed of offsite. The material would be transported to designated soil storage areas within the construction compounds where it would be processed (for example by either adding lime or applying other suitable methods in accordance with the specification of earthworks).

Temporary construction working areas

2.7.46 Temporary construction working areas, also referred to as worksites, are areas used for specific construction activities, including utilities works, and are generally required for a set period of time and not the entire construction period for that part of the works, or the Project as a whole. Examples include areas for drainage works and construction of structures. They differ from temporary haul roads as they do not facilitate bulk construction movements but simply the required temporary construction activities. The extent of the area required varies depending on the activity and the type of plant and equipment required for it.

2.7.47 The main alignment would also be used as a working area for construction.

Temporary works for structures

2.7.48 The construction of the various structural elements (such as under- or overbridges, support to deep excavations, and crane or piling pads) would require several differing temporary works systems. Depending on the final detailed structural designs and methods of construction, it is likely that the following types of temporary works could be employed for structures:

a. Crash decks/protective hanging decks for the demolition/removal of structures

b. Crane pad foundations for major crane lifts, e.g. for bridge construction

c. Launching gantries and launching beams for bridge beam placing

d. Scaffolding systems or mobile elevated working platforms (MEWPs) for access at height around structures

Site lighting

2.7.49 During all construction packages, temporary construction compounds and working areas would typically be lit during hours of darkness to provide a safe and secure working environment, when required.

2.7.50 Site lighting and signage would be provided by the Contractors to ensure the safety and security of the construction sites. It would be at the appropriate luminance required to provide safe working conditions. Where needed and appropriate, lighting to site boundaries would be provided, and illumination would be sufficient to provide a safe route for the passing public. Precautions would be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas. Where appropriate, lighting would be activated by motion sensors to prevent unnecessary usage.

2.7.51 Lighting would also be designed, positioned and directed to prevent or minimise light disturbance to nearby residents, ecological receptors, as well as motorists and rail and marine operations. This provision would apply particularly to sites where night working or security lighting would be required. It has been assumed that temporary lighting would include tower lighting, mounted on a mast up to a maximum height of 9m. Further information on lighting of construction sites is provided in Appendix 8.15: Construction and Operational Light Spill Calculations (Application Document 6.3).

Site fencing and hoarding

2.7.52 Fencing would be required to secure compounds and working areas during construction, and to demarcate the highway boundary.

Construction phase fencing

2.7.53 During initial works, site-specific security risk assessments would be carried out by the Contractors to determine the type of perimeter fencing or hoarding to be installed to secure the site.

2.7.54 This would include ensuring that the fencing, hoarding and other materials used are appropriate to the location and to the activities within the compound and working area that would affect noise levels within adjacent locations.

2.7.55 Fencing may be used in areas of low security risk to lessen the visual impact on the environment and help security management in the area. Heras fencing may be used as a temporary measure to secure a site or adapt the site boundary before installing permanent hoarding, or likewise when demobilising from an area.

2.7.56 Hoarding would be erected to the boundary of higher-risk activity sites or where visual screening is necessary. Hoarding would typically be 2.4m in height but could be greater in the higher security risk areas.

2.7.57 Fencing may be used within compounds and working areas to provide acoustic screening during construction, and mitigate the effects from noisy plant and equipment. Fencing may be placed around compound perimeters, or be placed directly around individual pieces of plant and equipment.

2.7.58 Temporary fencing installed during construction would also include silt fences to prevent sediment reaching watercourses (typically used around soil and topsoil storage sites where required). Environmental fencing (for example otter or badger fencing) may be required to exclude wildlife from working areas and would extend below ground level, requiring excavation. This would be carried out using a small excavator or by hand-digging.

2.7.59 The CoCP and REAC provide more information on the control measures for construction phase fencing (Application Document 6.3, Appendix 2.2).

Permanent fencing

2.7.60 The highway boundary would be identified by surveying and installing suitable pegs and posts. The fencing required to denote the permanent highway boundary would generally be a timber post and four-rail fence up to a height of 1.4m. This would, however, be complemented or substituted with additional specification fencing to meet other objectives (for example to deter wildlife from reaching the highway) where necessary and appropriate.

Drainage

2.7.61 The Project would require the installation of drainage systems to manage and treat surface water when the road and tunnel is operational and during the construction phase to minimise the impact of runoff on the surrounding environment.

Temporary drainage

2.7.62 Temporary drainage would be required for construction compounds and ULHs, working areas and haul roads, and would be installed as and when required to fit with the construction programme for that location.

2.7.63 For temporary construction working areas, appropriate temporary drainage would be implemented by the Contractors during site setup. This would typically include surface runoff drainage (for example, construction of ditches and placement of drainage pipes).

2.7.64 Where required, temporary attenuation of construction site generated surface water runoff to existing discharge rates / greenfield run off rates would be provided.

2.7.65 Where contamination is possible, treatment and disposal options would depend on factors including volume of water (such as the size of hardstanding), type of contamination, and area available for treatment. Temporary drainage systems would incorporate pollution control systems designed in line with industry good practice guidance and comply with the requirements of DMRB CG 501 (Highways England, 2020f).

2.7.66 The methods for treatment and disposal include the following:

a. Sustainable drainage systems – slowing waterflows associated with surface runoff to allow settlement, natural filtration and other treatment before discharging.

b. Disposal of water offsite using tankers – water would be stored onsite in temporary ponds or, where practicable, permanent drainage ponds. The water would then be transported by tankers.

c. Settlement ponds and lagoons – as above, a temporary or permanent pond would be used for this purpose.

d. Filtration system (including mechanical filtration) – aggregate, straw or similar material would be used as a filter.

e. Irrigation of crops and grassland where appropriate.

f. Discharging directly into an existing sewer using pipework to the nearest sewerage connection point, as a last resort and would need approval from the relevant Stakeholders.

2.7.67 Temporary drainage from the North and South Portals is discussed further in Section 2.7 of this chapter under the ‘Tunnels works’ heading.

Permanent drainage

2.7.68 Permanent drainage systems would be installed to manage and treat surface water during the operational phase. These would take several forms, including pipes, ditches, channels, filter drains and carrier drains. Drainage works would also include the construction of drainage ponds to store and treat surface water. These would be excavated prior to earthworks where practicable, and could be used during the construction phase to meet temporary drainage requirements, for example drainage from completed sections of road.

2.7.69 Construction of carriageway drainage would typically involve laying filter drains, carrier drains and outfalls to transport surface water runoff from side slopes, carriageways and other paved areas. Drainage products would include pipes of varying diameter, gully pots, cover gratings, gravel filter material and other stone pieces for balancing ponds and open channels. Manholes and chambers would typically be built with *in situ* concrete bases, a precast concrete ring or brickwork walls, and would be covered by precast concrete caps.

Culverts

2.7.70 Drainage works would also include the construction of culverts which would be carried out prior to earthworks. Culvert construction methods may vary but would typically involve either *in situ* construction or offsite pre-fabrication (and onsite installation) with the latter usually favoured.

2.7.71 Culverts are drains or pipes that allow water to flow under a road or other structure. They are typically made of concrete, plastic or steel. These are placed in an excavation that is then backfilled and compacted on top with gravel or soil.

Temporary culverts

2.7.72 Temporary culverts would be used during the establishment and use of construction working areas, compounds and haul roads. Temporary culverts can take many forms but are typically concrete box structures or plastic or steel pipes placed within an excavation backfilled with gravel or soil and compacted fill on top. These would be removed, and the watercourse reinstated once the culvert is no longer required.

Permanent culverts

2.7.73 The installation of permanent culverts would typically involve temporary diversion of the watercourse (in the form of ditch or similar). The final methodology to be followed would depend on the sensitivity of the watercourse and would be subject to consultation and agreement with the relevant Lead Local Flood Authority or the Environment Agency during detailed design.

2.7.74 The type of culvert used would vary but typically takes the form of either precast box culverts, *in situ* culverts or piped culverts.

Precast box culverts

2.7.75 Precast box culverts would typically require gravel for bedding and precast concrete culvert sections. The ground would be excavated to bedding level along the line of the culvert, and the gravel bedding material would be placed and levelled using a tracked excavator. The culvert sections would then be lifted in by a crane and connected onsite. External faces of the culvert sections would be treated with a waterproof membrane. The waterproof membrane would typically be a bitumen coating applied by brush or spray. Following this, the culvert would be backfilled as required.

In situ culverts

2.7.76 Construction would begin with excavation. A thin layer of concrete would be placed to provide an even surface on which to fix reinforcing and formwork. This would be followed by steel fixing, formwork and pouring concrete. Following the completion of the concrete works, the formwork would be removed once the concrete is cured. Waterproofing would be added, and the culvert backfilled as appropriate.

2.7.77 Culverts also require construction of a headwall. Headwalls are likely to be *in situ* concrete with a decorative finish. Headwall construction would involve excavation, steel fixing, formwork, concreting and backfill works.

Piped culverts

2.7.78 Piped culverts typically require gravel for bedding and surround and precast concrete pipes. The ground would be excavated to bedding level, gravel bedding would then be placed, and the pipe installed. A gravel surround would be added prior to backfill.

Flood compensation

2.7.79 Flood compensation would typically be built ahead of works in the floodplain. It involves lowering the finished ground level to store flood water. Flood compensation is normally carried out in phases to minimise the amount of land used and to make sure an agreed volume of storage is available throughout construction. The sequence comprises the following:

a. Stripping topsoil, which is usually stockpiled near or on the flood compensation area, using a scraper, bulldozer or a similar machine.

b. Material is removed to the designed level. Conventional flood compensation areas are relatively shallow (typically up to 1m deep). The depth of flow retention type compensation areas can be much deeper (the actual depth depends upon topography).

c. Reinstating the land by replacing topsoil, using a bulldozer or a similar machine.

2.7.80 Compensatory flood storage that would form part of the permanent works may be constructed and used during the construction phase of the Project.

Structures

Bridge construction

2.7.81 Various methods may be used to build the bridges, and these are described below. The sequence in which a bridge is built is determined by its location. For example, if the bridge crosses an existing road, the need to keep traffic flowing would require a more complex construction plan to minimise delays and disruption to road users and the local community.

2.7.82 The main elements of a bridge structure are usually made of steel, concrete, or a combination of both. Concrete may be cast *in situ* where it is poured into forms and cast onsite, or the bridge may include precast units transported to the site. The exact form and materials used on each bridge would be specific to the individual locations. These would depend on the bridge type, the alignment of the road it carries, and distances between the piers and abutments (spans). Abutments are formed to support the ends of the bridge deck; piers are formed in the central reserve or verge to support the inner parts of the deck. The deck is the surface structure of the bridge that is covered by the road.

2.7.83 The four main bridge construction elements are as follows:

a. Foundations

b. Abutments

c. Piers

d. Deck

2.7.84 Bridge foundations for the abutments and piers may be either concrete pad or piled, depending on ground conditions and associated design.

2.7.85 Pad footings are generally made from concrete with steel reinforcements and extend from an excavation. Steel reinforcement is fixed to allow abutment and pier construction on top of the foundation slab.

2.7.86 Piled foundations are constructed by installing piles to the designed depth, by driving these in with a hammer, or removing material to create a space and then pumping in concrete, as described below:

a. Driven piles: Driving preconstructed concrete or steel piles to the required depth with a piling hammer.

b. Bored piles: Using a piling rig to create the void for the pile, placing a casing in the void (if required) or slurry to support the walls followed by lowering steel reinforcement and pouring concrete to form the pile.

c. Continuous Flight Augering (CFA) piles: Using a piling rig to drill down to the required depth. Once at the designed depth, concrete is pumped into the void created whilst the auger is withdrawn (with the soil) at a controlled rate.

2.7.87 Bridge abutments are constructed at each end of the bridge to support the bridge beams and deck.

2.7.88 Bridge piers are not always needed (depending on design). Where necessary, bridge piers are constructed between the abutments to act as an intermediate support for the bridge beams and deck.

2.7.89 Bridge decks can take many forms. The two most common are concrete *in situ* deck, and beam and slab deck. For beam and slab deck, beams are usually precast steel and concrete, and the deck would be made from concrete cast *in situ*. The precise form of bridge decks will be determined during the detailed design of the Project. *In situ* decks typically use reinforced concrete cast onsite. The main difference between construction of an *in situ* deck compared to a beam and slab deck would be the delivery of precast and prestressed concrete or steel beams, and lifting into pier positions and abutments using cranes.

Box jacking

2.7.90 This is a trenchless method of construction that allows a shallow underground space to be created. It is intended to avoid disruption and minimise the impact on the surrounding environment. Box jacking would be used where the A122 crosses beneath the M25 and A13.

2.7.91 Box jacking would involve a site-cast concrete box structure, placed next to the embankment, using high-capacity hydraulic jacks.

2.7.92 Box jacking involves excavation equipment, ventilation fans and ducting, essential services and rear access for personnel. This is all contained within the space created by the box-jack. First, the face is excavated to create space, then

the box structure is jacked forward to the face and into the ground. This carefully controlled phased sequence continues with excavations and progressive, incremental, advancements of the box-jack.

2.7.93 On the exit side of the embankment, a temporary artificial ridge (sometimes called a 'berm') would be constructed to reinforce the embankment during the final stages of jacking. When the structure reaches its final position, all equipment is dismantled, and normal road construction can begin. It may be necessary to build entrance wings and parapets to support the face of the embankment.

Viaduct construction

Standard viaduct construction

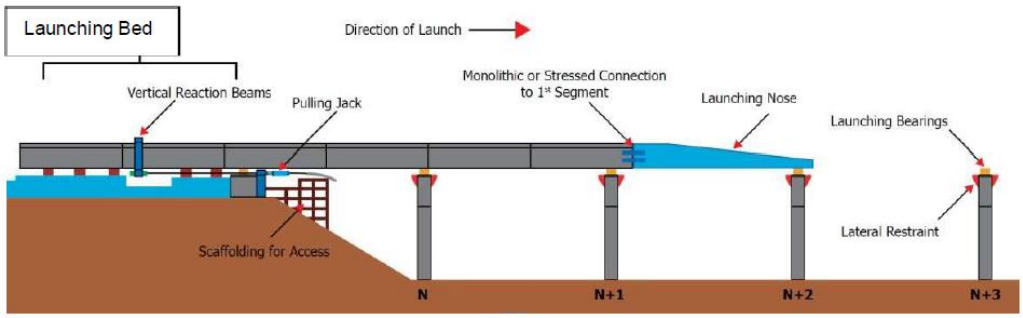
2.7.94 The standard construction methods for a viaduct are like those for bridge construction, with foundations, abutments, piers and a deck. Similarly, the use of precast concrete elements and steel beams would also need lifting equipment for placement onto the structure.

Incremental launching method

2.7.95 Alternative methods of viaduct construction may be used where site constraints prevent using standard methods. The construction of the Tilbury Viaduct, where the A122 rises to cross the Tilbury Loop railway line, would require an alternative method.

