High Speed Two Phase 2b
Crewe to Manchester
West Midlands to Leeds
Summary of route refinements 2016

November 2016
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Department for Transport

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1 Introduction

1.1.1 HS2 is the proposed high speed rail network for the UK that will run from London to the West Midlands, Leeds and Manchester, and beyond.

1.1.2 Phase One of the High Speed Two (HS2) network will run from London to the West Midlands, with a connection to the West Coast Main Line near Lichfield. Phase Two will extend HS2 to the north of England, with trains running to Manchester by way of Crewe, and to Leeds via the East Midlands and South Yorkshire. Connections to the East Coast and West Coast Main Lines will enable HS2 services to travel onwards on the existing network.

1.1.3 Proposals for HS2 Phase Two were presented for public consultation in July 2013. That consultation ran for seven months and enabled members of the public to give their views on the proposed route and stations. Since the consultation, we have developed and refined the rest of the Phase Two route. Based on this work, we presented our recommendations for changes to the route to the Secretary of State. The agreed changes have been incorporated into the route presented in this report.

1.1.4 In autumn 2015, the Government announced that delivery of part of the Phase Two route between the West Midlands and Crewe would be brought forward to 2027 in order to realise more of the benefits of HS2 further north, sooner. This project is known as Phase 2a. As part of this announcement in November 2015, we explained how the route between the West Midlands and Crewe had changed. You can find more information in West Midlands to Crewe - Summary of route refinements[1].

1.1.5 So the Phase 2a part of the Phase Two route between the West Midlands and Crewe is not included in this report.

1.1.6 This report addresses specifically the changes to the other parts of the Phase Two route, from Crewe to Manchester and the West Coast Main Line, and from the West Midlands to Leeds and the East Coast Main Line via the East Midlands and South Yorkshire. This scheme is referred to as Phase 2b.

1.1.7 Some of the changes that we have developed draw on the feedback and intelligence gathered through the Phase Two route consultation, and through ongoing engagement with stakeholders and communities. Other changes draw on what we have learned from the developing Phase One design. We have also reviewed the route as the strategic context evolves, taking into account developments like the Northern Powerhouse Rail project being established.

1.1.8 In early 2014, HS2 Ltd chairman Sir David Higgins published *HS2 Plus*[2]. This report made a number of recommendations for how the HS2 project should be taken forward, including accelerating the delivery of the route, now known as Phase 2a, between the West Midlands and Crewe. It also recognised the challenge presented by improving connectivity across the north of England. These recommendations have also helped to shape Phase Two, and the HS2 project more widely.

[1] Available at www.gov.uk/government/publications/west-midlands-to-crewe-summary-of-route-refinements
[2] Available at www.gov.uk/government/publications/hs2-plus-a-report-by-david-higgins

1.1.9 *Rebalancing Britain*[3], published in October 2014, considered transport connectivity across the north of England and called for the establishment of a new body to manage transport issues at a strategic level across the north of England. The Government established Transport for the North (TfN) as the body responsible for taking this work forward.

1.1.10 We have played an integral role in working with TfN to develop its strategy for improving transport across the north of England. At the same time, we have reviewed our own proposals to make sure that our plans reflect these wider aspirations and deliver the greatest possible value to the UK. We explain below how we have worked with TfN, and the impact that this has had on our work.

1.1.11 Some of our proposals for HS2 route changes have been set out in past publications. *The Yorkshire Hub*[4] report explained new proposals for a station in Leeds, and *HS2 in South Yorkshire*[5] set out an alternative approach to serving South Yorkshire.

1.1.12 We continue to work with Network Rail to understand how HS2 can best be integrated into the wider UK rail network. This has included collaborating closely to develop proposals for a hub station at Crewe, and considering the 'Capacity Plus' workstream that seeks to understand how HS2 could transform Britain's railways.

1.1.13 This report covers the HS2 route from Crewe to Manchester on the western leg, and from the West Midlands to Leeds on the eastern leg. It forms part of our advice to the Government and can be read alongside the *Route engineering reports*, *Sustainability statement*, and *Strategic outline business case*[6].

The route

1.1.14 The western leg of Phase 2b has a total length of 51 miles (82 km)[7]. At its southern end it connects to Phase 2a to the south of Crewe. Heading north, it passes under Crewe in a tunnel. At its northern end, the western leg joins the West Coast Main Line at Golborne, south of Wigan. A spur from the main line serves a new station at Manchester Airport before entering into an 8-mile (13km) tunnel to reach a new station at Manchester Piccadilly. The western leg also includes a rolling stock depot located to the north of Crewe, between the HS2 route and the West Coast Main Line.

1.1.15 The eastern leg of Phase 2b has a total length of 123 miles (198 km)[8]. At its southern end, it connects to the Phase One route at Marston. At its northern end, the eastern leg joins the East Coast Main Line by way of a connection at Church Fenton. The eastern leg includes new a station at Toton (East Midlands Hub), and a new station at Leeds served by a spur from the main line. South Yorkshire is served via a spur from the HS2 route, allowing services to join the Midland Main Line south of Chesterfield at Clay Cross, and travel on to Sheffield Midland station. The eastern leg also includes an infrastructure maintenance depot located at Staveley, and a rolling stock depot at New Crofton.

[3] Available at www.gov.uk/government/publications/rebalancing-britain-from-hs2-towards-a-national-transport-strategy
[4] Available at www.gov.uk/government/publications/the-yorkshire-hub-an-interim-report-on-the-redevelopment-of-leeds-station
[5] Available at www.gov.uk/government/publications/hs2-sheffield-and-south-yorkshire-report-2016
[6] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester
[7] This excludes the connection to the rolling stock depot.
[8] This excludes the connections to the infrastructure maintenance depot and rolling stock depot.

2 The project planning context

This section sets out some of the key considerations that have influenced the development of the Phase 2b network.

2.1 Phase One

2.1.1 Phase One of HS2 will, subject to Parliamentary approval, provide a high speed rail route between London and the West Midlands. It includes a connection to the West Coast Main Line at Handsacre, near Lichfield, so that HS2 trains can serve destinations north of Birmingham before the delivery of the full HS2 network.

2.1.2 The experience of developing the Phase One route has helped to inform our approach to Phase Two. This report notes some of the lessons learned from Phase One that we have applied to the development of this project.

2.1.3 The Phase One hybrid Bill completed its passage through the House of Commons in spring 2016 and, at the time of writing, is passing through the House of Lords, with the aim of receiving Royal Assent by the end of 2016.

2.1.4 The hybrid Bill will deliver powers for the construction of HS2 Phase One, including the delivery of new platforms at Euston station. With Network Rail, we are continuing to develop the proposal for Euston station. An Additional Provision to the hybrid Bill has been deposited in Parliament to seek the powers to deliver this updated project. Following Royal Assent we expect that construction will begin in 2017, with services expected to start running on the Phase One route from 2026.

2.1.5 Our experience with procurement for the delivery of Phase One and Phase 2a will also help to inform the approach that we adopt on Phase 2b. We are already applying these lessons in our procurement of contractors to support the development of a hybrid Bill. By the time we are in a position to deposit a hybrid Bill for Phase 2b, we will be able to draw on further learning and we will explain our proposed approach as part of an outline business case.

2.2 Phase 2a

2.2.1 The Phase 2a route runs for approximately 40 miles from the West Midlands to Crewe, connecting to the West Coast Main Line just south of Crewe and providing additional journey time and capacity benefits. Following the Secretary of State's decision last year, we are now working to deliver Phase 2a by the end of 2027.

2.2.2 Phase 2b would connect to the end of Phase 2a south of Crewe and continue under the town in a tunnel. We are continuing to work closely with the Phase 2a project to share lessons and to ensure that the schemes are aligned.

2.2.3 At the time of writing, the Phase 2a scheme is subject to further consultation and design development, which includes consideration of how the Phase 2a scheme will join with Phase 2b. As part of this work, the Phase 2a project is considering whether the portal for the tunnel under Crewe should move further to the south.

2.2.4 Following the outcome of the Phase 2a consultation, we will update the Phase 2b design as required, to ensure that it continues to join with the proposals for the Phase 2a scheme. The engineering drawings for Phase 2b show an indicative link to a

relocated tunnel portal alongside the current design, to demonstrate how this connection could be delivered.

2.2.5 We anticipate that a hybrid Bill to secure the powers for Phase 2a will be deposited by the end of 2017.

2.3 Working with Network Rail: Crewe Hub and 'Capacity Plus'

2.3.1 One of the recommendations in *HS2 Plus*[9] was to link HS2 with a transport hub at Crewe, which would work with HS2 and the existing network to improve connectivity across the North West. Network Rail was commissioned to develop proposals for a possible hub station.

2.3.2 Although the work is being led by Network Rail, we have played an important role in helping to shape the development of the scheme. For example, we are working with Network Rail to consider a possible new connection north of Crewe that would enable HS2 services to leave the high speed lines in order to serve Crewe, and then rejoin the HS2 network.

2.3.3 Until a specific proposal has been agreed, we continue to assume for the purpose of this decision that only currently committed works have been undertaken at Crewe. As the Phase 2b design process moves forward, we will keep working with Network Rail to consider how the design of the route could be refined to work with a hub station, should these proposals be taken forward.

2.3.4 More broadly, Network Rail is continuing its work to consider how the UK's rail network could operate following the opening of HS2. This work, known as 'Capacity Plus', will help to ensure that the benefits of HS2 are felt across the existing network through the most effective use of the capacity released by new HS2 services.

2.4 Working with Transport for the North

2.4.1 *Rebalancing Britain*[10], which was published in October 2014, focused on transport connectivity across the north of England, and called for the establishment of a new body to manage transport issues at a strategic level across these regions. The Government established Transport for the North (TfN) as the body responsible for taking this work forward. TfN has in turn established the Northern Powerhouse Rail (NPR) project to look at new and upgraded rail links across the north of England, focussed on a number of conditional outputs for journey times and frequency of train services between some of the major northern cities. These are set out in Figure 1.

2.4.2 HS2 will serve northern cities including Manchester, Liverpool, Leeds, Newcastle and Sheffield. So there is a clear link between our proposals and the aspirations of TfN, and we have played an integral role in working with TfN to develop its NPR project.

[9] Available at www.gov.uk/government/publications/hs2-plus-a-report-by-david-higgins
[10] Available at www.gov.uk/government/publications/rebalancing-britain-from-hs2-towards-a-national-transport-strategy

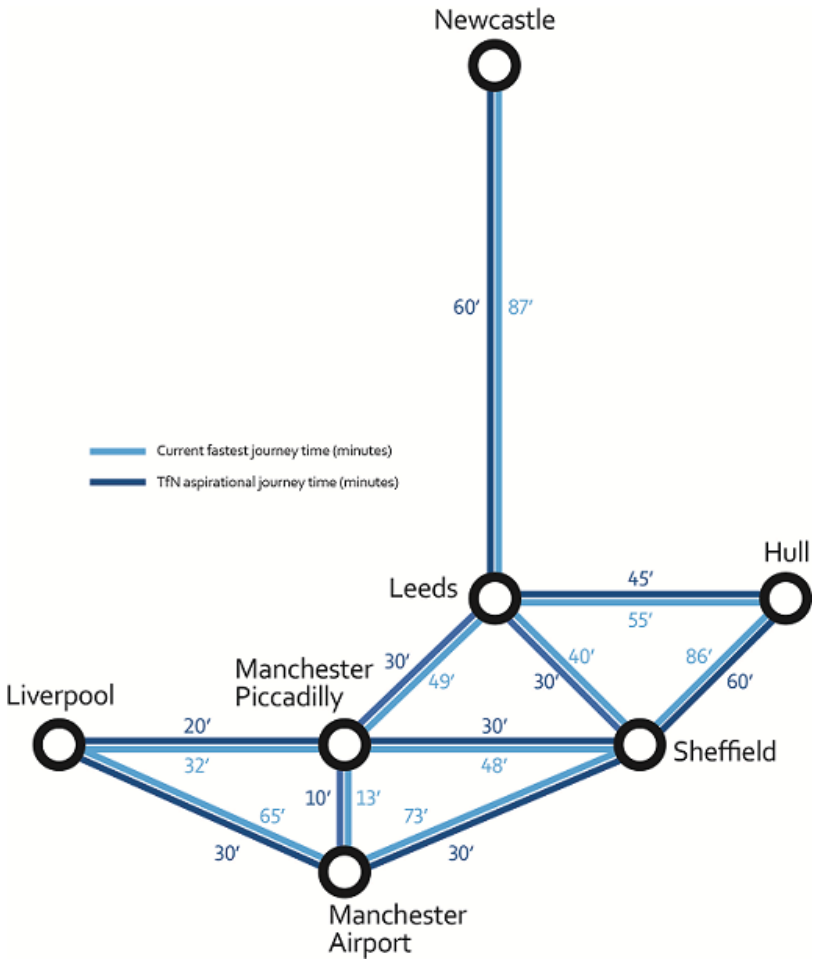


Figure 1: Northern Powerhouse Rail conditional outputs

2.4.3 We continue to work with TfN and Network Rail to look at options for rail investment in the north of England that might help to deliver these aspirations, whether through new rail lines, rail bypasses, or upgrades to the current network.

2.4.4 At the same time, we have reviewed our own proposals to make sure that our plans are co-ordinated and make the most of the opportunities presented by the NPR project. With this in mind, we have reviewed the route to consider whether it should change to accommodate potential future growth or connections. For example, our proposals for stations in South and West Yorkshire have been influenced by the wider debate on improving transport connectivity in the north of England.

2.4.5 Similarly, we are continuing to work with TfN to understand how the HS2 network can facilitate connectivity between key cities in the North West. For example, an additional junction could be provided on the Golborne link to deliver a new connection between Liverpool and Manchester. Work continues with TfN to understand whether this is the best way of delivering stakeholders' aspirations for improved connectivity.

2.4.6 We do not currently expect that the core Phase Two route will have to change significantly to accommodate NPR aspirations. This work will continue during the hybrid Bill design process to consider whether, for example, it would be appropriate to future-proof the HS2 route by including passive provision for possible future connections, including a potential northern connection in South Yorkshire.

3 Developing the route

3.1 The HS2 network north of Birmingham

3.1.1 The Government consulted on the proposed strategy for an HS2 network in 2010. As a result of this work, it was decided that a Y-shaped network was the right strategic approach to delivering high speed rail in the UK, and that a phased approach should be used to deliver the project.

3.1.2 Our initial consideration of options aimed to identify the best route to deliver the Government's strategic objectives for high speed routes to Leeds and Manchester that would also serve the East Midlands and South Yorkshire as well as the wider North East and North West. In addition, this work considered how the high speed network should be connected to the UK's existing rail network. The results of this work are presented in *Options for Phase Two of the High Speed Rail Network*[11].

3.1.3 Based on this work, the Government carried out a consultation on the proposed route and stations for HS2 Phase Two from July 2013 to January 2014. After that, we reviewed the Phase Two route and stations to ensure that our design had given due consideration to the consultation feedback.

3.2 Consultation and engagement

3.2.1 The consultation on the Phase Two route and stations was launched on 17 July 2013 with a closing date for responses of 31 January 2014. Just over 10,000 responses were received and independently analysed by Ipsos Mori on our behalf.

3.2.2 During this time, public events were held at locations along the Phase Two route. These events were designed to help people learn more about the proposed Phase Two route, and raise questions or concerns with technical specialists and representatives of HS2 Ltd and DfT. Members of the public were able to respond to the consultation by post or online.

3.2.3 This consultation built on an ongoing process of engagement with stakeholders across the Phase Two route. We have met a wide range of stakeholders including local authorities, businesses, MPs, communities, action groups and statutory bodies. This engagement helped to give us a deeper understanding of the areas through which the route as proposed would run, and the concerns of those people and organisations affected by the route.

3.3 What did the 2013-14 consultation ask?

3.3.1 The consultation invited responses to the following questions:

1. Do you agree or disagree with the Government's proposed route between the West Midlands and Manchester? This includes the proposed route alignment, the location of tunnels, ventilation shafts, cuttings, viaducts and depots as well as how the high speed line will connect to the West Coast Main Line.

[11] Available at www.gov.uk/government/publications/options-for-phase-two-of-the-high-speed-rail-network

2. Do you agree or disagree with the Government's proposals for:

   a. A Manchester station at Manchester Piccadilly?

   b. An additional station near Manchester Airport?

3. Do you think that there should be any additional stations on the western leg between the West Midlands and Manchester?

4. Do you agree or disagree with the Government's proposed route between West Midlands and Leeds? This includes the proposed route alignment, the location of tunnels, ventilation shafts, cuttings, viaducts and depots as well as how the high speed line will connect to the East Coast Main Line.

5. Do you agree or disagree with the Government's proposals for:

   a. A Leeds station at Leeds New Lane?

   b. A South Yorkshire station to be located at Sheffield Meadowhall?

   c. An East Midlands station to be located at Toton?

6. Do you think that there should be any additional stations on the eastern leg between the West Midlands and Leeds?

7. Please let us know your comments on the *Appraisal of sustainability* (as reported in the *Sustainability statement*[12]) of the Government's proposed Phase Two route, including the alternatives to the proposed route?

8. Please let us know your comments on how the capacity that would be freed up on the existing rail network by the introduction of the proposed Phase Two route could be used?

9. Please let us know your comments on the introduction of other utilities along the proposed Phase Two line of route?

3.3.2 An independent report of the consultation process and a summary of issues raised has been published as part of the Government's decision on the route. This was originally published in support of the route decision on Phase 2a and is available at www.gov.uk/hs2.

[12] Available at www.gov.uk/government/publications/options-for-phase-two-of-the-high-speed-rail-network-appraisal-of-sustainability

4 Reasons for refining the route

4.1 Responding to consultation

4.1.1 One of the main drivers for changes to the route has been the feedback that we received through the consultation. This included concerns over the impact of the route, proposals for alternative alignments, and new intelligence about issues relevant to the route such as the presence of landfills.

4.1.2 We considered the issues raised in the consultation, and developed options to enable us to answer the concerns. In some cases, this included examining specific options that were put forward through consultation. In addition, we generated and considered a range of alternatives for different sections of the route, to ensure that we could respond comprehensively to consultation feedback. Options for each refinement area were developed on a 'point-to-point' basis to ensure that the options could be compared with each other.

4.1.3 These options were compared through a sifting process. The most promising options at each stage were taken forward to be appraised at progressively greater levels of detail. Those options not taken forward were recorded for future reference. This enabled us to prioritise the more promising refinement options, while retaining a clear evidence trail.

4.1.4 Broadly, we considered the options on the basis of:

- constructability, including possible risks such as landfill or geological conditions;
- environmental impacts, including on communities, and sustainability;
- journey time;
- comparative cost; and
- demand / business case.

4.1.5 The relevance of each criterion is partly determined by the refinement in question. For example, issues of demand and business case can be particularly pertinent in sifting options for stations.

4.1.6 At this stage of route development, we have focused on refining the alignment of the route itself. We have not yet considered in detail the opportunities for further mitigation of impacts, which are generally considered later in the design process. In some cases, our work suggests that the best way of addressing the concerns raised in consultation is to design appropriate local mitigation measures. As we explain in Chapter Six, we will take this work forward through the next stage of design.

4.1.7 Highways impacts were considered where they were a differentiator between options, and we have reviewed the consultation route crossings of motorways and trunk roads with Highways England. At this stage, all highways realignments are indicative and would require further design, assessment and engagement. These

issues were not included in the *Appraisal of sustainability*[13], given the current level of design. They will be assessed during the *Environmental Impact Assessment* process.

4.1.8 The result of this work was a series of recommendations to Government for possible refinements to the route. Those changes that have been incorporated into the Phase 2b route are set out in this report. Developing a hybrid Bill will lead to more detailed consideration of impacts and possible associated mitigation, as set out below, and may also lead to further consideration of the route, where appropriate.

4.2 Changes in the strategic picture

4.2.1 We have summarised above how HS2 has been the catalyst for wider strategic discussions about transport connectivity across the North of England. In light of this work, we reviewed the Phase 2b route and stations to consider whether these should be changed to capitalise on new strategic opportunities. For instance, we have considered whether the route or stations should change to deliver better integration with the Northern Powerhouse Rail (NPR).

4.2.2 We have also reviewed the route to consider whether there are opportunities to deliver reductions in the cost estimate at this early stage of design development, by changing the route, while considering the overall impacts of the railway. Delivering efficiencies at this stage of the design provides greater confidence in HS2's overall cost envelope, including the scope for further refinement and mitigation of impacts.

4.2.3 We explain in the following sections where this has led us to propose a different approach to that presented in consultation, or where there may be issues that will require further consideration in the next stage of development.

4.3 Lessons learned from Phase One and updating our design

4.3.1 In addition to the findings from consultation, other changes came out of design development resulting from applying the lessons of Phase One. The deposit of the Phase One hybrid Bill in November 2013 meant that we could apply the lessons learned from this process to the Phase Two route.

4.3.2 This has resulted in modifications at certain locations, particularly to vertical alignments and gradient profiles. For example, we have assessed every watercourse crossing (major and minor) along the route and, where possible, have provided sufficient clearance to culvert the watercourse underneath the railway, as required. We have also reflected the updated route design standards on track alignment, which aim to deliver a better standard of ride comfort.

4.3.3 Some design changes have been the result of value engineering, which seeks to reduce the overall cost of the route by incorporating efficiencies into the design. This has included applying lessons learned from value engineering introduced into the Phase One design.

[13] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester

4.3.4 The advantage of undertaking this work at this stage is to offer increased confidence in the footprint, design and deliverability of the railway, at a comparatively earlier stage of design than in the Phase One project.

4.3.5 Design changes introduced into the route as a result of design development included:

- Reducing the width of the railway (the 'trace'), which reduces the overall land required by the railway and also reduces the cost.
- Reducing the diameter of tunnels, meaning that tunnelling would produce less excavated material, and could help to reduce costs.
- Reviewing locations where the route crosses watercourses. This helps to reduce flood risks to the railway and the surrounding area, as well as reducing detrimental impacts on watercourses.
- Adjusting the track alignment to improve drainage, offering improved operational performance.

4.3.6 Some small changes were also necessary where an individual refinement was inserted into the overall route to form a single coherent design, and to reflect updated digital terrain model data.

5 HS2 stations and route options

5.1 Introduction

5.1.1 We undertook a detailed process of refinement in selecting the stations to serve the Phase Two network, and this work is set out in *Options for Phase Two of the High Speed Network*[14]. When choosing station locations, we started by identifying options within a wide catchment area independently of our internal work looking at lines of route. We developed a long list of options around existing railway stations and other locations with good connectivity and / or proximity to the city centre.

5.1.2 We developed station proposals with local partners, who helped to identify potential station locations. In parallel, we undertook work on the lines of route and station approaches. Once we ceased work on a particular station option, we would also stop work on the associated line of route, unless it had particular potential.

5.1.3 When a line of route was not progressed, we considered the associated station and potentially took it further rather than immediately stopping work on it. This was to make sure we did not prematurely dismiss what could prove a strong option because we did not have an immediately viable line of route.

5.1.4 We carried out more detailed work on station options and on the lines of route that would serve them, assessing options to a greater level of detail against the sifting criteria. Through a process of sifting, much like that described above, we stopped working on the options that performed less well and took forward the more promising alternatives.

5.1.5 This chapter explains the further development work that we have undertaken on station selection after the consultation closed.

5.2 Manchester Airport Station

5.2.1 Following the consultation, we carried out further work to consider whether there were opportunities for alternative routes into the centre of Manchester.

5.2.2 We identified the scope for other routes to Piccadilly Station, which presented alternative opportunities and risks. However, these would not run in the vicinity of Manchester Airport and so would not enable the high speed network to serve the airport and the wider south Manchester region.

5.2.3 Given the importance of the proposed Manchester Airport Station as a hub for the wider area, and the scope for synergy with planned development in this area, we opted to continue with the current route corridor. Our assumption remains that the delivery of Manchester Airport Station will be supported by third party funding.

5.2.4 Further work is required to consider how Manchester Airport Station could link with Manchester Airport and the local area. We will continue to work with local and regional stakeholders to understand the options and opportunities to connect Manchester Airport Station into local transport networks.

[14] Available at www.gov.uk/government/publications/options-for-phase-two-of-the-high-speed-rail-network

5.3 Manchester Piccadilly Station

5.3.1 There has been strong agreement that locating a new high speed station alongside the existing Piccadilly Station is the right solution for Manchester city centre. Accordingly, although the approach to the station has moved as a result of route refinement, the main proposal is still an HS2 station at Manchester Piccadilly.

5.3.2 We will continue to work with local stakeholders to understand how the HS2 station can support and integrate with plans for regeneration in this area. This will become increasingly important as we move forward with more detailed designs in support of the hybrid Bill.

5.3.3 HS2's station in Manchester also needs to integrate with the wider aspirations set out as part of the Northern Powerhouse Rail programme. We will continue to work with TfN and other stakeholders to understand how HS2 can integrate with current and future rail services across the North.

5.4 East Midlands Hub Station

5.4.1 The East Midlands Hub at Toton sits between the cities of Derby, Nottingham and Leicester, and offers good opportunities to connect with the existing rail network and the highways network, including the M1. There is also scope to accommodate an extension of the Nottingham Express Tram. This location reflects the fact that demand for long distance rail travel is distributed across the East Midlands.

5.4.2 Consultation feedback suggested that, instead of a station, we should consider providing connections to the existing network so that HS2 services could run to destinations on the existing network like Leicester, and then join the HS2 network. At the moment, we consider that an HS2 station is the best way to make the most of existing and newly created capacity and connectivity. We will continue to examine any evidence advanced by stakeholders of the benefits of additional connections.

5.4.3 Although the Toton site offers good connectivity, there are also a number of challenges in this location, including the extensive floodplains of the rivers Trent and Erewash, the complex interfaces with existing railway infrastructure, and the need to thread the railway between two built up areas while maintaining road access across the corridor of the railway.

5.4.4 We therefore considered alternative locations for a station to serve the East Midlands. In particular, we developed an alternative option at Breaston, to the west of Long Eaton, which would provide an interchange with the Midland Main Line. Unfortunately, our work demonstrated that this would not be a feasible alternative to a station at Toton, owing to a range of factors including the engineering challenges of this location.

5.4.5 In addition, stakeholders across the East Midlands have united behind a hub station at Toton as the best solution for the region. Therefore we continue to recommend that the East Midlands Hub station be located at Toton, and we will continue to support local stakeholders as they develop their plans to make the most of the connectivity that HS2 will deliver.

5.4.6 We have also undertaken route refinements in the area of East Midlands Hub station; these are set out in greater detail in Chapter Six.

5.5 South Yorkshire

5.5.1 Following the consultation, we reviewed the options for a station in South Yorkshire in light of these five key factors:

- Demand – from South Yorkshire and markets further north
- The needs of Sheffield and the wider region
- Connectivity with existing rail and the wider transport network
- Topography, urban density, and the environment
- Consideration of cost.

5.5.2 In particular, we had to balance the need to serve South Yorkshire effectively with the need to avoid significant disbenefits to larger markets further north. The developing strategic context of the NPR project led us to reconsider how HS2 could improve connectivity between city centres in the north of England.

5.5.3 Accordingly, we have now recommended an alternative approach to serving South Yorkshire. This involves a spur from the HS2 route that connects to the existing network south of Chesterfield, to enable HS2 services to travel on to Sheffield Midland Station.

5.5.4 This approach also means that the HS2 mainline can take a different route through South Yorkshire and West Yorkshire, travelling to the east of Rotherham along the line of the M1 and M18, and then heading north-west to rejoin the consultation alignment south of Altofts.

5.5.5 We laid out the options for serving South Yorkshire in July 2016. For more detailed information about why we developed this alternative approach, please review the *Sheffield and South Yorkshire* report and accompanying technical report[15].

5.5.6 The Secretary of State has asked us to take forward this option, and further consultation is taking place on this route before a final decision is taken.

5.5.7 This new route is described in section 6.3. For more detail, please see the *Sustainability statement* and *Engineering report*[16].

5.5.8 There is scope to consider further connectivity options as we move forward with the project. We are currently considering the case for a parkway station in the region that could serve the distributed communities of South and West Yorkshire. We are also examining the case for HS2 services to run beyond Sheffield Midland to serve other destinations in the region.

5.5.9 As part of the consultation, we are seeking views from stakeholders on the scope for a connection back on to the HS2 route, via the Sheffield to York line, to allow services to join or leave the HS2 network north of Sheffield Midland Station. This

[15] Available at www.gov.uk/government/publications/hs2-sheffield-and-south-yorkshire-report-2016
[16] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester

could help to meet the TfN aspiration for faster journeys between Sheffield and Leeds city centres.

5.6 Leeds Station

5.6.1 In the consultation, we proposed locating Leeds high speed station at New Lane, south of the River Aire. Some feedback in consultation challenged this proposal and argued that the station should be more centrally located and deliver faster interchange times with the other services.

5.6.2 In *Rebalancing Britain*[17], published in October 2014, it was observed that Network Rail would be undertaking works to Leeds Station in the coming years, and that connectivity through this station would be an important consideration. Accordingly, it was decided to review the HS2 proposal for a station in Leeds.

5.6.3 We worked with stakeholders including Network Rail, Leeds City Council and West Yorkshire Combined Authority to develop alternative proposals. Consideration was given to whether HS2 could share platforms at an extended Leeds City Station, and whether an alternative configuration of stations would deliver better connectivity.

5.6.4 The proposal that we have now taken forward was presented in the *The Yorkshire Hub*[18] report in November 2015. HS2 will serve Leeds with a terminal station that will abut the existing station, forming a 'T' shape. This will provide improved connectivity to services on the existing network.

