hs2 engine for growth

ROUTE ENGINEERING REPORT

West Midlands to Manchester

July 2013

Department for Transport

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Contents

1 Introduction

1.1 The purpose of this report

1.1.1 This report provides a detailed route description of each leg of Phase Two of the High Speed Two (HS2) network, including the proposed stations and depots.

1.1.2 The technical requirements for line of route, stations and depot design are outlined in this report.

1.1.3 The historical work undertaken since the start of the route development in 2010, presented to the public in a series of documents published in January 2013, can be found on the Department for Transport website (https://www.gov.uk/government/organisations/department-for-transport). Additional information concerning the scheme can be found on the HS2 Ltd website (www.hs2.org.uk).

1.2 Overview of the route

1.2.1 The Manchester leg of the Phase Two network would commence at a spur of the high speed route from the south, just prior to the southern route's connection with the West Coast Main Line (WCML) railway and just north of Fradley Wood. The route would continue in a north-easterly direction, crossing mainly open countryside on a series of embankments, viaducts and cuttings, passing to the east of Rugeley and Stafford, and close to the west of Hopton, where it would pass through a raised or green tunnel. The line continues north-west, crossing over the M6 and passing to the north of Swynnerton and Baldwin's Gate, where it enters twin tunnels through a hill on Whitmore Heath. Continuing on a series of embankments, cuttings and viaducts, the route would pass through a hill in twin tunnels to the south west of Madeley and turn in a more northerly alignment on its approach to Crewe.

1.2.2 Just south of Crewe the route runs alongside the WCML corridor where it would spur, providing a connection to the WCML. An infrastructure maintenance depot would be provided in this area adjacent to the existing Network Rail sidings at Basford Hall. Just south of Crewe station the route would enter twin tunnels, which would extend north under Crewe, emerging alongside the WCML corridor just north of Coppenhall.

1.2.3 The route would then move away from the WCML corridor, continuing north in mainly open countryside and passing to the east of Lostock Green, Lostock Gralam and Higher Wincham. The route would again pass over the M6, following which the line would spur. The spur would pass east towards Manchester Airport and the terminus station at Manchester Piccadilly and the mainline would access the rolling stock maintenance depot and the WCML.

1.2.4 The Manchester spur turns east and passes to the north of Rostherne Mere, running parallel to the M56. It then turns north and passes under the M56 at Warburton Green and into an interchange station at Manchester airport. Just past the station, the route would enter twin tunnels taking it under south Manchester to emerge in the Ardwick area, where it would rise onto a viaduct to enter the terminus station at Manchester Piccadilly.

1.2.5 The mainline continues north-west through mainly open countryside, crossing under the M56, and over the Manchester Ship canal on a viaduct to the east of Hollins Green.

Passing over the M62 the route would curve to pass to the south-west of Culcheth, and then between Lowton and Lowton Common. The route would then curve east to enter the rolling stock depot, at Golborne, and provide a connection into the WCML at Bamfurlong.

1.2.6 Trains running between Manchester Piccadilly and the rolling stock depot would use a chord connecting to the Manchester spur just west of junction 8 of the M56. This chord would pass under the M56 and pass through open countryside to connect into the depot spur to the east of Broomedge.

1.3 The layout and content of this report

1.3.1 This report is laid out as follows:

- chapter one (this chapter), is introductory;
- chapter two sets out the technical requirements and assumptions underlying our work;
- chapter three describes the Line of Route;
- chapter four describes the stations along the route;
- chapter five describes the infrastructure maintenance depot and the rolling stock depot;
- chapter six discusses ancillary design works;
- chapter seven is a glossary of terms.

2 Design methodology

2.1 Overview

2.1.1 The route definition and selection process for Phase Two commenced in Autumn 2010 with the engagement of engineering and environmental consultancies to deliver the necessary technical design and appraisal input. The methodology applied was, in large part, the same as that applied to the route selection between London and the West Midlands, with improvements to the process implemented as necessary following lessons learned from that first phase of the project.

2.1.2 The remit was to identify a number of possible route and station options. This involved a process of identification of a long list with subsequent sifting to reduce the options for consideration down to a handful of alternatives that meet the remit set by the Government. At each sift, remaining options were developed and refined to a greater level of detail in order to identify the key differences between options. During these final stages, potential locations for the infrastructure maintenance depots and rolling stock depots were also developed and followed a similar sifting process.

2.1.3 The scope for the Manchester leg included Manchester city centre station locations and consideration of the potential for interchange/ intermediate station locations. Connections to the existing WCML would provide further routes to the North West and Scotland.

2.2 Technical requirements for line of route

2.2.1 HS2 Ltd has a technical specification, entitled *Options for Phase Two of the high speed rail network: Approach to design*[1], which sets out the engineering operational and performance requirements for the route and the engineering design parameters.

Alignment design assumptions

2.2.2 The alignment development work was generally carried out using Ordnance Survey MasterMap data, supplemented with elevation information from five-metre resolution terrain data and one-metre resolution surface data provided by HS2 Ltd. This mapping has been used to support the alignment design.

2.2.3 The alignment design was undertaken in line with a combination of industry standards and best practice:

- HS2 Ltd's *Options for Phase Two of the high speed rail network: Approach to design*;
- European Standards (the TSI 2002/732/EC – Technical Specification for Interoperability relating to the infrastructure sub-system); and
- Network Rail Standard (NR/SP/TRK/0049 – Track Design Handbook).

2.2.4 Key alignment parameters from the project specification include the following:

- The project shall assume a maximum line speed of 400kph where topographical, train performance and sustainability issues permit;

[1] High Speed Two Ltd, 2012. Options for phase 2 of the High Speed rail network, approach to design. HS2 Ltd, London. Available online at https://www.gov.uk/government/publications/options-for-phase-two-of-the-high-speed-rail-network-approach-to-design

- The line shall be designed to permit trains to maintain consistent high speeds;
- The maximum achievable turnout speed is assumed to be 230kph;
- The maximum vertical acceleration experienced due to the effect of vertical curvature shall normally be 2.25% of g; in exceptional circumstances, this can be increased to 4.25% of g; and
- The maximum vertical curve radius shall be 56,000m.

The width of the railway

2.2.5 For the majority of its length, the new route would be a twin-track railway.

2.2.6 The separation between the centre lines of the pair of tracks would be 5.0m where 400kph running was required. The track-bed width shall make provision for overhead line equipment (OHLE), access tracks wherever practicable, staff walkways, drainage, and fencing. The normal track-bed width would be 22m wide.

2.2.7 For cuttings and embankments, it is assumed that the side slope of the earthworks would be 1:2.5 (two vertical to five horizontal). This is an appropriate design assumption. In practice, it may be possible to use steeper cutting slopes or apply retaining walls to reduce the fence-to-fence dimensions. Elsewhere, shallower cutting and embankment slopes may be required where the ground conditions are less stable.

2.2.8 Where tracks enter tunnels in two separate tunnel bores, the distance between tracks would be dependent on the tunnel diameter, but would typically be 21m instead of the usual 5m.

2.2.9 Construction of HS2 would require some additional land take beyond the corridor footprint, together with larger discrete areas to act as construction compounds. Larger worksites would also be required at areas of major works including bridges, major structures and entrances to tunnels.

2.2.10 At this early design stage, consideration of construction issues has generally included identifying risks, opportunities and typical working methods and techniques. Given the more constrained nature of the station sites, further work has been undertaken, including initial identification of potential construction boundaries to assess the land take and demolition required.

Geotechnical assumptions

2.2.11 As one might expect from a project with such a large geographical scope, the geological conditions across the leg to Manchester are variable.

2.2.12 At this early stage of design, a common side slope has been adopted for earth structures. The development of the designs to a greater level of detail, with desk-based and later intrusive geotechnical investigations, may require our assumptions to be modified.

2.2.13 The following issues are typical of the influences that there have been on route selection:

- subsidence of natural cavities, in particular gypsum;
- areas with a known history of landslides or unstable ground;

- compressible deposits including alluvium, and on the approaches to Manchester, peat, which pose a settlement risk to loads;
- shallow mine workings occur widely; although primarily for coal mining, there are also shallow mine workings associated with ironstone, sandstone and gypsum. Deep mine workings are limited to coal – significant lengths of the routes cross such workings; and
- salt mining and brine extraction (where salt deposits are dissolved and extracted by pumping water through them).

Structures assumptions

2.2.14 Sufficient vertical clearance has been provided within the alignment design where HS2 would cross, or be crossed by, roads and other major obstacles including rivers, canals and other railways. Short bridges, such as those used to carry the railway over local roads, or roads over the railway, would likely be straightforward single spans. For longer structures, the provision of a viaduct structure has been assumed. In particular, viaducts have been assumed where the designed rail level would be greater than 15m above existing ground level, or where the feature to be spanned is longer than 60m, for example, where HS2 would cross a flood risk zone.

Tunnelling assumptions

2.2.15 The range of tunnel configurations used was as follows:

- twin bore, single track tunnels (with cross passages where required); and
- cut and cover tunnels.

2.2.16 The tunnelling methods considered were:

- tunnel boring machine (TBM) driven tunnels with precast tunnel linings - the type of machine will depend on the ground conditions; and
- sequentially excavated tunnels, generally utilising sprayed concrete lining (SCL) for initial ground support.

2.2.17 It is assumed that tunnels would be provided where the track alignment is at 22m or below existing ground level. The size of tunnel required would be dependent on design speed and length of tunnel. This is subject to an absolute minimum size of 7.25m for each bore of a twin bore tunnel – determined by the space required to accommodate the train and ancillary equipment such as the electrification system, emergency walkways and drains.

2.2.18 Vertical intervention shafts are provided for tunnel ventilation and emergency access and evacuation. Cross passages between twin bore tunnels have been assumed at a spacing of approximately 500m.

Cut and cover tunnels

2.2.19 In some locations, cut and cover tunnels are proposed. These would be formed by excavating what would be a normal cutting, constructing a box type of structure and then re-filling over its roof slab to restore the original ground level and surface features such as footpaths or woodland. Such tunnels would be constructed where a driven tunnel would be impracticable due to insufficient cover depth to the surface or

where very deep cutting is not economically viable.

2.2.20 In some locations and under exceptional circumstances, a 'green tunnel' could be used. These would be formed by enclosing the railway (where otherwise it would be in partial cutting or even on the surface) with a box type structure, with a landscaped area over the roof. Such tunnels would be constructed as an environmental mitigation for noise, visual intrusion or habitat.

Interfaces with existing transport infrastructure

2.2.21 Where HS2 would cross the path of an existing highway or railway, the route alignment design would provide sufficient vertical clearance to permit construction of a new bridge.

2.2.22 The route encounters major highways, including motorways. Where HS2 crosses the highway, either above or below, there would often be a requirement to locally modify the highway to accommodate the HS2 structure. Where HS2 crosses beneath the highway, new bridge structures would be incorporated.

2.2.23 The routes would also cross existing railway infrastructure, the engineering solutions for which would be similar to those described above.

2.2.24 There are locations along the routes where significant modifications to the existing railway network would be required, such as closure and diversion of existing lines or the realignment of tracks, so that HS2 would share an existing and possibly widened corridor.

2.2.25 Where the HS2 route follows an existing transport corridor, there would often be a requirement to permanently realign the corridor so HS2 would share the existing and sometimes widened corridor.

Environmental mitigation

2.2.26 For a major project such as this, environmental mitigation would be required. This could include significant earthworks and bunding/screening, planting areas, balancing ponds, replacement facilities, habitat enhancement and noise/visual screens. We have identified initial potential opportunities for environmental mitigation as part of the iterative design process to date. These matters will be addressed as the design of the scheme is developed.

2.3 Technical requirements for stations

2.3.1 The quality of station design will shape the passenger experience of the HS2 network. The station should promote a positive experience of the network through a design that provides passengers with a smooth, convenient and pleasant passage through the station with effective management of pedestrian throughput.

2.3.2 The design of stations and their integration with the surrounding built environment should create the opportunity not only to engender positive experiences of the network, but also to act as catalysts for improvements to the surrounding cityscapes.

2.3.3 Stations fall into two groups;

- terminal stations, generally in a city centre; and
- through or intermediate stations on the line of route, of a parkway or interchange nature.

2.3.4 The assessment criteria at the highest level considered:

- site availability and fit;
- integration with line of route options and approaches to city centres;
- impact upon and integration with existing transport infrastructure;
- constructability;
- passenger dispersal;
- cost;
- demand (insofar as location will affect it); and
- a range of sustainability considerations.

Station design

2.3.5 The station design encompasses a wide range of criteria. This includes designs that enable train dwell times to match service patterns, considerations of passenger comfort and safety, capitalising on commercial opportunities and working within the confines of the budget. Provision for perturbed situations and future growth must also be considered.

2.3.6 Station design and layout will vary across the network depending on station location, operational requirements, land availability, etc, and therefore the design of each station will be unique. However, whilst recognising the constraints of individual sites, all stations on the high speed network should maintain a common feel and standard that promotes passenger familiarity, regardless of where the station is.

2.3.7 Station design will be developed to address the following factors critical to station functionality:

- accommodate network operational requirements;
- station capacity planning;
- functional zoning;

- passenger movements, wayfinding and accessibility;
- safety and security;
- interchange with other transport modes; and
- passenger environment.

Technical requirements

2.3.8 The useful length of HS2 station platforms shall be at least 415m and the project shall identify where longer platform lengths are required. The platforms shall be designed to GC gauge, the height of such platforms being 760mm above rail level.

2.3.9 Where interchange facilities with the national rail networks are provided the platforms shall be designed to UK national railway standards.

2.3.10 Platform width shall be determined to accommodate expected passengers flows with reasonable practicable allowances made for perturbation of peak flows. Design shall also comply with relevant design standards for minimum clearances to fixed infrastructure. Minimum width of platforms has been assumed to be 12m.

2.3.11 Tapering at platform ends shall be permitted where there is justifiable reason to do so. Where a taper is applied it should taper from full width to no less than a width of 8m and the radius of platform curvature shall not be less than 1000m radius. The remaining length of the platform shall be straight to facilitate splitting and joining of trains. Platform obstructions shall be kept to a minimum in the tapered section of the platform.

2.3.12 The number of platforms required at each station is determined by the operational requirements that drive the timetable, including the necessary turnaround time to meet that timetable. It is further influenced by the length of the route sections, demand requirements and loading factors.

Terminal stations

2.3.13 Manchester terminal station will make provision for four platform faces.

2.3.14 The approach alignment design attempts to maximise entry and exit speeds to permit unimpeded acceleration and braking of trains.

Through or intermediate stations

2.3.15 The intermediate station on the Manchester leg makes provision for two platform faces only. Two through tracks would be provided for non-stopping trains.

2.3.16 The through station requires a facility to slow down and stop a train without impeding the passage of a following non-stopping train, and conversely to enable that train to re-join the railway without being impeded by an overtaking train. The lengths of the acceleration and deceleration lanes, or stopping lanes, are defined by the speed and frequency of the service. Invariably, these lanes are much longer than a platform stopping lane would need to be for a slower railway or a railway with a less intense service pattern.

2.3.17 The through station therefore incorporates two through running tracks. Platform faces serve lines that run parallel to the through running lines.

2.3.18 The normal two-track route would widen to four tracks for a station with only two platform faces.

2.4 Technical requirements for depots

2.4.1 The route to Manchester includes provision for a rolling stock depot (RSD) and an infrastructure maintenance depot (IMD).

2.4.2 RSDs would be used to stable trains overnight, for cleaning and maintenance. IMDs would be used as a base from which to carry out engineering activities to inspect, maintain and renew the infrastructure.

2.4.3 The depots would be required to operate for 24 hours, seven days a week.

2.4.4 The depots would provide immediate access to the trunk road network to facilitate access by large goods vehicles. Good transport links will enable a suitable and relatively local workforce; as such, the potential for access by public transport would be considered.

Requirements for rolling stock depot

2.4.5 The RSD would be configured for stabling and light maintenance, with heavier maintenance activities carried out at the Washwood Heath depot proposed for Phase One of the HS2 network.

2.4.6 The RSD would be positioned with access to the HS2 route, ideally within ten minutes of the terminus station. Access to the existing rail network to facilitate delivery of rolling stock and other materials by rail is desirable, but not essential.

2.4.7 The RSD would be configured to be able to deal routinely with 30 train sets and provide stabling for up to 40 sets in exceptional circumstances. This requirement approximates to a footprint one kilometre in length and 250m wide: an area of 25 hectares. Each train set is up to 200m long. Each depot would handle a mixture of full GC gauge sets and classic compatible sets.

2.4.8 The depot would provide a large covered maintenance building and a range of facilities to enable rolling stock inspection, repair, cleaning, light maintenance, re-watering and replenishing of consumables.

2.4.9 The maintenance patterns and flow through the depot will be defined to ensure sufficient capacity remains to move trains around the depot and prevent 'gridlock'.

Requirements for infrastructure maintenance depot

2.4.10 The IMD would be configured to support all infrastructure maintenance activities within the route.

2.4.11 The IMD would provide a maintenance, servicing and stabling facility both for HS2 on-track plant (including vehicles up to GC gauge, which would be too large to travel on the national rail network) and for HS2 maintenance rescue and recovery locomotives. It would be capable of acting as an incident control centre in the event of a serious accident or incident on the HS2 route.

2.4.12 The IMD would ideally be placed close to the mid-point of the respective leg, with direct access to the HS2 route. Access to the existing rail network to facilitate delivery of rolling stock and other materials by rail would be essential.

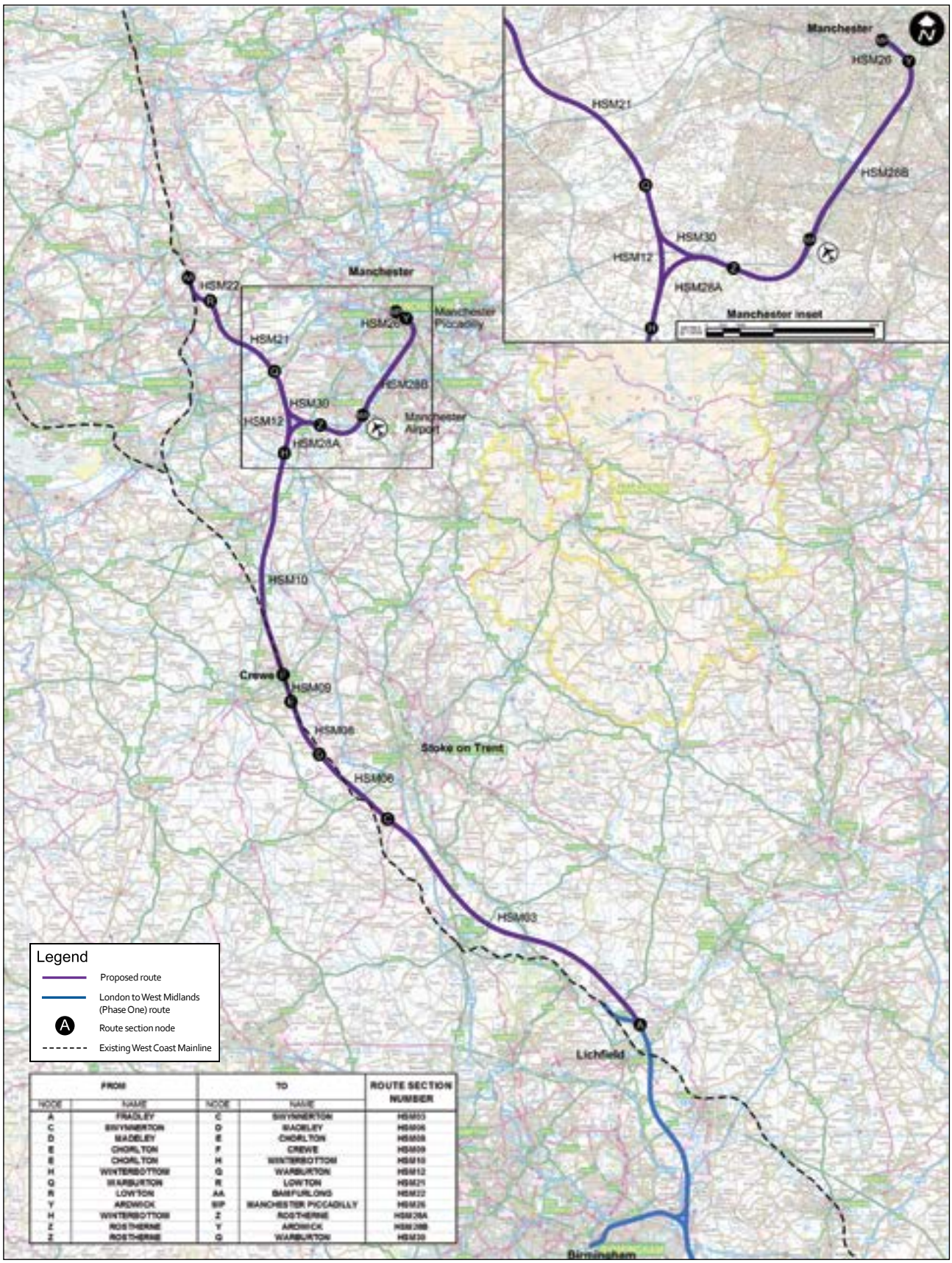
2.4.13 The IMD site would have the potential to be used as a construction depot for the works, thus avoiding additional land take.

2.4.14 The depot would be designed to serve both the HS2 route and the existing railway in both directions where possible. This would allow engineering trains to access and egress the depot with maximum flexibility. A switch and crossing (S&C) assembly area would be provided to enable the pre-assembly of the S&C units to be installed. Areas for storage would be provided with facilities to enable forklift trucks and overhead cranes to handle materials and plant safely. The depot would also store standard components and consumables.