2.7.96 The proposed incremental launching method for the Tilbury Viaduct crossing would require setting up a launching yard behind the end abutment of the structure, with associated equipment to guide pre-assembled girders into place. Plate 2.16 provides an overview of the main components of the launching method.

Plate 2.16 Incremental launching of a viaduct structure



2.7.97 The following steps would generally be expected during the incremental launch:

a. Construct abutments and piers

b. Establish launching yard behind the end abutment at one end of the proposed viaduct

c. Fabricate or pre-assemble girder segments into modular sections and prepare for launch

d. Push deck forward one module length at a time towards the opposite end of the abutment and continue, repeating steps until the end abutment is reached

e. Cast the deck slab on top of girders

f. Construct parapet, handrails, sidewalk, pavement and bituminous surfacing

Retaining walls

2.7.98 As with bridges, retaining walls can take varying forms depending on ground conditions, other constraints and the Contractor's preferred working methods. The more common forms are piled walls, reinforced concrete walls and reinforced earth walls.

Piled walls

2.7.99 Piled walls are constructed using one of the piling methods described above for structures. For piled walls, the piles are closely spaced to form a complete wall rather than being spaced apart. Piled walls are generally constructed by installing the piles and then excavating the soil in front of the piles.

Reinforced concrete walls

2.7.100 Reinforced concrete walls (gravity, cantilever and anchored) are formed by creating a concrete base within an excavation, followed by further concreting works for the main part of the wall. At each stage, formwork is in place to contain the wet concrete and form the shape and finish to the wall. Where required, a facing would be applied of brick, stone or other finish. Anchored walls are generally more slender than gravity or cantilever walls, which typically require a larger footprint. For anchor walls, steel cable rods or similar are driven horizontally through the concrete wall and into the soil behind, the ends then being filled with concrete to provide the anchor.

Reinforced earth walls

2.7.101 Reinforced earth walls are formed by placing and compacting layers of gravel, between which a plastic or metal reinforcing mesh or strips are placed.

Gantries and signage

2.7.102 Foundations for gantries and signage are normally concrete pads. The steel frame gantry or signage post is then fixed to the foundation.

2.7.103 Gantries are usually steel and would arrive in sections at site. This includes super span gantries that stretch across both carriageways of a road. These are then lifted using cranes and bolted together. They are generally installed during night closures on the roads such as the M25. For the offline sections of the Project, they are likely to be installed during the working day. Once the steel frame gantry has been erected, signage and cabling would be connected.

Road surfacing construction

2.7.104 The road surface (pavement) is made up of several layers and each layer must be laid, compacted and, in some cases, allowed to set before laying the next. Pavement works would include activities such as laying capping material, preparation of the sub-base and base course, and laying blacktop binder and surface course.

2.7.105 Construction of the pavement would involve plant such as graders, vibratory rollers, compactors, milling machines, asphalt pavers and road wagons.

Road widening works

2.7.106 The Project would use temporary traffic management when widening a road, allowing space for construction work and to separate traffic from the working area.

2.7.107 Widening works involve earthworks to raise or lower the adjacent ground to the designated height using excavators, bulldozers and compactors, followed by road surfacing works. Typically, a small amount of demolition to the edge of the existing carriageway would be needed to allow the new road surfacing to be connected to the existing surface.

2.7.108 Widening works may include activities such as laying mass concrete, inserting dowel bars (to stitch the widening area with the existing pavement), planing works to the existing road surface, repair joints to the existing concrete slab, and laying base course, binder course and surface course. In some cases, widening works will involve diverting any utilities installed in the existing road verges.

Tie-in works

2.7.109 Tie-in works involve connecting new carriageways into existing ones and may be temporary or permanent.

2.7.110 First, the new carriageway would be built offline as close to the existing carriageway as practicable with minimal disruption to traffic using existing highways. Temporary traffic management would then be utilised to allow the new road to be tied into the existing one. This would usually require a night or weekend closure. Earthworks, road surfacing works, drainage and finishing works would all be included.

Finishing works

2.7.111 These would take place following or during road surfacing works and require safety barriers, signs and cabling, and other intelligent transportation system equipment such as cameras. Sign installation works would involve excavation for concrete foundations before putting up the posts. The sign faces would then be fixed to the posts. Some signs may be lit and so would require cabling to be passed through the service ducts. Lighting columns would also be installed and connected where needed.

2.7.112 Any debris would be removed, and road markings would be sprayed onto the surface using specialist lorry-mounted equipment. Following finishing works, testing and commissioning, the road would be ready for public use.

Resurfacing works to the existing pavement

2.7.113 The pavement of existing roads may require resurfacing, for example where adversely affected by construction activities. Resurfacing works would involve activities such as planing and removing the existing road surface, either exposing the existing concrete slabs and undertaking repairs to the existing joints in the slab or simply checking the condition of the binder course and making repairs where required. A fresh surface layer would then be laid. Surface course would be laid in one or two parts to minimise the number of longitudinal joints. Resurfacing works would typically involve working on the existing carriageway. Therefore, traffic management measures would need to be put in place to facilitate the works.

Tunnels works

2.7.114 The Lower Thames Crossing would take the form of twin-bored 4.25km (2.6 mile) tunnels crossing beneath the River Thames, one for southbound traffic and one for northbound traffic. Our assessments have been based on a scenario in which two separate TBMs are used to construct the tunnels, working from the north of the River Thames southwards. Driving both tunnels from the northern entrance would negate the need for separate construction sites and would mean only a single central location would be needed for all tunnelling logistics, instead of needing to relocate them. It would also minimise impacts on the local area by reducing the number of construction traffic journeys. Tunnelling logistics would include the following:

a. The provision of an electrical power supply.

b. Concrete batching plants producing pre-cast concrete tunnel linings and other concrete items. By locating the plant producing them within the northern tunnel entrance compound, the tunnel linings and other concrete items can be efficiently moved to where needed for tunnel construction. The northern tunnel entrance compound is ideally located for the supply of bulk materials of sand and aggregates locally via the nearby port facilities.

c. A large land area that enables the tunnel boring machinery to be transported to site in small sections and assembled on the tunnel entrance ramp.

d. Welfare facilities adjacent to the tunnel entrance within the site area.

e. Removal of tunnel boring machinery and disassembly after completion of the tunnel. This would happen at the southern end where there is direct access to the SRN.

f. Spoil disposal at Goshems Farm, adjacent to the construction worksite. Locating the construction worksite next to Goshems Farm reduces the need to transport spoil offsite, hence reducing HGV movements on the local road network. Goshems Farm be used to dispose of spoil not used elsewhere within the Project. Having access within the construction site area to this location for disposal of spoil not used elsewhere within the Project reduces

the need to transport this offsite. This reduces HGV movements on the local road network.

2.7.115 Construction methods typically associated with major tunnelling projects would be implemented to construct the proposed tunnels and approach structures, as detailed further in this section. Assumptions have been made on the construction methodologies, based on a reasonable worst case, and the assessments presented in this ES have reflected this. Construction methodologies and working areas have been developed reflecting the LOD set out in the draft DCO (Application Document 3.1), the Works Plans (Application Document 2.6) and the Tunnel Limits of Deviation Plans (Application Document 2.15).

Current land use at the North Portal

2.7.116 The current land use at the North Portal structure presents particular challenges and risks to the construction activities as part of the excavation and construction of the tunnel launch structure and approach ramps. The northern tunnel entrance compound would be situated on and adjacent to Goshems Farm, a historical landfill site located between the North Portal and the River Thames that includes a parcel of land called Ashfields. Ashfields is currently managed by Ingrebourne Valley Limited (IVL) as part of a restoration project to raise the land using inert material and restore it back to high quality, arable farmland. IVL has been receiving excavated material from several major infrastructure projects in London such as the Northern Line Extension and the Thames Tideway project. A number of historical landfills of domestic and industrial nature exist nearby and at depths below the site, and a hazardous liquid co-disposal site decommissioned in the mid-1990s lies approximately 150m to the east of the site. The construction methodologies described below have taken these constraints into account.

Ground treatment and strengthening works

2.7.117 It is anticipated that soil mixing would be required to strengthen the ground within the northern tunnel entrance compound. The required depth of strengthening would vary depending on ground conditions; however, it is anticipated that deep soil mixing and other ground treatment techniques would be required in locations supporting heavy loads such as haul roads and the locations of the STP. Shallow soil mixing and other ground treatment techniques are anticipated to be required where loads are not so heavy, for example where used for offices and welfare facilities. These ground treatment works would take place as part of initial works.

2.7.118 The variations in the existing ground conditions at the tunnel portal construction sites present potential risks to the operation of the tunnel boring machinery and the construction of the bored tunnels.

2.7.119 It is envisaged that a number of ground treatment measures would be required as part of the tunnel works, designed to strengthen target areas of the ground or help to control groundwater flows. This would be an important aspect to ensure efficient tunnelling throughout the construction programme. It is anticipated that the Contractor would need to install grout blocks at critical locations in advance of the arrival of the tunnel boring machinery. The grout blocks would require different injection methods in Alluvium, Chalk and River

Terrace Deposits to allow for safe access to the cutting face. The locations and methods for ground treatment would be determined by ground investigation. Ground treatment is likely to involve the following techniques:

a. Compaction grouting: Low slump compaction grout is injected into granular soils forming grout bulbs that displace and densify the surrounding loose soils.

b. Compensation grouting: Used to control or reverse settlement of structures through the injection of material into the soil between foundations and the process causing settlement. The injected material is forced into fractures causing an expansion to take place.

c. Jet grouting: An erosion and replacement system that creates an engineered, in situ, soil/cement product for soft soil stabilisation, underpinning, excavation support and groundwater control.

d. Soil mixing: Typically used in soft soils, the soil mixing technique relies on the introduction of an engineered grout material to either create a soil-cement matrix for soil stabilisation or to form sub-surface structural elements to support earth or building loads. The depth of the mixing would vary depending on the ground conditions and the loads to be supported.

e. Fissure, or rock grouting: Primarily into the fissures within chalk to reduce permeability and, therefore, flows into the excavation. Particularly relevant for below the base-slab at the North Portal launch structure and cross-passage construction.

f. Permeation grouting: Uses low viscosity micro- and ultra-fine cement or gels to fill the interstitial voids within non-cohesive materials such as gravel, strengthening it.

g. Ground freezing: Temporarily reduces water flow and increases the strength of the soil so it can be safely excavated.

Ground protection tunnel

2.7.120 Where access is not available from the surface under the Thames Estuary and Marshes Ramsar site to facilitate the ground treatment, these works would involve construction of a ground protection tunnel. This would be approximately 825m long and have an outside diameter of approximately 5.8m. The top of the tunnel would sit at a depth of approximately 10m below ground level.

2.7.121 The ground protection tunnel would be used as an access to undertake permeation grouting within the tunnel alignment at key locations in advance of the tunnel boring machinery for the main bored tunnels.

2.7.122 The proposed ground protection tunnel would run along the main crossing alignment with a launch shaft (located to the south of Lower Higham Road) and a reception shaft constructed (located to the north of the Thames and Medway Canal and North Kent railway line, within the Milton compound).

2.7.123 Due to the proximity of overhead lines and pylons, the reception shaft would have to be sunk to the north of the Milton compound, which would conflict with an existing watercourse (main river). This watercourse would be diverted around the shaft location. The diversion would be less than 50m in length and would likely be permanent.

2.7.124 The reception shaft would be backfilled with material and the land above reinstated.

2.7.125 Tunnel boring machinery would be used to construct the ground protection tunnel. It is anticipated that this tunnel boring machinery would be 5.8m in diameter. Precast concrete segments would be delivered by HGVs and used to support the tunnel's shaft walls.

2.7.126 After the tunnel boring machinery is dismantled, removed from the shaft and taken from the site, grouting and settlement mitigation works would be undertaken from the ground protection tunnel until the main road tunnels have been successfully driven underneath this area.

2.7.127 On completion of the works, both the shafts and ground protection tunnel would be backfilled using the previously stockpiled spoil, with no temporary works left in the upper 2m of ground. The sites would then be returned to their original use.

2.7.128 The Contractors may also choose to undertake permeation grouting of the River Terrace Deposits in advance of the tunnel boring machinery to prevent settlement under the North Kent railway line. It has been assumed that this would be undertaken from underground, either within the ground protection tunnel or through the face of the tunnel boring machinery as it progresses.

2.7.129 The use of construction techniques (such as caisson) that avoid major dewatering would be employed during the excavation of the launch and reception shafts.

North Portal launch structure and approach ramp

2.7.130 The North Portal launch structure (sometimes referred to as 'box' or 'shaft') for the tunnel boring machinery would require a large, propped structure constructed within an excavation. The box structure would be open during tunnelling activities and then incorporated into the cut and cover tunnel.

2.7.131 Construction would involve diaphragm walling techniques. The process involves a trench sequentially dug using grabs or a rotating cutter wheel (hydrofraise) around the perimeter of the proposed excavation, depending on geology. These are mounted on large diesel-powered carrier machines not dissimilar to crawler cranes. Multiple attendant cranes would support the operation.

2.7.132 Cement (fissure) grouting of the chalk body below the base-slab is envisaged to reduce ingress to the excavation and the risk of leachate migration from the nearby East Tilbury Marsh hazardous landfill site to the east of the alignment. This may take place before or after diaphragm walling but must be complete before excavation works are undertaken.

2.7.133 The diaphragm walls would consist of individual trenches (or panels), approximately 3.5m by 1.5m, which are filled with a supporting bentonite slurry until each is excavated to full design depth. The slurry is then displaced by a

reinforcement cage and concrete. The displaced slurry is retained within the system and is reused. Reservation pipes may be installed inside the cage to assist pressure grouting at the base of the panel once the concrete has cured to minimise water flow into the excavation.

2.7.134 The depth and design of the diaphragm walls are subject to further hydrogeological assessment. This would determine the effective depth which minimises the effects of drawdown during the dewatering.

2.7.135 The support slurry is a solution of bentonite. This is a clay-type material which, when mixed with water, forms a thick thixotropic slurry capable of supporting the excavation sides.

2.7.136 The bentonite powder would be stored in silos, mixed and then stored in large tanks at the northern tunnel entrance compound. The slurry would be recirculated and reused as much as practicable but other tanks would be used to store waste bentonite prior to disposal offsite.

2.7.137 Adjacent panels would be constructed sequentially until a full diaphragm wall was made below the surface around the perimeter to form the structure. This wall would act as ground support and a cut-off barrier to groundwater.

2.7.138 Once the concrete panels have cured, excavation would begin using a combination of excavators within the structure, long reach excavators, cranes and skips at the surface. The supporting walls of the box structure would require temporary and permanent propping as the structure deepens. These may be steel props lifted into place or reinforced concrete cast within formwork.