5.6.5 As we continue to develop the scheme, we will further consider how Leeds Station can support the wider connectivity aspirations of Transport for the North. We will also continue to work with Leeds City Council as they take forward their master planning for this area, to ensure that our station goes with the grain of local development.

[17] Available at www.gov.uk/government/publications/rebalancing-britain-from-hs2-towards-a-national-transport-strategy
[18] Available at www.gov.uk/government/publications/the-yorkshire-hub-an-interim-report-on-the-redevelopment-of-leeds-station

6 Review of refinements

6.1 Introduction

6.1.1 The route refinements presented in this section cover the route from Crewe to Manchester on the western leg, and from the West Midlands to Leeds on the eastern leg. The Secretary of State has agreed that these changes should be included in the Phase 2b route at this stage.

6.1.2 The majority of the changes that we have recommended are within the same general route corridor as the route that we presented in 2013, and have been adopted based on the route refinement process set out in Chapter Four.

6.1.3 There are seven locations where we have introduced more substantial changes to the route presented in 2013, which involve new or different impacts (both positive and negative) on people, wildlife or property. We are carrying out further consultation in these areas, on behalf of the Secretary of State, to ensure that those people who would not previously have been consulted have the opportunity to give their feedback.

6.1.4 In the following text, we have highlighted in italics those areas where the route will be subject to further route refinement consultation[19].

6.1.5 As we develop a hybrid Bill for the full Phase 2b route, we will need to further develop the design of the scheme, including options for mitigating the impacts of the route on local communities and environmentally important features. As part of this work we will consult across the entire route on the draft and final Environmental Statement for Phase 2b, as well as on any further design refinements. So there will be further opportunities for people affected by the railway to influence the design of the route through their local areas.

6.1.6 In the following descriptions we have rounded all vertical measures to the nearest metre, and all horizontal measures to the nearest five metres.

6.1.7 More information on the design and impacts of this route is available in the accompanying *Route engineering report*[20] and the *Sustainability statement*[21].

[19] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester
[20] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester
[21] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester

6.2 The western leg

Crewe tunnel

6.2.1 The Phase 2b route will join the end of Phase 2a, to the south of Crewe. Our assumption is that this will be at the southern portal of the tunnel under Crewe, which will be delivered as part of this scheme.

6.2.2 As part of the development of the hybrid Bill for the Phase 2a scheme, consideration is being given to whether the tunnel portal to the south of Crewe should move further south, to reduce interactions with the existing network and highways. At the time of writing this is subject to consultation and design development. Therefore, until the Secretary of State has responded to this consultation, we will not move the design for this section of the route.

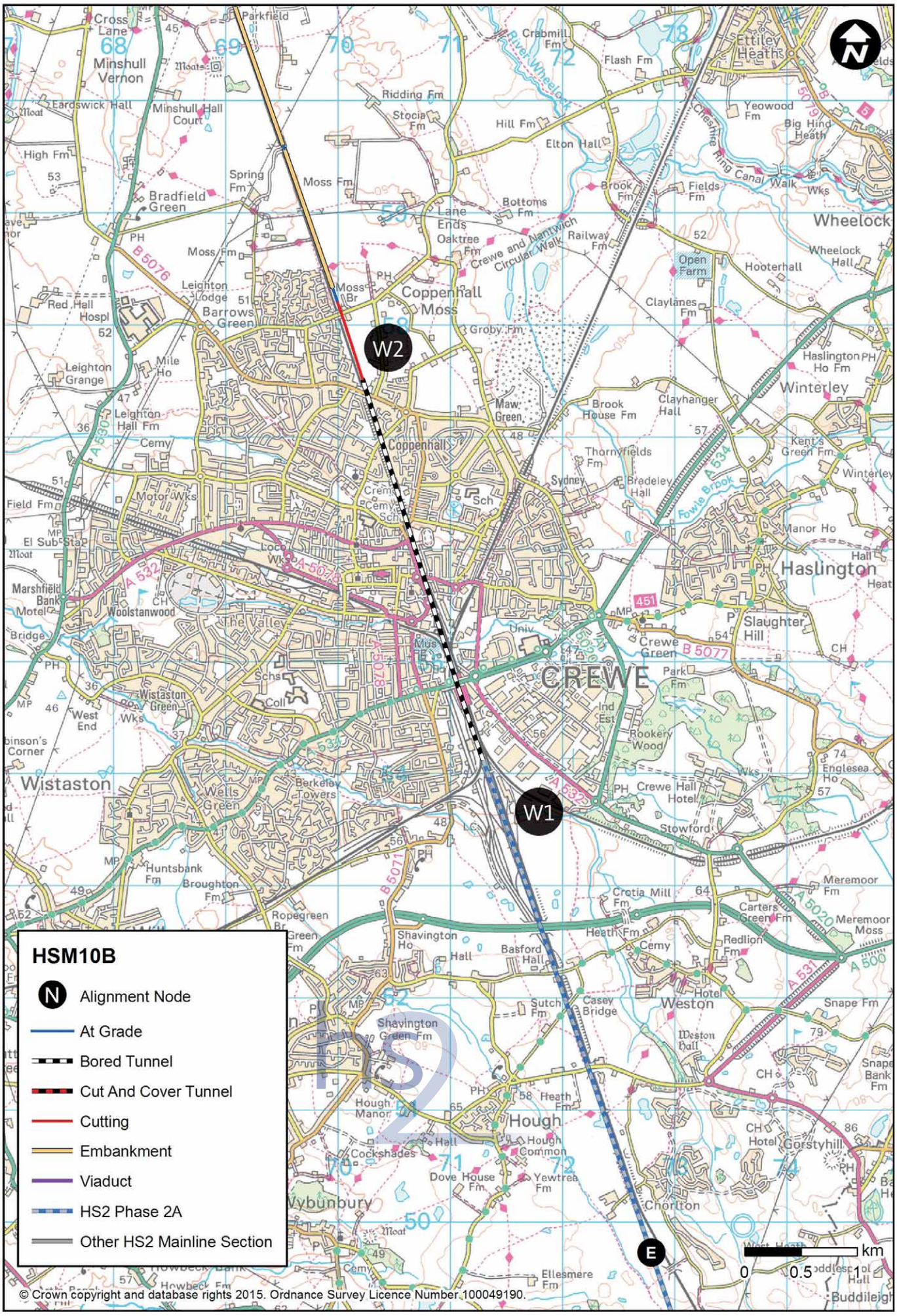
6.2.3 Following the results of the consultation for the Phase 2a scheme we will update the route design as required by updating the design of the proposed tunnel so that it connects with Phase 2a at the proposed portal location.

6.2.4 At the current time, we have also made no assumptions about the work being undertaken by Network Rail to consider the delivery of a new hub station at Crewe. We continue to work closely with Network Rail to ensure that our plans are aligned and to advise on the implications for HS2 of different proposals. As this project progresses, we will update the design of our route as required.

6.2.5 The tunnel as currently designed passes under Crewe, (W1) with a vent shaft required at a midway point. The location of this vent shaft will be subject to further development as part of the hybrid Bill process. The northern end of the tunnel has been moved approximately 270m southwards. (W2) This is because lessons learned from the development of Phase One enabled us to reduce the diameter of the tunnel and therefore reduce its depth.

6.2.6 As a result, there has been a reduction in the depth of the cutting to the south of Parkers Road, while to the north of Parkers Road the height of the embankment has increased to a maximum of 6m. This has in turn allowed us to improve the clearance of the railway over watercourses in this area.

6.2.7 As part of the next stage of route design, we will consider further how the impacts of the route in this area can be mitigated.


W2
W1
CREWE
Wistaston
Haslington
Winterley
Wheelock
Coppenhall
Hough
Weston
Vybunbury
HSM10B
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
HS2 Phase 2A
Other HS2 Mainline Section
km
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Crewe North rolling stock depot

6.2.9 The consultation route included a proposed rolling stock depot (RSD) located near Golborne, to the south of the HS2 junction with the West Coast Main Line. This RSD is designed for overnight stabling of trains, cleaning, and light maintenance, with heavy train maintenance taking place at Washwood Heath depot on the Phase One route.

6.2.10 During the consultation, concerns were raised about the environmental impacts of the RSD at Golborne, and we received suggestions that the depot should be relocated. As a result we reviewed a range of locations for the rolling stock depot that would meet the requirements for:

- A large, flat site
- A connection to the existing network
- A strategic location to facilitate access to the depot for HS2 trains serving destinations such as Liverpool, Manchester and Preston.

6.2.11 We expect that each HS2 Ltd RSD will support around 125 new jobs in the local area when the railway is in operation.

6.2.12 We considered a range of locations across the western leg that met these requirements. As with our other sifting, we considered the balance between a range of issues including environmental impact, cost, and engineering complexity.

Consulting on relocating the western leg rolling stock depot

6.2.13 Following this work, we recommended relocating the RSD to a site between the A530 Nantwich Road, and the West Coast Main Line near Wimboldsley. (W3) *This site, which following the construction of HS2 would sit between the HS2 route and the West Coast Main Line, would deliver a good fit with the requirements for an RSD.*

6.2.14 In order to provide access to the RSD from the HS2 main line, a grade separated junction is proposed in the area between Winsford and Middlewich. This junction would require a viaduct up to 16m high in order to allow one track to cross over the HS2 mainline to enable southbound trains to access the depot.

6.2.15 Siting the RSD *at this location would involve a number of demolitions and would have some additional visual impacts near Wimboldsey. This location would, however, deliver reductions in impacts elsewhere on the route, including at Golborne.*

6.2.16 Moving the RSD from Golborne to the north of Crewe also means that significantly less infrastructure is required at the junction to Manchester. Removing this infrastructure means that there are fewer impacts in this area, and reduces the estimated cost of the route. This is discussed in greater detail below.

6.2.17 Empty trains will access the rolling stock depot from both HS2 infrastructure and the existing network. Accordingly, we will continue to consider how the proposed RSD *should integrate with existing and proposed infrastructure in the Crewe area, including the West Coast Main Line and the developing Crewe Hub proposals.*

Crewe North to the Manchester Junction

6.2.18 Respondents to the consultation raised a number of issues in connection with the route through Cheshire, including the proximity of the route alignment to Lostock Green, Lostock Gralam and Pickmere Telescope. Impacts on the Trent and Mersey Canal Conservation Area, the River Dane, Peover Eye, Leonards and Smokers Wood and Winnington Wood ancient woodlands were also highlighted.

6.2.19 In addition, the consultation highlighted the potential for significant risk to HS2 as a result of the underlying geology of this area, and the associated industrial activity. Respondents raised concerns over the potential risk of ground movement and subsidence, and the consultation has enabled us to develop a much clearer view of the patterns of risk in this area. The refinements presented in this section are informed by these issues.

Salt and Gas Storage in Cheshire

Due to the geology of Cheshire, there are a number of existing controlled-brining and gas storage operations in the area and it was highlighted that the proposed consultation route would have significant impacts on infrastructure related to these operations. Both controlled-brining and gas storage pose a risk to the construction and operation of the railway. Of particular concern is the crossing of sub-surface brine extraction and gas storage caverns, where long-term liability for the operation of these assets could become an issue.

In addition to salt-related industries, the process of natural dissolution and corresponding subsidence also poses a challenge to the operation and management of HS2 through this area. Work has been undertaken to identify the corridors through the area that carry the least risk with regards to salt-related subsidence; however, it is recognised that the issue will require additional mitigation and we are continuing to work to understand and develop engineering solutions.

6.2.20 We considered a number of routes through Cheshire with the aim of avoiding the greatest concentration of risk due to salt, including alternatives to the east and west of the consultation route. Our work included consideration of the impacts on communities and the environment, and the other engineering challenges that might be involved in alternative routes.

Consulting on the route between Middlewich and Pickmere

6.2.21 *In response to the concerns about ground conditions, including those raised in consultation, we have raised the route in this area to allow for careful management of drainage and geological risk, and moved it westwards to avoid the main concentrations of risk in this area, particularly the risks of crossing currently active brine extraction cavities. In general the route through this area is at least a metre above ground level to help manage the risk of subsidence.*

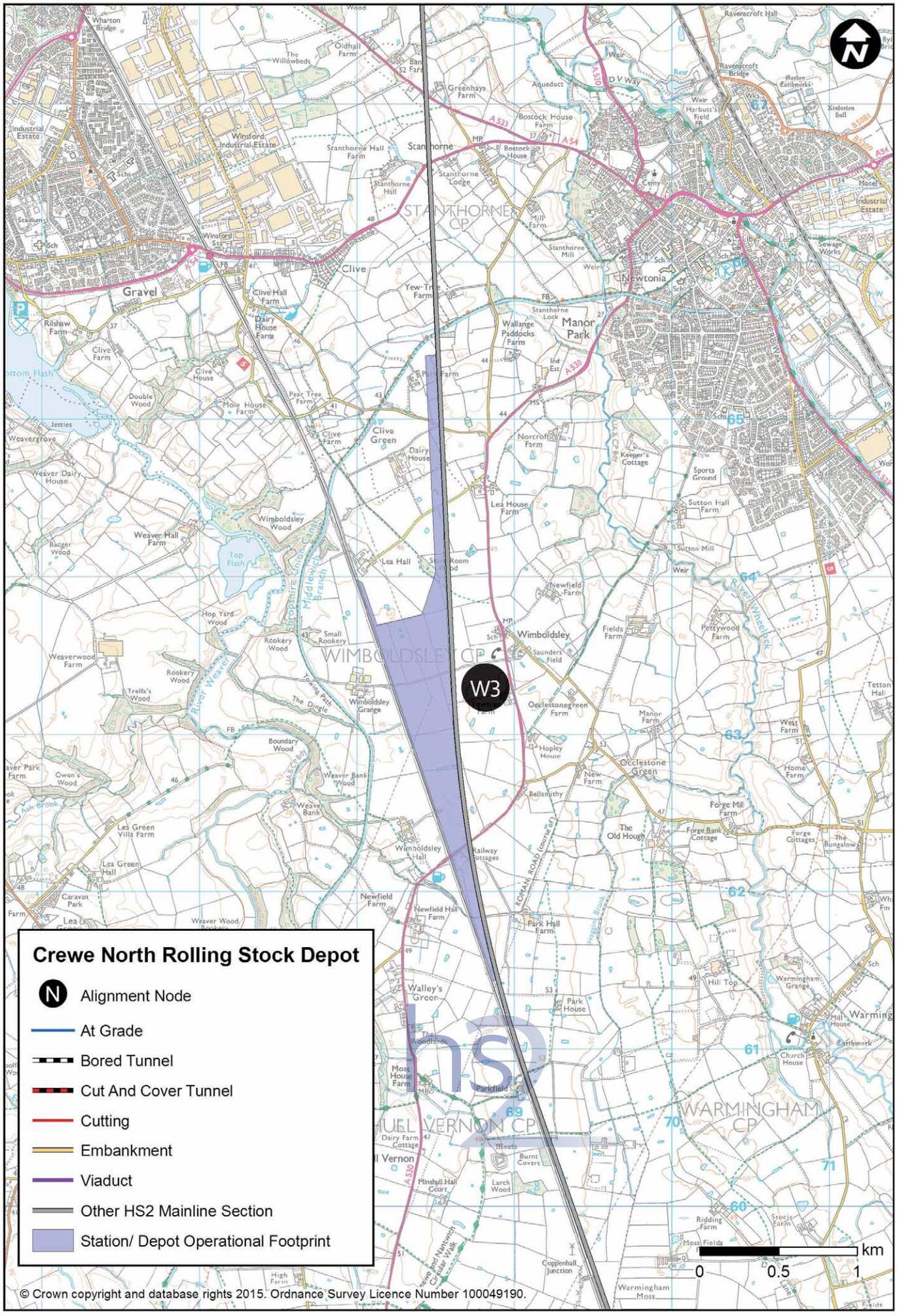
6.2.22 *For approximately 5km north of Crewe, the route has been raised by up to 8m, onto an embankment 2m to 7m high. (W4) As the route heads north, between Winsford and Middlewich, and past the new proposed rolling stock depot location, the HS2 main line has been raised out of cutting and lifted a maximum of 7m, so that it is on embankment up to 8m high. The viaduct over the River Dane Floodplain and Trent and Mersey Canal in this area has also been raised, from a maximum height of 10m to a maximum height of 26m.*

6.2.23 *We have also moved the route horizontally, to avoid constructing over existing cavities, which would introduce significant additional risk to the route. Between Winsford and Northwich, the route has moved westward by up to 800m.* (W5) *As a result, the viaduct over the River Dane has also been lengthened by over 400m and the route follows the existing A556 corridor for approximately 1km.* (W6) *North of Lostock Gralam, the route has been moved eastwards by up to 400m. This is again driven by the need to avoid construction over existing cavities*. (W7)

6.2.24 *To the north of the River Dane valley, for approximately 12km, the route has been raised up onto a series of embankments and viaducts. When on embankment, the route is generally 3-15m high, interspersed with viaducts over floodplains with a maximum height of 23m, over Peover Eye.* (W8)

6.2.25 *These changes would result in increased visual impacts because the route is now higher through this area. The proposed route has moved further away from Lach Dennis and passes to the west rather than the east of Lostock Green, with some additional demolitions required in this area. The route also passes closer to Lostock Gralam, but further away from Pickmere and Higher Wincham. For more information on the impacts of this proposed refinement, please see the Sustainability summary[22].*

[22] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester


Crewe North Rolling Stock Depot
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Station/ Depot Operational Footprint
W3
STANTHORNE CP
WIMBOLDSLEY CP
HULL VERNON CP
WARMINGHAM CP
Gravel
Clive
Newtonia
Manor Park
Wimboldsley
Occlestone Green
Warmingham
km
0
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1
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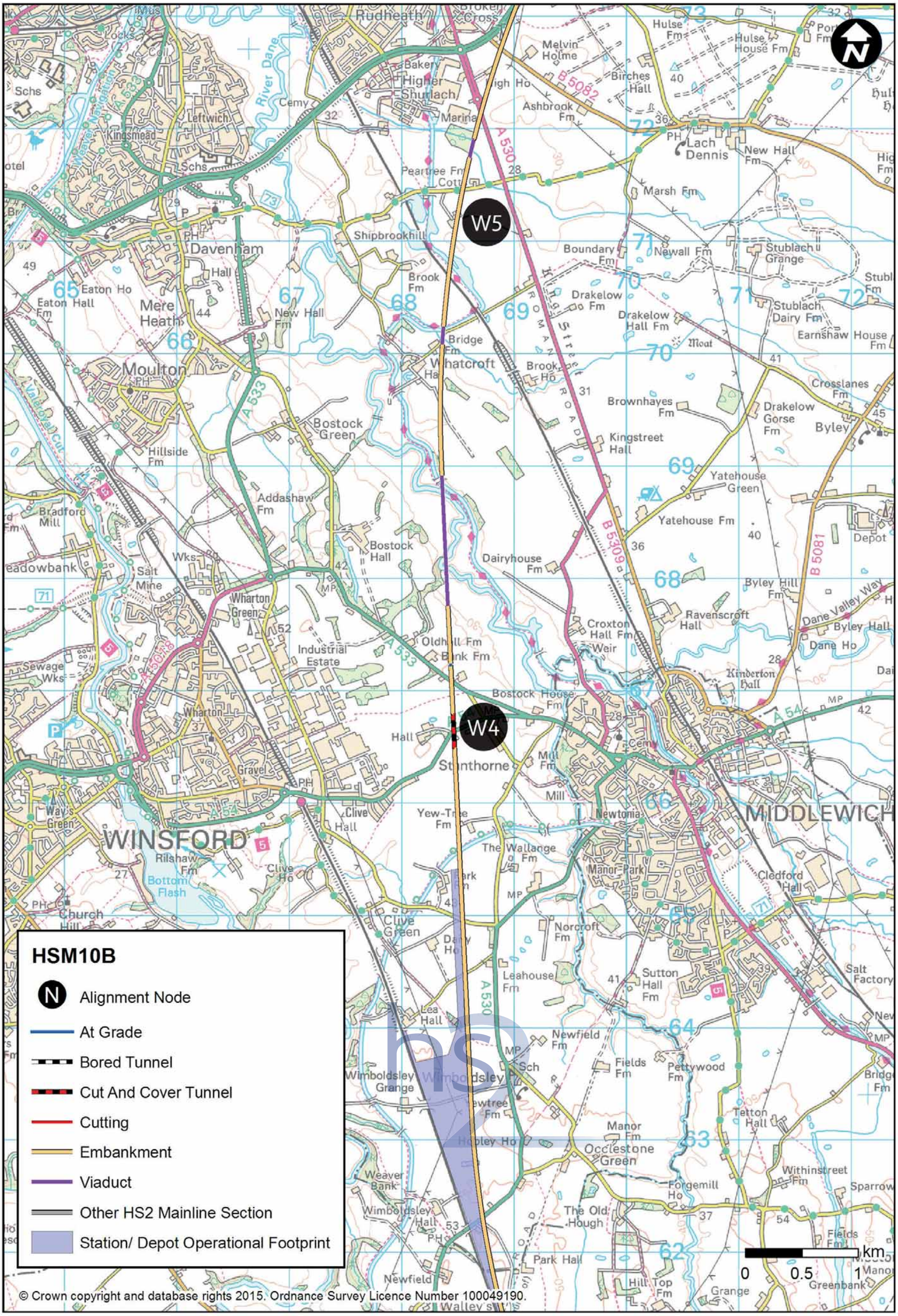

W5
W4
HSM10B
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Station/ Depot Operational Footprint
WINSFORD
MIDDLEWICH
Davenham
Moulton
Rudheath
Lach Dennis
Stanthorne
Wimboldsley
Occlestone Green
Clive Green
Wharton
Bostock Green
Byley
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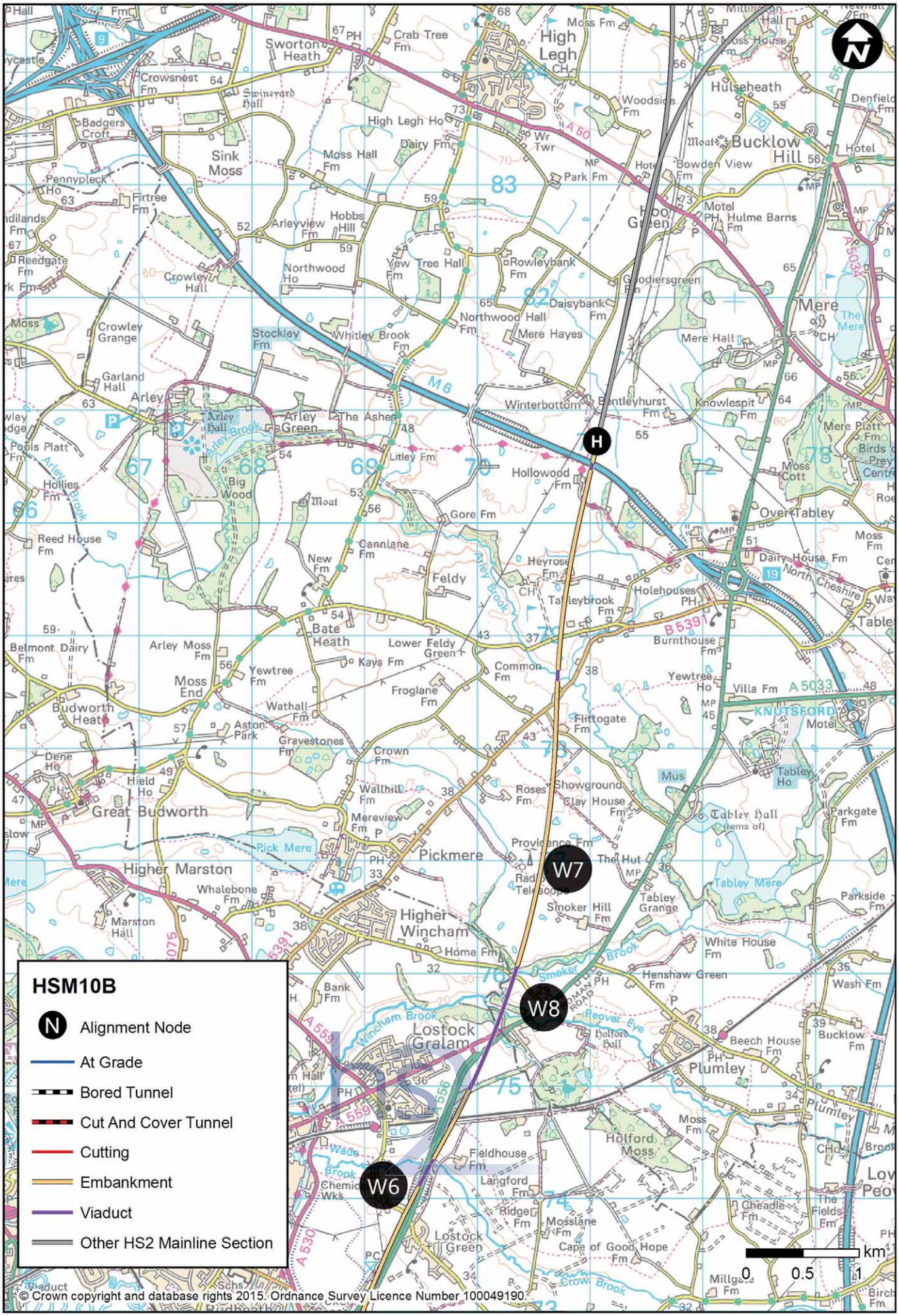
HSM10B
Alignment Node
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Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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W7
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The Manchester Junction

6.2.29 Heading north through Cheshire, the route crosses over the M6 (W9) before reaching a junction allowing services to leave the HS2 main line and join the HS2 spur to Manchester. The viaduct over the M6 has been raised by approximately 4m to a maximum height of 12m in order to comply with updated design standards and achieve better clearance of the motorway.

6.2.30 On the route presented at consultation in 2013, the spur to Manchester joined the HS2 main line using northern and southern chords. The 7km-long northern chord linked the Manchester spur and main line via grade separated junctions at each end.

6.2.31 The aim of this chord was to enable empty trains to move between Golborne rolling stock depot (RSD) and Manchester Piccadilly. The relocation of the RSD to Crewe North means this section of track will no longer be required. It has been removed from the Phase 2b proposals and correspondingly results in less land take, noise and visual impact in this area.

6.2.32 As well as removing the impacts directly associated with this piece of infrastructure, removing the northern chord has also enabled us to review the design of the remaining HS2 route. We have lowered the main line between the A50 and M56 by up to 12m, to a maximum cutting depth of 22m. (W10) This change responds to concerns raised in consultation, and will reduce the impact on the A50 crossing and improve clearance underneath a number of small watercourses.

Links with Northern Powerhouse Rail

We are working with partners including Transport for the North to consider how the high speed line in this area could facilitate east-west connectivity between destinations such as Liverpool, Manchester Airport, and Manchester.

For example, there may be scope for the route and station in this area to form part of a wider network delivered as part of the Northern Powerhouse Rail programme. It has been suggested that this could be delivered by a new connection between the existing network and the HS2 main line to allow services from Liverpool to serve Manchester via the airport.

Such a proposal would connect to the route proposed in this report but would require additional infrastructure in this area, beyond that set out in this report. We will continue to keep the design of the route in this area under review in the light of the developing aspirations for the Northern Powerhouse. Our work with Transport for the North will help us to understand the opportunities and implications of this approach, and whether using the Golborne connection represents the best way of delivering aspirations for improved connectivity.

Manchester Junction to the West Coast Main Line

6.2.34 Some consultation feedback suggested that, rather than delivering a new high speed connection to the West Coast Main Line near Wigan, there should be investment to increase the West Coast Main Line capacity between Crewe and Preston.

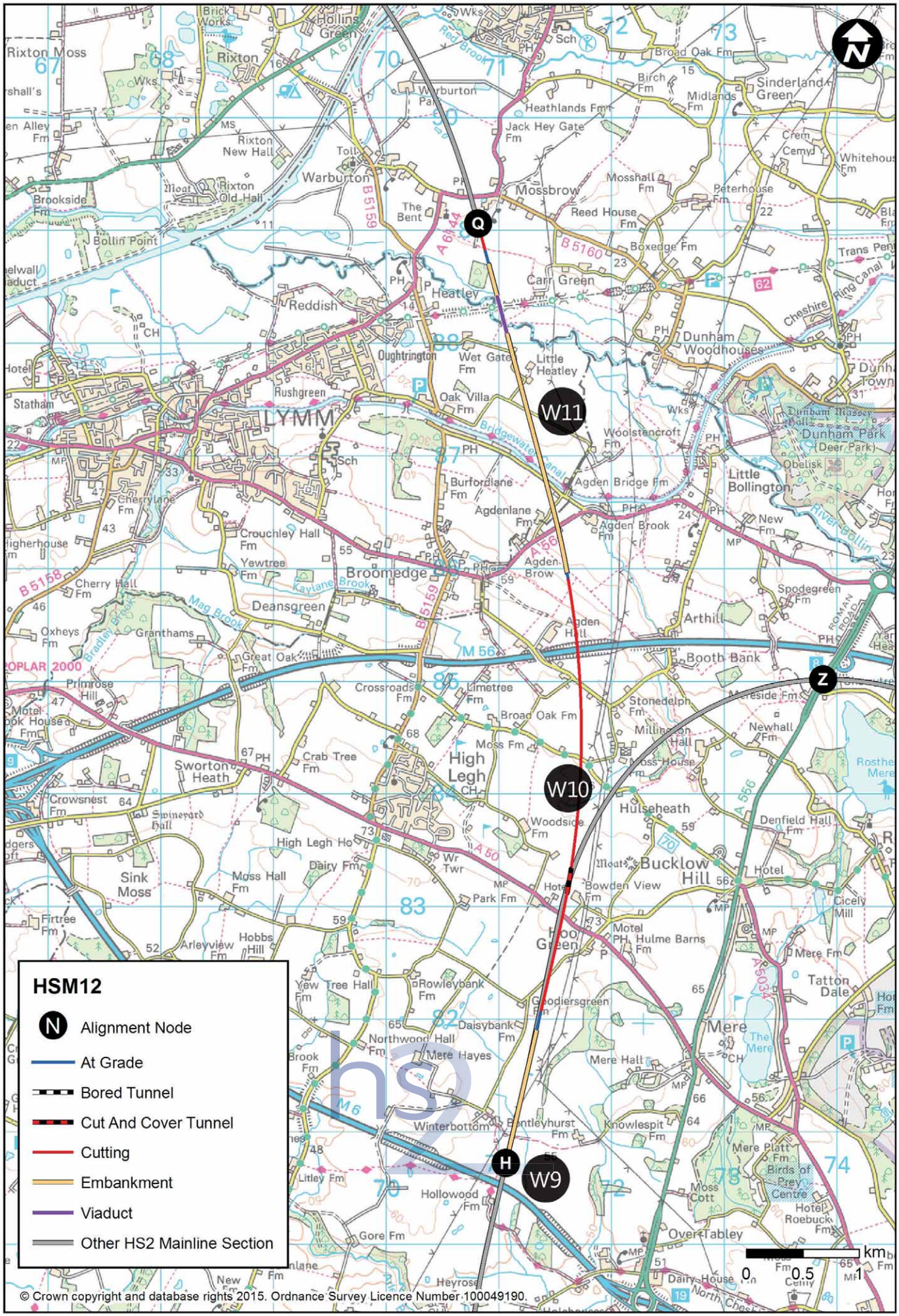
6.2.35 Working with Network Rail, we considered the likely costs and impacts of such investment. Our conclusions were that increasing capacity on this section of the West Coast Main Line was likely to involve a significant amount of work, including widening two-track sections of railway to four tracks. We expect that this would cause a significant amount of disruption over an extended period of time. The cost of upgrading the existing network to provide similar capacity benefits as was estimated to be higher than the equivalent cost of developing the HS2 link via Golborne, while delivering fewer benefits overall.

