

Lower Thames Crossing
7.4 Project Design Report
Part C: Design Rationale

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Project Design Report Part C: Design Rationale

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1. Project Design Report – introduction

1.1. Document structure

1.1.1. This Project Design Report (PDR) covers the Project vision, design rationale and approach to good design considered across the Project.



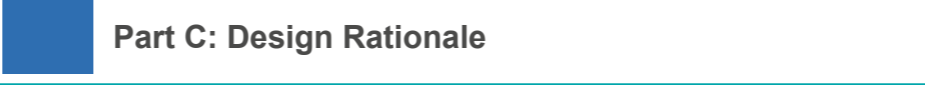







1.1.2. It broadly covers the following areas:

- a. The design rationale - the Project vision, relevance of Project Design Principles and the influence of the Road to Good Design
- b. The general approach to design and the main over-arching strategies

1.2. Navigation

1.2.1. This document, Project Design Report Part C: Design Rationale, is one of 10 parts that cover the preliminary design aspects of the Project.

1.2.2. Each part has been assigned a colour, as outlined below, to assist with navigation between documents and for further information on other preliminary design aspects of the Project.

-  Part A: Introduction and Project Background
-  Part B: Policy Context and Project Design Process
-  **Part C: Design Rationale**
-  Part D: General Design South of the River
-  Part D: General Design North of the River - Tilbury to the A13 Junction
-  Part D: General Design North of the River - North of the A13 Junction to the M25
-  Part E: Design for Walkers, Cyclists and Horse Riders
-  Part F: Structures and Architecture
-  Part G: Design Evolution
-  Part H: References and Glossary

2. Design rationale

2.1. Vision

2.1.1. The Project represents a once in a generation investment in England's strategic road network (SRN). It will act as an economic catalyst for the outer areas of London, and beyond, as well as transforming Kent, Thurrock and Essex through targeted investment, providing transport and economic resilience, social growth and landscape regeneration.

2.1.2. Its scale means that the Project will be experienced by large numbers of people in many different ways, including people travelling along the route, those living in the towns and villages close to it, those who make recreational use of the landscape through which it passes and those who will be employed in its construction or operation. With these people in mind, the following overarching Project values have been placed at the core of the design vision.

2.1.3. The design of the Project has been developed to:

- **Be landscape led:** With the exception of the tunnels, the majority of the Project is in green belt, as well as landscapes of exceptional value and variety. Therefore, it has been developed to be as green and sympathetic (forming a positive response) to its context as practicable within the constraints. The design of all architectural elements, such as overbridges, portals and operational buildings, has reflected the nature of their character area, while being recognisable as part of the wider Project as far as reasonably practicable.
- **Support the recovery of nature:** By addressing habitat fragmentation and taking a landscape-scale approach to mitigation and compensation, the Project will strive to improve severance between habitats providing a more resilient network around the Project route. The Project will improve access to natural and semi-natural open spaces (as well as providing some new ones) for people living near the works and, working in partnership with the existing stewards of green infrastructure, the Project will promote better knowledge of the value and benefits of a healthy natural world.
- **Celebrate key moments, differences and thresholds:** For the different people using and impacted by the Project, the Project route is characterised by key moments of transition through the varied landscape. For example, the River Thames is a key threshold in north-south journeys past and to London and is an important orientation feature for local residents. The road structures around the crossing have been designed to express a clear identity at this key moment of transition that give people a sense of arrival, destination and threshold. Similarly, for local residents and visitors new parks that exploit the wide vistas offered by the river have been provided on both its north and south shores.
- **Be smarter by design:** The Project has endeavoured to follow the best approach to design. Among other things, this has meant working collaboratively to design elements of the Project that are multifunctional. Mitigation measures have been developed to meet a variety of environmental needs and to be embedded as far as reasonably practicable into the engineering design. Proposals have been designed to enhance rather than detract from the local environment where practicable and in a way that aligns with broader aspirations of local communities and stakeholders in a more sensitive and imaginative way – smarter design.
- **Be safe, resilient and easy to use:** To serve its strategic transport objectives, the Project has been designed and built to make the operation, management and maintenance as easy as reasonably practicable and meet safety targets in order to achieve National Highways 2040 strategic goals on safety. It has been designed to be resilient to flood risk and climate change and to be robust, attractive and durable – considering solutions that are proportionate, and represent the best value over the whole life of the Project. In addition, it has sought to minimise adverse health and environmental impacts and meet the Department for Transport's target for construction cost.

2.2. Project Design Principles

2.2.1. To support this design vision, a set of Project Design Principles (Application Document 7.5) have been developed. These set out the key principles that will shape the design going forward. These commitments will be legally secured as part of the DCO application.

2.2.2. The Project Design Principles are split into two types: Project-wide (generic) and area-specific. They comprise the parameters that must be met in the final detailed design. The Principles fall within the framework provided by, and supplement the requirements of the Book of Plans (Application Documents 2.1 to 2.18) and the Environmental Masterplan (Environmental Statement Figure 2.4, Application Document 6.2).