2.7.139 Once full depth is reached, waterproofing and casting of the base slab would take place. The requirement for dewatering would be assessed to prevent buoyancy before the permanent concrete structure is built within the launch box and water ingress has stopped. While some of the internal structures concrete can be cast during the tunnelling with the tunnel boring machinery, most of this would take place after the bored tunnels are complete. Piles would be installed below the base slab of the structure where necessary to ensure appropriate ground support and/or permanent resistance to flotation (tension piles).

2.7.140 The approach ramp construction would be undertaken in parallel with the tunnel boring machinery assembly and tunnel construction. The ramp structure would be likely to include diaphragm or piled walls, with further piles to support the base slab. Multiple piling rigs would be used to maintain a reasonable rate of progress.

Tunnelling

2.7.141 Tunnelling work would begin from the North Portal launch structure. Construction of the twin-bored tunnel is likely to take approximately 20 months to complete using slurry tunnel boring machinery. This type of tunnel boring machinery has a ‘closed face’ to minimise groundwater impact and potential stability and settlement issues.

2.7.142 For slurry tunnel boring, the chamber containing the cutter head would be filled with pressurised slurry which applies pressure to the excavation face. The slurry acts as a ground support and transport medium for the excavated material, which is continuously circulated using pipes between the tunnel boring machinery and the surface.

2.7.143 At ground level the slurry arising from tunnel excavation is treated by filtration and pressing techniques to dewater the material. This is undertaken in the STPs. The arising drier material (such as Alluvium, gravels and reconstituted chalk) is placed as fill material locally within the designated stockpile area.

2.7.144 The tunnel boring machinery would excavate the tunnels, which would then be concurrently lined with precast concrete segments within the tunnel boring machinery itself. Before tunnelling starts, tunnel segments would be cast within the batching plant and then stockpiled ready for construction. This would begin while the launch shaft is being excavated and ground treatment work is carried out.

2.7.145 The tunnel boring machinery required for the construction of the Project is too large to be transported or lifted in one piece and must be delivered in component parts to site and assembled in the launch shaft. It is anticipated that the tunnel boring machinery component parts would arrive via nearby port facilities and, as the largest component may exceed 400 tonnes, would then be transported to the required launch location by multi-axle trailer. Substantial cranage would be necessary for the construction of the tunnel boring machinery, the trailing gantries which are towed behind the machines as they advance and the significant temporary equipment and seals necessary to launch them.

2.7.146 Our assessment is based on a scenario in which two TBMs are used to construct the tunnels working north to south. It has been assumed for assessment purposes that the first TBM would be launched towards the end of 2026 and would arrive at the South Portal during the second quarter of 2028. It has been assumed for assessment purposes that the second TBM would be launched in early 2027 and would arrive at the South Portal in mid-2028.

Slurry Treatment Plant (STP)

2.7.147 A STP is required to process the slurry generated by the tunnelling activities. Excavation arisings from the tunnel boring machinery are suspended in a water-based slurry (with bentonite additives) and pumped from the cutter head to the STP, which would be sited near to the tunnel portal, via steel pipes.

2.7.148 The purpose of the treatment plant is to separate the arisings from the slurry, to recondition the slurry with clean water and other additives such as bentonite, and then to pump it back to the advancing tunnel boring machinery.

Tunnel segment and culvert casting

2.7.149 It is envisaged that pre-casting facilities (segment factory) would be required onsite to produce tunnel segment lining and other elements such as culverts. It is likely that these facilities would be established early so that a stockpile of tunnel segments can be produced before tunnelling starts.

2.7.150 It is envisaged that independent facilities for concrete batching, including the creation of segments and culverts, would be required within the northern tunnel entrance compound. These batching facilities would be located on the hardstanding area which was formerly part of the Tilbury Power Station, within the plant storage area to the west of the North Portal and within the material storage area at Goshems Farm. A maximum height of 25m is assumed for each concrete batching factory and supporting facilities such as silos. The facilities

would be housed within a portal-framed enclosed structure providing acoustic screening to allow working on a 24-hour basis, in line with the tunnel boring machinery advancement.

Construction of cross-passages

2.7.151 Cross-passages would be constructed behind the tunnel boring machinery as it progresses. Our assessment is based on a scenario in which two TBMs are used to construct the tunnels with cross-passage construction starting approximately three months after a second TBM starts work in mid-2027.

2.7.152 The construction of the cross-passages would require several stages of construction including the following:

a. Ground treatment and dewatering

b. Temporary propping of excavated areas

c. Mining and support

d. Waterproofing

e. Secondary lining, involving the addition of a permanent layer of concrete to support the tunnel structure

f. Fit out (for example, installation of doors and lighting).

Tunnel fit out

2.7.153 Once the tunnel boring machinery has finished a section of the tunnel, the internal road deck would be installed sequentially, as large precast units within the tunnel. Due to their size and weight, it is anticipated that these units are likely to be produced onsite in the concrete batching facilities.

2.7.154 Some non-technical works, such as bracketry, may be installed as the tunnel progresses, but the bulk of mechanical and electrical plant and cabling, and communication equipment installation would take place once the use of the tunnel boring machinery is complete, and they are removed from the tunnel. This installation would also be on a 24-hour basis and would take place from both North and South Portals.

2.7.155 Ventilation, paint finishes, signage, lighting, cross-passage doors, pumps, transformers and communications equipment would all be installed concurrently with the civil structures for the TSB at both the North Portal and South Portal.

South Portal reception shaft

2.7.156 The southern tunnel entrance compound would be required to facilitate the bowl-shape excavation and headwall works that would take place prior to the reception of the tunnel boring machinery at the South Portal. These are significant earthworks and connect the start of the deep cutting between the tunnel and the A2/M2.

2.7.157 Arisings from this excavation would be stockpiled around the portal for later permanent landscaping as part of Chalk Park and the surplus removed for disposal. Initial works at the site would be completed under the standard working hours with extended hours and 24-hour working starting once

significant depth is reached for the large concrete pours at the headwall (and if supervision is required for the tunnel boring machinery arrival).

Drainage

Temporary drainage

2.7.158 Temporary drainage systems would be used during the construction and formation of worksites and haul roads. For temporary construction working areas, appropriate temporary drainage would be implemented by the Contractors during site setup. This typically includes surface runoff drainage (for example, construction of ditches and placement of drainage pipes).

Dewatering

2.7.159 During the construction of the launch structure, it is anticipated that dewatering would be required to keep the groundwater within the launch structure to a level below the excavation horizon. This would maintain base stability, reduce the risk of flooding, keep the discharge water relatively clean and make the operation easier and safer. Holes would be drilled to the required depth into which electric pumps would be installed and the water piped to surface for cleaning via the water treatment facilities prior to discharging.

2.7.160 Some treated waters may be used as grey water for onsite purposes such as wheel washing or dust suppression, if practicable. The groundwater level is measured in piezometers and maintained at the required level. This system would be installed prior to excavation.

Compound site runoff at the southern tunnel entrance compound

2.7.161 At the southern tunnel entrance compound, due to the size of the site, rainwater runoff cannot be managed by ditches and discharge pipes alone. Some rainwater would be harvested and used for site processes such as greywater flushing and dust suppression, but the remaining water would require discharge to a receiving water body. Rainwater falling into the proposed highway and South Portal excavation footprint and material stockpiles would need to be collected and pumped to ground level for treatment (suspended chalk solids removal) and discharge.

2.7.162 In order to effectively treat the water to meet discharge consent standards, a full collection and management regime would be implemented and be in operation on the site until full reinstatement of the compound area is complete.

2.7.163 A series of temporary, interconnected settlement ponds would be excavated between the A226 and Lower Higham Road to serve three purposes:

a. Provide a volume of storage for attenuation

b. Encourage gravitational settlement of solid fraction

c. Offer a degree of re-infiltration into the chalk ground

2.7.164 The clean water from the final settlement pond of the treatment system would be pumped under Lower Higham Road and into the ditch network, supplementing the Ramsar area water. The pipe under Lower Higham Road connecting to the ditch network would be installed via directional drilling, avoiding working within the designated Ramsar site. Any surplus water would

drain into ditch networks and finally into the River Thames. An access track would be incorporated into the system for pond cleaning and for the A226 Gravesend Road compound. The treated water from the final lagoon in the southern tunnel entrance compound would be pumped into the ditch network which forms part of the Thames Estuary and Marshes Ramsar site. The flow from the final settlement pond would be regulated to ensure the discharge flow rates into the ditch network are consistent with greenfield runoff rates.

Compound site runoff at the northern tunnel entrance compound

2.7.165 At the northern tunnel entrance compound, there would be similar issues as at the southern tunnel entrance compound regarding management of rainwater runoff. The approach described above would be followed for rainwater harvesting and the collection and treatment of water prior to discharge.

2.7.166 As at the southern tunnel entrance compound, a series of treatment settlement ponds and weirs would be constructed within the Order Limits. The water from the treatment process in the northern tunnel entrance compound would be pumped into a new outfall pipe and then subsequently pumped into the River Thames. The outfall structure is anticipated to be a simple pipeline installed to the edge of the intertidal zone, terminating in a diffuser head discharging below the lowest low water level (in the sub-tidal zone).

2.7.167 The installation of the pipeline and outfall is anticipated to require the use of a dumb-barge with stabilising legs or anchors on winches with a 30–50 tonne 360 excavator and multicat with 5 tonne lifting capacity to set the anchors. This would perform the excavation of a 2m wide pipeline trench, sheet piling along the trench (driven to or cut off at riverbed), installation of the pipeline in the trench and backfilling. The piling barge would be supplied by a feeder barge carrying sheet piles and a headwall/diffuser unit to be installed at the offshore end of the pipeline. The headwall/diffuser may require a minor cofferdam for installation and monopiles for support. Construction is estimated to take up to approximately 8 to 12 weeks, with all intertidal work carried out around periods of low water.

Earthworks at the tunnel entrances

2.7.168 A combination of excavators and cranes with grab attachments would move the excavated material from the North Portal area and ramp section. Temporarily, the spoil would be transported to Shed Marsh within the extents of the northern tunnel entrance compound.

2.7.169 The material excavated from the approaches, structures and tunnel construction would be used as part of the proposed landscape feature, Tilbury Fields, which would be situated on the existing Goshems Farm. The design of Tilbury Fields would utilise the excavated material generated from the construction of the tunnel and portal to create a multi-functional space located on the River Thames, next to the North Portal. The various materials excavated from the tunnel would be used to create the substrate for the creation of an open mosaic habitat at Tilbury Fields, for the benefit of invertebrates and other fauna.

2.7.170 Excess material not used at Tilbury Fields would be placed at Shed Marsh for temporary storage. The material would be transported from the STP to Shed

Marsh using a conveyor, and then distributed using excavators and loaders. This is shown on the indicative layout in Appendix 2.1: Construction Supporting Information (Application Document 6.3). Following appropriate treatment, material not reused onsite would be placed at Ashfields as part of the IVL land raising works, or removed offsite for suitable disposal. IVL operates the existing permits associated with the restoration project at Ashfields using inert spoil from other infrastructure projects located in London.

2.7.171 In the cutting that leads to the South Portal, multiple excavators, wheeled loaders and trucks would move material from the cutting to temporary stockpiles located within the southern tunnel entrance compound. This is shown on the indicative layout in Appendix 2.1: Construction Supporting Information (Application Document 6.3). Suitable surplus material would be reused as part of the creation of the Chalk Park open space.

2.7.172 Further information on the handling of excavated material is provided in the outline Materials Handling Plan (oMHP) (Application Document 6.3, Appendix 2.2, Annex B).

Walkers, cyclists and horse riders (WCH)

2.7.173 The construction of the Project would require permanent diversion or closure of WCH routes, include existing footpaths, shared use routes for pedestrians/ cyclists and existing bridleways.

2.7.174 Some footpaths, shared use routes for pedestrians/cyclists, and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network. The permanent changes to WCH routes are set out for each Project Section within Sections 2.3 and 2.4 of this chapter.

2.7.175 In addition, temporary works affecting WCH routes are also required to facilitate the activities associated with the construction phase. This would include the temporary severing or diversion of WCH routes, including PRoWs and minor roads utilised by WCH, during the construction phase as described in Chapter 13: Population and Human Health of this ES and the oTMPfC (Application Document 7.14). The proposals for temporary diversion of WCH during the construction of the Project are identified on Figure 2.5: Construction Information (Application Document 6.2) and shown in detail on the General Arrangement drawings (Application Document 2.5). The proposals for temporary severing/closure of WCH routes during the construction of the Project are indicated on Rights of Way and Access Plans (Application Document 2.7).

2.7.176 This section describes the construction of the permanent WCH works and the temporary WCH works associated with the construction of the Project, both north and south of the River Thames.

2.7.177 Where WCH routes are affected during the works, appropriate measures would be introduced by the Contractors to minimise disruption as far as practicable. Typical measures include the following:

a. Stopping up the route

b. Closing the route and diverting onto an alternative existing route

c. Closing the route and diverting onto a temporary route

d. Closing the route and diverting onto the new permanent route

e. Maintaining the existing route and using traffic management measures to allow users through

2.7.178 The measures implemented would be chosen having regard for the following factors, and in consultation with relevant stakeholders as necessary:

a. Number of users of the route (for example if a route has relatively low numbers, it may be stopped up)

b. Safety implications (for example it may not be possible to install suitable traffic management measures due to the nature of the work at a location)

c. The type of route (for example an alternative commuter leisure route with minimal additional journey time)

2.7.179 The construction techniques to provide temporary routes varies, ranging from minimal earthworks (using an excavator and roller) to a temporary pavement (importing pavement material and constructing in layers). The design of the temporary route would depend on the existing route design, number of users, duration of usage and existing ground/land constraints.

2.7.180 Typical construction methods for installation and upgrade of WCH routes have been assumed, as detailed further in this section. Requirements for temporary and permanent closure and diversion have been identified. Temporary diversion routes have been identified but would be subject to further development by the Contractors in liaison with relevant stakeholders. The assessments presented in this ES are based on a reasonable worst case.

WCH routes south of the River Thames

2.7.181 WCH routes located to the south of the River Thames that would be temporarily severed or otherwise affected by the construction of the Project are described in Chapter 13: Population and Human Health of this ES and the oTMPfC (Application Document 7.14). Existing routes are shown in Figure 2.3: Environmental Constraints Plan (Application Document 6.2) and the affected routes are shown on Figure 2.5: Construction Information (Application Document 6.2). Detailed information on proposals for WCH routes are shown in the Rights of Way and Access Plans (Application Document 2.7) and described in Part E of the Project Design Report (Application Document 7.4).

2.7.182 All PRoWs to the south of the River Thames that would be severed by the Project during construction would be reconnected, with the exception of NS367, which would be closed permanently as a result of the Project. All minor roads crossed by the Project would be reconnected.

