

High Speed Two Limited
Engineering Options Report
Heathrow

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March 2012

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

ARUP

Preface

This report was submitted to Government by HS2 Ltd at the end of March 2012 and is part of a suite of documents produced to provide preliminary advice to Government on potential options for phase two of the high speed rail network.

For details of the initial preferred scheme selected by Government, please see the Command Paper "High Speed Rail: Investing in Britain's Future - Phase Two: The route to Leeds, Manchester and beyond". The initial preferred scheme will form the basis of further engagement. A preferred scheme will be published in 2013 that will form the basis of full public consultation.

Anyone reading the March 2012 reports should be aware of the following:

- The reports describe the development of options. The base proposition referred to is not a recommended or preferred scheme.
- The reports describe route and station options serving Heathrow T5. The options do not reflect an initial preferred scheme. The Government has announced its intention to suspend work on high speed rail options to Heathrow until the Airports Commission has reported.

Where the Ordnance Survey Licence Number is shown on maps it should read 100049190.

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1 Introduction

1.1 Arup's Commission

(1.1.1) Arup was commissioned by HS2 Ltd to undertake a study of route engineering options for a proposed connection between the London to West Midlands trunk high speed line and Heathrow Airport.

(1.1.2) This report concerns only the engineering issues.

1.2 The Layout of This Report

(1.2.1) This report is laid out as follows:

- Chapter 1, this chapter, is introductory.
- Chapter 2 outlines a brief history of work which has looked at a Heathrow connection.
- Chapter 3 is the engineering description of the spur and loop alignment.
- Chapter 4 describes the station at Terminal 5.
- Chapter 5 describes the historic route alignments.
- Chapter 6 describes the historic station options.
- Chapter 7 is a glossary of terms.

1.3 Remit

(1.3.1) In September 2011, HS2 Ltd instructed Arup to review options for connecting the trunk HS2 route to Heathrow Airport Terminal 5. This remit was to consider:

- A junction with the trunk HS2 route to allow traffic to travel to and from the north and the Continent to Terminal 5;
- The optimum alignment between the trunk HS2 route and Terminal 5;
- A suitable station design and connection to Terminal 5; and
- The implications of making any of the identified route options a loop, rather than a spur, at a later date.

1.4 Design Standards

1.4.1 HS2 Ltd Technical Specification

(1.4.1) The HS2 Project Specification Version 2 was applied to this work. This sets out the engineering, operational and performance requirements for the route, and sets out the engineering design parameters.

1.4.2 Area Specific Specification

(1.4.2) Specific requirements for this work were provided by HS2 Ltd and include:

- The connection between the Heathrow Spur and HS2 trunk route shall be 230km/h; and
- The alignment shall be able to support a line speed of at least 160km/h.

The geotechnical issues have only been addressed in an indicative manner to aid comparison of the options. However, it should be noted that the area does have a number of current, past and potential future gravel extraction sites. The existing and past sites are of unknown and variable depth. Although some are backfilled with material of unknown properties, some are lakes. The unknown depth and properties of these features causes risk to foundations for structures, settlement of embankment over them and depth of tunnels under the features.

1.5 Geographical Setting

(1.5.1) The study area runs north-south, aligned with the broad valley of the River Colne, in which the M25 is situated, again running north-south. The valley bottom features a number of current, past and potential future gravel extraction sites, the historic ones often now filled with water bodies used for recreational purposes, together with golf courses, and valley/country parks.

(1.5.2) This north-south axis is interrupted at regular intervals by major east-west transport routes; the Chiltern Railway, the M40, the A40, the Great Western Main Line and the M4 (whose interchange with the M25 is a four-level junction presenting obstacles to route location) and the A4. These present major constraints on both horizontal and vertical alignments.

(1.5.3) Uxbridge lies to the immediate east of the Colne valley, while to the west of the M25 are Denham and Iver Heath, with Wraysbury Reservoir further south.

(1.5.4) Heathrow Airport is situated at the southern end of the study area, and its complex of approach roads, motorway junctions and perimeter roads present more obstacles. The study assumes that Terminal 5 is the ultimate destination of the Heathrow Spur or loop. Sub-surface options would overcome the constraints, while a surface solution is highly constrained.

2 A Brief History of Heathrow Work

2.1 A Brief History of Heathrow Work

(2.1.1) Within their report to Government entitled *High Speed Rail – London to the West Midlands and Beyond* published in March 2010, HS2 Ltd recommended that Heathrow was best served by a station at Old Oak Common.

(2.1.2) HS2 Ltd was later asked to develop route options for a direct high speed link to Heathrow, including options for a loop and a spur from the main trunk route of HS2.

(2.1.3) HS2 Ltd concluded that a spur to Heathrow offered the best solution and that an alignment roughly following the M25 was preferred.

(2.1.4) Several locations were considered for a station, including:

- Central Terminal Area;
- Terminal 5;
- A site on the Northern Perimeter Road; and
- Iver on Great Western Main Line (GWML).

(2.1.5) These locations were the subject of previous Arup work.

(2.1.6) HS2 Ltd considered the evidence and concluded that the most suitable location was a station at Terminal 5.

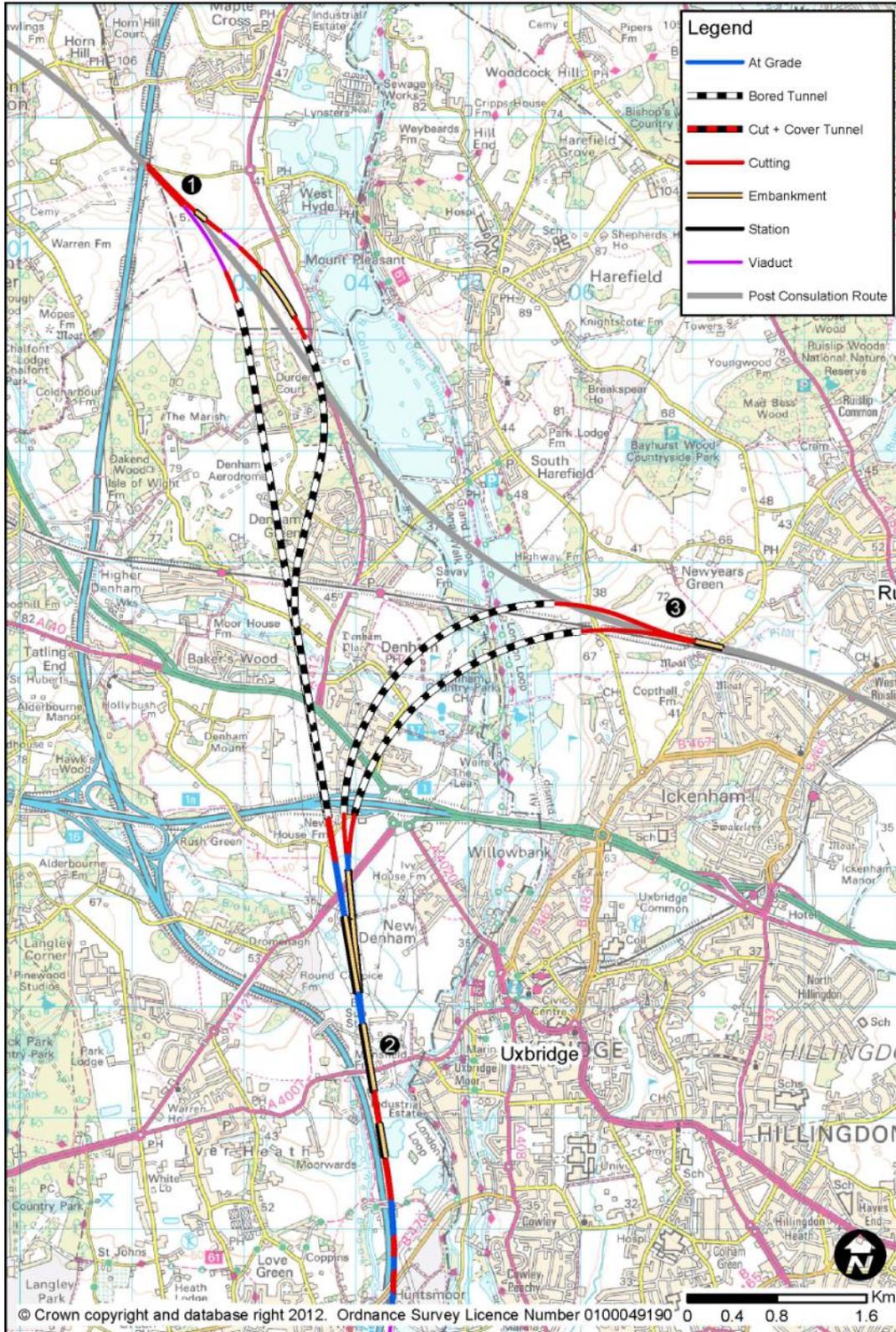
(2.1.7) The work within this report considers the options to serve Terminal 5 with a spur broadly following the M25.

3 Line of Route: Engineering Description

3.1 Line of Route

(3.1.1) There are a limited number of options available within this corridor for the route. The connection to the trunk HS2 route can only be made over a short length given the position of the Colne Valley Viaduct and Chiltern and Ruislip Tunnels. The configuration and location of northernmost section is largely fixed by these constraints. Equally, the end point of the spur is fixed at Terminal 5.

(3.1.2) The following sub-chapters describe the alignment options which remain after a review process by HS2 Ltd. The discounted options are presented in Chapter 5.



3.2 HSH02: Spur Alignment to Terminal 5

3.2.1 Birmingham-Facing Connection

(3.2.1) The Birmingham-facing connection would start immediately after the Chiltern Tunnel portal on the trunk HS2 route (1). There would be high speed 230 km/h turnouts off both the up and down main lines.

(3.2.2) The southbound line would pass between the trunk HS2 line and the Colne Valley lakes, passing over an access track on a short bridge, then descending steeply before entering a retained cut. The route would turn southwards entering a single-track bored tunnel with a line speed of 160 km/h and passing under the A412 and HS2 trunk route. It would remain in tunnel below Denham, emerging south of the M40. Further work would be needed to optimise the portal locations to minimise the impact on the SSSI at the edge of the water bodies in the Colne Valley.

(3.2.3) The northbound line would descend less steeply having left the trunk HS2 route, on a gentle southwards curve, before entering a single-track bored tunnel. Like the southbound connection, it would remain in tunnel but passing to the west of Denham, emerging south of the M40 alongside the southbound track. The tunnel would require an intervention shaft, which could be placed in a suitable location adjacent to roads.

(3.2.4) The north and southbound Birmingham-facing connection run parallel from this point towards Heathrow.