2.4.15 The IMD would stable and service/maintain a variety of on-track plant and engineering supply train equipment. It would also provide strategic engineering material stores. HS2 ballast and spoil wagons would need to be able to run on and off the existing rail network, bringing supplies.

2.4.16 It is assumed that engineering trains would only operate on HS2 after the last passenger trains have ceased to run, and would return to the IMD before morning train operations commence.

2.4.17 Provision would be made for ancillary buildings and facilities such as offices, car parking, incident control rooms, workshops and storage.



FROM		TO		ROUTE SECTION NUMBER
NODE	NAME	NODE	NAME	
A	FRADLEY	C	SWYNNERTON	HSM03
C	SWYNNERTON	D	MADELEY	HSM06
D	MADELEY	E	CHORLTON	HSM08
E	CHORLTON	F	CREWE	HSM09
E	CHORLTON	H	WINTERBOTTOM	HSM10
H	WINTERBOTTOM	G	WARBURTON	HSM12
G	WARBURTON	R	LOWTON	HSM21
R	LOWTON	AA	BARFURLONG	HSM22
Y	ARDWICK	SP	MANCHESTER PICCADILLY	HSM26
H	WINTERBOTTOM	Z	ROSTHERNE	HSM28A
Z	ROSTHERNE	Y	ARDWICK	HSM28B
Z	ROSTHERNE	G	WARBURTON	HSM30

3 Line of route

3.1 Route sections

3.1.1 This chapter describes a series of individual route sections, which combined form a continuous route from Fradley to Manchester and the WCML near Bamfurlong. The text also makes reference to station locations in the Manchester area.

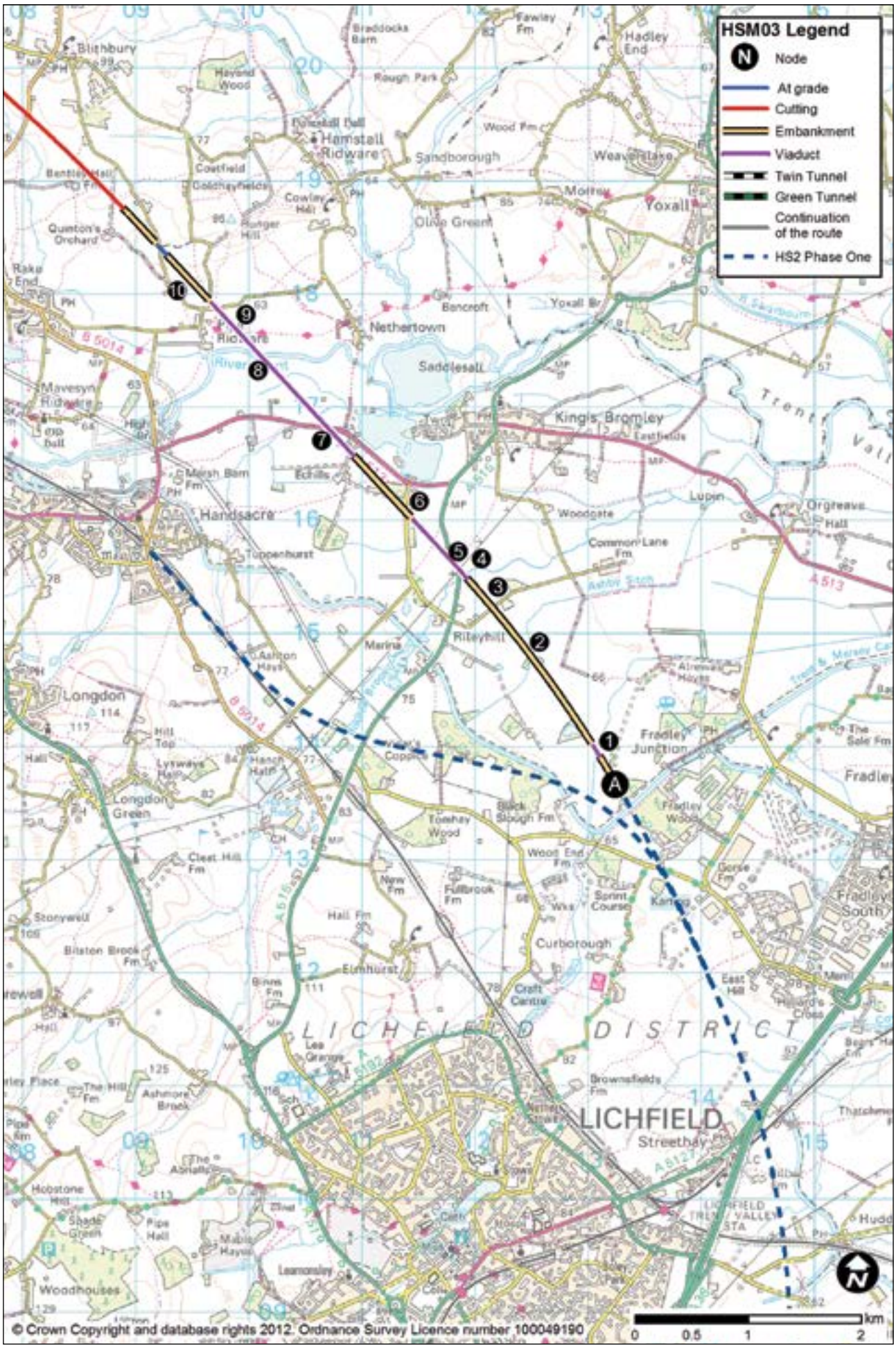
3.1.2 The main line of Phase One of HS2, the London-West Midlands section, would run to the west of Coleshill in Warwickshire on its way to the WCML connection at Streethay, north of Lichfield. A junction would be provided at Fradley to include the route described in this report.

3.1.3 The key plan on the previous page presents the individual route sections and provides the reader with the guide to the layout of the rest of the sections of this report. Each route section was given a reference number, such as 'HSM03', covering a discrete geographical length. The report describes these sections. The total length may need to be sub-divided in order to allow a piece of text to be read against a map on the corresponding page; typically, each map presents about 10-12km of route.

3.1.4 The plan also shows that the route sections run between 'nodes', such that the reader can identify the location they are interested in as, for instance, being 'between node A and node C'. These node letters appear in the title of each section. A node defines the beginning (and/or the end) of each of the route sections in which the line of route is divided. Each section of line of route running from one node to another is uniquely identified with a reference number. The locations of these nodes have been chosen in order to easily appraise the line of route.

3.1.5 The plans show numbered features of interest presented, for example, as (4), to allow the reader to study the route alongside a corresponding piece of text. The route sections are:

- HSM03: Fradley (A) to Swynnerton (C);
- HSM06: Swynnerton (C) to Madeley (D);
- HSM08: Madeley (D) to Chorlton (E);
- HSM09: Chorlton (E) to Crewe (WCML connection) (F);
- HSM10: Chorlton (E) to Winterbottom (H);
- HSM12: Winterbottom (H) to Warburton (Q);
- HSM21: Warburton (Q) to Lowton (R);
- HSM22: Lowton (R) to Bamfurlong (AA);
- HSM28A: Winterbottom (H) to Rostherne (Z);
- HSM28B: Rostherne (Z) to Ardwick (Y);
- HSM26: Ardwick (Y) to Manchester Piccadilly (MP); and
- HSM30: Rostherne (Z) to Warburton (Q).


HSM03 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
LICHFIELD DISTRICT
LICHFIELD
Nethertown
Handsacre
Kings Bromley
Fradley Junction
Longdon
Longdon Green
Curborough
Streethay
Saddlesall
Riley Hill
Yoxall
Hamstall Ridware
Blithbury
Woodhouses
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0
0.5
1
2
km

3.2 HSM03: Fradley (A) to Swynnerton (C)

Fradley to Handsacre

3.2.1 The route section between Fradley and Swynnerton would be 38km long with a design speed of 400kph.

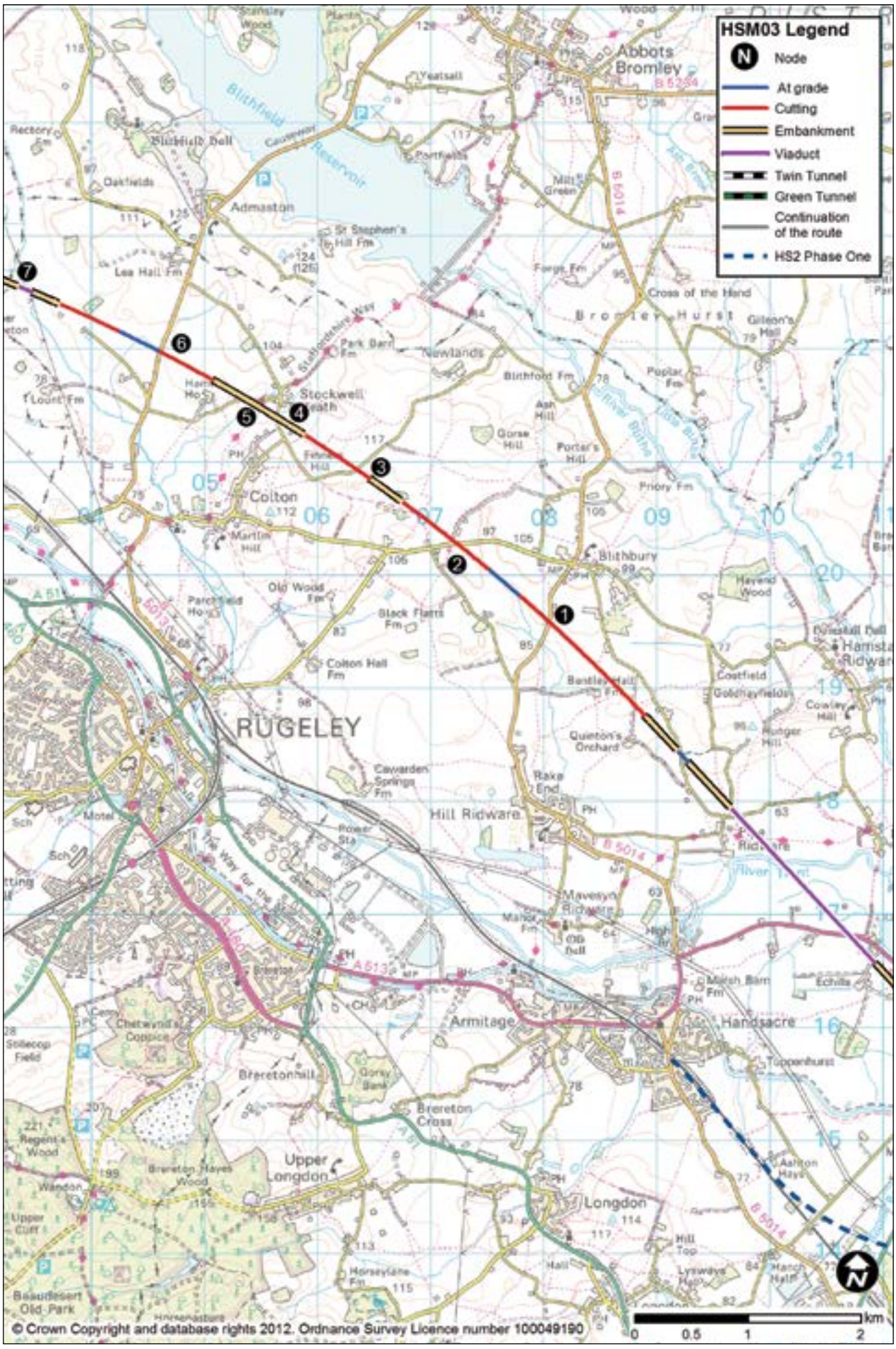
3.2.2 The route to Manchester would commence at the intersection point with the London-West Midlands route just north of Fradley Wood.

3.2.3 At this location the line would be on embankment of 6m height and shortly after it would cross Curborough Brook (1). The crossing of the Curborough Brook floodplain would be on a 130m long viaduct at a height of 11m.

3.2.4 The route would then run on an embankment with an average height of 6m and pass over Ashby Stitch watercourse (2). Common Lane (3) would be realigned. The route would then cross Bourne Brook floodplain (4) on a 730m long viaduct with an average height of 8m. The viaduct would pass through the route of overhead power lines and over the A515 (5).

3.2.5 West of Bourne Brook the route would continue on a 9m-high embankment crossing over Shaw Lane (6). The route would pass through Tomlinson's Spinney and Little Spinney.

3.2.6 The route would cross the A513 (7), River Trent floodplain (8) and a lane (9) on a 1.9km long viaduct with a maximum height of 9m (average height 8m). Pipewood Lane (10), immediately north of Pipe Ridware, would be realigned to avoid crossing it.


HSM03 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
RUGELEY
Colton
Stockwell End
Admaston
Abbots Bromley
Blithbury
Hill Ridware
Armitage
Handsacre
Longdon
Upper Longdon
Brereton Cross
Cross of the Hand
Brownhurst
Blithfield Reservoir
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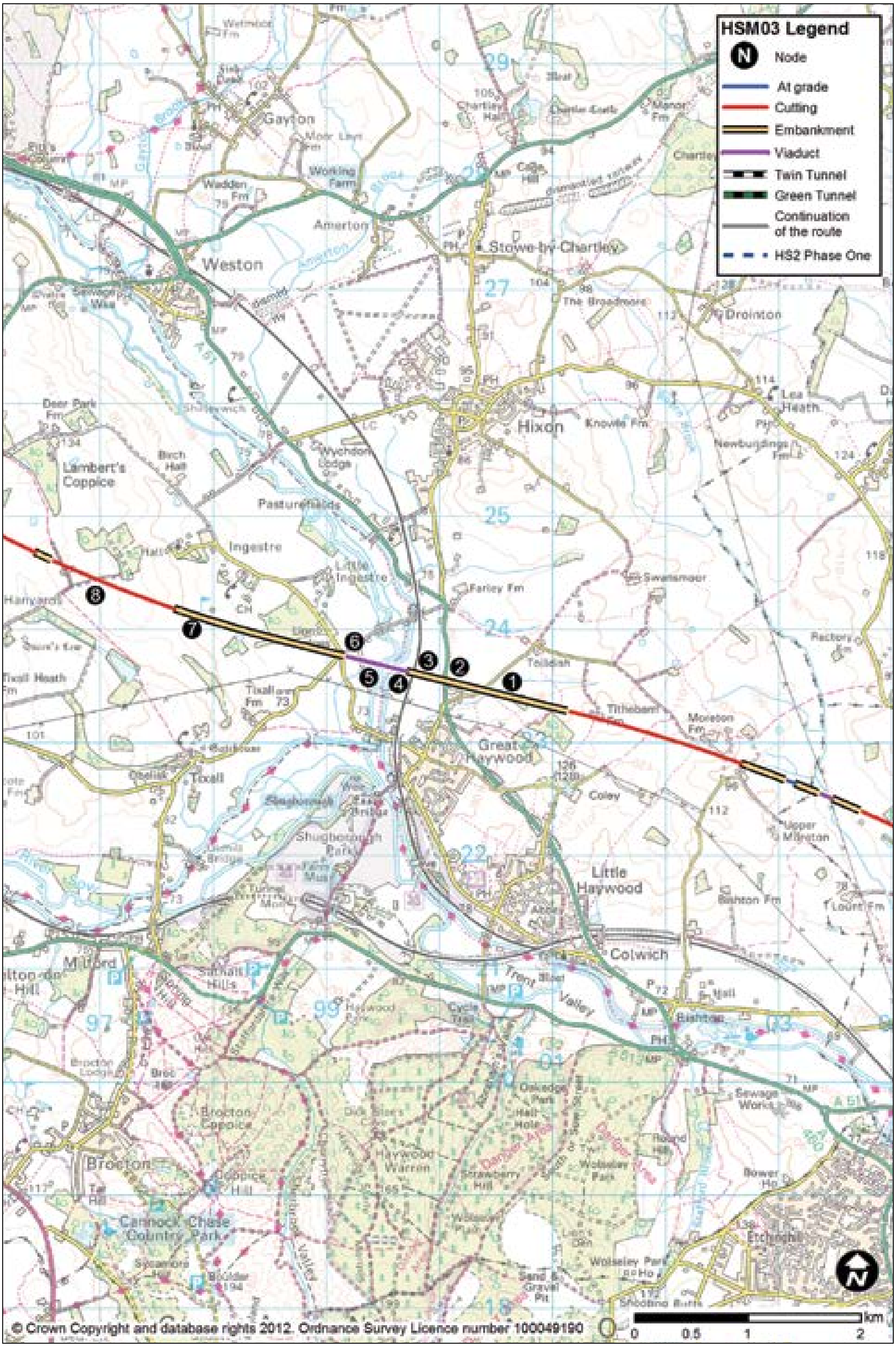
0
0.5
1
2
km

Handsacre to Upper Moreton

3.2.7 The route would then follow the topography for 3.0km with a series of embankments up to 6m high and cuttings up to 9m deep. The B5014 (1) would be realigned onto a bridge over the route. Blithbury Road (2) would be realigned onto a bridge over the route as well as Hadley Gate being realigned to avoid crossing HS2.

3.2.8 The route would then cross a small valley on an embankment with a maximum height of 12m. Newlands Lane (3) would be realigned onto a bridge over the route. The route would pass between Colton and Stockwell Heath on an embankment with a maximum height of 12m. The route would pass over Newlands Lane (4) and Moor Lane (5).

3.2.9 The route would then descend towards Moreton Brook initially in a cutting up to 10m deep passing under the B5013 (6). The route would then be at grade for 600m passing into a cutting up to 4m deep followed by an embankment up to 6m high. The route would pass through overhead power lines and cross the Moreton Brook (7) floodplain on a 140m long viaduct at a height of 7m.


HSM03 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
Gayton
Weston
Amerton
Stowe-by-Chartley
Drointon
Hixon
Lambert's Coppice
Ingestre
Pasturefields
Little Ingestre
Farley Fm
Swansmoor
Tithebarn
Moreton Fm
Great Haywood
Tixall
Coley
Upper Moreton
Little Haywood
Colwich
Bishton
Milford
Brocton
Brocton Coppice
Haywood Warren
Cannock Chase Country Park
Wolseley Park
Trent Valley
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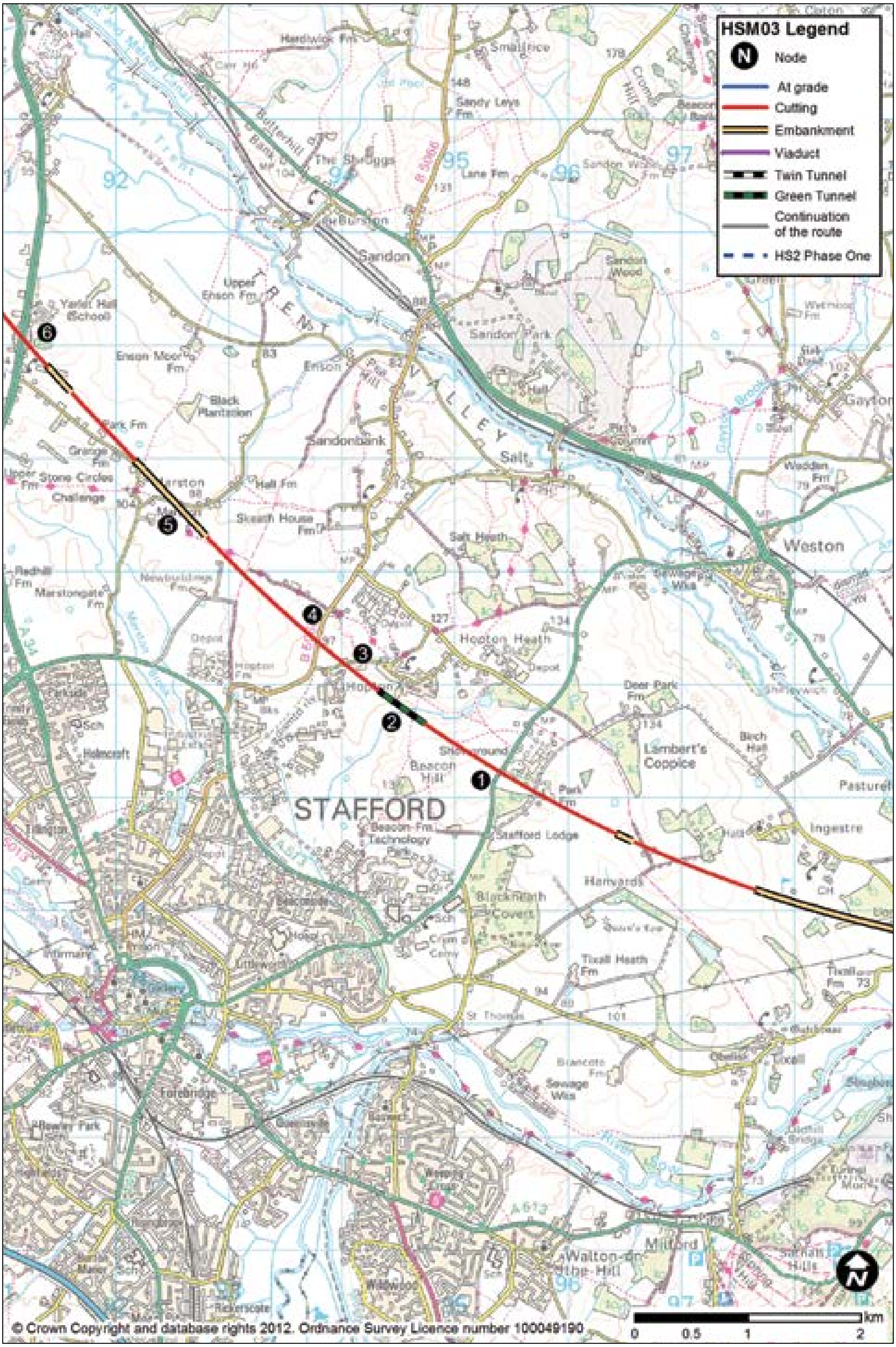
0
0.5
1
2
km

Upper Moreton to Hanyards

3.2.10 The route would pass into cutting with a maximum depth of 19m and then be on an embankment up to 12m high passing over Tolldish Lane (1), the A51 (2) and the railway line to Stoke-on-Trent (3). The route would cross the Trent and Mersey Canal (4) and the River Trent (5) floodplain on a 570m long viaduct with a maximum height of 11m (average height 9m). At the crossroads (6), Hoomill Lane and Trent Walk would be realigned to avoid the route and Mill Lane would be diverted to pass under the viaduct. The route would continue on an embankment (up to 13m high) over Ingestre golf course (7) then pass into a cutting up to 12m deep and under Hanyards Lane (8).