WCH routes north of the River Thames

2.7.183 WCH routes located to the north of the River Thames which would be temporarily severed or otherwise affected by the construction of the Project are described in Chapter 13: Population and Human Health of this ES and the oTMPfC (Application Document 7.14). Existing routes are shown in Figure 2.3:

Environmental Constraints Plan (Application Document 6.2) and the affected routes are shown on Figure 2.5: Construction Information (Application Document 6.2). Detailed information on proposals for WCH routes are shown in the Rights of Way and Access Plans (Application Document 2.7) and described in Part E of the Project Design Report (Application Document 7.4).

2.7.184 Permanent effects on WCH routes north of the River Thames are described in Chapter 13: Population and Human Health of this ES and the oTMPfC (Application Document 7.14). The affected routes are shown on Figure 2.5: Construction Information (Application Document 6.2) and the General Arrangement drawings (Application Document 2.5), and further information on the permanent changes to these routes is provided in the Project Design Report (Application Document 7.4).

2.7.185 All WCH routes to the north of the River Thames that would be severed by the Project during construction would be reconnected, with the exception of Hornsby Lane, which would be closed permanently to both vehicular traffic and WCH use as a result of the Project. The northern section of Low Street Lane, where it connects to Muckingford Road, would also be permanently closed for WCH, preventing access to Muckingford Road.

Utilities works

2.7.186 The utilities works to divert or protect existing assets or provide connections for construction sites can be classified as either contestable or non-contestable, as defined in Section 2.4 of this chapter.

2.7.187 Utilities works are expected to start early in the construction programme and would coincide with initial works, including undertaking some of the contestable utility diversions and the required connections for the site compounds. Other utilities works would be undertaken during the main works construction activities.

2.7.188 The utilities works that are required would vary by utility asset, depending on how the assets are affected by Project construction. The appropriate treatment of the asset, whether it requires diversion or protection, has been determined with the relevant asset owner who has assessed the ability to operate and maintain their network during construction and operation of the new road. This has included a compliance check against industry standards, to minimise risk to their asset, their customers and to the Project workforce.

2.7.189 Trenches and chambers may need to be constructed so that utility assets such as cables and pipelines can be installed. This would be completed in close coordination with the respective utility providers to ensure that the works comply with their requirements. Disruption of existing services would be reduced by planning the construction works programme in liaison with the utility providers. This would enable the efficient diversion of utilities and reduce disruption to the many customers of these utility companies.

2.7.190 Utility diversion works can be classified as follows:

a. Offline diversions – These would be required where construction activities would otherwise impact on the asset or the adjacent road network, where the asset cannot be accommodated within the new proposed alignment or structure for safety or operational reasons.

b. Online diversions – These would be required where construction activities would otherwise impact environmental receptors, buildings, landowners or railways, or would impede the utility network owners ability to maintain supplies to their customers. The asset would be located within the highway alignment or structure for mitigation or operational reasons.

2.7.191 Construction methods typically associated with major infrastructure projects would be implemented for the utilities works, as detailed further in this section. Assumptions have been made on the methodologies used for construction, based on a reasonable worst case, and the assessments presented in this ES have reflected this. Construction methodologies and working areas have been developed reflecting the LOD set out in the draft DCO (Application Document 3.1) and the Works Plans (Application Document 2.6).

2.7.192 The diversion and protection of utilities would include the following construction activities:

a. Overhead powerline and telecommunication cable diversions including the construction of pylons and the associated foundations; stringing of powerlines; and demolition of removed pylons or removal of poles.

b. Open trench methods of installation for underground utilities, where excavations are opened to install the utility and then backfilled.

c. Trenchless methods of installing underground utilities, where pipes are pushed below ground to where they are required. This reduces surface disturbance.

d. Protection works, where underground utilities are protected from damage by the construction of slabs or piles.

2.7.193 Specific utilities works would require extended working hours to reduce risk and minimise disruption to the public, transport or utility networks. These works could include trenchless installation of cables and pipework and/or works within the boundaries of existing roads, railways and other constraints. These specific works are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3). The environmental assessments presented in the ES have considered the requirements for extended working hours. Where extended working hours are not known but there is a likelihood they would be required, these longer hours have been assumed in the assessments to reflect a reasonable worst case.

Typical utility diversions

2.7.194 The following is a brief description of the typical diversion works which would be required to support the Project.

2.7.195 For underground utilities, the type of utility does not affect the choice of installation method; for example, a communications cable and a water pipeline that are underground may have similar construction methodologies. The detail in laying (trench width, depth, backfill materials) would vary by utility and location, and the choice of open or trenchless methods may be selected due to other physical restrictions. For example, trenchless techniques would be required for SGN's gas pipeline diversion (Work number G1b) and National Grid

Feeders 5 and 18 (Work numbers G3 and G4), due to the requirement for tunnelling work beneath the Project; for UKPN's undergrounded 132kV network due to the crossing of the Tilbury Loop railway line (Work number OH3); and for Cadent's crossing of the A13 (Works number G6).

Overhead powerline diversions

2.7.196 Overhead powerline diversions of the 132kV, 275kV and 400kV networks are all non-contestable works. This section describes the typical method for the construction of pylons and overhead lines.

2.7.197 For the construction of a new lattice tower (pylon) a minimum working area of approximately 50m by 50m, with surrounding access area, would be required to provide sufficient space for the construction of the foundations and erection of the pylon structure. Pylons would be between 30m and 55m tall on average with large foundations.

2.7.198 The nature of the foundations would depend on the ground conditions at the pylon location and would be determined at the detailed design stage. These would take the form of either concrete pad foundations, or piled foundations as described for structures under the 'Highways works' heading within Section 2.7 of this chapter. Once the foundation is completed, the pylons would be erected with the help of a mobile crane. The lattice element components of the pylon would be delivered to site and assembled into larger sections that are then lifted into place to form the pylon structure.

2.7.199 Following completion of the pylon structure, the powerline would be installed by pulling/stringing the powerline from a tension (angle) pylon.

2.7.200 Where the stringing oversails sensitive areas such as railways or highways, then a netted scaffold protection would be installed across the affected area or an alternative catenary system would be used.

2.7.201 The final process required for the installation of a new powerline would be raising them to the design profile, clamping into the insulator sets and required fittings installed. A security fence of up to 2.4m height may be installed around the pylon if deemed necessary to prevent unauthorised access, followed by the reinstatement of the temporary work areas.

2.7.202 Removal of existing structures and lines would be carried out using the reverse process, and foundations would be removed as required to a depth of 1.2m below the finished surface level.

Open trench methods

2.7.203 Open trench utility laying is a method that may be used in the diversion of underground utility assets. This comprises opening the ground using an excavator with a suitably sized bucket, to a fixed depth. The depth of the trench would be dictated by the utility type, the location of the diversion, the existing ground conditions, intended land use above the asset and the required bedding depth. The trench width would be determined by the size and number of the asset to be buried, plus the required surround width.

2.7.204 The trench is excavated, with soft spots removed and bedding material laid to the required depth. The utility duct or pipe would then be placed and surrounded with the designed surround material. The trench would then be backfilled with the arisings from the trench.

2.7.205 Depending on the depth of excavation and the geotechnical assessment, trench support may be required to prevent collapse and provide safe working methods.

2.7.206 Where pipelines are installed, a pit of approximately 30m x 30m x 3m would be required for works to connect to an existing pipeline. Appropriate methods would be followed to limit the vent-off of gas during connection.

Trenchless technologies

2.7.207 Where assets cross beneath existing highways, railway lines, watercourses, environmentally sensitive areas, or the proposed Project route, it may be necessary to use trenchless techniques to minimise disturbance to the surface such as micro-tunnel or directional drilling.

2.7.208 The specifics of the construction method would depend on the technology used, but generally these subsurface construction techniques involve pushing or pulling a pipe from the launch area to the reception area.

2.7.209 The construction may be completed wholly at surface level, or the pipe may be pushed from a shaft constructed for this purpose.

2.7.210 A combination of geology, working space, crossing depth and current surface use would be part of the consideration when determining the appropriate methods.

Removal of temporary utilities installations

2.7.211 The installation of utilities would be required temporarily to supply construction compounds and the tunnel boring machinery. These would include power, water, foul water and communications connections.

2.7.212 Temporary diversions would also be required to maintain supply during the installation of the new infrastructure, such as Work number MUT19 which would connect networks during the construction of Rectory Road bridge or MUT30 which would do the same for the assets at Ockendon Road. Temporary diversion would be required for the construction of new pylons and overhead powerline networks, for example the diversion of the National Grid powerline at Tilbury to Linford (Work number OH4). Temporary utilities diversions are described in Section 2.6 of this chapter.

2.7.213 The removal of the temporary utility diversions, utilities supplies and associated infrastructure would take place as part of the completion of works or the demobilisation of site compounds. In general, the removal would follow the reverse of the installation process. An exception is the removal of the temporary towers associated with the National Grid overhead lines. The foundations would not be fully removed unless there are conflicts with other engineering proposals. Removal would typically be to 1.2m below ground level and the steel piles would remain *in situ*.

2.7.214 There are some situations where the need to remove utilities has not been confirmed, for example where the asset may be retained for future use by the landowner or other interested parties. This would require the development of proposals with relevant stakeholders, landowners and other developers. Where the need for removal has not been agreed, the environmental assessments have assumed removal as a reasonable worst case.

Treatment of redundant assets

2.7.215 Existing utility network assets would be made redundant by the Project through the realignment of the network via a diversion or through the extinguishment of the customer it is supplying. Those assets to be made redundant by the Project would be managed in one of three ways: removal, void filling, or cap and leave. The treatment of redundant assets would be determined at the detailed design stage in accordance with the detailed design and construction proposals and in accordance with the relevant protective provisions in Schedule 14 of the draft DCO. The management of redundant assets would adhere to all relevant guidance and policies regarding redundant assets.

2.7.216 To determine the treatment of the asset, several factors would be considered, including the environmental impact of removing the asset; the potential impact to the assets at the surface above and around the asset, including disruption to the road or railway networks; and the risk of harm to persons and the environment.

2.7.217 The removal of assets requires the demolition, breaking out or digging up of the redundant asset and is typically completed in areas where the existing asset directly interfaces with the highway alignment and its supporting structures or drainage proposals. This would typically be completed by cutting the asset approximately 5m from the point of interface each side or at the point of the diversion and then removing the asset. Redundant pylons, masts and poles, and the connecting overhead lines would be removed and the foundations broken out to 1.2m below the surface of the ground, unless a more extensive removal is required as part of the permanent utilities works.

2.7.218 Pipes and ducts that are to be made redundant but left *in situ* would typically be filled with cementitious grout to prevent the collapse of the asset. If an asset were to collapse, it could have a detrimental impact at the surface above it. As well as preventing collapse, filling the redundant asset would also prevent it from becoming a pathway for contaminants.

2.7.219 Small bore pipes and ducts and/or those made of plastic, where risk of collapse and contamination are minimal, would be capped at each end of the pipe and left *in situ*.

Substation installation

2.7.220 To provide power to the South Portal TSB and the tunnel, a new primary substation would be constructed. This would be located south of the A226 (Work number MU21) and would be connected to the existing Northfleet Grid Substation via the installation of an 8.63km cable network (Work numbers MU15, MU17 and MU19). This substation would be approximately 50m x 50m and would be landscaped to mitigate potential visual impacts.

2.7.221 Throughout the Project, 15 smaller substations of 3m x 3m x 3m would need to be installed to ensure network connectivity and customer supply. The construction material and appearance of these would be developed with UKPN, to incorporate them into the setting while ensuring compliance with UKPN's design standards.

Protection works

2.7.222 As part of initial works, a risk assessment would be undertaken to ascertain the likelihood of a failure of an asset. This would consider both the permanent and temporary indirect impacts to existing assets during and after construction.

2.7.223 The design and implementation of the protection methodology for all protection works would be undertaken as part of initial works and may involve the construction of slabs, rafts or piles to prevent damage/impact to the services.

Environmental mitigation and compensation

2.7.224 As set out in Sections 2.2 and 2.3 of this chapter, a number of measures have been embedded into the Project design to mitigate adverse impacts arising from the operation of the Project on the environment and surrounding communities.

2.7.225 This section summarises the construction activities required to deliver these measures across the Project. This section also discusses the good practice and essential mitigation measures set out within the REAC to control the impacts of construction on sensitive natural and human receptors. This is an introduction to, rather than a duplication of, the measures, and full details are provided in the REAC, within the CoCP (Application Document 6.3, Appendix 2.2).

2.7.226 The early stages of ecological mitigation including preparing habitats and the translocation of protected species, where not completed as preliminary works, would continue through the initial works and main construction works phases, while some landscaping and restoration would happen towards the end of the programme.

2.7.227 The environmental assessments reported in this ES have considered the potential environmental effects that could arise from the inclusion of these mitigation measures within the Project proposals.

Embedded mitigation

2.7.228 As part of the Project design, mitigation and compensation measures are proposed to reduce and offset adverse environmental effects of the operational Project. These embedded measures include the construction of green bridges, WCH improvements and flood compensation areas as described above and which are not duplicated here.

2.7.229 As set out within Section 2.4 of this chapter, the Project's embedded environmental mitigation and compensation measures also include the following:

a. Acoustic measures
b. Hedgerow creation
c. Ancient woodland compensation
d. Woodland, marsh and grassland planting
e. Protected species receptor sites and habitat creation and enhancement
f. Landscaping measures
g. Nitrogen deposition compensation areas
h. Replacement special category land

2.7.230 The location of proposed environmental mitigation and compensation features embedded within the Project design are shown within Figure 2.4: Environmental Masterplan (Application Document 6.2). Further details on these measures are provided in the Project Design Report (Application Document 7.4) and Design Principles (Application Document 7.5).

2.7.231 The following paragraphs summarise the construction activities associated with the provision of these embedded environmental mitigation and compensation measures. Mitigation measures associated with the underground elements of the tunnel are discussed within the tunnel information provided above in Section 2.4 of this chapter.

2.7.232 The oLEMP (Application Document 6.7) provides further information, including an outline of the proposed management of the landscape and ecological elements during and beyond the construction phase.

Acoustic measures

2.7.233 Acoustic barriers would be installed prior to road opening at the locations identified on ES Figure 12.6: Operational Road Traffic Noise Mitigation (Application Document 6.2). Acoustic barriers of the required specification would be installed as posts with a piled or concrete pad foundation, with panels installed between.

2.7.234 Low noise surfacing systems would be installed prior to road opening at the locations identified on Figure 12.6: Operational Road Traffic Noise Mitigation (Application Document 6.2). Further information on road surfacing works is provided in Section 2.7 of this chapter under the ‘Highways works’ heading.