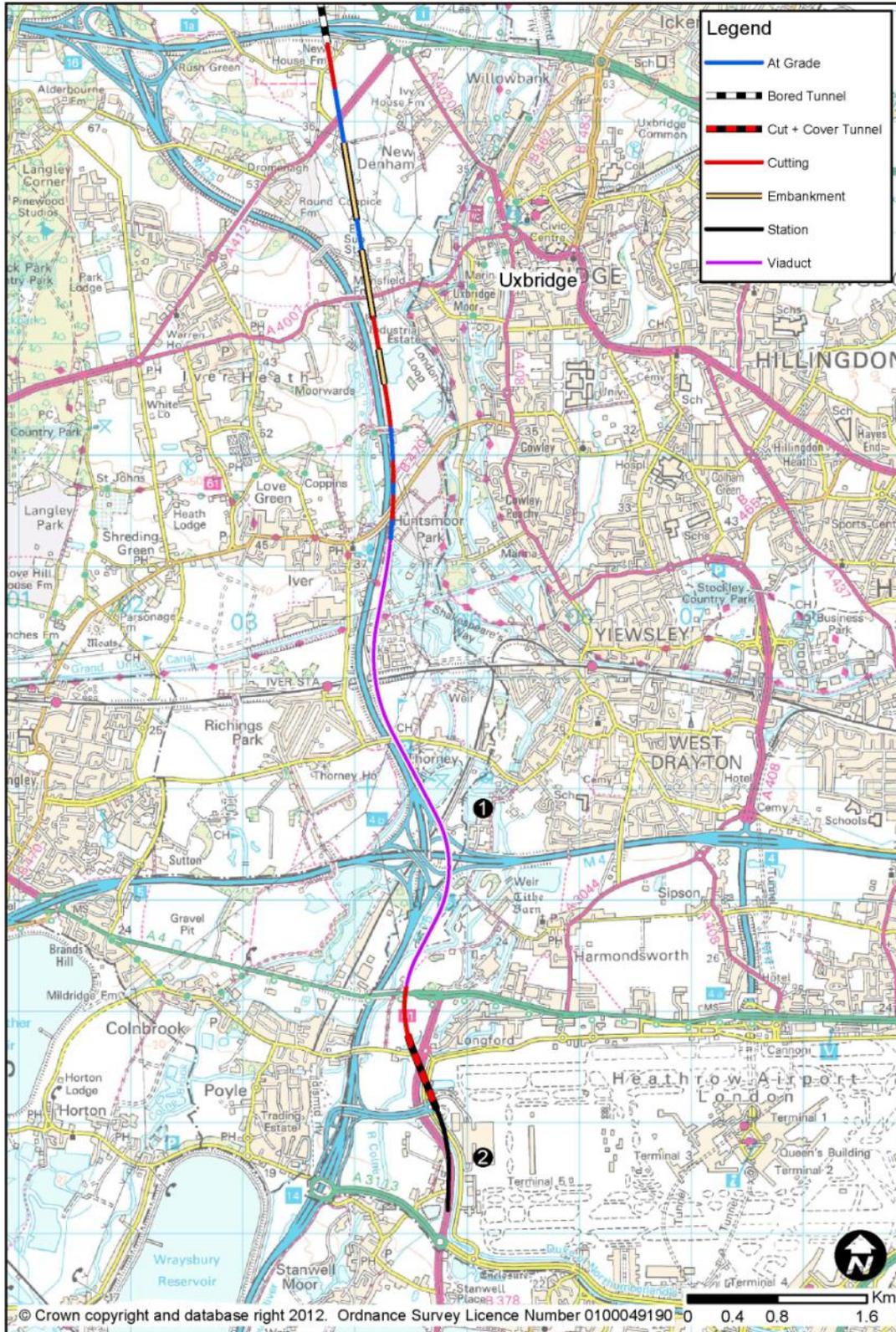
(3.2.5) The alignment would progress south on embankment and low level viaducts and would provide flat junctions with the Continent-facing connection, alongside Uxbridge Moor (2). From this point southwards, there would be two tracks towards Heathrow.

3.2.2 Continent-Facing Connection

(3.2.6) The Continent-facing connection would comprise 160km/h turnouts on both the up and down trunk HS2 route in the vicinity of Breakspear Road South (3).

(3.2.7) The northbound Continent-facing connection, on the northerly side of the trunk HS2 route, descends sharply, passing below Harvill Road and the trunk HS2 route in a retained cut. The route would then enter a single-track bored tunnel, which would continue to south of the M40.

(3.2.8) It would pass below water bodies at a relatively shallow depth, with about 15m from the crown of the tunnel to the water surface. The tunnel would require an intervention shaft, which could be placed in a suitable location adjacent to roads.



(3.2.9) The northbound tunnel returns to ground level south of the M40, between, and about 100m from, both the Birmingham connection tracks and southbound Continent-facing connection track and continues on the surface parallel to those before joining them through a flat junction.

(3.2.10) The southbound Continent-facing connection also descends steeply, passing below Harvill Road and the Chiltern Railway in a retained cut, before entering a single-track bored tunnel. It continues to descend steeply, passing below the water bodies with about 15m of clearance from the tunnel crown to surface of water.

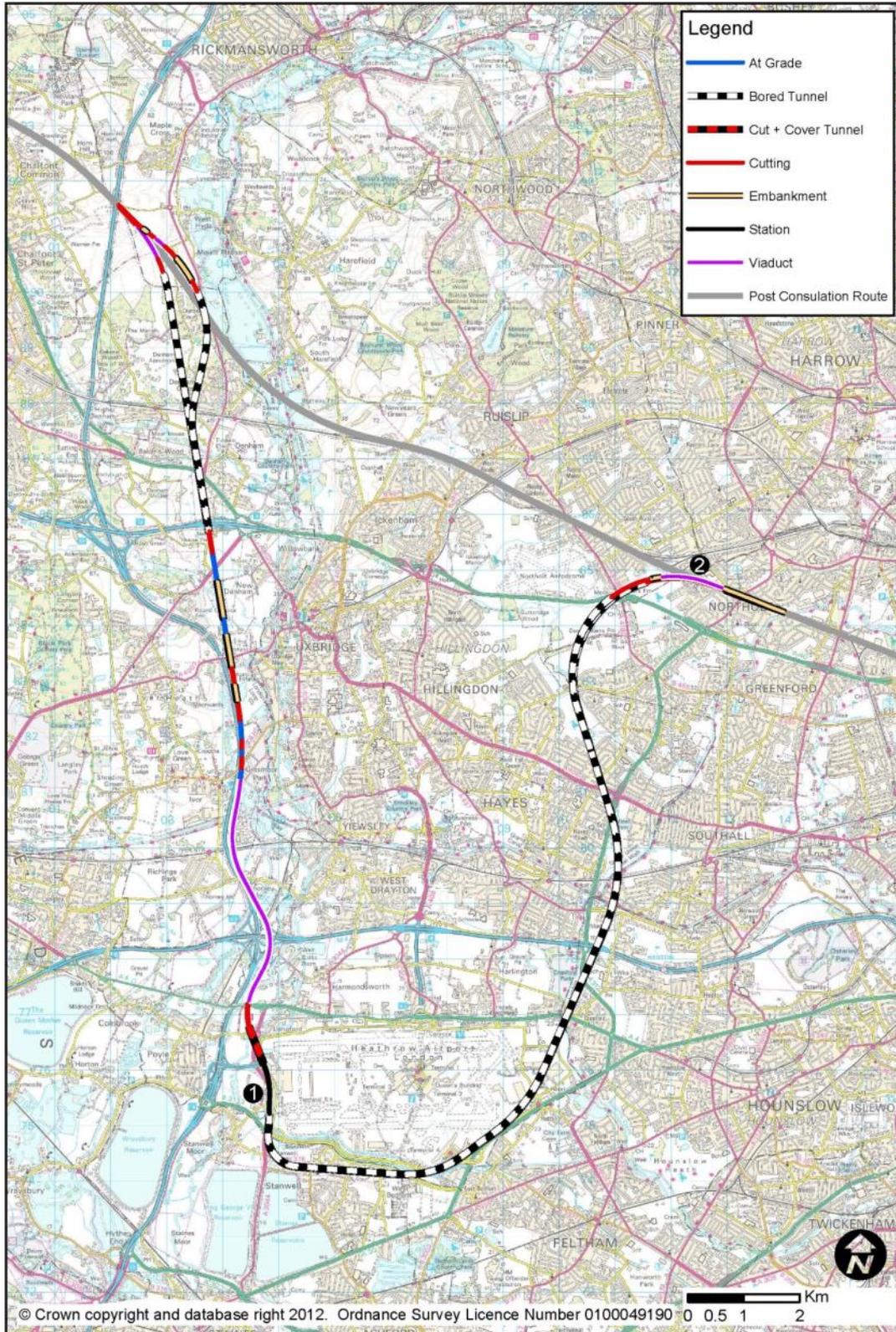
(3.2.11) The section under the lakes would be bored tunnel. If this is not viable then shallower construction could be adopted but this would require significant temporary works within the lake. These temporary works could comprise cofferdams and temporary dewatering of the construction area, with construction of the tunnel using a system such as precast units. The water could then be refilled around the constructed tunnel. The tunnel would have to be permanently drained.

(3.2.12) The southbound connection remains in tunnel until south of the M40, emerging about 100m east of the northbound Continent-facing connection, continuing at ground level until it joins the other lines through a flat junction.

3.2.3 Alignment to Heathrow

(3.2.13) The alignment heads south closely following the M25 on the eastern side. South of the portal the route involves a series of cuttings, embankments and at grade sections to keep the route at a similar elevation to the motorway. Cuttings are up to five metres deep and embankments up to three metres high.

(3.2.14) South of the B470 the route is on viaduct structure, crossing the Grand Union Canal and Great West Main Line and then climbs steeply to pass over the M4/M25 junction (1). The highest point of the viaduct is about 2m above the highest slip road carriageway of the M4/M25 junction before descending to pass into a short length of cut and cover tunnel to ensure the necessary clearance to the northern runway exclusion zone. The alignment then rises slowly to enter a North/South oriented station at Terminal 5 (2).