2.3. The Road to Good Design (2018) and DMRB (GG 103)

2.3.1. As stated in *Project Design Report Part B: Policy Context and Project Design Process (Section 2.2)*, new schemes shall comply with these principles and guidance on good design.

2.3.2. Throughout this PDR, summaries have been provided as to how National Highways' 10 principles of Good Design (National Highways, 2018) have been applied to the Preliminary Design for the Project. A description of how they have been applied at a project-wide scale can be found in Section 4 of this document.

2.3.3. These principles have subsequently become part of the Design Manual for Roads and Bridges (DMRB) GG 103 (National Highways, 2019) and it is a project requirement to comply with them.



National Highways 'The Road to Good Design' and the 10 Principles of good road design

3. Project-wide approach to Good Design

3.1. Introduction

3.1.1. The Project will be experienced by large numbers of people in various ways. For all these people, the Project route can be defined and experienced as a series of events with an underlying narrative drawn from both context and function. The preliminary design has been developed to:

- Be landscape led
- Support the recovery of nature
- Celebrate key moments, differences and thresholds
- Be smarter by design
- Be safe, resilient and easy to use

3.1.2. This section gives more detail on how the preliminary design has been developed to meet the design vision of the Project.

3.1.3. The plans and graphical representations in this report are illustrative and reflect the ongoing design process. The proposed design is set out in the General Arrangement plans (Application Document 2.5), and finalised visualisations are set out in the Environmental Statement (Application Document 6.1, Chapter 7: Landscape and Visual).

3.2. Landscape led

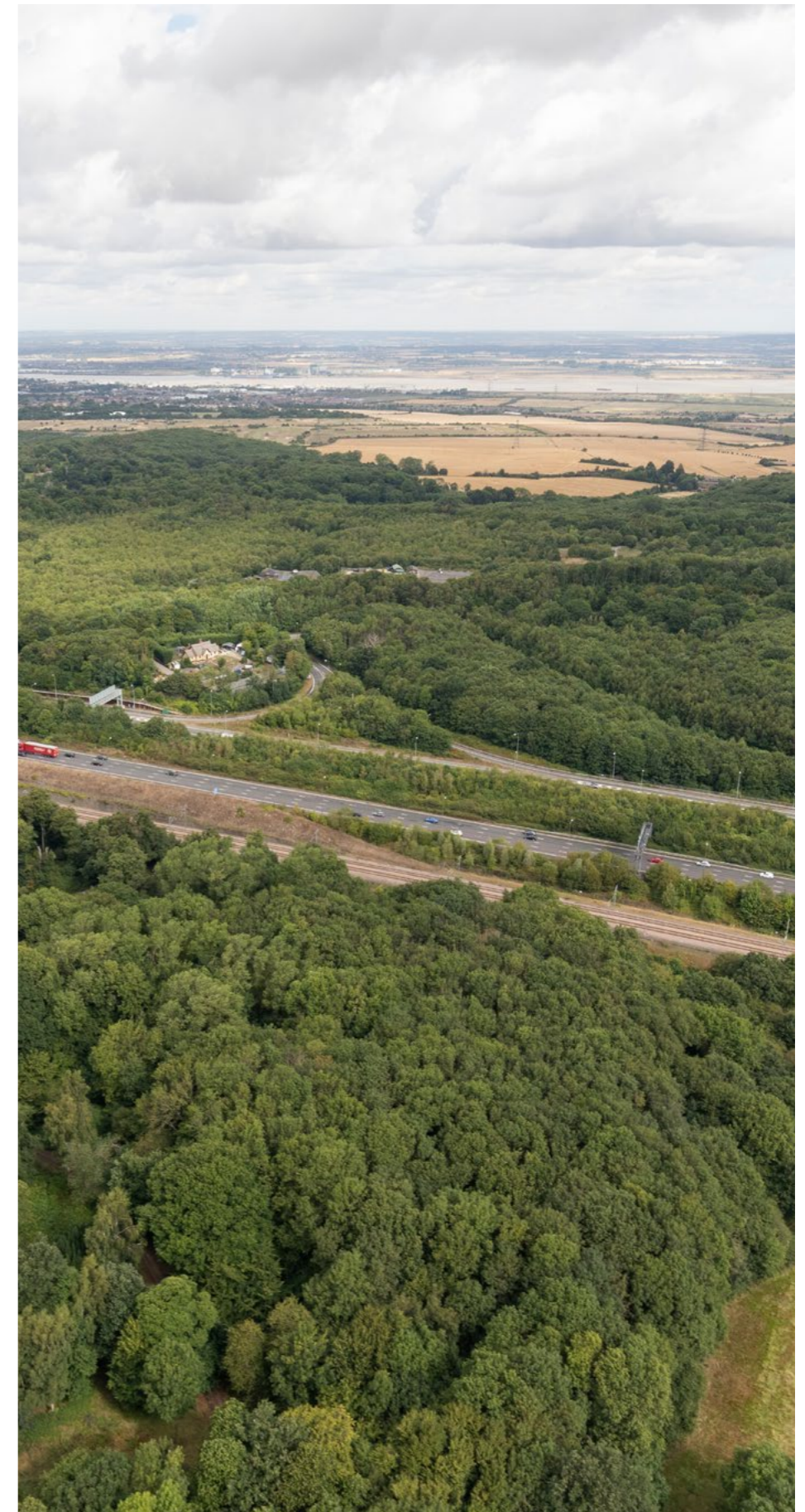
3.2.1. The overarching context is one of landscape expressed in specific local characteristics such as marshes or chalk hills, or features on the horizon such as churches or the River Thames. The landscape is not fixed, its seasonal variation creates a dynamic environment which has been understood and recognised in the design. This has informed design decision-making from strategy to detail.