Habitat creation, enhancement, and landscaping measures

2.7.235 Habitat affected by the construction of the Project would be compensated for through the creation of new and enhancement of existing habitats, at the locations shown on Figure 2.4: Environmental Masterplan (Application Document 6.2), using appropriate species mixes.

2.7.236 Areas of habitat creation, enhancement and landscaping would be provided in accordance with the planting and habitat typologies and management requirements identified in the oLEMP (Application Document 6.7), and would include activities not limited to the following:

a. Clearance of existing vegetation where required
b. Ancient woodland and acid grassland soil salvage
c. Groundworks limited to soil remediation (for example through deep ploughing)
d. Fencing and securing areas
e. Tree, hedgerow and shrub planting
f. Seeding and plug planting
g. Construction of ponds and ditches
h. Installation of protected species boxes
i. Management regimes to promote natural regeneration of habitats

2.7.237 These activities would be undertaken using standard agricultural equipment, such as tractors, trailers, ploughs; other standard construction machinery (including for example excavators, dumpers and other light machinery); and a range of hand tools appropriate to the specific task.

2.7.238 Planting, seeding and management would be undertaken as early in the construction programme as reasonably practicable having regard for the completion of other construction activities that might affect the planting area and seasonal requirements for planting.

2.7.239 New watercourses would be planted to ensure they have flora diversity to benefit a wider range of species than the existing watercourses affected by the Project.

2.7.240 The landscape planting would involve initial ground preparation works, including removal of vegetation where required, subsoil treatment and preparation of soils to the appropriate depth for the required planting.

2.7.241 On completion of planting, all disturbed accesses to, and the ground around, the planting would be reinstated to their former condition as far as reasonably practicable.

2.7.242 Where works form part of a protected species licence, issued by Natural England, all works would be undertaken in accordance with said protected species licences and associated good working practices and method statements.

2.7.243 New and enhanced habitat areas would be subject to the required establishment, maintenance and management regimes outlined in the oLEMP. The oLEMP is described further in Section 2.8 of this chapter.

Good practice and essential mitigation

2.7.244 The impact of construction on sensitive natural and human receptors would be controlled through the range of good practice and essential mitigation measures set out in the REAC, which forms part of the CoCP (Application Document 6.3, Appendix 2.2). These include but are not limited to the following Project commitments for mitigating impacts on sensitive ecological, noise, air quality, cultural heritage, landscape and visual receptors, the water environment and other human and environmental receptors throughout the construction of the Project.

2.7.245 A qualified and experienced Environmental Clerks of Works would be employed throughout the construction phase of the Project to supervise the implementation of environmental mitigation and protection commitments.

Ecological measures

2.7.246 The REAC contains numerous mitigation measures for implementation throughout construction of the Project, including but not limited to those below, to mitigate the impacts of the Project on ecological receptors including designated sites, protected species, notable species and habitats.

2.7.247 Where related to preliminary works activities, these controls would be in place on the date the DCO comes into force to provide appropriate environmental controls.

2.7.248 Ecological mitigation works during preliminary works would include preparing habitats and moving existing species into the new habitats and suitable retained habitats.

2.7.249 Other ecological mitigation measures, as set out in full within the REAC, include the following:

a. Compliance with all required Natural England licences and associated working practices and method statements

b. Avoiding impacts on breeding birds through timing of works or appropriate supervision

c. Relocation of protected and notable species, and important habitat features, from works areas

d. Creation of receptor sites for protected species prior to habitat clearance, including provision of appropriate replacement resting, roosting and hibernation structures

e. Identification and management of invasive species

f. Appropriate control of construction site lighting

g. Compliance with conditions identified by the Marine Management Organisation in the Deemed Marine Licence

h. Compliance with the commitments identified within the Habitats Regulations Assessment (Application Document 6.5), to avoid disturbance to the passage and overwintering birds associated with the European designated sites.

i. Erection of noise attenuation measures

j. Appropriate siting of equipment to minimise disturbance to habitats and species

k. Appropriate management of fields adjacent to the Thames Estuary and Marshes SPA and Ramsar site to enhance functionally linked land during construction

Acoustic measures

2.7.250 Acoustic measures to mitigate the potential impacts of the Project on noise sensitive receptors during the construction phase, as set out in full within the REAC, include the following:

a. Compliance with Best Practicable Means as defined under section 72 of the Control of Pollution Act 1974 and an approved Noise and Vibration Management Plan

b. Control of noise and vibration levels in accordance with BS 5228: Code of practice for noise and vibration control on construction and open sites (British Standards Institution, 2014)

c. Obtaining and compliance with consents from the relevant local authorities under section 61 of the Control of Pollution Act 1974 (which may include noise and vibration limits where relevant) for the proposed construction works

d. Appropriate layout of construction compounds and working areas to minimise effects of sensitive receptors

e. Appropriate siting of noisy plant and equipment away from sensitive receptors and/or screened using bunds formed from stockpiled material, or the use of acoustic fencing and structures as appropriate

f. Noise and vibration monitoring

Air quality measures

2.7.251 Air quality measures to mitigate the potential impacts of the Project during the construction phase, as set out in full within the REAC, include the following:

a. Implementation of good practice measures and controls throughout demolition and construction activities to manage dust generation and dispersal

b. Air quality monitoring in accordance with an approved air quality monitoring programme

Cultural heritage measures

2.7.252 Cultural heritage measures to mitigate the potential impacts of the Project on known and unknown heritage assets during the construction phase, as set out in full within the REAC, would include the following:

a. Additional site investigations in compliance with the mitigation strategy set out within the approved Archaeological Mitigation Strategy and Written Scheme of Investigation (Application Document 6.3, Appendix 6.9)

b. Recording of heritage assets before and possibly during construction

Landscape and visual measures

2.7.253 Landscape and visual measures to mitigate the potential impacts of the Project on sensitive receptors during the construction phase, as set out in full within the REAC, include the following:

a. Preparation of and implementation of an Arboricultural Method Statement and Tree Protection Plan in accordance with BS 5837:2012 (British Standards Institution, 2012), identifying measures for the protection of retained woodland, trees and hedges prior to the commencement of site clearance works

b. Sensitive positioning of works compounds, access tracks, haulage routes, material storage areas, generators and other construction activities

c. Installation of fencing, buffer zones and screening barriers to protect veteran trees, ancient woodland and important retained habitats throughout construction

d. Stockpiling of retained excavated soil as earth bunds to provide visual screening of compounds

e. Phasing of works to soften visual appearance

f. Reinstatement of land temporarily impacted to its former condition and composition upon completion, as far as reasonably practical

Drainage and water environment measures

2.7.254 Measures to mitigate the potential impacts of the Project on drainage and the water environment during the construction phase, as set out in full within the REAC, include the following:

a. Measures to safeguard surface and groundwater quality, including potable water supplies

b. Preparation of a construction phase flood risk assessment and management of water to reduce flood risk and ensure compliance with Environment Agency Flood Risk Activity Permit

c. Site drainage inspections

d. Appropriate management of compound wastewater

e. Protection of watercourses during utilities works

f. Compliance with Environment Agency agreed/licensed groundwater abstraction rates and specification of discharge licence

g. Implementation of appropriate bank protection where required and the protection of the River Thames flood defences

h. Implementation of a construction phase drainage plan for the management of surface water runoff

i. Incorporation of pollution control systems in accordance with the Control of Water Pollution from Construction Sites C532 (CIRIA, 2001), or as otherwise agreed with the Secretary of State

j. Compliance with the measures agreed in the Deemed Marine Licence

k. Groundwater monitoring in accordance with a monitoring regime agreed with the Environment Agency

l. Reinstatement of bankside vegetation at culvert entries and exits following the completion of construction works as soon as conditions are suitable for planting, including where appropriate root barriers and design specifications for fish passage

Geology and soils measures

2.7.255 Measures to safeguard underlying soils, groundwater and suitable excavated soils and materials for reuse, and to manage the risk of contamination arising from the Project during the construction phase, as set out in full within the REAC, include the following:

a. Preparation of a Materials Handling Plan

b. Pre-construction soil surveys

c. Procedures for the management of soil resources, appropriate soil storage and handling

d. Measures for reinstatement of soils affected by temporary works

e. Ground gas investigation and monitoring associated with the historic landfill sites around the North Portal location

f. Pre-condition surveys for all compound areas to determine the current land quality, followed by a repeat survey undertaken on completion of construction to confirm that the compound area has been restored in line with article 35 of the draft DCO (Application Document 3.1)

g. Management of geotechnical risks through further ground investigation and establishment of a programme of instrumentation and monitoring for implementation throughout construction

h. Implementation of pollution control measures across construction compounds and working areas to manage the risk of accidental spillages and pollution events/contamination

i. Treatment of groundwater before discharge in compliance with an Environment Agency discharge licence

j. Procedures for soils management (covering vegetation clearance, setting out haul routes, soil stripping, stockpile creation and management, soil reconditioning (where required) and soil reuse) to be set out prior to any soil stripping works commencing, covering all proposed end uses (for example agricultural land, woodland or other habitat types)

Material assets and waste measures

2.7.256 Measures to mitigate the potential impacts of the Project on material assets and waste during the construction phase, as set out in full within the REAC, include the following:

a. Use of materials with a measured recyclable or secondary content where feasible

b. Responsible sourcing and management of materials

c. Preparation of a material efficiency design report, identifying opportunities to increase materials efficiency and reduce waste production

d. Pre-demolition surveys to identify and quantify opportunities for reuse of materials

e. Appointment of a materials and waste manager responsible for ensuring the waste hierarchy is implemented and ensuring compliance with the requirements of the REAC and regulatory controls

f. Implementation of a Site Waste Management Plan

Communication and engagement

2.7.257 The CoCP (Application Document 6.3, Appendix 2.2) sets out the requirements for communications and engagement during construction. The Applicant would develop a Communications and Engagement Strategy (CES) that outlines the objectives and processes for engagement and communications with all stakeholders. The Contractors would each develop a Communications and Engagement Plan in support of the CES that would ensure that stakeholders are informed of the works activities, and to maintain communications with other parties such as local authorities, parish councillors and the local community.

Demobilisation and reinstatement

Demobilisation

2.7.258 Upon completion of construction, all compounds, ULHs and temporary working areas would be demobilised. All personnel, materials, construction equipment and temporary facilities, including utility supplies, would be removed, unless identified to remain in article 35 (Temporary use of land for carrying out the authorised development) of the draft DCO (Application Document 3.1).

2.7.259 The process of demobilisation would involve an element of demolition, for example breaking out of temporary concrete and hardstanding. Vehicles and relevant equipment would be involved in the clearance of these areas and reinstatement to the previous condition, or as agreed with the landowner in accordance with the article 35 (Temporary use of land for carrying out the authorised development) of the draft DCO (Application Document 3.1).

Site reinstatement

2.7.260 Areas of land temporarily required during construction would be reinstated to their previous condition, where practical, on completion of the construction works, in accordance with article 35 of the draft DCO and in line with the Requirements in Schedule 2, Part 1 of the draft DCO (Application Document 3.1).

Testing and commissioning

2.7.261 A programme of testing for the road and tunnel prior to, and following, opening would be undertaken, to ensure that the road and associated equipment function as intended. Commissioning refers to the completion of the testing phase, at which point the new road would be brought into public use.

Construction traffic

Construction traffic modelling

2.7.262 The construction phase of the Project would require new temporary traffic movements associated with the construction works, as well as changes to existing traffic flows through the introduction of temporary traffic management across the road network.

2.7.263 The construction traffic model provides an extensive quantitative assessment of the impact of construction works on the road network, using the same traffic baseline and forecasting work that has informed the operational modelling. The construction traffic that is represented in the Transport Assessment (Application Document 7.9) and within the assessments presented in this ES incorporates the following elements:

a. HGV movements associated with the construction of the Project

b. Vehicle movements associated with staff attending the construction sites

c. Temporary traffic management measures associated with:

   i. the construction of the new junctions with the A2, A13 and M25

   i. the construction of new structures over existing highways

   ii. the modification of existing roads

   iii. construction and use of access routes to the construction sites

   iv. utilities diversions and new utility connections required for the Project.

2.7.264 As acknowledged in the Transport Assessment (Application Document 7.9) and as is typical for major infrastructure projects, assumptions about the construction programme and traffic management arrangements have been made and represent a reasonable worst case for the purposes of the assessment. These details would inevitably be refined as Contractors are appointed and as the detailed design is developed. It is not anticipated that the refinements to the construction planning would lead to material changes in the environmental effects reported in the ES.

2.7.265 The construction programme for the Project is forecast to run from January 2025 to December 2030, with preliminary works taking place during 2024. Throughout this period, the construction activities and traffic management measures would vary. For the purposes of modelling the impacts of these measures on the transport system, and for the environmental assessment, the schedule has been divided into 11 phases. For each phase a representative set of traffic management measures were coded into the representation of the highway network in the construction traffic model.

2.7.266 For each of the 11 phases, the HGV movements associated with the construction of the Project and staff travel movements were added to the forecast number and pattern of vehicle movements in the construction traffic model. Further information on this construction phasing and the construction traffic impacts is provided in the Transport Assessment (Application Document 7.9).

Temporary traffic management during construction

2.7.267 Temporary traffic management would be implemented whilst construction and utilities works are taking place to manage the flow of traffic and effects on the surrounding network and local communities. The traffic management proposals aim to minimise disruption by maintaining road capacity as far as reasonably practicable whilst ensuring safety to road users and the construction workforce. Wherever reasonably practicable, traffic management for the Project would be shared by main works and utilities works so as to minimise disruption to the travelling public and local communities.

2.7.268 Proposed traffic management measures include the following:

a. Closure – full carriageway closure of road. In some cases this would only be nights and/or weekends, as traffic levels are generally lower and impacts on traffic would be reduced.

b. Contraflow – typically two-way traffic lights closing one half of the road.

c. Crossing point – where the haul routes bisect the local road network, thereby requiring a crossing point to maintain flow for construction vehicles and public traffic. This would typically require traffic lights.

d. Lane closure – single lane closure on given road.

e. Narrow lanes – maintaining the same number of lanes (unless coupled with another measure) but with narrower lanes. This measure would generally be implemented on the SRN network with associated reduced speed limits.

f. Switchover – where the alignment of the road is temporarily or permanently moved from one road alignment to another road alignment. The switchovers to temporary alignments are not envisaged to add more than a couple of minutes to the journey time. For example, this would be required where the road may need to be realigned to go around overbridge works, thereby increasing the length of the road by a few hundred metres.

g. Lane restrictions – traffic flow would be maintained and the road would not be closed, but some restriction may be in place such as speed restrictions and narrow lanes.

2.7.269 The oTMPfC (Application Document 7.14) provides further information on the approach to carrying out temporary traffic management for the safe construction of the new road. In this context, and in accordance with National Highways standard practice and the control plan described in the Introduction to the Application (Application Document 1.3), the draft DCO (Application Document 3.1) requires a Traffic Management Plan (TMP) to be submitted and approved by the Secretary of State before works commence.