HSM03 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
STAFFORD
Sandon
Salt
Weston
Hopton Heath
Stafford Lodge
Lambert's Coppice
Ingestre
Tixall
Milford
Walton-on-the-Hill
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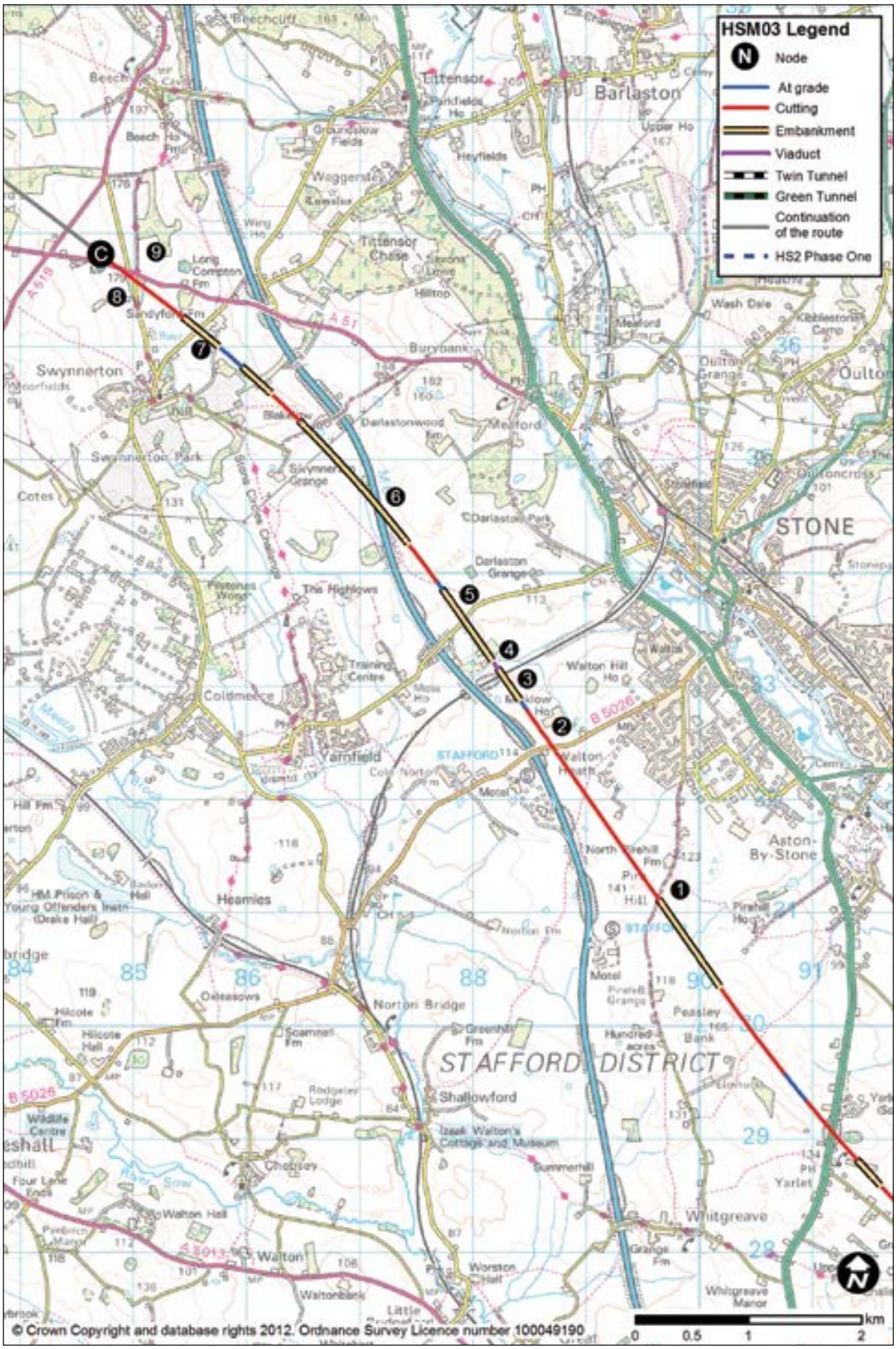
0
0.5
1
2
km

Hanyards to A34

3.2.11 Following a short section of embankment (up to 3m high) the route would pass into a cutting for the next 2.3km with a maximum depth of 17m. The route would pass under the A518 (1) immediately south of the Staffordshire County Showground.

3.2.12 The route would emerge from the cutting immediately south of Hopton. To mitigate the impact on the village a green tunnel (2) 510m long would be provided. The route would then pass back into cutting (up to 20m deep) for the next 2.2km. Hopton Lane (3) would be realigned to Sandon Road (B5066) to avoid the route. The route would pass under Sandon Road (4).

3.2.13 The route would then follow the ground profile for the next 2.0km on a series of embankments (up to 8m high) and in cuttings up to 4m deep. The route would pass over Marston Lane (5), an area of mudstone with soluble deposits (risk of subsidence from dissolution) and then under the A34 (6) in a cutting 16m deep.


HSM03 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
STONE
STAFFORD DISTRICT
Barlaston
Swynnerton
Yarnfield
Heamies
Norton Bridge
Shallowford
Whitgreave
Aston-By-Stone
Walton
Tittensor Chase
Darlaston Park
Walton Hall
Izaak Walton's Cottage and Museum
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
km
0
0.5
1
2

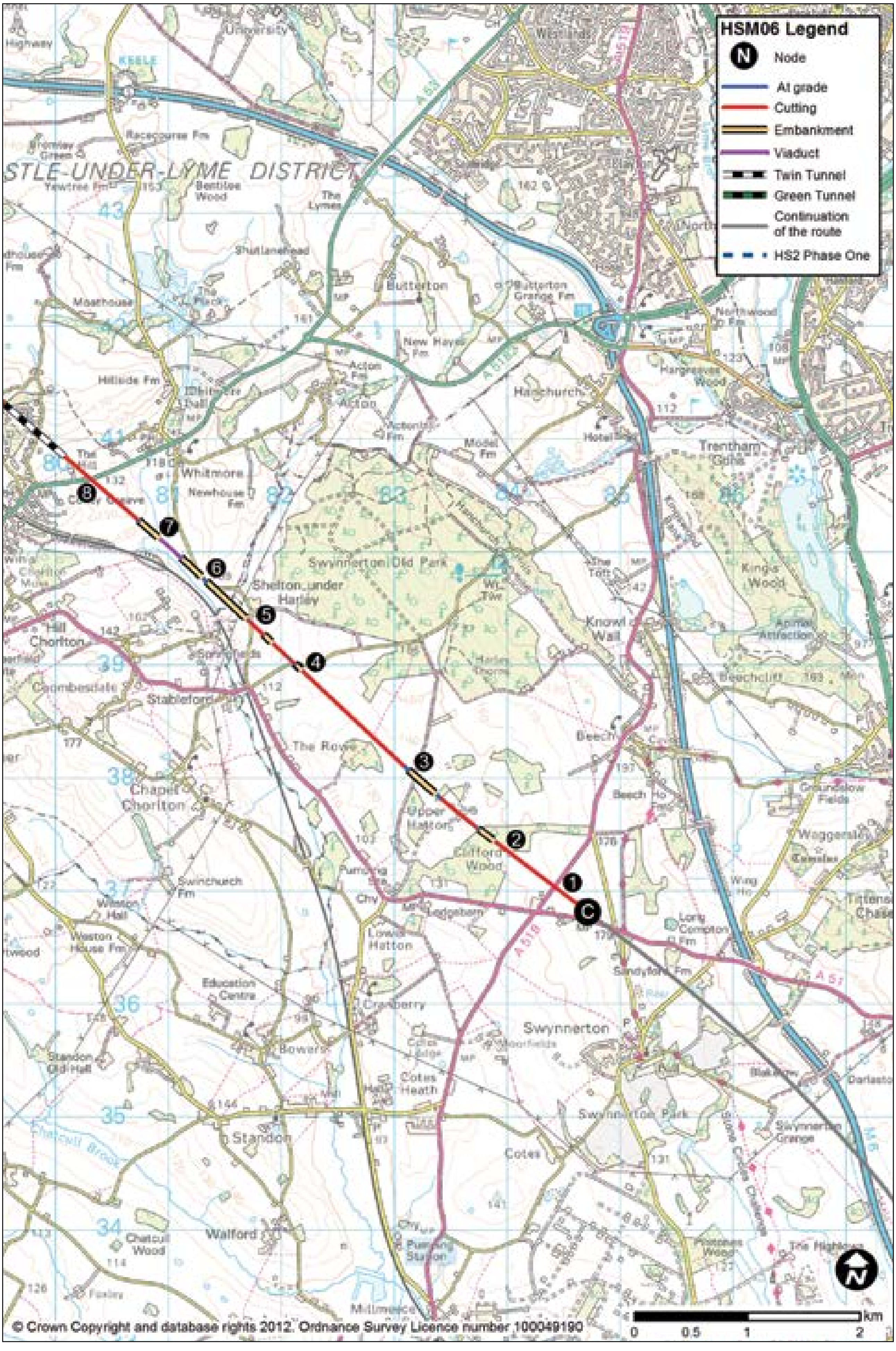
A34 to Swynnerton

3.2.14 Emerging from a cutting the route would be at grade for 500m before passing into a cutting up to 16m deep. The route would move onto an embankment (maximum height 16m) and pass over Pirehill Lane (1) which would be realigned. The route would then follow the slope down towards Filly Brook in a cutting (up to 14m deep). Eccleshall Road (B5026) (2) would be realigned onto a bridge over the route.

3.2.15 For the next 2.6km the route would run within 500m of the M6. The route would be on embankment (up to 12m high), crossing over the Norton Bridge to Stone railway (3) and then the Filly Brook (4) floodplain on a 75m long viaduct at a height of 11m. Yarnfield Lane (5) would be realigned under the route.

3.2.16 After running in a section of cutting up to 3m deep, the route would rise onto embankment crossing the M6 (6) and through the route of overhead power lines. An embankment (up to 14m high) would follow with the route passing over Tittensor Road between the A51 and Swynnerton (7) and then running into a deep cutting (maximum depth 20m). The route would pass under Bottom Lane (8) and the A51 (9).

3.2.17 At Swynnerton the route would continue along section HSM06 to Madeley.


HSM06 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0
0.5
1
2
km
STLE-UNDER-LYME DISTRICT
Keele
University
Westlands
Butterton
Acton
Hanchurch
Trentham Gdns
Whitmore
Swynnerton Old Park
Shelton under Harley
Hill Chorlton
Stableford
Knowl Wall
Beechcliff
King's Wood
Beech
The Rowe
Upper Hatton
Clifford Wood
Chapel Chorlton
Lower Hatton
Swynnerton
Swynnerton Park
Cranberry
Bowers
Cotes Heath
Standon
Cotes
Walford
Chatcull Wood
Millmeece
Waggersley
Long Compton Fm
Sandyford Fm

3.3 HSM06: Swynnerton (C) to Madeley (D)

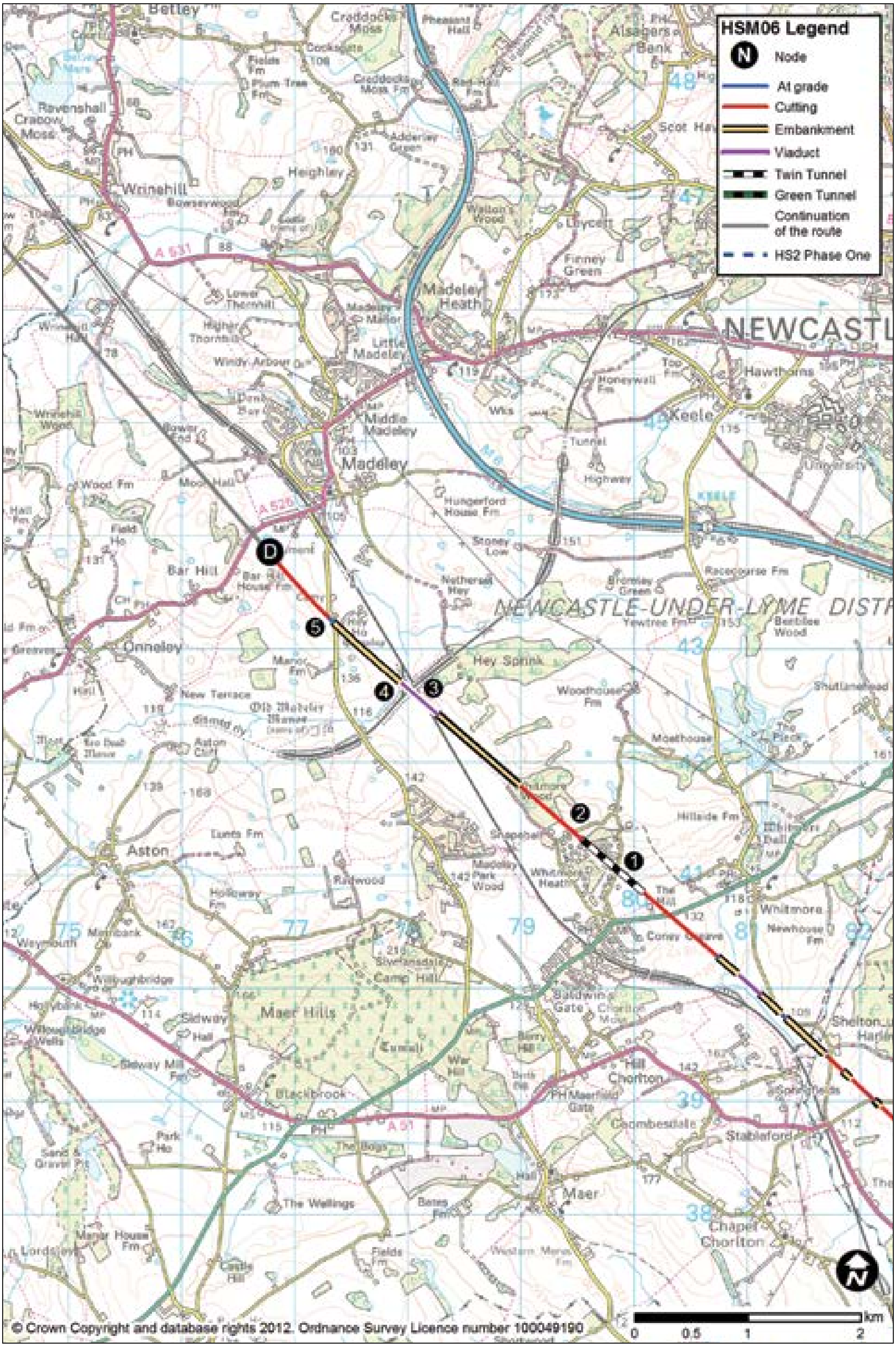
Swynnerton to Whitmore

3.3.1 The route section between Swynnerton and Madeley would be 10.6km long. The design speed would be 400kph.

3.3.2 From Swynnerton, the route would descend and follow the ground profile for the next 4.0km, firstly passing under the A519 (1) in a cutting with a maximum depth of 18m. The route would then be on a short section of embankment 6m high through Clifford's Wood (2) followed by a cutting with a maximum depth of 3m. A short section on embankment (maximum height 7m) crossing over Common Lane (3) would lead to a section of cutting with a maximum depth of 9m.

3.3.3 The route would then descend towards the Meece Brook, passing onto two short sections of embankment with a maximum height of 6m and two short sections of cutting (up to 4m deep). The route would then be on an embankment with a maximum height of 8m and would pass through the route of overhead power lines. Dog Lane (4) would be realigned along the eastern side of the route to Bent Lane (5). The route would cross Bent Lane (6) which would be realigned.

3.3.4 The route would cross the Meece Brook floodplain on a viaduct (7) 270m long with a maximum height of 12m. After a short length of embankment (maximum height 11m), the route would pass into a cutting and under the A53 (8).

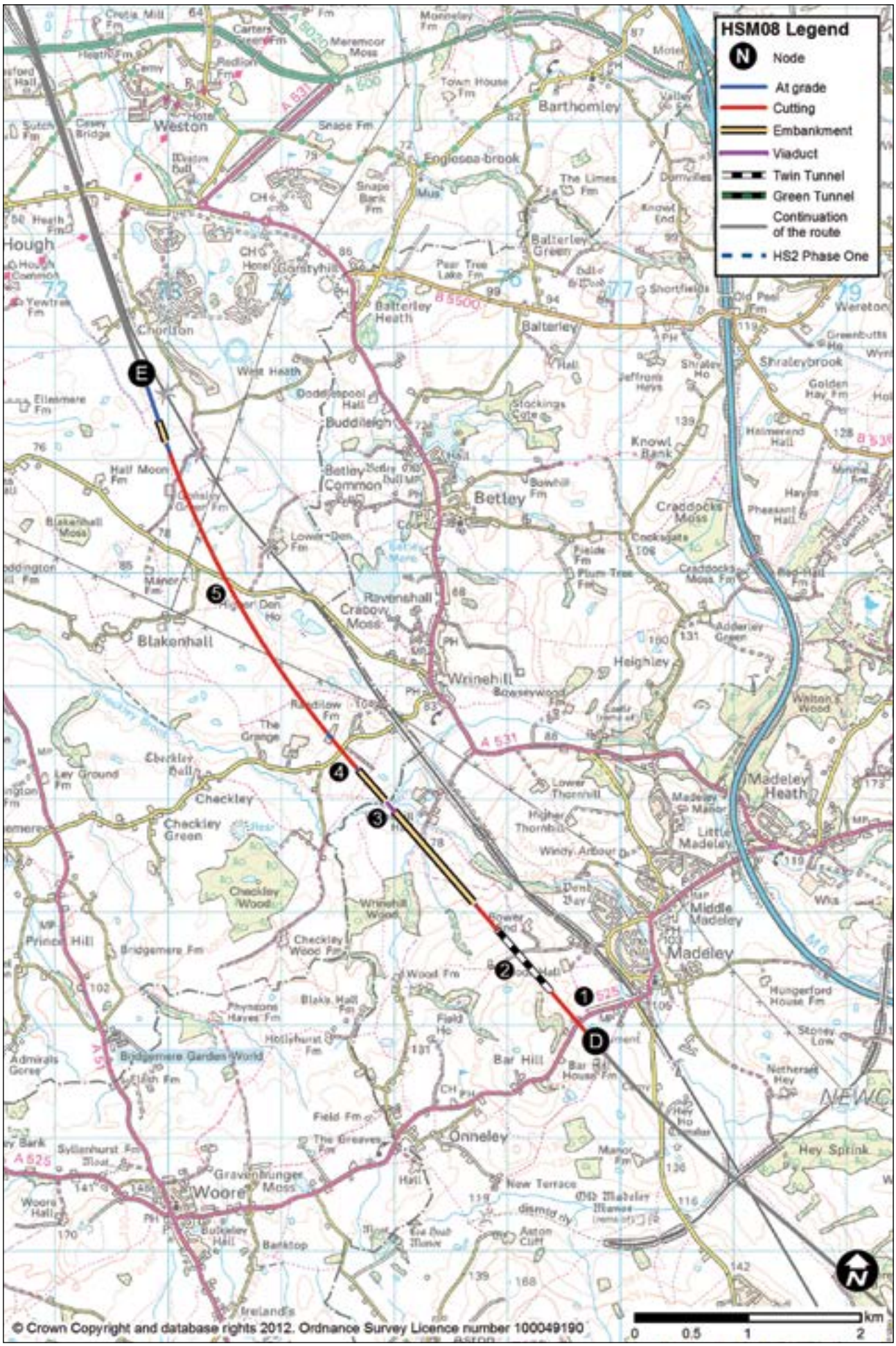

HSM06 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0
0.5
1
2
km

Whitmore to Madeley

3.3.5 The route would be in cutting leading to the southern portal of a 710m long twin tunnel (1) under Whitmore Heath. North of the tunnel, the route would be in cutting up to 13m deep, passing under Snape Hall Road (2) before following the hillside down towards Madeley on an embankment up to 11m high. The route would cross over the WCML (3), the disused Silverdale to Madeley railway (4) and the River Lea floodplain on a viaduct 440m long with a maximum height of 11m.

3.3.6 The route would continue on an embankment (maximum height 10m) crossing under Manor Road (5) which would be realigned. To the south-west of Madeley the route would pass into a cutting with a maximum depth of 9m, passing under Red Lane.