3.2.2. The Preliminary Design response is that the Project route has provided a road that lies subservient within its context. The existing and proposed landscape has a higher visual hierarchy than the road and the structures that support it. This enables impacts on local communities and the environment to be minimised and opportunities for enhancement to be identified where reasonably practicable and appropriate to its context.

3.2.3. This strategy is also mirrored in the 10 principles of National Highways' Road to Good Design which drives a context-based design response to integrate structures and is key to ensuring a positive contextual intervention.

3.2.4. In addition, a design narrative has been developed in keeping with the Design Manual for Roads and Bridges (DMRB) GG 103 (Introduction and general requirements for sustainable development and design). This narrative covers the Project extents and provides an overarching context-led design response for the emerging proposals. In part, it required the translation of environmental mitigation into clear visual proposals that are embedded within the Project.

3.2.5. To enable more detailed consideration of the way the Preliminary Design has responded to its context and enhance the experience of users, the Project design narrative divides the route of the Project into eight character areas which are derived from variations in existing landscape character along the course of the route. (Refer to the character area plan on page 8 of this PDR)



Aerial view of the landscape character, south of the River Thames

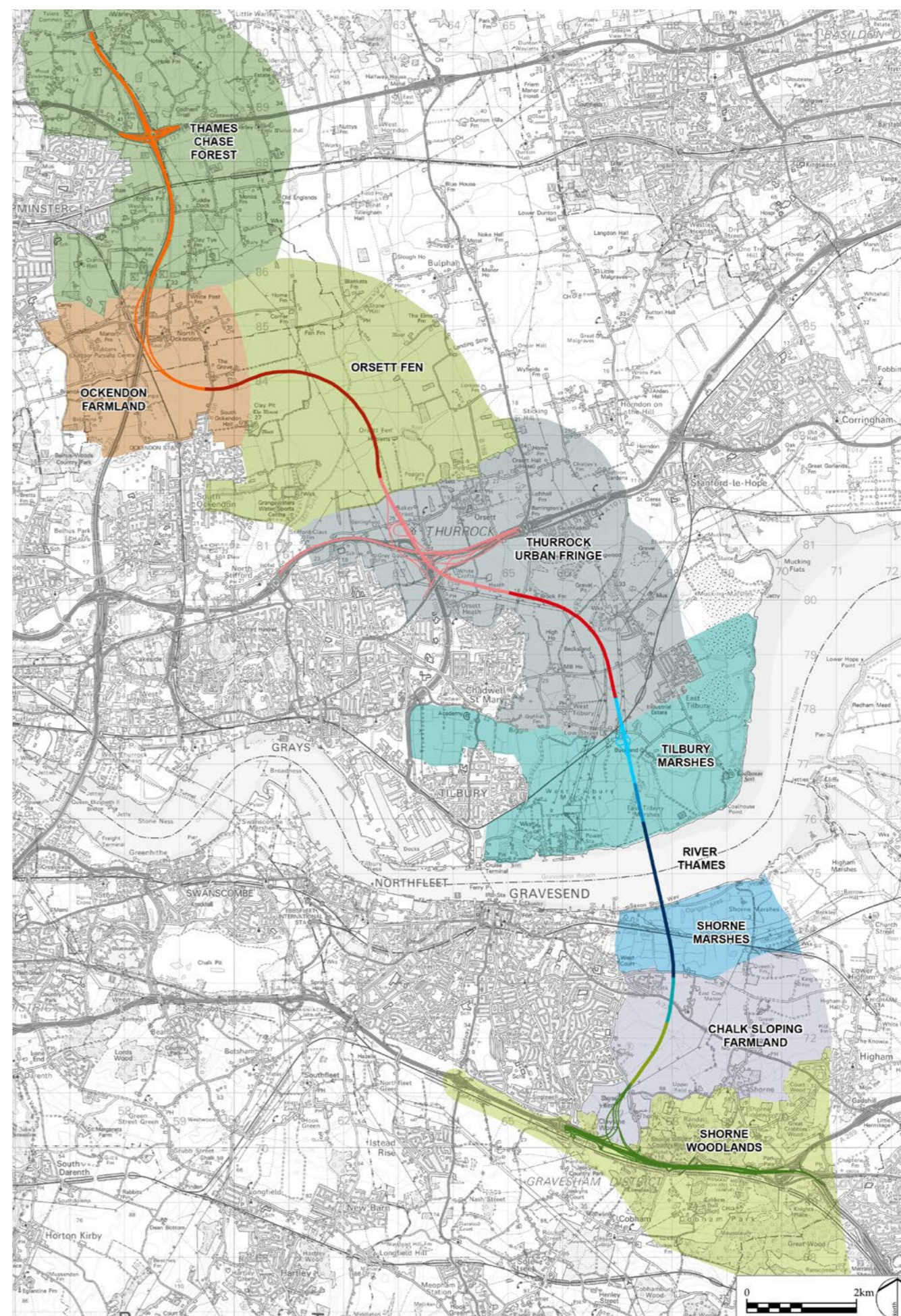
Landscape character areas

3.2.6. To facilitate a design response to context at an appropriate scale, the route of the Project has been divided into eight character areas. These have been derived by analysing variations in landscape character along the course of the route and by consulting local policy guidance and character appraisals. The figure opposite illustrates how the character areas map over the Project route. They are:

- Shorne Woodlands: Wooded ridge of the Kent Downs Area of Outstanding Natural Beauty (AONB), where works include widening the A2/M2 corridor and creating a junction with the A2.
- Chalk Sloping Farmland: Arable landscape sloping down towards the Thames, including the South Portal and Thong Lane green bridge north.
- Shorne Marshes and the River Thames: The river and the marshland area along its south bank. The Project will tunnel beneath this entire area.
- Tilbury Marshes: Flat, open marshland on the north bank of the river, including the North Portal.
- Thurrock Urban Fringe: Farmland close to the edge of Chadwell St Mary and Grays. The Project will have a junction with the A13, which runs along a low ridge within this area.
- Orsett Fen: Flat, open fenland north of Orsett, including viaducts crossing the Mardyke and floodplain.
- Ockendon Farmland: Farmland west of and elevated slightly above Orsett Fen; the Project will have its junction with the M25 in this area.
- Thames Chase Forest: Undulating, predominantly rural landscape; the M25 within this area will be widened as part of the Project.

3.2.7. For more detailed character assessments please refer to the Environmental Statement (Application Documents 6.1, 6.2 and 6.3).

3.2.8. In addition to the character areas, ecological compensation measures required in the Blue Bell Hill area have been integrated into the wooded and farmed landscapes of the Kent Downs AONB. This is to ensure the environmental effects on the wider road network are addressed appropriately.



Character areas map showing the Project route with the character areas

Landscape integration strategies

3.2.9. The overall strategy of the landscape design proposals along the route is to reflect and enhance the surrounding landscape character. Woodland planting in the Kent Downs AONB would be appropriate, however woodland planting in the Orsett Fen landscape character could detract from the existing landscape. Vegetation and earthworks are used across the Project to help blend it into and screen it from the surrounding landscape (approximately 80% of it is in a cutting, false cutting or tunnel). However, the species type and pattern of vegetation, and height and form of earthworks has been designed to be appropriate to the surrounding landscape.

3.2.10. To integrate the proposals into the wider landscape and minimise visual impact, the proposed landscape design has included increased levels of planting throughout the Project alignment. The planting strategy has followed a contextual approach with regards to species selection and pattern and is appropriate to its locale and scale of the Project alignment.

3.2.11. Boundary fencing would be required along the majority of the Project route to prevent access to National Highways' land and mark the boundary. Although likely to be low impact post and rail timber fencing or similar, it would add an increasing urban visual element to the rural landscape it passes through and exacerbate the Project alignment. By placing hedgerow planting adjacent the fence line, it would help soften views towards the fence line and screen views of surface water storage features. The hedgerows would also provide additional biodiversity benefits and by connecting into existing woodland poor hedgerows where appropriate, would provide landscape scale ecological connectivity along the Project route.

3.2.12. Surface water storage features sit alongside the Project alignment to manage the drainage and flow of water across the Project. These features have been integrated into the landscape design minimising the Project impact and don't appear as sterile features. The water bodies do not detract from the existing landscape character whilst still performing their function. The detail design of ponds and basins will be designed to appear as sympathetic elements within the wider setting that respond to existing topography and field boundaries, in accordance with the Project Design Principles (Application Document 7.5).



Woodland planting in the Kent Downs AONB



Flat, open landscape of the Orsett Fen



Example of a surface water feature (retention pond) by the M25



Example of a species rich hedgerow to soften engineered earthworks

A landscape-led approach to buildings and structures

3.2.13. Applying a landscape-first approach that responds to the diverse character of the eight areas would create a strong and memorable sequence of experiences for users of the Project route. This is especially relevant to the design structures so that all users understand the journey they are making, the landscape they are travelling through and the places they are passing.

3.2.14. The Project includes a variety of structures along the Project route including tunnels portals, bridges, viaducts, retaining structures, noise barriers, fences and gantries. The Project is committed to a coherent and consistent aesthetic quality to these that can be adapted to suit the varied landscapes along the Project route.

3.2.15. The interface between these structures and adjacent landscape is important to the successful integration of the Project within its context. The engineering, landscape and architecture proposals have been designed to work together as one, both functionally and aesthetically. Engineering structures are designed to sit subservient to the landscape – and landscape is used to help blend them into the surrounding landscape and maximise opportunity for net environmental gain.