6.2.36 We continue to recommend that this section be included in the HS2 route. Removing the northern chord, as described above, means that the crossing of the Bridgewater Canal can be simplified, as a grade separated junction is no longer required here.

6.2.37 Between the Bridgewater Canal and River Bollin, the route has been raised by up to 5m, to a maximum height of 10m as a result of updated track standards and changes to the route to the north and south of this area. (W11)

6.2.38 As the route heads further north, it passes over the Manchester Ship Canal on a 28m high viaduct. (W12) The height of the viaduct is determined by the need to allow seagoing cargo vessels to pass along the canal, including the need to avoid constructing viaduct piers in the canal. In response to concerns raised in consultation, we considered alternative options to tunnel underneath the canal. However, the combination of disruption during what would be a complex construction, impacts on the sensitive environmental features to the north of the canal, geological and landfill risks, and cost, means that we continue to recommend a viaduct as the best method of crossing the canal. In addition, any route must also cross the Chat Moss railway line and the M62.

6.2.39 As a result of lessons learned from Phase One, the viaduct over the canal has been lengthened by approximately 120m to improve the track geometry. The design speed over the viaduct has also been reduced to 320kph, to avoid the need to further increase the height of the associated structures, delivering a reduction in the expected noise impacts. As services travelling on this section of route will need to slow to join the West Coast Main Line, we do not consider that this will have a significant impact on the overall journey times to the North West.


HSM12
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Cutting
Embankment
Viaduct
Other HS2 Mainline Section
Q
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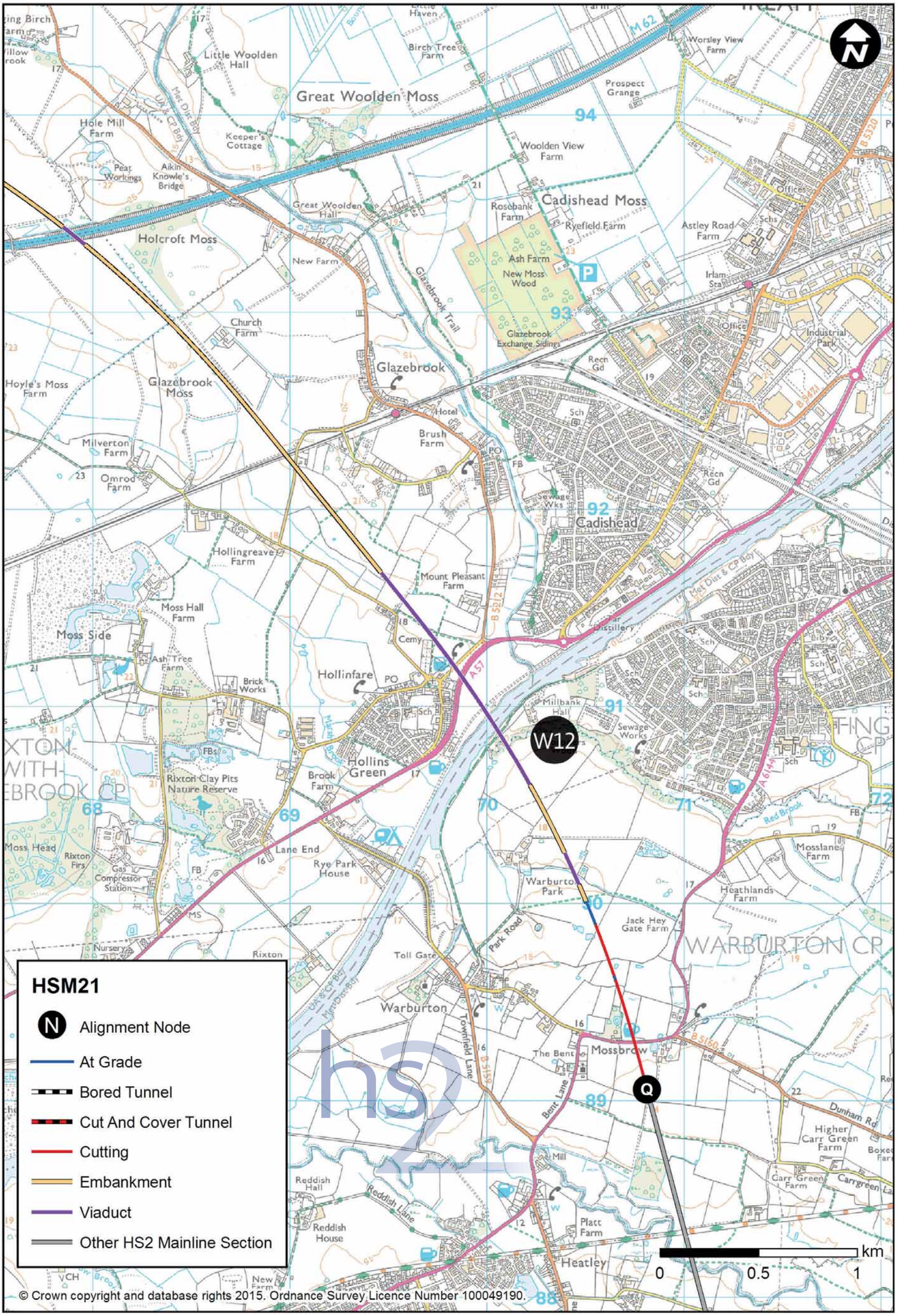
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Alignment Node
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Cut And Cover Tunnel
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Embankment
Viaduct
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km
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Great Woolden Moss
Holcroft Moss
Cadishead Moss
Glazebrook
Glazebrook Moss
Cadishead
Hollinfare
Hollins Green
Moss Side
Warburton
Mossbrow
Heatley
WARBURTON CP
Irlam Sta
Rixton Clay Pits Nature Reserve
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6.2.44 North of the Manchester Ship Canal, the route crosses the M62 on a viaduct. This has been raised by up to 4m to a height of approximately 11m in order to reflect design lessons learned from Phase One, achieving better clearance of the motorway. In common with elsewhere on the route, we will consider as part of the hybrid Bill design process how to maintain road and footpath access in this area.

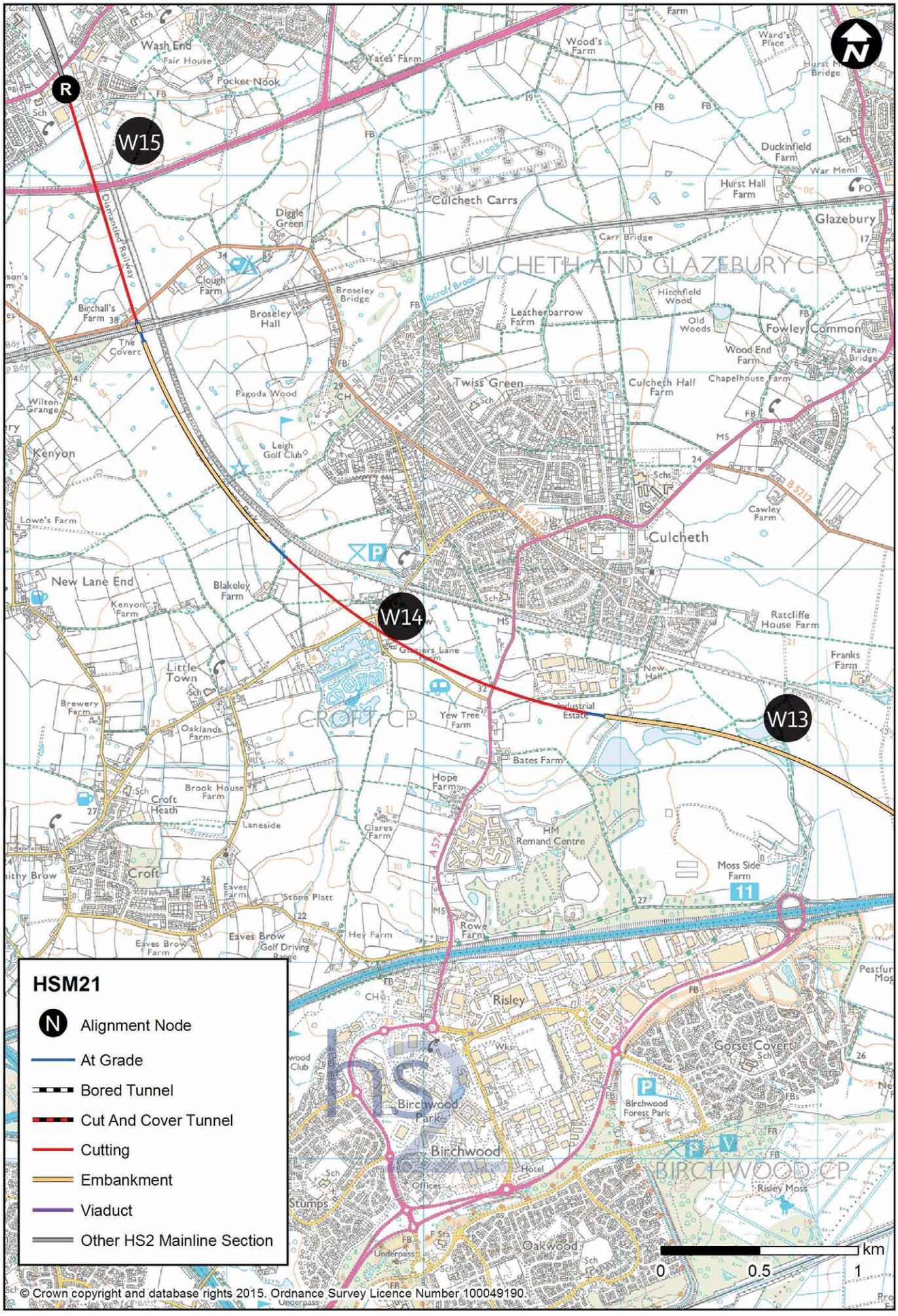
6.2.45 As it passes Risley landfill, to the south of Culcheth the route has been raised from a maximum height of 3m to a maximum height of 7m. (W13) The consultation route then skirted Culcheth along the line of a dismantled railway. Feedback received in the consultation highlighted concern over the proximity of the HS2 line to the village, the impacts on Culcheth Linear Park, and the fact that the consultation route would pass through the middle of Taylor Business Park, which is the site of a number of important local employers.

6.2.46 Accordingly, we have moved the route approximately 300m to the south-west, further away from the town and avoiding these features. (W14) As a result, the route has now moved closer to a small cluster of businesses on Wigshaw Lane and, as we develop the design, we will need to consider further how best to manage or mitigate the impacts of the route through this area.

6.2.47 The route is generally at ground level through this area, before descending into a cutting through Lowton. (W15) In response to consultation, we considered whether a station could be delivered at Leigh where the HS2 line would cross the existing network. This would require realignment of the HS2 route to deliver a long enough section of straight track, which would lead to additional impacts in this area. In addition, the demand case for an intermediate high speed station in this area was not sufficiently strong to warrant the inclusion of a further intermediate station, given the proximity of other stations that would be served by HS2 including Wigan, Warrington, and Manchester Piccadilly.

6.2.48 In the consultation route, a rolling stock depot was located to the north of Lowton. As described above, it is proposed to move this depot to a location north of Crewe. Accordingly, we have been able to refine the design of the route through this area, reducing the overall impacts of the railway here.

6.2.49 The main line has been shifted approximately 410m further south, away from Pennington Flash. We have also raised the route in this area to improve clearance over watercourses and aid drainage in the area, while still maintaining a lower profile than the infrastructure previously required to access the depot. The route was in cutting up to 7m deep with a depot connection on viaduct up to 10m high, but is now on embankment in the region of 3m to 5m high. The south-facing connection to the West Coast Main Line has also been removed, further reducing the overall impacts of the route in this area. (W16)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Embankment
Viaduct
Other HS2 Mainline Section
R
W15
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W13
N
CULCHETH AND GLAZEBURY CP
CROFT CP
BIRCHWOOD CP
Culcheth
Culcheth Carrs
Glazebury
Twiss Green
Culcheth Hall Farm
Leatherbarrow Farm
Fowley Common
Hitchfield Wood
Old Woods
Wood End Farm
Chapelhouse Farm
Cawley Farm
Ratcliffe House Farm
Franks Farm
New Hall
Industrial Estate
Bates Farm
Hope Farm
Yew Tree Farm
Glazier's Lane
New Lane End
Blakeley Farm
Kenyon
Kenyon Farm
Lowe's Farm
Wilton Grange
Leigh Golf Club
Pagoda Wood
Broseley Hall
Broseley Bridge
Clough Farm
Birchall's Farm
The Covert
Diggle Green
Dismantled Railway
Wash End
Fair House
Pocket Nook
Yates' Farm
Wood's Farm
Ward's Place
Hurst Hall Farm
Duckinfield Farm
War Meml
Carr Brook
Libcroft Brook
Carr Bridge
Raven Bridge
Little Town
Brewery Farm
Oaklands Farm
Croft Heath
Brook House Farm
Laneside
Croft
Eaves Farm
Stone Platt
Eaves Brow
Eaves Brow Golf Driving Range
Hey Farm
Rowe Farm
Glares Farm
HM Remand Centre
Moss Side Farm
Risley
Gorse Cover
Birchwood Park
Birchwood Forest Park
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Oakwood
Risley Moss
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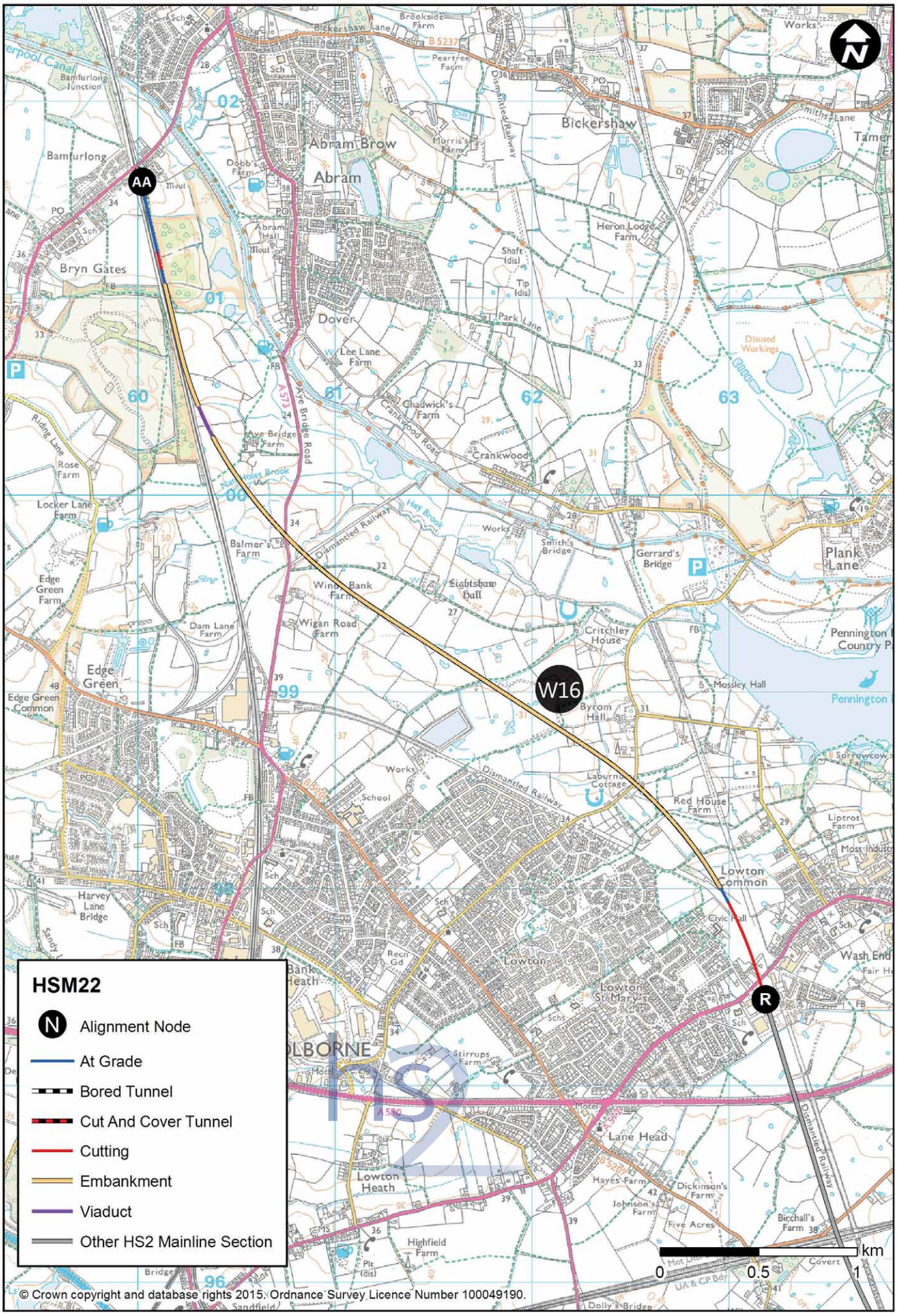
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The Manchester spur

6.2.53 Leaving the main line at the junction described above, the Manchester spur would serve proposed stations at Manchester Airport and Manchester Piccadilly. The route in this section is influenced by a number of features, including the Registered Park and Garden at Tatton Park, and Rostherne Mere Ramsar Site of Special Scientific Interest (SSSI), as well as local communities.

6.2.54 Lowering the HS2 mainline will also allow the spur towards Manchester (which crosses over the main line) to be lowered by up to 9m. (W17) Previously, the track towards Manchester would have crossed over the main line on a viaduct up to 5m above ground level. Most of this section (south of Peacock Lane) is now in cutting.

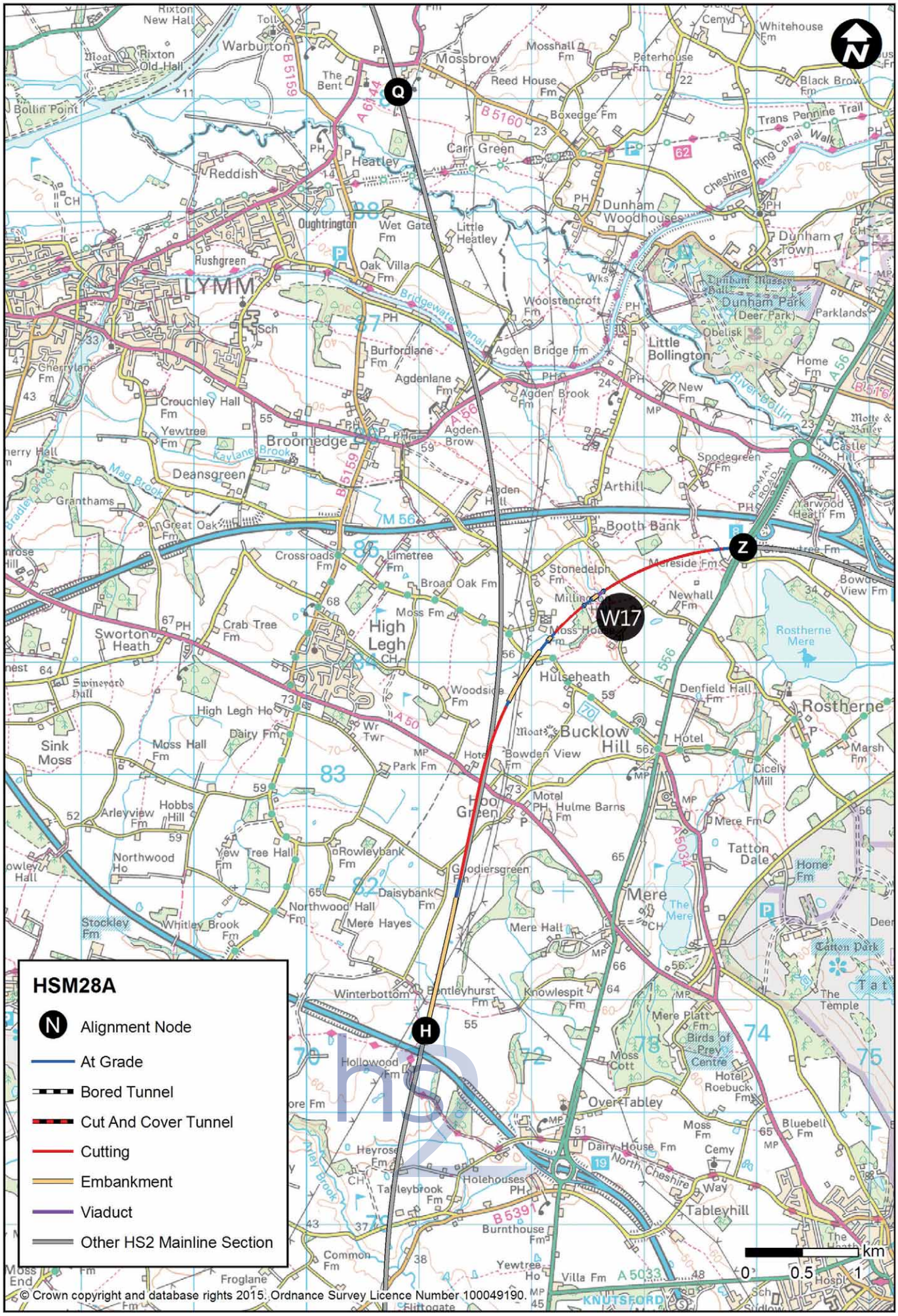
6.2.55 As the route heads away from the junction, it has been raised by up to 7m between Millington Lane and Peacock Lane. The route now runs in cutting up to 6m deep. A short section of route to the west of the A556 has been lowered by approximately 4m and now runs in a cutting at least 2m deep.

6.2.56 As noted in section 5.2, we considered whether Manchester could be approached from an alternative alignment. From our early consideration of different route options, we continue to recommend an approach via Manchester Airport.

6.2.57 As a result of the removal of the northern chord, there is no longer a grade separated junction to the north-east of Rostherne Mere. In order to improve clearance over watercourses, the route has been raised by up to 6m as it passes over Blackburn's Brook and Birkin Brook. (W18) Heading further towards Manchester, the route has been lowered by approximately 4m to the west of Ashley and the viaduct over the River Bollin has been lowered by up to 6m. (W19)

6.2.58 As we explained in the 2013 consultation, the eventual delivery of Manchester Airport Station is dependent on securing third party funding to support its delivery. However, we continue to make assumptions about the design of the station to inform our work. In response to concerns raised during public consultation, the proposed access arrangements and layout of Manchester Airport Station have been altered in order to maximise the use of space in between the M56 and the HS2 station and reduce the impact on open land. As a result, the station car park has been moved to the east of the station. (W20) We will continue to work with local partners to develop the design of the station and associated infrastructure as plans develop.