2.7.270 The oTMPfC (Application Document 7.14) sets the principles which would be applied during the construction of the Project. The TMP would be drafted in accordance with the oTMPfC.

2.7.271 To facilitate construction of the Project, sections of the local road network (LRN) would need to be used for construction activities. While this would be minimised

as far as practicable, there would be a requirement to use the LRN for a number of reasons, including the following:

a. During initial works as part of set up of compounds and establishment of haul roads. Demobilisation and removal of compounds at the end of construction would similarly require the use of the local road network.

b. During road closures, for example to carry out tie-in works for a new overbridge.

c. As part of temporary traffic management, for example to carry out utilities works on one side of the road, as described earlier in this section of this chapter.

2.7.272 The oTMPfC (Application Document 7.14) provides further information on the proposed approach for managing the use of the road network during construction.

2.7.273 Following liaison with relevant local authorities and stakeholders, the oTMPfC proposes restrictions on the use of certain local roads by HGVs associated with construction of the Project. The relevant restrictions for each Construction Section are identified under the 'Compounds' heading in Section 2.6 of this chapter.

2.7.274 The provision of traffic management may require diversion routes to be provided as required. The exact diversion route would be subject to engagement with the relevant authorities during the development of the TMP.

Haul roads and construction traffic

2.7.275 The access to the site compounds (including the offline haul roads linking the construction compounds to the road network), temporary accesses and haul roads have been designed to allow and facilitate construction activities. Haul roads and site accesses are shown on Figure 2.5 (Application Document 6.2).

2.7.276 Access routes for construction compounds have been selected by following the key principle of reducing the use of the local road network by construction traffic. Haul roads would be created on land within the Order Limits to provide direct links between compounds and construction working areas. The SRN would be used as an alternative to local roads, wherever practicable, and there has been engagement with local landowners and businesses to establish access via private roads. All compounds would have at least one access point, with larger compounds having more. These access points would connect directly to the public road network or via a dedicated haul road. Where practicable, compounds would connect directly to the SRN, such as the M25 or A2, resulting in fewer HGVs using local roads. Access routes to each compound are discussed under the 'Compounds' heading within Section 2.6 of this chapter. The methodology for creation and removal of haul roads is provided in Section 2.7 of this chapter under the 'Construction compounds and ULHs' heading.

Construction logistics

2.7.277 A number of established practices and developing technology would be applied to plan and manage the logistics of construction the Project.

2.7.278 The overall objective would be to minimise the impact on the environment and road users and minimise risk to vulnerable road users. This would be addressed through the following:

a. Consolidation – the principles of consolidated deliveries would be implemented within the existing construction worksites, compounds and ULHs. Additional land for the construction of warehouses or additional storage has not been sought.

b. Temporary construction working areas and compounds – these have been located to support distinct works such as the tunnel portals or areas such as the northern tunnel entrance compound or the A2 compound. Compounds and ULHs are sized based on forecast labour demand (office and site), catering and welfare, and plant and material storage.

c. Delivery booking – a delivery booking system would be implemented during construction which would allow forecast and actual vehicle movements to be planned and monitored and peaks in demand identified and addressed in advance.

d. Multimodal transport – a combination of road, water and rail would be used to optimise the transport and delivery of material. The location of the construction sections and compounds provides access to ports, rail (in some locations), and the SRN. The outline Materials Handling Plan provides further information on the approach for transport and delivery of construction material.

e. Planning – Construction Logistics Plans would be produced by the Contractors to demonstrate how delivery of the works, materials and personnel movement have been planned and implemented. This is a requirement set out in the CoCP (Application Document 6.3, Appendix 2.2).

f. Vulnerable road users – appropriate measures in accordance with the following national standards would be implemented to identify the risks relevant to each area of works, how they would be managed and what incremental improvements can be made to working practices, both on and offsite:

    i. Construction Logistics Community Safety (CLOCS)

    ii. Freight Operator Recognition Scheme (FORS)

    iii. Considerate Constructors Scheme (CCS)

    iv. Driving for Better Business (DfBB)

Heavy Goods Vehicle (HGV) movements

2.7.279 The Contractors would be required under the oTMPfC (Application Document 7.14) to develop access routes taking into account the constraints and requirements in the DCO and in consultation with highway authorities.

2.7.280 Routes have been reviewed leading to and from the Project for suitability for HGV use. Provision has been made within the Order Limits for the completion of remedial or enabling works to allow the route to be used for the Project construction traffic. Any required works would be carried out following consultation with the relevant local highway authority and planning authority on matters related to its functions and in accordance with the oTMPfC and the CoCP.

2.7.281 The Project would require a number of abnormal load movements, with components for the tunnel boring machinery being the largest. It is anticipated that it would be delivered by the heavy lifting berth at the Port of Tilbury and moved to the North Portal construction worksite via the new access road to Tilbury2, accessing the northern tunnel entrance compound east of Tilbury2.

2.7.282 Overall, construction vehicle movements would be booked and monitored as detailed above, with coordination between respective Contractors to identify and, where practicable, address peaks in demand.

2.7.283 Proposed restrictions have been identified for use of local roads by HGVs associated with construction of the Project. The relevant restrictions for each Construction Section are identified under the 'Compounds' heading in Section 2.6 of this chapter.

Materials movements

2.7.284 The outline Materials Handling Plan (oMHP) (Application Document 6.3, Appendix 2.2, Annex B) sets out the out the approach and high-level principles for handling construction materials and waste associated with all construction activities on the Project.

2.7.285 Construction traffic modelling, and subsequent noise and air quality assessments which are presented in the ES, have been progressed on the assumption that the Project would utilise port facilities to transport at least 80% by weight of the bulk aggregates imported to the North Portal construction worksite. This is equivalent to 35% of the total bulk aggregates across the Project being transported via port facilities.

2.7.286 It has been assumed that other materials, including those transported to construction locations south of the River Thames and to the north of the North Portal construction worksites, would be carried by HGV using the road network. The predicted HGV trips within the construction traffic modelling included an uplift in the number of journeys to allow flexibility for the Contractors during the construction phase.

2.7.287 The delivery booking system would enable forward planning and coordination of delivery vehicle movements on the road network, including management of non-conformance to delivery slots and proactive resolution of peaks in demand.

2.7.288 The proposals for movement of materials excavated as part of construction are set out in the oMHP (Application Document 6.3, Appendix 2.2, Annex B). These have been reflected in the traffic modelling and assessment presented in the ES. It is anticipated that the Project would require onsite retention (within the Order Limits) of approximately 11,836,500m^3 of excavated materials. In addition to this, the volume of material requiring management offsite, is estimated to be approximately 663,500m^3. These quantities are indicative of a reasonable worst

case and have been used in the assessments presented in this ES, but it may be feasible for a greater volume to be reused onsite, requiring less offsite disposal.

2.7.289 Where practical, the material which would be reused onsite would be transported via internal haul roads using heavy duty vehicles. Where local roads would be crossed by haul roads, appropriate traffic management measures would be in place. Where local roads are closed as a result of construction works, these would also be used for the movement of excavated material within construction working areas. Within the northern tunnel entrance compound, conveyors would also be used to transport material within the construction site.

2.7.290 It has been assumed that, in some locations, transport of materials would be required using the road network. This is where movements are constrained, for example by a railway line or the SRN. The oMHP (Application Document 6.3, Appendix 2.2, Annex B) provides details of the anticipated quantities of materials and numbers of vehicle movements. Movement of materials via the road network using earthmoving construction vehicles is anticipated at the following locations:

a. A2 compound – material imported from offsite

b. Worksites near the Brentwood Road compound, the Stifford Clays Road compound East and the M25 compound to the northern tunnel entrance and Station Road compounds, where material would be moved between sites

2.7.291 Excavated hazardous material as well as surplus inert excavated material that cannot be reused onsite would be transported offsite to suitable receiver sites and waste facility sites. The transportation of this material would be via the road network using earthmoving construction vehicles. The oMHP (Application Document 6.3, Appendix 2.2, Annex B) provides details of the anticipated quantities of materials and numbers of vehicle movements.

River transport for construction

2.7.292 As identified above, it is anticipated that material supply vessels would be used to supply a proportion of the required bulk materials via the River Thames. The oMHP (Application Document 6.3, Appendix 2.2, Annex B) recognises the opportunity that the use of the River Thames for material transportation presents for reducing the impacts of vehicle movements. Subject to the exceptions listed in the oMHP, the Project would utilise port facilities for at least 80% by weight of bulk aggregates imported to the North Portal construction worksite. This commitment translates into 35% of the total bulk aggregates across the Project being transported via port facilities.

2.7.293 Estimates have been made for the number of material supply vessels likely to be required for each three-month period (quarter of a year) during construction. These range between two and 21 vessels per quarter, and come to a total of 238 vessels over the five-year construction phase. The highest predicted annual number of material supply vessels is 63 in 2026. These numbers

assume approximately 70% of vessels have a capacity of 8,000m^3 and 30% have 777m^3 capacity.

2.7.294 As a comparison, the Port of Tilbury handled an average of 3,260 vessels per year between 2014 and 2019. The predicted annual number of material supply vessels for the Project in its busiest year is less than 2% of the Port of Tilbury's annual average between 2014 and 2019. The total number of predicted material supply vessels for construction of the Project over five years is less than 1.5% of the Port of Tilbury's average over an equivalent time period.

2.7.295 Tilbury2 opened in 2020, enabling the Port of Tilbury to increase its capacity, with an expected doubling of the annual tonnage it handles from 16 million to 32 million tonnes over 15 years.

2.7.296 It is not anticipated that port facilities would be used for the export of surplus excavated material, or waste.

People movements

2.7.297 Provision has been made within the construction worksites and compounds for staff parking based on a reasonable worst case scenario.

2.7.298 The Framework Construction Travel Plan (FCTP) (Application Document 7.13) sets out a framework to reduce the impact of the Project's construction workforce on the road network as a result of travel to and from construction worksites and compounds. The FCTP sets out proposed measures, which include reducing single-occupancy vehicle trips and encouraging sustainable and active modes of travel.

2.7.299 The FCTP sets out guidance for developing Site Specific Travel Plans (SSTP), which would adhere to the following principles for promoting sustainable transport:

a. Walking and using sustainable forms of transport at sites shall be supported where travel can be completed in a lit highway environment, with footways for pedestrians.

b. Parking will be controlled at each compound to ensure demand does not exceed supply.

c. Shuttle buses would operate from existing transport hubs on both sides of the River Thames. These hubs are currently envisaged as Gravesend (Bus, HS1, National Rail), Grays (Bus, National Rail), Pitsea (Bus, National Rail) and Upminster (Bus, National Rail, London Underground, London Overground). Shuttle buses would provide routes to each compound, and inter-compound connectivity, and would be for the Project workforce only.

Use of the River Thames during construction

2.7.300 In addition to the use of the River Thames for import of materials discussed above, the Project vessels would also use the River Thames as part of construction activities. These vessels would comprise the following:

a. Temporary works site investigation vessels – these would be likely to comprise small inshore survey vessels or barges with spudcans (a stability

device) or an anchor spread for mooring. A safety boat may also be required. These would be present for the survey works associated with construction of the outfall pipeline into the River Thames from the North Portal.

b. Temporary works construction vessels – for the installation of the temporary drainage from the northern tunnel entrance compound. These works are described in Section 2.7 of this chapter under the 'Tunnels works' heading.

2.7.301 As identified in the preliminary Navigation Risk Assessment (pNRA) (Application Document 7.15), the Project vessels listed above would be limited in number (likely to be less than 10 in total) and would be operational for limited periods. Therefore, as explained in the pNRA (Application Document 7.15), the Project vessels would have no discernible cumulative impact on overall vessel numbers in the study area, which typically sees over 900 vessel transits per month in some sections of the authorised channel within the Order Limits, as well as some use of the navigable water on the north side of the channel within the Order Limits.

Construction compounds and ULHs

2.7.302 It is envisaged that 18 construction compounds and 15 ULHs would be required to construct the Project. The locations for these construction compounds and ULHs have been identified to reflect the construction requirements of the Project, with the aim to avoid environmental constraints where practicable and provide access for personnel and material deliveries in relation to the main working areas. The construction compound and ULHs locations are shown on Figure 2.5 (Application Document 6.2) and described in Section 2.6 of this chapter. Indicative compound layouts are provided in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

Definitions

2.7.303 The Project would use a range of construction compound types, depending on their location and use. Table 2.10 describes the different types of construction compounds and ULHs.

Table 2.10 Construction compound and ULHs definitions

Compound type	Primary use
Main compound	Main compounds would primarily be used for overall Project and area management and would include the following: • Materials and aggregates storage • Parking • Plant management • Project offices • Workshops • Refuelling • Security control • Concrete batching plant (box structures, tunnelling and viaducts) • Sleeping accommodation (at the northern tunnel entrance compound only) • Stockpiling and treatment (e.g. soil, spoil, slurry) • Welfare facilities • Vehicle and wheel wash These sites would generally be in place throughout the construction phase and would be used as the main hub for the respective section of works (i.e. Construction Sections A, B, C, D).
Satellite compound	Satellite compounds would primarily be used for delivery of the works and would include the following: • Local site office • Local welfare facilities • Refuelling • Security and access control • Vehicle and wheel wash • Storage area for plant and material • Workshops • Parking These sites are similar to main compounds but are smaller in area and generally not in operation for the full construction duration as they would facilitate specific works within the respective construction section. Once the specific works within the construction section are complete, the satellite compounds would be demobilised.
Welfare site	Welfare sites are localised facilities along the Project route and would include the following: • Site agent office • Welfare facilities These sites are smaller than satellite compounds and would be located where required for works activities. They would provide basic facilities (e.g. welfare cabin, toilets) and would be set up and demobilised as required.
Utilities Logistics Hub (ULH)	Facilities for the receipt, storage and distribution of plant, machinery and materials for specific utilities works. ULHs would also include:

Compound type	Primary use
	• Local site office • Local welfare facilities • Refuelling • Security hub • Vehicle and wheel wash • Parking

2.7.304 Table 2.11 provides a summary of the types and proposed total areas of construction compounds and ULHs, as presented in Section 2.6 of this chapter. Locations of compounds and ULHs listed in Table 2.11 are shown on Figure 2.5 (Application Document 6.2). Locations of welfare sites are not shown as these would be identified by the Contractors and have not been confirmed at this stage.