3.3.7 At Madeley the route would continue along section HSM08 to Chorlton.


HSM08 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
E
5
4
3
2
1
D
Weston
Barthomley
Hough
Chorlton
Balterley Heath
Balterley
Buddileigh
Betley
Blakenhall
Ravenshall
Wrinehill
Checkley
Checkley Green
Madeley Heath
Middle Madeley
Madeley
Bar Hill
Onneley
Woore
Shraleybrook
Knowl Bank
Craddocks Moss
Heighley
Hey Sprink
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0
0.5
1
2
km

3.4 HSM08: Madeley (D) to Chorlton (E)

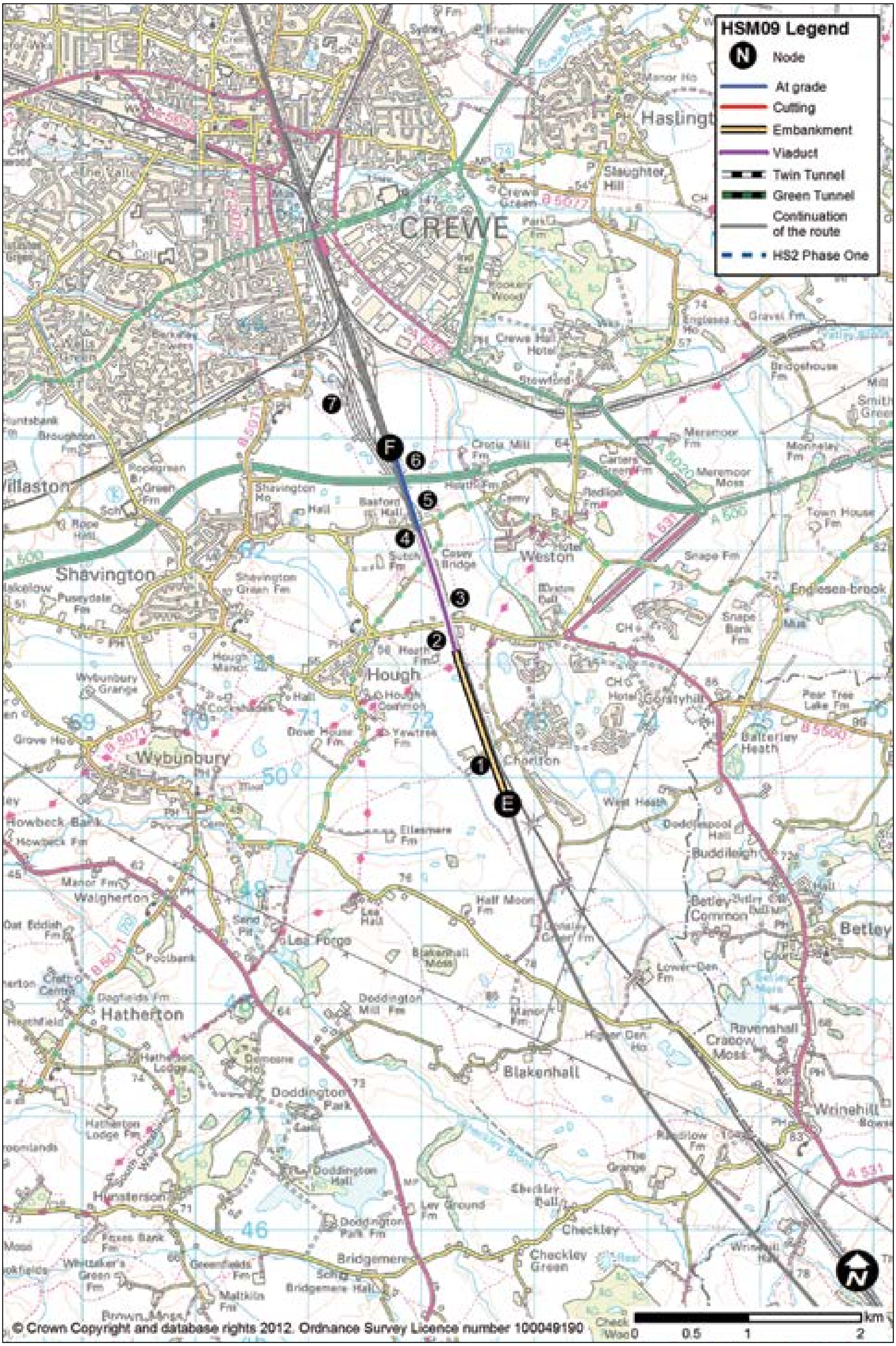
3.4.1 The route between Madeley and Chorlton would be 7.2km long. The design speed would be 400kph.

3.4.2 The route would run to the west of the WCML for the next 10km to Crewe. To achieve the required speed of 400kph the route would not be parallel to the existing railway until a point 5.0km south of Crewe.

3.4.3 The route would pass under Bar Hill (A525) (1) in a cutting (maximum depth 19m) leading to the southern portal of a 720m long twin tunnel (2). On leaving the cutting north of the tunnel the route would be on an embankment (maximum height 14m) and would cross Checkley Brook (3) on a viaduct 120m long and 14m high.

3.4.4 For the next 3.3km the route would be in a cutting with a maximum depth of 13m and would pass under Checkley Lane (4) and Den Lane (5). The route would pass through two routes of overhead power lines. This section of the route would be over an area of mudstone with soluble deposits (risk of subsidence from dissolution). The route then passes onto a short section of embankment (maximum height 3m) and continues at grade.

3.4.5 At Chorlton the route would continue along section HSM09 to connect to the WCML south of Crewe station (section 3.5) and HSM10 to Winterbottom (section 3.6).


HSM09 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
CREWE
Shavington
Hough
Wybunbury
Weston
Chorlton
Hatherton
Blakenhall
Doddington Park
Checkley
Betley
Bridgemere
Wrinehill
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0 0.5 1 2 km

3.5 HSM09: Chorlton (E) to Crewe (WCML connection) (F)

3.5.1 This route section between Chorlton and Crewe WCML connection would be 3.4km long.

3.5.2 This section would provide a connecting spur between the HS2 route and the WCML south of Crewe station. The design speed of the junction on the HS2 route is 230kph and on the WCML is 200kph. Both junctions are grade separated.

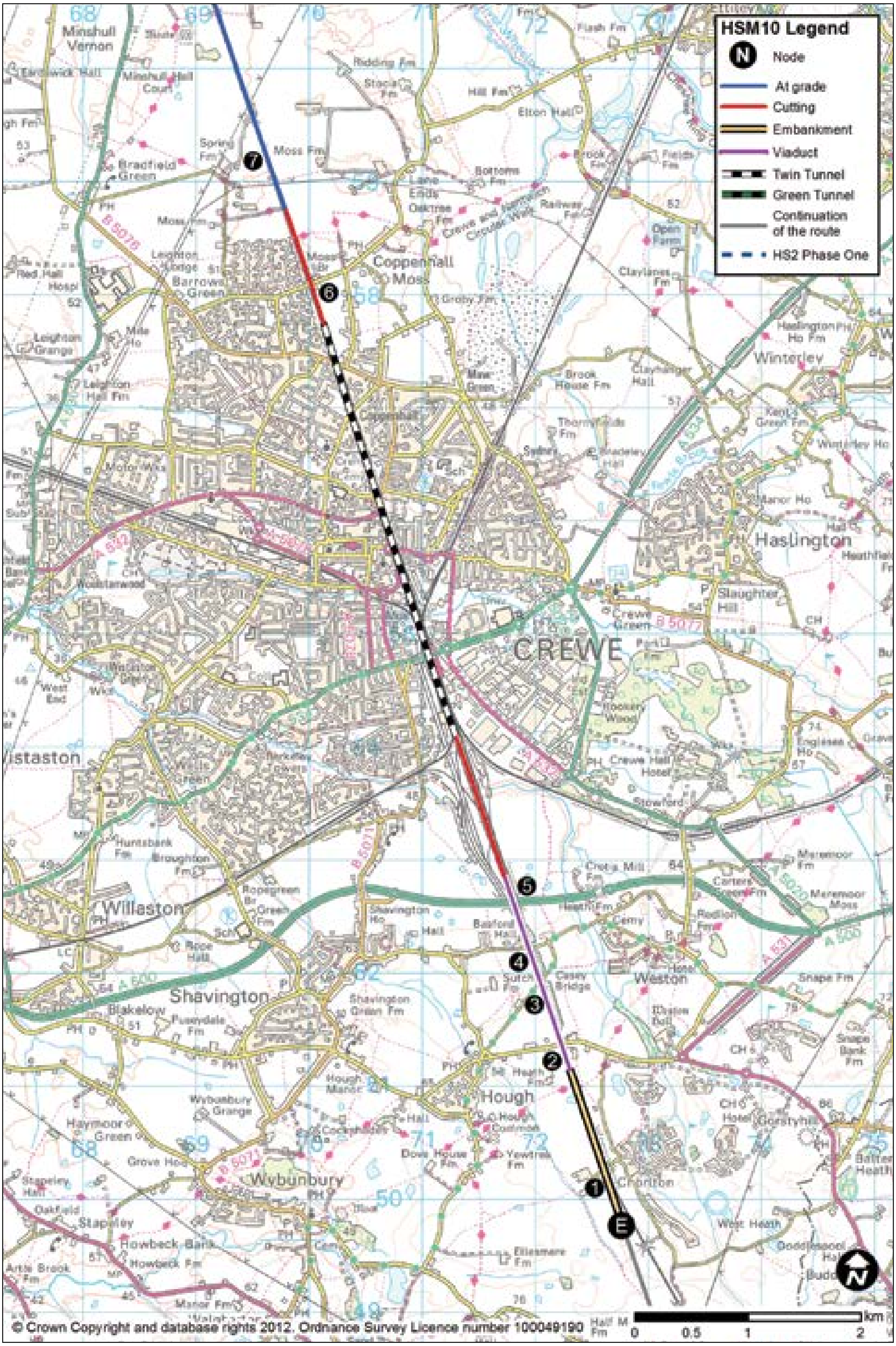
3.5.3 The HS2 route would run on the west side of the WCML between Chorlton and Crewe.

3.5.4 The route would be on an embankment (with a maximum height of 10m) for 1.2km and would pass over Chorlton Lane (1). The route would then rise onto a viaduct to pass over the connection to Basford Hall sidings. The spur would be on a 1.1km long viaduct (at a maximum height of 15m) to cross the HS2 main route viaduct (3). The spur would then descend to join the WCML.

3.5.5 At Hough the route would cross Newcastle Road (2), Casey Lane (4), Weston Lane (5) and the A500 (6). The roads would be realigned to prevent severance of these routes.

3.5.6 Alterations to the existing rail layout of the WCML would be required, including moving the junction for Basford Hall sidings to the south. Extensive temporary works would be required during construction to maintain the existing lines.

3.5.7 A potential infrastructure maintenance depot site (7) has been identified alongside Basford Hall sidings, and is described in Section 5.2. A separate spur and headshunt would connect the HS2 mainline to this depot.


HSM10 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
CREWE
Haslington
Winterley
Willaston
Shavington
Wistaston
Wybunbury
Hough
Weston
Coppenhall Moss
Minshull Vernon
Slaughter Hill
Crewe Green
Chorlton
Stapeley
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0
0.5
1
2
km

3.6 HSM10: Chorlton (E) to Winterbottom (H)

Chorlton to Barrows Green

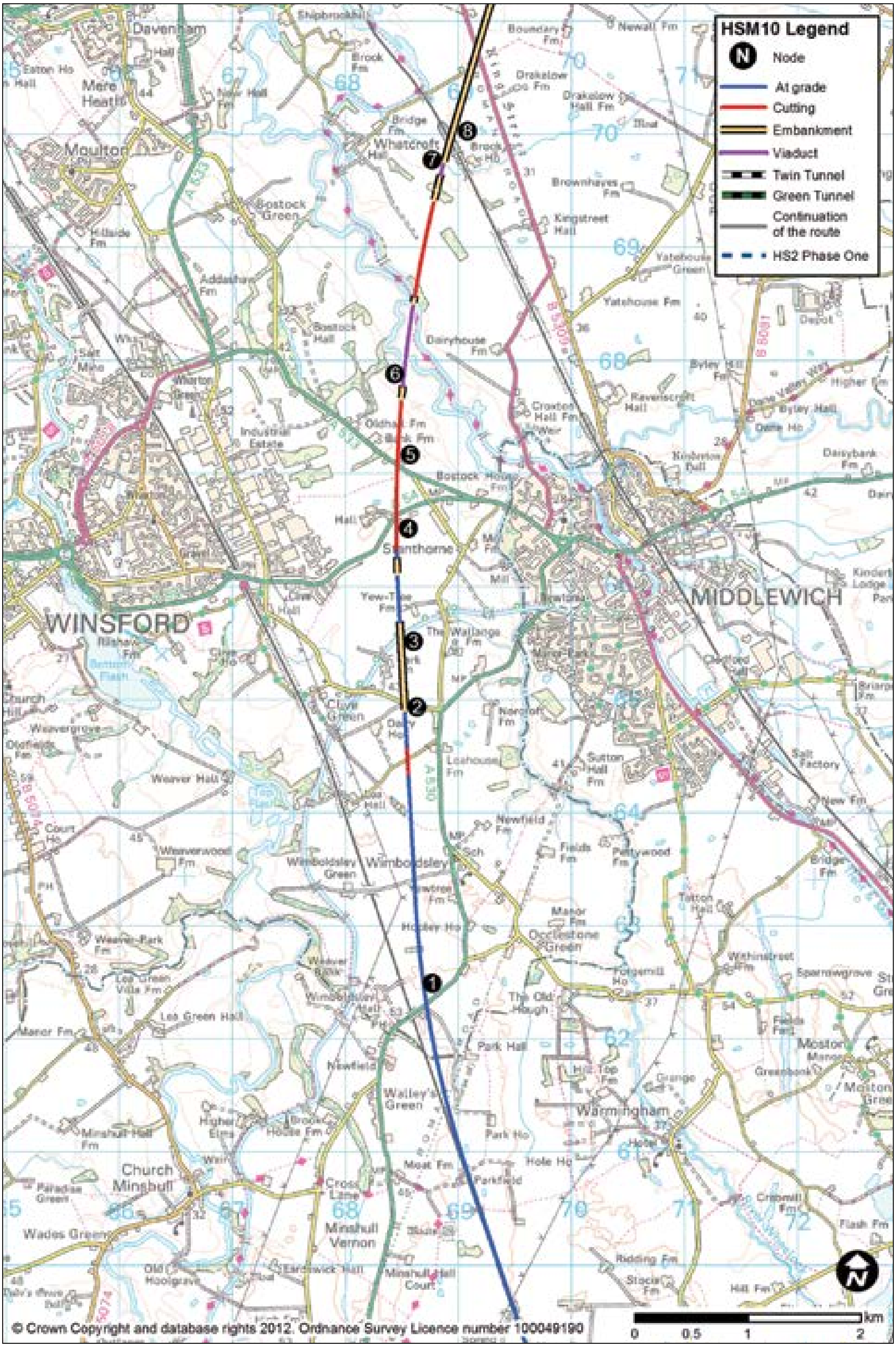
3.6.1 The route section between Chorlton and Winterbottom would be 31.9km long. The section of route connecting to Chorlton from the south would be HSM08 from Madeley (section 3.4). The design speed would be 400kph.

3.6.2 The HS2 route would run on the west side of the WCML between Chorlton and Crewe. During construction, stabilisation of and support to the WCML would be required.

3.6.3 The route would commence this section on embankment passing over Chorlton Lane (1). The route would then be on a 17.2km long viaduct of up to 8m height, where it would cross Newcastle Road (2), Casey Lane (3) and Weston Lane (4) where road realignments would be implemented to resolve the severance of these roads. The A500 (5) would also be realigned to prevent severance of this route.

3.6.4 North of the A500 the route would descend into a retained cutting to a tunnel portal. The twin tunnel under Crewe would be 3.82km long. A ventilation shaft would be positioned according to HS2 Ltd's *Options for Phase Two of the high speed rail network: Approach to design*, approximately at mid-point.

3.6.5 The northern tunnel portal would be 400m south of Parkers Road bridge (6). The route would rise from the portal in a retained cutting. Parkers Road would cross over the route and the WCML on a bridge. The route would reach ground level to the east of Spring Farm (7) and run within 50m of the WCML.


HSM10 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
WINSFORD
MIDDLEWICH
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0
0.5
1
2
km

Barrows Green to Whatcroft

3.6.6 The route would run within 50m of the WCML for 2.0km before bearing slightly east. The route would be within 1m of ground level for 6.0km, with some sections of shallow cuttings and embankments. It would then pass through the route of overhead power lines. The remaining 21.5km of this route section would be over an area of mudstone with soluble deposits with active and historic salt mines (risk of subsidence).

3.6.7 The A530 (Nantwich Road) (1) would be realigned onto a bridge over the route and the WCML. Clive Green Lane (2) would also be realigned onto a bridge over the route.

3.6.8 The route would then rise on embankment to cross over the Shropshire Union Canal (3) at a height of 6m before descending into a 1.3km long cutting up to 11m deep. The A54 (4) would be realigned. The A533 (5) would cross over the route. The route would then pass onto a 745m long viaduct (6) to cross the River Dane floodplain and the Trent and Mersey Canal at a maximum height of 10m.

3.6.9 The route would then run in a shallow cutting (up to 5m deep) for 900m through an active landfill site before crossing the Puddinglake Brook floodplain (7) on a 120m long viaduct at a height of 9m. A section of embankment (up to 9m high) follows with the route crossing over the Sandbach to Northwich railway (8).


HSM10 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
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0
0.5
1
2
km
Pickmere
Higher Wincham
Lostock Gralam
Plumley
Lower Peover
Rudheath
Great Budworth
Higher Marston
Wincham
Lach Dennis
Tabley Hill
Knutsford
Tabley Hall

Whatcroft to Winterbottom

3.6.10 For the next 3.0km the route would be on embankment at a maximum height of 7m. Whatcroft Lane (1) would be realigned to avoid the route. The route would pass over the A530 (2) and cross the Gad Brook floodplain (3) on a 150m long viaduct at a height of 6m. Crowder's Lane (4) would be realigned under the route. It would pass through the route of overhead power lines. The B5082 (5) would be realigned onto a bridge over the route.

3.6.11 Birches Lane (6) would be realigned onto a bridge over the route. The route would cross the Wade Brook floodplain (7) on a 185m long viaduct with a maximum height of 14m. It would continue on embankment (maximum height of 12m) for a further 3.5km crossing over the Altrincham to Chester railway (8), the A556 (9) and the A559 (10). Peover Eye floodplain (11) would be crossed on a 185m long viaduct at a height of 18m. The route would cross over Linnards Lane (12) (which would be realigned), followed by two crossings of Smoker Brook floodplain on viaducts 65m and 440m long at heights of 10m and 3m respectively.

3.6.12 Where the route passes into a shallow cutting (up to 4m deep), the B5391 (Pickmere Lane) (13) would be realigned onto a bridge over the alignment. School Lane (14) would be realigned to avoid the route.

3.6.13 The route would rise onto a low embankment (maximum height 5m), crossing the Arley Brook floodplain on a 70m long viaduct at a height of 5m. Budworth Road (15) would be realigned onto a bridge over the route. The embankment height would increase to 8m to allow the route to pass over the M6 (16).

3.6.14 At Winterbottom the route would continue along section HSM12 to Warburton (section 3.7) or HSM28A to Rostherne (and then to Manchester Piccadilly; section 3.10).


HSM12 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
Q
H
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0
0.5
1
2
km
LYMM
High Legh
Bucklow Hill
Rostherne
Tatton Park
Dunham Park
Broomedge
Warburton
Heatley
Mere
Little Bollington
Dunham Woodhouses
Agden Brow
Hulseheath
Hoo Green

3.7 HSM12: Winterbottom (H) to Warburton (Q)

3.7.1 The route section between Winterbottom and Warburton would be 8.5km long.

3.7.2 The design speed for the section between Winterbottom and Warburton is 400kph, reducing to 360kph just south of the M56. This reduction is driven by the design required for the route to pass between Mossbrow and Warburton.

3.7.3 The route would be on an embankment for 1.7km with a maximum height of 8m. It would pass through the route of overhead power lines. Hoo Green Lane (1) would be realigned onto a bridge over the route. The route would then pass into a cutting for 1.3km with a maximum depth of 8m. The A50 (2) would be realigned onto a bridge over the route.

3.7.4 A short section of low embankment (up to 2m high) would be followed by a cutting with a maximum depth of 17m. Peacock Lane (3) would be realigned onto a bridge over the route. Agden Lane (4) would cross over the route on a bridge. The route would pass under the M56 (5) and then move onto an embankment (maximum height 7m) for 2.8km crossing over the A56 (6). Agden Lane (7) and Warrington Lane (8) would be realigned to avoid the route. There may be requirements for temporary diversions and traffic management on the M56 during construction.

3.7.5 For the next 2.0km the route would be over an area of mudstone with soluble deposits (risk of subsidence from dissolution).

3.7.6 The route would cross over the Bridgewater Canal (9) at a height of 5m. It would then cross under Spring Lane (10) (which would be realigned) and Wet Gate Lane (11) would be realigned to avoid four crossings. The route would then cross over the River Bollin floodplain (12) on a 345m long viaduct at a height of 4m before passing into a cutting with a maximum depth of 9m.

3.7.7 At Warburton the route would continue along section HSM21 to Lowton (section 3.8).


HSM21 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
Culcheth
Little Woolden Moss
Glazebrook
Partington
Rixton
Warburton
Lymm
Broomedge
Dunham Woodhouses
1
2
3
4
5
6
7
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0
0.5
1
2
km

3.8 HSM21: Warburton (Q) to Lowton (R)

Warburton to the M62

3.8.1 The route section between Warburton and Lowton would be 11.8km long. The sections of route connecting to Warburton from the south would be HSM12 from Winterbottom (section 3.7) and HSM30 from Rostherne (section 3.13).

3.8.2 The design speed would be 360kph, reducing to 300kph. The speed reduction is a result of the design required to pass over the Manchester Ship Canal between Hollins Green and Cadishead, the landfill site at Risley, the west side of Culcheth and the route through Lowton on the line of the dismantled railway.