3.3 HSH03: Loop alignment

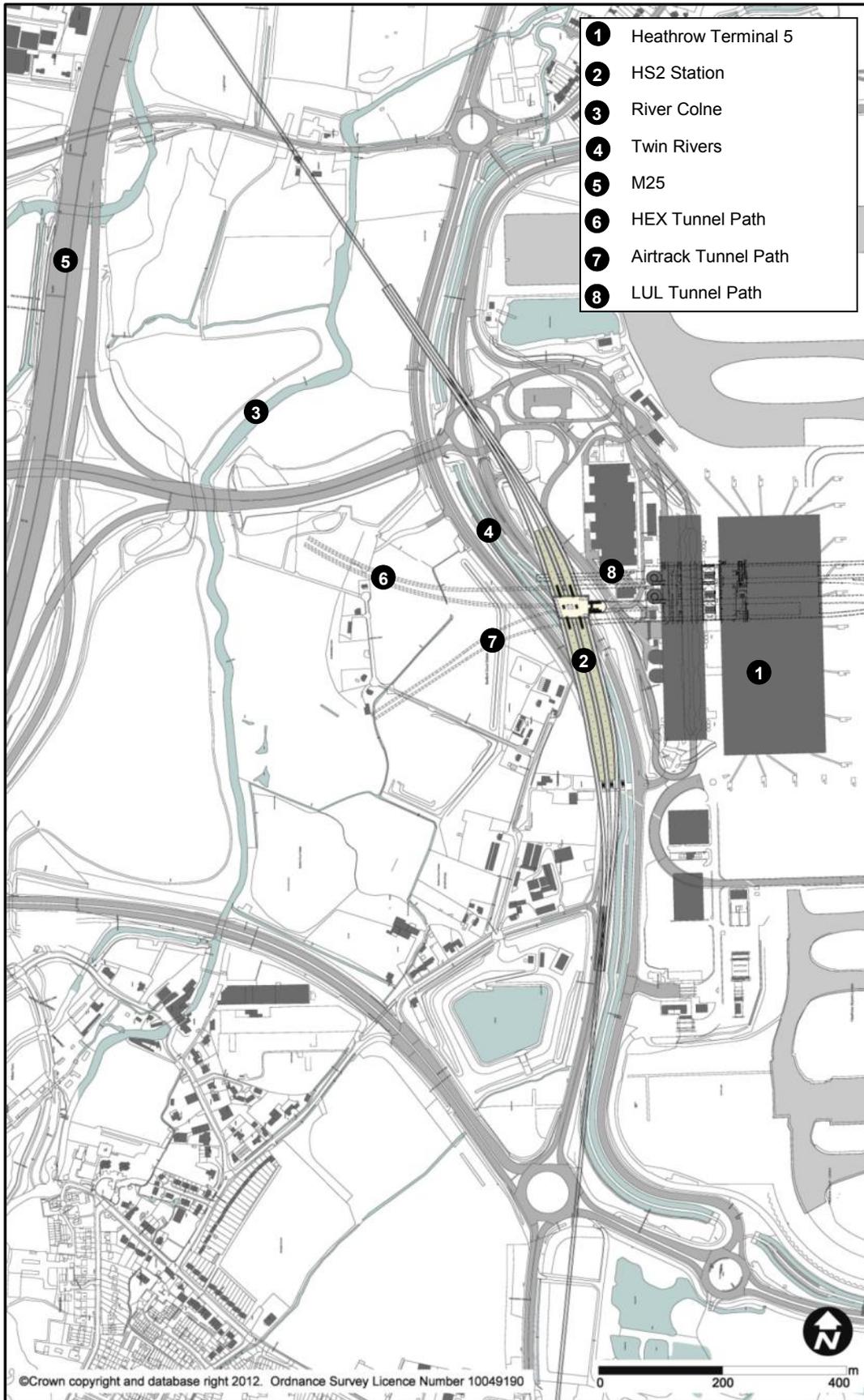
(3.3.1) The alignment would be an extension of HSH02, with an additional section which would comprise a southern tunnelled connection from the station (1) around the airport perimeter to then rejoin the mainline near Northolt. This could be arranged so that there are no access shafts within the airport boundary although additional intervention shafts would be required along the length of the tunnel which would be placed at suitable locations adjacent to roads.

(3.3.2) The tunnel could be constructed without impact on to the operational Terminal 5 HS2 station if a spur line or overrun were constructed as part of a first phase.

(3.3.3) The portal would be south of Northolt and join the mainline with a grade-separated junction. This would comprise a bridge structure over the London Underground Limited (LUL) and main Chiltern lines for the up connection, descending on viaduct to meet the HS2 main up line as it rises eastwards from the Ruislip tunnel (2).

(3.3.4) The down connection would be by a cut and cover tunnel under the LUL line connecting with the HS2 main down line as the main line rises out eastwards from the Ruislip tunnel. There would be level differences to be retained as the HS2 main line is in retained cut in this area and the Heathrow loop connections pass both over and under the main line.

(3.3.5) If the entire loop alignment were to be constructed as one phase of works then there would be no operational requirement for a London facing connection at Ruislip. However, if the loop alignment is constructed in phases with the first phase being a spur which is later extended, then a London facing connection would be needed for spur operations.



4 HSH01: Station

4.1 Station Location and Site Description

(4.1.1) The station would lie on a North-South orientation between the M25 and Terminal 5. The station, shown in the illustrations opposite, would be set in a shallow open box approximately six metres below existing ground level, and would pass perpendicularly above London Underground Limited (LUL), Heathrow Express (HEX) and Airtrack tunnels.

(4.1.2) The construction of the station would be in-situ concrete by diaphragm wall construction and a base slab.

(4.1.3) The station would require some permanent and temporary diversions of existing roads and waterways. The River Colne would not have to be diverted, but the existing twin rivers would have to be diverted around the station box. The existing roads and services would have to be temporarily diverted and re-provided as bridges over the station and in particular the link from the M25 to Terminal 5 would have to be modified.

4.2 Platforms

(4.2.1) The high speed platforms would be at the same level as the existing unused mezzanine level of the Heathrow Terminal 5 building. Due to the platforms running north-south two changes of level would be required for HS2 passengers to access the interchange hub for all existing rail services.

(4.2.2) The station would incorporate two island platforms providing four platform faces to serve high speed trains. The platforms would be curved to give a footprint which would minimise the impact on existing roads and water bodies whilst ensuring that the station is located as close to Terminal 5 as reasonably possible.

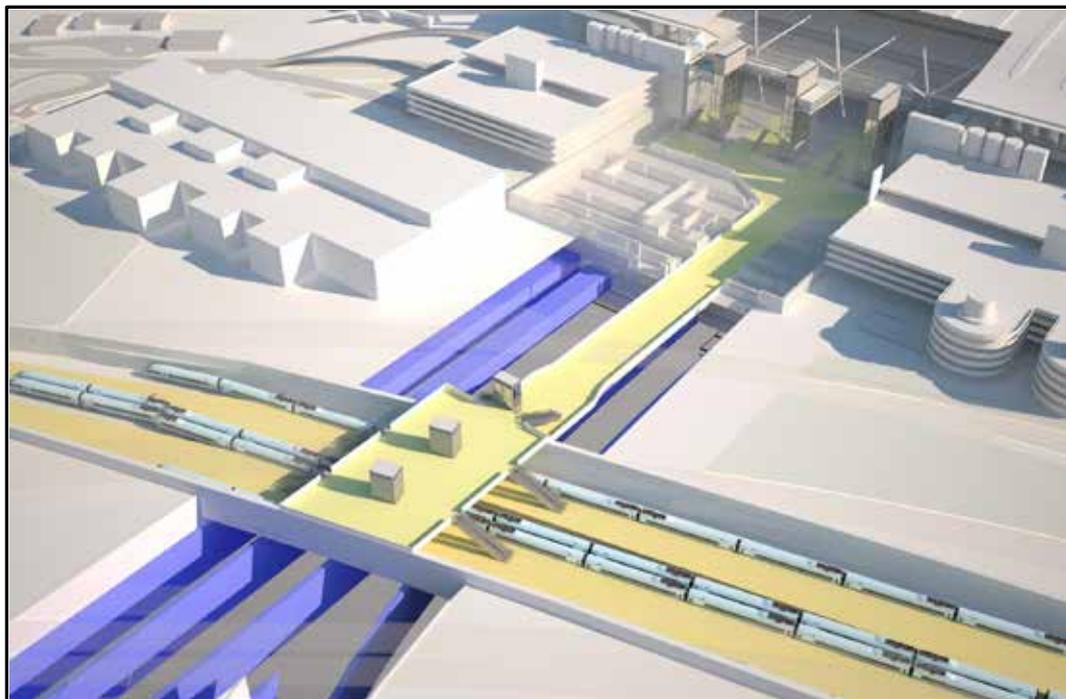
(4.2.3) The new island platforms would be tapered at both ends to achieve a track alignment that can be continued in the future if a Heathrow loop is required. As this station has centre-loaded platforms, and a need to change level, a minimum platform width would be 12m to achieve station standards

(4.2.4) Escape stairs would be provided at the southern end of the platforms to provide alternative means of escape from both platforms. A continuous canopy would cover each platform, except where the escalators and upper concourse level are raised above the platforms.

4.3 Concourse

(4.3.1) Passenger access to the HS2 platforms would be through a central concourse located above the platforms. Banks of escalators, stairs and lifts would link the platforms to the concourse above.

(4.3.2) A connecting concourse, just below ground level, would connect the station to Terminal 5. Travelators could be provided if required.



(4.3.3) The connecting concourse to the terminal building would cut across the existing Heathrow Express tunnel vents, which would need to be re-routed.

(4.3.4) The station would link into Terminal 5 through the currently unused area at the back of the mezzanine level under the Terminal 5 car park (MSCP5), bus stops and passenger pick-up point. By opening up multiple access points on the mezzanine level, increased access to the main vertical circulation zone should negate any pinch points for passengers. The new HS2 concourse configuration would increase commercial opportunities, due to the unused space in this area.

(4.3.5) The concourse, including all station facilities (ticket office, back-of-house, gates, etc.), would be located within the existing volume of unused back-of-house area on the mezzanine level.

4.4 Intermodal Interchange

(4.4.1) As briefly outlined above, the new station layout would facilitate efficient interchange between high speed rail and other modes of transport.

(4.4.2) The new station concourse would be easily accessible from both departures and arrivals levels in Heathrow Terminal 5. Passengers from Terminals 1,2,3 and 4 would utilise the free shuttle service on the Heathrow Express which terminates one level below the new HS2 station. As the Piccadilly line terminates at Terminal 5, connectivity to the LUL network would also increase passenger options.

(4.4.3) As Heathrow borders the M25 and M4, good road connectivity would open opportunities for access to and from HS2 to the surrounding areas.

(4.4.4) The existing local bus, coach, taxi and car passenger pick-ups and drop-offs would remain in place.

