

Lower Thames Crossing
7.4 Project Design Report
Part D: General Design South of the River

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Project Design Report Part D: General Design South of the River

Contents	
1. Project Design Report – introduction.....	4
1.1. Document structure	4
1.2. Navigation	4
2. Existing regional context.....	5
2.1. Introduction.....	5
2.2. Character Areas	6
2.3. Existing historical context	9
2.4. Recreational access	10
3. Proposed regional strategies.....	12
3.1. Overview	12
3.2. Burham and Blue Bell Hill nitrogen deposition compensation.....	14
3.3. Routes for Walkers, Cyclists and Horse Riders.....	15
3.4. Design constraints and opportunities	16
4. A2/M2 Corridor	19
4.1. Introduction.....	19
4.2. Existing context summary	20
4.3. Preliminary Design: highways and operational requirements	26
4.4. Preliminary Design: utility works.....	27
4.5. Preliminary Design: landscape.....	28
4.6. Preliminary Design response summary to the 10 Principles of Good Design	35
5. M2/A2/A122 Lower Thames Crossing Junction	37
5.1. Introduction.....	37
5.2. Existing context summary	39
5.3. Preliminary Design: highways and operational requirements	42
5.4. Preliminary Design: utility works	43
5.5. Preliminary Design: landscape.....	44
5.6. Preliminary Design response summary to the 10 Principles of Good Design	52
6. Gravesend Link and South Portal.....	53
6.1. Introduction.....	53
6.2. Existing context summary	55
6.3. Preliminary Design: highways and operational requirements	58
6.4. Preliminary Design: utility works.....	59
6.5. Preliminary Design: landscape.....	60
6.6. Preliminary Design response summary to the 10 Principles of Good Design	66

1. Project Design Report – introduction

1.1. Document structure

1.1.1. This document covers the general preliminary design for the section South of the River.











1.1.2. General design broadly covers the following areas:

- a. Existing context
- b. Preliminary design: landscape
- c. Preliminary design: highways
- d. Preliminary design: utilities

1.2. Navigation

1.2.1. This document, Project Design Report Part D: General Design South of the River , 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

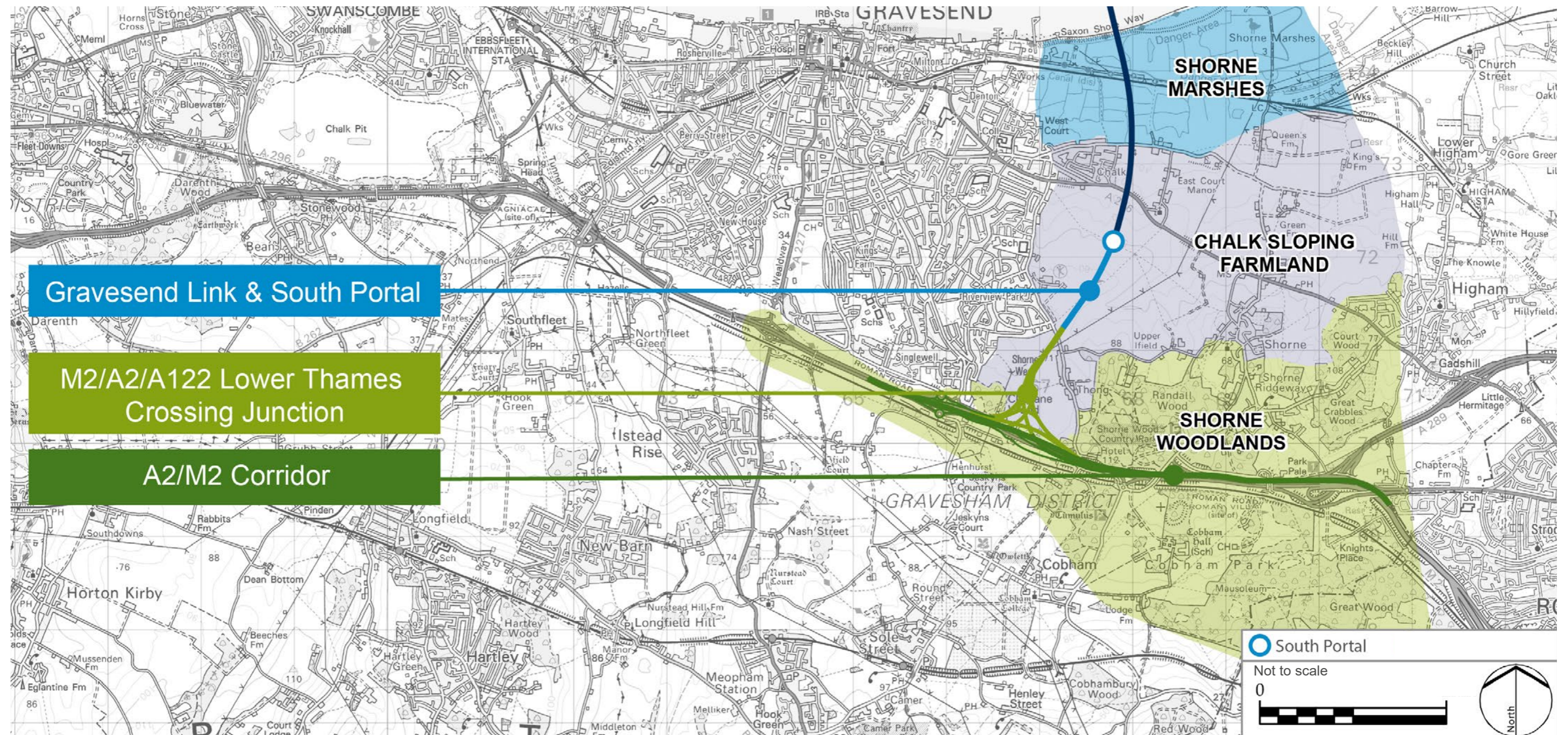
2. Existing regional context

2.1. Introduction

2.1.1. The South of the River Thames region contains the following area-specific sections: the A2/M2 Corridor, M2/A2/A122 Lower Thames Crossing Junction and Gravesend Link and South Portal. It spans the character areas of Shorne Woodlands, Chalk Sloping Farmland and Shorne Marshes and the River Thames.

2.1.2. The Preliminary Design has been developed for the purposes of this application. The design will continue to be developed at detailed design stage within the context of the Preliminary Design presented in accordance with the requirements of the Development Consent Order (DCO).

2.1.3. The designs and images shown in this document are preliminary, which are illustrative proposals of one possible design outcome. Proposals shown may be developed differently during detail design to comply with the Project requirements.



2.2. Character Areas

Shorne Woodlands

2.2.1. The landscape character area is dominated by woodland. An extensive area of woodland lies between the villages of Thong and Shorne, including young woodland associated with the centre of Shorne Woods Country Park and areas of ancient woodland that surround it to the east, west and north. The heavily trafficked A2 dual carriageway is a dominant feature in the landscape and the separation it creates is reinforced by the High Speed 1 (HS1) corridor that lies to the south of the road.

2.2.2. The Kent Downs Area of Outstanding Natural Beauty (AONB) designation is located within this character area. It lies predominantly south of the A2, but extends north to include woodland between Thong and Shorne. Further areas of woodland lie south of the transport corridor, including Ashenbank ancient woodland, new and mature woodland associated with Cobham Hall and new woodland creating the framework to Jeskyns Community Woodland. Claylane Wood, west of the proposed Project route is more isolated, lying on the edge of Gravesend. The southern outskirts of Gravesend bring urban influences to the landscape.



Aerial view north towards Shorne Woods



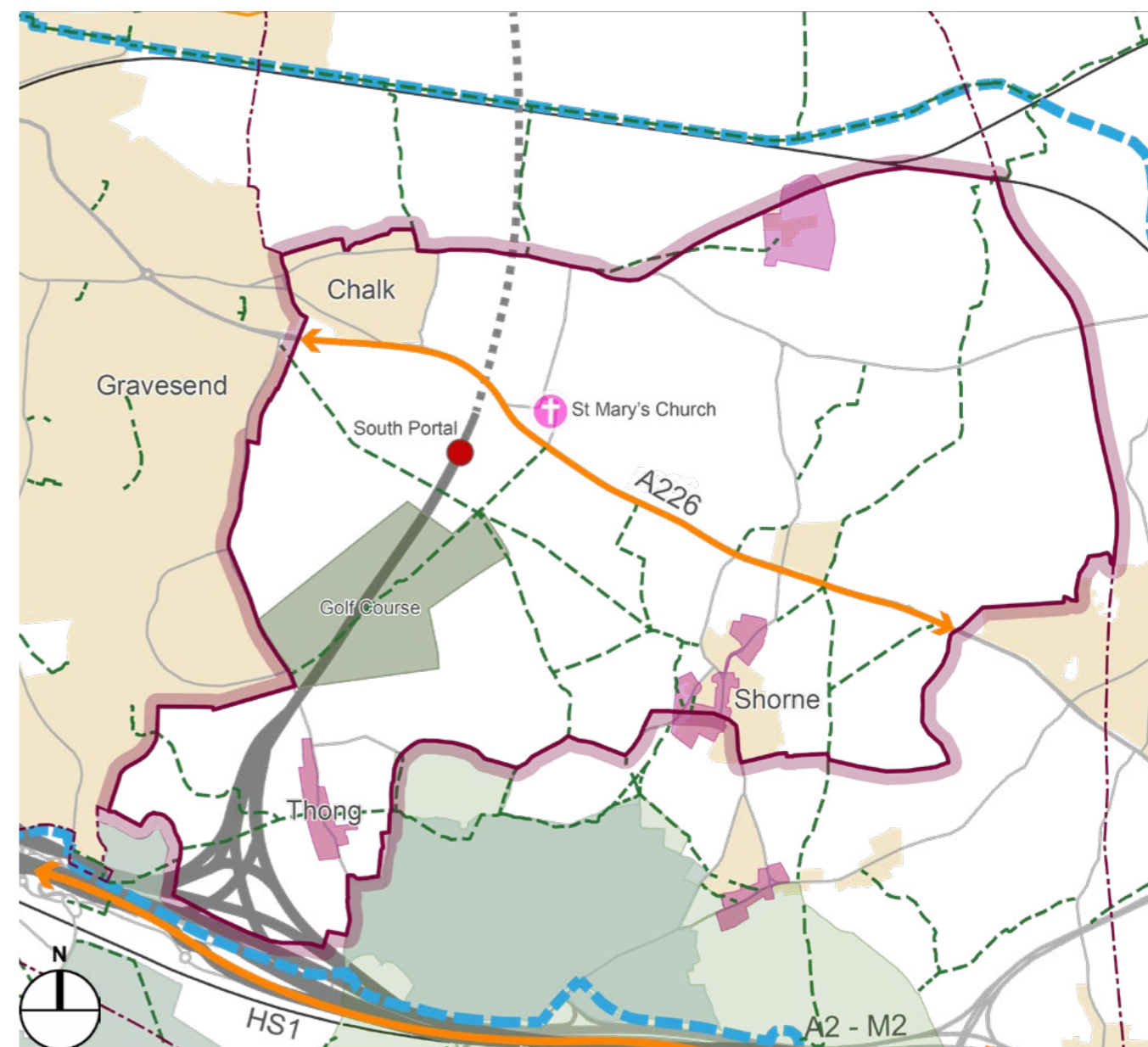
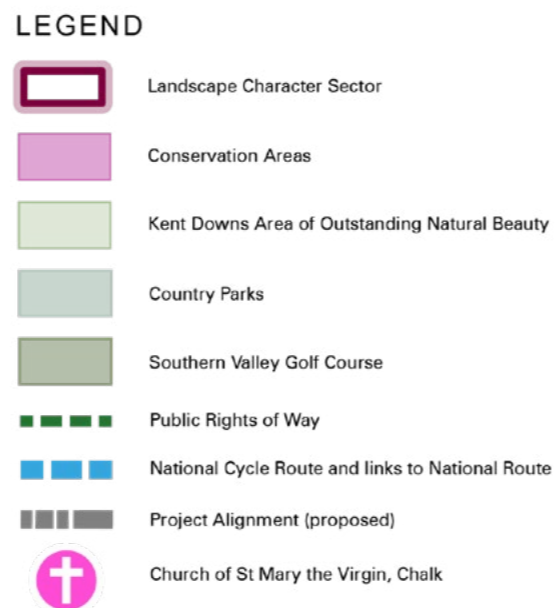
Shorne Woods Country Park



Shorne Woods Visitor Centre

Chalk Sloping Farmland

2.2.3. Chalk Sloping Farmland is characterised by large arable fields on rolling topography sloping toward the marshes to the north, with small dry valleys running down the slopes. The higher ground offers expansive views north over marshes and the River Thames. The eastern edge of Gravesend forms the western edge of the character area. The urban edge is prominent at times, having less of a relationship with the topography than smaller nearby settlements. Like many older roads in the character area, the approach to Thong and route through the village is enclosed by vegetation, retaining a rural character despite its proximity to the urban edge of Gravesend.



Aerial view north towards Chalk and the River Thames



St Mary's Church, Chalk

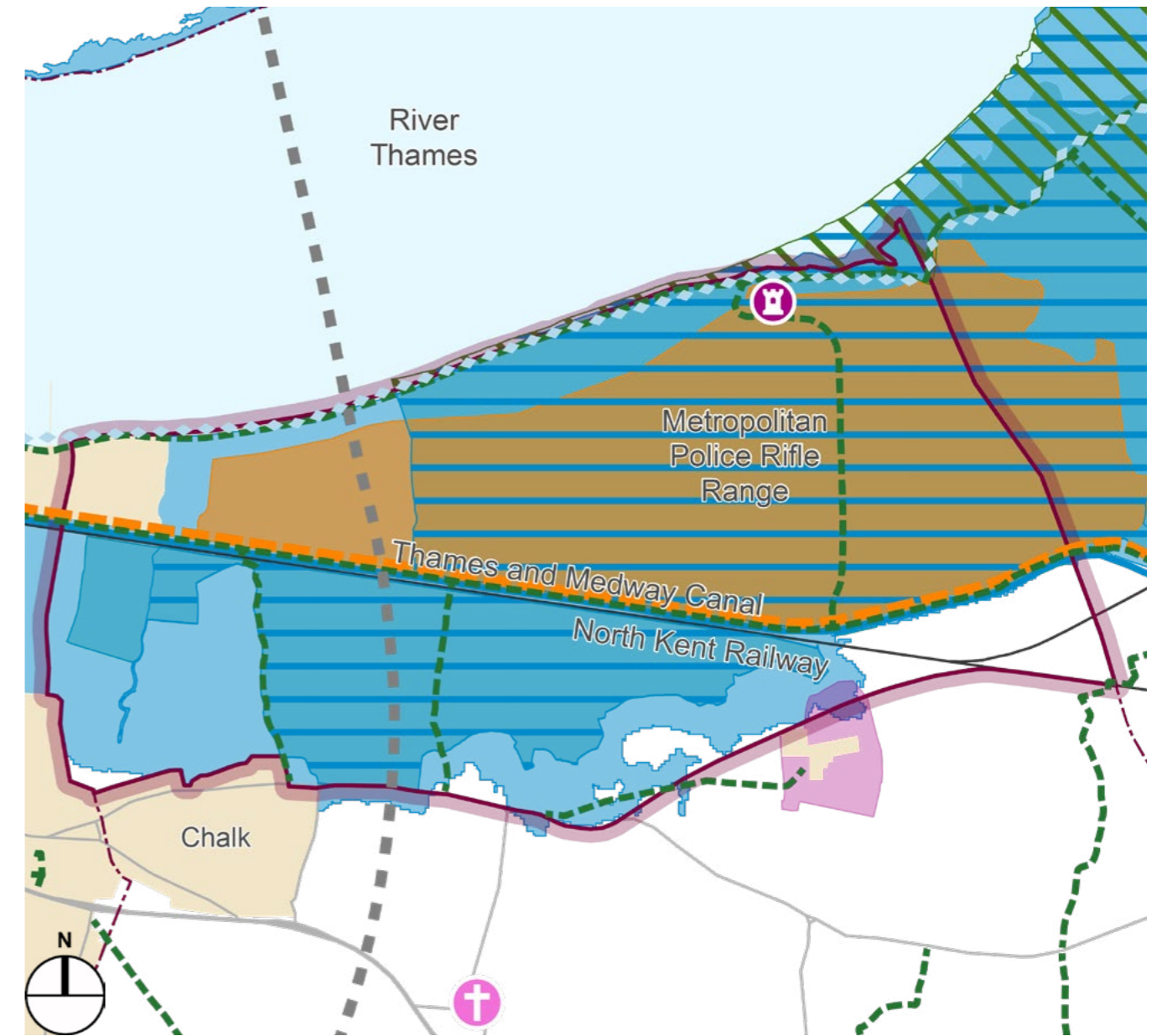


View from Shorne Ifield Road towards the River Thames

Shorne Marshes and the River Thames

2.2.4. The landscape flattens from Chalk Sloping Farmland closer to the river to form a network of meandering ditches, creating a patchwork of irregularly shaped land parcels. There is a strong contrast between these naturalistic irregular shapes and the linear Thames and Medway Canal and North Kent railway line that intersect the area. Few roads and limited development coupled with a lack of shrubs and trees give the character area a sense of open remoteness. The River Thames is over 1km wide at this point bounded by marshes to both banks, offering expansive views.

2.2.5. Close to the river is the Thames Estuary and Marshes Ramsar site. The site supports internationally important numbers of wintering waterfowl, and the saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates. The need to minimise impacts on this habitat was a key driver in the Project opting for a tunnelled rather than bridge solution to cross the Thames.



Aerial view north towards Shorne Marshes



Shorne Marshes



River Thames

2.3. Existing historical context

2.3.1. Within the region, there are a number of historical points of interest (see Environmental Statement, Chapter 6: Cultural Heritage (Application Document 6.1)), and although the rural character has predominantly been retained, there have been changes in the landscape and impacts from urbanisation and settlements over time.

2.3.2. In the east, the area retains its rural character with areas of pre-19th century and 19th century coppice woodland found in Shorne Woods. To the west of the village of Shorne, there is a small area of rectilinear fields with curving boundaries. These may be remnants of late medieval, or early post-medieval field systems and may be the element of the landscape in this area that demonstrates the greatest time depth.

2.3.3. In the south, the development of the park and garden at Cobham Hall led to the creation of further woodland in the 18th and 19th centuries.

2.3.4. In the central area, the landscape was greatly modified during and after the post-medieval period. In addition, removal of field boundaries during the 20th century created large prairie type fields, with the exception of the site of the former Gravesend Airfield which is now a golf course and leisure centre. Gravesend also expanded significantly in the 20th century, adding to the urbanisation of the area.

2.3.5. The modern alignment of the A2 cuts through the area, following the route of Roman Watling Street.

2.3.6. Between the village of Thong and Gravesend, there are several locations where cropmarks have been recorded, thought to indicate Iron Age or late prehistoric settlement. To the north of this, in the area between Thong Lane and the A226, a large number of cropmarks have been recorded, indicating various probable prehistoric remains, Romano-British occupation and a number of probable post-medieval field boundaries.

2.3.7. Thong is a small, rural historic settlement located along Thong Lane. It contains one listed building, the 17th century Grade II listed White Horse Cottage, built in the local vernacular style. There are key historic views to and from Thong village, including from Claylane Wood to the west, Watling Street to the south-west and from the edge of Shorne Woods Country Park to the east.

2.3.8. To the south of the A226, is the Grade II* Listed St Mary's Church. The church is a prominent landmark in the flat marshland landscape north towards the River Thames.