3.8.3 The route would be at ground level and then pass into a cutting with a maximum depth of 8m between Mossbrow and Warburton. The A6144 (1) would be realigned onto a bridge over the route. It is likely the B5160 would be extended to connect to it.

3.8.4 The floodplain (2) at Warburton Park would be crossed on a 180m long viaduct at a height of 7m. It would then rise steeply and pass through the route of overhead power lines. The route rises on an embankment to cross over the Manchester Ship Canal (3) between Hollins Green and Cadishead on a 28m high, 1.2km long viaduct, providing navigation clearance. The viaduct also crosses Caldwell Brook, a historic landfill site, the A57 (4) and Manchester Road.

3.8.5 The route continues on embankment for the next 3.6km, reducing in height from the viaduct, and through an area of peat. Works to maintain the groundwater regime, including during the removal of peat, would be required during construction. The route would cross over Dam Head Lane (5), the Manchester to Warrington railway (6) and the M62 (7).

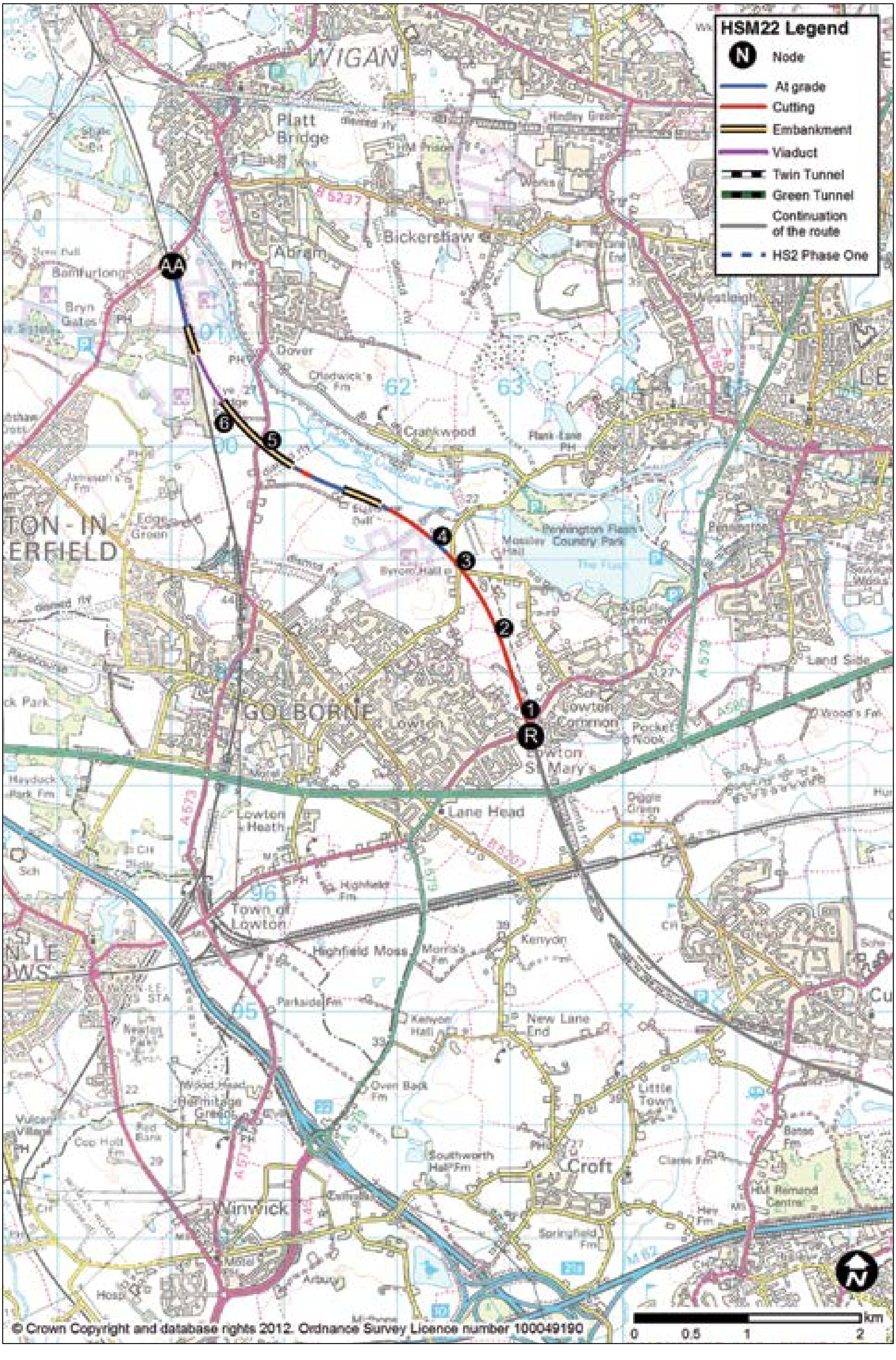

HSM21 Legend
N Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0 0.5 1 2 km

M62 to Lowton

3.8.6 The route would pass through the north-east corner of the Risley landfill site (1) at ground level and then pass into a cutting for 2.6km at a maximum depth of 8m. The route passes through the Taylor Industrial Estate (2). New Hall Lane (3) would be realigned and the A574 (4) realigned onto a bridge over the route. The route passes west of Culcheth in a cutting between 6m and 8m deep to limit noise and visual impact. Wigshaw Lane (5) would cross over the route on a bridge at the location of the dismantled railway.

3.8.7 The route then runs at ground level for 700m before passing into a cutting with a maximum depth of 6m. The route would cross over the Liverpool to Manchester railway (6). Wilton Lane (7) would be realigned onto a bridge over the route. The A580 (8) would cross over the route on a bridge.

3.8.8 At Lowton the route would continue along section HSM22 to Bamfurlong (section 3.9).


HSM22 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
AA
R
WIGAN
Platt Bridge
Bickershaw
Abram
Golborne
Lowton
Lowton Common
Lowton St Mary's
Lane Head
Kenyon
Croft
Winwick
km
0
0.5
1
2
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3.9 HSM22: Lowton (R) to Bamfurlong (AA)

3.9.1 The route section between Lowton and Bamfurlong would be 5.5km long. The design speed is 230kph. This section of route provides a connection to the WCML and the proposed rolling stock depot at Golborne. The depot is located on the south side of the route (See section 5.3)

3.9.2 At Lowton Common the A572 (1) would be realigned onto a bridge over the route at the location of the dismantled railway.

3.9.3 The route would be in cutting, passing through a historic coal mining area and landfill site, which would extend for 1.6km at a maximum depth of 7m. Just north of the A572, junctions would be provided allowing the route to continue towards the WCML and tracks to branch off into the rolling stock depot. The eastern track would rise (at a maximum height of 2m above ground level) to cross over the route to form the connection to the proposed rolling stock depot. The western track would rise up to ground level forming a connection into the proposed rolling stock depot (2).

3.9.4 Byrom Lane (3) would be realigned to avoid the route. Slag Lane (4) would be realigned onto a bridge over the route east of Byrom Hall. After a short length at ground level the route would run in a shallow cutting (up to 4m deep), on a low embankment (up to 3m high), at ground level and then on an embankment with a maximum height of 12m. The A573 (5) would be realigned onto a bridge over the route.

3.9.5 The existing most easterly of the four WCML lines would be realigned (6) to allow this route to pass over it (at a height of 8m) and then descend to connect to the WCML at a junction 300m south of the A58 at Bamfurlong in a historic coal mining area. The length of the realignment would be approximately 2.0km.


HSM28A Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
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0 0.5 1 2 km

3.10 HSM28A: Winterbottom (H) to Rostherne (Z)

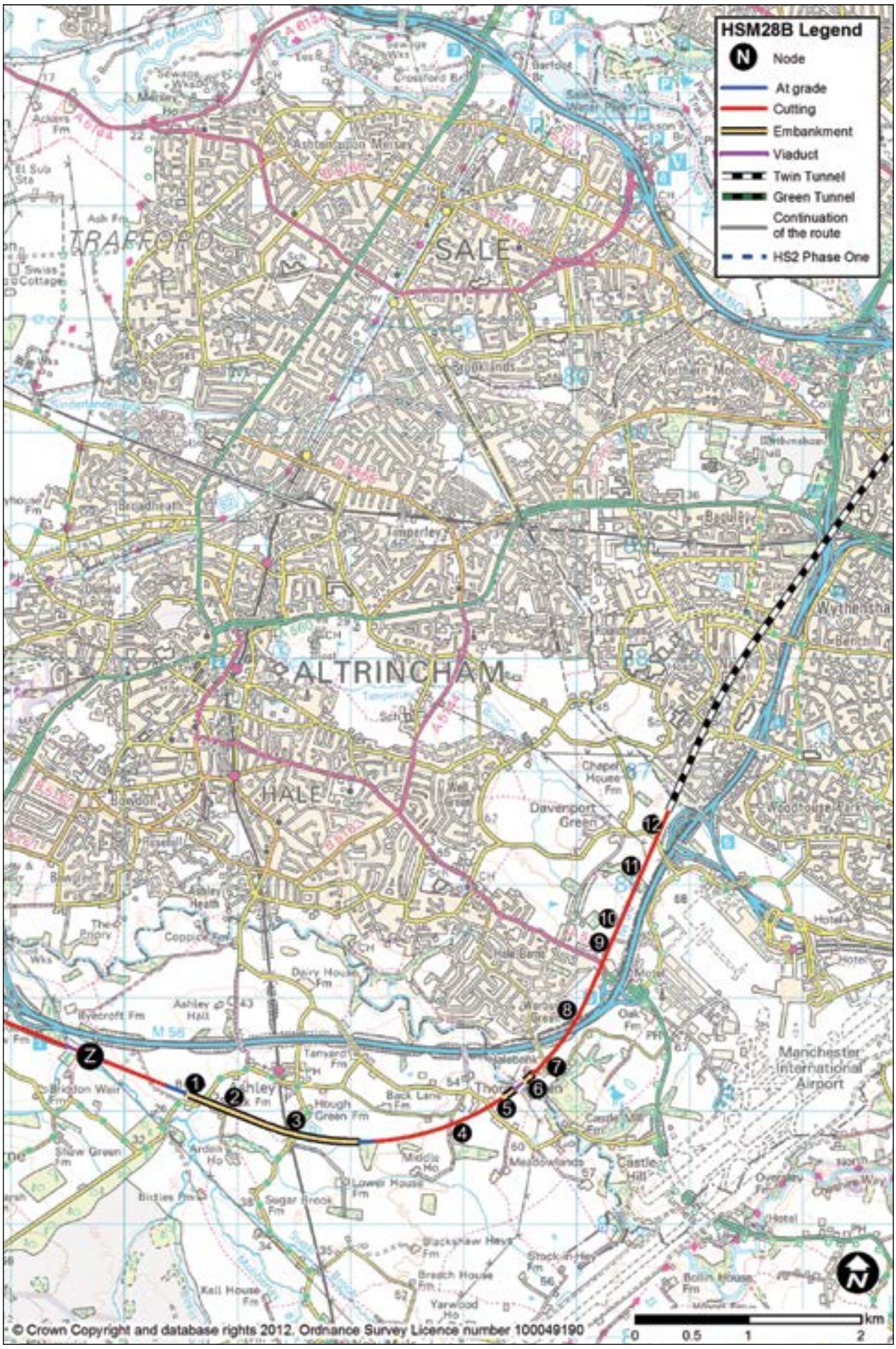
3.10.1 The route section HSM28 is split into two. HSM28A runs from node H to node Z and HSM28B from node Z to node Y (Ardwick).

3.10.2 The route between Winterbottom and Ardwick (continuing to Manchester Piccadilly) would be 26.8km long. The section of route connecting to Winterbottom from the south is HSM10 from Chorlton (section 3.6). The design speed is 400kph south of the grade separated junction and 230kph through the junction and on the spur towards Ardwick.

3.10.3 The route would be on an embankment with a maximum height of 8m for 1.0km before the junction, where it would pass through the route of overhead power lines. A grade separated junction (1) would be provided on the through route (HSM12) with the two lines splitting to four 500m south of Hoogreen Lane (2). The outer two lines would form the diverging spur towards Manchester Piccadilly. Hoogreen Lane would be realigned onto a bridge over the route. The A50 (3) would be realigned onto a bridge over all four lines. The western diverging line would rise to cross over the through route, joining the eastern line on an embankment with a maximum height of 5m, again passing through the route of overhead power lines. Peacock Lane (4) would be realigned onto a bridge over the route

3.10.4 The route would then pass into cutting with a maximum depth of 8m, cross the Agden Brook floodplain (5) on a 45m long viaduct (height 6m) and enter a further length of cutting up to 9m deep, passing under Millington Lane (6). After 400m at ground level the route would pass under the A556 (7) and run between Rostherne Mere and the M56 in a retained cutting up to 11m deep. It will be necessary to prevent groundwater flows into the deep cutting and possibly to seal the cutting and provide a permeable flow route. Tom Lane (8) would cross over the route on a bridge.

3.10.5 Blackburn's Brook (9) would be crossed on a 75m long viaduct which would pass through the route of overhead power lines. Birkin Brook (10) would be crossed on a 135m long viaduct at a height of 4m. A short length of cutting (maximum depth 4m) follows with the route then rising onto an embankment (height up to 7m).


HSM28B Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
TRAFFORD
SALE
ALTRINCHAM
HALE
Wythenshawe
Manchester International Airport
Z
1
2
3
4
5
6
7
8
9
10
11
12
N
0
0.5
1
2
km
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3.11 HSM28B: Rostherne (Z) to Ardwick (Y)

Rostherne to Davenport Green

3.11.1 The route from the south is HSM28A (section 3.10). The curve linking Manchester with the route northwards (HSM30, section 3.13) also connects to the start of HSM28B.

3.11.2 Ashley Road (1) would be realigned onto a bridge over the alignment with Lamb Lane (2) realigned to avoid the route.

3.11.3 The route would cross over Mobberley Road and the Altrincham to Chester railway (3). The road would be realigned to cross over the existing railway and the route. The route would then pass into a cutting with a depth up to 8m with Brickhill Lane (4) and Mill Lane (5) on bridges over the route. The River Bollin floodplain (6) would be crossed on a 110m long viaduct at a height of up to 16m. The route would also pass through the route of overhead power lines.

3.11.4 The route would then continue in a cutting with a depth up to 22m for 2.7km to the portal of a tunnel. Sunbank Lane (7) would be realigned onto a bridge over the route. The route would pass under the M56 (8), the A538 (Hale Road; 9), Hasty Lane (10) and Timperley Brook (11). The construction of the route under the M56 may require traffic management on the motorway.

3.11.5 A junction would be provided at Sunbank Lane to increase the two lines to four. The two outside lines would be the through route to Manchester Piccadilly and the two inside lines platform lines for the Manchester Airport High Speed Station (see section 4.2), which would be located north of Hasty Lane.

3.11.6 After Timperley Brook the route would pass through the route of overhead power lines. Thorley Lane (12) would cross over the route on a bridge. The two stopping lines rejoin the through lines at a junction north of the station. The through lines remain apart to pass into twin tunnels just after Thorley Lane.


HSM28B Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
MANCHESTER
GATLEY
CHEADLE
Wythenshawe
© Crown Copyright and database rights 2012. Ordnance Survey Licence number 100049190
0
0.5
1
2
km

Davenport Green to Ardwick

3.11.7 The twin tunnels are 11.9km long and pass under the built-up area between Manchester Airport and Longsight, through historic limestone workings. Four shafts would be positioned according to HS2 Ltd's *Options for Phase Two of the high speed rail network: Approach to design*, at roughly equal spacings. The design speed profile reduces from 230kph to 120kph over the last 2.0km of this section for the approach to the Manchester terminus station
(see section 4.1).

3.11.8 The route would emerge from the tunnels immediately north of the A57 (Hyde Road) (1). It would rise in a cutting alongside the WCML approaching Manchester Piccadilly station. The cutting would be fully retained as it would be in a section of floodplain. Bennett Street (2) would cross over the route on a bridge and Rostron Avenue (3) would also affected. Underpinning works may be required to the adjacent WCML viaduct structure.

3.11.9 At Ardwick the route would continue along section HSM26 to Manchester Piccadilly (section 3.12).


HSM26 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
MANCHESTER
MP
4
3
2
1
Y
N
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0
0.5
1
2
km

3.12 HSM26: Ardwick (Y) to Manchester Piccadilly (MP)

3.12.1 The route section between Ardwick and Manchester Piccadilly would be 1.5km long. The design speed of the section is 115kph reducing to 80kph for the approach to the Manchester Piccadilly terminus station.

3.12.2 The route emerges from the tunnel in a cutting and then passes onto a viaduct. In this area, significant alterations to the local highway network would be required. Blind Lane, Tongue Street, Dainton Street and Midland Street would be affected where the route would be at grade (1) before rising on the viaduct.

3.12.3 The A665 (Chancellor Way) (2) would be lowered under the route with associated alterations to connecting highways. North Western Street, Cresbury Street, Dark Lane and Union Street would be affected by the route.

3.12.4 The route would pass over the A635 (Mancunian Way) (3) with Chapelfield Road and Crane Street affected by the route. The route would then pass over Fairfield Street (4). Travis Street, Sheffield Street, Baird Street and Boad Street would also be affected by the route.

3.12.5 Major road traffic management would be required during construction. Road diversions and closures may be required. There would also be a number of alterations to the local highway network to provide access to the station.


HSM30 Legend
Node
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
Continuation of the route
HS2 Phase One
Q
Z
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Parrington
Warburton
Heatley
Carr Green
Dunham Woodhouses
Dunham Town
Dunham Park
Little Bollington
Broomedge
High Legh
Hulseheath
Bucklow Hill
Rostherne
Tatton Dale
Mere
Tatton Park
0
0.5
1
2
km
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3.13 HSM30: Rostherne (Z) to Warburton (Q)

3.13.1 The route section between Rostherne and Warburton would be 7.4km long. The route connecting to Rostherne from the east would be the spur from Manchester Piccadilly (HSM28B from Ardwick, section 3.11). This section provides a chord from Manchester Piccadilly and the Manchester Airport High Speed Station to the through route heading north (HSM21). The design speed would be 200kph. The route would be over an area of mudstone with soluble deposits (risk of subsidence from dissolution) for 3.5km.

3.13.2 A grade separated junction would be provided on the spur from Manchester (HSM28B) with the two line spur increasing to four lines. One chord line would leave the spur on the south side, 200m east of Blackburn's Brook (1). The Brook would be crossed on a 75m long viaduct with a height of 4m, followed by a cutting 4m deep. The other chord line would leave the spur on the north side 450m west of the Brook. The chord line on the south side would rise to cross over the spur and the other chord line 600m west of Blackburn's Brook (1) at a height of 1m above ground level, before descending back into cutting to run parallel to the spur for 700m. This cutting would be 2.4km long with a maximum depth of 13m. Tom Lane (2) would be realigned onto a bridge over the route. The route would pass under the A556 (3) with retaining walls supporting the M56 slip road. Coe Lane (4) would be realigned with the route moving north-west to pass under the M56 (5) and Reddy Lane (6). Stabilisation of and support to the A556 and traffic management on the M56 would be required during construction.

3.13.3 The route would then cross Agden Brook (7) on a 95m long viaduct at a height of 4m before passing through the route of overhead power lines. The route would then rise onto an embankment with a maximum height of 7m. The A56 (Agden Brow) (8) would be realigned onto a bridge under the route.

3.13.4 Agden Lane (9) and Warrington Lane (10) would be realigned to avoid the route. The route would cross over the Bridgewater Canal (11). At this point a second grade separated junction would be provided to connect onto the route to the north (HSM21). The eastern chord line would join the eastern through route line at a junction 100m north of the canal. The western chord line would descend to cross under the through route 800m north of the canal, rising back to the level of the through route on the west side. Spring Lane (12) would be realigned onto a bridge over the route. Wet Gate Lane (13) would be realigned to avoid four crossings . The through route and the chord line on its west side would cross over the River Bollin floodplain (14) on a 345m long viaduct at a height of 4m. On the north side of the viaduct a junction would be provided for the chord line to join the through route.

3.13.5 At Warburton the route would continue along section HSM21 to Lowton (section 3.8).

Manchester Piccadilly station – location and footprint

4 Stations

4.1 Manchester Piccadilly station

Route overview

4.1.1 The existing Piccadilly station in relation to the proposed station option is illustrated above. The HS2 lines and platforms would be located to the immediate north of the existing station. Approaching from the east, the spur route from the south would be in a twin tunnel and would emerge at a tunnel portal immediately north of the A57 (Hyde Road). The route would rise at a gradient of 2.5%, continuing in a retained cutting alongside the existing elevated railway lines. It would then cross underneath the Ardwick branch railway line, which would be carried on a new structure. A junction would be located adjacent to the branch line where the route would increase from two lines to four.