Table 2.11 Project compounds and ULHs

Compound	Project Construction Section	Compound type	Approximate total area of compound (ha)	Approximate compound durations (months)
Marling Cross compound	A	Satellite	0.3	31
A2 compound	A	Main	5.0	62
Southern tunnel entrance compound	B (south of the River Thames)	Main	163.0	63
A226 Gravesend Road compound	B (south of the River Thames)	Satellite	5.6	36
Milton compound	B (south of the River Thames)	Satellite	3.2	36
Northern tunnel entrance compound	B (north of the River Thames)	Main	155.0	63
Station Road compound	C	Satellite	4.5	36
Brentwood Road compound	C	Main	11.0	53
Stanford Road compound	C	Satellite	0.5	24
Long Lane compound A	C	Satellite	4.3	19
Long Lane compound B	C	Satellite	1.4	19
Stifford Clays Road compound West	C	Satellite	4.0	25
Stifford Clays Road compound East	C	Main	6.7	50

Compound	Project Construction Section	Compound type	Approximate total area of compound (ha)	Approximate compound durations (months)
Mardyke compound	D	Satellite	2.9	30
Medebridge compound	D	Satellite	4.2	59
M25 compound	D	Main	22.6	60
Ockendon Road compound	D	Satellite	3.3	39
Warley Street compound	D	Satellite	2.4	32
Park Pale Lane ULH	A	ULH	0.9	27
A2 East ULH	A	ULH	1.6	16
A2 West ULH	A	ULH	5.3	16
Shorne Ifield Road ULH	A/B	ULH	6.1	14
Low Street Lane ULH	C	ULH	1.4	14
Muckingford Road ULH	C	ULH	1.4	14
Brentwood Road ULH	C	ULH	1.3	14
Hornsby Lane ULH	C	ULH	1.4	33
Long Lane ULH	C	ULH	1.8	33
Stifford Clays Road ULH	C	ULH	1.3	33
Stanford Road ULH	C	ULH	1.5	27
Green Lane ULH	C	ULH	1.3	27
Medebridge ULH	D	ULH	1.4	33
Folkes Lane ULH	D	ULH	0.2	13
Beredens Lane ULH	D	ULH	1.3	13

Compound and ULH facilities

2.7.305 The construction compounds and ULHs would provide the typical core facilities identified in Table 2.10, with the type and number of facilities depending on the number of personnel using the compound or ULHs and associated nearby construction activities.

2.7.306 Construction compounds related to tunnel construction and viaduct launch sites (see description of construction techniques above) would receive and support specialist plant and equipment, and this would be sited within the compound or specific worksite as required.

2.7.307 Project offices, welfare facilities and workshops would be constructed from a mix of single and modular units. Styles and calculations for the number of potential units are based on anticipated 12m x 3m x 3m units, stacked to minimise surface area taken up at ground level. This includes sleeping accommodation at the northern tunnel entrance compound.

2.7.308 It is anticipated that these units would be stacked to an equivalent maximum height of approximately 15m, with potential for viewing areas at the top of some.

2.7.309 Indicative layout drawings have been prepared for the site compounds and ULHs and these are shown in Appendix 2.1: Construction Supporting Information (Application Document 6.3). It is anticipated that the heights of materials storage and operations within the compounds would be as follows:

a. Up to 6m high operations: earth and material and plant storage, general access and compound activity

b. Up to 15m high operations: segment factory, workers accommodation, earth and material storage (northern tunnel entrance compound only), site offices, welfare facilities, workshops, and stores

c. Up to 25m high operations: STP and concrete batching plants

Offices

2.7.310 Project offices would be required during the construction phase, for the overall management of the Project. These would vary in size from larger office facilities at the larger compounds for managing the complex works undertaken, to single office units within worksites for local management of drawings and records and other equipment.

2.7.311 Offices would provide the following typical resources:

a. Briefing and visualisation areas (typically open plan with use of IT and 3D technology)

b. Filing and storage

c. IT and network infrastructure

d. Meeting rooms

e. Office working area

f. Security

Welfare

2.7.312 Project welfare facilities would comprise changing rooms, lockers, canteen and cooking facilities, multi-faith rooms, toilets and showers.

2.7.313 Welfare facilities are typically established and then expanded or reduced according to the changing numbers of personnel onsite. Where shift patterns are being followed, for example at the tunnel sites, sufficient lockers and toilet facilities would be provided for both the incoming and outgoing shifts, to meet peaks in demand.

Sleeping accommodation

2.7.314 The nature of the tunnelling means that specialist personnel would be required during construction, so it is anticipated that sleeping accommodation would be required within the northern tunnel entrance compound.

2.7.315 The Project currently assumes sleeping accommodation would be provided for up to 400 construction personnel at the northern tunnel entrance compound. During the tunnelling works there would also be a need for hyperbaric accommodation at the northern tunnel entrance compound for an additional 80 people who would remain under pressurised conditions for extended periods to facilitate emergency access to the tunnel head. No sleeping accommodation would be provided within the other compounds or ULHs. The locations of these accommodation units within the northern tunnel entrance compound would be confirmed once the Contractors have been appointed.

Parking

2.7.316 Parking areas would be provided at all compounds for cars, minibuses, motorbikes and bicycles.

2.7.317 The FCTP (Application Document 7.13) has been produced to minimise adverse local disruption or traffic impacts on the highway network from worker and visitor travel to and from construction worksites and compounds, by reducing the number of single-occupancy vehicle trips and encouraging the uptake of sustainable and active modes of travel.

Hardstanding

2.7.318 Hardstanding would be required within all site compounds and ULHs to provide for management of plant and equipment, inspection of materials, assembly of components and assets, and general management of works.

2.7.319 It is assumed that hardstanding would be required for all areas designated as offices, plant and material storage, accommodation, welfare, workshops and security on the compound layouts. Hardstanding would typically not be required in areas designated for stockpiling.

Lighting

2.7.320 Construction compounds and worksites would be lit for safety, security and working requirements, with a lux (i.e. lighting) level appropriate to the task and in line with industry best practice. Further information on site lighting during construction is provided under the ‘Highways’ heading in Section 2.7 of this chapter.

Compound and ULH establishment

2.7.321 Site compounds and ULH, as proposed in Table 2.11, would be set up during initial works or the early stages of main works, to enable the rapid mobilisation of the main works activities.

2.7.322 Additional welfare compounds would be required for construction, and these would be constructed as and when required to ensure that suitable welfare and logistics provisions are established for the delivery of the works. Where required, all welfare compounds would be constructed within the Order Limits and within the constraints of the provisions of the draft DCO (Application Document 3.1).

2.7.323 Once a site compound or ULH is no longer needed, it would be decommissioned. This would require the removal of all welfare and office units and surfacing materials. Utilities would be taken back to a termination point

(normally to the local road interface) and capped unless they are going to be incorporated into permanent works. Once surfacing materials are removed and the required depth has been reached, the area would be graded as required under the handback condition agreement with the landowner. Where required, the site would be re-covered with topsoil and seeded.

Temporary site access and haul roads

2.7.324 The access to the site compounds, including the offline haul roads linking the compounds to the road network, temporary accesses and haul roads would be designed and constructed to allow and facilitate both initial and main works activities. Haul roads and site access are shown on Figure 2.5 (Application Document 6.2).

2.7.325 Site accesses and temporary haul roads would be created by stripping the topsoil and replacing with capping material to create hardstanding suitable for the required vehicles. (The exact specification would be determined at a later date once sufficient ground condition data is available.)

2.7.326 For very heavy delivery movements associated with tunnelling, haul roads would be of a heavier construction type using ground improvement measures and appropriate foundation techniques.

2.7.327 The assessments presented in this ES have assumed that once the temporary haul roads are no longer required, they would be decommissioned, with material either reused onsite or transported offsite. The routes would then be reinstated using the topsoil, and seeded as required. Where the landowner has obtained the appropriate permissions, the haul roads could remain permanently in place.

Temporary supply connections for compounds

2.7.328 As part of the works and to ensure the power requirements for the construction activities are met, temporary utility connections would be required for some compounds. The utilities works to provide temporary connections are described in Section 2.6 of this chapter.

2.7.329 The demands for utility provisions include water, wastewater, power and communications. It is envisaged that the temporary utilities would be provided at a designated location within the site compound, where practicable, and that the Contractors would carry out the distribution to the required workspaces as deemed necessary.

2.7.330 The approach to construction has assumed mains water provision from the relevant statutory undertaker. The REAC, within the CoCP (Application Document 6.3, Appendix 2.2) has included a commitment for water efficiency and leakage reduction measures as identified in ES Chapter 14: Road Drainage and the Water Environment.

Working hours

2.7.331 Working hours would depend on the construction activities undertaken and the location of the works. Standard working hours have been identified which would apply to most work activities, but there would be circumstances where the Contractors would need to undertake work under extended working hours. The standard working hours are defined as 07:00 to 19:00 weekdays and 07:00 to

16:00 on Saturdays, plus up to one hour before and/or after for mobilisation (start-up and close down) procedures.

2.7.332 The CoCP (Application Document 6.3, Appendix 2.2) defines the activities that would be undertaken during standard working hours. It also defines the circumstances where extended working may apply, which are summarised below:

a. Extended working hours may be required for repair and maintenance of plant and equipment.

b. Large concrete pours and diaphragm walling may take longer to complete than the standard working hours. In some circumstances would not be safe or reasonably practicable to pause these activities for completion the next day.

c. Some earthworks activities would extend beyond the standard working hours, to minimise risk of disruption from poor weather and adverse conditions. These extended hours would only apply in agreed locations.

d. Tunnel construction activities which would operate on a continuous basis, 24 hours a day, seven days a week.

e. Specific works within existing highway and railway boundaries during night-time, weekends and bank holidays would be required, for safety reasons or to minimise disruption to the operation of the network. These works could include installation of bridge decks or gantries, surface tie-ins, installation of signage and technology, implementation of traffic management and road resurfacing. These specific works are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

f. Specific utilities works would require extended working hours to reduce risk and minimise disruption to the public, transport or utility networks. These works could include trenchless installation of cables and pipework and/or works within the boundaries of existing roads, railways and other constraints. These specific works are identified in Appendix 2.1: Construction Supporting Information (Application Document 6.3).

g. Extended working hours may be required in response to an emergency or a short notice event.

h. Extended working may be required for working in the tidal river, where the working is dictated by tidal cycles

i. Abnormal loads or those that require a police escort may be delivered outside of standard working hours, subject to the appropriate requirements and approvals.

j. Security personnel and monitoring will be operational on a continuous basis, 24 hours a day, seven days a week.

k. Non-intrusive environmental and construction monitoring would be operational on a continuous basis, 24 hours a day, seven days a week.

l. Other requirements for extended working hours may arise and would be agreed with the local authority.

2.7.333 The environmental assessments presented in the ES have considered the requirements for extended working hours. Where extended working hours are not known but there is a likelihood they would be required, these longer hours have been assumed in the assessments to reflect a reasonable worst case.

Waste and materials

Waste

2.7.334 Waste would be generated during the construction phase from activities including the following:

a. Site clearance/utility connections/enabling works

b. Demolition (properties and structures)

c. Construction (including earthworks, compounds, haul roads, tunnel and highways)

d. Waste generated from these activities would include:

e. Excavated materials

f. Concrete

g. Steel

h. Plastic

i. Asphalt

j. Bentonite

k. Excess vegetation

2.7.335 The outline Site Waste Management Plan (oSWMP) (Application Document 6.3, Appendix 2.2, Annex A) sets out the proposals for management of waste in accordance with the principles of a circular economy and the waste hierarchy, which prioritises the following in order:

a. Prevention

b. Preparing for reuse

c. Recycling

d. Other reuse

e. Disposal

2.7.336 A number of factors, including the aim of reducing waste, have influenced the Project throughout the design development process, from early route options assessment through to refinement of the Project design. An iterative process has facilitated design updates and improvements, informed by environmental assessment and input from the Project engineering teams, stakeholders and public consultation.

2.7.337 Waste prevention has been achieved in a variety of ways, including the following:

a. Moving towards a balance of cut and fill to reduce the offsite management of excavated materials

b. Altering the tunnel alignment and portal locations to reduce excavation volumes

c. Reviewing the extent of the Order Limits to reduce the need to demolish buildings and structures

d. Reusing demolition materials as recycled aggregate within the temporary and permanent works design

e. Retaining vegetation from site clearance for use in ecological mitigation works

f. Developing an efficient design which has a reduced the demand for material assets and as a result would generate less waste

g. Retention and reuse of all topsoil within the Order Limits subject to relevant testing/quality checks

2.7.338 There are many types of waste that could be generated through the construction of the Project. Where practical, waste would be reused onsite, for example excavated material used as earthworks fill material, and concrete from demolition used as secondary aggregate. Waste that cannot be reused would be recycled offsite or disposed of to an appropriate facility.

2.7.339 Diversion from disposal and into reuse, recycling and/or recovery is required to reduce the impact on finite landfill capacity and divert potential waste into resource streams and thus deliver a circular economy. Mitigation measures and targets have been identified in the REAC within the CoCP (Application Document 6.3, Appendix 2.2) to drive the diversion of waste from disposal.

2.7.340 The Contractors would produce a Site Waste Management Plan or equivalent for the construction phase. This would set out procedures for the characterisation, management and monitoring of wastes arisings. A Materials and Waste Manager would be appointed to ensure that the waste hierarchy and opportunities to reduce waste generation or improve recovery/recycling rates are implemented.

2.7.341 The movement of waste generated during construction is discussed in Section 2.7 of this chapter under the 'Construction traffic' heading. The oMHP (Application Document 6.3, Appendix 2.2, Annex B) sets out the approach and high-level principles for handling construction materials and waste for the Project.

Materials

2.7.342 Materials would be required in significant quantities for construction of the Project including metals, aggregate, pavement, concrete and soils, among others. Most of these material resources would originate offsite, purchased as construction products. Others would arise onsite such as excavated soils/minerals (including sand and gravel) or recycled road planings.

2.7.343 The design and proposed construction methodology for the Project have been influenced by the application of the circular economy principles and the waste hierarchy to manage and mitigate likely significant effects.

2.7.344 A circular economy is defined by the Waste and Resources Action Programme (WRAP) as '*an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life*' (WRAP, 2020).

2.7.345 The sources for materials are unknown at this stage. However, mitigation is presented in the REAC within the CoCP (Application Document 6.3, Appendix 2.2) to manage material use during the construction phase. These measures include the following:

a. Minimising use of primary materials

b. Responsible sourcing

c. Design for materials optimisation

d. Design for materials optimisation

e. Demolition audits

2.7.346 The movement of materials for use during construction is discussed in Section 2.7 of this chapter under the 'Construction traffic' heading. The oMHP (Application Document 6.3, Appendix 2.2, Annex B) sets out the approach and high-level principles for handling construction materials and waste for the Project.