2.3.9. Between 2019 and 2021 an extensive programme of archaeological trial trenching took place to determine the presence and importance of buried archaeological remains; several significant archaeological sites have been discovered including Roman and later prehistoric settlements and a salt working site. Where they are affected by the Project these will be archaeologically excavated, recorded and published. But in some situations the Project has been able to avoid any impact:

- a. To the south of the A226 deeply buried at the base of a dry valley a Mesolithic campsite was found during archaeological trial trenching. This comprised scatters of flint tools and the bases of several hearths, indicating a temporary campsite used by hunter gatherers at the end of the last Ice Age some 10,000 to 12,000 years ago.
- b. To the north of Claylane Wood the remains of a Bronze Age ditch and bank that would have formed a boundary some 3,000 years ago was found during trial trenching. This was an important part of a wide network of monuments that divided the landscape in this period.
- c. North of Upper Ifield trial trenching examined cropmarks seen on aerial photographs. Archaeological work showed this was an important medieval settlement.

2.3.10. Therefore, key considerations around cultural heritage in this region include:

- a. Effects on heritage assets including archaeology and harm to the significance of Cobham Hall Registered Park and Garden from the new highways layout and associated lighting, gantries, flyovers and loss of central wooded reservation on the A2
- b. Impacts on the setting of Thong and its Conservation Area
- c. Buried archaeology



St Mary's Church, Chalk



White Horse Cottage, Thong



Former Gravesend Airfield (Google Earth)

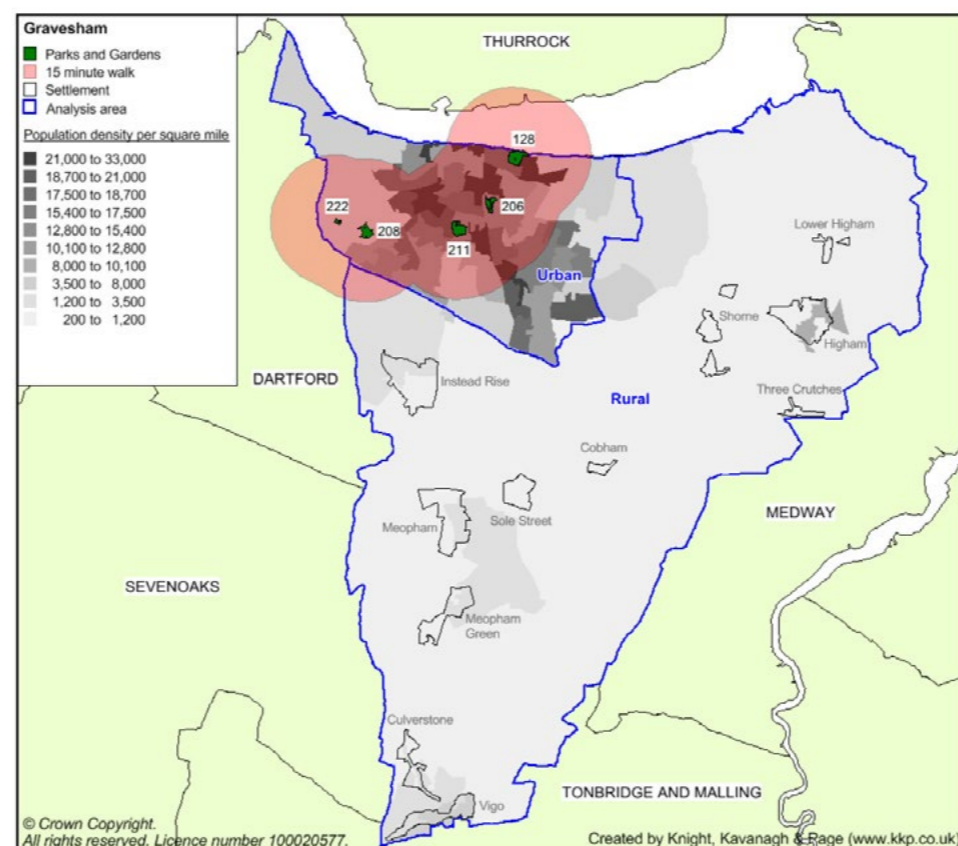
2.4. Recreational access

2.4.1. A group of private recreational facilities lies in a cluster north of Thong Lane. These include:

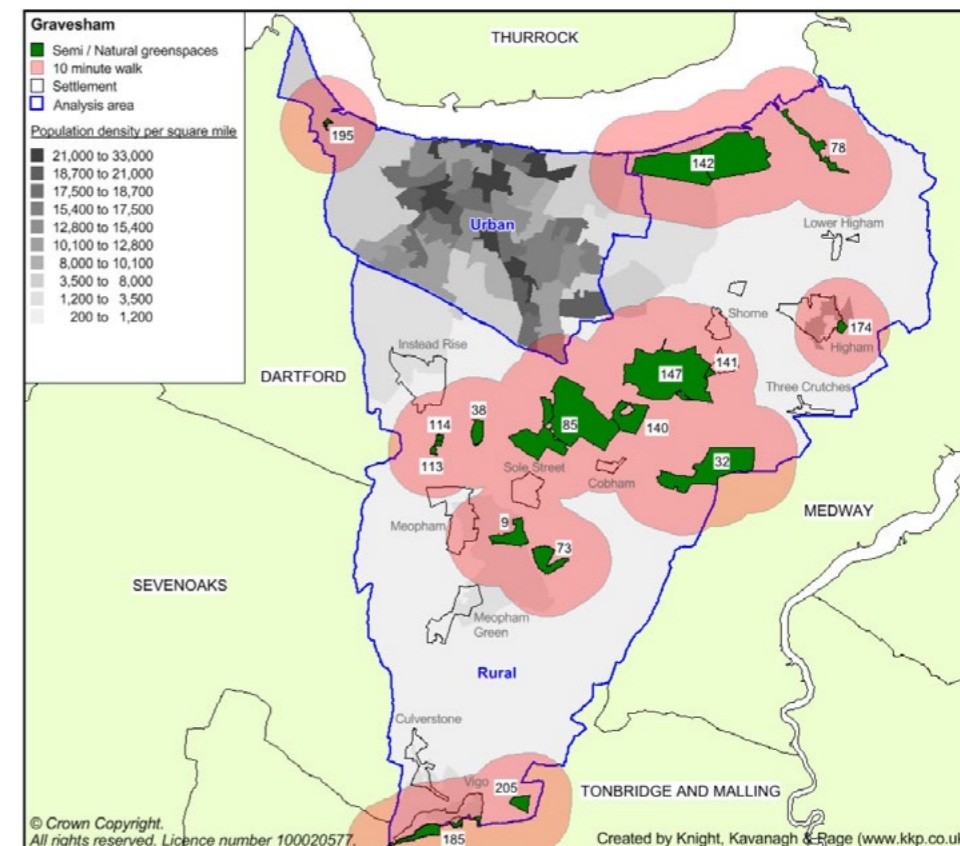
- Cascades Leisure Centre: A multifunctional site predominantly providing sports facilities and sports pitches.
- Gravesend Golf Centre: Comprising two elements separated by sports pitches: a pitch and putt course to the north-east and driving range adjacent to Cascades Leisure Centre. The pitch and putt element is within the Project Order Limits.
- Southern Valley Golf Club: An 18-hole golf course with clubhouse. There is one public footpath which passes through the site.
- Thamesview School sports pitches: The school (on the opposite side of Thong Lane) has sport pitches seasonally configured for football or athletics just outside of the Project Order Limits.

2.4.2. Despite these facilities, and the proximity to Shorne Woods Country Park, Gravesham Borough Council Open Space Assessment (April 2016) identifies catchment gaps for Parks and Gardens and Natural and Semi-Natural Green Space within walking distance for the residents of Gravesend East.

The extracts below, from the Gravesham Borough Council Open Space Assessment, show the catchment gaps in open space provision. It should be noted that the western section of site 142 (Shorne Marshes) is not publicly accessible.



Gravesham Borough Council Open Space Assessment
 Parks and Gardens mapped against analysis area



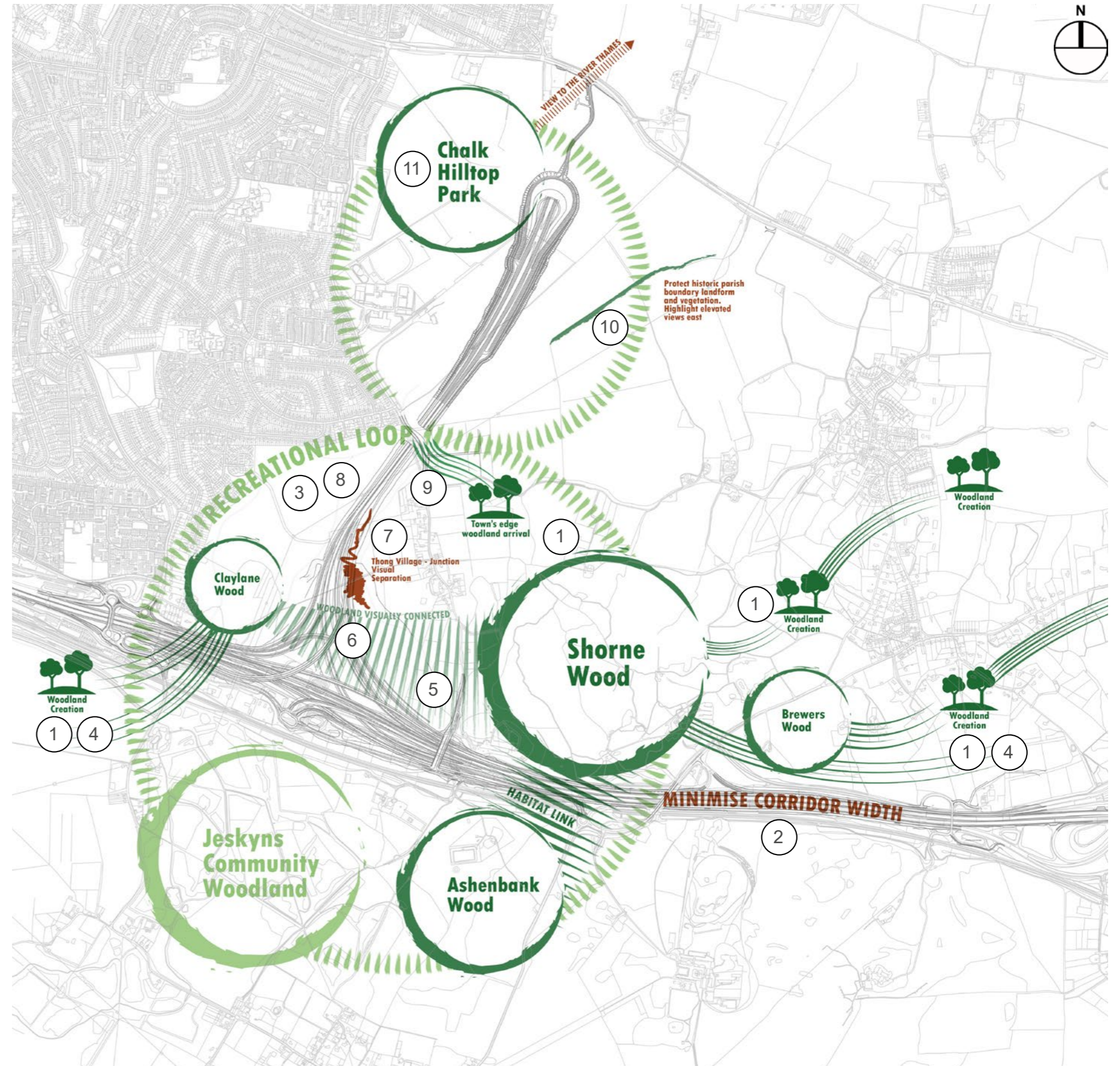
Gravesham Borough Council Open Space Assessment
 Natural and semi-natural greenspace within a 10 minute walk time mapped against analysis area

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3. Proposed regional strategies

3.1. Overview

3.1.1. The following pages outline the regional design proposals at a broader scale that have informed and shaped the more detailed preliminary design proposals in the area-specific sections.



1. Ancient woodland and woodland habitat creation through compensation planting

3.1.2. Woodland creation, including to compensate for loss of ancient woodland and effects of nitrogen deposition, has been located to improve connectivity between existing habitats, for visual mitigation and to enhance the local woodland landscape character. The design, implementation and management of these areas have been developed to be specific to each site.

3.1.3. The sites for ancient woodland compensation will be assessed for their ability to aid natural woodland regeneration of appropriate species. Envisaged maintenance will be discussed with the body taking ownership of the land and the detailed design and specification of the woodland will be moulded by the requirements of the maintenance regime.

2. Minimise corridor width

3.1.4. Minimising the width of the A2 corridor (with carriageways grouped together more closely) helps to avoid impacts on adjacent woodland.

3. Recreational loop

3.1.5. New links will be provided between proposed and existing open spaces, including the new Chalk Park, to provide local circular routes for all users.

4. Woodland creation and visual mitigation

3.1.6. As well as providing areas of ancient woodland compensation, woodland creation helps to provide visual mitigation for sensitive areas, screening the Project junction where necessary and appropriate. The proposed woodland creation provides a 'wooded loop' around the junction, creating links between the existing woodland at Jeskyn's Community Woodland, Ashenbank Wood, Claylane Wood and Shorne Woods. By linking the proposed woodland into existing, the woodland mitigation would have greater resilience in comparison to providing isolated pockets of woodland.

5. Thong Lane car park

3.1.7. To provide improved access to the local recreational areas a new car park is proposed south of Thong village. The location also provides convenient access to the improved local Public Rights of Way (PRoW) network.

6. Visually connected woodland

3.1.8. Two green bridges proposed over the A2 corridor, (replacing the existing Thong Lane and Brewers Road bridges), provide a visual link of woodland across the A2 corridor. Proposed planting on the green bridges would connect the existing woodland at Shorne Woods in the north with woodland areas south of the A2. Claylane Wood, west of the Project route, and Shorne Woods to the east, will be visually connected by proposed woodland planting within the Project junction.

7. Thong village – Project junction visual separation

3.1.9. An important aspect of the landscape proposals in this area is to provide visual separation between the village of Thong and the Project junction. This is achieved through the use of an area of sensitively designed woodland planting.

8. Improved Walkers, Cyclists and Horse Riders (WCH) links

3.1.10. Improvements to links between Shorne and Ashenbank Wood and Jeskyns Community Woodland for all types of recreational users.

9. Improved access to woodlands and country parks

3.1.11. Proposed woodland to the north of the village of Thong provides a wooded link from Gravesend and the Thong Lane north green bridge to the woodland at Brummelhill and Shorne.

10. Maintaining historical parish boundary

3.1.12. Proposals to include measures to protect historical parish boundary to the east of the South Portal and its associated elevated views east.

11. New recreational site

3.1.13. Improved access to semi-natural open space by the creation of a new recreational area for the public between Gravesend and the South Portal will be provided. Named Chalk Park the new green space will provide views out towards the Thames and to the Kent Downs AONB to the east. The recreational area will re-use excavated material from the South Portal and chalk cutting construction and incorporate improved PRoW links.

3.2. Burham and Blue Bell Hill nitrogen deposition compensation

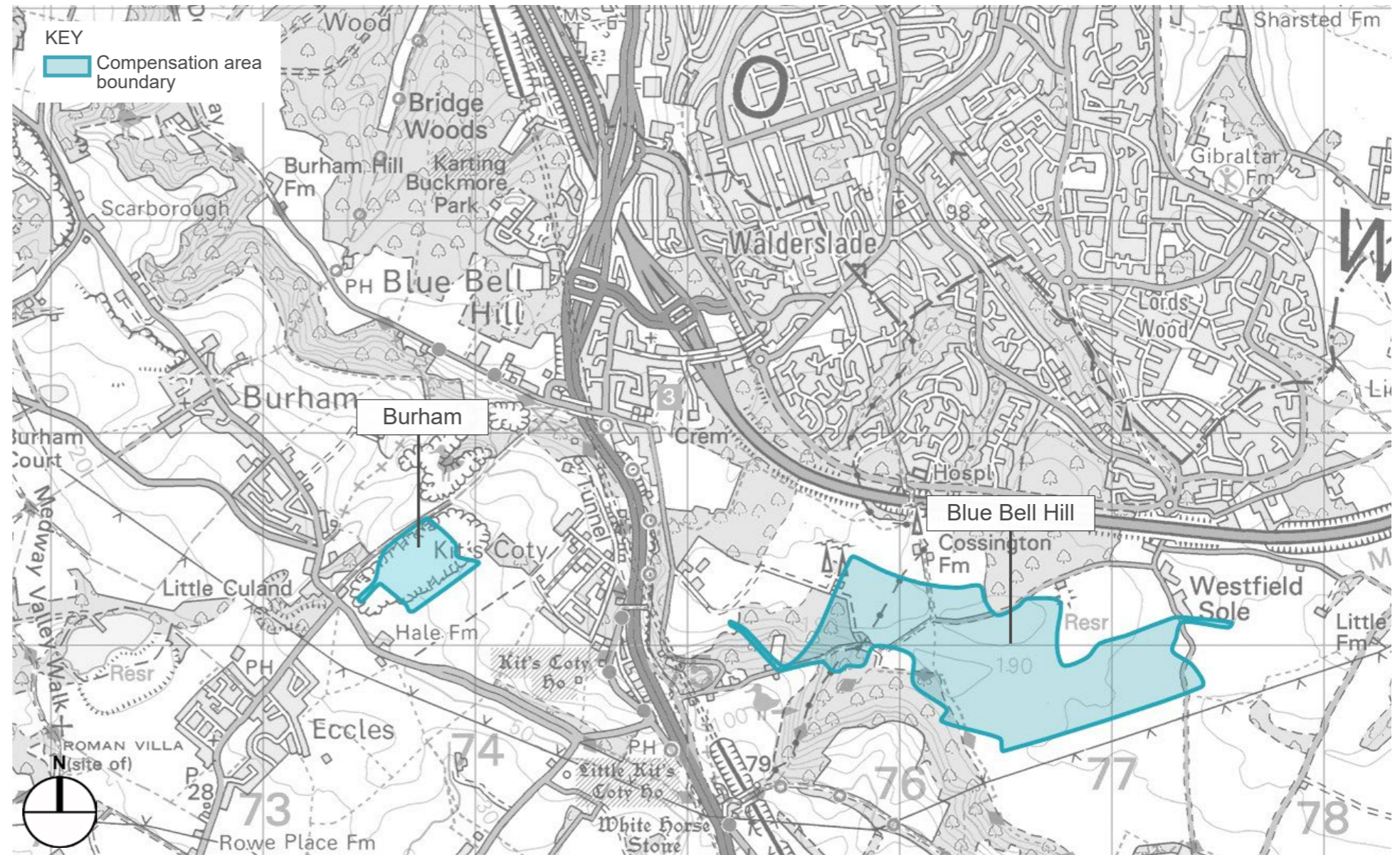
3.2.1. Habitat creation for compensating the effects of nitrogen deposition on habitats around the wider affected road network are mostly integrated into the approach to the landscape character areas, where they coincide with the project itself. However, at the Burham and Blue Bell Hill area, habitat creation for nitrogen deposition effects is proposed at some distance from the Project. This is because some of the effects on the wider road network are further away from the Project route.

3.2.2. This area is located south of Chatham and is made up of privately owned farmland that has been identified, due to their size and proximity to several affected designated habitats, as well as other designated sites that are not impacted by the Project.

3.2.3. The number of these sites bordering this area, such as Frith and Westfield Woods, provide an opportunity to enhance ecological links, including to the North Downs Woodlands Special Area of Conservation.

3.2.4. The compensation area is located within Kent Downs AONB. This provides an opportunity to compensate for effects on the AONB as well as from nitrogen deposition.

3.2.5. For more information on the nitrogen deposition compensation areas, please refer to the Environmental Statement (Application Document 6.3, Appendix 5.6: Project Air Quality Action Plan).