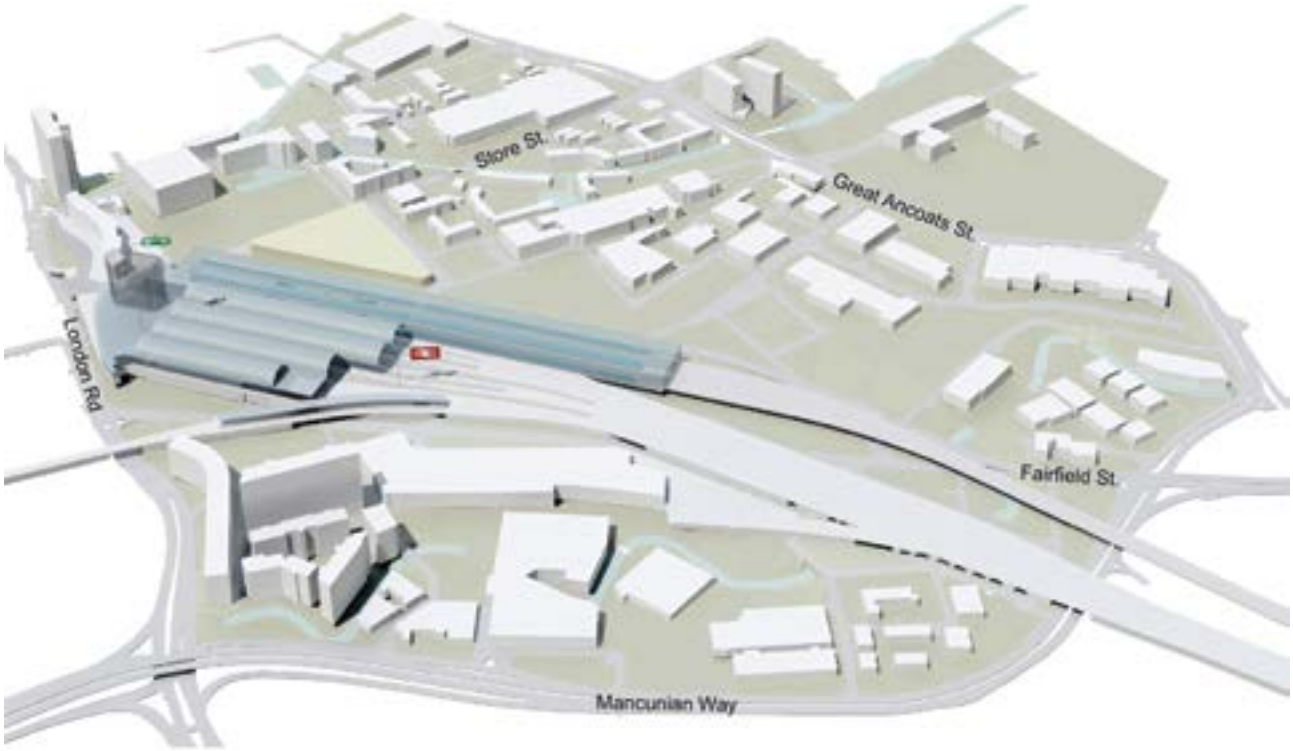
4.1.2 Beyond the crossing of the Ardwick branch railway, the lines would continue to rise. At the A665 (Chancellor Lane), the lines would not have achieved sufficient height to cross over the existing highway. Consequently, either a lowering of Chancellor Lane/ Devonshire Street North, the construction of a new alignment for the A665 to the east or a rerouting of traffic would be required. The lowering, which could be of up to 6.5m, would also require the closure of Temperance Street and North Western Street.

4.1.3 The lines would then rise to a level slightly above that of the existing adjacent railway tracks and would be at a sufficient height to cross over A635 (Mancunian Way) and B6469 (Fairfield Street). The level of the lines would then fall slightly to achieve HS2 platform levels similar to the existing platform levels. See also Section 3.12 (HSM26) for further route details.

Station location and existing site

4.1.4 The existing station is located directly south-east of Manchester city centre on a site bounded by London Road to the west, Fairfield Street to the south and Sheffield Street to the north. The train shed is a grade II listed structure; the station opened in 1842 as London Road station and has undergone major rebuilding and renovation works at several stages since then. The most recent major improvement programme was carried out in time for the 2002 Commonwealth Games.

Manchester Piccadilly station – intermodal options



Manchester Piccadilly station – model view

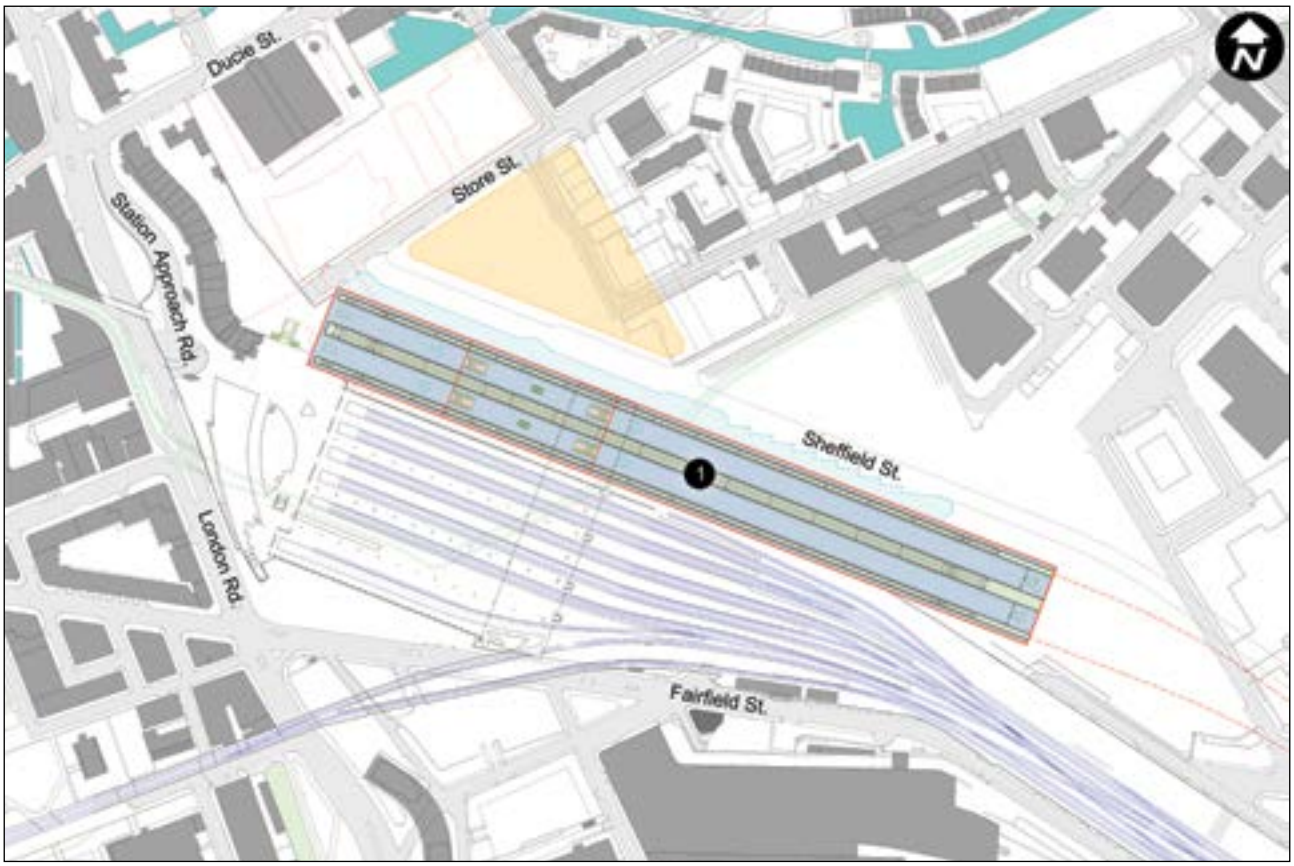
4.1.5 Manchester Piccadilly station handles over 83,000 passengers and 1,000 train movements every day. The station is served by six train operating companies running intercity routes to London Euston, Birmingham New Street, South Wales, the south coast of England, Edinburgh and Glasgow Central, as well as routes across northern England. The station consists of 14 rail platforms elevated to approximately 9m above the adjacent ground level. Twelve of these platforms terminate within the main train shed. Two through platforms, platforms 13 and 14, are on a viaduct to the south of the station. The longest platforms are 360m which, together with the concourse, result in an overall station length of 435m.

4.1.6 Future expansion of the station as part of the proposed Northern Hub works would result in two new through platforms, 15 and 16, also to the south of the station, and a direct link to Victoria station via a new curve at Ordsall. These works are expected to be in place well in advance of the construction of HS2.

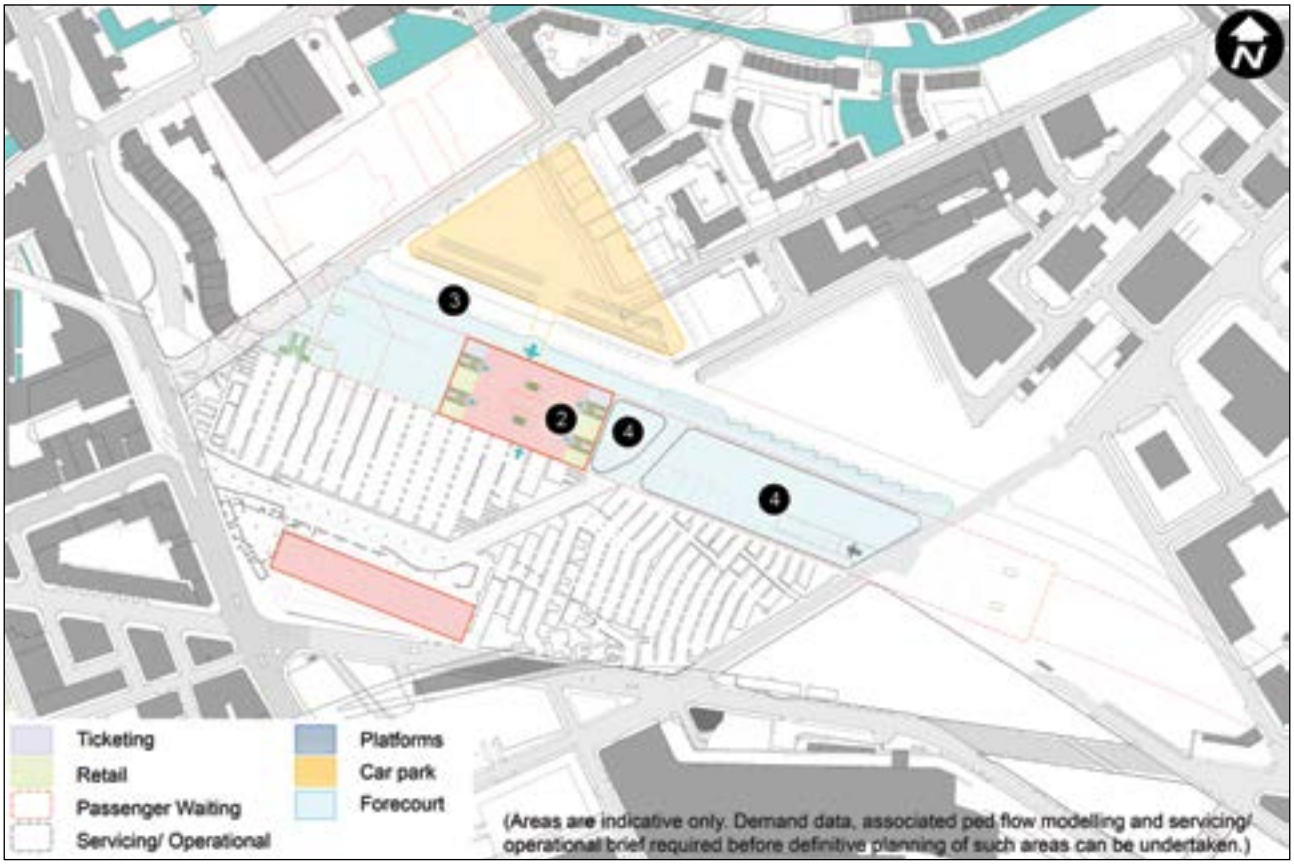
4.1.7 Piccadilly station serves as a terminus for Manchester Metrolink services to Eccles and Altrincham, with Bury to Droylsden services passing through the station. These services are accessed via two platforms within the brick undercroft of the station. An extension of the Metrolink from Droylsden to Ashton-under-Lyne is planned to open by winter 2013/14.

4.1.8 Passenger parking is provided at various locations around the existing station as follows:

- Piccadilly station multi-storey car park to the north of the station (820 spaces);
- Piccadilly station surface car park to the north of the station (140 spaces);
- Sheffield Street surface car park to the north-east of the station (150 spaces);
- Store Street Arches to the west of the station (120 spaces); and
- Store Street surface car park to the north-west of the station (380 spaces).



Manchester Piccadilly station – plan (platform level)



Manchester Piccadilly station – plan (concourse level)

Station description

Platforms

4.1.9 The brief for the HS2 station requires 4x440m long platforms. These platforms would service six arriving and six departing trains per hour. Half of these trains would be carrying approximately 1,100 passengers each and half approximately 550 passengers each. The overall length of the station would be 442.7m, which accommodates a structural zone to the end of the platforms. The overall width of the platforms is 47.3m. Accommodating the new station requires the demolition of a number of buildings to the north of the existing station.

4.1.10 The proposed station consists of two island station platforms (1) parallel with, and alongside, platform 1 of Manchester Piccadilly station. The platforms would be elevated to the same level as the existing platforms at Piccadilly station. The four platforms would be a consistent 14m width in order to accommodate vertical access cores and the necessary clearance to the platform edge. Platforms would be straight along their whole length. Escalators and stairs to platforms would be located as central as possible, within the given site constraints, to aid the efficient dispersal of passengers and encourage intuitive wayfinding by means of filtering passengers through one concourse area.

4.1.11 The station roof would cover the full length of the HS2 platforms and be approximately the same height as that of the existing train shed of Manchester Piccadilly station.

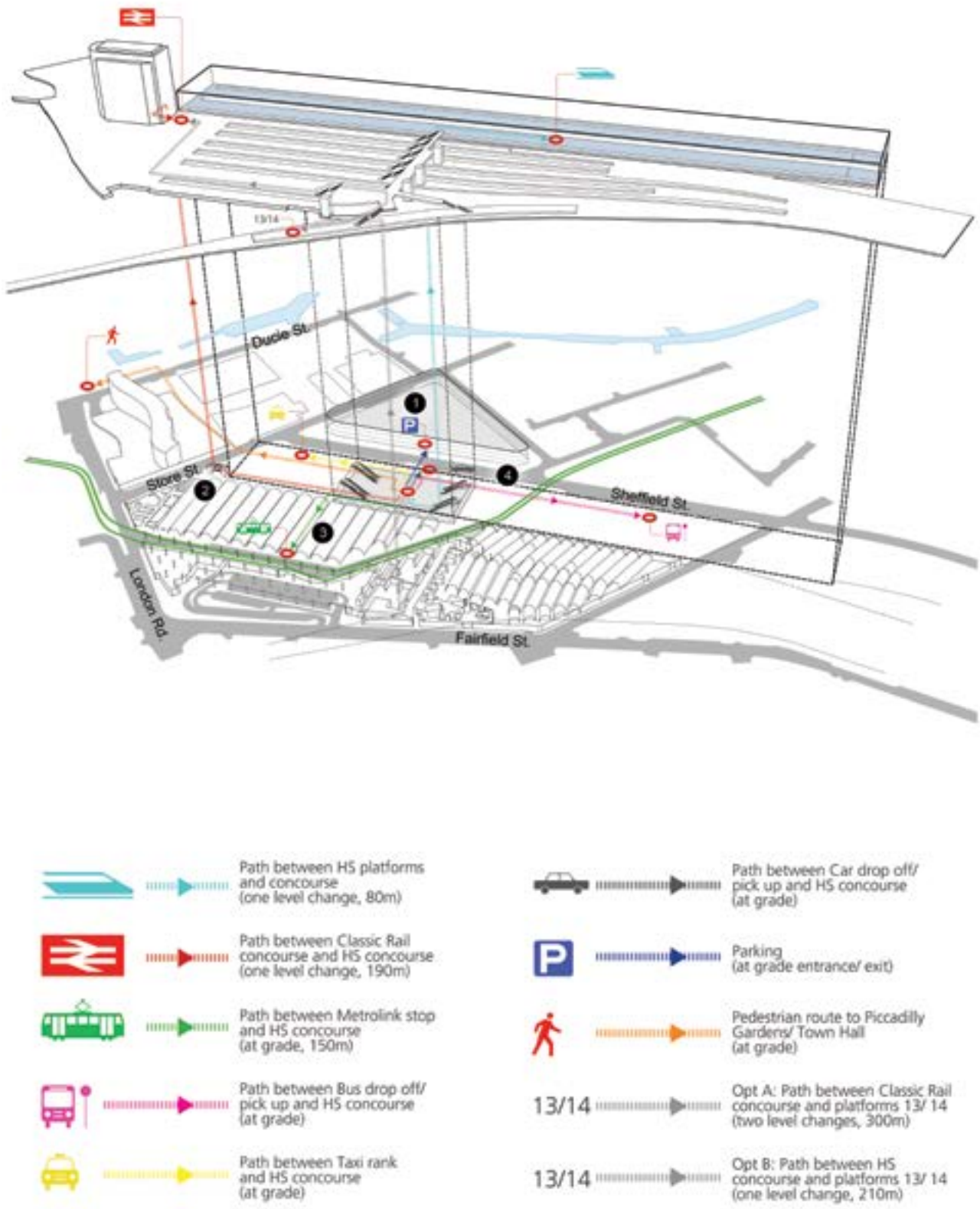
Concourse

4.1.12 HS2 concourse facilities (2) would be located at ground level, beneath the elevated platforms and to the west side of the Metrolink. The route between concourse and platforms would be via stairs, escalators and lifts through the platforms.

Forecourt and car park

4.1.13 A new combined station forecourt and car park (3) is proposed to the northern edge of the site. A new 2,100 space multi-storey car park (MSCP) would serve both existing rail and HS2 passengers and accommodate spaces displaced through the demolition of existing car parks.

4.1.14 Areas directly adjacent to the east side of the concourse have been identified as zones for servicing and operational support (4) to platforms and the concourse areas. Locating the servicing to the east end of the station would avoid conflict with passenger movements towards the concourse.



Manchester Piccadilly station – passenger circulation

Accessibility

4.1.15 The primary pedestrian entrance to the HS2 concourse would be from the realigned Sheffield Street parallel with, and to the north of, the HS2 station. Onward pedestrian travel from the concourse to the city centre would be either via Store Street and London Road, or the pedestrian link between Store Street and Ducie Street (which is proposed as part of the adjacent Inacity Tower development).

4.1.16 The existing entrances to Piccadilly station from the Station Approach road and Fairfield Street would be retained. Passengers would transfer directly between the existing rail and HS2 concourses via a new vertical circulation core adjacent to the western end of the HS2 platforms.

4.1.17 Vehicular access to the site from the inner ring road would be via a new spur off the Fairfield Street junction with Mancunian Way. Traffic accessing the station would travel from this junction along a realigned Sheffield Street running in a one-way system parallel to the HS2 station. Traffic connecting back onto the inner ring road would either turn right at the top of Sheffield Street onto Store Street and onto Great Ancoats Street or turn left at the top of Sheffield Street and left onto London Road which connects with Mancunian Way.

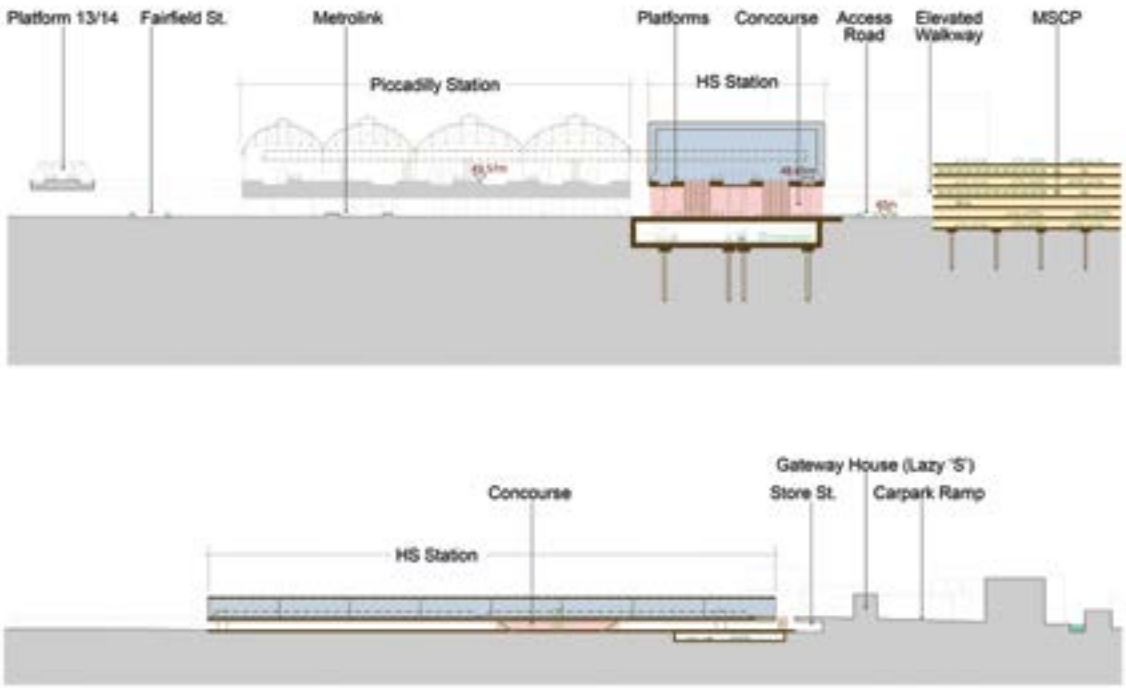
Intermodal interchange

4.1.18 The site benefits from good connections to major highways, existing Metrolink and bus services which would aid good onward dispersal of passengers. A newly-combined existing rail and HS2 forecourt and car park is proposed for the northern edge of the site (1).

4.1.19 The close proximity of the HS2 and existing rail stations presents a variety of options for interchange between the two rail services. Passengers transferring from the existing rail concourse would descend one level via a new circulation core adjacent to the western end of the HS2 platforms and continue a short distance to the HS2 concourse (2).