6.2.59 Immediately north of Manchester Airport Station the route enters the 13km tunnel into central Manchester. This tunnel will need four ventilation shafts evenly spaced along its length, and their location will be agreed as part of the development of the hybrid Bill. This will include further engagement with local stakeholders to understand the most appropriate locations and designs for these structures.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Viaduct
Other HS2 Mainline Section
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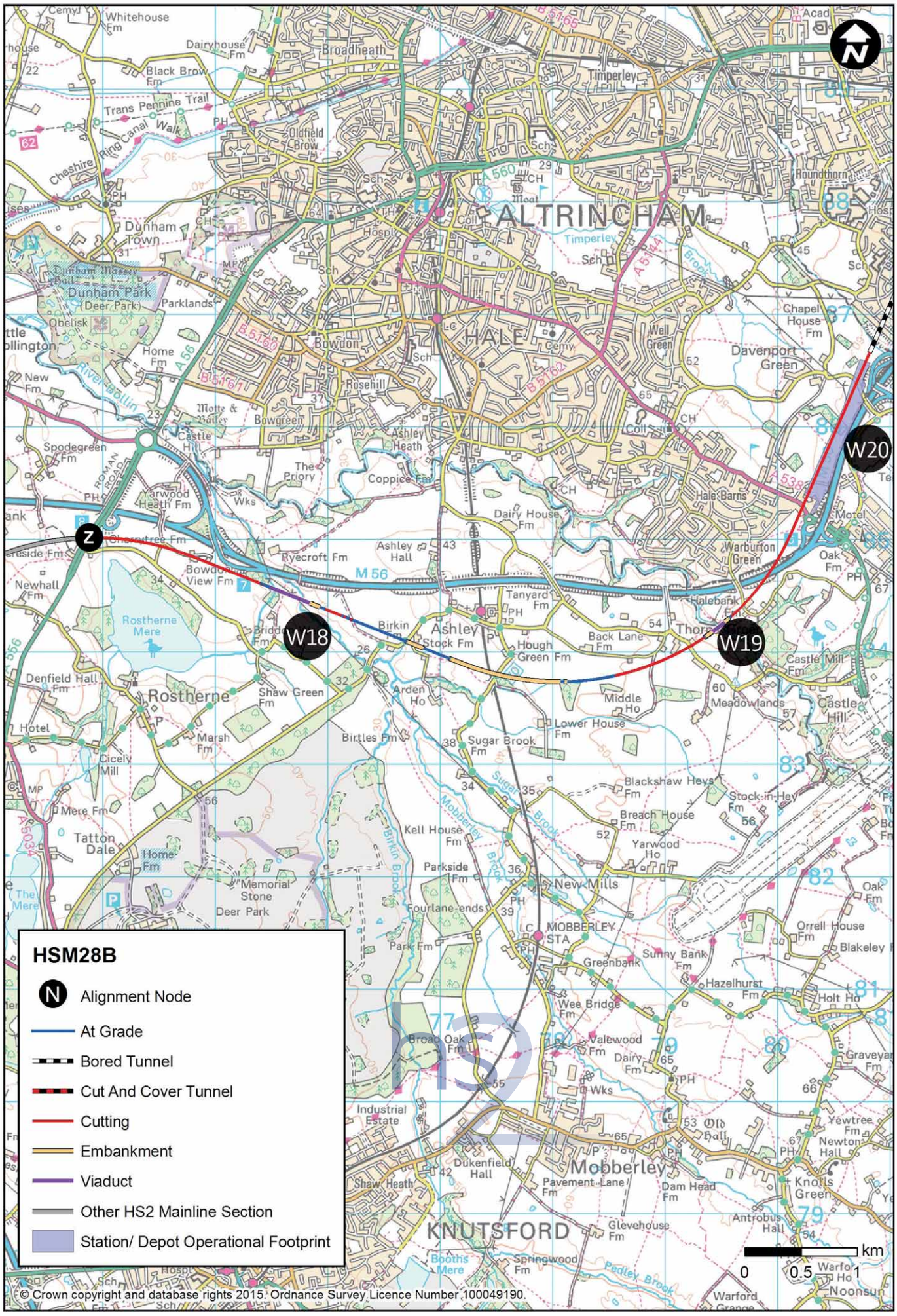
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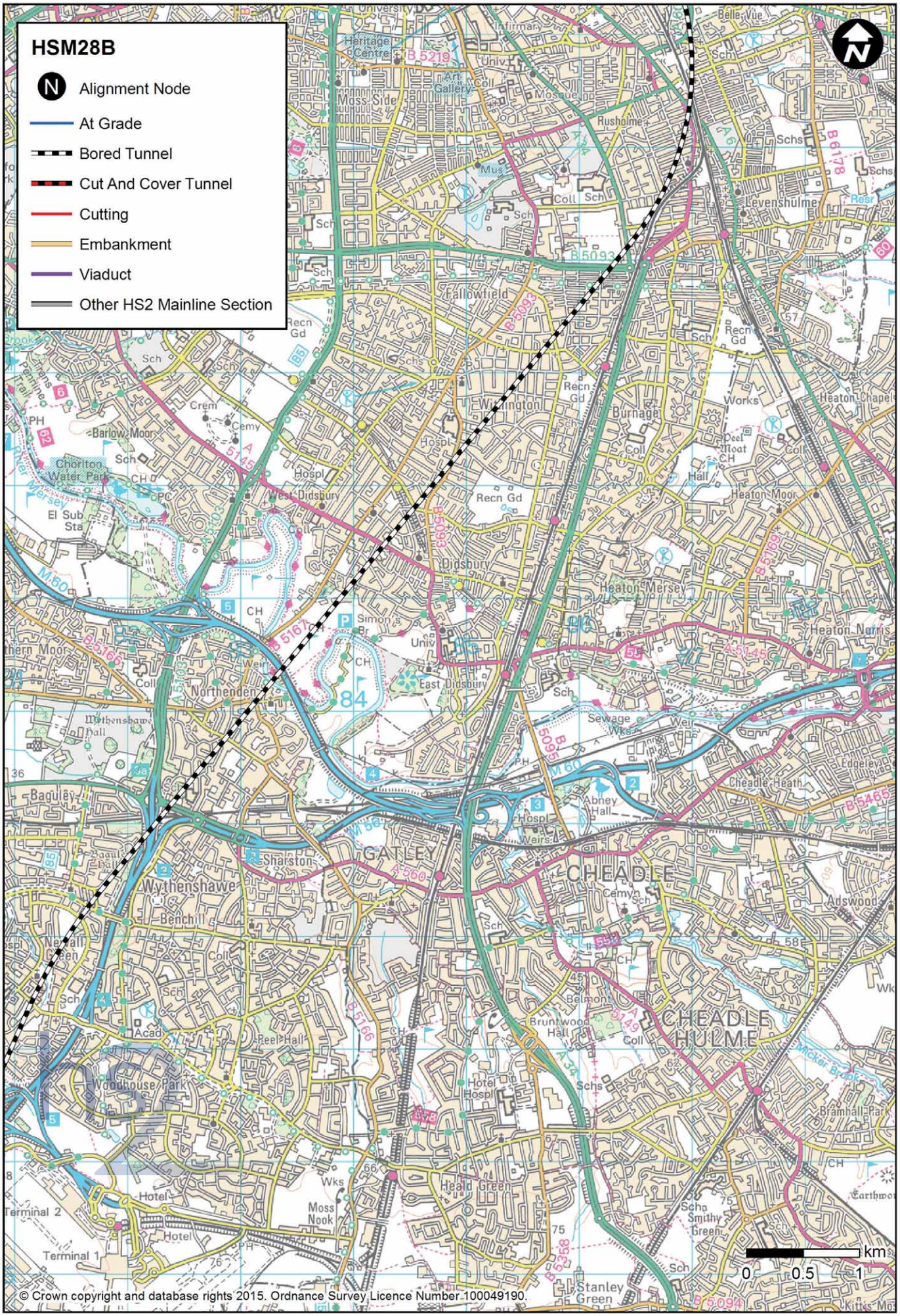
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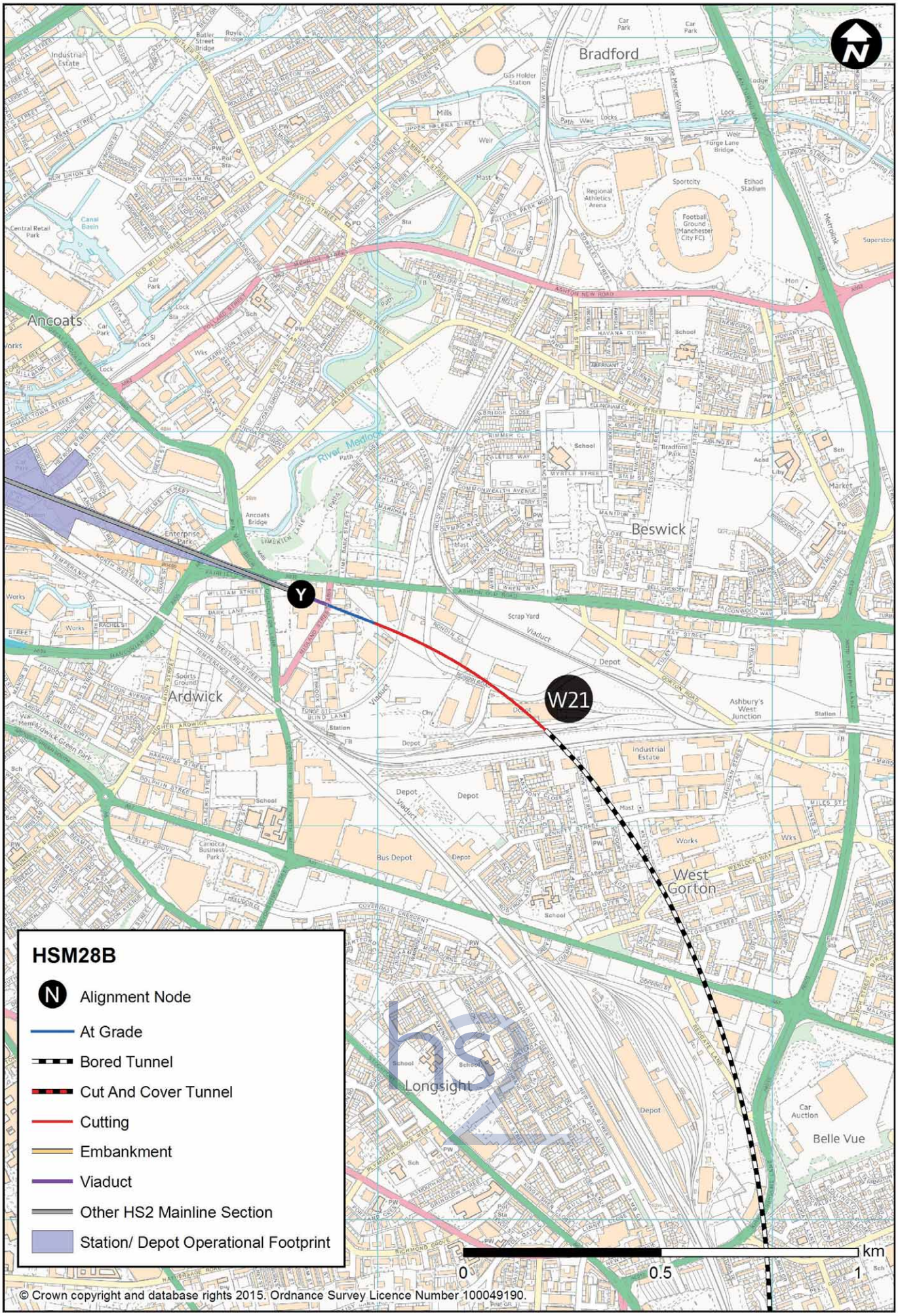
Consulting on the Manchester Piccadilly approach

6.2.64 *The Manchester Tunnel has been shifted eastwards by up to 370m to the east of West Gorton and lengthened by approximately 880m, so that the northern tunnel portal is now located in the existing Ardwick rail depot.* (W21) *We are continuing to work to understand how the portal can be accommodated within the depot footprint.*

6.2.65 *This removes engineering complexities associated with the Corn Brook floodplain and existing railway viaducts, allowing improvements to the approach to Manchester Piccadilly Station, and reflects concerns raised during consultation about impacts on West Gorton. We will work with local businesses during the next stage of design, to understand and where appropriate mitigate the impacts of the route.*

6.2.66 This change also allows the approach into Manchester Piccadilly Station to be straightened in order to maximise operational capacity and reduce impact on the structure of the existing station. Correspondingly, the footprint of the station has shifted slightly further northwards and the two island platforms have been replaced with one island platforms and two side platforms. (W22)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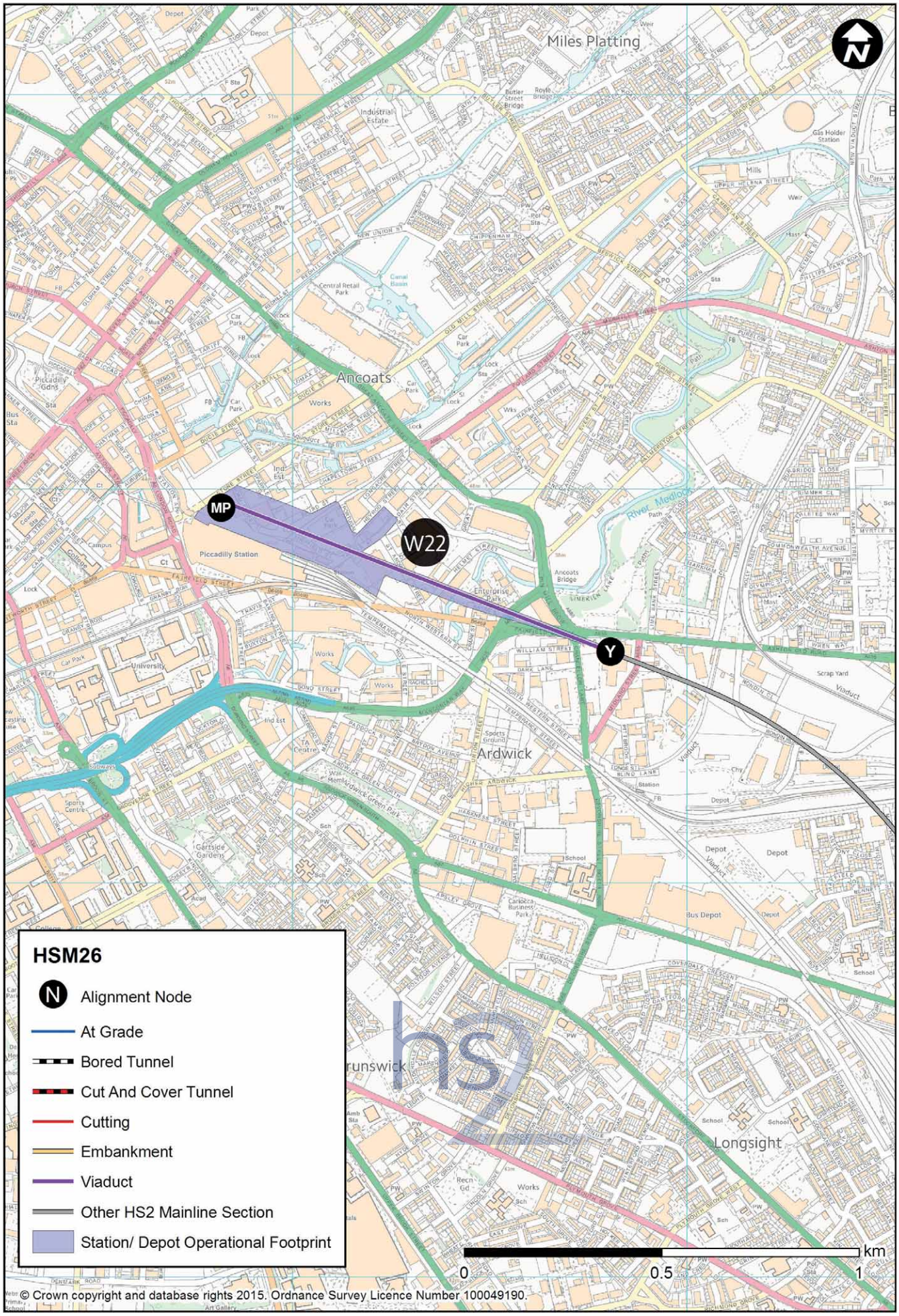
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6.3 The eastern leg

Phase One to the East Midlands

6.3.1 The eastern leg joins Phase One near the village of Bodymoor Heath and heads north-east along the transport corridor formed by the M42.

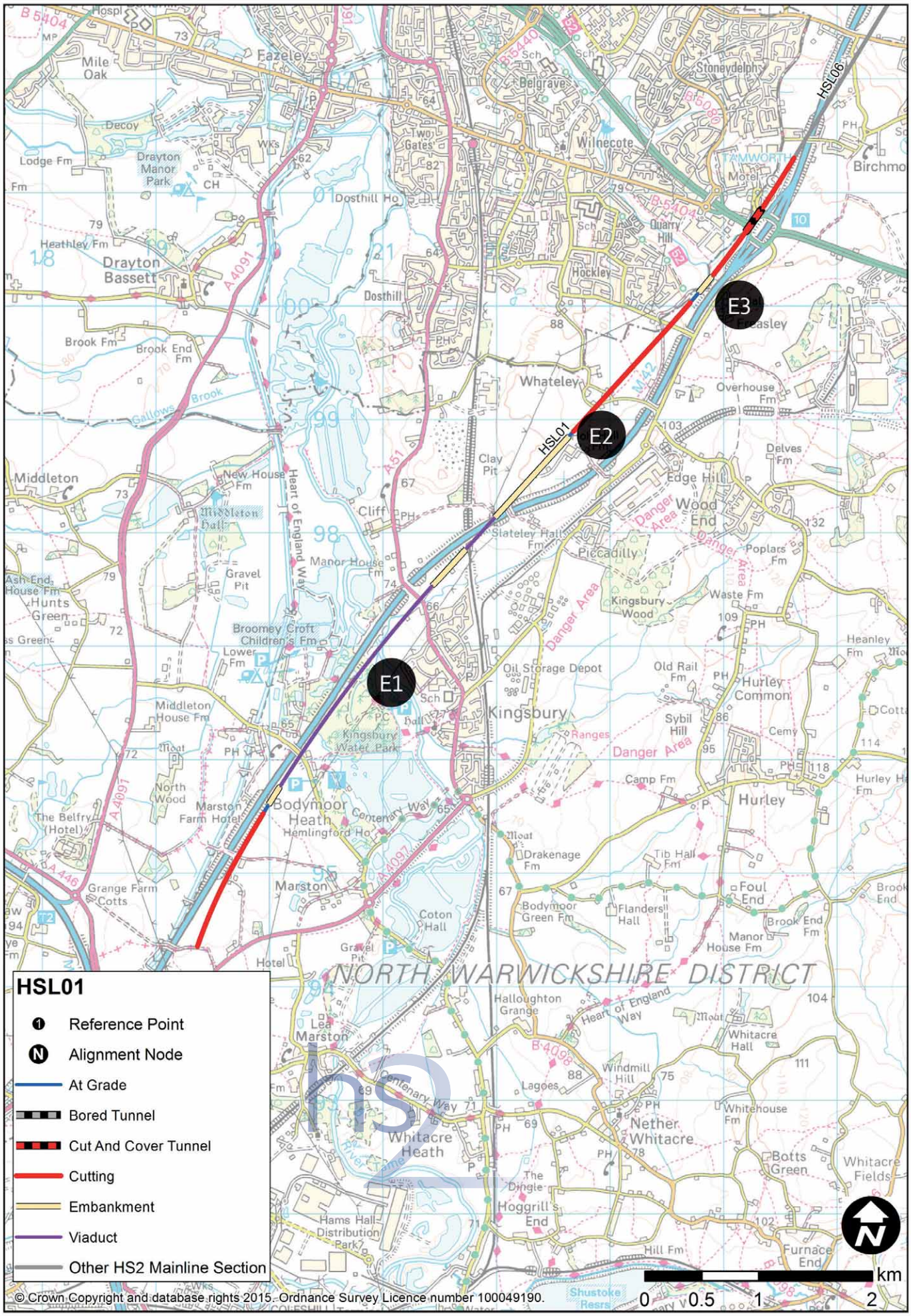
6.3.2 The route crosses Kingsbury Water Park on a viaduct. Feedback from consultation requested that the route be moved or lowered in this area. The need to connect to Phase One, and to ensure that the design complies with our design standards, meant that there were limited opportunities to redesign the route in this area.

6.3.3 The route in this area is now up to 14m high, a reduction of 4m from the consultation alignment which was up to 18m high, and has moved approximately 35m west - closer to the motorway - as it passes through Kingsbury Water Park. In addition, the consultation route featured three short viaducts interspersed with two short sections of embankment; this has now been redesigned into a single 2,240m viaduct, which avoids operational drainage issues while keeping the route as low as possible in this area. (E1) The design of the viaduct would be considered during the development of the hybrid Bill.

6.3.4 As it passes Whateley and Holt Hall Farm, the route is now 4m lower in cutting, with a maximum depth of 11m, to reflect lessons learned from Phase One track alignment standards. (E2) Feedback in consultation asked that we reconsider the current line of route past the village of Whateley. People also raised concerns about the impacts of the route past Tamworth.

6.3.5 We developed a range of alternatives for review, including a tunnelled option and a route that passes to the other side of the M42. However, we considered that none of these changes would be an overall improvement on the route presented in consultation. Moving the route horizontally, for example, would simply transfer and potentially exacerbate the impacts of the consultation route. Accordingly, our view is that it would be more appropriate to consider opportunities for how the impact of the route might be mitigated during the hybrid Bill design.

6.3.6 The route passes Hockley and crosses the Kettle Brook. (E3) The height of this crossing has increased by approximately 4m to improve the crossing over this watercourse. The route then crosses the floodplain of the River Anker and Pooley Country Park on a single 900m viaduct to avoid the need for a separate short section of viaduct to cross the Coventry Canal.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NORTH WARWICKSHIRE DISTRICT
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6.3.8 The route presented in consultation continued along the line of the M42, passing through the north-western side of the town of Measham. We received significant feedback from the consultation about the impacts on both local business and a significant local development site, as well as concerns about the impacts on the area more widely. An additional challenge in this area is the River Mease Special Area of Conservation, which is subject to a European-level environmental designation.

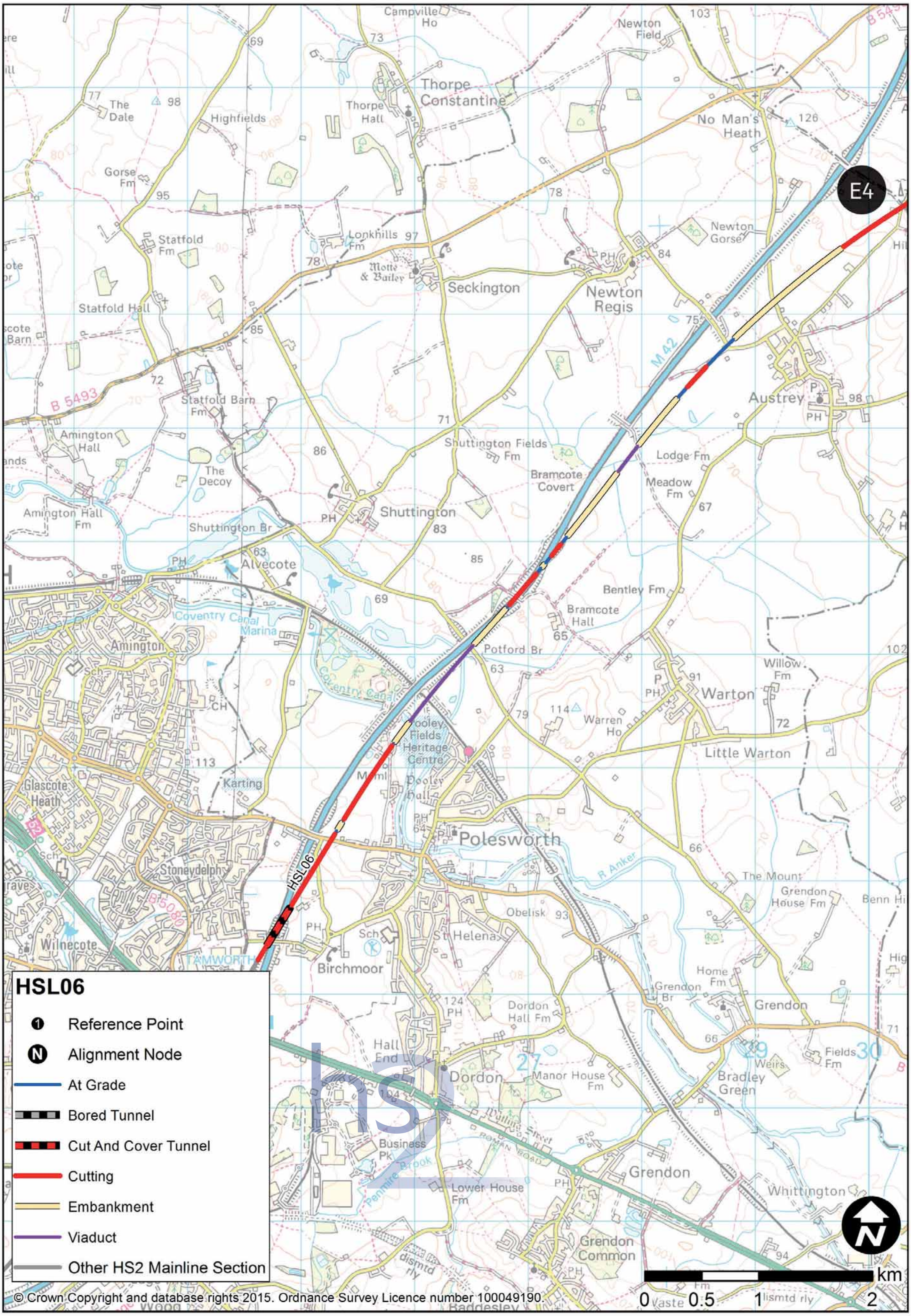
Consulting on the route around Measham, Leicestershire

6.3.9 In the light of these impacts we have reconsidered the line of route in this area and developed an alternative alignment to the east of Measham. This route diverges from the M42 to the south of Appleby Parva (E4) *and heads to the east of Appleby Parva and Appleby Magna, passing Appleby Magna in cutting.* (E5)

6.3.10 The route crosses the River Mease on an 880m-long viaduct approximately 11m high, rising with the terrain in shallow cutting, and passing over Gilwiskaw Brook and its floodplain on a 60m viaduct up to 8m high. (E6) *It rejoins the corridor of the M42 to the south of Packington, running to the west of Packington in a cutting up to 8m deep.* (E7)

6.3.11 This route avoids some of the significant impacts in Measham itself, as set out above, and would lead to reduced noise impacts to the west of Measham. There will be some new impacts in the areas to the south and east of the town, as well as a new crossing of the River Mease.

6.3.12 Following this announcement we are now undertaking further consultation on this route refinement. In addition we will also need to continue considering how the impacts of the route on the landscape, and on communities and businesses in this area, can be mitigated as we develop the hybrid Bill.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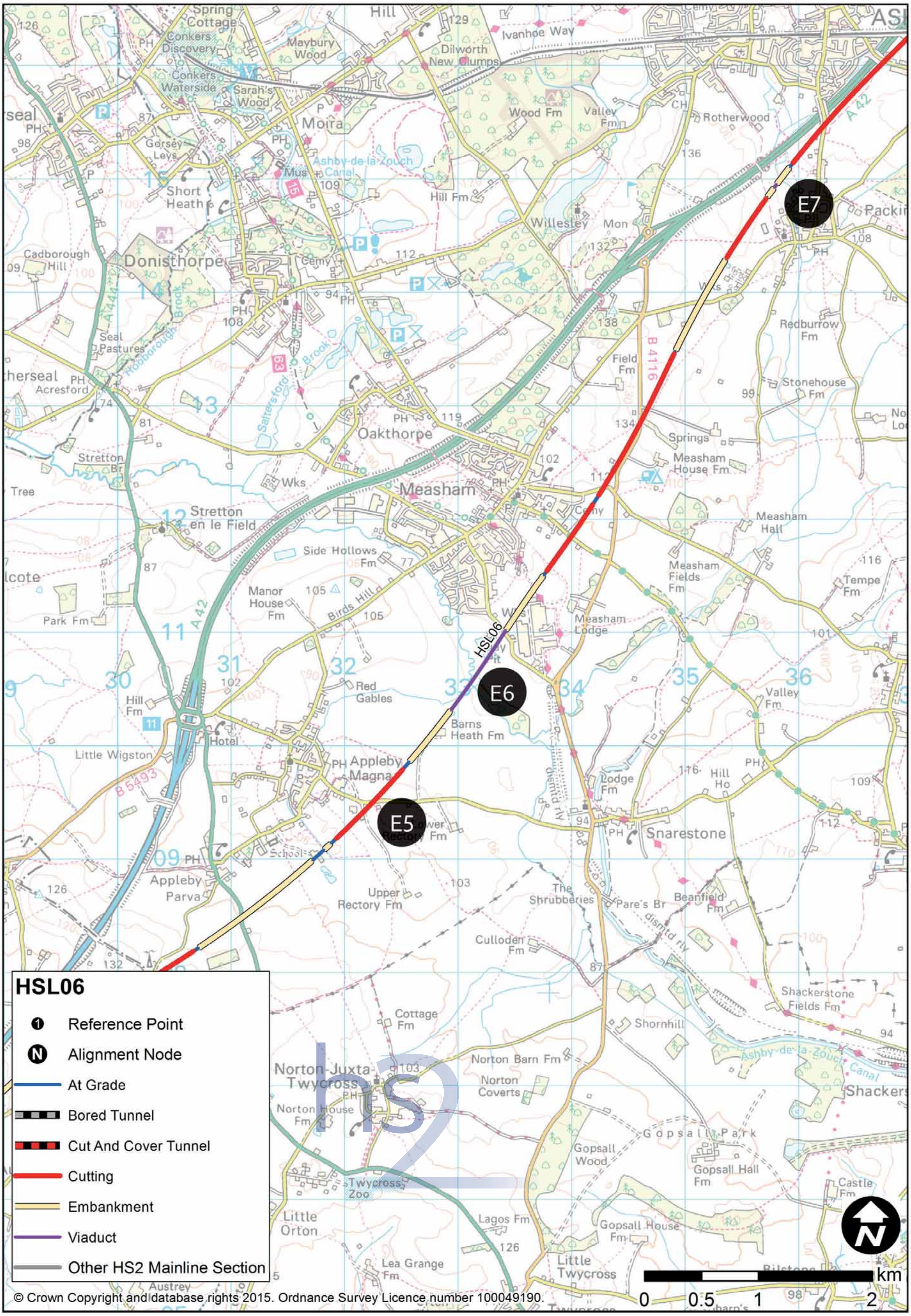
© Crown Copyright and database rights 2015. Ordnance Survey Licence number 100049190.
Thorpe Constantine
No Man's Heath
Newton Gorse
Seckington
Newton Regis
Austrey
Statfold Hall
Amington
Alvecote
Shuttington
Polesworth
Warton
Little Warton
Stoneydelph
Glascote Heath
Wilnecote
Birchmoor
Dordon
Grendon
Whittington
Bradley Green
Grendon Common
M42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Measham
Oakthorpe
Donisthorpe
Moira
Appleby Magna
Appleby Parva
Snarestone
Norton-Juxta-Twycross
Little Orton
Twycross Zoo
Gopsall Park
Ashby-de-la-Zouch Canal
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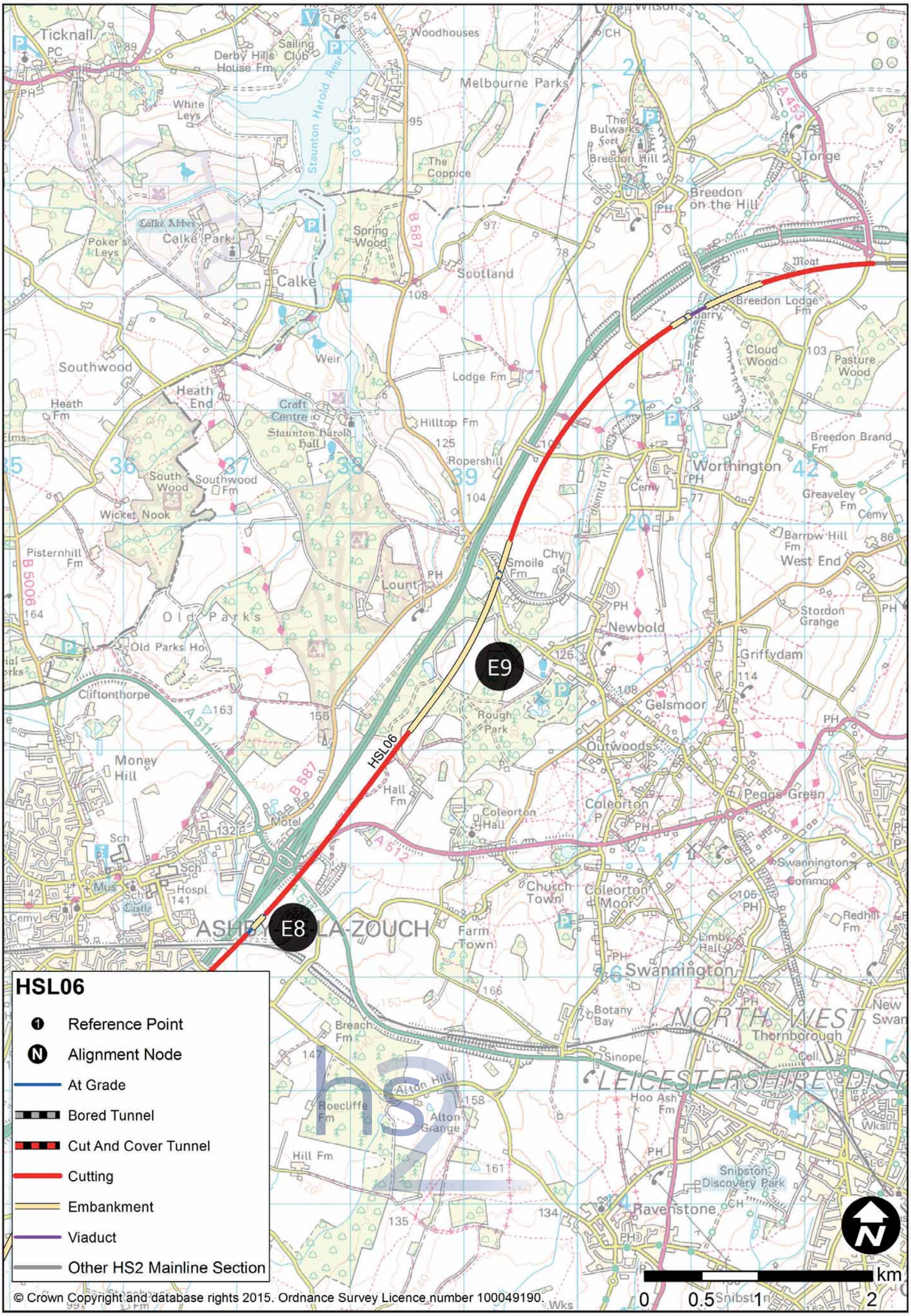
6.3.16 The route continues along the line of the existing transport corridor and crosses under Junction 13 of the A42, near Ashby-de-la-Zouch. (E8) We are aware of a new commercial development at this junction and we considered alternative routes through this area as part of our wider refinement activity. Although we have not recommended a change to the route in this area, we will continue to work with the developer as part of the development of the hybrid Bill to understand the impacts of the construction and operation of HS2 on this site.