Location of Burham and Blue Bell Hill nitrogen deposition compensation

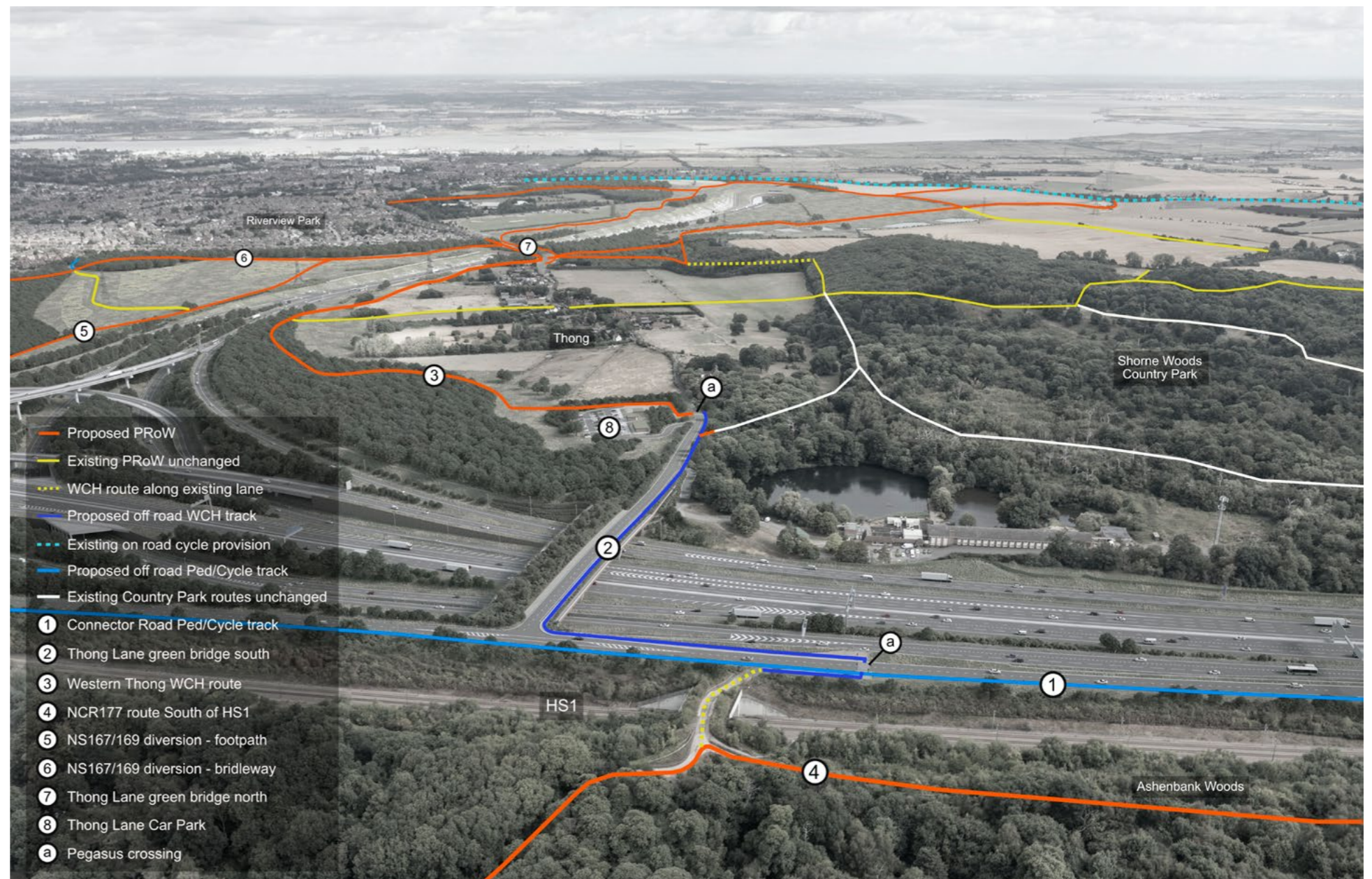
3.3. Routes for Walkers, Cyclists and Horse Riders

3.3.1. The WCH strategy for this region can be divided into two distinct but interconnected proposals. These are:

- a. NCR 177 Realignment: The M2/A2/A122 Lower Thames Crossing Junction severs the existing alignment of Sustrans Route National Cycle Route (NCR) 177 which runs adjacent to the north side of the A2. To ensure continued connectivity for cycle and pedestrian users, an alternative east-west route is proposed to the south of HS1 prior to the closure of the existing NCR177, by upgrading existing tracks and footpaths. On completion of the Project, an additional roadside route south of the A2 is proposed. NCR177 will remain south of the A2, removing the need for overbridges, underpasses and ramps through the M2/A2/A122 Lower Thames Crossing Junction, that would have been required to re-establish it north of the A2.
- b. To provide new links between proposed and existing open areas and the country parks surrounding the M2/A2/A122 Lower Thames Crossing Junction and the South Portal such as Shorne Woods Country Park, Chalk Park and Jeskyns Community Woodland, and to better link these to residential areas. The intended benefit of which is to improve access for WCHs to these country parks, but also to create more local looping routes. They also facilitate onward movement from Chalk Park to the new PRoW network and routes north of the A226.

3.3.2. While the realignment of NCR 177 is located in and around the A2/M2 Corridor the proposal to create recreational loops is spread across the junction and Gravesend Link areas. The individual components of these loops will be discussed in the relevant area of this report but the intended benefit is the improvement of WCH connections across the broader region.

3.3.3. Further detail on the WCH routes can be found in Rights of Way and Access Plans (Application Document 2.7).



Preliminary WCH routes around the A2/M2 Corridor and the M2/A2/A122 Lower Thames Crossing Junction

Further details on the routes for WCHs, including the proposed preliminary designs, can be found in Project Design Report Part E: Design for Walkers, Cyclists and Horse Riders

3.4. Design constraints and opportunities

3.4.1. The main constraints and opportunities with respect to the integration of the Preliminary Design into the region are set out in the table below. These have been considered and integrated into the preliminary design where practicable.

	Constraint	Opportunity
Designated sites	Need to minimise direct loss of land and impact on designated sites such as Kent Downs Area of Outstanding Natural Beauty and ancient woodland.	Improve connectivity between habitats and redress historical severance.
Topography	Retain the natural rolling hill topography as far as reasonably practicable.	Exploit expansive views from the higher ground across the marshes and across the river. The road is in deep cutting in this section. Conceal structures and buildings within this cutting. Use landscape to address exposed urban edge of Gravesend.
Communities	Impact on residential areas and the visual impact of highways structures. Increased noise levels within Shorne Woods Country Park impacting on wildlife and recreational use of the park. WCH routes, particularly NCR 177, need to be reinstated. Increased noise levels for residents of Thong and Riverview Park. Connectivity on NG7, NG8 and NS165 needs to be maintained. Retaining public recreational amenities for community use.	Design landscape and structures to screen the road and associated noise from residents and users of the country park. Explore ways to enhance access and the experience for recreational users of the WCH network and linkages to green infrastructure. Improve connectivity between Shorne Woods Country Park, Jeskyns Community Woodland, Cobham Hall and Gravesend. Potential for elevated view of the Thames and marshes. Use proposals to address the shortage of semi-natural open space to the east of Gravesend.
User experience	Need to accommodate complex set of weaving and merging movements, including local road connections, safely with associated requirements around signage and lighting. Ensure deep cutting and entrance into tunnel does not feel claustrophobic or unsettling.	Create strong and recognisable experience for users of the M2/A2/A122 Lower Thames Crossing Junction to signify the start or end of their journey on the Project. Chalk is a good material to cut into. The deep chalk cutting will be a highly memorable part of the journey. Reduce severance through the use of a green bridge to maintain rural lane character.
Historic context	Maintaining the setting and views from and to the tower of St Mary's Church, Chalk. Impact on Cobham Hall Registered Park and Garden from the new highways layout and associated lighting, gantries, flyovers and loss of central wooded reservation on the A2. Retain the open rural character of the setting of Thong Village conservation area. Mesolithic finds south of the A226.	Use a contextual palette of materials. Balance the landscape design to ensure retention of historical views while screening works where reasonably practicable. Consider the historic site of the former RAF Gravesend airfield and Gravesend Airport. Redress field aggregation and restore hedgerows.
Ecology	Habitats including irreplaceable ancient woodland – impacts must be minimised. Designated sites and habitats – impacts from habitat loss and nitrogen deposition must be minimised and compensated where mitigation unfeasible	Provide well designed mitigation and compensation planting to improve connectivity between Claylane Wood, Shorne Woods and Great Crabbles Wood to the east. Provide interpretation to enhance understanding and appreciation of local ecology. Use green bridge and compensation planting to improve connectivity between Claylane Wood and Shorne Woods and to reconnect habitat and woodland severed by the A2. Exploit landscape character to provide chalk grassland and open mosaic habitat.

Constraint		Opportunity
Existing infrastructure	<p>HS1 and its existing structures.</p> <p>Utilities corridors including high pressure buried gas pipelines and overhead power transmission lines.</p>	<p>Integrate clearances in landscape design to minimise areas of restricted planting. For example by combining with routes for access and maintenance.</p>
Construction	<p>Constructing the junction around an operational A2/M2 corridor.</p> <p>Extensive cutting and filling operations required.</p> <p>Portal box to be constructed away from and above the ground water.</p> <p>Need to minimise construction traffic on the A226 and A2.</p>	<p>Utilise excavated material in the landscape design to reduce construction traffic movements.</p>

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4. A2/M2 Corridor

4.1. Introduction

4.1.1. The A2/M2 Corridor contains the A2 dual carriageway between the M2/A2 connection and the Pepper Hill junction. The Preliminary Design in this area includes the widening of the A2 and associated replacement bridges at Thong Lane and Brewers Road. The A2/M2 Corridor runs through the high ground of the Kent Downs AONB and the character area of Shorne Woodlands.



4.2. Existing context summary

4.2.1. The A2/M2 Corridor area extends from the A2/M2 connection near Strood, to the Pepper Hill junction near Springhead. This area includes the existing A2 road corridor, HS1 railway and surrounding landscape within the Order Limits boundary (Refer to Application Document 2.1, Location Plan).

4.2.2. The A2/M2 Corridor area lies within the Shorne Woodlands character area described in 2.2.1.

4.2.3. Key existing features of the A2/M2 Corridor area are summarised below:

- a. It is the most elevated section of the route, rising to around 110m Above Ordnance Datum (AOD).
- b. The heavily trafficked A2 dual carriageway is a dominant feature, disturbing the tranquillity of the adjacent landscape.
- c. HS1, the high-speed rail route to the continent runs alongside and to the south of the A2 in a cutting.
- d. There are existing green bridges over HS1, particularly around Thong Lane/Brewers Road junction.
- e. Cobham Hall and its associated historic park lie south of the A2 and HS1 with important views across the corridor.
- f. Suburban areas of Gravesend along the north side of the A2 west of the Project route, bring localised urban influences to this part of the landscape character area.
- g. Recreational access to the landscape is also provided at Jeskyns Community Woodland which lies to the south of HS1, west of Cobham and at Ashenbank Wood (also a Site of Special Scientific Interest (SSSI) and ancient woodland) to the north.
- h. PRowS, including Pilgrims Way National Trail, the Darnley Trail and cycle route NCR 177 along the north side of the A2.
- i. The Kent Downs AONB east of the Project route, lies predominantly south of the A2 but extends north to include woodland between Thong and Shorne, and significant areas of ancient woodland close to the proposed M2/A2/

A122 Lower Thames Crossing Junction. These include Claylane Wood, north of the A2 corridor, adjacent to the edge of Gravesend.

- j. The wooded central reservation of the existing A2 reinforces the wooded character of the area and helps to break up the dominance of the existing A2/M2 Corridor.
- k. A SSSI designation covers much of the woodland east of Thong, with an ecology that includes species of fungi, lichens and bryophytes vulnerable to increased levels of pollution. The area forms Shorne Woods Country Park, a popular and well used area of public open space.



Urban edge of Gravesend



Jeskyns Community Woodland



1

Shorne Woods Country Park and the A2



2

Local fishing ponds



3

Brewers Road bridge



4

HS1 and M2 slip road



5

Shorne Woods Country Park



6

Shorne Woods Country Park Visitor Centre



7

Grade I Listed Cobham Hall



8

St Margaret's Church, Ifield

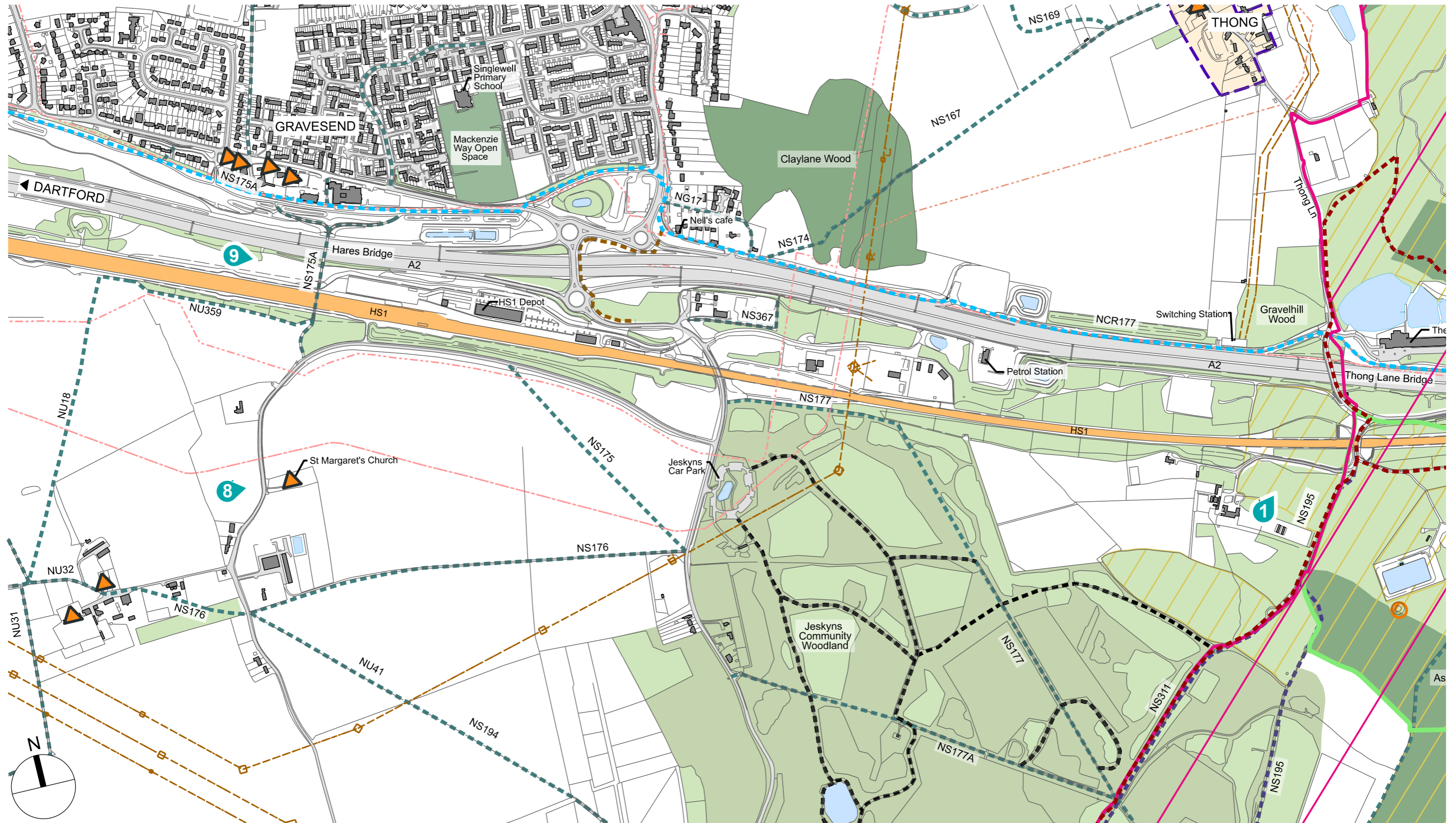


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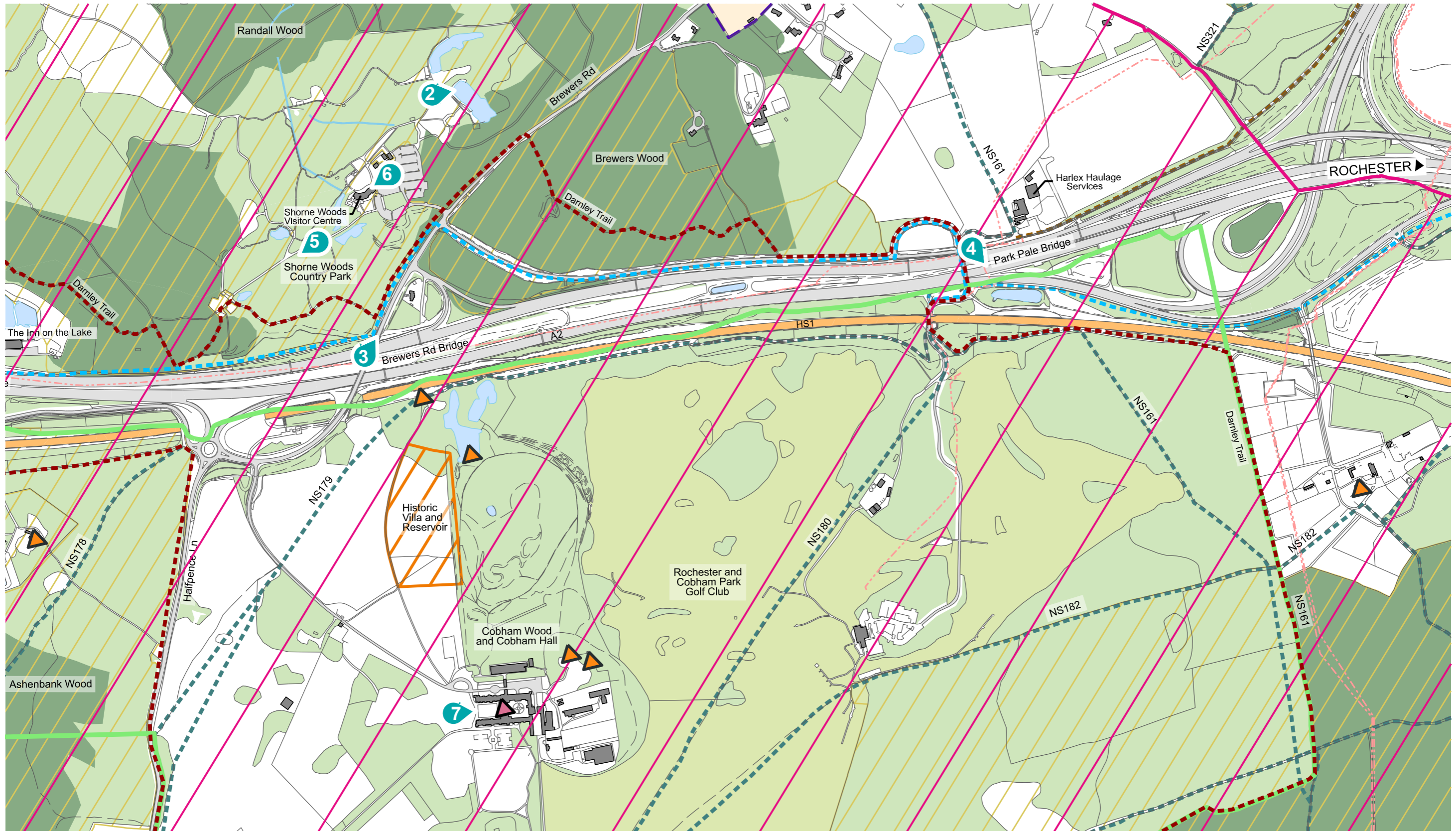
Eastern view along A2 and HS1