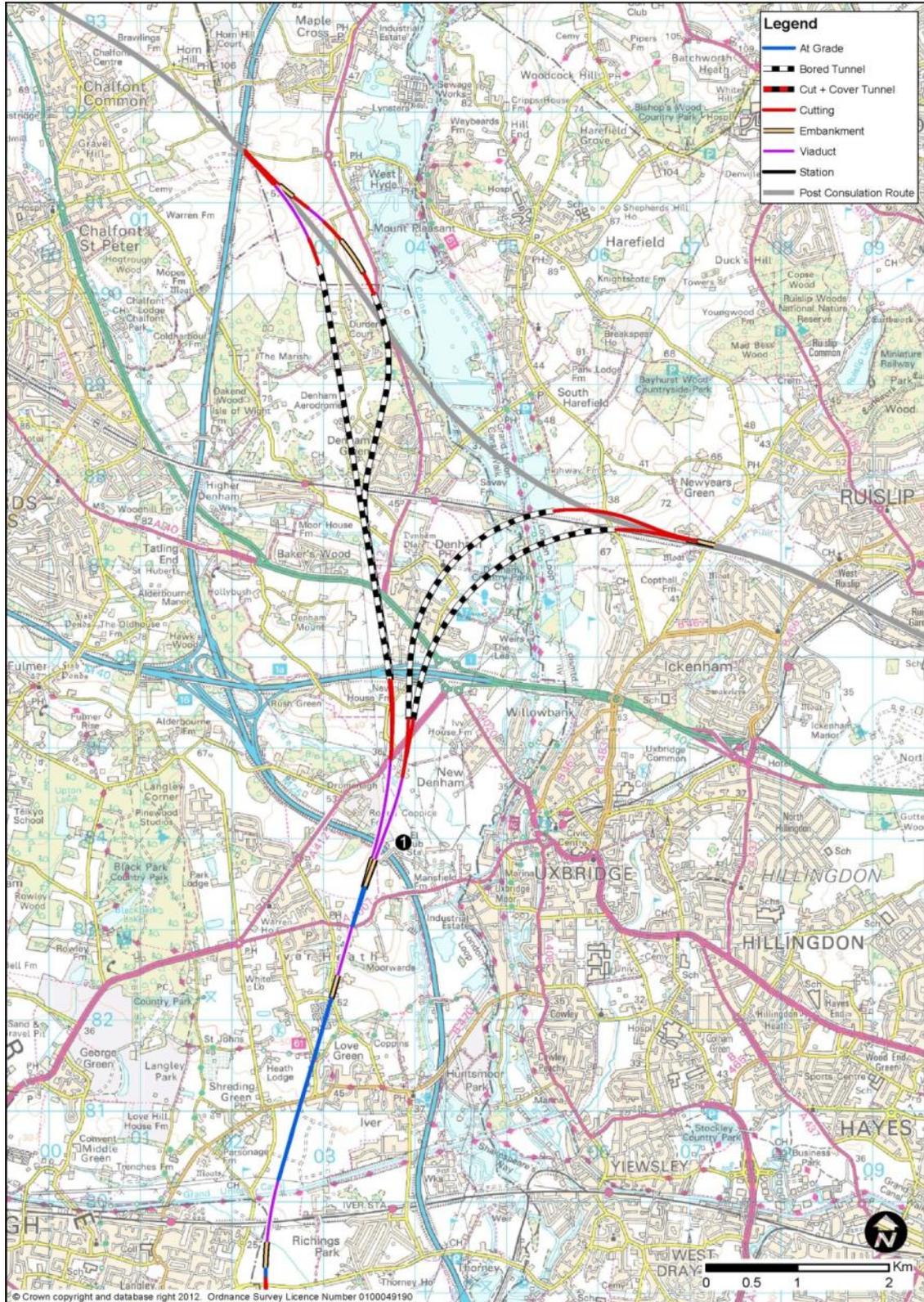
4.5 Car parking

(4.5.1) Short-term parking for private cars would be located in the existing Terminal 5 car park (MSCP5), which has sufficient capacity. No additional car park facilities would be provided. Long-term parking options are numerous around the airport, with the BAA Pod providing shuttle access to long-term car parks north of the runway and with access on the second floor of the Terminal 5 car park.

5 History of Line of Route Options Studied

The following options have been considered and are described in this Chapter. The alignment names describe the approximate location of the alignment adjacent to the M25. Both the 'M25 West' and 'M25 East' alignments have a tunnelled section from north of the M4 to Terminal 5. The 'M25 East East' alignment is a variant of the 'M25 East' alignment with a surface connection from the M4 to Terminal 5 rather than a tunnel.

Option	Spur or loop	Continent-facing connection	Alignment	Station
HSH04	Spur	Twin track tunnel	M25 West	East/West station
HSH04.1	Spur	Twin track tunnel	M25 West	North/South station
HSH05	Spur	Twin track tunnel	M25 East	East/West station
HSH05.1	Spur	Twin track tunnel	M25 East	North/South station
HSH05.01	Spur	Twin track tunnel	M25 East East	North/South station
HSH06	Loop	Not Applicable	M25 East	North/South station
HSH07	Loop	Not Applicable	M25 East East	North/South station
HSH08	Spur	Single track tunnel	M25 East East	North/South station
HSH08.1	Spur	Single track tunnel	M25 East East	North/South station
HSH09	Spur	Single track surface	M25 East East	North/South station
HSH10	Spur	Twin track surface	M25 East East	North/South station
HSH11	Loop	Not Applicable	M25 West	North/South station



5.1 HSH04: M25 Western Alignment, East/West Station

(5.1.1) The connections to the trunk HS2 route would be the same as option HSH02.

(5.1.2) However, south of the M40, the route would rise from the tunnel portal to pass over the M25 motorway (1).

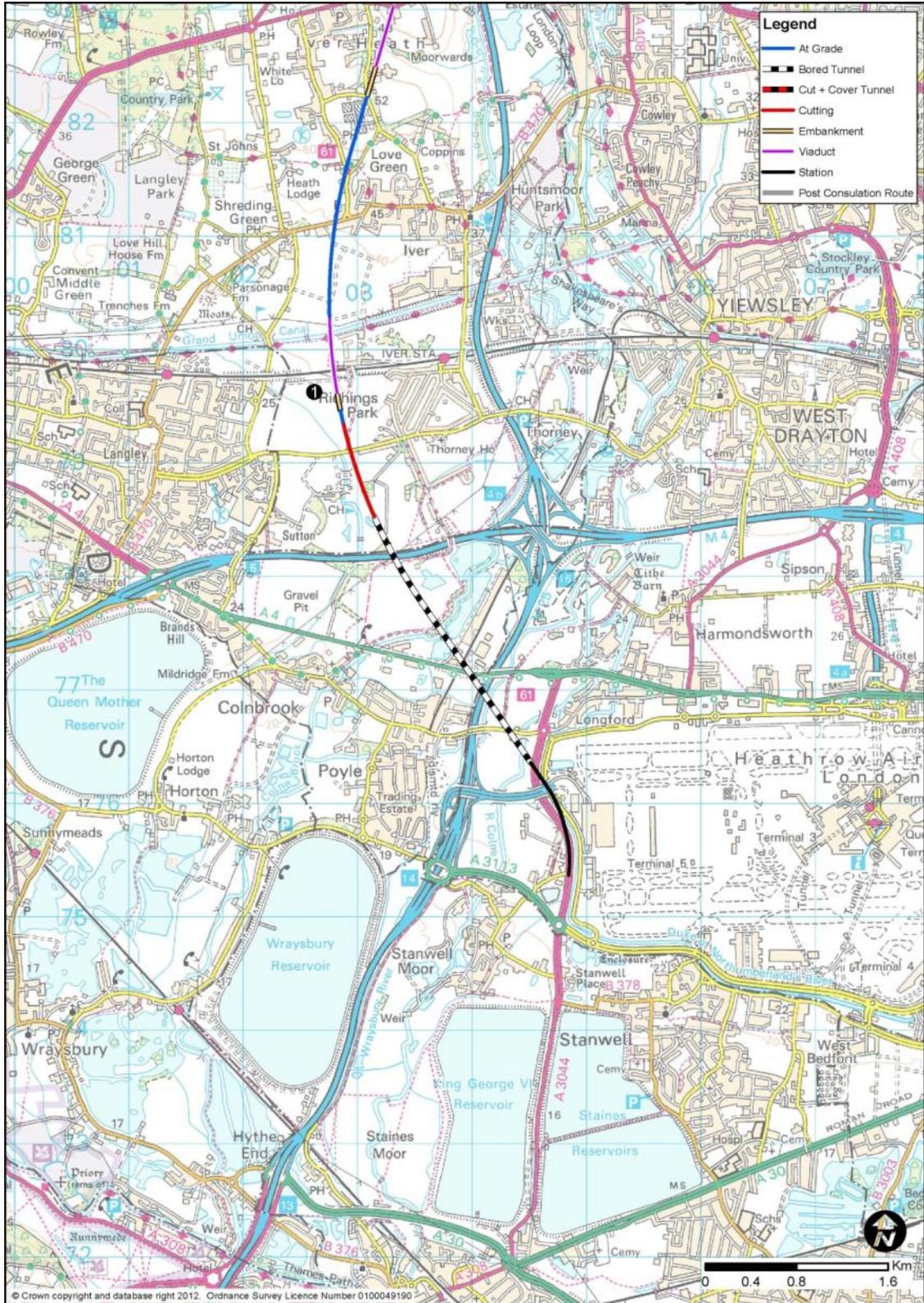
(5.1.3) The route would remain at around ground level and on viaduct to pass between Iver Heath and Iver.



(5.1.4) The route would pass over the Great Western Main Line on a viaduct (1).

(5.1.5) The route would then descend to enter twin bored tunnels and would pass below the M4 (2) and would remain in tunnel until just east of the M25.

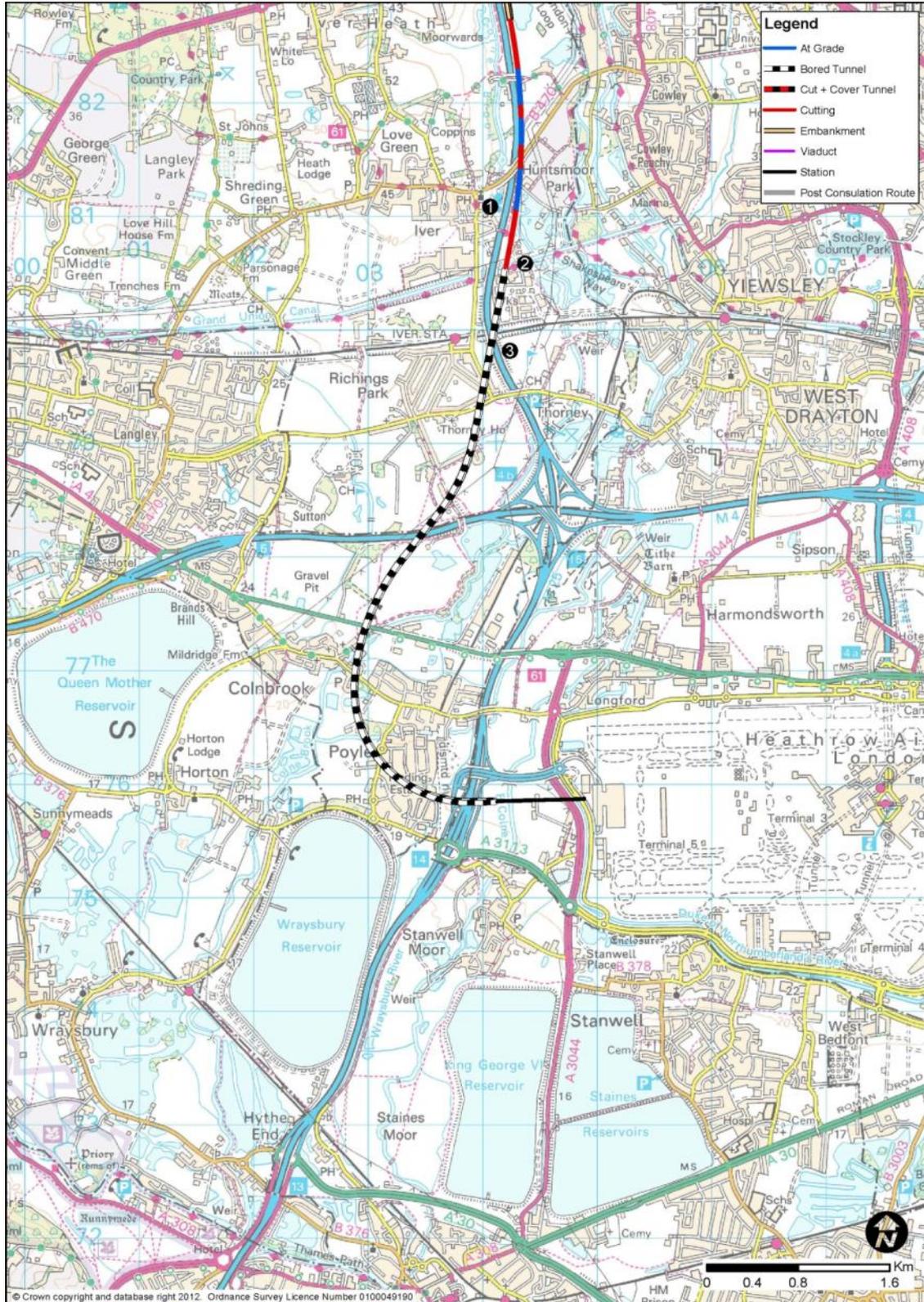
(5.1.6) The station would be of East/West orientation as described in Chapter 6.