4.1.20 The undercroft of Manchester Piccadilly station presents opportunities for direct at-grade links between the Metrolink platforms and the HS2 concourse. Rail passengers connecting to Metrolink services would continue to use the existing links between the Piccadilly station and Metrolink concourses (3).

4.1.21 A new forecourt running parallel with the station and a realigned Sheffield Street would combine drop off/pick up and taxi facilities for both HS2 and Piccadilly station passengers. Car parking would be located in a 2,100 space multi storey car park directly opposite the HS2 concourse (4).



Manchester Piccadilly station – cross section looking south (top), long section looking west (bottom)

Site constraints

4.1.22 There are three primary constraints on the site which have dictated how the scheme could be developed for construction:

- The East Manchester Metrolink extension;
- The proposed Inacity Tower development; and
- Gateway House.

4.1.23 Metrolink dictates the concourse location and prevents the concourse being centrally located with the platforms above. The proposed Inacity Tower development prevents the HS2 station from being located closer to the city. In its current configuration Gateway House is something of a barrier to intuitive wayfinding towards the city centre. While the HS2 station proposal works within these three constraints, further opportunity exists at detailed planning stages for improving the integration of the HS2 station around these constraints.

Constructability

4.1.24 The work would be carried out in three main stages. Initial studies were carried out to identify methods of constructing the station with the following primary objectives:

1. Identifying any major risks associated with the site;
2. Minimising the number of demolitions and extent of disruption to existing infrastructure; and
3. Minimising the land take associated with the station development.

4.1.25 Stage 1 (18 months)

- Prepare access off Mancunian Way at the junction with Fairfield Street.
- Demolish and clear the working and construction site east of the Metrolink and the area for the new MSCP only, including the stabilisation of the existing railway arches.
- Construct temporary accommodation for the train drivers behind the Station Approach buildings and unloading bay off Store Street, north of the railway bridge, to be used for servicing the existing station facilities.
- Part-construct the new MSCP around the old car park.
- Construct new foundations and station structure to platform level east of the Metrolink.
- Construct a temporary at-grade parking area for cars currently located in the undercroft.

4.1.26 Stage 2 (two years)

- Divert train drivers' accommodation, station car parking, undercroft car-parking and service unloading.
- Demolish the remaining buildings including the old MSCP and the stabilisation of the existing railway arches.
- Construct the remainder of new foundations and station structure to platform level.
- Complete the construction of new MSCP.
- Construct a new ground-level concourse.

4.1.27 Stage 3 (three years)

- Construct the station roof.
- Install escalators and construct new station facilities below, above and at platform level.
- Construct a new loading bay and access for servicing station facilities and any amendments to existing servicing infrastructure.
- Construct new drop-off, taxi and bus ranks including the final road layout and carry out any amendments to the Metrolink station.

4.1.28 The station would be ready for installation of railway systems (track, signalling, etc) during Stage 3, with the station available for commissioning approximately two years later. As there would be considerable overlap between the stages it is expected that the overall programme would continue for approximately six years. It is assumed that all existing operational signalling, telecoms and power equipment, as well as catering facilities, are removed from the proposed station footprint prior to the construction of the station. This enabling work would be carried as a separate exercise during the final development stages of the HS2 design.

Manchester airport high speed station – location and footprint

4.2 Manchester Airport High Speed Station

Route overview

4.2.1 The platforms for the proposed Manchester Airport High Speed Station would be located west of the M56 between junctions 5 and 6. The stopping lines which serve the platforms would diverge from the route to Manchester Piccadilly at a junction approximately 600m south of the centre of the station, and re-join at a junction approximately 600m north immediately prior to the route descending into tunnel. The through lines at the station location would diverge from each other to provide sufficient separation for the twin tunnels immediately to the north; the stopping lines would diverge into the centre rather than the outside to utilise this additional width. See also Section 3.11, HSM28B, for further details on the proposed line of route.

Station location and existing site

4.2.2 This station would be located less than 1.0km west of Manchester Airport. The site lies immediately west of the M56. The distance by road to junction 5 would be 2.5km and it would be 1.2km to junction 6. The station footprint would be 415m long by 37.6m wide (excluding the car park) with platforms in cutting approximately 8.5m below existing ground level.

Station description (see plans overleaf)

Platforms

4.2.3 The two outer through lines on the spur to Manchester Piccadilly would enable HS2 trains to run straight into the city, while the two inner stopping lines would enable trains to stop and serve the Airport station via an island platform. The platform would be 14m wide.

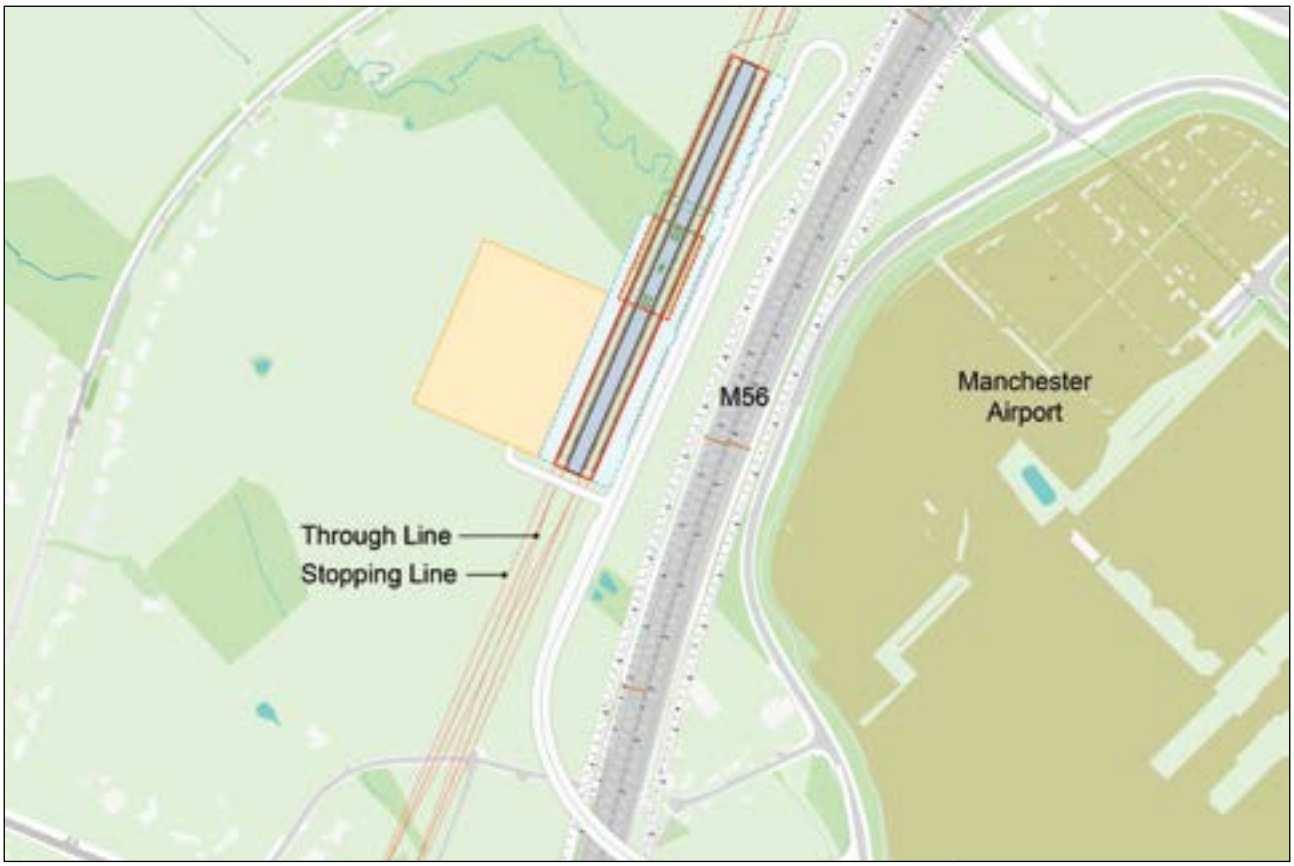
Concourse

4.2.4 HS2 concourse facilities would be located at grade above the platforms. The main entrance to the concourse would be located on the eastern, airport facing side of the station. The route between concourse and platforms would be via stairs, escalators and lifts through the concourse.

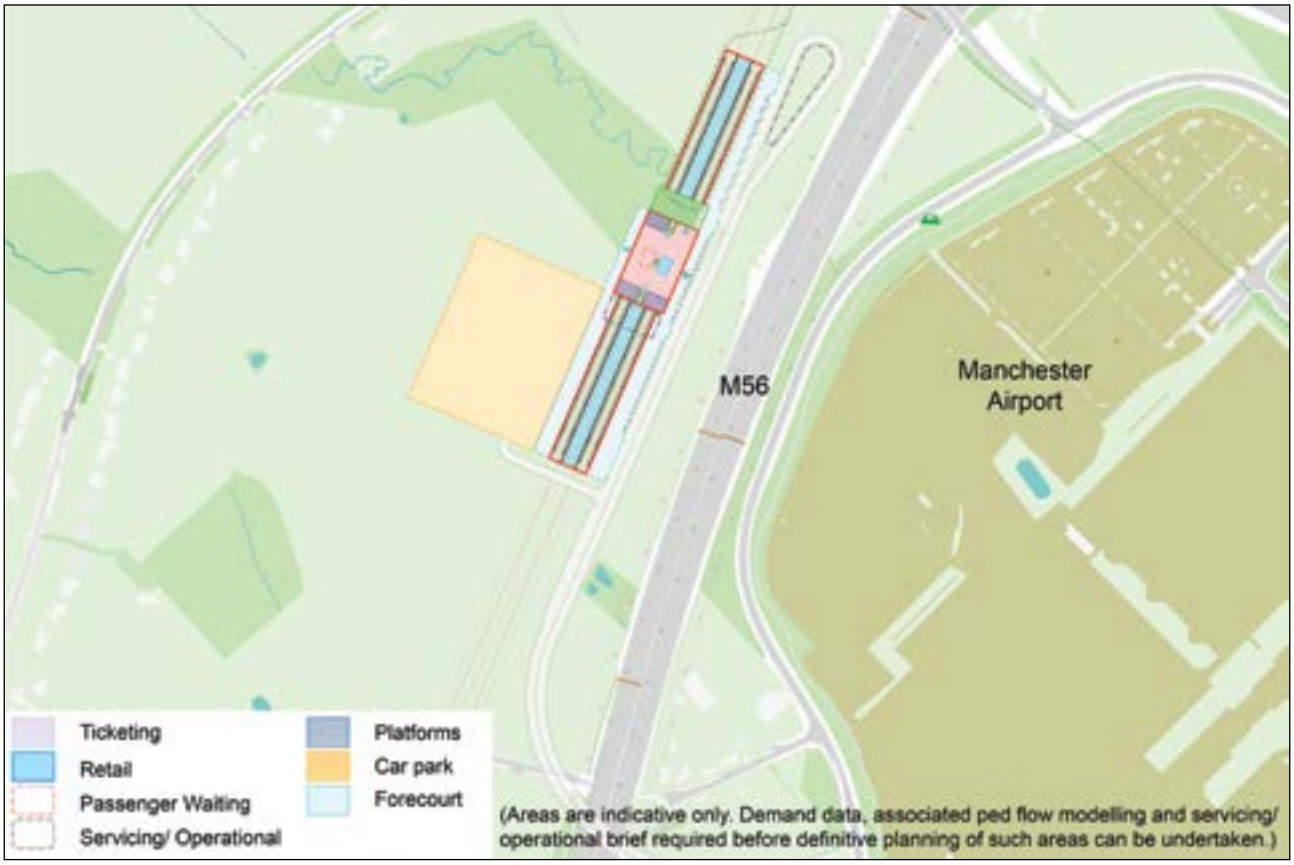
Forecourt and car park

4.2.5 A linear forecourt arrangement would run along the full length of the eastern side of the station. The station multi-storey car park would be located to the west of the station and would accommodate 3,000 cars.

4.2.6 Areas directly adjacent to the concourse have been identified as zones for servicing and operational support to platforms and concourse areas.



Manchester Airport High Speed Station – plan (platform level)



Manchester Airport High Speed Station – plan (concourse level)

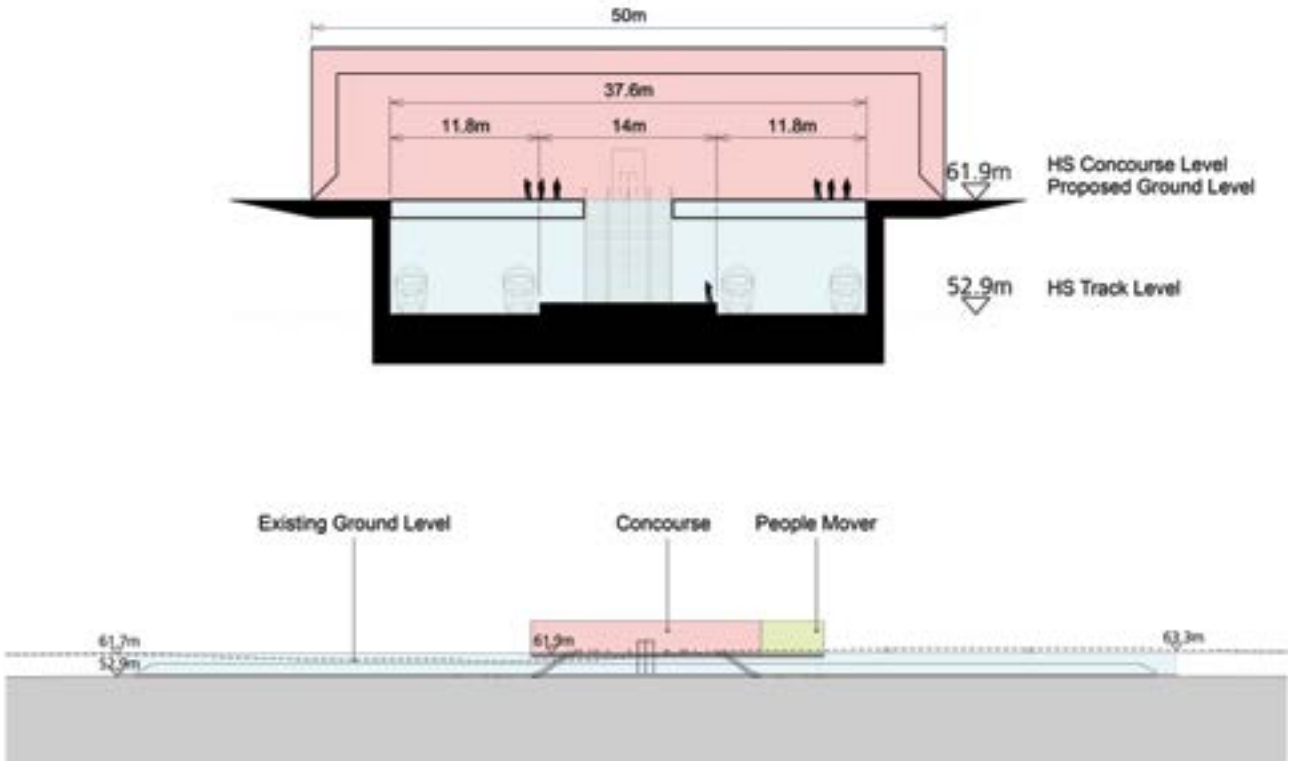
Accessibility

4.2.7 The initial preferred route proposition presented in January 2013 featured vehicular access to the site from the M56 via an improved junction 6. These improvements included the construction of a large, higher capacity, signalised roundabout and new link roads joining junctions 5 and 6, immediately alongside the M56.

4.2.8 Subsequent discussions with the Highways Agency and others have resulted in areas of potential improvement to the design. Furthermore, it is now understood that works are currently planned as part of existing planning agreements for growth at Manchester Airport to help ease congestion on the M56 between Junctions 5 and 6. These works are promoted by the Manchester Airport Group in consultation with the Highways Agency.

4.2.9 Works to deal with the additional traffic resulting from HS2 can be better integrated with existing proposals to improve the transport network in the area. These include commitments to improve the M56 (between J5 & J6) to improve access to Manchester Airport, the potential to expand the Metrolink network and improvements to serve the Airport City Enterprise Zone.

4.2.10 Revised proposals will emerge from ongoing work with the local stakeholders and communities involved through the consultation process. Their performance will be validated by combining the various traffic components such as those associated with the Airport, the Airport City Enterprise Zone, HS2 station and wider traffic growth in the M56 corridor.



Manchester Airport High Speed Station – cross section looking south (top), long section looking west (bottom)

Intermodal interchange

4.2.11 The unconstrained nature of the site would facilitate the efficient planning of station arrangement and a resultant short interchange from platform to concourse to forecourt facilities. Taxi and private vehicle drop off and pick up facilities would be located next to the station entrance.

4.2.12 Passengers transferring to Manchester Airport could use a people mover system. The proposed arrangement of the people mover interchange area would be as an extension north of the main HS2 concourse facilities. The distance from the HS2 station to Terminal 1 of Manchester Airport via people mover would be 2.1km, with a journey time of approximately five minutes.

4.2.13 There are two bus routes along the A538 Hale Road/Wilmslow Road; Route 18 services connect the airport with Hale and Altrincham via the A538 to the Cargo Centre, main terminal complex and Trafford Centre; and services along Route 19 during the early morning connect the cargo centre with the main airport complex, Wythenshawe and Altrincham. A slight modification to these routes would enable them to serve the HS2 station.

Manchester Airport High Speed Station – intermodal options

4.2.14 Constructability

4.2.15 The works would be carried out in three main stages. The constructability of the station has been assessed with the following objectives:

- identifying any major risks associated with the site; and
- minimising the number of demolitions and extent of disruption to existing infrastructure.

4.2.16 Stage 1 (26 months)

- Clear the construction area and set-up site compound using temporary access from Hasty Lane.
- Construct new roundabout and road connection to airport M56 link.
- Excavate and build and concrete box.

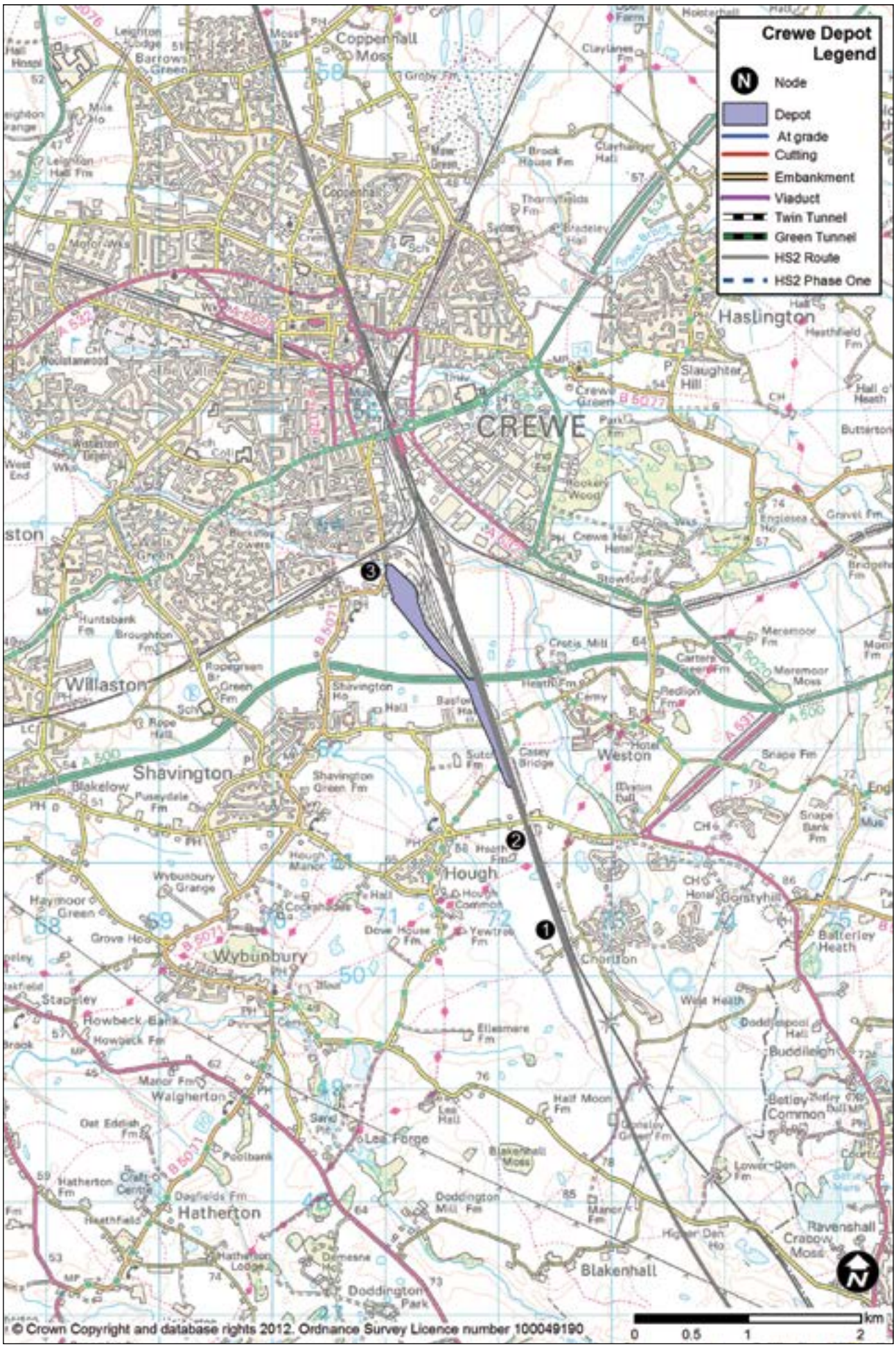
4.2.17 Stage 2 (12 months)

- Construct platforms.
- Construct ground level concourse.
- Level area for car park.