Existing context diagram of the A2/M2 Corridor

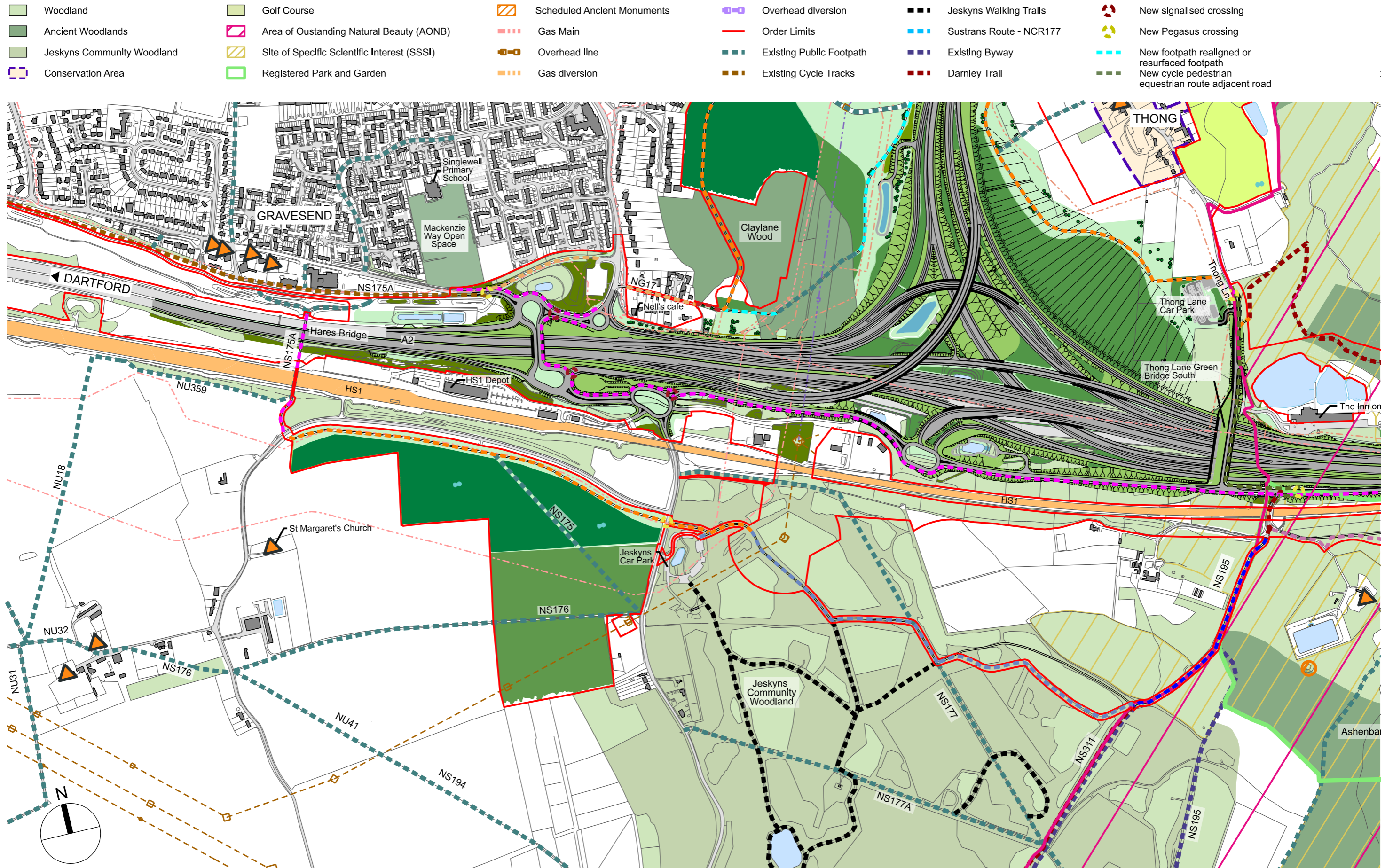
- | | | | | | |
|-------------------|----------------------------|---|---|-----------------------------|------------------------|
| Woodland | Jeskyns Community Woodland | Golf Course | Site of Specific Scientific Interest (SSSI) | Scheduled Ancient Monuments | High Voltage Overhead |
| Ancient Woodlands | Conservation Area | Area of Outstanding Natural Beauty (AONB) | Registered Park and Garden | Below ground Gas Main | Jeskyns Walking Trails |




















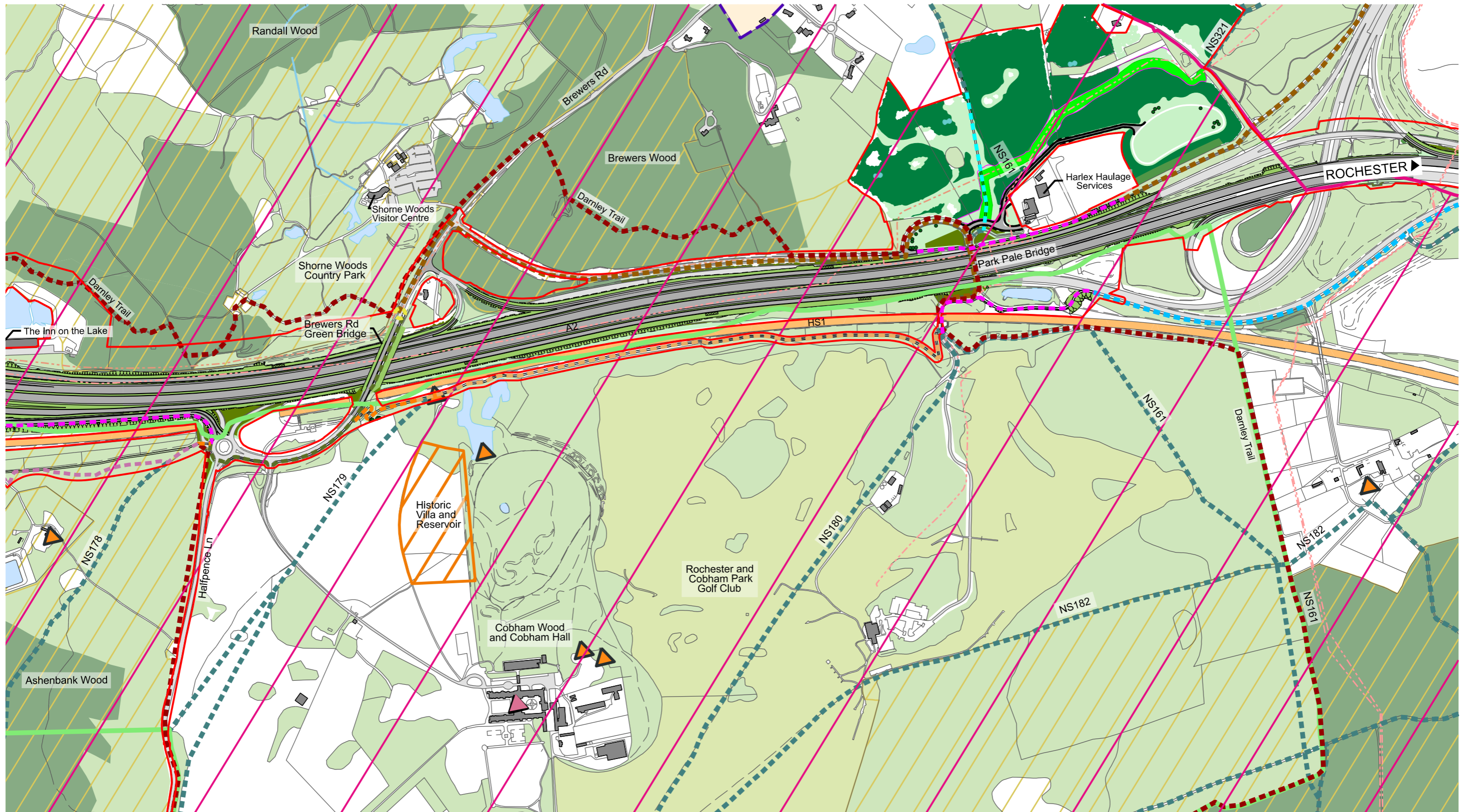
- Existing Cycle Tracks
- Existing Public Footpath
- Darnley Trail
- ▲ Grade II Listed Building
- Existing Byway
- Existing Sustrans Route - NCR177
- ▲ Grade I Listed Building
- Photomarker



Existing context diagram showing proposed preliminary design at the A2/M2 Corridor



- | | | | | |
|---|--|--|---|---|
|  New cycle and pedestrian route |  Existing Permissive Bridleway resurfaced |  Proposed Woodland |  Ancient Woodland Compensation |  Environmental Barrier |
|  Upgrades to existing byway |  New Permissive ped-cycle route |  Proposed Grassland |  NDEP Compensation | |
|  New Bridleway |  Native Hedgerow with Trees |  Proposed Scattered Tree Woodland |  Grade I Listed Building | |
|  Existing footpath upgraded to bridleway |  Untrimmed Native Species Hedge |  Open Mosaic Habitat |  Grade II Listed Building | |



4.3. Preliminary Design: highways and operational requirements

4.3.1. The Project has been designed to commence at the existing A2 and includes the widening of the A2 between the junction with Henhurst Road and Valley Drive through to junction 1 of the M2 to generally provide four lanes each way with hard shoulders.

4.3.2. To achieve the proposed widening of the A2, the alignment has been altered to the west of the M2 junction 1. Through the M2 junction 1 the design includes the widening of the A2 from three lanes to four, with intermittent hard shoulders along this length.

4.3.3. The Preliminary Design was developed in order that the A2/M2 remains near to or at its current vertical alignment.

4.3.4. The Preliminary Design includes the provision of two new two-lane link roads, north and south of the A2, connecting to the existing A289 and the A2 at the eastern end. These link roads have been designed to re-provide the two connections removed from the existing arrangement. Both the eastbound and westbound connecting roads have hard strips.

4.3.5. The Preliminary Design has been developed to accommodate traffic continuing along the A2 via the connector roads, with the connections being made at the M2/A2/A122 Lower Thames Crossing junction.

4.3.6. To minimise the land-take requirement outside of the existing highway boundary, which includes ancient woodland, the design includes the removal of an area of vegetation in the central reservation of the existing A2.

4.3.7. All existing connections onto and off the A2 are maintained within the design.

4.3.8. The design includes the replacement of Brewers Road crossing of the A2 with a new green bridge on the existing route.

4.3.9. Thong Lane crossing of the A2 has been replaced in the Preliminary Design with a new green bridge over the widened corridor to the west of the existing bridge.

Refinement of Preliminary Design in the AONB

4.3.10. The setting of the AONB, Cobham Hall Registered Park and Garden and Shorne Woodlands character area have been taken into account in the design of highways infrastructure by:

- a. Locating signs and signals on gantries wherever practicable, to reduce clutter
- b. Working across disciplines on the use of long cantilevered gantries to minimise the quantity of super-span gantries and reduce the visual impact
- c. Reviewing proposed utility diversion works to minimise their impact on the AONB

4.4. Preliminary Design: utility works

4.4.1. Significant works include the diversion of a medium pressure gas pipeline and some of the electrical assets between the M2/A2 and Shorne and Brewers Woods. The gas pipeline is diverted from Marling Cross to Park Pale where it connects back into the existing network.

4.4.2. Within the Preliminary Design the water mains, power cables and most of the existing communications networks are diverted to the south side of the A2; this is being approached as a middle service corridor between the M2/A2 and HS1.

4.4.3. A water main will be required to cross beneath the M2/A2 at Park Pale to reconnect to the existing network.

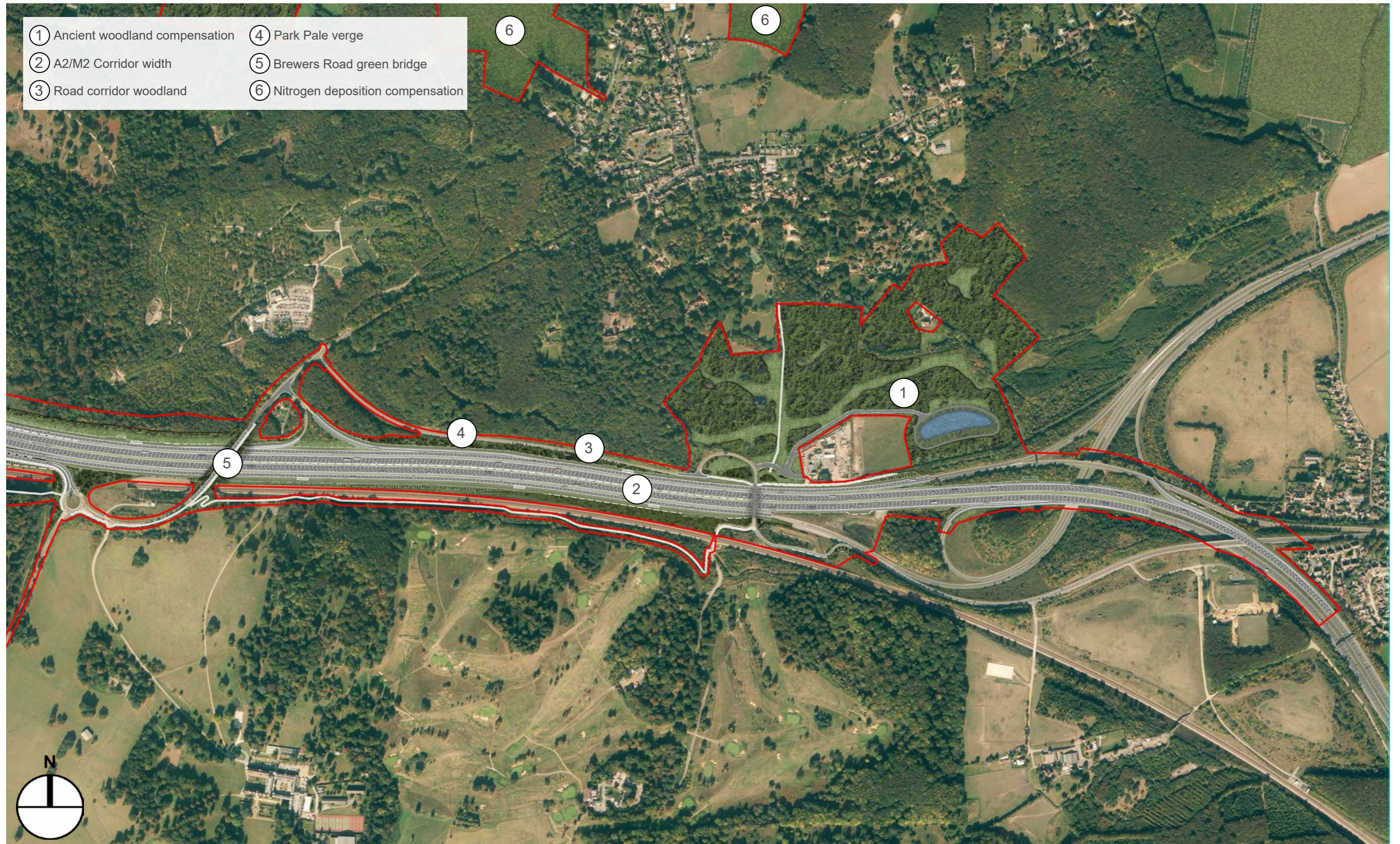
4.4.4. All permanent assets such as substations and valve requirements have been designed to be visually mitigated and integrated with the Project design as far as reasonably practicable.



Existing view of overhead powerlines, looking north towards the River Thames, with the A2/M2 Corridor in the foreground

4.5. Preliminary Design: landscape

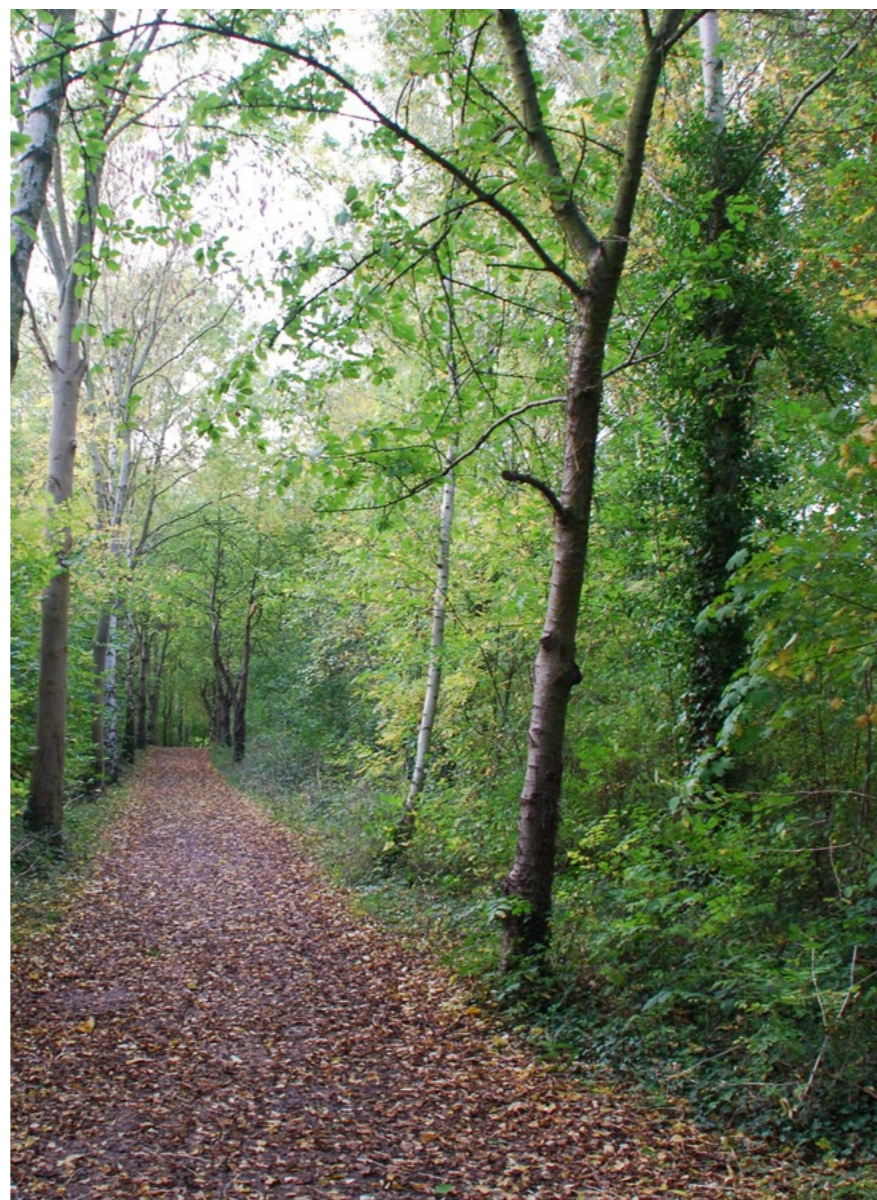
4.5.1. The key proposed landscape components in the A2/M2 Corridor are described in this section.