5.2 HSH04.1: M25 Western Alignment, North/South Station

(5.2.1) The connections to the trunk HS2 route and alignment as far south as the Great Western Main Line would be the same as option HSH04.

(5.2.2) After passing over the Great Western Main Line (1), the route would head south-east, more directly towards Terminal 5 and would approach the airport in bored tunnel to a North/South station as described in Chapter 4.



5.3 HSH05: M25 Eastern Alignment, East/West Station

(5.3.1) The connections to the trunk HS2 route and alignment as far south as the B470 Iver Road (1) would be the same as option HSH02.

(5.3.2) The alignment would then descend into tunnel north of the Grand Union Canal (2), continue in tunnel beneath the GWML (3) and remain in tunnel until just east of the M25.

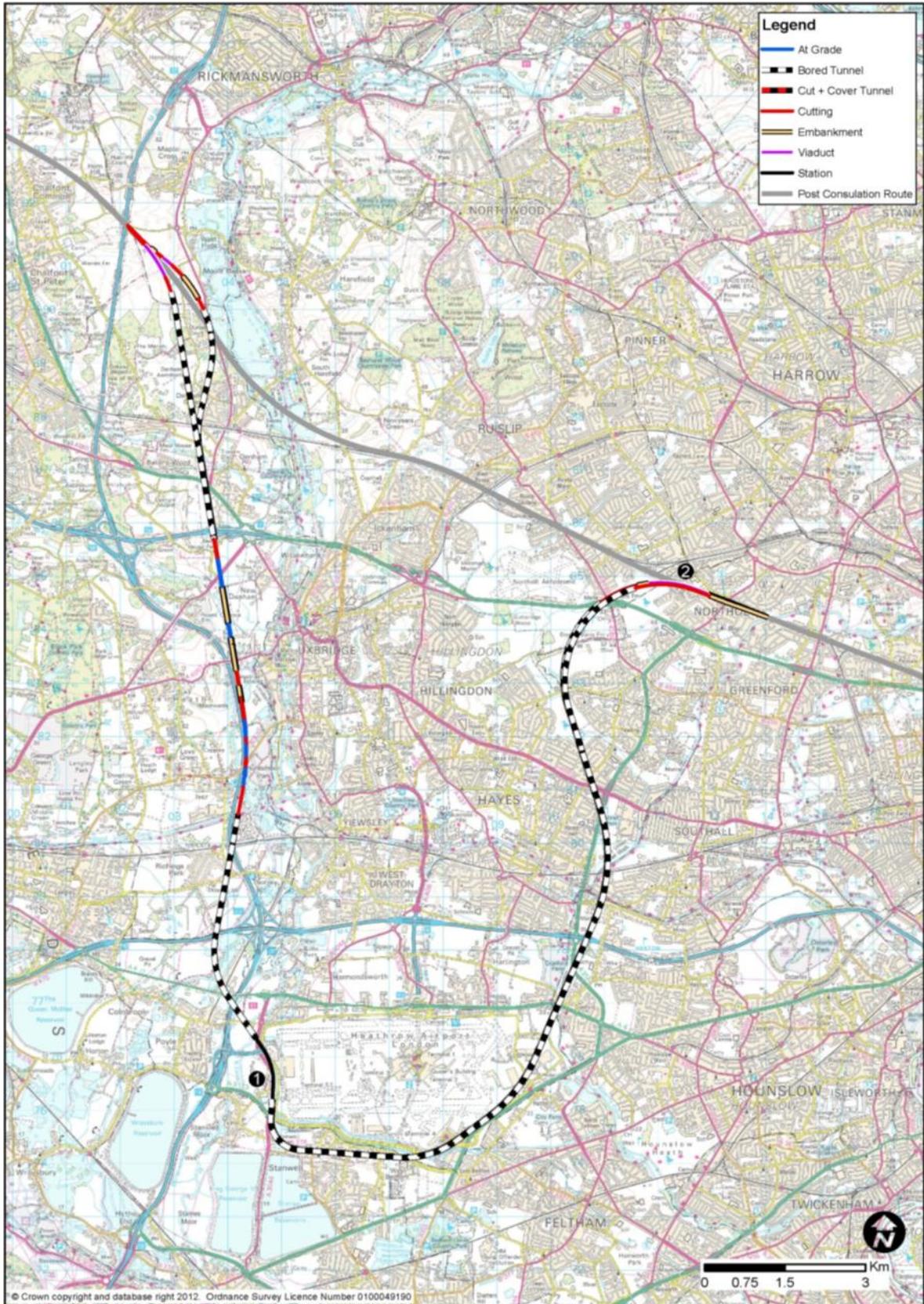
(5.3.3) The station would be of East/West orientation as described in Chapter 6.



5.4 HSH05.01: M25 Eastern Alignment, North/South Station

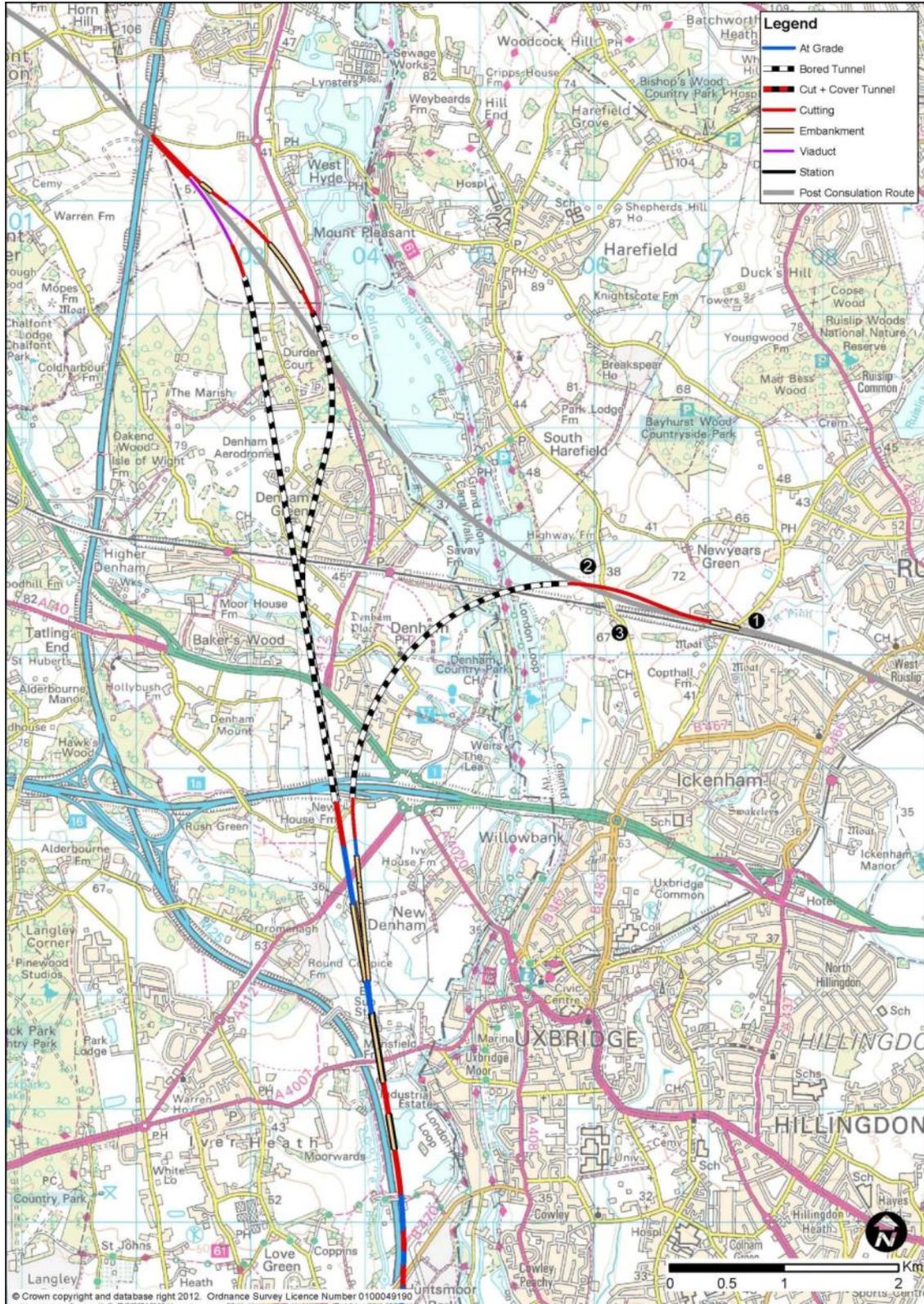
(5.4.1) The connections to the trunk HS2 route and alignment as far south as the B470 Iver Road (1) would be the same as option HSH05.

(5.4.2) South of the B470 Iver Road, the tunnelled route would differ from HSH05 by heading more directly towards Terminal 5 but would still pass under the Grand Union Canal (2) and M25 (3) in tunnel. The route would approach the Airport in tunnel to a station as described in Chapter 4.



5.5 HSH06: Loop - M25 Eastern Alignment, North/South Station

(5.5.1) This option comprised the spur alignment and station as described in option HSH05.1 and included the HSH03 loop as described in Chapter 3.



5.6 HSH08: M25 Eastern Alignment (East), Single Track Tunnel Connection, North/South Station

(5.6.1) The Birmingham-facing connection to the trunk HS2 route would be the same as option HSH02.

(5.6.2) The connection from the Continent differs from HSH02 and would be single track. It would comprise high speed, 230 km/h turnouts to both the up and down trunk HS2 lines to a Heathrow spur track lying between them, immediately to the west of the Ruislip Tunnel portal.

(5.6.3) All three tracks would remain parallel to pass over the River Pinn **(1)**, before the central Heathrow track descends steeply, allowing it to enter single track bored tunnel and pass under the HS2 trunk down line and to pass below the water bodies with a clearance of 25m from crown of the tunnel to the water surface and then under the Chiltern Lines.