3.2.16. A Preliminary Design has been developed for each type of bridge structure as a baseline reference. These will be developed at detailed design in accordance with the Project Design Principles. It is recognised that variations in landscape character along the course of the route and construction methods will influence the approach. A common approach is most achievable on the overbridges that connect local roads across the Project alignment. These will be key wayfinding features on the Project route that is largely screened from the surrounding landscape. The Preliminary Design has adopted a more standard and flexible approach to these structures in junctions that are generally more constrained.

3.2.17. The Project Design Principles (Application Document 7.5) require a common material palette to be applied across the Project and therefore, an illustrative material palette has been developed for preliminary design. This palette has been most strongly influenced by the most sensitive landscape impacted; the Kent Downs AONB.



Illustrative view of the proposed Thong Lane green bridge north with planting, integrating it into the landscape

Further details on the preliminary design of buildings and structures can be found in Project Design Report Part F: Structures and Architecture

3.3. Support the recovery of nature

3.3.1. While the Project Design has been developed to reduce its environmental impacts as far as practicable, large areas of mitigation and compensation planting are still required at a landscape-scale. Ecological mitigation and compensation is proposed to offset unavoidable effects of habitat loss, degradation and disturbance in the form of creation of woodland, wetland, grassland and habitats for invertebrates and protected species such as water voles. The Project has sought to integrate these measures carefully in such a way that they maximise their benefits for the recovery of nature and, where practicable, the enjoyment of people.

3.3.2. Wherever practicable, the Project has located mitigation to provide better connectivity and continuity of habitat, whilst being mindful of other Green Infrastructure projects that are proposed by others, with the aim of creating thriving and resilient habitats for the future. For example, the Project is providing a 'wooded-loop' around the A2/M2 junction that will better link currently isolated wooded areas across green bridges (see page 12) at Jeskyns, Claylane Wood and Shorne Woods Country Park. Similarly, at Tilbury Fields the Project is looking to connect disparate pockets of invertebrate habitat and wetlands around the North Portal.

3.3.3. The Project is proposing significant new ecology-led country parks at Chalk Park, Tilbury Fields and Hole Farm. Replacement and reinstated public open spaces throughout the Project are a key component of how the Project is being integrated into its surroundings and providing legacy benefits for local communities.

3.3.4. The design of open space areas has responded to the local landscape character and incorporated local landscape features into the design wherever practicable to retain a strong sense of place. Replication of existing features, such as woodlands, wildflower grassland, scrub and water elements has added value to the open space and help integrate it into the existing landscape.

3.3.5. Providing access for walkers, cyclists and horse riders (WCHs) to the recreational assets along the Project route has been a key priority of the design. New and improved paths for walkers, cyclists and horse riders link key green infrastructure

assets – country parks, watercourses and trails – with nearby urban areas. Providing suitable interpretation along the routes and at new habitat creation areas (where suitable), will allow people to understand the role and function of the habitat in the wider landscape.

3.3.6. Whilst the Project respects existing landscape, it is also looking to the future and anticipating a changing climate. The infrastructure (e.g. flood defences) and planting is designed for more extreme temperatures and weather events. The Project is also providing a variety of planting typologies (e.g. some planted, some self-establishing woodland) and the inclusion of some non-native species used to drier/hotter conditions in anticipation of a changing climate. Increasing the diversity of planting mixes will ensure the planting is more resilient to future diseases.



Illustrative view of Chalk Park



Illustrative view of Tilbury Fields



Existing landscape of Hole Farm

Green bridges

3.3.7. Major roads running through the landscape provide connectivity for humans but are barriers to wildlife. There are a number of locations along the Project route where green bridges are used to promote connectivity of sensitive landscapes and habitats for animals such as bats, badgers and dormice, as well as mitigating landscape severance and providing an improved experience for WCHs. There are seven green bridges across the Project:

- Brewers Road green bridge (Work No. 1D)
- Thong Lane green bridge south (Work No. 1H)
- Thong Lane green bridge north (Work No. 3B)
- Muckingford Road green bridge (Work No. 6B)
- Hoford Road green bridge (Work No. 6C)
- Green Lane green bridge (Work No. 7M)
- North Road green bridge (Work No. 8D)

3.3.8. The design and integration of each green bridge has been tailored to suit the surrounding landscape character, specific engineering constraints, its use by humans and the types of flora and fauna that it needs to accommodate.



Illustrative view of the approach to Thong Lane green bridge north



Illustrative aerial view of Thong Lane green bridge south

3.4. Key moments, differences and thresholds

3.4.1. The aesthetic quality of a road and its design in relation to the places through which it passes, is integral to its function and the experience of those that use it. With the majority of the Project alignment in cutting or false cutting it is shielded as far as practicable from the surrounding landscapes. It is therefore even more important that where practicable, key physical features along the route act as “key moments” that respond to and celebrate the character of the places through which the new road passes.

3.4.2. The tunnels will be a memorable part of the user experience – a key journey moment with its dramatic cutting on the southern approach and elevated approach overlooking old marshland from the northern side. The two portal structures and approaches have been designed to have a complimentary architectural treatment that responds to the significantly different topography on the north and south sides.