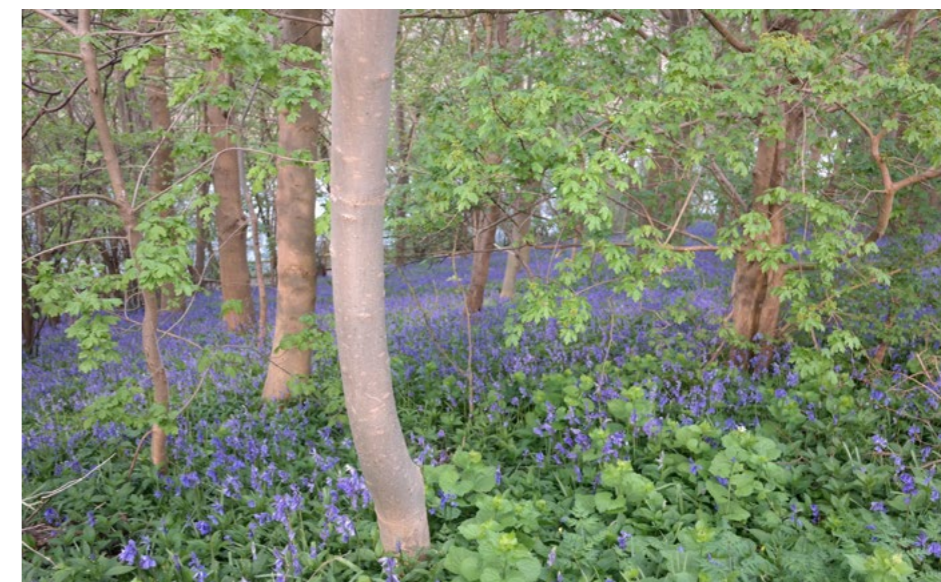
1. Ancient woodland compensation planting between Shorne Woods/Brewers Wood and Great Crabbles Wood

4.5.2. An area of ancient woodland planting proposed between Shorne Woods/Brewers Wood and Great Crabbles Wood has been specifically located to provide a wooded link between these existing woodlands, enhancing the woodland provision in this area. The proposed planting includes individual and small areas of mature trees. A managed process of natural colonisation may be appropriate to limit the risk of disease that could be introduced through planted stock, whilst retaining any minor changes in genetic code a species may have developed to adapt to local conditions.

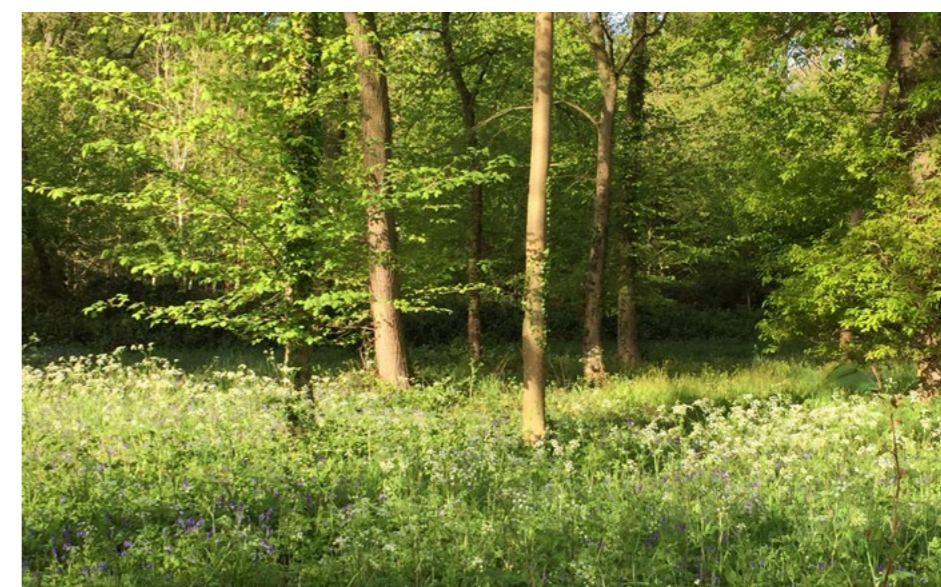
4.5.3. This compensation planting will be combined with an area of open space replacement provision which will act as a 'ride' through the site which as a result provides greater access between areas of existing woodland for both wildlife and people.



Precedent image of 30 year old woodland plantation

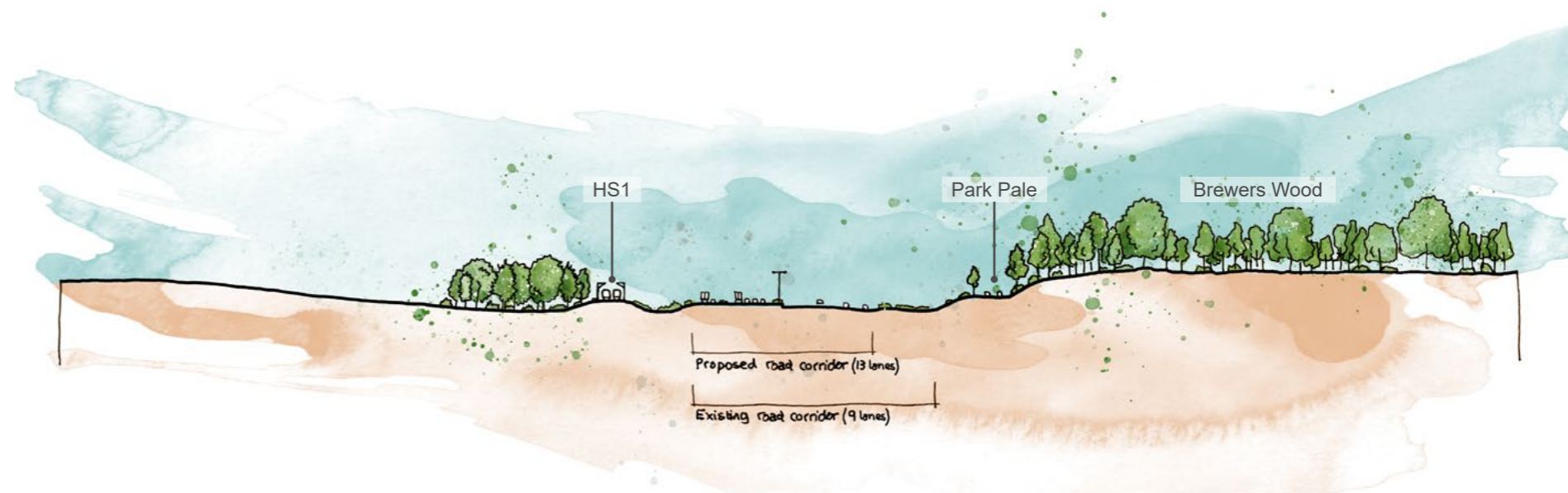


Precedent images of ground flora within ancient woodland



2. A2/M2 Corridor width

4.5.4. Between the Inn on the Lake and the Park Pale overbridge, the eastbound and westbound carriageways of the A2 are separated by a wide woodland belt. To protect Brewers Wood, the proposed carriageways have been grouped more closely, keeping the road corridor as narrow as reasonably practicable and subsequently freeing up additional space between the A2 and Park Pale despite the additional lanes. The space between the widened A2 and Park Pale has been designed to accommodate the diverted utilities which form a large proportion of the land requirements for the Project.



Illustrative cross section through the A2/M2 Corridor

3. Road corridor woodland

4.5.5. The retention of woodland has been designed to be a key factor in the multi-disciplinary development of the A2/M2 Corridor proposals. Woodland reinstatement and woodland edge planting has been proposed where woodland has been removed. With time, the light-demanding woodland edge species creates a dense green edge that limits light within the woodland inner stand helping to protect the existing ground cover that relies upon low light resource limiting the spread of less stress tolerant species. The species with prominent flowering and fruiting within the woodland edge mix creates a visually diverse roadside and a long season food source for pollinators, birds and small mammals.



Existing vegetation along the A2/M2 Corridor

4. Park Pale verge

4.5.6. The realigned A2/M2 Corridor and the design of the utilities diversions has created an opportunity to retain and strengthen the vegetation adjacent Park Pale Road. For further habitat diversity and to create a greater sense of separation between Park Pale and the area of A2/M2 Corridor, parts of the road verge and embankments have been designed to include shrubs with intermittent tree planting, incorporating woody pioneer species.



Existing vegetation along Park Pale

5. Brewers Road green bridge

4.5.7. The existing Brewers Road HS1 green bridge successfully reduces the impact of the rail line on the route, however its benefits are reduced by its connection to the conventional A2 crossing, a link emphasised by the vehicle restraint system which visually gives a sense of urbanisation. The Project has provided the opportunity to complete the green link from habitats north and south of the transport corridor.

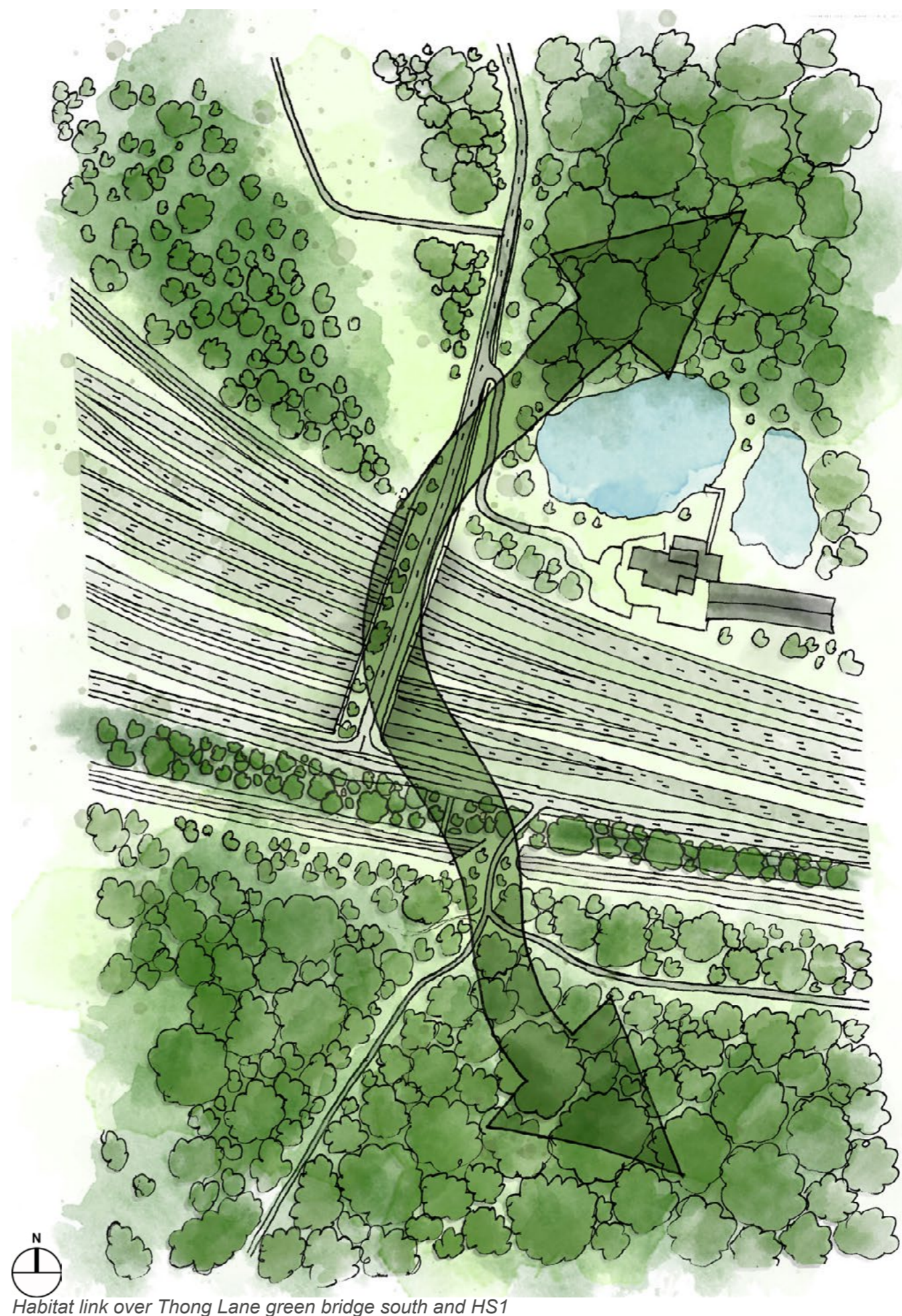
4.5.8. The green bridge soft landscape proposals include a drought tolerant species diverse grassland and drought tolerant shrub mix resembling a woodland edge. The design includes detailed contouring that raises the soil profile in the area of shrub mix, increasing soil volume for rooting capacity and water retention. The raised profiles have also been designed to increase the feeling of separation from the road in the early years of the Project while the planting is establishing. Although the design includes a shrub mix that has been designed to be limited in height, its dense edge helps to reduce people's perception of crossing a bridge while giving the impression of a continuation of woodland prominent in the local landscape.

4.5.9. From the driver's perspective on the Project route, the new Brewers Road green bridge acts as a green gateway and signifies the entrance to/exit from the Kent Downs AONB depending on the direction of travel.

Habitat link between ancient woodland north and south of A2/M2 Corridor and HS1

4.5.10. As part of the HS1 works, green bridges were built for the Brewers Road crossing and to link Thong Lane with the byway west of Ashenbank Wood, with a larger green bridge in between. These bridges link land both sides of HS1, however movement is then interrupted by the A2. The Project has been designed to rectify this by integrating these crossings into complete green corridors between the areas of ancient woodland north and south of the A2/M2 Corridor and HS1.

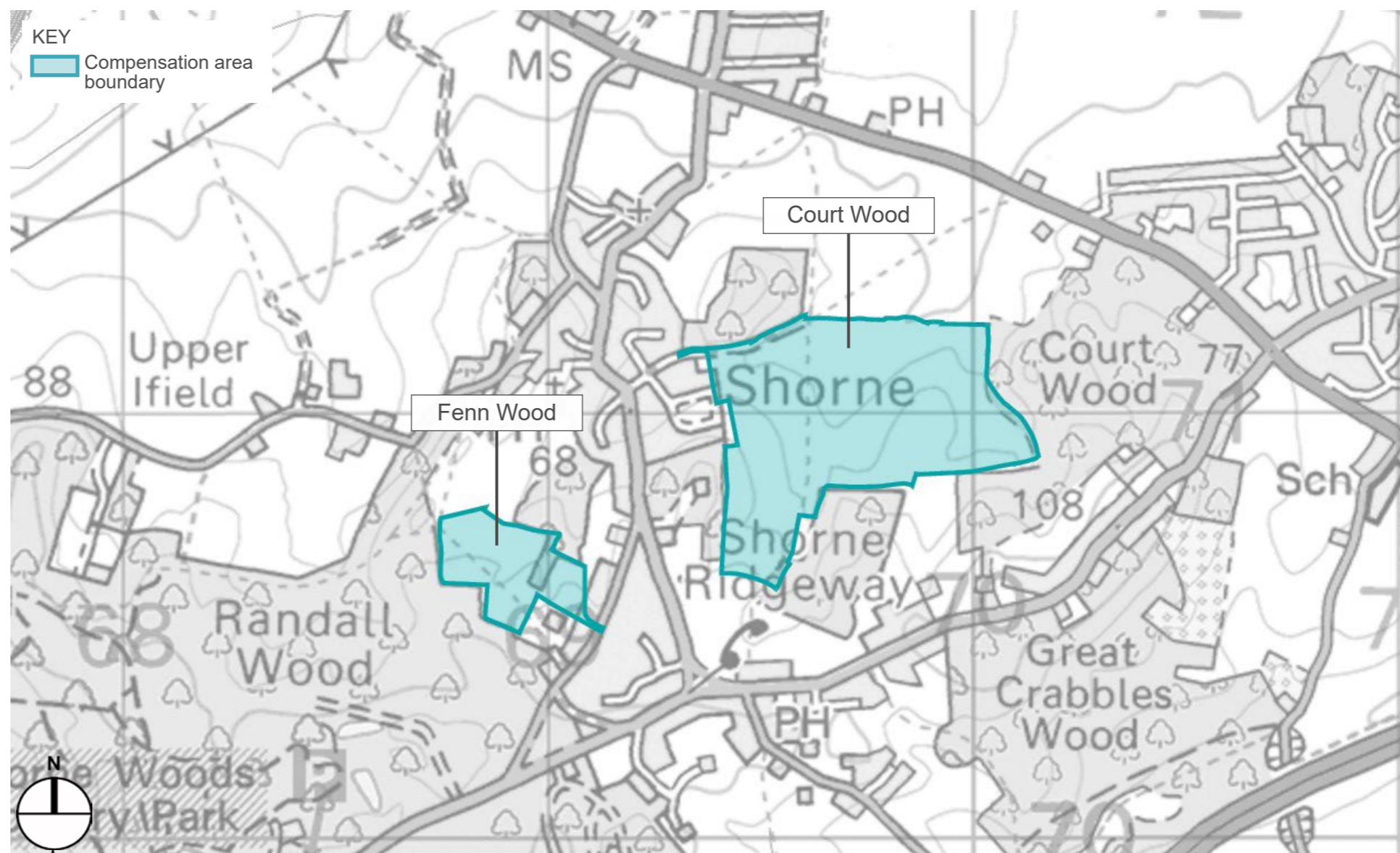
Further details on the preliminary design of Brewers Road green bridge can be found in Project Design Report Part F: Structures and Architecture



Habitat link over Thong Lane green bridge south and HS1

6. Nitrogen deposition compensation to the south of Shorne

4.5.11. Two areas of habitat creation have been specifically located at Fenn Wood and Court Wood to provide additional ecological connectivity between existing woodland habitats. A mosaic of wildlife-rich habitats will be created through natural regeneration and planting to provide a woodland dominated mix of habitats to enhance biodiversity in the area.



Location of nitrogen deposition compensation to the south of Shorne

- ① Ancient woodland compensation and nitrogen deposition planting
- ② A2/M2 Corridor planting strategy



1. Ancient woodland compensation and nitrogen deposition planting west of Jeskyns' Community Woodland

4.5.12. The site of the proposed ancient woodland and nitrogen deposition compensation south of the A2, lies adjacent to the young woodland associated with HS1 and the plantations that form Jeskyns' Community Woodland. However, the site is not near to existing ancient or mature woodlands.

4.5.13. Because of these constraints, the benefits of self-colonisation may be limited. The whip planting option is therefore likely to be most appropriate in this location. The pattern of the ancient woodland compensation has been designed to reflect the historic field pattern of the area and has been set back away from St Margaret's Church in order to preserve the church's setting.

4.5.14. The compensation planting has also been located to improve connectivity between existing habitats, for visual mitigation and to enhance the local woodland landscape character.

2. A2/M2 Corridor planting strategy

4.5.15. The existing A2/M2 Corridor is within a wooded landscape. The planting proposals for this part of the Project have been designed to be predominately woodland. Areas of ancient woodland exist to the north and south of the A2/HS1 corridor and their species composition has influenced the proposed species composition of the plantations at maturity.

4.5.16. However, the design has been developed such that planting will be undertaken in different conditions and as such different mixes have been proposed that, through natural succession and effective management should result in a relatively similar mature composition but will develop in a way that suits the site conditions.

4.5.17. Species mixes are broad in an effort to increase resilience in a changing climate through diversity. Native species with a broad climatic range stretching south have been selected and naturalised and non-native plants, again with a range that extends into warmer parts of the world, have been selected where appropriate.



Illustrative view along Church Road showing proposed compensation planting on the left

Non-native species



Alnus cordata
(Italian Alder)

Nurse species

Native species



Betula pendula
(Common Birch)

Nurse species



Tilia cordata
(Small Leaved Lime)

Ultimate canopy



Sorbus torminalis
(Wild Service Tree)

Broad climatic range

Planting palette

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

4.6.1. Some examples of how the proposed design of the A2/M2 Corridor responds to the 10 Principles of Good Design are described below:

Is inclusive

4.6.2. The inclusion of green bridges across the corridor allows safe access for WCHs. They provide a better-quality experience for people crossing the corridor and connect amenities like Shorne Woods Country Park and Ashenbank Wood, Jeskyns Community Woodland and Cobham Park. Improving recreation access across and along the A2/M2 Corridor is a key aim of the Project's approach to WCHs, for example, the relocation of NCR177. Brewers Road and Thong Lane green bridges have both been designed to equestrian standard.