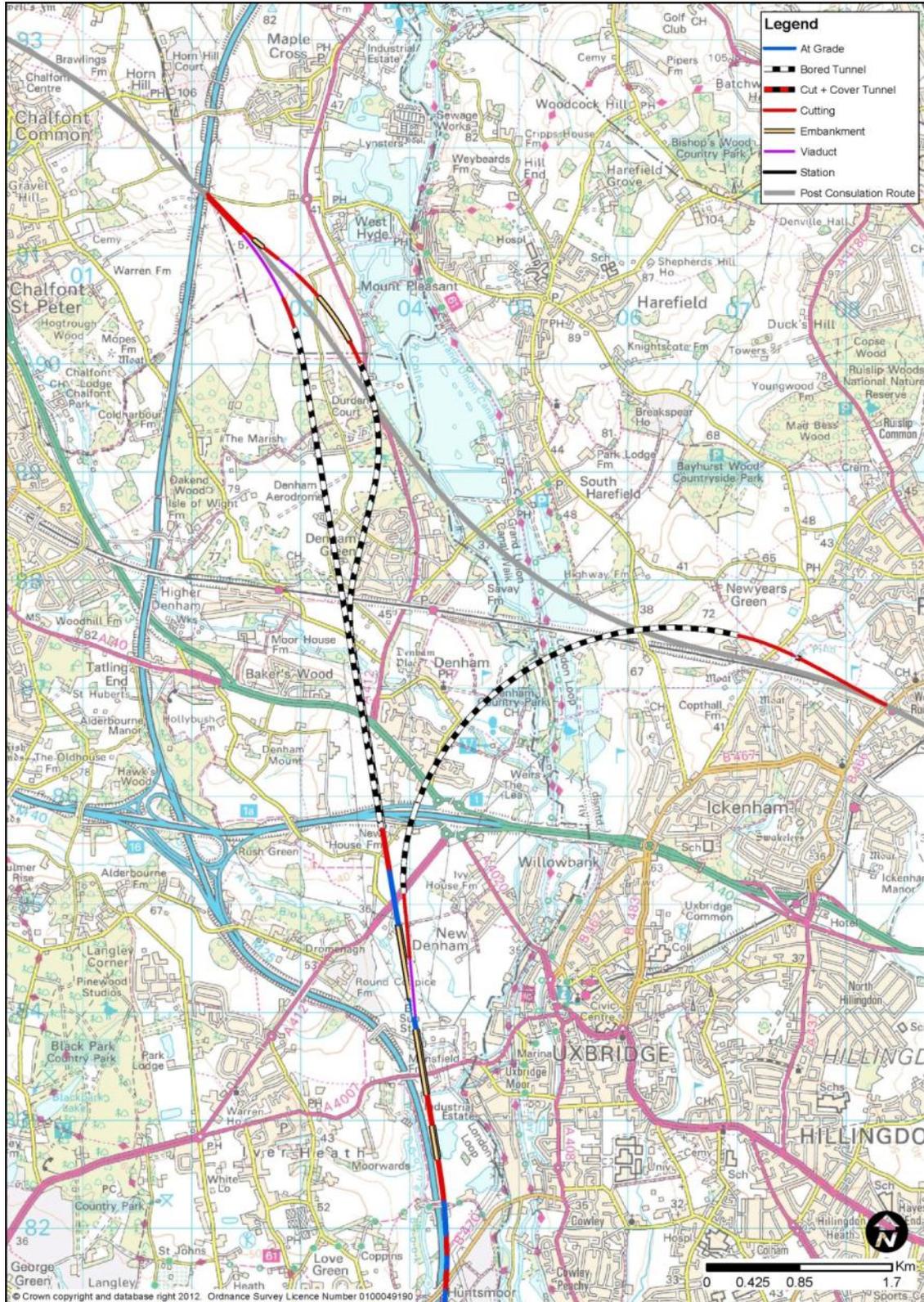
(5.6.4) The tunnel would require an access shaft, which could be placed in a suitable location adjacent to roads.

(5.6.5) The tunnel portal is south of the M40, about 100m east of the Birmingham connection tracks and the route continues at around ground level parallel to the Birmingham tracks before joining them through a flat junction.

(5.6.6) The post-consultation trunk HS2 alignment **(2)** would require amendment to its alignment to facilitate this single track connection. These amendments are not shown on the map opposite.

(5.6.7) The West Ruislip tunnel would be retained as in the post-consultation proposals, and a length of straight would be created immediately west of the portal. This moves the trunk route in a northerly direction, away from the Chiltern Line **(3)**. The map opposite does not show the amended location of the main line. The trunk route would then enter a deep cutting before passing onto viaduct to pass over the Colne Valley. The viaduct would be of similar length and height as the post-consultation route.

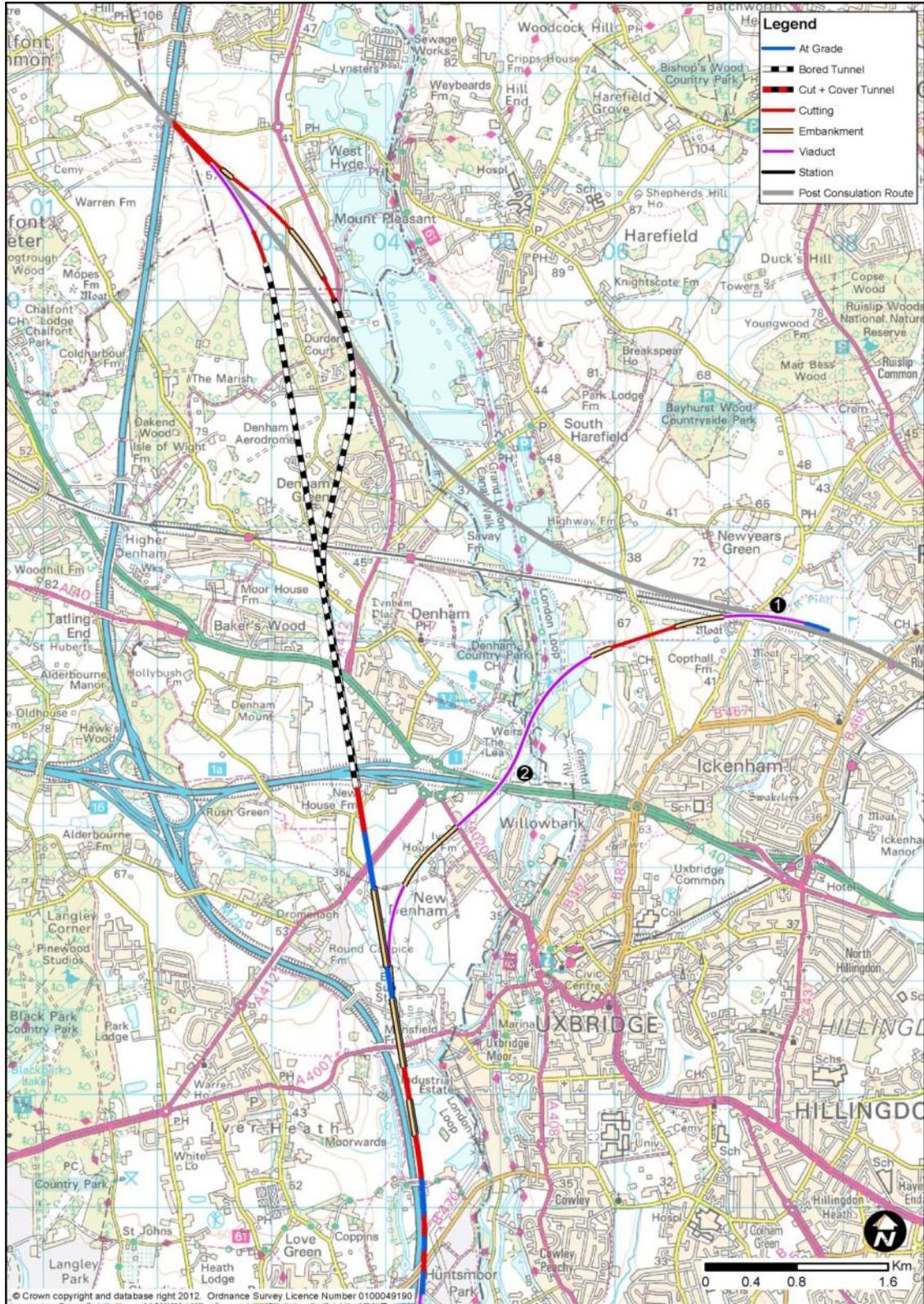
(5.6.8) The alignment to the south of the junction between the Birmingham and Continent-facing connections would be the same as HSH02.



5.7 HSH08.1: M25 Eastern Alignment (East), Single Track Tunnel Connection, North/South Station

(5.7.1) In this option, as with option HSH08, a single spur connection at Ruislip would be formed by a single tunnel. In this option, in order to accommodate the single tunnel turn out, the post-consultation trunk HS2 alignment would require amendment to its alignment to facilitate this single track connection. These amendments are not shown on the map. The alterations to the trunk HS2 route would move the tunnel below West Ruislip northwards rather than move the Colne Valley viaduct as in option HSH08.

(5.7.2) After joining the Birmingham-facing connection the route would be as HSH02 and reach a North/South station as described in Chapter 4.



5.8 HSH09: M25 Eastern Alignment (East), Single Track Surface Connection, North/South Station

(5.8.1) This option is the same as HSH02 described in Chapter 3 except that the Continent-facing connection would be a single track surface connection.

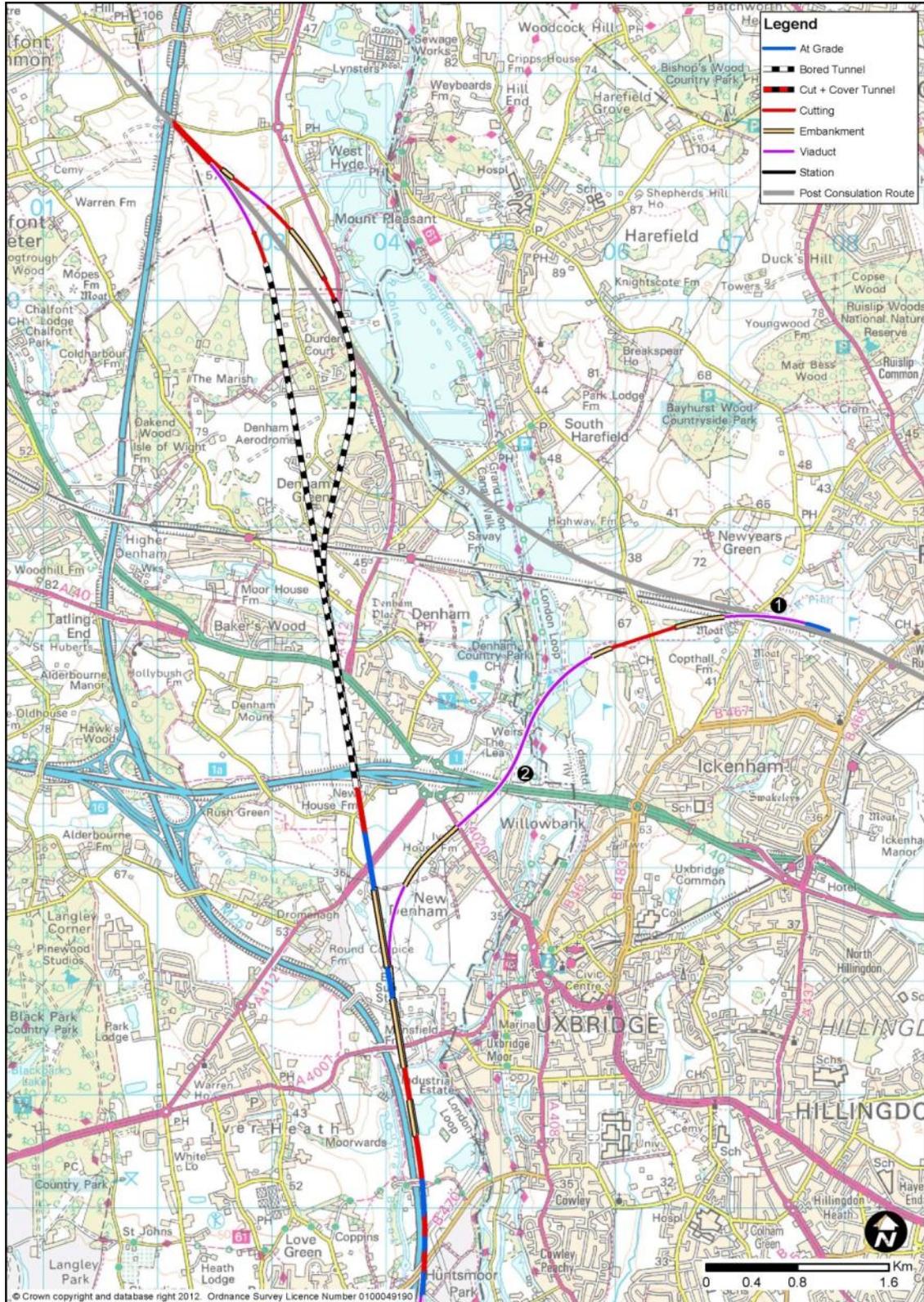
(5.8.2) To achieve this, the junction with the trunk HS2 route would have 160km/h turnouts to both the up and down trunk HS2 lines to a single Heathrow spur track lying between them. The Heathrow connection would climb on viaduct to pass over the trunk HS2 route down line (1) and Chiltern Line before entering a cutting then rising to pass over the Colne Valley and A40 on viaduct (2). The viaduct would be approximately 15m high through this section.