3.4.3. The landscape-first hierarchy (see above) is also reflected in the approach to key moments. For example, in the section of the Project route that crosses the Mardyke, the road has been treated as a secondary element passing through the fenland landscape, with the viaduct forming an enhanced feature rather than a prominent design ‘statement’ at odds with its context. This is a response to the context. This engagement with the design helps define the user experience and in turn form a sense of place, highlighting an event, a passing of the road and a landscape feature that might otherwise have gone unnoticed.

3.4.4. Between these ‘key moments’, users will pass through varied landscapes – the wooded high ground of the Kent Downs AONB to the south, the open Tilbury Marshes, the valley farmland of Thurrock Urban Fringe and the expansive Orsett Fen. The Preliminary Design response sought to enhance the differing character of the landscape in these areas and enable users to experience it. Wherever reasonably practicable, views from higher ground have been exploited.

3.4.5. Through the response to the landscape and the detailing of structures, the design connects road users with the places through which they pass, whilst also minimising impacts on local communities, wildlife and other environmental assets.



Existing wooded landscape of the Kent Downs AONB, looking north towards the River Thames (top) in comparison with the flat, open landscape of the Tilbury Marshes on the north bank of the River Thames (bottom)

Project Enhanced Structures at Key Thresholds

3.4.6. Project Enhanced Structures represent key moments along the Project route for those using the highway and for people crossing or living next to the route. They have been identified where the design and appearance of specific parts of the Project infrastructure is particularly important due to the wider impact they have, not just on those using or looking at the structures, but on the landscape and environment of which they form part.

3.4.7. These Project Enhanced Structures have the potential to enhance the aesthetic quality of the road and its design in relation to the places through which it passes and are integral to its function and the experience of all those that use it. They will utilise and exemplify the consistent proposed material palette and design approaches that will be used throughout the rest of the route.

3.4.8. The Project Enhanced Structures located along the route are:

- The South Portal (including cutting, short tunnel approach ramp and retaining walls, and the Tunnel Service Building incorporated within the cut and cover tunnel structure) (Work No. 3C).
- The North Portal (including tunnel approach ramp and retaining walls, and the Tunnel Service Building above the cut and cover tunnel structure) (Work No. 5A).
- Thong Lane green bridge north (Work No. 3B)
- North Portal operational access bridge (Work No. 5E)
- Mardyke and Orsett Fen Viaducts (Work No. 8B)
- Thames Chase WCH bridge (Work No. 9O)

3.4.9. The two portal structures represent significant thresholds to the river crossing to Kent in the south and the entrance to Thurrock and beyond in the north. The North Portal operational access bridge forms a key part of this context in the journey to/from the North Portal.

3.4.10. Thong Lane green bridge north and the Thames Chase WCH bridge are proposed new structures at the most southerly and northerly end of the Project route respectively. These locations have been selected to define the key moment of arriving and leaving the Project route.

3.4.11. The Mardyke and Orsett Fen viaducts also represent a key moment for people moving around the Project route. The structures in this location will be distinct vertical elements within a flat open landscape and will require a contextually led design response.



Illustrative driver's eye view approaching the North Portal



Illustrative view of the Mardyke and Orsett Fen viaducts as they pass through the fenland landscape



Illustrative view of Thames Chase WCH bridge

3.5. Smarter by design

3.5.1. Effective design is an iterative process informed by stakeholder and community engagement. The landscape, architecture and engineering designs have been developed concurrently with environmental mitigation and compensation measures. 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. This has resulted in multifunctional landscape proposals across the Project route.

3.5.2. The design seeks to combine mitigations as efficiently as practicable to provide maximum benefit. An example of this would be providing woodland planting at junctions. The landscape character analysis showed that there were woodlands and wooded ridges at the three principle junctions on the Project route at the A2/M2, A13 and M25. Woodland planting here will be appropriate to context and help screen the junction from local views and mitigates impacts on existing woodland habitat. This planting typology has the added benefit that, once mature, it would narrow the road users' focus in at the junctions: the place where most concentration is required to navigate. There are other examples throughout the PDR of how the collaborative design process has enabled better value in the Project, including:

- Agreeing the location of Green Bridges. Where there were options as to the location to successfully link habitats, the user experience and needs of WCH's as well as local Green Infrastructure initiatives were taken in to account for the benefit of all.
- Repurposing of the construction phase compound near Shorne Woods Country Park as a new car park giving people better recreational access to the broader area.
- Using required utilities clearances in areas of tree planting as 'woodland rides' for better access for maintenance and movement.



Illustrative view of increased planting and woodland where the Project route meets the M25

3.6. Safe, resilient, and easy to use

3.6.1. For over 56 years the Dartford Crossing has provided the only significant road crossing of the River Thames to the east of London. However, frequent congestion and poor journey time reliability make it one of the least reliable sections of the strategic road network with significant negative impacts on economic productivity and trade, social and user experience and the environment.

3.6.2. The Project is designed to avoid the operational challenges of the Dartford Crossing to optimise its successful operation. Proposals include twin bored tunnels approximately 4.25km in length. The size of each of the twin tunnels has been designed to accommodate three lanes of traffic with enough headroom to accommodate all vehicles capable of using the normal road network; therefore, it is not necessary to provide for over height vehicle detection systems or mitigation for re-routing oversized vehicles.