4.6.3. The green bridges also cater to wildlife with their primary purpose of relinking habitats across the corridor and countering the urbanising effect of the road.

Fits in context

Strengthening the wooded character

4.6.4. Minimising the loss of existing trees, maximising new areas of planting and strengthening the wooded character reinforces local identity, allows the road to fit with context and offers road users the opportunity to understand and appreciate the surrounding landscape heritage.

4.6.5. Through careful implementation and specification, the tree planting within the Preliminary Design has been developed as far as reasonably practicable to:

- a. Retain the historical woodland landscape character within the Kent Downs AONB and strengthen its sense of place for users of that landscape and the road.
- b. Screen the Project and associated infrastructure in the surrounding landscape – especially from within Shorne Woods Country Park (including users of Park Pale) and valuable heritage assets such as Cobham Park.
- c. Provide connectivity of habitat between existing areas of woodland – particularly when combined with the proposed green bridge provision. Provide a legacy of additional woodland areas for public use and enjoyment.
- d. Increase resilience of the woodland through the inclusion of a small proportion of non-native species appropriate to anticipated climate change.

Utilising green bridges

4.6.6. The proposed design of the green bridges responds positively to the aesthetic of their environmental context by utilising appropriate planting - continuing the character and identity of a country lane for example.

4.6.7. Green bridges are still unusual on the strategic road network (SRN), and therefore have been designed to act as local landmarks for people using the network. The planting design has reinforced the wooded character of the area for road users to increase their appreciation of setting and sense of place.

Is environmentally sustainable

Minimise loss of existing trees and maximise new areas of planting

4.6.8. Maximising native woodland, whilst maintaining local character, makes an important contribution to the environment and to the issue of sustainability. Many design iterations of the A2/M2 Corridor and the adjacent M2/A2/A122 Lower Thames Crossing Junction were considered to try and achieve a balance between meeting the operational requirements of the road and minimising impacts on the woodland in this area.

4.6.9. Whilst tree loss has not been avoided completely (including the loss of ancient woodland) in the design of the highway, earthworks and associated utilities diversions, the width of the corridor and the landscape scheme aims to minimise, mitigate and (where this is not possible) compensate for this loss. To this end the Preliminary Design has considered:

- a. Minimising the width of the A2/M2 Corridor to avoid impacts on woodland to the north as far as reasonably practicable
- b. Using sensitively designed retaining walls or steep planted engineered embankments (as opposed to cuttings) to minimise the footprint of the works in the corridor
- c. Planting as many trees as reasonably practicable within the corridor and junction while making allowances for constraints around above and below ground utilities
- d. Providing areas of compensation planting along the corridor

4.6.10. Where tree planting cannot be provided, other green screening or planted solutions have been favoured. For example, additional hedgerow planting east of M2 junction 1 has been provided to screen the road from residents of Watling Street and an environmental barrier is proposed along the edge of Park Pale.

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5. M2/A2/A122 Lower Thames Crossing Junction

5.1. Introduction

5.1.1. This area contains the Project junction with the A2, the slip roads of the junction north of the A2, the cutting leading down towards the South Portal and Thong Lane green bridge north. The area spans both Shorne Woodlands and Chalk Sloping Farmland character areas.



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5.2. Existing context summary

5.2.1. The M2/A2/A122 Lower Thames Crossing Junction area extends from the existing A2 alignment in the south, to Thong Lane.

5.2.2. The M2/A2/A122 Lower Thames Crossing Junction area is located within both the Shorne Woodlands and Chalk Sloping Farmland character areas described in 2.2.1 and 2.2.3.

5.2.3. Other key features of this landscape are summarised below:

- a. The landscape is framed to the south by the wooded ridgeline of Shorne Woods, including Brummelhill and Claylane Woods.
- b. Overhead high voltage powerlines with pylons running south-west to north-east.
- c. Conservation Area in Thong and the open setting to the village.
- d. Thong village sits below Brummelhill Wood. This pattern of settlement below wooded hill tops is common to the broader area.
- e. PRowS linking residential areas through open countryside.
- f. Older roads are often sunken and lined by hedgerows.
- g. Designated sites such as the Kent Downs AONB and its setting.



View of proposed M2/A2/Lower Thames Crossing junction location



Thong Lane, looking north into the village



Views of overhead powerlines



Existing view of switching station adjacent to A2

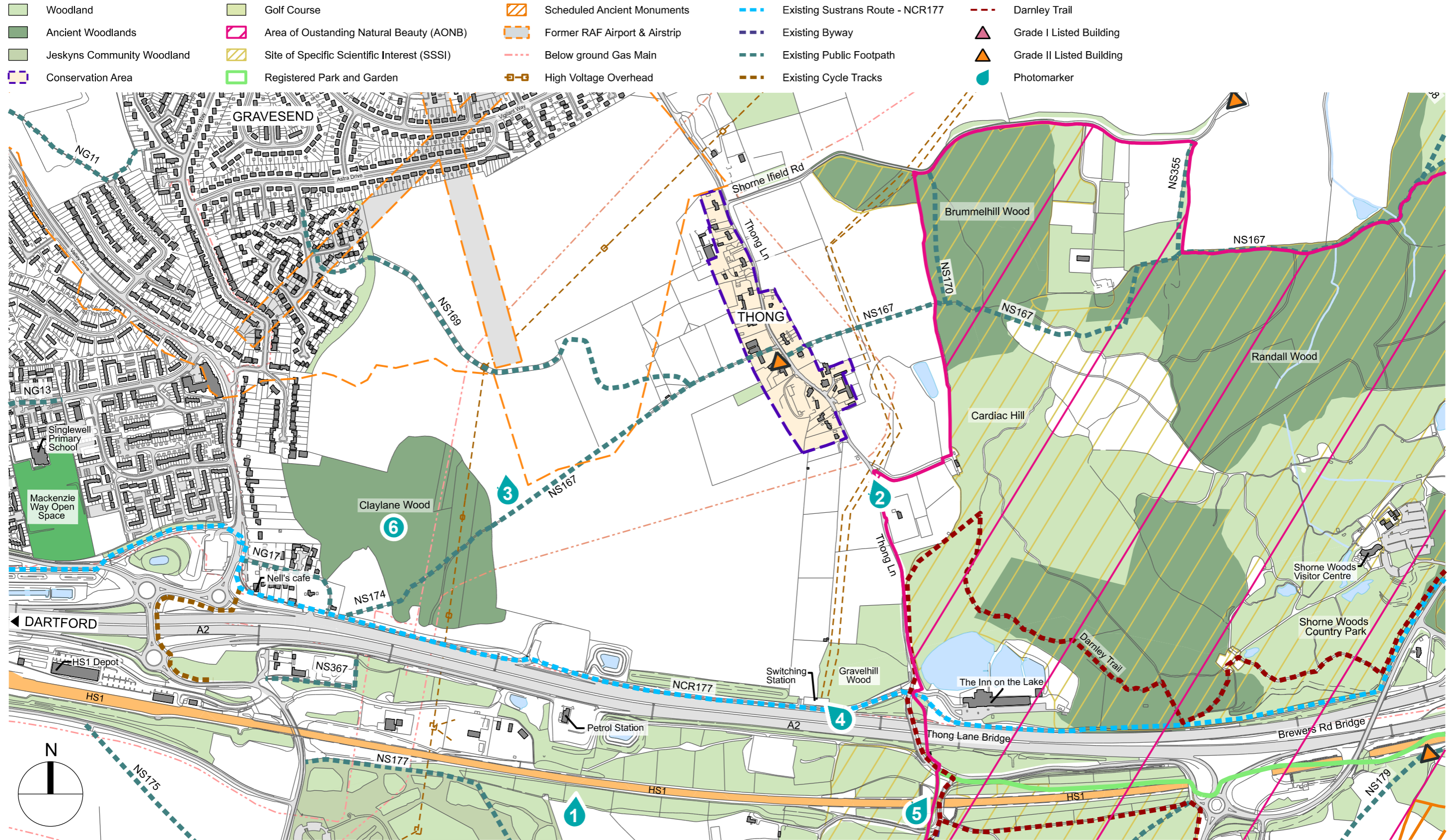


Kent Downs AONB and the Inn on the Lake



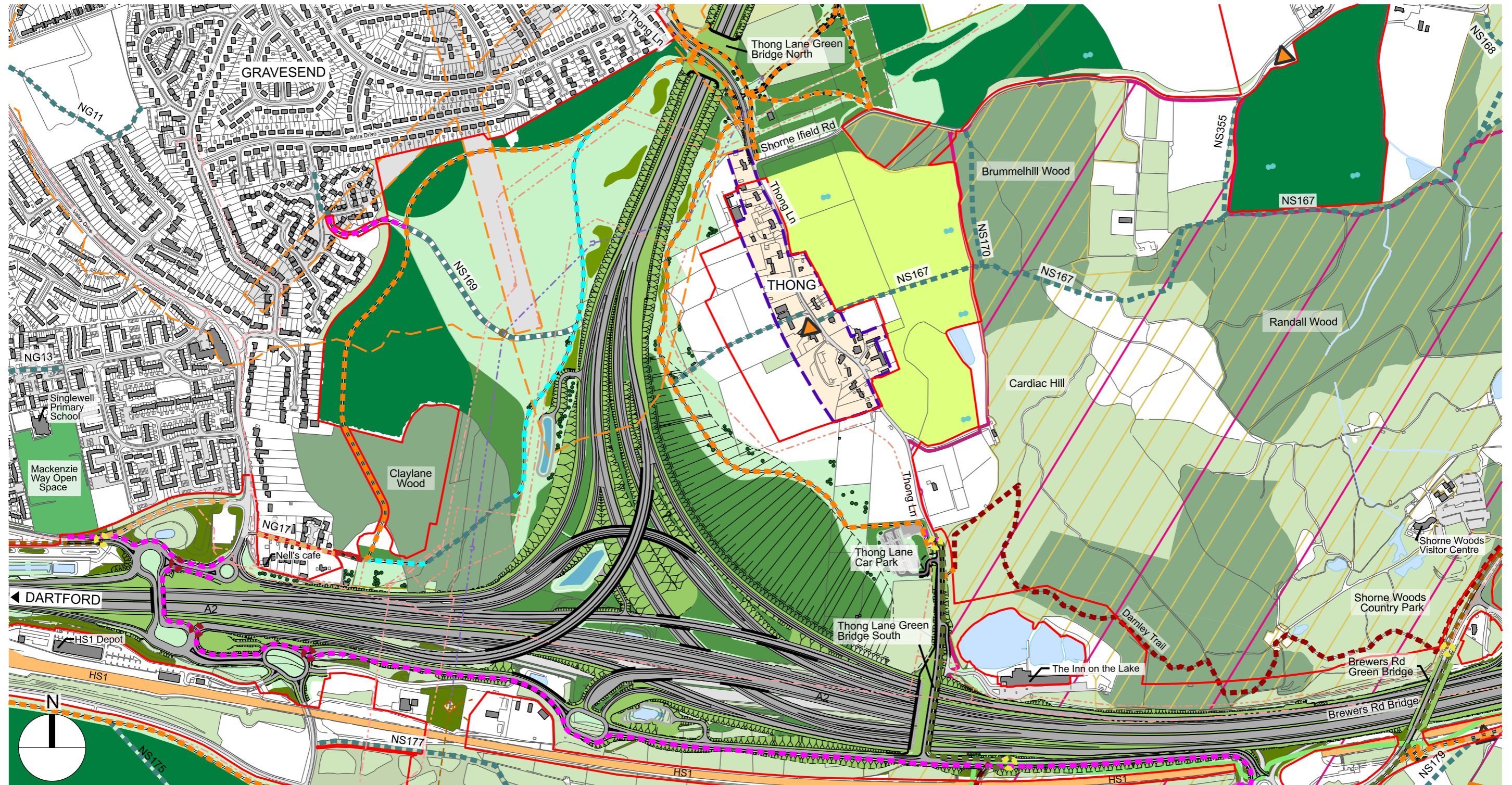
View of Claylane Wood from Thong Lane

Existing context diagram of the M2/A2/A122 Lower Thames Crossing Junction



Existing context diagram showing proposed preliminary design at the M2/A2/A122 Lower Thames Crossing Junction

- | | | | | | | | | | | | |
|--|---|--|-------------------------------|--|---|--|--|--|--------------------------------|--|--|
| | Woodland | | Registered Park and Garden | | New signalled crossing | | Existing footpath diverted and upgraded to bridleway | | NDEP Compensation | | Overhead line |
| | Ancient Woodlands | | Scheduled Ancient Monuments | | New Pegasus crossing | | Proposed Woodland | | Environmental Barrier | | Gas diversion |
| | Jeskyms Community Woodland | | Former RAF Airport & Airstrip | | New footpath realigned or resurfaced footpath | | Proposed Grassland | | Native Hedgerow with Trees | | Overhead line diversion |
| | Conservation Area | | Existing Byway | | New cycle pedestrian equestrian route adjacent road | | Proposed Scattered Tree Woodland | | Untrimmed Native Species Hedge | | Parking facilities for proposed recreational spaces and walking routes |
| | Golf Course | | Existing Public Footpath | | New cycle and pedestrian route | | Reinstated Agricultural Land | | Grade II Listed Building | | Order Limits |
| | Area of Outstanding Natural Beauty (AONB) | | Existing Cycle Tracks | | New Bridleway | | Open Mosaic Habitat | | Gas Main | | |
| | Site of Specific Scientific Interest (SSSI) | | Darnley Trail | | Existing footpath upgraded to bridleway | | Ancient Woodland Compensation | | | | |



5.3. Preliminary Design: highways and operational requirements

5.3.1. Just east of Claylane Wood the proposal includes a new junction to connect the Lower Thames Crossing to the existing A2, providing eastbound and westbound connections.

5.3.2. The Preliminary Design has been developed such that the Project route southbound to the A2 westbound is elevated on an embankment and structure passing over:

- a. The Project route southbound to the M2/A2 eastbound slip
- b. Gravesend east to A2/M2 eastbound slip
- c. M2/A2 westbound to Project route northbound slip
- d. A2 eastbound to A2 eastbound collector road slip
- e. The A2 main carriageway
- f. A2 westbound collector road to A2 westbound slip

5.3.3. The maximum elevation would be approximately +88m AOD (16m above ground level (AGL)).

5.3.4. In the Preliminary Design the Project route southbound links directly to the A2/M2 eastbound and is in cutting (max depth approximately 12m below ground level (BGL) passing under the Project route southbound to A2 westbound connection, the Gravesend East to A2/M2 eastbound connection and the A2 eastbound link road connection, before passing under Thong Lane at-grade.

5.3.5. An off-slip from the Project route southbound to A2/M2 eastbound link has been designed to connect to the A2 eastbound link road, providing access to the A2 and the A289. The link to the eastbound link road is elevated on embankment (maximum height approximately +92m AOD, 15m AGL + additional 4m of false cut), returning to grade as it passes under Thong Lane green bridge south.

5.3.6. A link coming from the Project route southbound to A2 westbound connects directly to a modified Gravesend East junction. The link is approximately at-grade (approximately half length at 2m AGL and half at 2m BGL).

5.3.7. The design was developed with the current A2/M2 connection maintained. Traffic heading for the Gravesend East junction transfers onto the A2 westbound link road and has been designed to be at the current level.

5.3.8. In the proposal, westbound traffic from the M2 on the A2 westbound is able to connect to the Project route northbound in a cutting passing under Thong Lane, the A2 main carriageway and multiple slip roads (maximum depth approximately 12m BGL).

5.3.9. Westbound traffic on the A2 westbound link road, from the A2 or the A289, links directly to the Project route northbound, in cutting passing under Thong Lane at a depth of approximately 8m BGL.

5.3.10. Westbound traffic from the A2 and the A289, on the A2 westbound link road, is able to link to the A2 westbound at-grade, while in cutting under Thong Lane (maximum depth approximately 11m BGL) and the M2 westbound off-slip.

5.3.11. Westbound traffic from the A2 and the A289, on the A2 westbound link road, is able to leave the A2 at Brewers Road roundabout to connect onto the local road network, including access to the Gravesend East roundabout. These links have been designed to be mainly at-grade.

5.3.12. In the proposal the current A2/M2 connection is maintained. Traffic heading for the A2 or the A289 transfers onto the A2 eastbound collector road. The alignment is at the current elevation.

5.3.13. The A2 eastbound connects to the Project route northbound, elevated (maximum height approximately +73m AOD, 4m AGL) on embankment structure and in cutting (approximately 7m BGL) passing under the Gravesend East to M2 Eastbound Loop Road.

5.3.14. Eastbound traffic on the A2 is able to connect onto the A2 eastbound link road, providing access to the A2 east of the M2 junction, and to the A289. This is approximately at-grade, passing under the Project route southbound to A2 westbound connection, elevated (maximum height approximately +92m AOD, 6m AGL) over the M2/A2 westbound to the Project route northbound connection and the Project route southbound to M2 eastbound connection, then approximately at-grade under Thong Lane.

5.3.15. Eastbound traffic from Valley Drive and Gravesend East is able to connect directly onto the Project route northbound. This link is elevated on embankment (maximum height +71m AOD, 7m AGL) before passing into cutting (approximately 7m BGL) as it links to the Project route northbound.

5.3.16. A slip road off the Gravesend East junction to the Project route northbound connection links to the Project route southbound to M2 eastbound connection, providing access onto the M2. The alignment is at-grade except:

- a. Where passing over the A2/M2 to Project route connections and under the Project route southbound to A2 westbound connection it is on structure (maximum height approximately 76m AOD, 8m AGL).
- b. Where passing between the Project route connections and the A2 Eastbound to A2 Eastbound link road it is in cutting (approximately 9m deep).

5.3.17. To maintain connections for local traffic, the proposal includes a two-way local link road provided to the south of the A2 from a new roundabout at Henhurst Road to Brewers Road with an intermediate roundabout connected to a slip road off the A2 westbound. Slip roads are maintained on and off the eastbound parallel connecting road at Brewers Road. On the westbound parallel connecting road, a slip road connects to Brewers Road roundabout, and a westbound connection from Brewers Road roundabout connects to the local link road described above. This link is approximately at-grade.

- a. East of the connection with Thong Lane the road is elevated on an embankment to approximately +100m AOD (6m AGL).
- b. East of the Gravesend East junction the road is elevated on a structure over a balancing pond at approximately +76m AOD (10m AGL).

5.3.18. The Project route continues north between Gravesend and the village of Thong, descending into cutting and passing under Thong Lane green bridge (approximately 9m BGL).

5.4. Preliminary Design: utility works

5.4.1. Significant works include the diversion of two high pressure gas pipelines which need to be diverted in three locations from the A2 interface, crossing the Project tunnel approach and Thong Lane before connecting back to the existing assets.

5.4.2. The works also require temporary and permanent modification to an existing transmission overhead line affected by the Project. Modifications, including a taller new pylon are required at the A2 crossing. A permanent diversion of the powerline is required to enable the crossing of the Project and the Thong Lane green bridge north. To facilitate these works temporary diversions of the overhead powerlines onto temporary pylons are required to maintain supply during the installation of the new permanent assets.

5.4.3. Additionally, there is a diversion of a medium pressure gas pipeline. From the eastern connection point at Marling Cross it is diverted north, under the Project tunnel approach and then back south to the Inn on the Lake and along the M2/A2 to Park Pale where it connects to the existing network.

5.4.4. The majority of the remaining utilities (water, power and communications networks) are being approached as a middle service corridor to bring the utilities to the south of the A2 between HS1 and the A2, from Marling Cross to Park Pale and crossing the A2 in a few strategic locations utilising passages through the proposed structures.

5.4.5. The proposed works in this area include the installation of utilities to supply power and services to the construction sites and the south portal building which permits the removal of a local overhead electricity network and the removal of the associated poles, subsequently opening up views of the local areas.