(5.8.3) The route would then curve sharply back to merge with the Birmingham-facing connection tracks east of Uxbridge Moor.

(5.8.4) To allow the Heathrow connection to avoid Denham, the connection with the trunk HS2 route would need to be further east than other options, requiring the West Ruislip tunnel to be shortened from the post-consultation route, and the track spacing widened, through this section. These amendments are not shown on the map.

(5.8.5) This would also require the temporary closure of West Ruislip station for a period of about two years.

(5.8.6) After joining the Birmingham-facing connection the route would be as HSH02 and reach a North/South station as described in Chapter 4.



5.9 HSH10: M25 Eastern Alignment (East), Twin Track Surface Connection, North/South Station

(5.9.1) This option is the same as HSH02 described in Chapter 3 except that the Continent-facing connection would be a twin track surface connection.

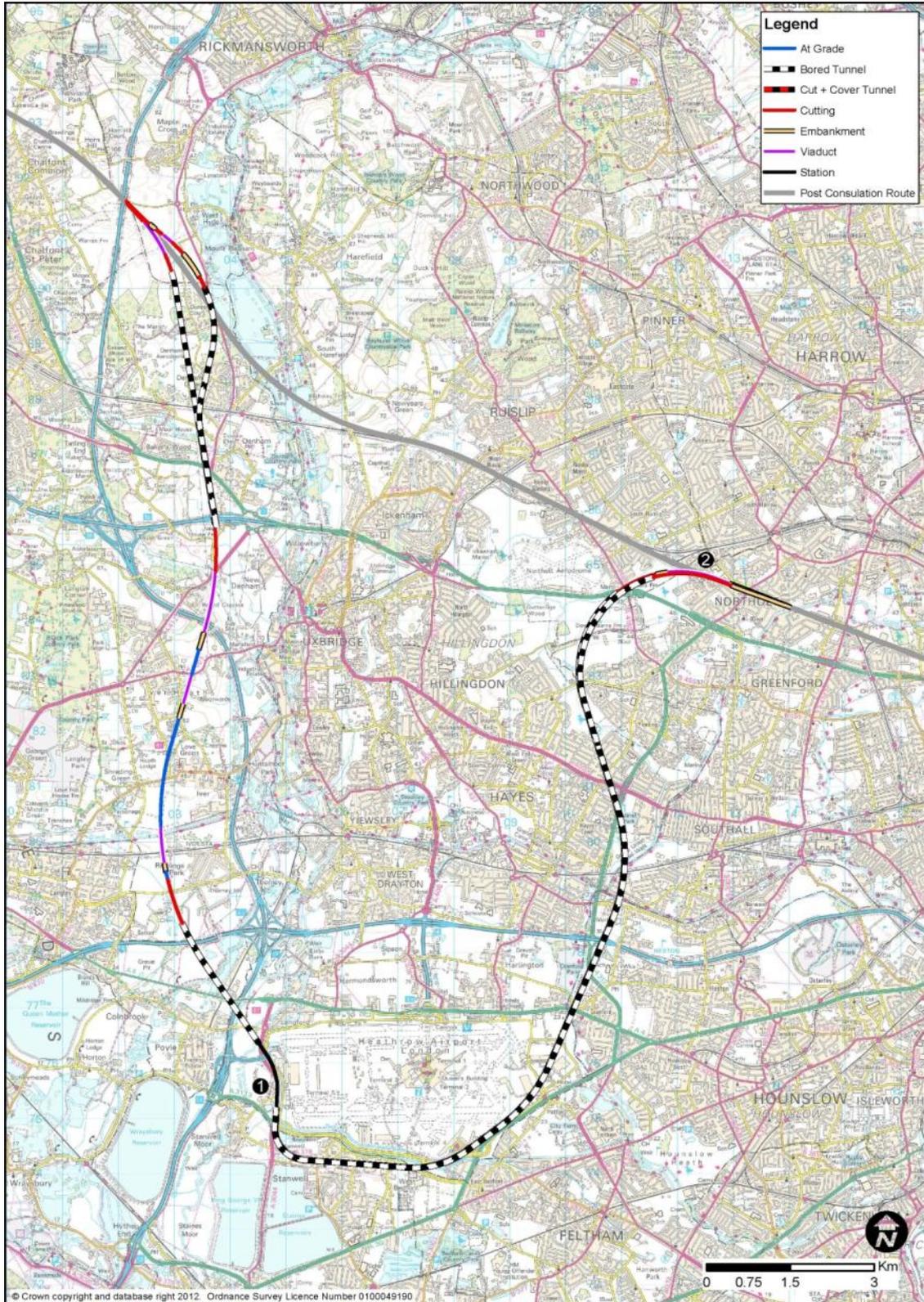
(5.9.2) To achieve this, the junction with the trunk HS2 route would have 160km/h turnouts to both the up and down trunk HS2 lines. The northbound Heathrow connection would climb on viaduct to pass over the trunk HS2 route (1). The southbound Heathrow connection (not shown on the map) would converge with and run parallel to the northbound, and together they would pass over the Chiltern line on viaduct. After entering a cutting the route would climb to run on a viaduct over the Colne Valley and A40. The viaduct would be approximately 15m high through this section.

(5.9.3) The route would then curve sharply back to merge with the Birmingham-facing connection tracks east of Uxbridge Moor.

(5.9.4) To allow the Heathrow connection to avoid Denham, the connection with the trunk HS2 route would need to be further east than other options, requiring the West Ruislip tunnel to be shortened from the post-consultation route, and the track spacing widened, through this section. These amendments are not shown on the map.

(5.9.5) This would also require the temporary closure of West Ruislip station for a period of about two years.

(5.9.6) After joining the Birmingham-facing connection the route would be as HSH02 and reach a North/South station as described in Chapter 4.



5.10 HSH11: Loop - M25 Western alignment, Twin track tunnel connection, North/South station

(5.10.1) This option adds a loop similar to that described for HSH03 in Chapter 3 to option HSH04.1.

6 History of Station Options Studied

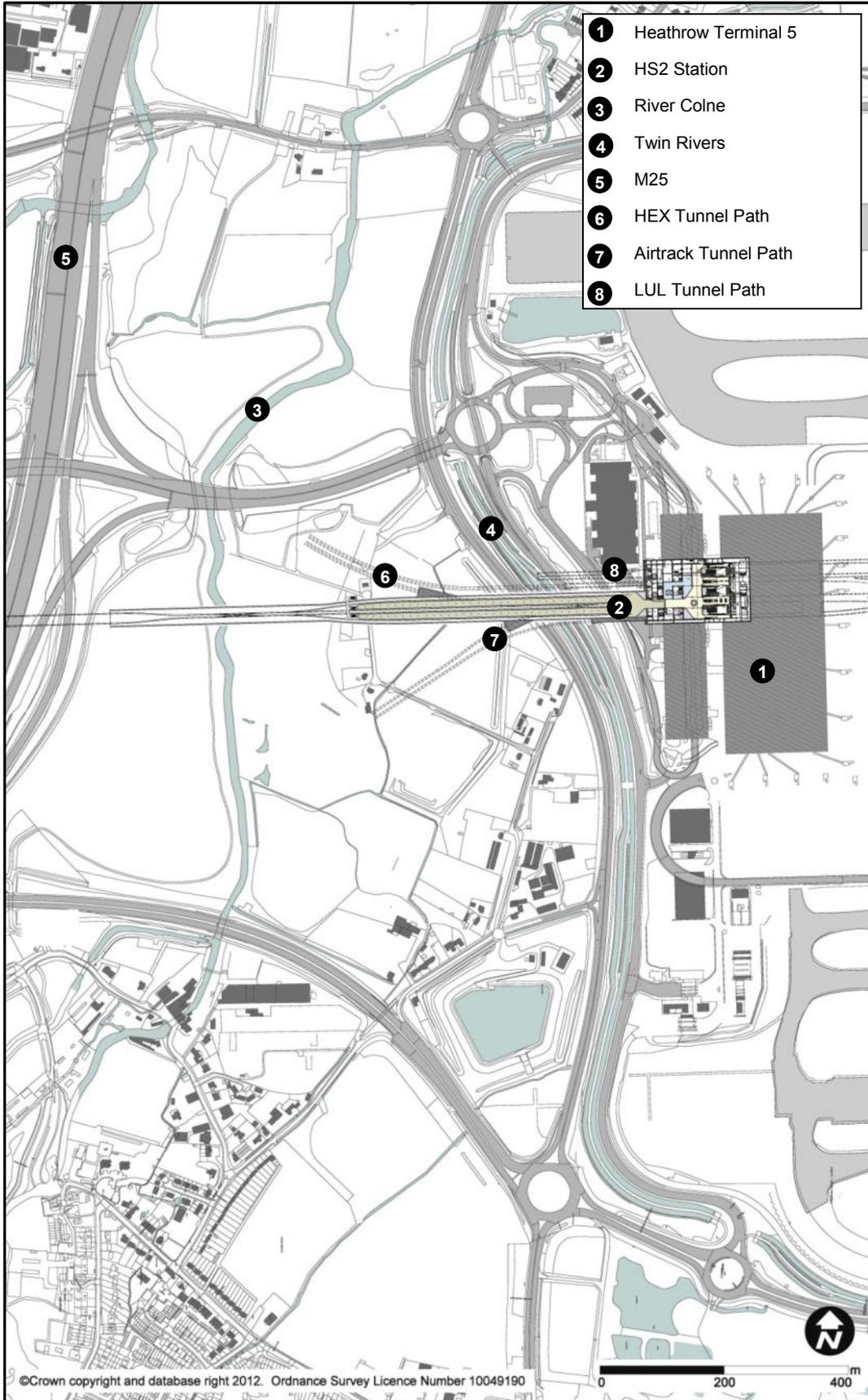
(6.1.1) A number of station options were considered at feasibility stage. Each of these was discounted for the reasons described below.