3.6.3. Safety is fundamental to the design of the Project route and the road alignment, signage, barriers, structures and other highways elements have been designed to ensure the safety of users while being also following the best current guidance making it intuitive to navigate. New routes for WCHs have been developed to meet the latest standards in order to make them as accessible and easy to use as is practicable.

3.6.4. Emergency access has been a key consideration in design across the Project. The Project team has liaised closely with National Highways tunnels specialists, National Highways Operations Directorate, the emergency services, adjacent local highway authorities and environmental bodies to ensure comprehensive measures including, for example, cross-passages connecting each tunnel, have been designed for emergency evacuation and response.

3.6.5. In order to build the Project, overhead electricity lines and pylons, gas pipelines and other utilities have to be diverted or protected, and new service connections will have to be installed at several locations in Kent, Thurrock and Essex. The diversions and protection measures will allow the road to be built, to operate safely and will ensure that standard safety clearances and easements are maintained for future maintenance to be undertaken.

3.6.6. Throughout the development of the Project, liaison with statutory undertakers has continued, resulting in the refinement of the design to reduce the impact on utilities, particularly overhead powerlines and the high pressure gas network.

3.6.7. The Project design has taken into account the identified potential effects of climate change and incorporates measures to ensure capacity for climate change resilience within the design for these eventualities. Climate change considerations have been assessed for the construction of the Project as well as for 60 years of its operation, including for operational vulnerability.

3.6.8. For example, where highways cross the floodplain, it is proposed that they would be elevated on embankments and viaducts with the road level set above the design flood level. This would provide protection from tidal flooding (1 in 200-year event) and fluvial flooding (1 in 100-year event).

3.6.9. Due to the extensive resilience mitigation proposed within the design, the Environmental Statement (Application Document 6.1, Chapter 15: Climate) concludes that the Project should be capable of withstanding the climate change likely to occur during the design life.



Dartford Crossing

4. Preliminary Design response summary to the 10 Principles of Good Design

4.1.1. Throughout the development process the Project has paid close regard to ensuring the preliminary design meets National Highways' 10 Principles of Good Design. The summary below is not an exhaustive list of how the principles have been applied, but serves to demonstrate a few key examples for each principle in the overall Project design.

Makes roads safe and useful

4.1.2. Safety is fundamental to the design of the Project route and the road alignment, signage, barriers, structures and other highways elements have been designed to ensure the safety of users. The issue of safety becomes the overriding concern with design issues, such that the moving of the Thong Lane green bridge over the Project route was proposed north during the Design Refinement Consultation, as its former planned position clashed with a gantry required for safety.

4.1.3. At present, congestion, delays and poor journey time reliability at the Dartford Crossing and on surrounding roads is a major impediment to economic growth in the South East of England. The River Thames acts as a barrier between Kent, Thurrock and Essex and affects the ability to build strong connections between these communities.

4.1.4. The new proposed crossing would act as a catalyst in unlocking the development and growth between the communities north and south of the River Thames and to alleviate the issues with congestion and delays currently experienced at Dartford.

Is inclusive

4.1.5. To improve local community access to natural and semi-natural open spaces, the Project is providing a number of new publicly accessible areas. This includes the proposed parks at Chalk and Tilbury Fields both of which are accessible via local walking, cycling and horse riding routes.

4.1.6. Whilst the highways environment along the route is not open to equal use by all users on safety grounds, the Project has sought to ensure that all WCH routes that have been severed by the route (and historic severances where reasonably practicable) have been reconnected. These routes and crossings across the Project have been designed to allow for inclusive use by ensuring they allow sufficient space and a quality user experience for all.

4.1.7. As part of the wider WCH strategy, routes have been upgraded to improve connectivity and access for more users. Bridges have been designed to accommodate equestrian standards and tie into the wider network. The WCH strategy has also explored the wider benefits of improving and enhancing the WCH network that can improve connectivity between the surrounding communities.

Make roads understandable

4.1.8. The road layout has been designed to be legible and easy to understand, with the scale and character of each route designed to reflect the use and the surrounding character.

4.1.9. As part of the wider design narrative, a design rationale around maximising the woodland planting around the main junctions on the route (A2 junction, A13 junction and M25 junctions) was developed to keep views inward focused for road users and not distract when making driving decisions within the junctions.

Fits in context

4.1.10. The Project route has been designed to fit in within the surrounding context and where reasonably practicable become a subservient visual element to the surrounding landscape. Mitigation in the form of planting for replacement for vegetation loss, habitat creation and visual mitigation has been designed to reflect the local planting patterns and species mixes found within the local landscape character. The height, extents and gradients of earthworks used along the route and for visual mitigation purposes have also been designed to not contrast against the existing topography and where reasonably practicable enhance the local landform.

4.1.11. The Project Design Principles (Application Document 7.5) require a project-wide material palette. An illustrative version of this is shown through the representations of the Project Enhanced Structures. The materials in the palette will be selected for their longevity, durability and how they integrate and complement the surrounding landscape context. They are functional, but are appropriate and respond positively and elegantly to the context, expressing the character and identity of the place.