5.4.6. All permanent assets such as substations and valve requirements have been designed to be visually mitigated and integrated with the Project design as far as reasonably practicable.



View north from Shorne Ifield Road towards the River Thames estuary with existing pylons in the landscape

5.5. Preliminary Design: landscape

5.5.1. Key proposed landscape components in the M2/A2/A122 Lower Thames Crossing Junction area are described below:



1. Thong Lane Car Park

5.5.2. To provide recreational access to the area, a preliminary design for a car park area to the west of Thong Lane has been designated, re-utilising an existing construction compound. This was based on stakeholder feedback from the Design Refinement Consultation where concern was raised that the previous proposed location north of the village of Thong would increase the through-traffic likely to come from the A2 corridor.

5.5.3. The car park design includes an asphalt surfaced with marked bays, and pedestrian walkways between bays. The car park area includes provision for horsebox parking with suitable surfaced parking for 10-12 horseboxes, located away from the main car park circulation.

5.5.4. The car park area repurposes hardstanding and utility connections from the construction phase. Facilities include a building with provision for a kiosk, toilets, changing and storage facility, and provide an area for cycle hire and cycle wash facility.

5.5.5. The location of the car park provides convenient access to connections for the improved local PRow network including a new Pegasus crossing over Thong Lane. The car park will release pressure on Park Pale, a local road where people currently park on busy days, by offering roughly 100 extra spaces for the local area as well as providing horsebox parking, provision for cyclists and other welfare facilities.

5.5.6. A wooded buffer between Thong Lane and the car park, within the constraints of proposed utilities and visibility splays to the car park entrance, provides a more sensitive integration within the existing landscape.

5.5.7. Screen planting has been designed to the north of the car park to screen views from the village of Thong. Boundary planting has been designed to provide and integrate the car park into the surrounding landscape.

5.5.8. The location of substations have been designed to integrate with the character of the car park and surrounding landscape, as far as reasonably practicable.



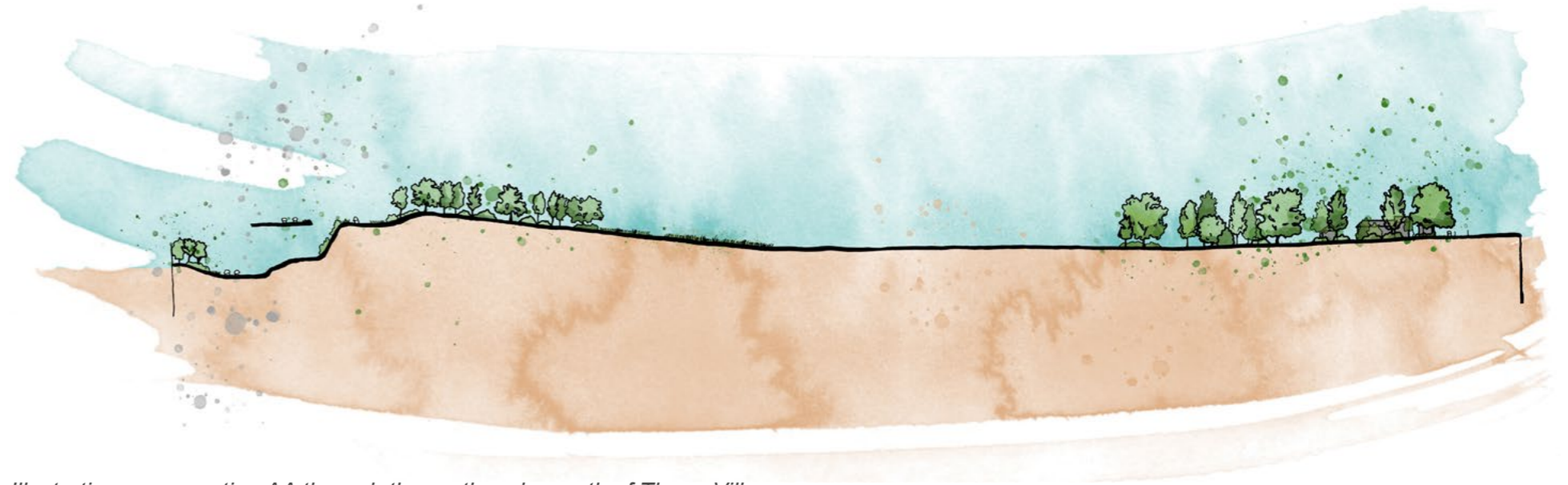
Illustrative aerial view of Thong Lane car park and Thong Lane green bridge south

2. Thong village – Project junction visual separation

5.5.9. Although Thong Lane is quite enclosed both on the approach to the village and within it, the village is surrounded by open land, with arable/equestrian land to the west and pasture/equestrian land to the east. Woodland lies behind the open land both to the east and west. The Preliminary Design includes earthworks between the proposed road infrastructure and the village of Thong. Woodland planting is proposed on the earthworks with open grassland between the village and foot of the earthworks. The design has been developed such that the land falls from the village then rises again before the woodland starts. The relationship between topography and open and wooded land relates to this existing character.

False cut

5.5.10. The false cutting incorporates a shallow bank facing Thong Village. The false cutting profile is further softened by the woodland cover that also acts as a screen for the elevated road and associated infrastructure within the junction. Where topography is unaltered grassland is proposed retaining a sense of openness around the immediate edge of the village.



Illustrative cross section AA through the earthworks south of Thong Village



Illustrative plan showing location of cross section AA cut

3. Junction woodland character visually linking Claylane and Shorne Woods

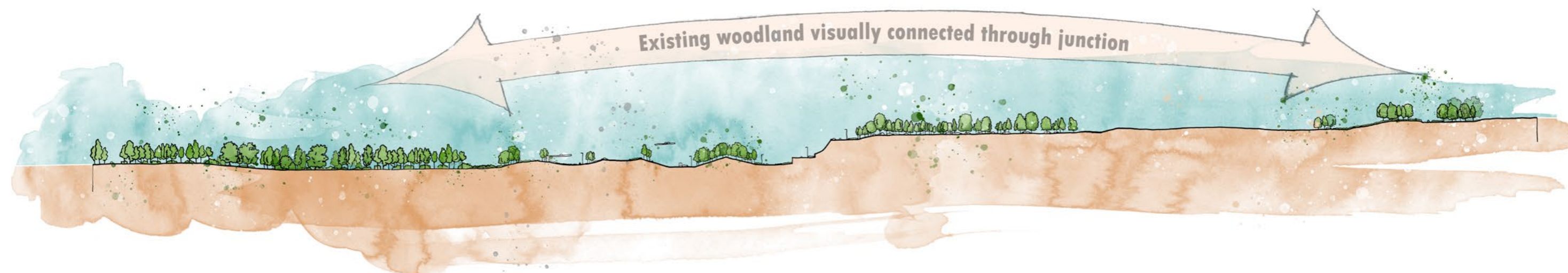
5.5.11. The A2/M2 Corridor is currently heavily wooded with strong woodland planting between the A2 and HS1. To the north of the A2, Claylane Wood adjoins the eastern edge of Gravesend. Gravelhill Wood and Brummelhill Wood form the western edge of the wider Shorne Wood. In between, arable land interrupts the woodland cover.

Wooded junction

5.5.12. Woodland is proposed within the M2/A2/A122 Lower Thames Crossing Junction's land parcels and along its edges. The proposal has sought to create a unified wooded skyline in time, reducing the visual impact of the junction and visually connecting areas of ancient woodland north of the A2. The proposed woodland cover also limits the perceived complexity of the junction for the road's users and strengthens the wooded character of the A2 corridor.



Illustrative view of the junction towards Thong from east of Claylane Wood



Illustrative cross section through the junction showing woodland character that visually links Claylane Wood and Shorne Wood

4. Claylane Wood

5.5.13. Claylane Wood is affected by utilities diversions. It is important that ground disturbance be kept to a minimum to avoid damage to soil profile and ground flora. It is also important that existing coppice stools be left to regenerate and that new planting is undertaken early on. A quickly fused canopy aids the regeneration of the ground flora which has previously coped with periods of openness within this coppice woodland. Elsewhere ground flora has been shown to regenerate after mass tree removal and replanting.



Existing view from footpath NS167 towards Claylane Wood



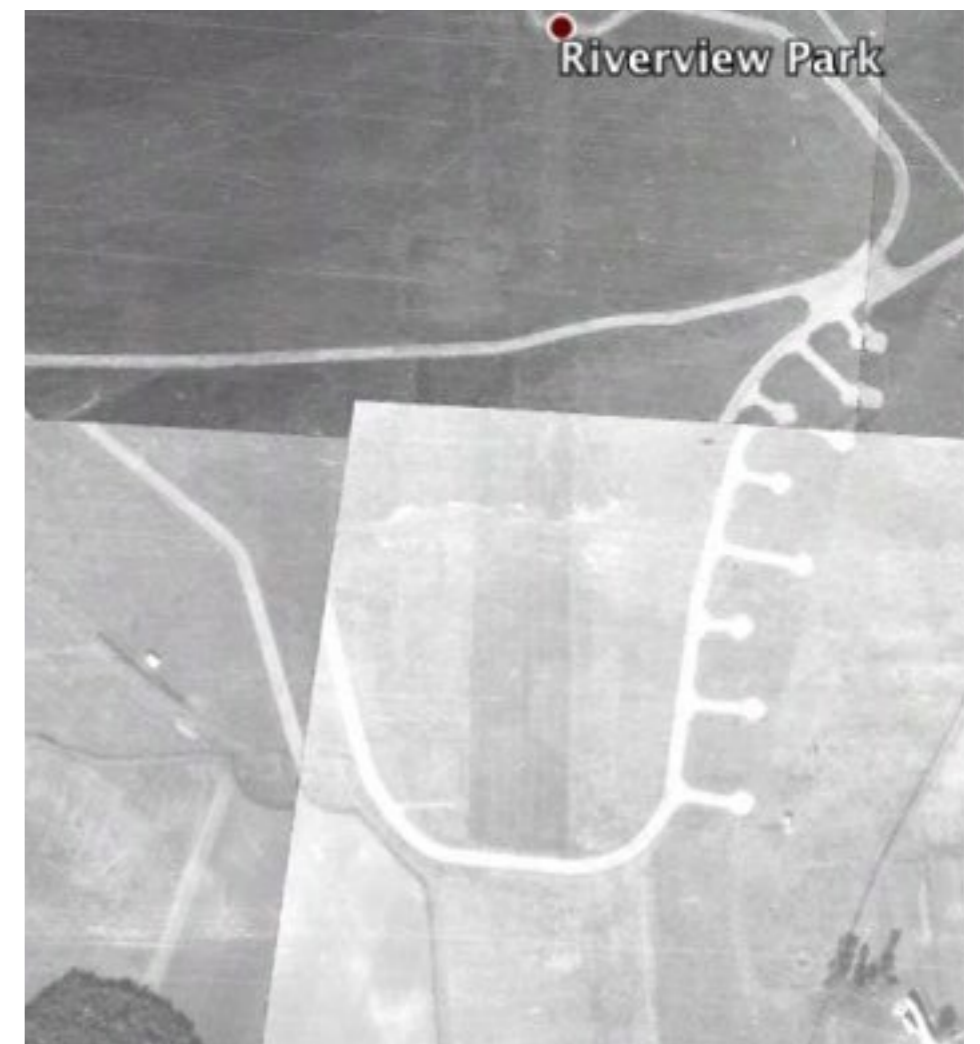
Existing footpath through Claylane Wood

5. Airfield site

5.5.14. The proposal includes variation in grassland vegetation to emphasise the past use of this site as an airport. The woodland and woodland edge planting in this area have been designed to reflect the historic RAF boundary.



Proposed landscape to reflect the former RAF airfield



Historic aerial image of former airfield (Google Earth)

6. Thong Lane green bridge north

5.5.15. Woodland planting along the eastern edge of Gravesend has been designed to form part of a circular wooded habitat corridor linking Claylane Wood and Brummelhill Wood. The green bridge has been designed to form a vital part of this wooded connection. The general arrangement creates a woodland corridor across the bridge that also creates a sense of separation between the Project and local road and WCH routes, whilst still ensuring a limited sense of enclosure around the footway/cycleway created by young woodland. To feel safe and secure, many people need a sense of openness and inter-visibility, especially within a peri-urban setting. Multi-stem hawthorn (*Crataegus monogyna*) specimens have been proposed along the verge between the road and footway/cycleway. The design draws inspiration from remnant hedgerows in the local vicinity, giving the landscape a level of maturity, whilst retaining a sense of openness through eye level inter-visibility.

5.5.16. The land profiles over the bridge aim to increase soil level to create depths capable of sustaining tree planting, whilst minimising path gradients on an arched bridge that needs to tie in with existing road and path levels. Subsequently, the levels of the footway/cycleways lie slightly below the levels of the planting areas between the footway/cycleway and road. This helps to increase the feeling of separation from the road in the early years of the Project whilst the planting is establishing, but retains sightlines between the path and the road.

Further details on the preliminary design of Thong Lane green bridge north can be found in Project Design Report Part F: Structures and Architecture



Illustrative view from Riverview Park towards Thong Lane green bridge north



Illustrative view from Thong towards Thong Lane green bridge north

7. Connection to Brummelhill Woods and Shorne Woods Country Park from Gravesend

5.5.17. A new high intensity space has been designed to provide a connection to the naturalistic recreational space associated with Shorne Woods. The space provides a more convenient entrance for residents of Gravesend, shortening and in many cases removing the need for car journeys associated with recreation. The access route leads from Gravesend, across Thong Lane green bridge north, to woodland (linking to previous land use) that acts as a gateway into Brummelhill Wood and the wider wooded landscape.



Illustrative proposal of the connection to Brummelhill Woods and Shorne Woods Country Park

8. WCH links between Shorne and Ashenbank Wood/ Jeskyns Community Woodland

5.5.18. Gravesend is served well by restorative recreational areas with Shorne Woods Country Park and associated woodland, Jeskyns Community Woodland and Ashenbank Wood all within two kilometres from the edge of the settlement. However, infrastructure to visit these spaces via active travel is limited, with segregated walking and cycling routes often covering only part of the route or limited in their appeal by their proximity to the A2/ M2 Corridor and the associated noise and visual detractors. The Preliminary Design was developed with the aim of reducing car journeys by creating enjoyable routes to and between these local resources for recreation and provide the start of a restorative experience closer to people's homes.

Further details on the routes for WCHs, including the proposed preliminary designs, can be found in Project Design Report Part E: Design for Walkers Cyclists and Horse Riders



Existing WCH bridge over HS1



Existing Hares bridge over the A2



Existing WCH route adjacent to the A2



Existing WCH route adjacent Church Lane

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

5.6.1. Some examples of how the proposed design of the M2/A2/A122 Lower Thames Crossing Junction responds to the 10 Principles of Good Design are described below:

Fits in context

5.6.2. Earthworks around the junction have been designed to mitigate the visual and noise impacts of the road. False cuttings to the south of Thong have been designed with shallow outer banks to screen views of the elevated roadways and blend into the existing topography.

5.6.3. The planting strategy for the junction follows the overarching principle of creating a wooded character to all major junctions on the Project, to integrate the infrastructure and earthworks into the surrounding landscape.

5.6.4. Woodland planting around the slip roads and within the junction itself, draws the character of Shorne Woods into the southern part of this area, strengthening the woodland. Carefully considered planting softens the exposed edge of Gravesend south of Thong Lane and strengthens the linkage between Claylane Wood and Shorne Woods.

5.6.5. Green bridges have been designed to fit into the landscape context by extending the woodland and country lane local character across the Project route.

5.6.6. The Preliminary Design includes woodland planting concentrated at the edge of Gravesend, the former RAF airfield asphalt track retained as part of the wider WCH routes, and the former airstrips reflected by a mixture of woodland, species rich chalk grassland and wildflower meadow planting. The areas of woodland and woodland edge planting on the periphery of Gravesend have been designed to reflect the historic RAF boundary, while an adjacent area of grassland and wildflower meadow reflect the alignment of an historic ditch.

5.6.7. By retaining elements of important local heritage through sensitive and thoughtful landscape design the road development in this area has enabled an enhancement of a sense of place helping to connect the community and future generations to the past.

Response to historic landscape

5.6.8. The woodland planting and wildflower meadows, located north of Claylane Wood have been designed to reflect the remains of a Bronze Age ditch and bank that would have formed a boundary some 3,000 years ago.

Is restrained

5.6.9. The landscape proposals have also been developed to retain open views across the landscape south of Thong Lane and to retain the open setting to the village of Thong.

Is inclusive

5.6.10. Thong Lane green bridge north is designed to retain a natural connectivity between Thong and Gravesend. The bridge has been designed to allow the woodland character to extend across the bridge itself and link the edge of Shorne Woods to Claylane Wood and provide habitat connectivity over the carriageway.

5.6.11. It is also a focal point for WCH provision in the south, becoming the intersection between two looping routes, and helps rationalise the local PRoW network and how existing routes are reinstated across the Project. The width of the bridge combined with the planting has been designed to enhance the quality of experience for users of PRoW in this area.

Is environmentally sustainable

5.6.12. Thong Lane green bridge north and woodland connections make an important contribution to the conservation of the natural environment by providing habitat connectivity and helps to achieve net environmental gain.

Makes roads safe and useful

5.6.13. For road users, within what is a complex junction the earthworks and associated woodland planting help to focus views which contributes to a safe and understandable journey.

6. Gravesend Link and South Portal

6.1. Introduction

6.1.1. This area contains the approach road to the tunnels and the portal openings to the tunnels. Like the A2 junction, the Gravesend Link and South Portal also lie in the Chalk Sloping Farmland character area.



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6.2. Existing context summary

6.2.1. The Gravesend Link and South Portal area extends from the existing Thong Lane in the south to the River Thames and includes the South Portal and the tunnel.

6.2.2. The Gravesend Link and South Portal is located within both the Chalk Sloping Farmland and Shorne Marshes and the River Thames character areas described in 2.2.3 and 2.2.4.

6.2.3. Other key features are summarised below:

- a. Framed to the south by the wooded ridgeline of Shorne Woods.
- b. Overhead high voltage powerlines with pylons running south-west to north-east.
- c. PRow in a north-south orientation linking the A226 and Thong Lane.
- d. Southern Valley Golf Course towards the centre of the area.
- e. Cascades Leisure Centre and sports pitches and Gravesend Golf Centre facilities (Driving Range and Pitch and Putt course) adjoining Gravesend.
- f. Chalk village lies at the north edge of this area adjoining Gravesend, with its church beyond the village to the east.
- g. St Mary's Church, Chalk, lying east of the village along the A226. The church tower is a prominent landmark.
- h. Expansive views from the higher ground of Thong and Shorne towards the River Thames and the marshes.
- i. Older roads are often sunken and lined with hedgerows.
- j. Thames and Medway canal.
- k. The North Kent Railway Line.
- l. The Milton rifle range within the Thames Marshes.
- m. Overhead high voltage powerlines with pylons running east-west in the Thames Marshes area.