6.3.17 To the north of Ashby-de-la-Zouch, the route has moved around 40m to the east, further uphill, in order to improve the track alignment and watercourse crossings in the area. This has also resulted in an increase in the height of the route by approximately 7m, from 13m to 20m. (E9)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Consulting on the route along A42 around East Midlands Airport

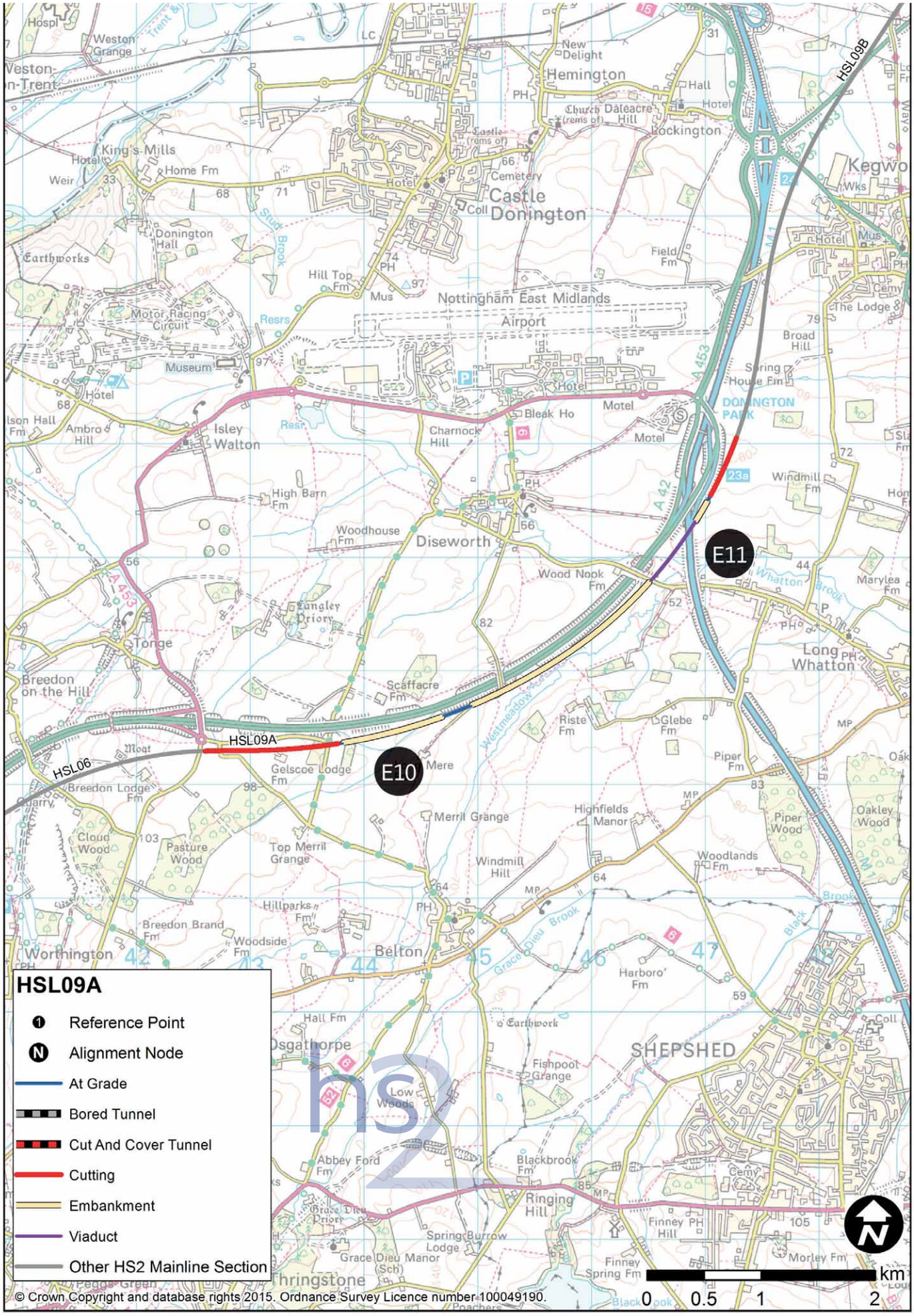
6.3.19 *The route presented in consultation then continued north-east to pass under East Midlands Airport and most of the proposed East Midlands Gateway development in a tunnel. We received a range of feedback about the route in this area, particularly from respondents who were concerned about the impact of the route as it crossed the A42 on a viaduct around 16m high on the approach to East Midlands Airport.*

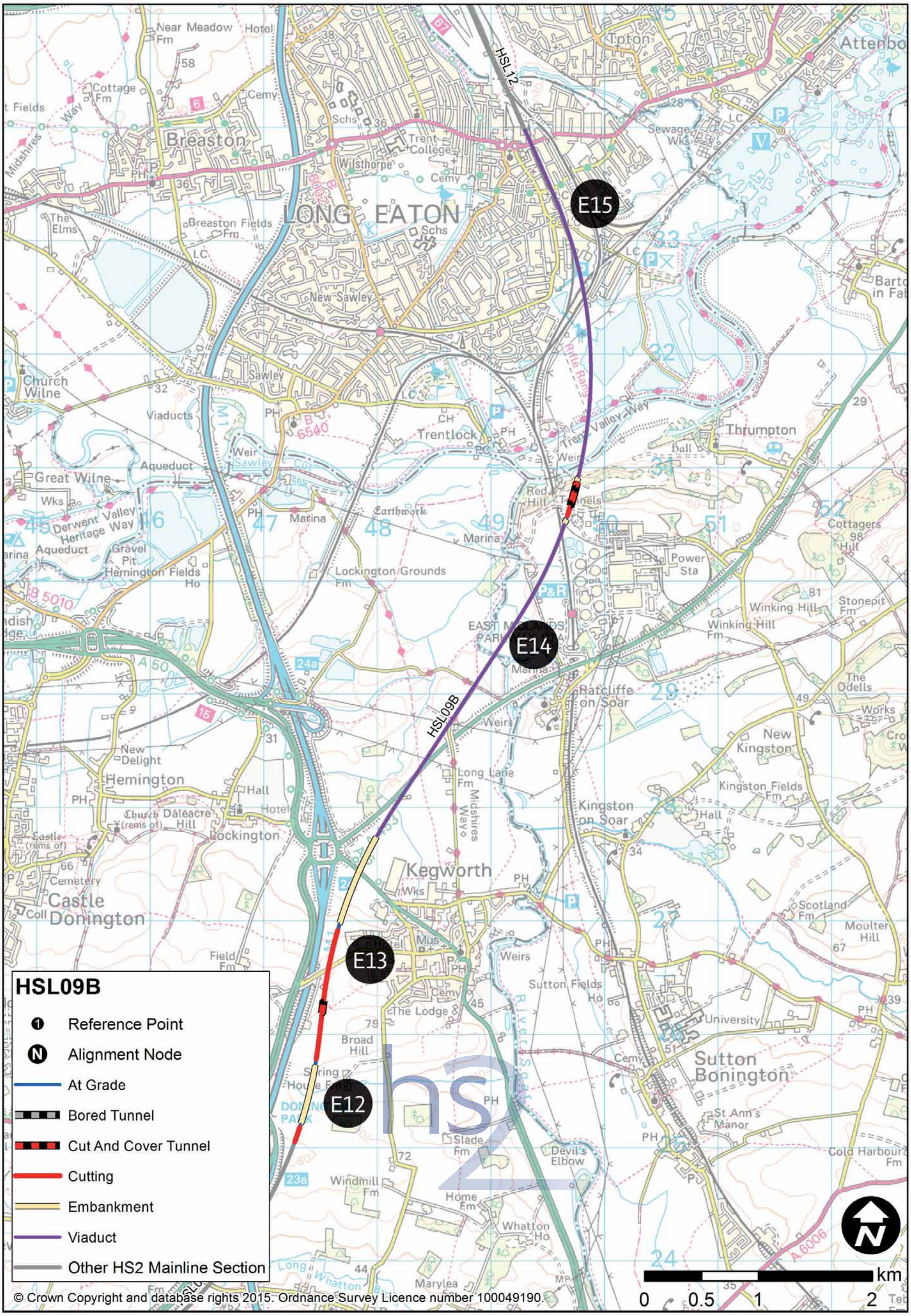
6.3.20 *As well as examining this feedback, we also reviewed the proposed tunnel, which would be almost 3km long and would require a vent shaft approximately halfway along its length. Our consideration focussed on whether there was an alternative route that could avoid the need for the A42 crossing and the tunnel under the airport, delivering efficiency savings and reducing the number of highways crossing required.*

6.3.21 *Accordingly, we have designed a new route in this area. This alignment would follow the A42 more closely on a mixture of cutting and embankment, remaining to the east of the A42.* (E10) *This would avoid the need for the 16m high crossing of the A42 proposed in consultation and enable the route to sit lower in the landscape as it passes through this area. The route would cross the Boden Brook on a viaduct up to 8m high, followed by a viaduct up to 16m in height to cross the Diseworth Brook flood plain and the M1 to the east of its junction with the A42. This would be followed by short sections of cutting and embankment.* (E11)

6.3.22 *The route would pass by the end of the runway at East Midlands Airport on the far side of the M1 below ground level, to avoid having an impact on the operation of the airport. The route would then cross under the proposed access road for the East Midlands Gateway development.* (E12) *We will continue to work with the developer to understand how this interface could best be managed, but our initial work suggests that there is a solution to maintain access.*

6.3.23 *The route then passes Kegworth in a cutting, which would be up to 12m deep as it crosses Ashby Road.* (E13) *It would rise on to an embankment before crossing the River Soar floodplain on viaduct, where it would rejoin the alignment presented in consultation.* (E14) *As part of the design development for the Phase 2b hybrid Bill, we will consider options to mitigate the impacts of the route in this area including any impact on the proposed housing development at Kegworth.*

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Cutting
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E15
HSL12
HSL09B
LONG EATON
Breaston
Toton
Sawley
New Sawley
Trentlock
Thrumpton
Ratcliffe on Soar
Kegworth
Kingston on Soar
Hemington
Lockington
Castle Donington
Sutton Bonington
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East Midlands Hub Station and approach

6.3.26 The route crosses the River Soar and River Trent Valleys on two viaducts on the approach to the East Midlands Hub Station at Toton. Following consultation, we undertook extensive work to consider alternative options for station locations in the East Midlands, which would have required a change to this line of route. As well as designing and appraising alternative station options, we also engaged with key local stakeholders to understand how well these options fit with local aspirations. As a result of this work, we continue to recommend that Toton is the best location for an East Midlands Hub Station.

6.3.27 There are a number of significant constraints and challenges in this area, including interfaces with the existing network, interactions with highways, and the River Erewash flood plain. The HS2 route needs to reflect these constraints while considering the impacts on local communities, particularly the need to avoid creating a physical barrier across the communities of Long Eaton and Toton. Our design must also reflect the technical requirements for HS2 so that we can be confident it will be deliverable and operable.

6.3.28 The consultation highlighted concerns over local connectivity in this area, particularly owing to the possible impact on local highways of the construction and operation of the railway. In addition, following consultation, we undertook further work to understand the wider rail network through this area. This highlighted that the consultation proposition would involve work on two rail corridors through Long Eaton, which could involve construction impacts being spread more widely in this area than the HS2 corridor alone.

Consulting on the East Midlands Hub approach around Long Eaton

6.3.29 We therefore considered options that would focus construction on a single corridor. (E15) *One option is to lengthen the viaduct over the River Trent flood plain to approximately 4,700m, so that the route would pass through Long Eaton on a viaduct, with HS2 directly to the east of the existing low-level corridor. The viaduct would cross Main Street at a height of approximately 17m, Station Road at approximately 16m in height, and the A6005 Nottingham Road at approximately 8m high. The current level crossings on the existing network would continue to operate as normal.*

6.3.30 An alternative option was for a lower alignment through Long Eaton, with HS2 crossing Station Road at a height of 4m and then travelling through Long Eaton at ground level, on the same general horizontal alignment as the route described above. We expect that this would introduce a number of conflicts with the existing highways network that would need to be resolved, including Station Road, and the A6005 Nottingham Road. Further work would be required to understand how we could best address severance of these highways, which might require additional construction work to provide bridges or diversions.

6.3.31 For the purpose of design development and appraisal, we have incorporated the viaduct option into the scheme at this stage because this option would reduce impacts on the local highways network, as local roads could continue to operate beneath the HS2 viaduct. Placing the route on a viaduct would also reduce the interactions between HS2 and the existing network, requiring less disruptive work on the existing railway

infrastructure, and would help to address concerns over the interaction between HS2 and the floodplain in this area (requiring fewer flood defences).

6.3.32 *The Secretary of State has not currently expressed a preference for either alignment and in the Route refinement consultation invites comments from stakeholders on both options to help him make a decision on the route through this area. Following any decision, further development and engagement will be required to understand all local preferences and to ensure that the design for the route in this area balances concerns over permeability, visual impacts, and flooding.*

6.3.33 Although the East Midlands Hub Station is still proposed to remain at Toton, we have made some small changes to accommodate changes to the route design as a result of lessons learned from Phase One. The configuration of the station, including new platforms on the existing network, has not changed. However, owing to the need for the route to pass between the gap between Sandiacre and Stapleford, the station has moved approximately 150m southwards to accommodate the updated alignment.

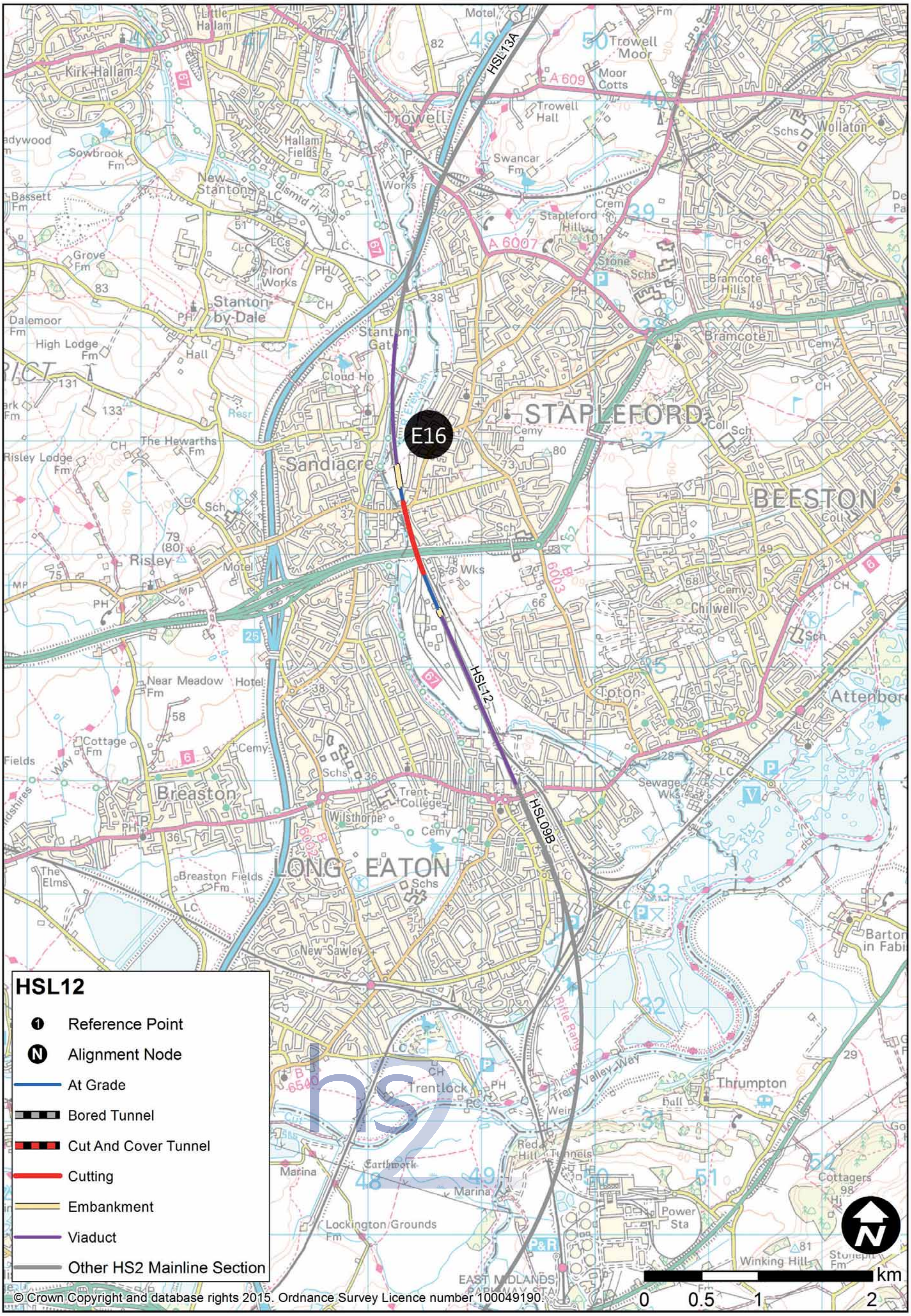
6.3.34 We will continue to work with local stakeholders on the design of the station as we develop the hybrid Bill, to ensure that it goes with the grain of local development aspirations.

The East Midlands to Derbyshire

6.3.36 Following the consultation, we reconsidered an alternative route corridor in this area, to consider whether an option following the Erewash Valley was preferable if we applied updated standards to the design. Our work suggested that this route could have more sustainability impacts, including impacts on communities, as well as a number of engineering challenges. Accordingly we continue to recommend that the route in this area should broadly follow the M1 corridor.

6.3.37 Leaving the East Midlands Hub Station, the route has moved around 50m west closer to Lenton Street (Sandiacre). The route now crosses the Erewash Canal in a slightly different location, around 100m further south, and has also moved about 50m to the west at Stanton Gate. The route through this area was on alternate sections of embankment and viaduct. This has now been changed to a single, continuous viaduct approximately 2,660m in length, and approximately 2m lower over the Erewash Canal and the existing rail line. (E16)

6.3.38 Following the broad corridor of the M1, the route approaches the village of Strelley. (E17) In response to feedback from consultation, we considered alternatives to the proposed cut-and-cover tunnel under Strelley, including lengthening it or changing the design to a bored tunnel. Our work established that alternative options would involve significant additional cost and would involve other sustainability impacts. A bored tunnel in this area would be very long and would require very deep cuttings to the south. Accordingly, we consider that it would be more appropriate to consider mitigation measures in some sections to be explored at a later stage.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STAPLEFORD
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Sandiacre
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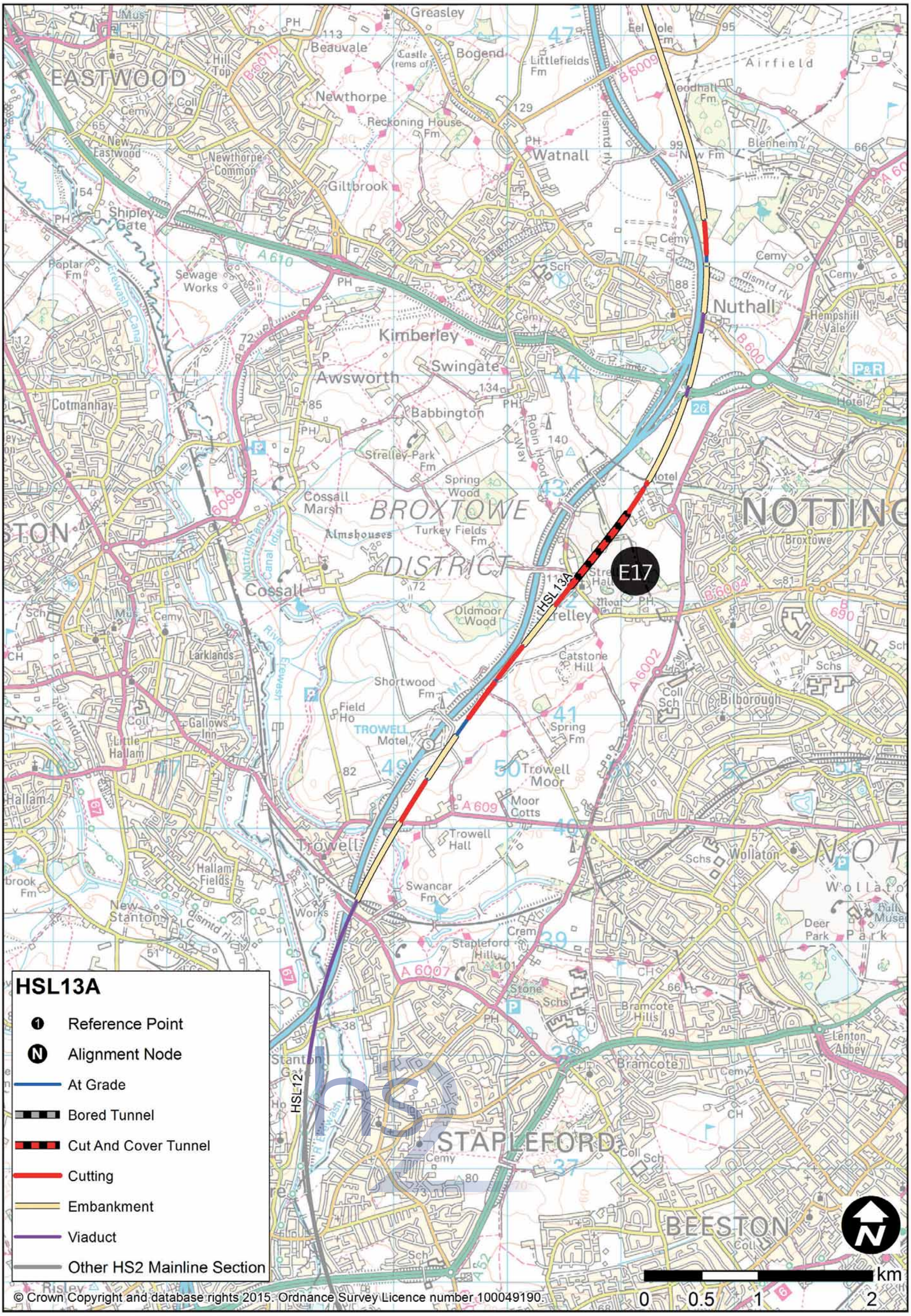
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Kimberley
Awsworth
BROXTOWE
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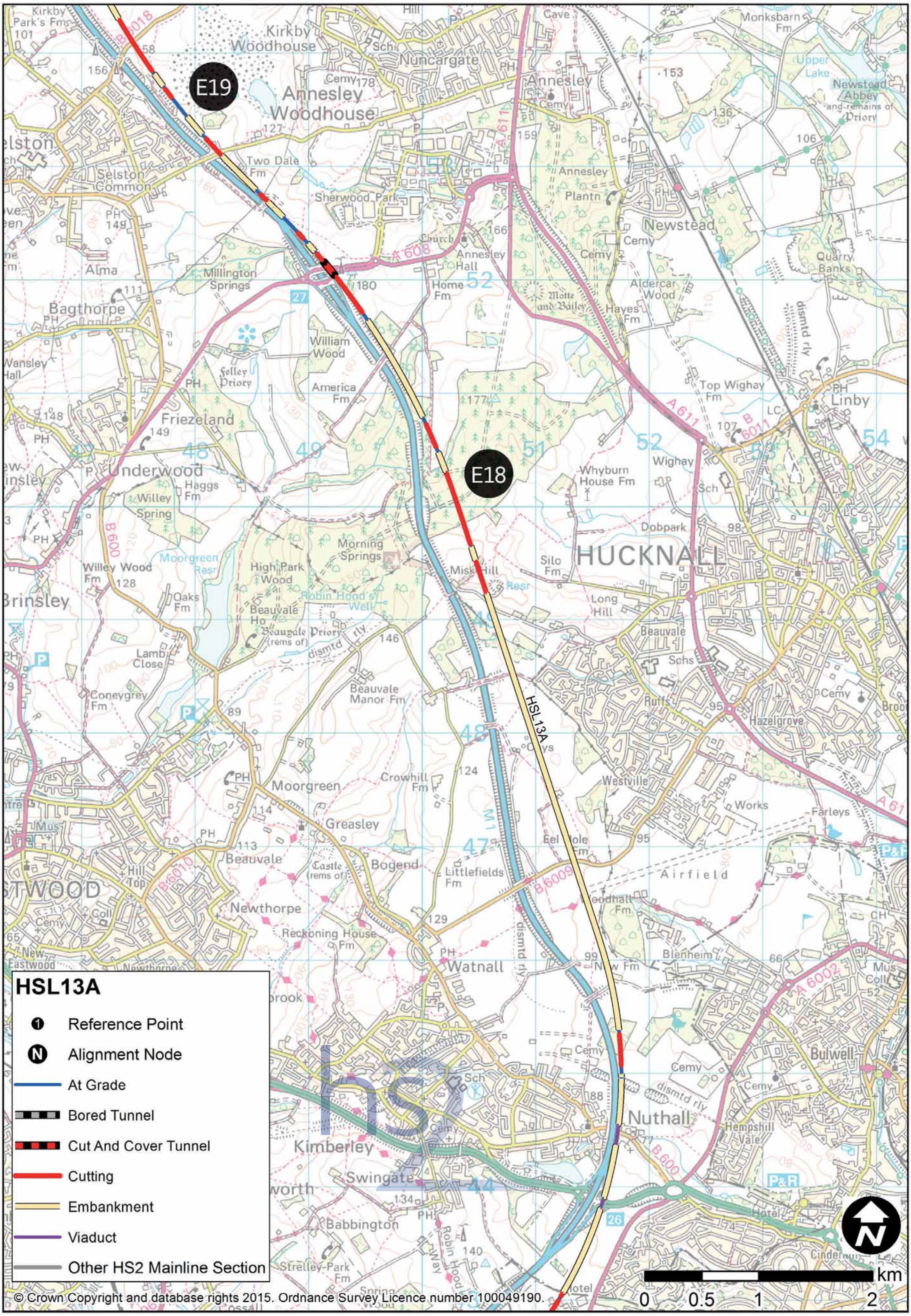
6.3.42 Applying design lessons learned from the Phase One design has led to some smaller changes in this area, with the route moving east by approximately 15m at the southern portal of the tunnel, and 10m east at Bulwell Wood Site of Special Scientific Interest (SSSI). Beyond Strelley, the route is up to 3m higher, to improve clearances over watercourses and roads, with higher embankments at Bulwell Wood SSSI and Nuthall, and a reduction in the depth of the cutting through Park Forest. (E18)

6.3.43 The route continues to head north along the M1 corridor. Consultation feedback highlighted particular concerns as the route approaches Junction 28 of the M1, including impacts at Hucknall, residential demolitions at Langton Hall, impacts to the remediation scheme at Bentinck Colliery and the associated landfill, and the impact on the shopping outlet at Castlewood Grange, as well as Bogs Farm SSSI.

6.3.44 We considered a number of options for refining the route in this area to reflect the feedback from consultation, and we have amended the design in this area so it follows the line of the M1 more closely, moving approximately 80m nearer the motorway past Bogs Farm. (E19)

6.3.45 As a result, the route now largely avoids the Bogs Farm SSSI, intersecting only its western edge. The route also avoids crossing the Bentinck Colliery landfill site and spoil heap, which would otherwise entail significant construction and environmental risk, and moves approximately 250m further away from Langton Hall, largely avoiding the demolitions that were associated with the previous design. The refinement moves the route about 30m closer to the Castlewood Grange shopping outlet, but still avoids the main buildings of this site.