Is restrained

4.1.12. Whilst the majority of the route has been designed to integrate itself into the surrounding landscape, there are opportunities for the design of structures and the landscape strategies to contribute towards creating a sense of place and enhancement of the existing character.

4.1.13. The North and South Portals and the surrounding earthworks strategy have been designed to create bold new landscapes and elements that can add to the local character without being unnecessary superficial or superfluous visual statements.

4.1.14. In the south for example, the creation of Chalk Park is reflective of the local character and developments being located around wooded hill tops. At the North Portal, the earthworks reflect the history of the site being used for defence of the estuary and create direct lines of sight towards the river and estuary.

Is environmentally sustainable

4.1.15. The carbon commitments in the Carbon and Energy Management Plan (Application Document 7.19) would provide the mechanisms National Highways would use to lead the industry in the adoption of low carbon innovation and deliver the level of carbon reduction required on the Project to support the transition to Net Zero. The ambition is to achieve carbon neutral construction but will also develop a carbon offsetting strategy to address residual emissions where they cannot be reduced completely. The strategy would prioritise actions in the construction industry, in transport and within the region. Carbon emissions related to operation of the Project would be net zero throughout the 60-year appraisal period and emissions related to maintenance, repair and replacement would be net zero by 2040, in line with the Net Zero Highways Plan (National Highways, 2021).

4.1.16. Throughout the Project, the design development has minimised vegetation loss where reasonably practicable along the route. Mitigation in the form of replacement planting has been designed to comprise native stock of local provenance that is suited to the growing environment and provide opportunities for ecological enhancement. The planting palette, as described within the Project Design Principles, contains a small percentage of non-native species that would tolerate future climate change predictions. The addition of non-native species not only becomes more adaptive to climate change but will also be more resilient to future diseases by increasing the diversity of the planting mix used along the route.

4.1.17. The Project design has sought to be efficient in the use and reuse of materials. For example, the earthworks design re-uses as much of the excavated material in the proposed landscape to retain as much material on-site as reasonably practicable.

Is thorough

4.1.18. The Preliminary Design is a result of a thorough design development utilising multi-disciplinary workshops within the Project team and responding to the feedback from consultation and engagement events. The design evolution sections demonstrate how this feedback, particularly from the National Highways Design Review Panel (NHDRP), has been used to inform the ongoing design development and resulted in positive design changes, for example alterations to the route alignment and the earthworks strategies around the portals.

4.1.19. A multidisciplinary approach to design has been used to resolve design issues along the route and maximise design coordination, for example utilising maintenance access track for WCH routes and using the excavated material from the portals and tunnels approach for placemaking opportunities north and south of the River Thames. Elements of the road network have been considered together and integrated into one design.

Is innovative

4.1.20. The first NHDRP review of the Project in 2017 made the following recommendation:

‘This process [next stage of design] should pursue the highest level of ambition. We recommend the design team explore the range of possibilities at the outset, and test these against the range of physical, technical and regulatory and financial constraints. We recommend that the narrative for the scheme is explored and refined through the next stages of the Project, utilised through consultation.’

4.1.21. As a result, the Project commissioned the development of the design narrative. This described the approach to designing the Project, firstly for consent and ultimately for detailed design and construction. It was intended to guide those making decisions about the Project – across the disciplines – and to inform conversations with stakeholders internally and externally.

4.1.22. The Design Narrative was presented to the panel in November 2018, and received the following feedback:

‘The Highways England Design Review Panel strongly welcome the creation and application of a design narrative document for the Lower Thames Crossing. The review panel are pleased to see the architect and landscape architect leading the strong inception of an integrated design strategy...We believe a Design Narrative Document would support many of the strategic aims set out in the Road to Good Design Highways England publication.’

4.1.23. The tunnels will be the longest road tunnels in the country and, at 16 metres, one of the largest diameter bored tunnels in the world, almost doubling road capacity across the River Thames east of London.

Is collaborative

4.1.24. The Green Infrastructure (GI) study commissioned by the Project is an example of a collaborative approach to the

Preliminary Design, The GI study provided the ‘bigger picture’ and the perspective for how the Project could deliver GI as part of its design and mitigation. The study involved mapping out the existing and proposed GI assets and their connectivity through desktop study and engagement workshops with relevant stakeholders.

4.1.25. As a result of this collaboration and focus on GI, the Project proposed seven green bridges designed to be multi-functional by reducing severance for ecology, providing a better experience for WCHs and contributing towards mitigating the Project impacts on landscape character.

Is long lasting

4.1.26. Major structures have been designed to a 120-year design life. Building fabric materials (cladding, roofs, walls, surface pavements, doors and louvres) should typically achieve a 25 to 40 year design life or more where deemed practical or required by the relevant standards, such as in areas adjacent or over operational highway. Many materials will last considerably longer.

4.6.27. The planting palette takes into consideration the potential impacts of climate change, such as extreme temperatures and weather events. A variety of planting typologies are proposed, which include some non-native species and are more adaptable to future climate conditions, which will build resilience within the proposed planting.

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