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



Northern view towards the River Thames



Exposed urban edge of Gravesend



View from Southern Valley Golf Club to Kent Downs AONB



St Mary's Church, Chalk

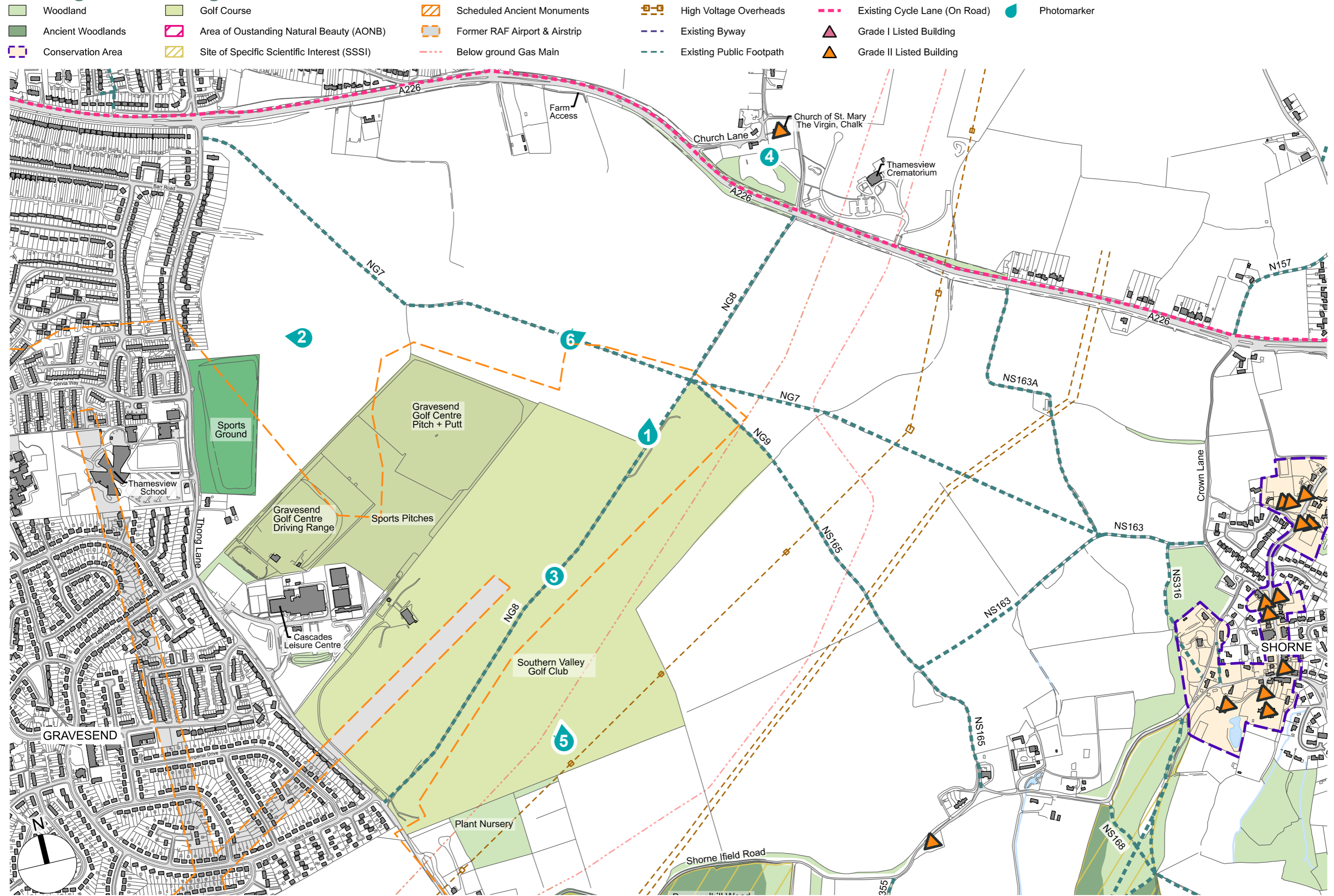


Southern Valley Golf Club



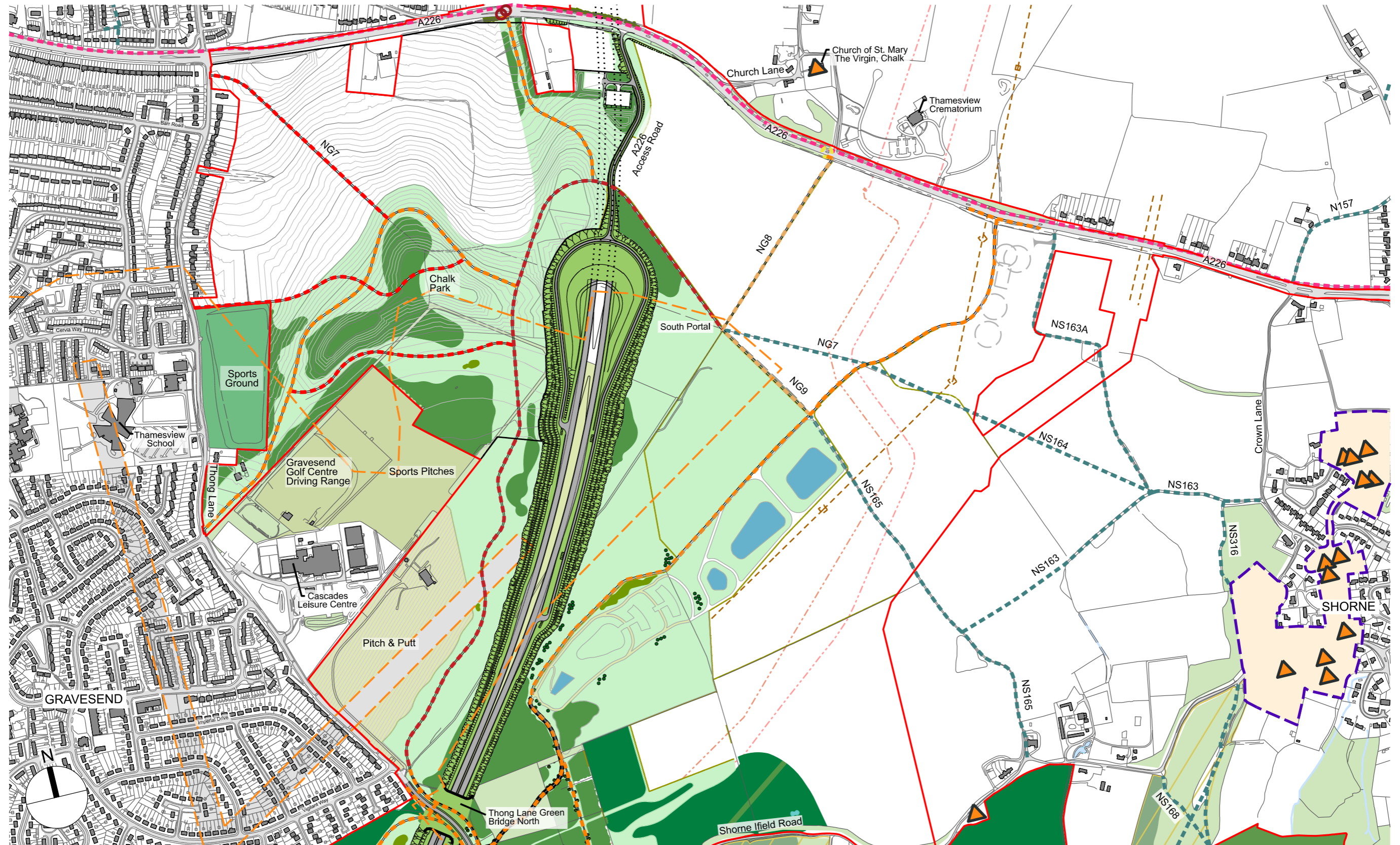
View from footpath NG8 towards the River Thames estuary

Existing context diagram of the Gravesend Link and South Portal



Existing context diagram showing proposed preliminary design at the Gravesend Link and South Portal

- | | | | | | | |
|---|---|---|--|--|--------------------------------|-------------------------|
| Woodland | Site of Specific Scientific Interest (SSSI) | Existing Cycle Lane (On Road) | Existing footpath diverted and upgraded to bridleway | Proposed Scattered Tree Woodland | Native Hedgerow with Trees | Gas Main |
| Ancient Woodlands | Scheduled Ancient Monuments | New signalled crossing | New Bridleway | Proposed Grassland | Untrimmed Native Species Hedge | Overhead line |
| Conservation Area | Former RAF Airport & Airstrip | New pegasus crossing | Reinstated Agricultural Land | Environmental Barrier | Heritage Assets | Gas diversion |
| Golf Course | Existing Byway | Existing footpath upgraded to bridleway | Ancient Woodland Compensation | Parking facilities for proposed recreational spaces and walking routes | Grade I Listed Building | Overhead line diversion |
| Area of Outstanding Natural Beauty (AONB) | Existing Public Footpath | New/improved footpath | Proposed Woodland | | Grade II Listed Building | Order Limits |



6.3. Preliminary Design: highways and operational requirements

6.3.1. From the M2/A2/Lower Thames Crossing Junction, the new route crosses the site of the Southern Valley Golf Course towards the A226, passing into the South Portal approximately 500m south of the A226.

6.3.2. As the highway approaches the South Portal, the central reservation increases in width to align with the tunnel separation. A crossover between the carriageways has been provided on the tunnel approach, to allow for management of traffic in the event of a tunnel closure.

6.3.3. An access road joins the two carriageways by forming a loop which passes over the tunnel at ground level to the north of the South Portal. A single lane access road also connects to the A226 to the north. These roads provide access for emergency services and maintenance.

6.3.4. The South Portal comprises a bowl-shaped excavation and a concrete headwall that functions as a reception point for the tunnel boring machines (TBMs) during construction. A rock trap is required to protect the road from falling debris, upon commencement of the opening of the Project.

6.3.5. Rendezvous points have been included in the scheme close to the north and south portals for the emergency service to be able to have an area to set up for marshalling of resources in the case of a significant incident.

Further information on the preliminary design of the South Portal can be found in Project Design Report Part F: Structures and Architecture

6.4. Preliminary Design: utility works

6.4.1. The works in this area include installing utilities to supply power and services to the construction site on a temporary basis and for the permanent tunnels and south portal building operation.

6.4.2. Significant works include the diversion of a high-pressure gas pipeline from the A2 interface, crossing the Project tunnel approach and Thong Lane before connecting back to the existing assets south of the A226 to ensure compliance and safe operation of the Project and the pipeline.

6.4.3. A new electricity substation has been sited on the southern side of the A226 by the South Portal. The substation is part of the permanent above ground infrastructure. Landscaped earth berms have been proposed, in order for the substation to sit more contextually within the adjacent landscape. The Project proposal permits the removal of a local overhead electricity network and the removal of the associated poles, subsequently opening up views of the local areas.

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



View over Thong looking north-east towards the River Thames

6.5. Preliminary Design: landscape

6.5.1. Key landscape components in the Gravesend Link and South Portal area are described below.



Existing view towards exposed houses at the edge of Gravesend



Existing access into Brummelhill Wood



1. Recreational replacement land

6.5.2. The space between the proposed relocation site for the pitch and putt golf course and the Project route facilitates public access to Chalk Park and on to the wider countryside from Thong Lane. A treed mixed species hedgerow to form the boundary has been proposed, echoing nearby rural boundaries.

2. Cutting edge

6.5.3. Open views across the landscape north of Thong Lane have been maintained. The proposal includes grading back the cutting near to existing ground levels. The graded land allows for the establishment of wildflower grassland, reducing the views toward bare chalk face from the surrounding landscape. The graded back cutting allows fencing to be hidden from view from within the cutting, however if the fencing proposals have a larger impact than envisaged, then an increased level of planting associated with existing landscape features, or localised earthworks may be required. This will limit the fence proposal's ability to emphasise the route and cutting.

3. A226 access road

6.5.4. An emergency access route has been designed from the A226. The road has been positioned along an historical field boundary and has been lined with hedgerows to create the appearance of a typical country lane from within and a field boundary from nearby viewpoints. The proposed hedgerows link with and incorporate remnant hedgerow trees still present along the old field boundary.

4. Field boundaries and woodland mitigation

6.5.5. To the east of the proposed cutting, field boundaries are planted with hedgerows to reverse the appearance of field aggregation, creating a finer grain landscape that is more capable of accepting elements associated with the development. An area of woodland is proposed north of Shorne Ifield Road which responds to the site's topography, extending Brummelhill Wood on to the upper slopes of Harts Hill. Woodland located on higher land is part of the distinct local landscape character.



Illustrative view showing the cutting with wildflower grassland at the top, and in the background, the A226 access road

5. Infiltration basins

6.5.6. To protect the portal from flooding, infiltration basins are proposed south east of the South Portal. Ensuring the proposal maximises the potential of the roadside green estate to reintroduce diverse ecologically valuable planting in areas of intensive arable land has been the key principle behind the landscape proposals. The design of the infiltration basins has responded to existing topography and the basins lie within species diverse grassland parcels, that have been designed to be able to function as stepping stones within monocultural arable land.



6. Historical parish boundary

6.5.7. The design was developed to ensure that the historical parish boundary to the east of the South Portal will be protected during construction and retained. The elevation gain on the west of the boundary creates strong views over the varied landscape to the east. A new WCH route has been designed to make these views more accessible, as part of a wider network of routes, whilst being offset far enough to the west to protect the landform and associated vegetation.



Historical parish boundary (above) and views from boundary looking east (below)

7. Chalk Park

6.5.8. The Department for Environment, Food and Rural Affairs (Defra) family objectives for this area call for woodland creation, habitat buffering and creation of multifunctional accessible spaces to mitigate the impact of the route.

6.5.9. A review of local policy and the existing context has identified a catchment gap for the open space typologies for parks and gardens, and natural and semi-natural green space (Gravesham Borough Council Open Space Assessment – April 2016).

6.5.10. Within the surrounding context, development has generally been located adjacent to wooded hill tops on the lower reaches of the slopes, such as the residential properties in the village of Shorne.

6.5.11. Therefore, the Project has sought to generate a positive legacy of green infrastructure and identified an opportunity to improve access to semi-natural open space. This includes a mitigation proposal that creates a wooded hill in this location providing open space and creating a desirable separation between the South Portal and the edge of Gravesend, whilst also softening the edge of the settlement. The hill proposal references the distinct local characteristic of settlements located on the slopes below a wooded hill.



Illustrative view of Chalk Park



Illustrative view from the top of Chalk Park

Location and access

6.5.12. Country parks provide access to a more naturalistic space for those living in towns and cities and are normally located on the edge of development to facilitate easy access. Although Shorne Woods Country Park is near Gravesend, many people, even from Gravesend, will find it more convenient to drive there. To discourage people from using vehicles to access the nearest country park, it is preferable for there to be an additional public open space on the edge of Gravesend that is within walking and cycling distance.

6.5.13. The proposed Chalk Park is located in an area of land to the north-west of the South Portal, where a new amenity space is most accessible to the residents of Gravesend East. It is also slightly removed from the existing setting of St Mary's Church, Chalk.

6.5.14. It has been designed to provide a recreational landscape for north-eastern Gravesend and Chalk which currently have a limited public open space provision.



Existing view from St Mary's Church, Chalk rooftop west towards proposed location of Chalk Park



Existing view from St Mary's Church, Chalk rooftop west towards proposed location of Chalk Park



Illustrative view of Chalk Park from St Mary's Church, Chalk rooftop

Landform

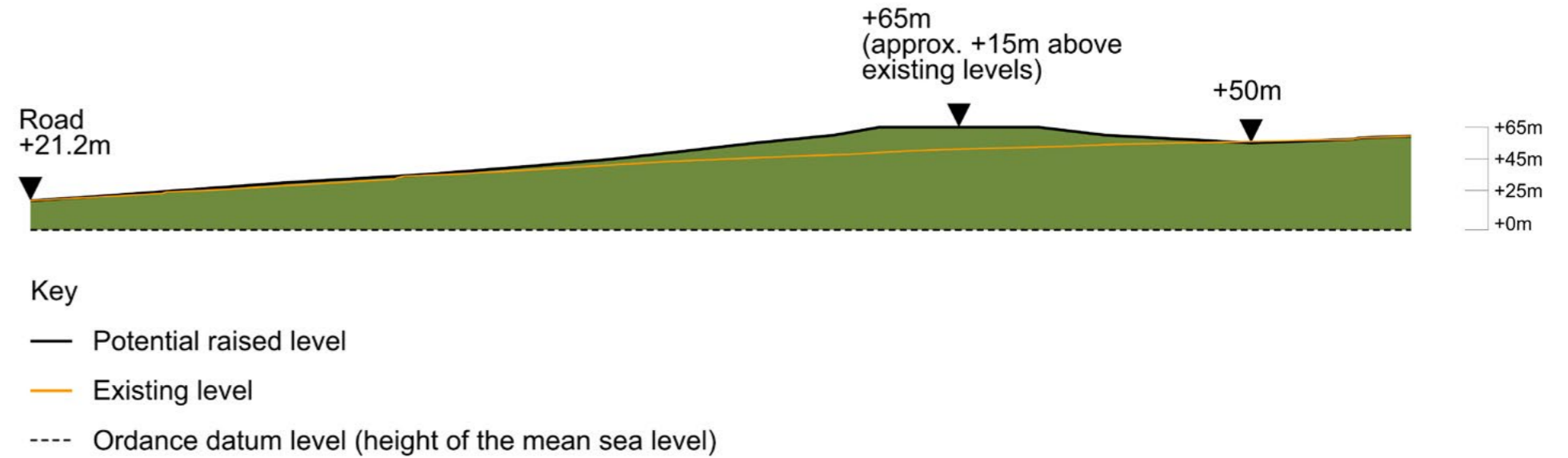
6.5.15. Recreational routes have been designed that build upon the routes of existing PRoW and respond to the proposed topography. The woodland associated with the proposed hill has been moulded to include open land near the summit, providing open views toward the Thames. The made ground gives the opportunity to create favourable conditions for species diverse chalk wildflower grassland.

6.5.16. The landform is shaped by the amount of excavated material from the South Portal and Gravesend link cutting, which produces significant amounts of excavated material: approximately 2,000,000m³.

6.5.17. The Project has developed Chalk Park as a mitigated proposal that makes beneficial reuse of this excavated material onsite. Beneficial reuse was supported by the Environment Agency's (EA) initial scoping opinion and Kent responses at Statutory Consultation as additional benefits including fewer vehicle movements to transport the excavated material, leading to a lower carbon footprint and improved ecological enhancement opportunities.



Chalk Park plan showing contours of the landscape and section cuts



Illustrative cross section AA through the earthworks and A226



Illustrative cross section BB through the earthworks and the Project at Chalk Park

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

6.6.1. Some examples of how the proposed design of the Gravesend Link and South Portal responds to the 10 Principles of Good Design are described below:

Fits in context/is restrained

6.6.2. The South Portal structure is concealed from the wider landscape by being designed to be contained within the cutting and tunnel approach. Locating the portal, and associated traffic and infrastructure (signage, gantries and lighting columns) in the cutting retains the open views across the landscape in this area.

6.6.3. The chalk cutting faces offer potential for establishment of valuable habitats with the top few metres of the cutting being proposed to be graded back to allow the establishment of chalk grassland. This prevents the edge of the cutting being exposed across wider views.

6.6.4. The form and profile of the chalk cutting face helps to create a seamless transition between the M2/A2/A122 Lower Thames Crossing Junction and the South Portal. Terracing of the chalk cutting face encourages natural colonisation of vegetation and reduces the glare from sunlight for road users as they enter or leave the tunnel.

6.6.5. Fencing has been designed to be located within the chalk cutting, retaining the open views.

Response to historic landscape

6.6.6. The local area has a number of historical points of interest, and the design responds to this historical context by:

- a. A series of infiltration basins have been relocated further south of the A226 to avoid a deeply buried Mesolithic campsite found during archaeological trial trenching.
- b. The Order Limits have been altered and woodland mitigation planting has been relocated to avoid an important Medieval settlement found north of the Upper Ifield trail.

Is innovative

6.6.7. Excavated material from the cutting and portal has been used to create Chalk Park – a bold landscape and recreational space, to the west of the South Portal. This enhances the quality for WCH users and provides open views north towards the River Thames and marshes.

Is environmentally sustainable

6.6.8. It is proposed that excavated material from the tunnel will be reused locally, this makes an important contribution to the issue of environmental sustainability by limiting lorry journeys.

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