6.3.46 Moving the route west also means that it sits deeper into the hillside. The cuttings are approximately 2m deeper than in consultation as the route passes the SSSI and Langton Hall. These refinements also mean that the crossing of the Erewash floodplain is 11m lower, at a maximum height of 25m rather than the 35.6m reported in consultation.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Annesley Woodhouse
Nuncargate
Annesley
Newstead
Selston Common
Two Dale Fm
Sherwood Park
Annesley Hall
Home Fm
Millington Springs
Bagthorpe
William Wood
Felley Priory
America Fm
Friezeland
Underwood
Haggs Fm
Willey Spring
Morning Springs
High Park Wood
Misk Hill
HUCKNALL
Linby
Wighay
Whyburn House Fm
Dobpark
Silo Fm
Long Hill
Beauvale
Hazelgrove
Westville
Moorgreen Resr
Brinsley
Beauvale Manor Fm
Moorgreen
Crowhill Fm
Greasley
Bogend
Littlefields Fm
Newthorpe
Reckoning House Fm
Watnall
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Babbington
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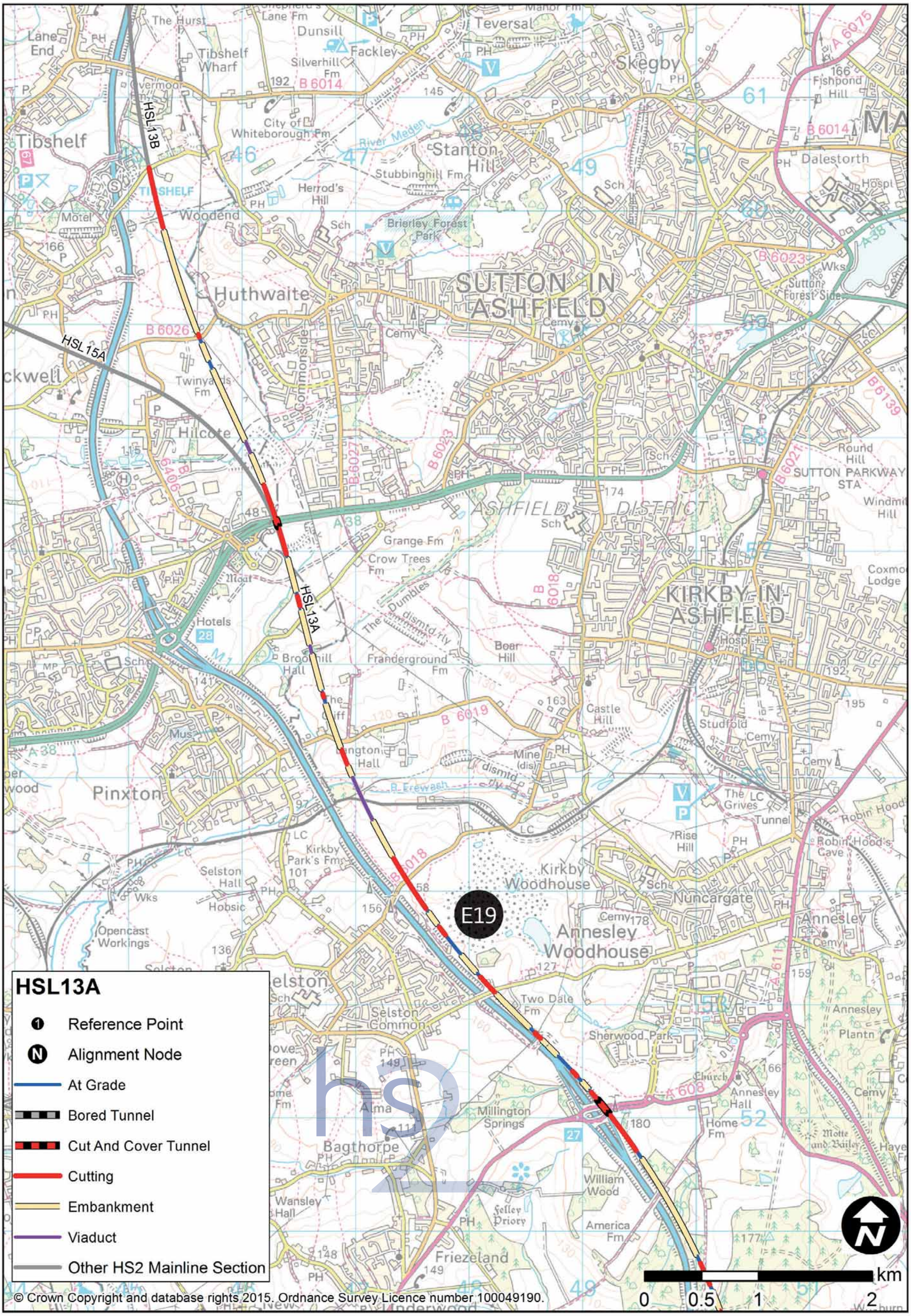
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E19
Tibshelf
Huthwaite
SUTTON IN ASHFIELD
KIRKBY IN ASHFIELD
Hilcote
Pinxton
Teversal
Skegby
Stanton Hill
Annesley Woodhouse
Kirkby Woodhouse
Bagthorpe
Friezeland
ASHFIELD DISTRICT
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Consulting on Derbyshire to West Yorkshire (M18 / Eastern route)

Consulting on the southern spur

As discussed in Chapter Five, the proposal is now to serve South Yorkshire via a spur to the existing network north of Pinxton. This spur would leave the HS2 network on a grade separated junction as the route passes between Huthwaite and South Normanton.

The route would leave the HS2 mainline, with the northbound spur passing under the A38 in a cutting approximately 16m deep. The southbound spur would also pass under the A38, at a depth of 20m, before passing under the main line. The route would run in cutting, passing under the M1 and between the villages of Newton and Blackwell. (E20)

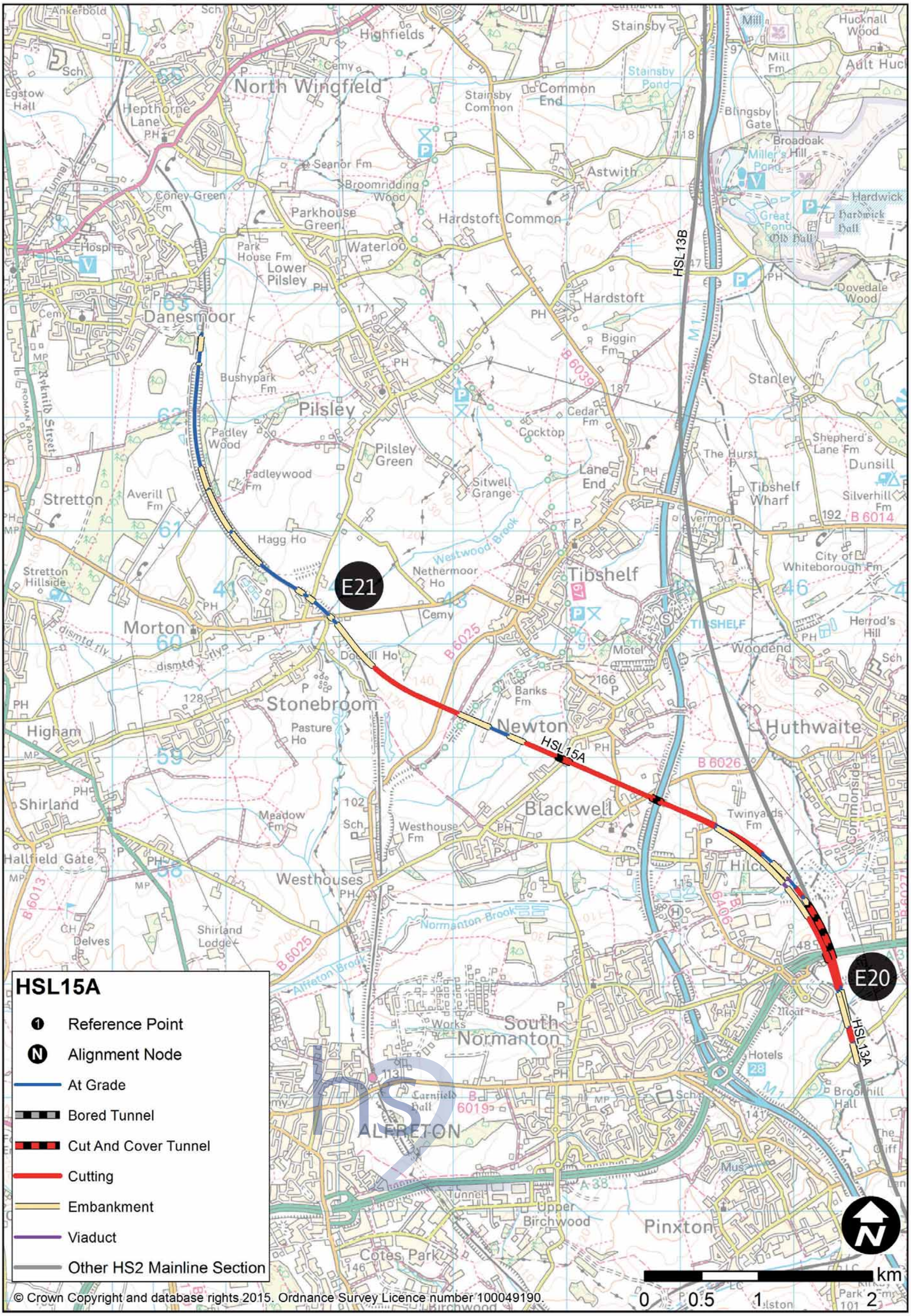
The two tracks would cross over the Normanton Brook, before heading westward on embankment and then cutting as it approaches Stonebroom.

The route would continue in cuttings up to 7m deep, moving to embankment as the ground level starts to fall. The spur would join the corridor of the existing Erewash Valley Railway immediately to the east of Stonebroom, before joining the existing railway with a flat junction at Clay Cross to enable HS2 trains to serve Chesterfield and Sheffield. (E21)

6.3.50 North of Tibshelf, the railway crosses the M1. We considered alternative alignments for this crossing to improve the alignment and avoid impacts at Sawpit Lane industrial estate. However, given the sensitive heritage features to the north of this location, our alignment continues to pass under the M1 and then continues in the M1 corridor to the immediate west of the motorway. (E22)

6.3.51 A number of stakeholders raised concerns about the impact of the route on the landscape in this area, given the number of historic sites in this area. Accordingly, we considered a range of options including running the route through a tunnel in this area. Given that the route runs in the same corridor as the M1 at a broadly similar height, we considered that the substantial additional cost of a tunnel would not be appropriate when compared to the opportunity to introduce site-specific mitigation measures as part of the hybrid Bill design. In addition, introducing a tunnel at this location could require the inclusion of other infrastructure, such as vent shafts, which would entail their own impacts.

6.3.52 We have raised the route as it crosses the Doe Lea floodplain, with an increase in height of 5m at the viaduct over Mill Lane, in order to improve clearance over the floodplain. (E23) It will continue to be at the same general height of the M1 and therefore we expect the impacts to be limited, and comparable to those reported for the consultation route. We will continue to work with stakeholders to understand how the impacts of the route in this area could be mitigated and how we could apply lessons learned from the design of the Phase One route.


HSL15A
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E21
E20
HSL15A
HSL13A
HSL13B
M1
North Wingfield
Danesmoor
Pilsley
Stretton
Morton
Stonebroom
Higham
Shirland
Westhouses
Newton
Blackwell
Tibshelf
Huthwaite
South Normanton
Alfreton
Pinxton
Hardstoft
Stanley
Astwith
Hardwick Hall
B 6025
B 6026
B 6014
B 6039
B 6019
B 6013
B 6406
A 38
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0
0.5
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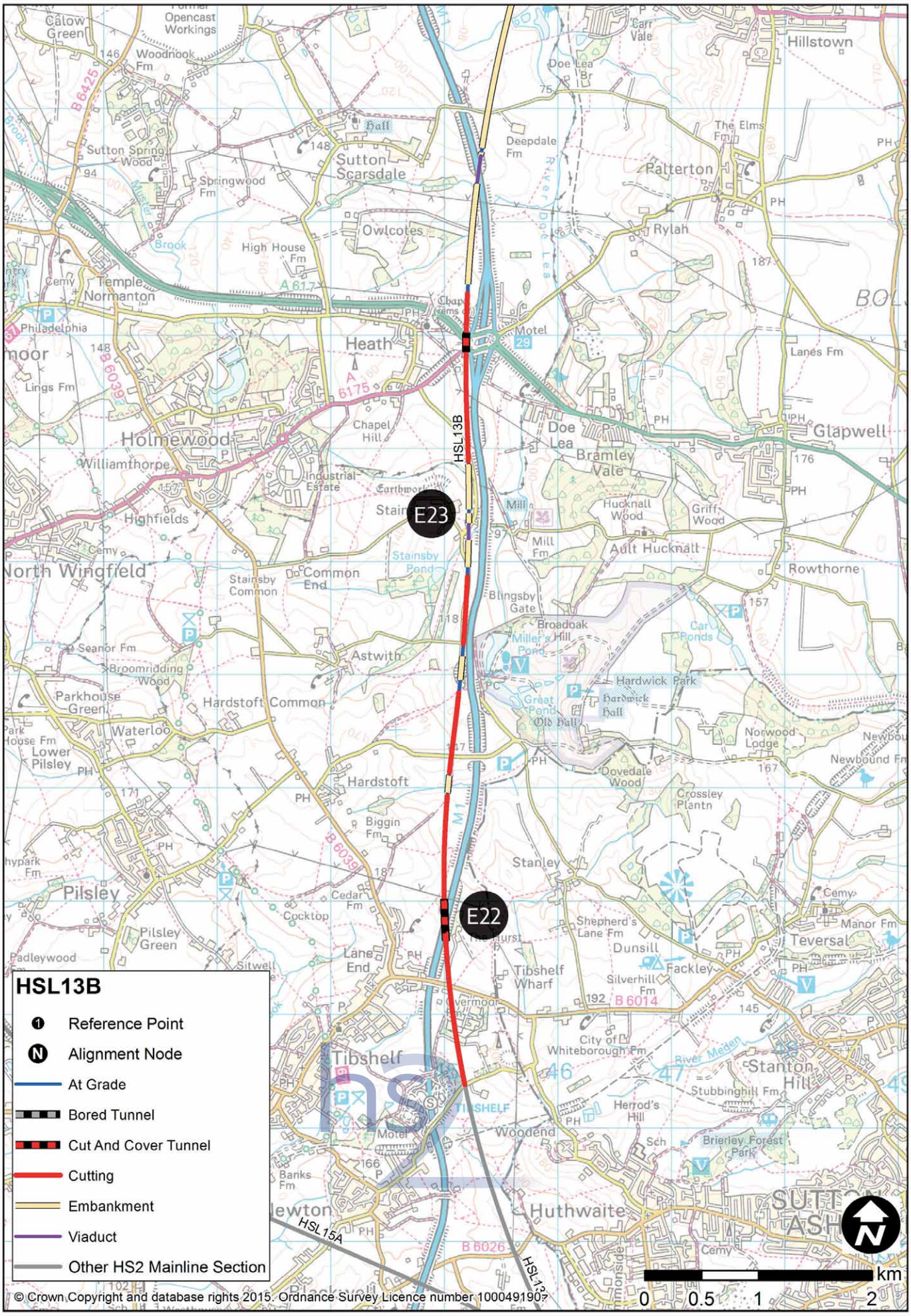
km


HSL13B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E23
E22
HSL13B
HSL15A
HSL13?
© Crown Copyright and database rights 2015. Ordnance Survey Licence number 100049190?
0
0.5
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2
km

Derbyshire to West Yorkshire

6.3.56 *The route presented in consultation travelled to a station at Meadowhall along the line of the Rother Valley, before heading north into West Yorkshire.*

6.3.57 *As described in Chapter Five, we have developed a new proposal to serve Sheffield via a connection to the Midland Main Line that would allow HS2 services to run on the existing network to Sheffield Midland Station. As a result of this proposal, we have revisited the line of route through South Yorkshire to consider whether there is the opportunity to deliver an alternative line of route.*

6.3.58 *As a result, we have now adopted a different route alignment that passes to the east of Rotherham and rejoins the consultation alignment near Altofts. This avoids some of the engineering complexities and impacts of the route via Meadowhall, as well as having the potential to offer faster journey times to cities further north.*

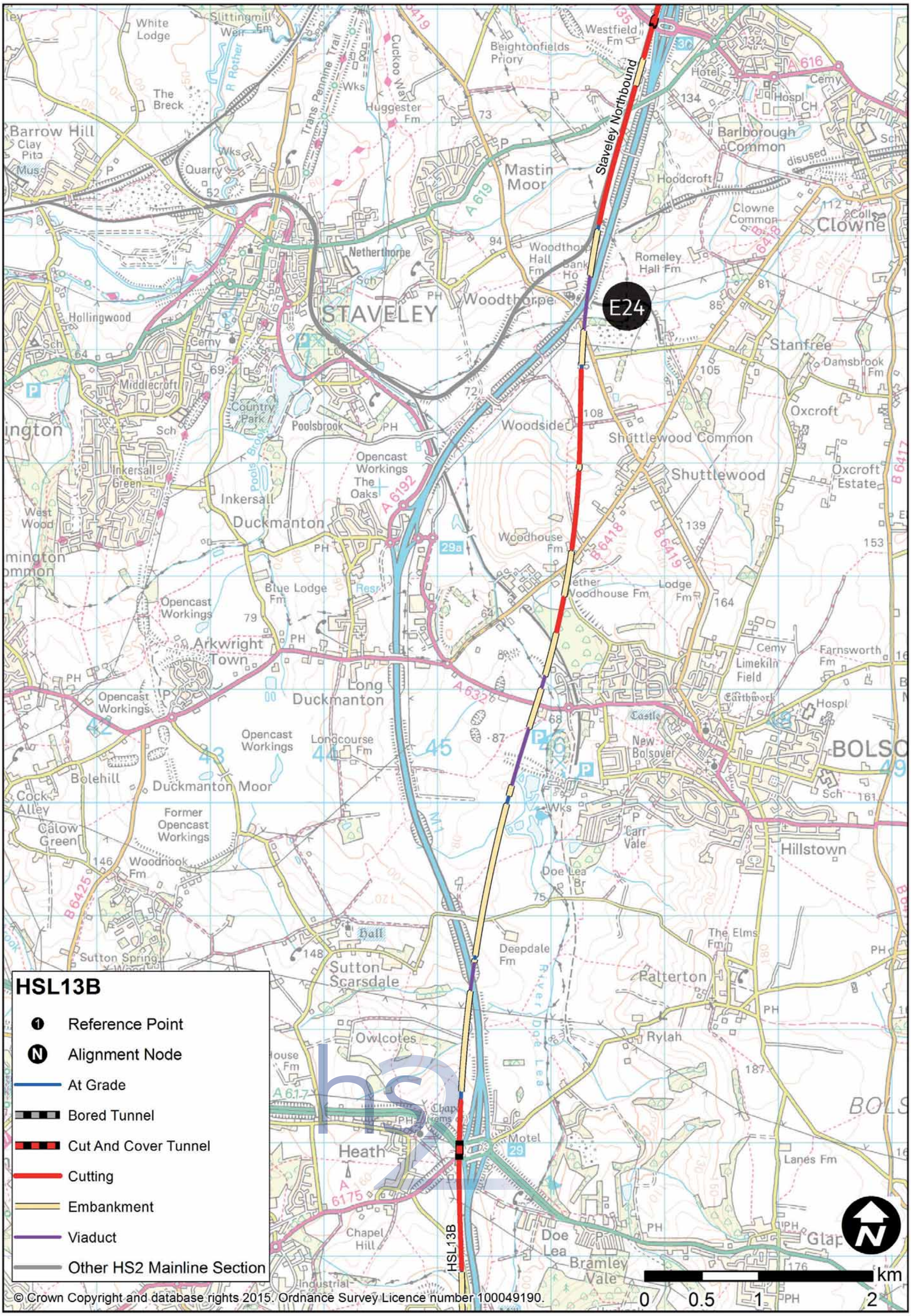
6.3.59 *As this route differs so significantly from that presented in the 2013 consultation, we have not offered a direct comparison between the two options in this section. A comparison between these options, as well as alternative options for serving South Yorkshire, is presented in the Sheffield and South Yorkshire Report 2016[23].*

6.3.60 *For more information on the design of the route, please consult the Route engineering report (West Midlands – Leeds)[24]. For more information on the impacts of this route, please consult the Sustainability statement[25].*

6.3.61 *On this alignment, the route would run closer to Bolsover, to the west of the town on a mixture of viaduct and embankment, passing into longer sections of cutting to the north of the town.*

6.3.62 *The alignment would then cross the M1 on a 490m-long viaduct, crossing the M1, the B6419 and an existing mineral railway at a height of up to 29m. (24) It then continues to run to the west of the M1, in the existing transport corridor, largely in cutting of up to 15m deep, heading north of Barlborough. (E25)*

[23] Available at www.gov.uk/government/publications/hs2-sheffield-and-south-yorkshire-report-2016
[24] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester
[25] Available at www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester


HSL13B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E24
Staveley Northbound
HSL13B
STAVELEY
Duckmanton
Long Duckmanton
Shuttlewood
Clowne
Sutton Scarsdale
Heath
Palterton
Hillstown
New Bolsover
0
0.5
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2
km
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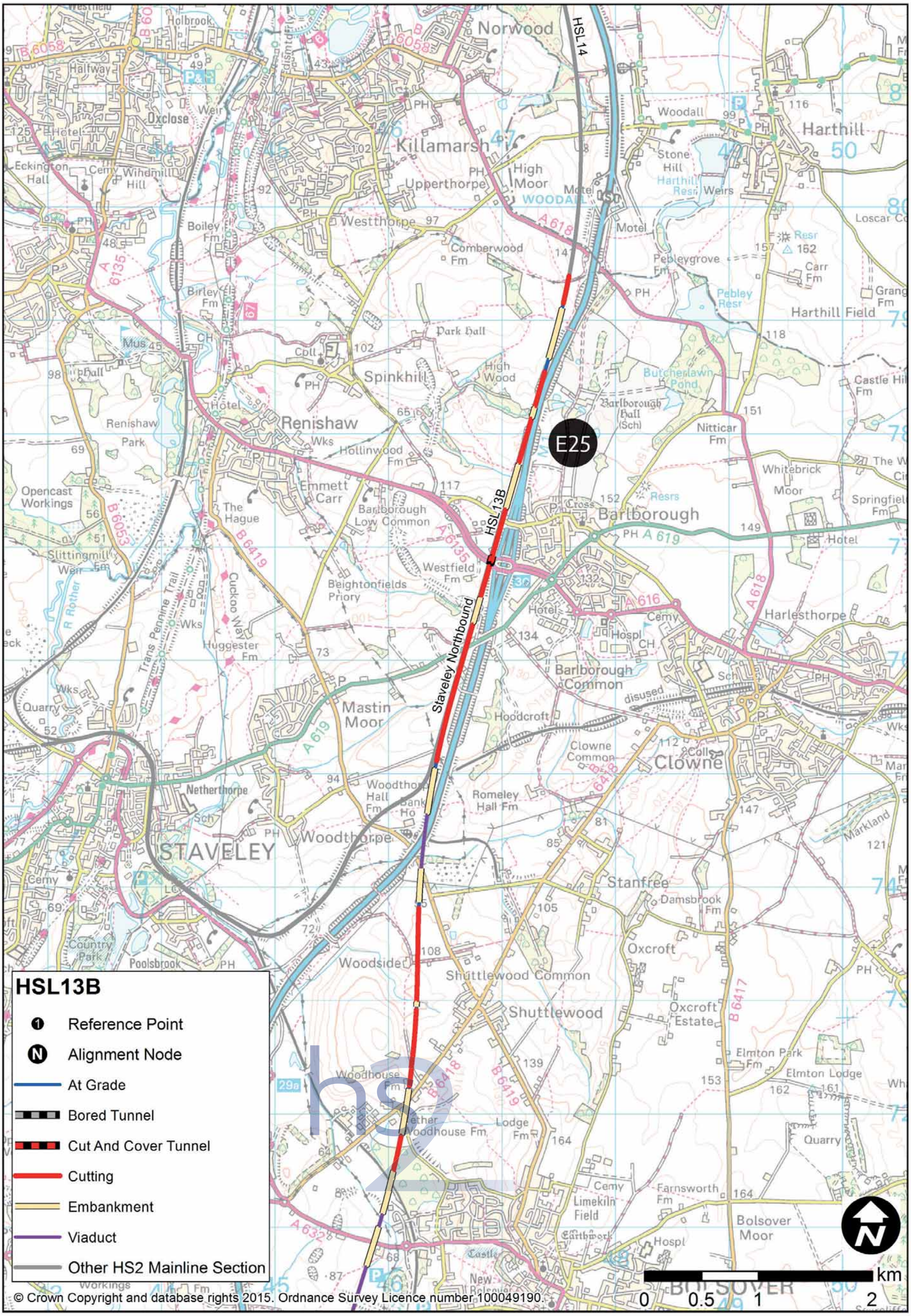
HSL13B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E25
HSL14
HSL13B
Staveley Northbound
Killamarsh
Norwood
Harthill
Spinkhill
Renishaw
Barlborough
Clowne
STAVELEY
Mastin Moor
Woodthorpe
Stanfree
Oxcroft
Shuttlewood
Netherthorpe
Woodside
Bolsover Moor
km
0
0.5
1
2
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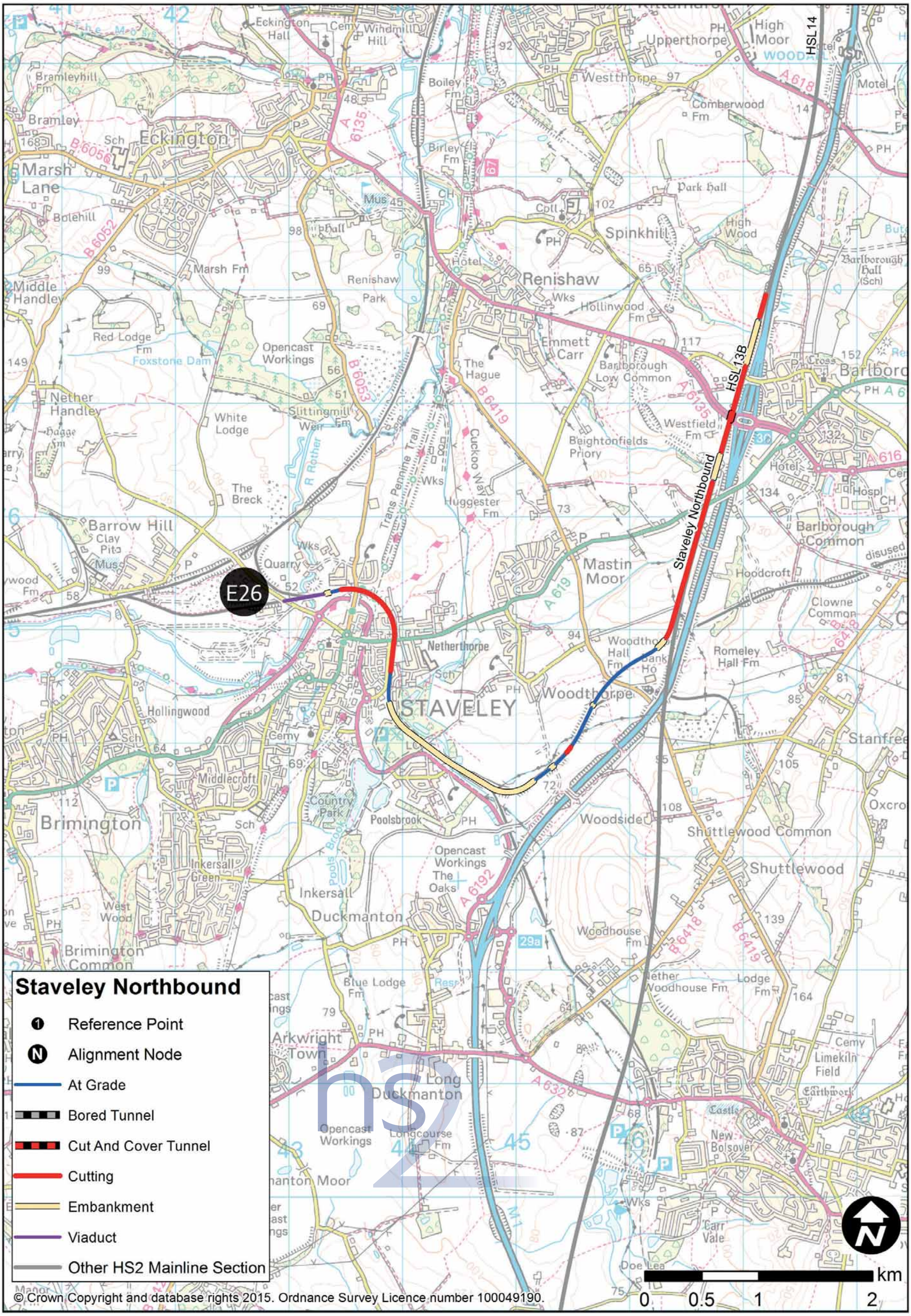
6.3.66 In response to consultation feedback, we have reviewed and refined the layout of the infrastructure maintenance depot at Staveley so it better aligns with local development plans. This depot now occupies 26 hectares of land to the north-west of Staveley. As the route is now further away from the depot we have proposed an alternative connection from the mainline, which follows the line of a currently disused mineral railway and connects to the mainline to the east of Mastin Moor with a grade separated connection that passes under the mainline. (E26)

6.3.67 *The route passes to the east of Killamarsh and Norwood, following the motorway corridor as closely as possible. It passes Wales to the immediate west of the M1 in a cutting up to 10m deep. We would expect to use retaining walls in this area to minimise the footprint of the route.* (E27)

6.3.68 *Passing Aston, the route would rise towards the M1 / M18 interchange, crossing the Sheffield to Worksop Railway and the A57 on viaducts. (E28) The route would then cross the M1 and M18 slip roads on two further viaducts, separated by embankment. It would run immediately to the west of the M18 past Bramley in cutting up to 11m deep; we would again expect to use retaining walls in this area to minimise the footprint of the route.* (E29) *Past Bramley, the route would curve northwards towards Conisbrough in cutting up to 19m deep through Conisbrough Parks.*