Excavated material

2.7.347 The proposals for movement of materials excavated as part of construction are set out in the oMHP (Application Document 6.3, Appendix 2.2, Annex B). Excavated material would be reused as part of the construction of the Project, where suitable. It is anticipated that there would be material that would be considered to be unsuitable for reuse, or is surplus to requirements, and so would require management at a receiver site. A proportion of the unsuitable material would be managed within the Ashfields site operated by IVL, which is within the Order Limit boundary. The remainder would be transported for offsite

management. The anticipated quantities of materials that would be reused, or managed within a receiver site are set out below:

a. 11,176,500m^3 of excavated material retained within the Order Limits and reused as part of construction of the Project

b. 660,000m^3 of excavated material retained within the Order Limits, for management within the Ashfields site

c. 663,500m^3 of excavated material transported for offsite management

Workforce accommodation

2.7.348 The construction of the Project would create jobs for construction workers, many of whom would commute from home. The Project would provide temporary sleeping accommodation at the northern tunnel entrance compound (as described under the earlier 'Compound and ULH facilities' heading in this section of the chapter). It is acknowledged that the Project would stimulate demand for construction workers who may require sleeping accommodation in the local area, such as private rented properties, visitor accommodation such as hotels, and owner-occupied homes. The impacts of the Project on the local accommodation market have been assessed and are presented in the Worker Accommodation Report (Application Document 7.18).

2.7.349 The Applicant would employ measures to reduce the impact on local accommodation and associated services such as healthcare. The Applicant and its Contractors would implement Site Specific Travel Plans to encourage sustainable travel from home. The Applicant would also help workers to find accommodation and would implement an accommodation helpdesk to align need with supply, therefore benefiting local accommodation providers and the local economy.

2.8 Operations, maintenance and management

Operation of the A122

2.8.1 Once the A122 opens to traffic, it would form part of the SRN that includes the Dartford Crossing. The road would operate as an All Purpose Trunk Road (APTR) with an 'A road' classification and would be subject to Variable Mandatory Speed Limits (VMSL) with a default speed limit of 70mph. The forecast traffic flows on the A122 and on adjacent roads are discussed in the Transport Assessment (Application Document 7.9) with a high level description provided in Section 2.4 of this chapter. The A122 would be managed on a day-to-day basis by National Highways in accordance with its standards and procedures at that time.

Handover

2.8.2 Following the completion of construction, and testing and commissioning activities, responsibilities for the roads and associated assets and utilities would be handed over to the relevant parties for the operational phase. The relevant parties would be as follows:

a. A122 road and tunnel – National Highways

b. Local roads – local highways authorities

c. Utilities – statutory utilities companies

d. Land and property

i. Permanently acquired land – National Highways

ii. Temporarily acquired land and land with permanent rights of access – landowner.

2.8.3 Relevant handover documents would be prepared by the Contractors, providing the information needed by the relevant parties and setting out the maintenance and operation requirements. These documents would include the control plan documents relevant for the operational phase.

Post construction/operational management

2.8.4 As fully explained in the Introduction to the Application (Application Document 1.3), potential adverse effects arising after the completion of the construction phase of the Project would be managed by a series of control documents, included in the Project control plan. Table 2.12 identifies the control documents that are relevant at the operational phase of the Project.

Table 2.12 Operational phase control documents

Application documents that control operational impacts
• Environmental Management Plan • Outline Landscape and Ecology Management Plan (oLEMP) • Wider Network Impacts Management and Monitoring Plan (WNIMMP) • Carbon and Energy Management Plan • Preliminary Navigational Risk Assessment • Stakeholder Actions and Commitments Register

2.8.5 These documents contain measures to be implemented following construction, and afterwards during the operation of the road, to ensure that the different phases of the Project are appropriately managed to reduce the adverse effects of the Project. Compliance with these documents is secured via various Requirements in Schedule 2 of the draft DCO (Application Document 3.1).

2.8.6 The control documents which are relevant to the management of the environmental effects of the Project following construction are described below.

2.8.7 Elements of the Preliminary Navigational Risk Assessment (pNRA) (Application Document 7.15) and the Stakeholder Actions and Commitments Register (Application Document 7.21) that apply to the operational phase of the Project would also be implemented to provide additional control post construction.

Third iteration of the Environmental Management Plan

2.8.8 Following construction, a third iteration of each EMP (EMP3) would be prepared by the construction Contractors for handover and implementation during the operational phase of the Project. This would set out the approach to

environmental management once the new road is open and being managed by National Highways. Each EMP3 would outline existing and future environmental commitments and objectives that need to be honoured, and actions and risks to be managed. It would reflect the relevant content of the CoCP and REAC and the EMP2. It would include information covering the operational phase of the new road and other details in a form that can be used for the long-term operational management of the Project.

Landscape and Ecology Management Plan (LEMP)

2.8.9 The LEMP would be created by the Contractor for implementation during the establishment of landscape and ecology measures and following the establishment period. The final LEMP would need to be substantially in accordance with the oLEMP (Application Document 6.7).

2.8.10 The oLEMP outlines the proposed management of the landscape and ecological elements of the Project. National Highways' standards establish the general maintenance and inspection requirements for motorways and all-purpose trunk roads. The oLEMP focuses on the management requirements for the land parcels that perform specific landscape and ecological mitigation functions for the Project. It details the management regimes, management expectations and monitoring requirements for each of those land parcels and the typologies contained within. It should be read in conjunction with Figure 2.4: Environmental Masterplan (Application Document 6.2).

2.8.11 The oLEMP does not include routine vegetation management activities required for safety, such as maintaining visibility splays; or routine maintenance tasks such as rubbish removal, repairing fences, or reinstatement of habitat following incidents or incursions to the verge.

2.8.12 The oLEMP is based on the preliminary design to date. The LEMP would be submitted for approval by the Secretary of State in consultation with relevant stakeholders, including but not limited to:

a. Natural England

b. Relevant local planning authorities

2.8.13 The oLEMP also identifies the need to establish an advisory group to inform decision making during the implementation of the LEMP.

2.8.14 The LEMP would include the habitat management requirements, targets and prescriptions set out in the oLEMP, and must reflect the Design Principles document (Application Document 7.5) and the mitigation measures set out in the REAC (Application Document 6.3, Appendix 2.2). It would be based on Figure 2.4: Environmental Masterplan (Application Document 6.2).

Wider Network Impacts Management and Monitoring Plan (WNIMMP)

2.8.15 The WNIMMP (Application Document 7.12) has been produced to demonstrate sufficient management of the impacts of the Project on the road network. The WNIMMP sets out a traffic impact monitoring scheme to be carried out at least a year prior to opening (to establish a baseline) and for it to feed into Post Opening Project Evaluation (POPE) reports at one and five years after the road opens.

2.8.16 While the Project is expected to provide wide-reaching benefits to the road network, it is recognised that there will be adverse traffic impacts at some junctions and links within the wider road network. These impacts are identified in the Transport Assessment (Application Document 7.9).

Carbon and Energy Management Plan (Third Iteration)

2.8.17 A Third Iteration of the Carbon and Energy Management Plan would be developed and completed by the end of the construction, commissioning and handover stage, in accordance with the process set out in the First Iteration of that plan (Application Document 7.19).

2.8.18 The Third Iteration of the Carbon and Energy Management Plan would address the matters set out in the Second Iteration that are relevant to the operation and maintenance of the Project and must contain the long-term commitments to manage and minimise carbon emissions during the operation and maintenance of the Project.

Road user charging

2.8.19 In line with the NPSNN paragraph 3.25, which states that river and estuarial crossings will normally be funded by tolls or road user charges, the Project would include road user charges for vehicles using the tunnel. The road user charges would not apply to the link roads. The road user charges would be operated as a 'free-flow' scheme, meaning that vehicles would not be required to stop at barriers to pay, but would be detected using automatic number plate recognition technology. Charges would be collected remotely, similar to the current Dart Charge arrangements at the Dartford Crossing.

2.8.20 More information on road user charging is available within the Road User Charging Statement (Application Document 7.6).

2.8.21 The charges that have been used for the purpose of assessing the likely traffic and environmental impacts of the Project are as described in Sections 6.1 and 6.2 of the Transport Forecasting Package, which is Appendix C of the Combined Modelling and Appraisal Report (Application Document 7.7).

Operating states

2.8.22 The Project would operate under three distinct operating states:

a. Routine operation

b. Emergency/incident operation

c. Planned maintenance operation

2.8.23 Associated operational plans for each of these operating states would be developed between the Applicant and stakeholders prior to road opening. The stakeholders working with the Applicant on the operational plans would include but not be limited to the following: National Highways Traffic Officers, local authorities, emergency services, local highway authorities, and area service providers and maintainers.

2.8.24 The escalation from routine operation to emergency/incident operation would be activated following existing SRN protocols.

Routine operation

2.8.25 Routine operation is the default state that the Project road would be in, for the majority of time during peak and off-peak periods. The Project road and the VMSL would be managed by the Regional Operations Centre which would include the Tunnel Control Centre.

Emergency/incident operation

2.8.26 Emergency/incident operation would be activated when any occurrence or situation occurs that has the potential to disrupt the effective operation of the Project road or threatens serious damage to human welfare or the environment. This is a wide-ranging definition which covers everything from minor to very significant issues. Specific emergency and incident response plans would be in place to manage and respond to issues on the Project road, including, but not limited to, the following:

a. Vehicle breakdowns

b. Tunnel minor incidents

c. Tunnel fires – based on magnitude of fire

d. Tunnel evacuation

e. Road traffic collisions

f. Incidents such as trespass

g. Police operations

h. Adverse weather conditions

i. Significant traffic congestion impacting the safe operation of the tunnel

j. Use of the Project road for wider network resilience purposes

k. Unplanned maintenance – emergency repairs

Planned maintenance operation

2.8.27 Planned maintenance operation would be activated where maintenance and roadworks need to be carried out. This may include, but would not be limited to, the following:

a. Single-lane closure

b. Multiple-lane closure

c. Tunnel closure

2.8.28 To safely carry out periodic planned inspection and maintenance activities, or for renewals, a partial or full closure of part of the Project road would be required during off-peak times. This would be coordinated with the rest of the surrounding road network to reduce traffic impacts.

Maintenance

2.8.29 Maintenance and renewals would be undertaken as required to maintain the appropriate standards for the SRN over the life of the asset. Maintenance activities would be as authorised under the DCO.

2.8.30 Typical activities for maintenance of the road would include gully cleaning, severe weather maintenance (including de-icing surface treatments), landscape management, asset inspections, reactive road maintenance following road accidents, asset renewals, and major maintenance and associated traffic management.

2.8.31 The tunnel would require additional maintenance activities including inspections of the tunnel linings, periodic washing of tunnel linings and regular inspections of the mechanical and electrical equipment.

2.8.32 Elements of the Project road and tunnel would need to be renewed as appropriate or once they reach the end of their design life, such as bridge bearings and the fans in the tunnel.

2.8.33 Additional maintenance activities would be required at short notice in response to emergency situations, such as to repair damage to the Project road or structures after a traffic incident.

2.8.34 The draft DCO (Application Document 3.1) includes easements for maintenance access, and these are detailed in the Statement of Reasons (Application Document 4.1).

2.8.35 Utility assets that were diverted as part of the Project works would have appropriate access to allow them to be maintained by the appropriate owners. Where practicable, this access would be via the local road network.

Decommissioning

2.8.36 It is highly unlikely that the Project would be decommissioned before the end of its 120-year design life, as the Project road would have become an integral part of the SRN. However, if the Project needed to be decommissioned, this would conform to the statutory process at that time, and an EIA or similar assessment would be undertaken in line with regulatory requirements at that future point in time.

2.8.37 During the construction of the Project, buildings and structures may need to be demolished or removed; these items have been considered as part of the EIA in the relevant topic chapter assessments.

2.9 Benefits and outcomes

2.9.1 In addition to the delivering the objectives of the Project, there would also be numerous additional benefits delivered which currently sit outside of the DCO application and control documents. The Benefits and Outcomes Document (Application Document 7.20) outlines the key benefits and the mechanisms by which these benefits will be secured. This includes commitments that the Applicant is able to make within the scope of the Project and legacy proposals that are under development at the time of submission and which are intended to be implemented during its operation.

2.9.2 The legacy projects currently in development along the Project route would be funded through the National Highways Designated Funds programme and maximise the positive outcomes of the Project for local communities and the environment. The legacy projects fall under the following themes:

a. Environment

b. Heritage

c. Active travel

d. Skills and employment

e. Investing in communities

Hole Farm

2.9.3 One of the environmental legacy projects currently in development is Hole Farm. The legacy project proposals overlap with the Project proposals in this location. National Highways owns the agricultural land north of the M25 junction 29 known as Hole Farm. National Highways is proposing to create a community woodland through conversion of the farm into a woodland dominated mosaic of wildlife-rich habitats.

2.9.4 National Highways is developing the proposals for Hole Farm in partnership with Forestry England and the wider Thames Chase Community Forest partners. The site would be managed by Forestry England on behalf of National Highways.

2.9.5 The land at Hole Farm would be used for a number of purposes, both as part of mitigation and compensation for the Project and as a legacy project for the benefit of the local community. The proposals at Hole Farm include the following:

a. Approximately 2.9ha of Hole Farm is proposed as replacement special category land to compensate for the effects of the Project at Folkes Lane Woodland. Further information on special category land is available in Sections 2.3 and 2.4 of this chapter and Appendix D of the Planning Statement (Application Document 7.2).

b. Approximately 75.2ha of the site has been identified to provide habitat creation as compensation for the potential impacts of nitrogen deposition on designated ecological sites caused by changes to traffic resulting from the Project. Further information on nitrogen deposition compensation is provided in Section 2.4 of this chapter.

c. Approximately 26ha of woodland planting is proposed at Hole Farm to compensate for the effects of the Project on ancient woodland. Further information on compensation is presented in Sections 2.3 and 2.4 of this chapter.

d. Ancillary hard infrastructure associated with a community woodland, such as a tree nursery, visitors' centre, new vehicular access, car parking and routes through the site for use by walkers, cyclists and horse riders. These works are excluded from the DCO application.

2.9.6 The creation of the community woodland at Hole Farm would be through a combination of natural regeneration and planting. It is proposed that some of the woodland planting element of the proposals would take place from winter 2022/2023 as advanced delivery of the mitigation and compensation for the Project. The creation of new woodland would be undertaken in accordance with the Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999, where relevant. It has been agreed with Brentwood Borough Council that the planting would not require planning permission. The long-term management of the woodland would be secured through the DCO process via the oLEMP (Application Document 6.7). The environmental assessments presented in this ES have assumed that the mitigation and compensation planting areas are in place and have begun to establish prior to the start of construction.

2.9.7 It is proposed that the visitor facilities, which do not form part of the proposed mitigation and compensatory planting, would be consented separately from the DCO application, via an application submitted under the Town and Country Planning Act 1990, to be submitted by Forestry England, in partnership with National Highways, in late 2022. This application has been included in the inter-project cumulative effects assessment presented in Chapter 16 of this ES. Although the application was not submitted by the cut-off date used in the assessment, this has been included as National Highways is the Applicant and information on the proposals is available for inclusion in the assessment.

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