6.2 Deep Stations

(6.2.1) To avoid conflict with existing infrastructure, the station could be at low level. However, this would have to be more than 50m deep to avoid the London Underground Limited (LUL), Heathrow Express (HEX) and Airtrack tunnels and the building foundations around Terminal 5, and hence would be considered as a cavern station. These options are not considered further due to the high cost of construction.

6.3 Elevated Stations

(6.3.1) An elevated station aligned North-South or North-West / South-East would impinge on the protected approach/departure surfaces for the northern runway and hence would not be viable. An elevated station aligned east-west would have to cross over the M25 and would then be elevated through a residential area. This would also not be viable.



6.4 East-West Station Option

6.4.1 Station Location and Site Description

(6.4.1.1) The station would lie on an East-West orientation between the M25 and Terminal 5. The station would be set in a shallow open box approximately six metres below existing ground level. Passenger access would be via end-loaded platforms into the unused mezzanine level of the existing Terminal 5 station.

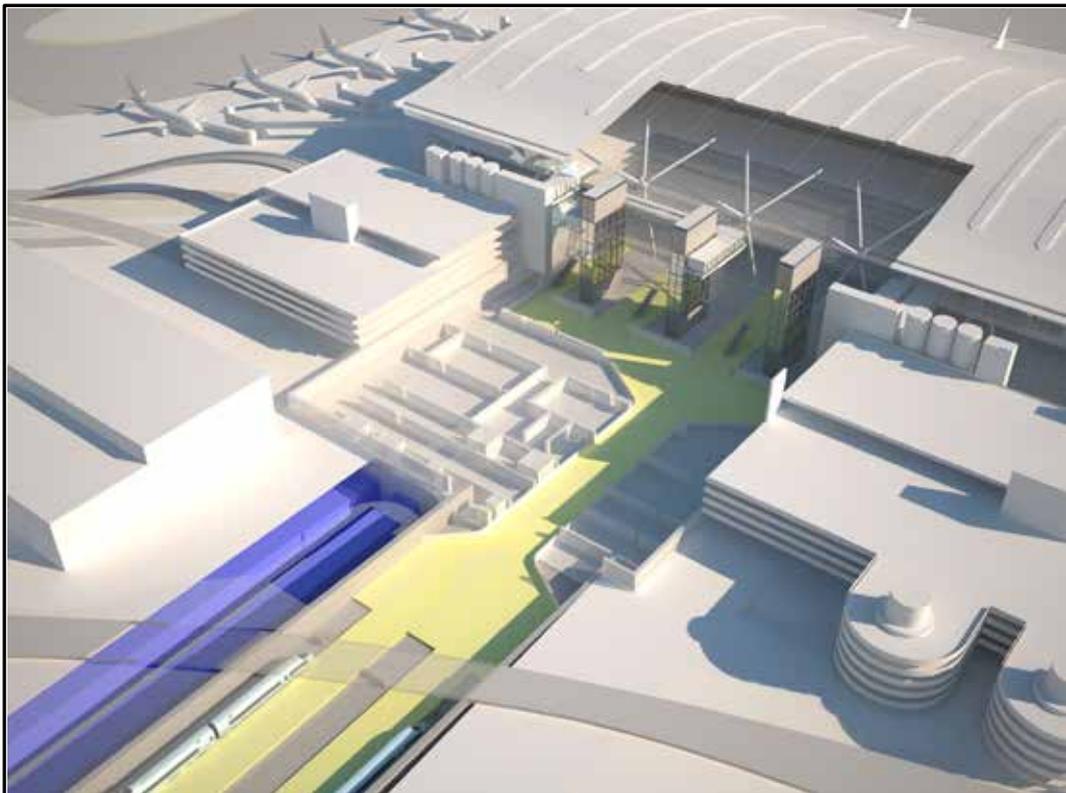
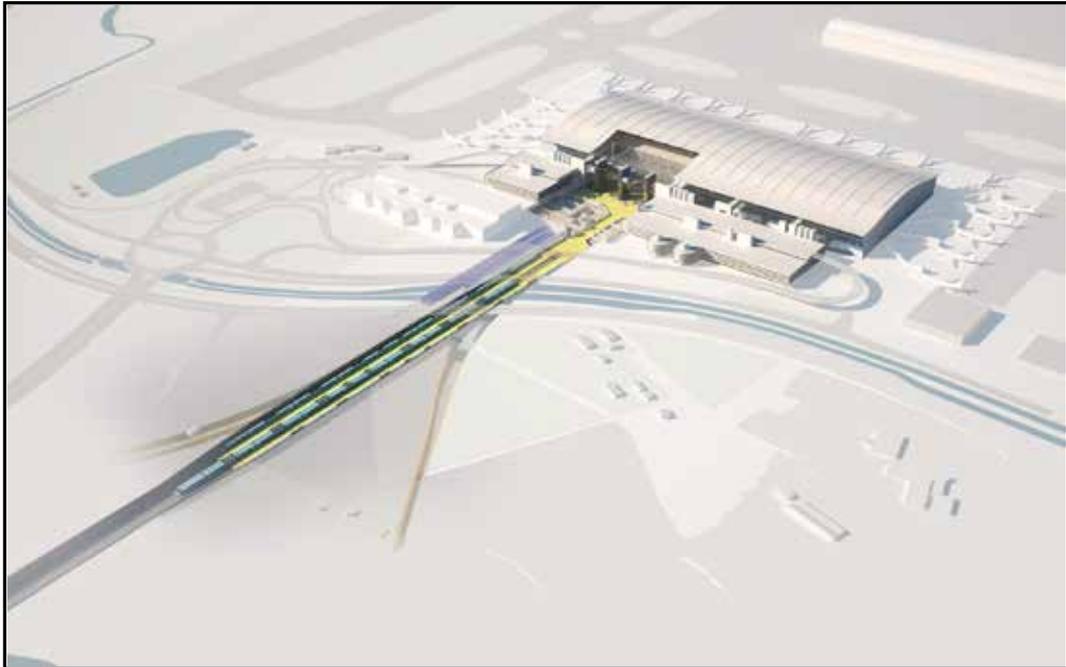
(6.4.1.2) The station would require some permanent and temporary diversions of existing roads and waterways. The River Colne would have to be diverted around the end of the station box. The existing twin rivers would have to be diverted into the River Colne. The existing roads and services would have to be temporarily diverted and re-provided as bridges over the station.

6.4.2 Platforms

(6.4.2.1) The high speed platforms would be at the same level as the existing unused mezzanine level of the Heathrow Terminal 5 building, providing direct passenger interchange to existing rail services.

(6.4.2.2) The station would incorporate two island platforms providing four platform faces to serve high speed trains. These platforms would be located on an East-West alignment to avoid conflict with existing rail company tracks and airport operations. The new island platforms would be tapered at the western end so that the required track crossovers can be accommodated before reaching the M25. As this station is an end-loaded option, the buffer zone has been incorporated into the ticketed concourse side, which will reduce the walking distance for passengers leaving the platform.

(6.4.2.3) Escape stairs would be provided at the western end of the platforms to provide alternative means of escape from both platforms. A continuous canopy would cover each platform, except where the three road bridges cross over the station box.



6.4.3 Concourse

(6.4.3.1) The new concourse at Heathrow Terminal 5 would utilise the current unused area at the back of the mezzanine level under the Terminal 5 car park (MSCP5), bus stops and passenger pick-up point. By opening up multiple access points on the mezzanine level, increased access to the main vertical circulation zone should negate any pinch points for passengers. The new HS2 concourse configuration would increase commercial opportunities, due to the volume of unused space in this area. The concourse corridor which would lead passengers from the gateline to the trains would cut across the existing Heathrow Express tunnel vents, which would need to be re-routed.

(6.4.3.2) The concourse, including all station facilities (ticket office, back-of-house, gates, etc.), would be located within the existing unused back-of-house area on the mezzanine level. This arrangement would create clear sight lines from the platforms to the intermodal hub.

6.4.4 Intermodal Interchange

(6.4.4.1) As briefly outlined above, the new station layout would facilitate efficient passenger interchange between high speed rail and other modes of transport.

(6.4.4.2) The new station concourse would be easily accessible from both departures and arrivals levels in Heathrow Terminal 5. Passengers from Terminals 1,2,3 and 4 would utilise the free shuttle service on the Heathrow Express which terminates one level below the new HS2 station. As the Piccadilly line terminates at Terminal 5, connectivity to the London Underground Limited (LUL) network would also increase passenger options.

(6.4.4.3) As Heathrow borders the M25 and M4, good road connectivity would open opportunities for access to and from HS2 to the surrounding areas.

(6.4.4.4) The existing local bus, coach, taxi and car passenger pick-ups and drop-offs would remain in place.

6.4.5 Car parking

(6.4.5.1) Short-term parking for private cars would be located in the existing Terminal 5 car park (MSCP5), which has sufficient capacity. Long-term parking options are numerous around the airport, with the BAA Pod providing shuttle access to long-term car parks north of the runway and with access on the second floor of the Terminal 5 car park.

6.4.6 Loop compatibility

(6.4.6.1) It would not be possible to extend the route through an east/west station to become a loop at a future date due to the car park and terminal buildings clashing with an extended alignment.

7 Glossary of Terms

(7.1.1) Throughout this report, there has been reference to technical issues, or abbreviations / acronyms. The following list contains most of those as a glossary of terms:

(7.1.2) **Airtrack** – The proposed rail line between Heathrow airport and Southern England.

(7.1.3) **BAA** – The operator of Heathrow airport.

(7.1.4) **Chiltern Line** – Intercity railway route from London to the West Midlands.

(7.1.5) **Great Western Main Line (GWML)** – Intercity railway route connecting London, Bristol and Cardiff.

(7.1.6) **Heathrow Express (HEX)** - The rail link between London Paddington Station and Heathrow airport.

(7.1.7) **High Speed Two Limited (HS2 Ltd)** – The company set up by the Government to develop proposals for a new high speed railway line between London and the West Midlands and to consider the case for new high speed rail services linking London, northern England and Scotland.

(7.1.8) **London Underground Limited (LUL)** – London regional surface and underground commuter railway.

(7.1.9) **MSCP5** – Multi-Storey Car Park 5 serving Terminal 5.

(7.1.10) **HS2 Phase one** – The Government’s proposal is to deliver the high speed rail network in two phases, with the first phase being a high speed line from London to the West Midlands, including a link to the West Coast Main Line (WCML) and to High Speed 1.

(7.1.11) **HS2 Phase two** – The second phase would comprise the lines from the West Midlands to Manchester and Leeds, including stations in South Yorkshire

and the East Midlands and a direct link to Heathrow Airport, along with connections to the West Coast and East Coast Main Lines.

(7.1.12) **Piccadilly Line** – The London Underground line which serves Heathrow airport.

(7.1.13) **Site of Special Scientific Interest (SSSI)** – Conservation designation denoting an area of particular ecological or geological importance.