Staveley Northbound
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E26
Staveley Northbound
HSL13B
HSL14
0 0.5 1 2 km
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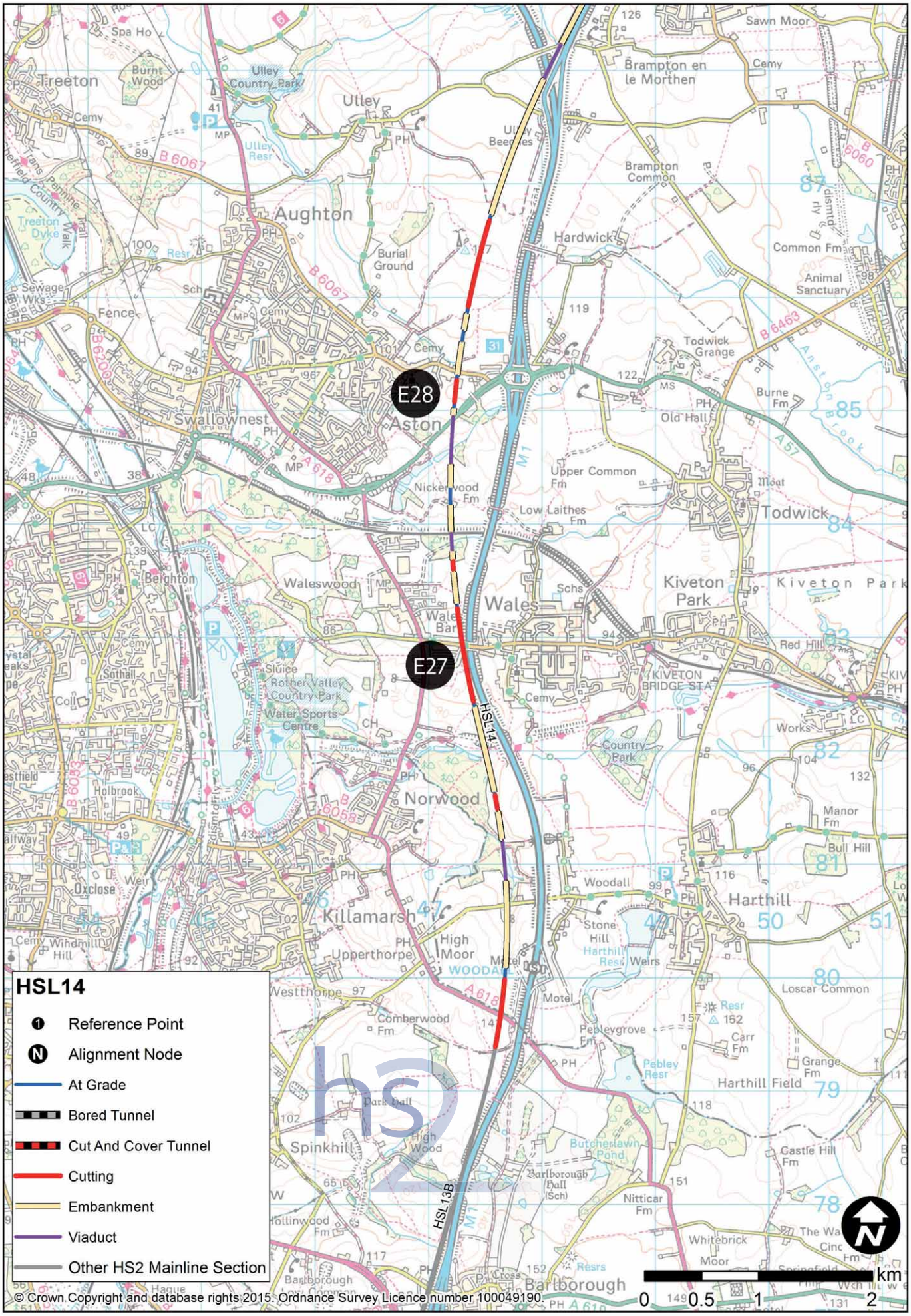
E28
E27
HSL14
HSL13B
Aughton
Swallownest
Aston
Waleswood
Wales
Todwick
Kiveton Park
Norwood
Killamarsh
Harthill
Spinkhill
Barlborough
Treeton
Ulley
Brampton en le Morthen
Hardwick
Todwick Grange
Upper Common Fm
Low Laithes Fm
Nickerwood Fm
Rother Valley Country Park
Water Sports Centre
Sluice
Holbrook
Oxclose
Woodall
Stone Hill
Harthill Resr
Loscar Common
Pebleygrove Fm
Pebley Resr
Harthill Field
Castle Hill Fm
Butcherlawn Pond
Barlborough Hall (Sch)
Nitticar Fm
Whitebrick Moor
Comberwood Fm
Upperthorpe
High Moor
Spink Hill
High Wood
Park Hall
Hollinwood Fm
Manor Fm
Bull Hill
Grange Fm
Carr Fm
Red Hill
Kiveton Park
KIVETON BRIDGE STA
Country Park
Motel
Sawn Moor
Brampton Common
Common Fm
Animal Sanctuary
Burne Fm
Old Hall
Moat
Burial Ground
Ulley Country Park
Ulley Resr
Treeton Dyke
Burnt Wood
Sothall
Berghton
Windmill Hill
Weir
Schs
Works
Cemy
PH
MP
Resr
CH
LC
MS
HSL14
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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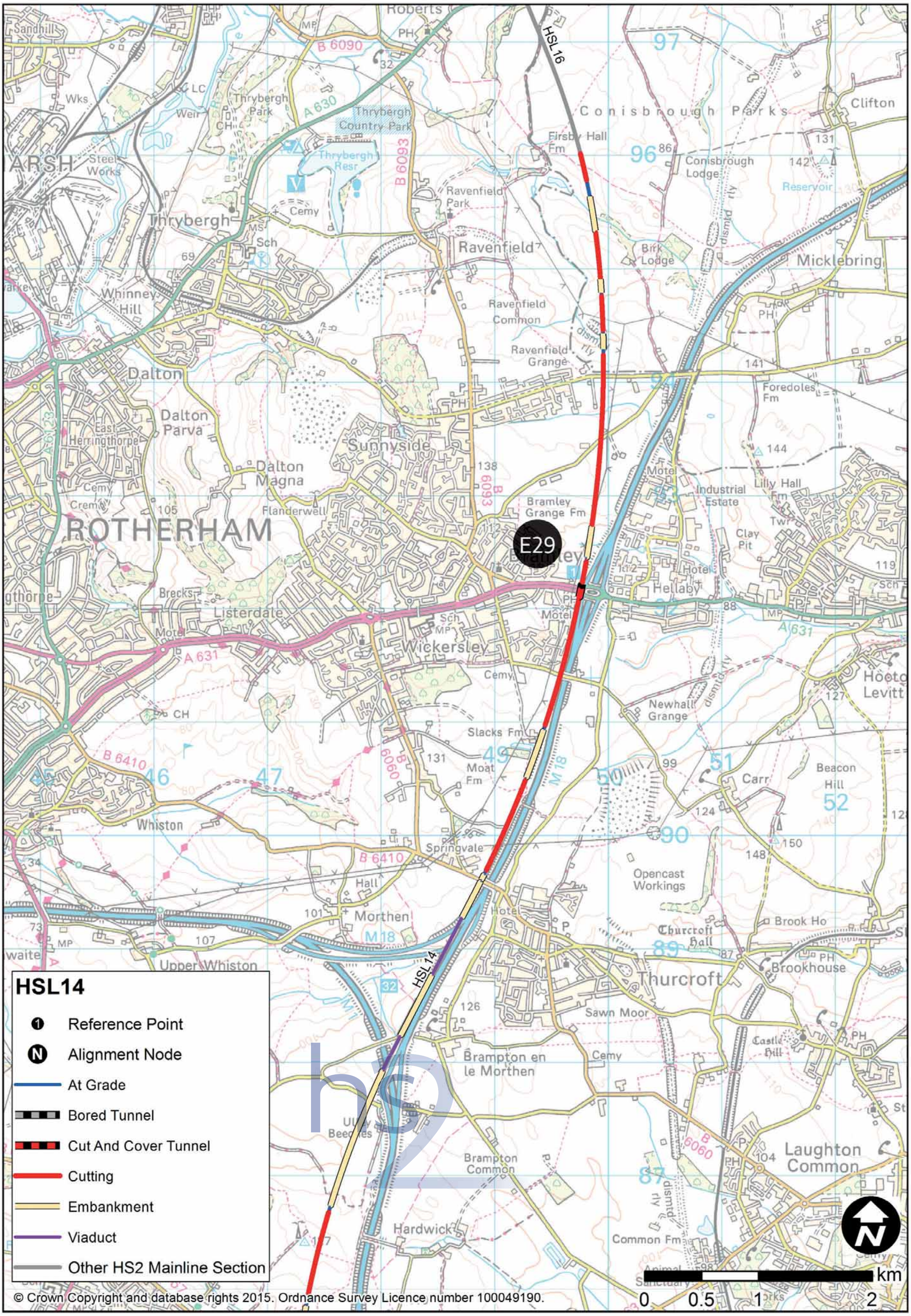
0 0.5 1 2
km


HSL16
HSL14
E29
ROTHERHAM
Thrybergh
Ravenfield
Dalton
Dalton Parva
Dalton Magna
Sunnyside
Bramley
Wickersley
Listerdale
Whiston
Upper Whiston
Morthen
Thurcroft
Hellaby
Brampton en le Morthen
Brampton Common
Laughton Common
Micklebring
Clifton
Conisbrough Parks
Hardwick
M18
M1
A631
A630
HSL14
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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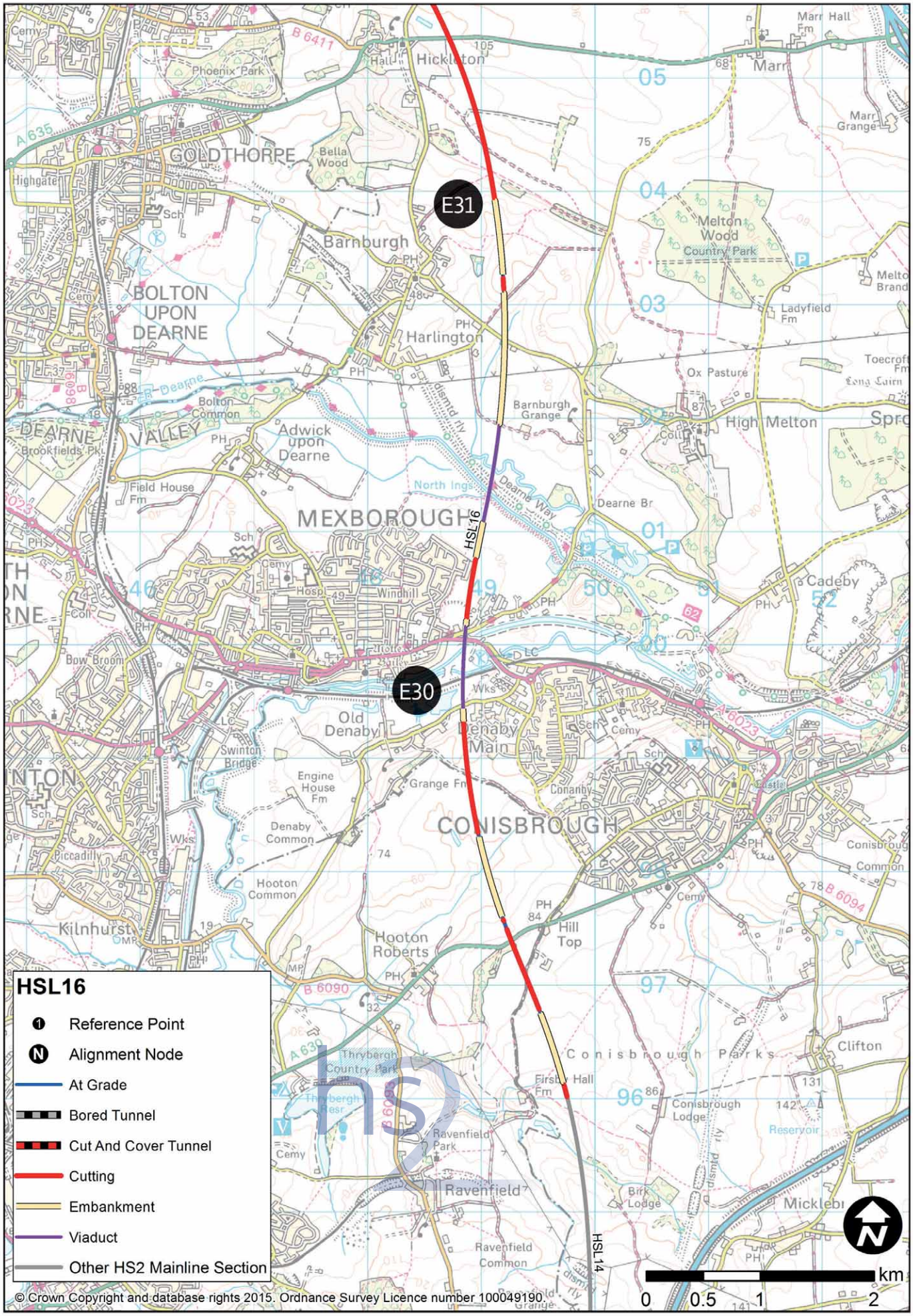
0 0.5 1 2 km

6.3.73 *The route descends into the valley of the river Don, on embankment up to 15m high and cutting up to 10m deep. The route would pass between Conisbrough and Mexborough, crossing the valley of the rivers Dearne and Don.* (E30) *We are aware of new developments in this area, as well as existing communities, and will further consider the most appropriate design and alignment of the route in this area as we move forward with consultation and further design development.*

6.3.74 *The route then heads north, climbing out of the river valley, and attempts to follow local ground levels, which rise sharply. This results in embankments up to 21m high to the east of Barnborough, and then cutting up to 25m deep.* (E31) *The route starts to head west past Hickleton, and passes between Thurnscoe and South Kirby, crossing the existing Sheffield to York railway at Clayton.*



Northern Junction

Where the HS2 main line crosses the existing network at Clayton, there is scope to construct a junction between HS2 and the existing network that would allow northbound HS2 services to rejoin the HS2 main line. (E32) *This would enable services to run directly between Sheffield Midland Station and the proposed HS2 station in Leeds, and help to meet TfN's aspiration for fast, frequent journeys between these city centres.*

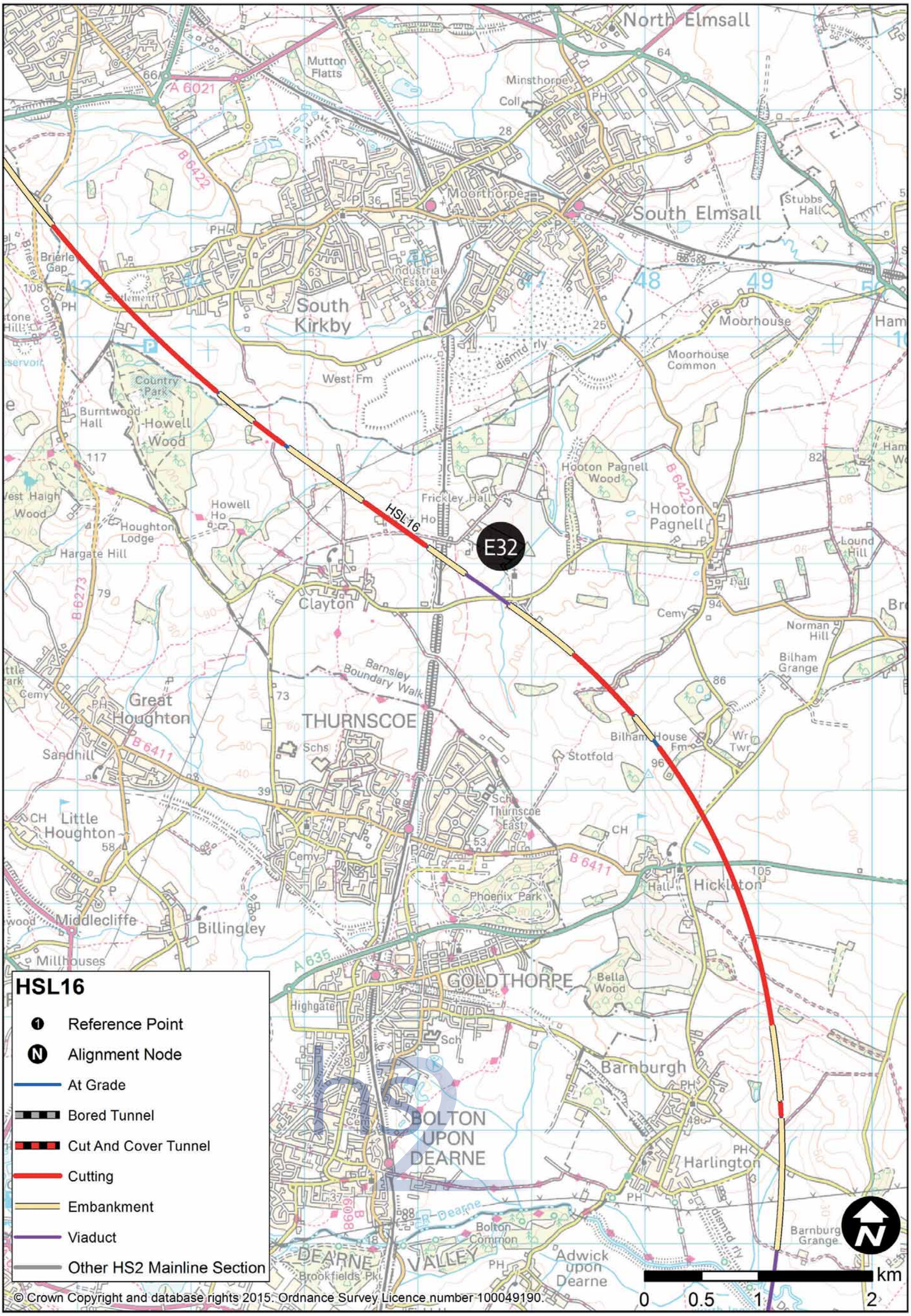
At the moment, we have not undertaken detailed design of this connection, although we expect that this would be a grade separated connection on to HS2, with one line of the junction crossing under the HS2 main line. We welcome views on this proposal to help the Secretary of State decide whether or not this should be incorporated into the Phase 2b scheme.

6.3.76 The HS2 route will pass under Common and Holmesly Lane to the west of South Kirby, and then pass to the west of Hemsworth in cutting. (E33) In consultation, the proposed route passed Crofton to the west. Following changes to the route alignment the railway now approaches Crofton from the south-east, passing the village to the east. It would start to climb to cross the existing Doncaster to Wakefield railway line at a height of 17m. The mainline would then cross the A638, on a 300m viaduct up to 19m high.

6.3.77 We proposed in consultation that a rolling stock depot should be sited at New Crofton, as this site was a good fit with the requirements for a rolling stock depot. (E34)

6.3.78 For the purpose of environmental appraisal and engineering design, the depot is in the same general location, with a slight westward shift, and an approach from the east rather than the west. At this stage, no decision has been taken on its location.

6.3.79 Following the change in the route through South and West Yorkshire, we are undertaking further work to consider the most appropriate location for the rolling stock depot. We remain confident that some of these may be viable alternatives for the Secretary of State to consider.


HSL16
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E32
HSL16
North Elmsall
South Elmsall
South Kirkby
Moorthorpe
Clayton
THURNSCOE
Great Houghton
Little Houghton
GOLDTHORPE
BOLTON UPON DEARNE
Barnburgh
Harlington
Hickleton
Hooton Pagnell
Frickley Hall
Billingley
Middlecliffe
km
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2
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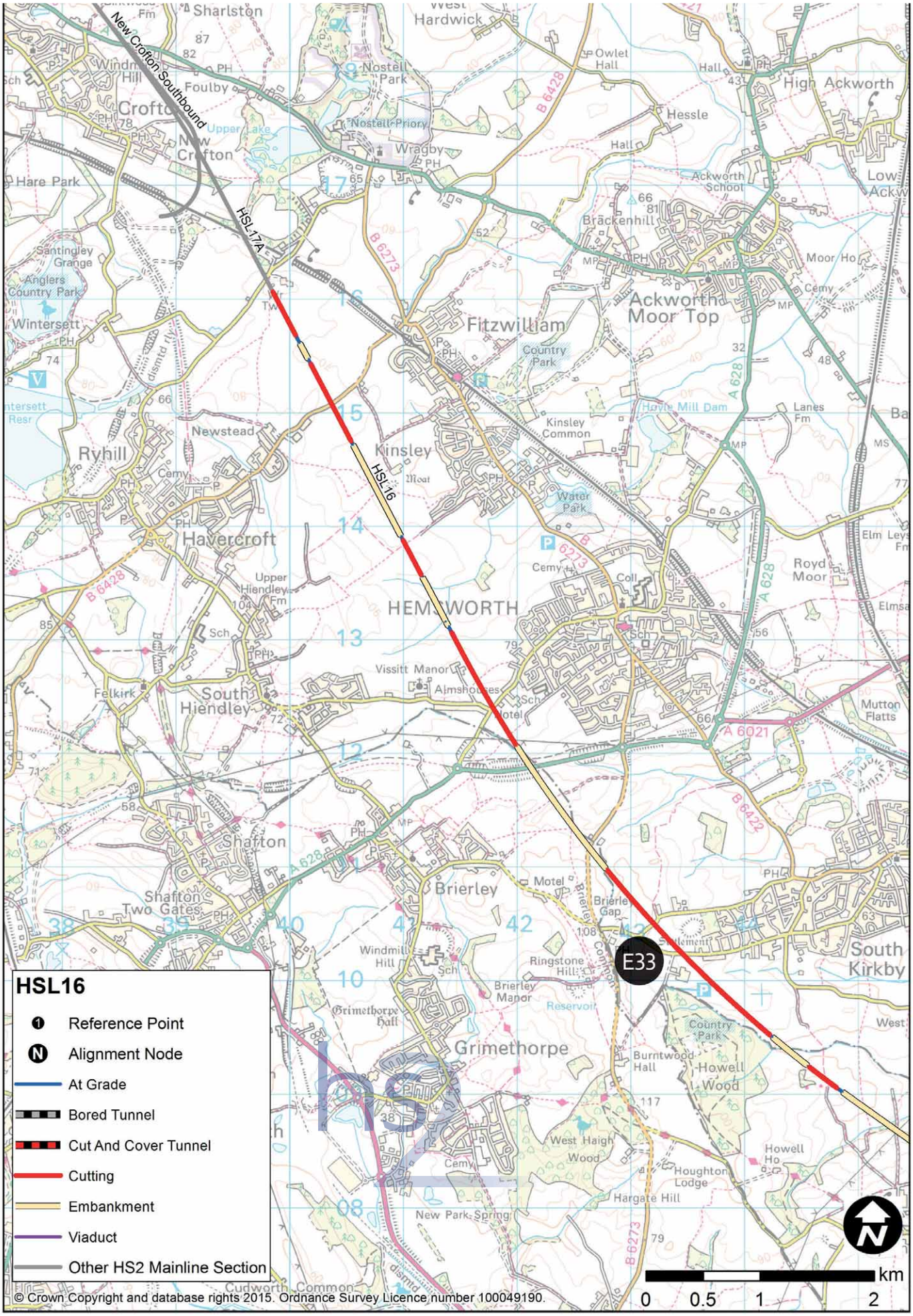
HSL16
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HSL 17A
HSL 16
New Crofton Southbound
E33
Sharlston
Hardwick
Nostell Park
Nostell Priory
Wragby
Crofton
New Crofton
Upper Lake
Foulby
Hare Park
Santingley Grange
Anglers Country Park
Wintersett
Fitzwilliam
Country Park
Ackworth Moor Top
High Ackworth
Hessle
Owlet Hall
Bracken Hill
Ackworth School
Moor Ho
Hoyle Mill Dam
Kinsley Common
Kinsley
Newstead
Ryhill
Havercroft
Water Park
HEMSWORTH
Upper Hiendley
South Hiendley
Felkirk
Vissitt Manor
Almshouses
Royd Moor
Mutton Flatts
Elm Leys
Elmsall
Shafton
Shafton Two Gates
Brierley
Brierley Gap
Windmill Hill
Ringstone Hill
Brierley Manor
Reservoir
Grimethorpe Hall
Grimethorpe
South Kirkby
Country Park
Burntwood Hall
Howell Wood
West Haigh Wood
Houghton Lodge
Howell Ho
Hargate Hill
New Park Spring
Cudworth Common
A 628
A 6021
B 6273
B 6428
B 6422
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km
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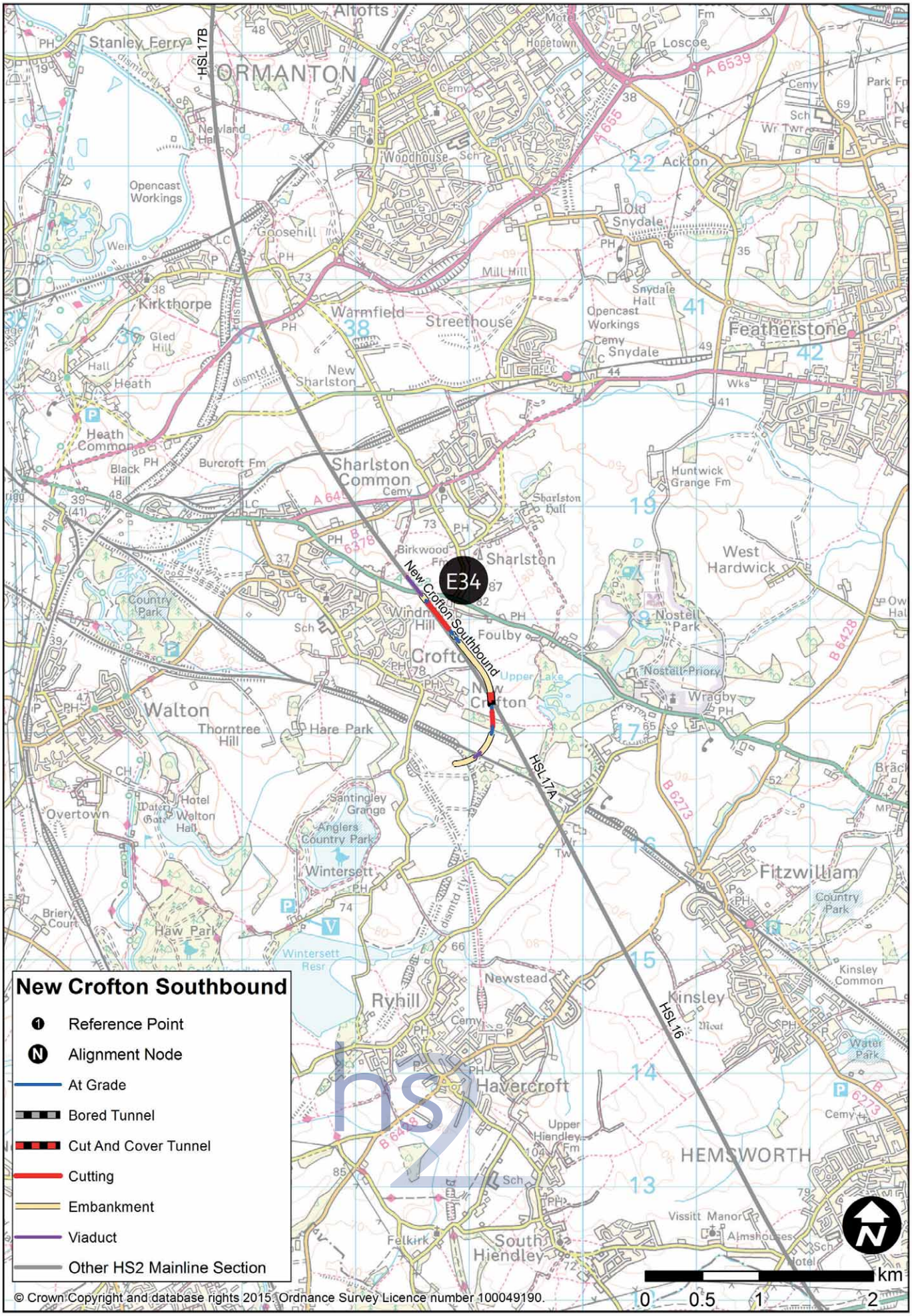
New Crofton Southbound
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E34
New Crofton Southbound
HSL17B
HSL17A
HSL16
ORMANTON
Altofts
Stanley Ferry
Loscoe
Ackton
Old Snydale
Featherstone
Kirkthorpe
Warmfield
Streethouse
New Sharlston
Sharlston Common
Sharlston
West Hardwick
Nostell Park
Nostell Priory
Wragby
Walton
Thorntree Hill
Hare Park
Overtown
Walton Hall
Wintersett
Haw Park
Fitzwilliam
Country Park
Kinsley
Kinsley Common
Newstead
Ryhill
Havercroft
HEMSWORTH
South Hiendley
Upper Hiendley
Felkirk
Foulby
Windmill Hill
Birkwood Fm
Huntwick Grange Fm
Sharlston Hall
Opencast Workings
Goosehill
Woodhouse
Mill Hill
Snydale Hall
Gled Hill
Heath
Heath Common
Black Hill
Burcroft Fm
Santingley Grange
Anglers Country Park
Briery Court
Vissitt Manor
Almshouses
Water Park
A 6539
A 655
A 642
B 6378
B 6428
B 6273
B 6474
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km

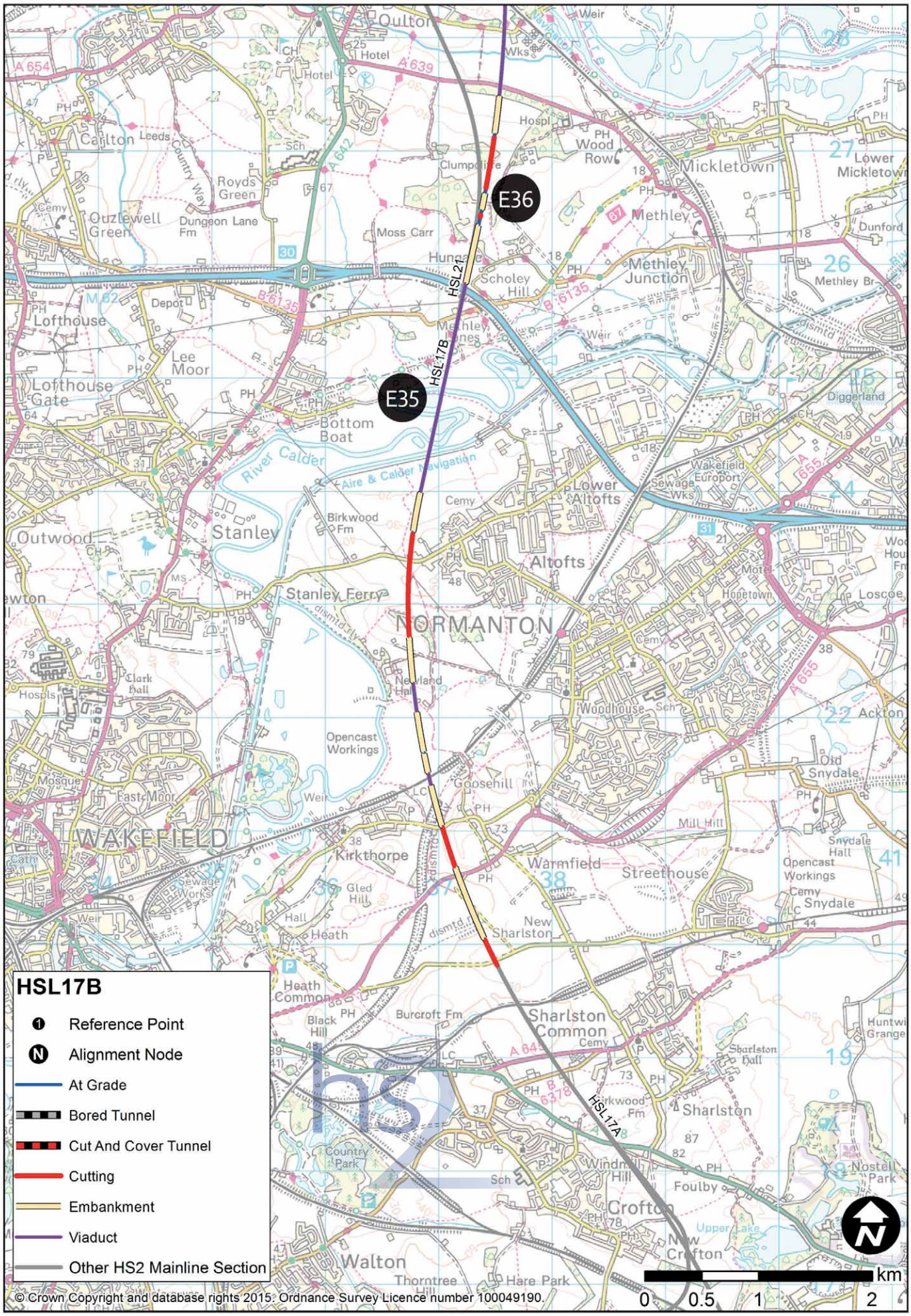
West Yorkshire to Leeds

6.3.83 Shortly beyond the New Crofton Depot, the railway rejoins the corridor set out in the consultation. The route heads north, passing to the west of Normanton and crossing the Rivers Calder, Aire and Calder Navigation, the M62, and local roads. In the consultation design, these features were crossed with individual viaducts separated by short sections of embankment. Building on the lessons learned from the Phase One design process, we have now introduced a single, 1,900m-long viaduct across these features. (E35)

6.3.84 At the northern end of this viaduct, we have introduced a grade separated junction to provide the spur into Leeds. (E36) In the consultation proposition, the Leeds spur left the mainline on a grade separated junction, around 600m further north, and curved round to the north of Woodlesford, running along the River Aire valley and Aire and Calder Navigation. A great deal of concern was raised in consultation about the impact of these structures, which would have been up to 2,340m long and up to 14m high. Further work to consider lessons learned from Phase One would have brought these viaducts further into the line of the river, introducing additional risks.

6.3.85 Accordingly, we reviewed a number of options in this area, including proposals that would see the Leeds spur leaving the mainline further to the south and following the line of the M62 and M1.

6.3.86 As a result of this work, we have developed a new route for the Leeds spur. This spur to Leeds would leave the main line near Clumpcliffe, and approach Woodlesford from the south-east in cutting. The route would then pass under Woodlesford in 1,110m of bored tunnel and a further 470m cut-and-cover tunnel. It would emerge within the corridor of the existing Woodlesford railway lines, to the north of Rothwell Country Park, rejoining the consultation alignment. (E37) This change would reduce the level of impacts in this area, particularly visual intrusion.


E36
E35
HSL21
HSL17B
HSL17A
HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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0
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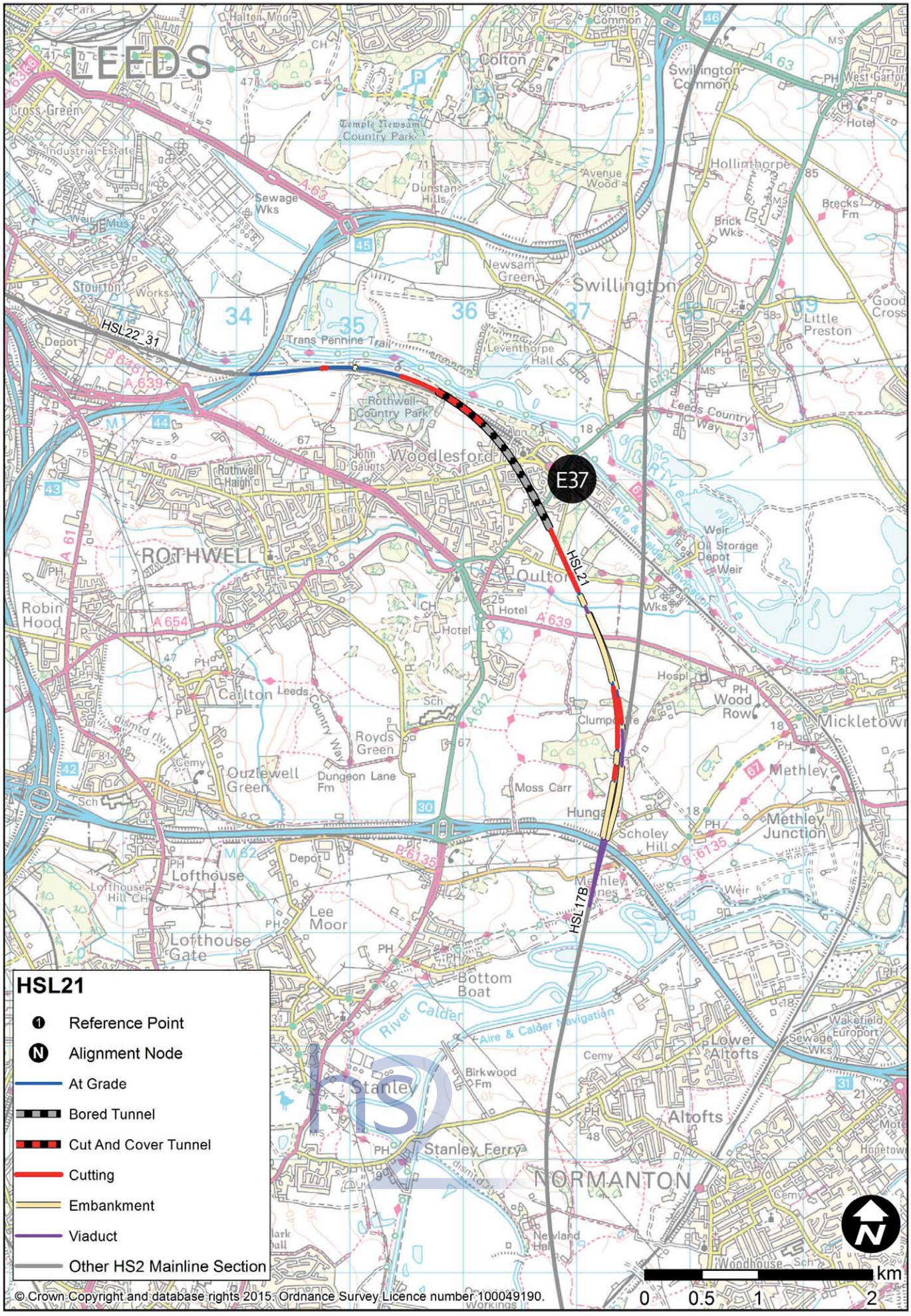
km


LEEDS
Colton
Swillington Common
Cross Green
Temple Newsam Country Park
Hollinthorpe
Sewage Wks
Dunstan Hills
Avenue Wood
Brick Wks
Brecks Fm
Newsam Green
Swillington
Stourton
Works
Depot
HSL22_31
Trans Pennine Trail
Leventhorpe Hall
Little Preston
Rothwell Country Park
Leeds Country Way
Woodlesford
John Gaunts
Rothwell Haigh
E37
ROTHWELL
Oulton
HSL21
Weir
Oil Storage Depot
Robin Hood
Hotel
Carlton
Royds Green
Dungeon Lane Fm
Outlewell Green
Moss Carr
Wood Row
Mickletown
Methley
Methley Junction
Scholey Hill
Lofthouse
Lofthouse Gate
Lee Moor
HSL17B
Bottom Boat
River Calder
Aire & Calder Navigation
Wakefield Europort
Lower Altofts
Birkwood Fm
Stanley
Altofts
Stanley Ferry
NORMANTON
Newland Hall
Woodhouse
HSL21
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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0
0.5
1
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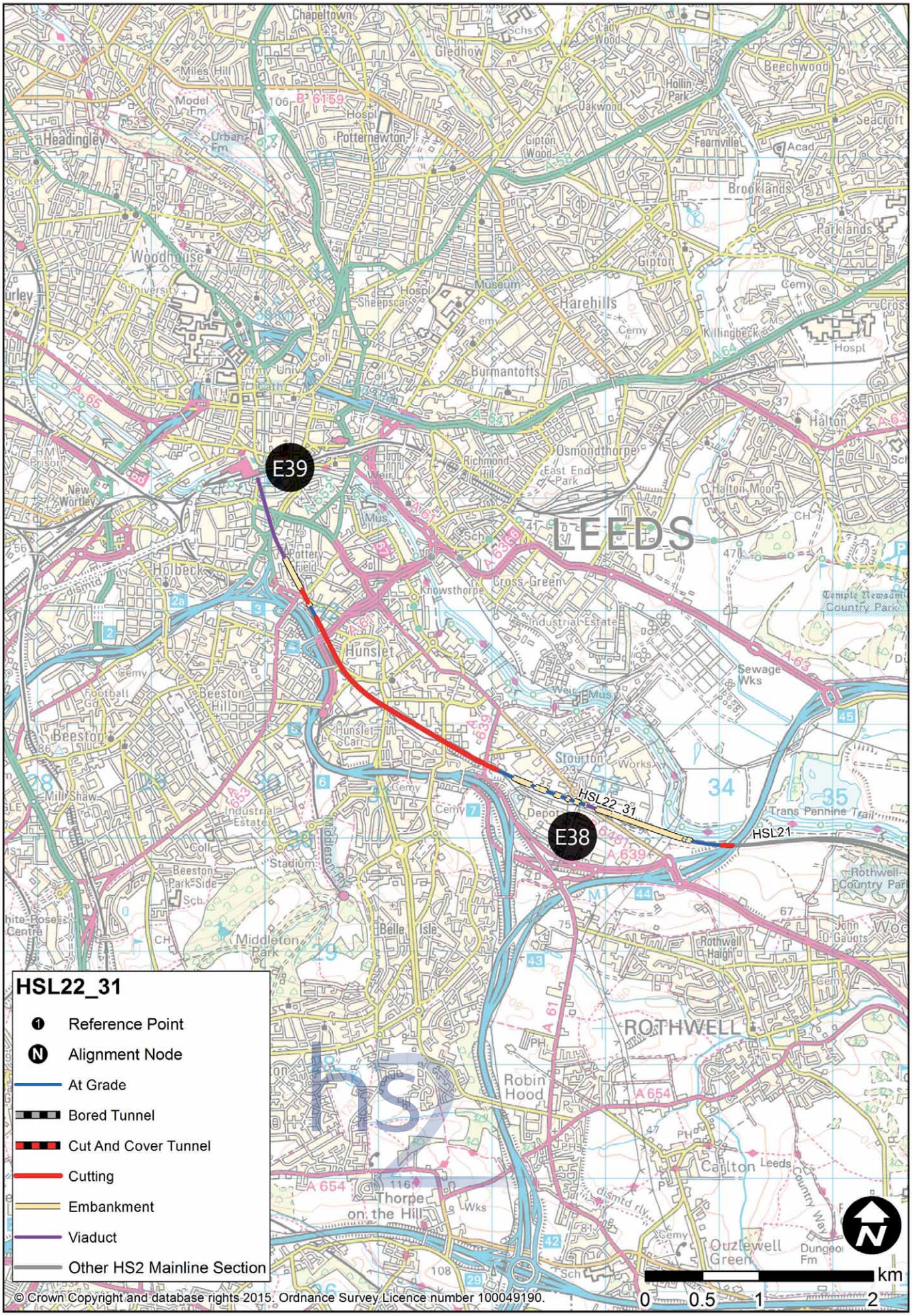
km

6.3.90 The spur continues to follow the corridor of the existing railway, crossing the B6481 on a short 80m viaduct and terminating at a new Leeds city centre high speed station. (E38)

6.3.91 The proposal put forward in consultation was for a station at New Lane, located to the south of the River Aire, five to ten minutes' walk from Leeds City Station, and approached via a 290m-long viaduct.

6.3.92 During consultation, some stakeholders raised concerns over the quality of the linkage between the high speed station at Leeds New Lane proposed in consultation, and the existing Leeds City Station. These concerns were further highlighted by the growing strategic focus on transport in the North of England, and particularly the aspiration for better connectivity between urban centres and need for greater integration of transport at the strategic level as set out in Chapter Five.

6.3.93 The proposed high speed station in Leeds has accordingly moved approximately 250m to the north of the station proposed in consultation, with platforms spanning the River Aire. The approach and HS2 platforms will be on a 750m-long viaduct over Holmes Street, the A653, New Lane, Sovereign Street and Neville Street, and the River Aire, and will include five 440m-long HS2 platforms. The maximum height of this viaduct will be 13m, and it will enable the HS2 station to join directly to the existing station. (E39)


E39
E38
HSL22_31
HSL21
LEEDS
ROTHWELL
HSL22_31
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
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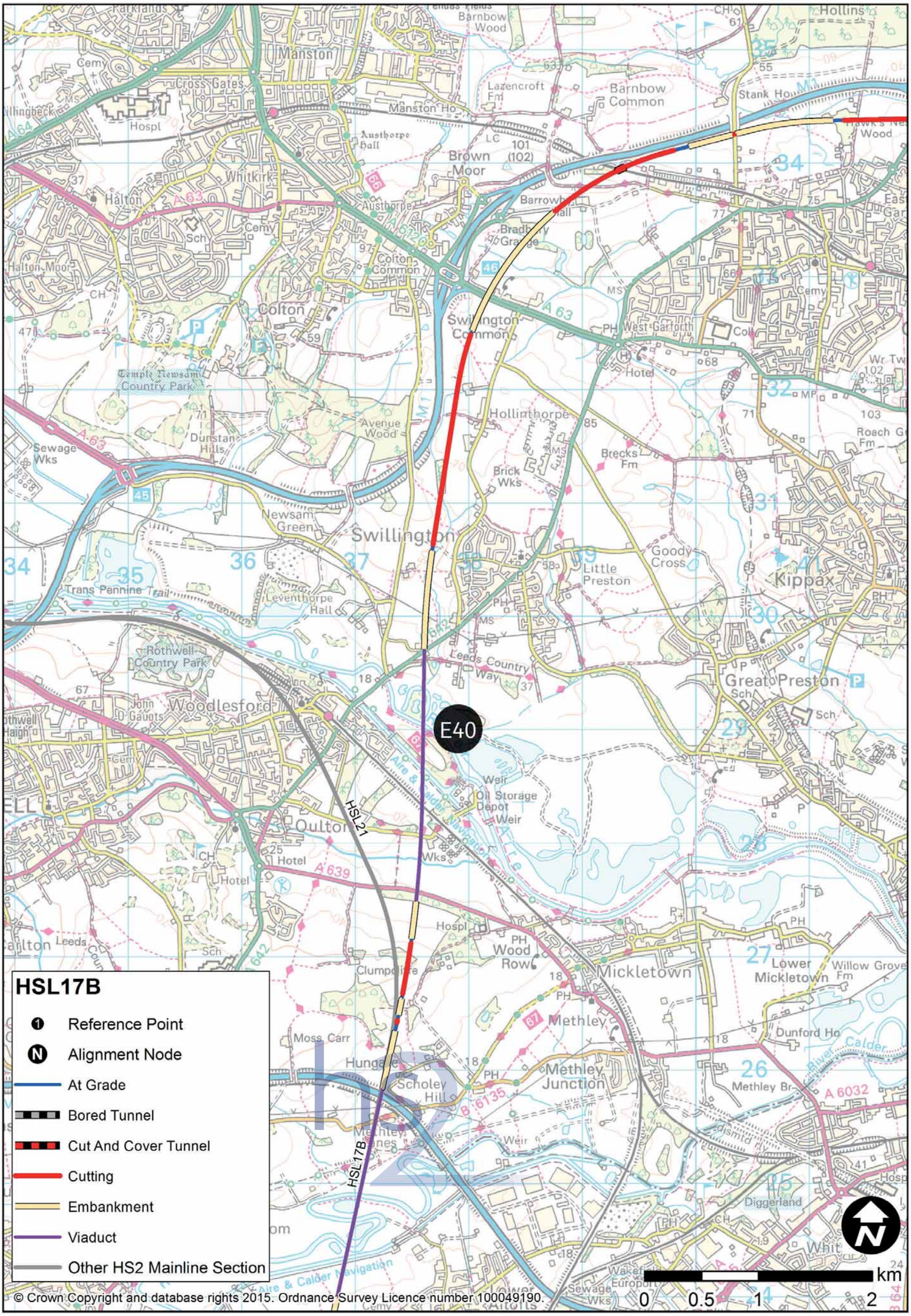
0 0.5 1 2
km

Connecting to the East Coast Main Line

6.3.96 The route to the East Coast Main Line continues north past the Leeds junction and crosses a number of features including the A639, the existing railway, the Aire and Calder Navigation, the River Aire and the A642. The consultation proposition proposed crossing these features with series of short viaducts separated by sections of embankment. Building on the lessons learned from Phase One, these have now been replaced by a single 2,230m-long viaduct with a maximum height of 29m. (E40)

6.3.97 The preferred route connects to the existing network with a grade separated junction at Church Fenton. In response to concerns raised in consultation, we considered alternatives to this proposed connection that would join the existing network in different locations. Based on this work we considered that any alternative connection would simply transfer existing impacts to a new area of route, rather than delivering an overall improvement, while potentially introducing additional journey time disbenefits or complexities on the existing network.

6.3.98 We have not moved this connection. However, we have combined four short sections of viaduct in this area, with a maximum height of 12m, into a single 2,170m-long viaduct with a maximum height of 13m. (E41) We will continue to develop the design in this area during the hybrid Bill development process as we get a better understanding of issues such as the flood risk in this area, which may enable us to further refine the vertical and horizontal alignment of the route.


HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E40
HSL21
HSL17B
Manston
Cross Gates
Whitkirk
Halton
Halton Moor
Colton
Colton Common
Austhorpe
Barnbow Common
Brown Moor
Swillington Common
Swillington
Temple Newsam Country Park
Dunstan Hills
Newsam Green
Leventhorpe Hall
Rothwell Country Park
Woodlesford
Oulton
Hollinthorpe
Brecks Fm
Brick Wks
Little Preston
Goody Cross
Kippax
Great Preston
West Garforth
Leeds Country Way
Trans Pennine Trail
Oil Storage Depot
Weir
Wks
Hospl
Wood Row
Mickletown
Lower Mickletown
Methley
Methley Junction
Scholey Hill
Hungate
Moss Carr
Clumpcliffe
Dunford Ho
Methley Br
Diggerland
Willow Grove
Aire & Calder Navigation
River Calder
A 63
A 639
A 6032
B 6135
0 0.5 1 2 km
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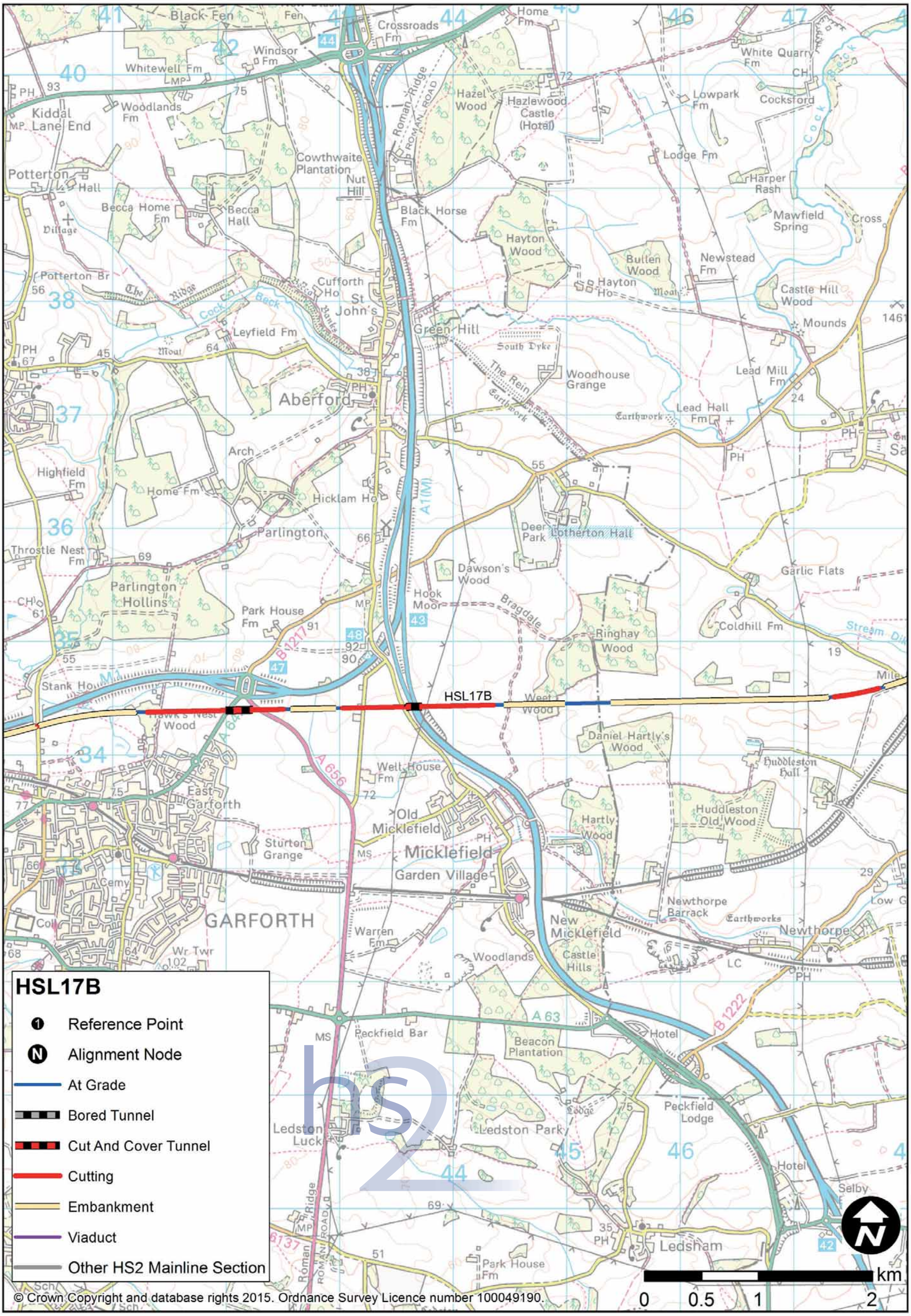
HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
HSL17B
Aberford
GARFORTH
Micklefield
Lotherton Hall
Ledsham
0 0.5 1 2 km
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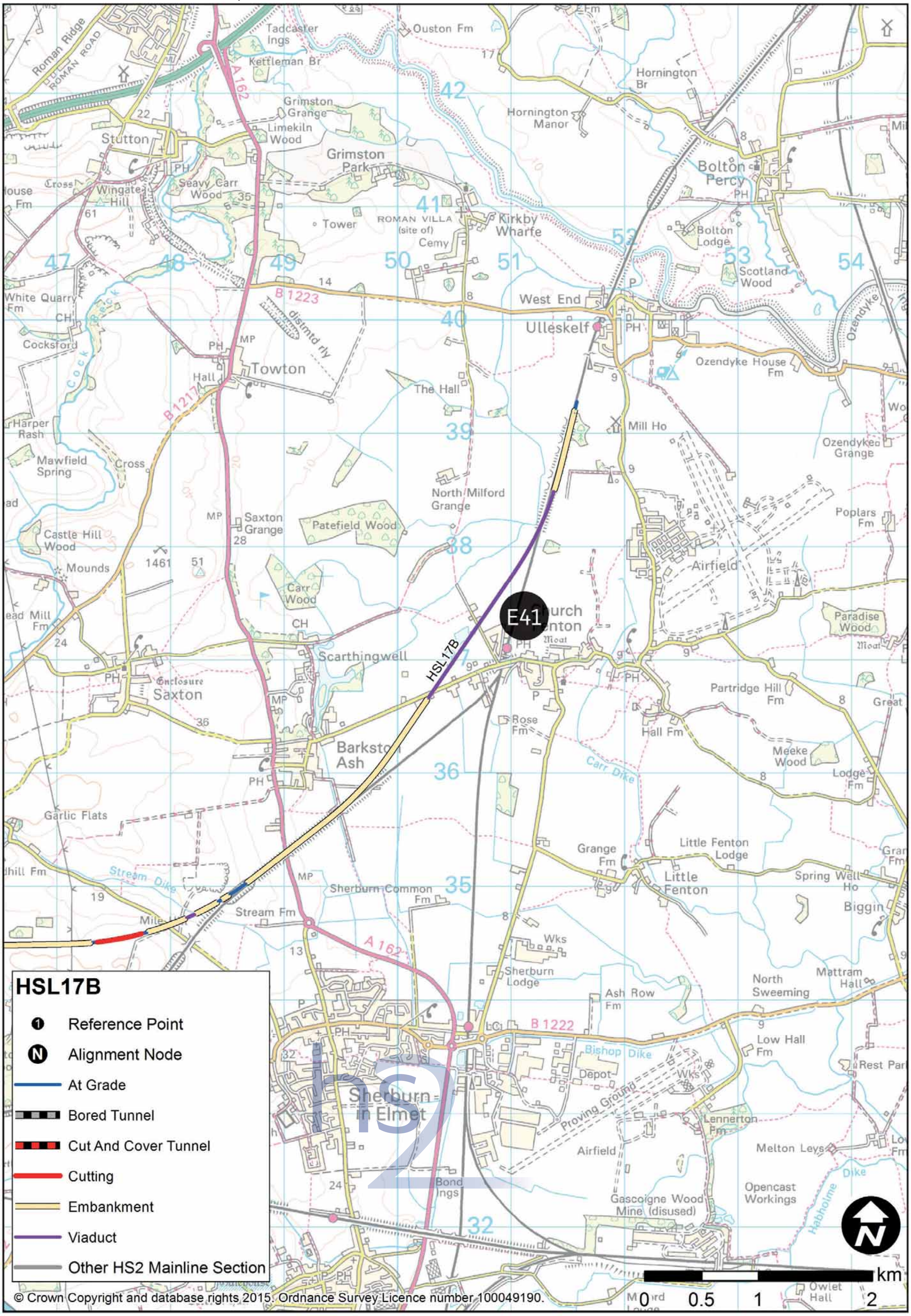
HSL17B
Reference Point
Alignment Node
At Grade
Bored Tunnel
Cut And Cover Tunnel
Cutting
Embankment
Viaduct
Other HS2 Mainline Section
E41
HSL17B
Ulleskelf
Church Fenton
Barkston Ash
Saxton
Scarthingwell
Towton
Sherburn in Elmet
Bolton Percy
Kirkby Wharfe
Little Fenton
Airfield
km
0
0.5
1
2
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7 Next steps

7.1.1 In order to secure powers from Parliament for the construction of the preferred route, we will develop a hybrid Bill. Our approach will be similar to that adopted in the development of the Phase One and 2a hybrid Bills, building on the lessons that we have learned in this process.

7.1.2 At the same time, we will also consider the feedback that we have received on those areas of the route on which we are now consulting. Where we decide to make changes to the route, these will be incorporated into the hybrid Bill design. We expect to make a further announcement on the results of this consultation in 2017.

7.1.3 As part of developing a hybrid Bill we will undertake an Environmental Impact Assessment. This work involves surveying, modelling exercises, analysis and engagement with relevant stakeholders to further understand the likely significant effects of the route and to design the most appropriate environmental mitigation along the route.

7.1.4 Other issues that will be considered at this stage include the realignment of local highways and the impacts of construction. In addition, we will undertake further work to consider ancillary items, including power supply locations, signalling systems, drainage and railway access.

7.1.5 Our current schedule would see us depositing a hybrid Bill by the end of autumn 2019, with construction work starting by 2023, leading to the first services using the route in late 2033.

7.1.6 Detailed construction planning, including phasing, management of construction traffic and location of work sites, will also take place as part of the development of the hybrid Bill.

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