4.2.18 Stage 3 (17 months)

- Construct station roof.
- Complete platform fit-out and install HS2 escalators to concourse.
- Construct new station facilities including commercial.
- Construct new MSCP.
- Construct access roads, taxi and bus ranks and car drop-off points.
- Completion works including constructing footpaths, landscaping, etc.

4.2.19 The station would be ready for the installation of railway systems (track, signalling, overhead line equipment, etc) during Stage 3, with the station available for commissioning approximately 18 months later. As there would be considerable overlap between the stages it is expected that the overall programme would continue for approximately four years.


Crewe Depot Legend
Node
Depot
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
HS2 Route
HS2 Phase One
CREWE
Haslington
Willaston
Shavington
Weston
Hough
Wybunbury
Hatherton
Blakenhall
Ravenshall
1
2
3
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0
0.5
1
2
km

5 Depots

5.1 Introduction

5.1.1 Two depots would be required for the operation of the West Midlands to Manchester leg. One would be an infrastructure maintenance depot (IMD) as a base from which to carry out engineering activities to inspect, maintain and renew the infrastructure. The second would be a rolling stock depot (RSD) at which trains would be stabled overnight for cleaning and maintenance.

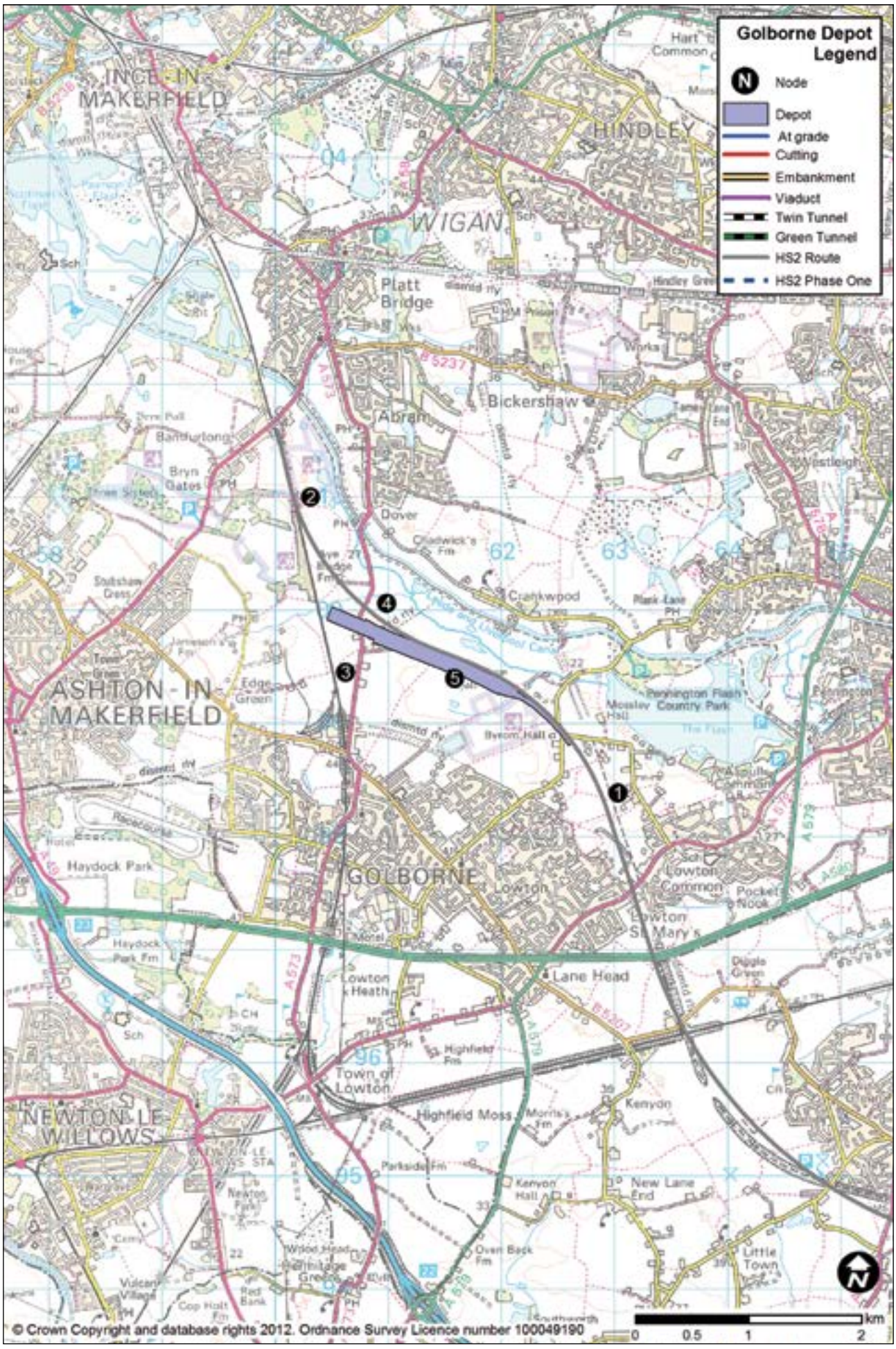
5.2 Infrastructure maintenance depot

5.2.1 The proposed IMD would be located approximately 1.5km south west of Crewe and west of the WCML and Network Rail sidings at Basford Hall. It would be connected to HSM09 (see section 3.5) and the WCML. The depot would be situated on relatively level farmland alongside the existing sidings. A section of the depot would cross Basford Brook and its floodplain.

5.2.2 The depot would comply fully with HS2 design criteria and specifications, except that it would be single-ended.

5.2.3 The connection to the existing sidings on the WCML would be moved south. A connection from the HS2 route to the south (HSM09) to the sidings would be provided between Chorlton Lane (1) and Newcastle Road (2). A headshunt would be provided in this area to provide access onto and from HS2 to the north. Access to the depot from the WCML would also be provided. A new highway access to the depot would be constructed from Gresty Road (3).

5.2.4 Construction of the depot in this location would use standard methods.


Golborne Depot
Legend
Node
Depot
At grade
Cutting
Embankment
Viaduct
Twin Tunnel
Green Tunnel
HS2 Route
HS2 Phase One
WIGAN
HINDLEY
ASHTON - IN - MAKERFIELD
GOLBORNE
NEWTON-LE-WILLOWS
Platt Bridge
Abram
Bickershaw
Lane Head
Lowton
Highfield Moss
Haydock Park
Crankwood
Dover
1
2
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km
0
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1
2

5.3 Rolling stock depot

5.3.1 The proposed rolling stock depot would be situated on relatively level farmland between the WCML north of Golborne and the HS2 connecting route to the WCML (HSM22, see section 3.9). The site would be strategically located to serve Manchester and allow access to the WCML.

5.3.2 The depot would meet all HS2 design criteria and specifications. It would have rail access at both ends.

5.3.3 Access from HS2 would be provided from the south using a grade separated junction from the connecting route (HSM22) to the WCML. This would allow trains to run south to Manchester. One line on each side of the connecting route would be provided from a junction east of Lowton (1) to the depot. The eastern line, which would be 1.5km long, would cross over the connecting route to run into the depot. At the north end of the depot, additional lines 1.2km long would be provided to connect to the WCML at a grade separated junction (2). This junction would enable classic compatible trains from the depot to access the WCML north. In addition, at the north end of the depot, a line 700m long would connect to the WCML at a flat junction (3) to provide access for classic compatible trains to the WCML south. The A573 (4) would be realigned to prevent serverance of this road. Access to the site during operations would be from the A573 which would need to be diverted to cross the site.

5.3.4 The depot would be designed to avoid the demolition of Lightshaw Hall (5) in the centre of the site. Construction of the depot in this location would use standard methods. Connecting to the WCML would require reconfiguration of the WCML and the junctions at Bamfurlong, Golborne and Lowton.

6 Ancillary design works

6.1 Tunnel portals

6.1.1 Tunnel portals are required to fulfil a number of purposes. These include:

- a structure to retain the surrounding ground at the entrance of the tunnel;
- to provide emergency intervention access to the tunnels from the surface;
- providing emergency passenger evacuation where evacuation through the portal is part of the emergency strategy; and
- reducing noise and air pressure effects as trains enter or exit the tunnel.

6.1.2 Tunnel portals would incorporate some or all of the following features:

- portal hoods (tapered, perforated, reinforced concrete structures, up to 100m long);
- building housing services such as power, telecommunications, water supply, fire safety, drainage and ventilation equipment to service the tunnel in what is generally known as a 'headhouse'; and
- parking for service vehicles.

6.1.3 Tunnel portals would take different forms, depending on ground conditions, local terrain and train speeds. In rural locations, portals would typically be constructed in open excavation, with soil and rock slopes benched (i.e. cut in steps) and reinforced as necessary, and reinforced concrete headwalls and wing walls around the tunnel entrances. In urban locations and where space is restricted, portals would utilise earth retaining structures.

6.1.4 Where excavation is relatively shallow, tunnel portals would be constructed by open cut. For deeper excavations, diaphragm wall or contiguous bored pile techniques would be utilised, requiring support by propping beams or a cover slab for the deepest excavations.

6.1.5 A minimum 'rescue' area of 550m^2 for emergency services would be provided at both portals for tunnels longer than 1.0km and at one portal for those shorter than 1.0km.

6.1.6 The function of the headhouse is to accommodate ventilation fans, lift winding gear and other plant, together with emergency access doors. The headhouse structures would generally be a single storey building of 4-5m in height depending on whether air intakes to fans are required.

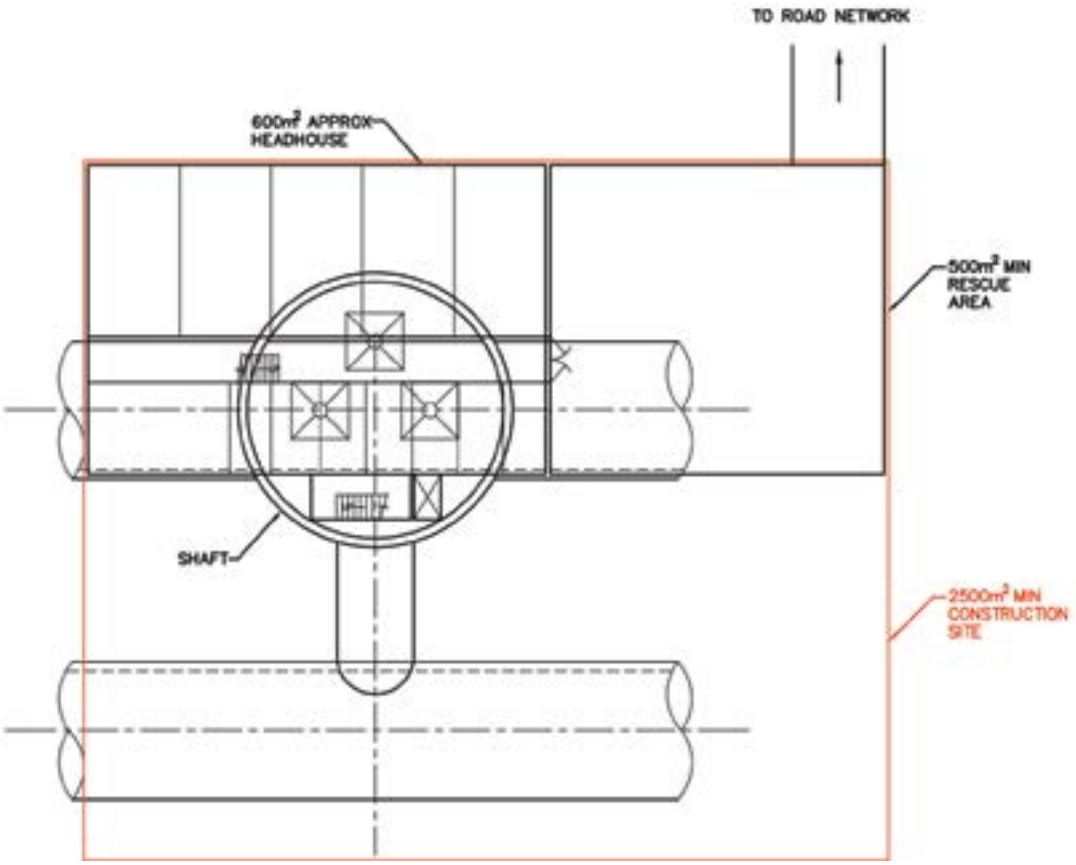
6.2 Ventilation shafts

6.2.1 Typically, tunnels would have shafts for ventilation maintenance, pressure relief and emergency intervention located at 2.0km-3.0km intervals as follows:

- the vent shafts would require mechanical ventilation for smoke extraction purposes in the event of fire, air temperature and air quality inside the tunnel;
- vent shafts would incorporate both lifts and stairs, terminating at ground level in 'headhouses' where ventilation fans, lift winding gear and other plant for servicing the tunnel and the shaft would be located;
- access for emergency services intervention. A minimum 'rescue' area of 550m^2 for emergency services would be provided adjacent to each intervention point.

6.2.2 Tunnel shafts would be constructed by various techniques depending on the location and ground/groundwater conditions.

6.2.3 An indicative layout and footprint of the ventilation shaft is shown below. Ideally, a site of 2,500m^2 would be required to facilitate the overall construction of the shaft.



Ventilation shafts – indicative layout

6.2.4 The indicative vent shaft locations can be found on plan and profile maps.

6.2.5 On the Manchester leg there are five tunnels varying in length from 500m to nearly 12km. Based on these requirements, Crewe Tunnel would have one shaft at approximately mid-point and the Manchester Piccadilly station approach tunnel would have four shafts at roughly equal spacing. Each shaft would service both tunnel bores. The remaining three tunnels would not require any shafts. This is summarised in the table below:

Tunnel	Length	No. of shafts
Manchester Piccadilly station approach	11,890m	4
Crewe	3,820m	1
Madeley	720m	0
Whitmore Heath	710m	0
Hopton	510m	0

Table 1: Number of shafts required – Manchester leg

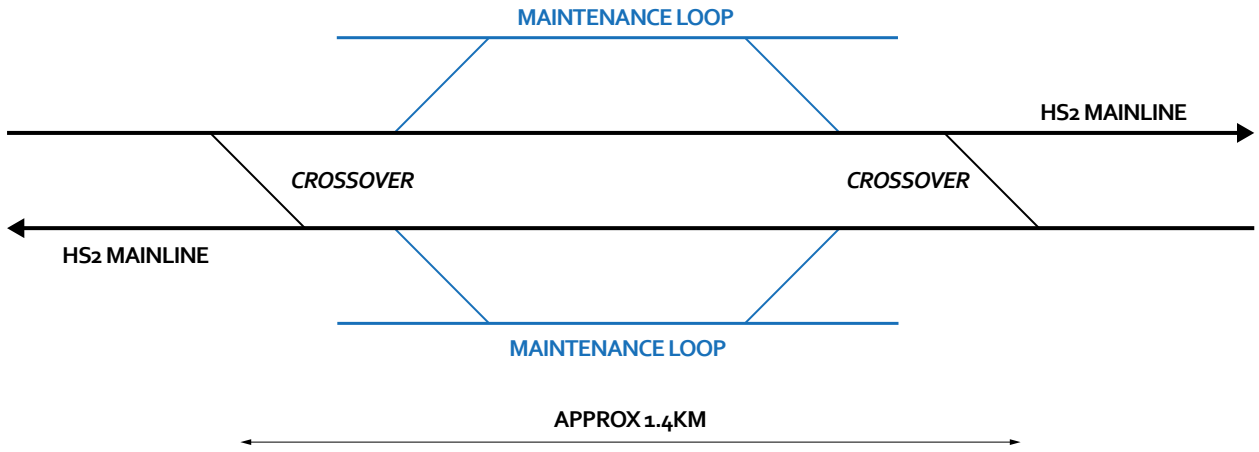
6.2.6 For the proposed tunnel at Crewe we have identified a site located in the large grassed area behind Rosedale Manor Care Home with access off Middlewich Street via Ridgeway Street.

6.2.7 For the proposed tunnel approaching Manchester city centre we consider there to be a viable option at the commercial development at the junction of Altrincham Road (A560) and the M56. Alternatively it would be possible to use the car parking structure behind this location. The indicative location of the second shaft would be in an area adjacent to Withington golf course off Palatine Road. The indicative location of the third vent shaft would be on the site of the Public House and its car park at the corner of Lapwing Lane and Palatine Road. The fourth vent shaft would be located close to the corner of Whitworth Lane and Old Hall Lane in an area presently occupied by a University car park and playing fields.

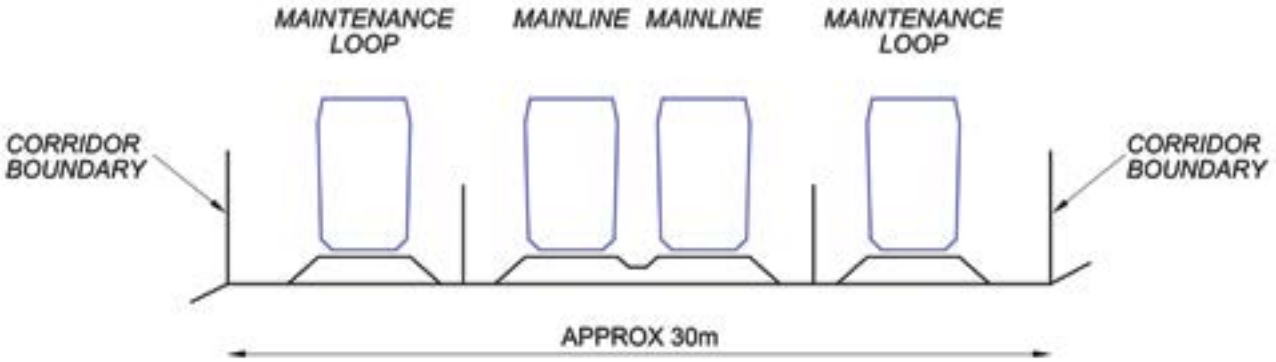
6.3 Maintenance loops

6.3.1 Maintenance loops are a series of sidings used to provide stabling for maintenance trains required for operational maintenance work, and failed trains that cannot be pushed through to the next station readily, allowing the line to be cleared with limited delay. Depots can be used for this purpose, but, due to the nature of the lengths between depots and stations on the proposed high speed network, it is necessary to provide loops between these locations to allow the quick start-up of work when the limited engineering hours commence. Assessment of requirements in this respect indicate that such berthing facilities should be supplied on the network, be they stations depots or loops, at no more than approximately 60km along the route.

6.3.2 Ideally, the layout of maintenance loops would comprise two loops or sidings, one either side of the mainline. Each of these loops would be approximately 1.4km long. Crossovers would also be provided at either end of the maintenance loops to allow for operational movements.



Maintenance loop – typical layout



Typical cross-section configuration

6.3.3 Road access would be provided to these maintenance loops on one side as a minimum. A road rail access point would also be incorporated into the spur siding adjacent to the car park.

6.3.4 Maintenance loops are available on the Phase One Route at Washwood Heath RSD. Based on these, loops would be located at Pipe Ridware as per the layout shown above.

7 Glossary of terms

At-grade – at ground level.

Classic compatible trains – a European high speed standard train which can also run on existing UK rail lines, also known as the 'classic network'.

Concrete trough – a concrete structure in which the route would cross a floodplain at a level below flood level and which would prevent water affecting the route.

Conservation area – designated areas of special architectural and historic interest.

Engineering hours – the hours during the night when passenger services are not running and engineering work can be carried out on the tracks.

Floodplain – area of land surrounding a watercourse which will be subject to flooding.

GC gauge – gauge is the shape beyond which a vehicle is not to be built, or within which a structure is not to intrude. GC Gauge is an intermediate shape between a vehicle gauge and a structure gauge, defining limits that a vehicle should conform to in a limited range of operating conditions.

Grade separated junction – a junction where one or more routes cross other routes at a different level by being raised above or below them. This could apply to either to railways or highways.

Grade I listed building – a listed building of exceptional interest, sometimes considered to be internationally important.

Grade II listed building – nationally important buildings that are of special interest.

Grade II* listed building – a listed building of particular importance, of more than special interest.

Green tunnel – where earth is built-up around and over a section of the rail line to reduce its environmental impacts.

High Speed Two Limited (HS2 Ltd) – a company wholly owned by the Department for Transport responsible for developing and promoting HS2 London to West Midlands and preparing proposals for HS2 to Leeds, Manchester and Heathrow.

Intermodal interchange – interchange between different forms of transport, for example between rail and tram or bus.

Infrastructure maintenance depot – Base for maintenance of infrastructure associated with the proposed high speed rail line, including track, signalling equipment, cuttings and embankments.

Listed buildings - a building of special architectural and historic interest brought under the consideration of the planning system by English Heritage.

Maintenance loop – sidings to allow the berthing of engineering or failed trains alongside the Mainline.

Network Rail – owner and operator who runs, maintains and develops Britain's rail tracks, signalling, bridges, tunnels, level crossings, viaducts and selected rail stations. Network Rail owns and manages Birmingham New Street station, Liverpool Lime Street station and Manchester Piccadilly station.

OHLE - Overhead Line Equipment, the cables above the trains that carry the electricity supply.

Rolling stock depot – Depot used to service and maintain trains operating on the proposed route.

Sprayed concrete lining (SCL) – A method for the construction of tunnels, by spraying concrete immediately on the exposed ground to retain it.

Spur – a railway line which branches off the main through route.

S&C – Switch and Crossing, a rail junction (or set of points) allowing a train to pass from one set of tracks to another, i.e. where a single set of railway tracks split into two sets of tracks.

TBM – Tunnel Boring Machine, used to construct tunnels.

Tunnel portal – the entrance to a tunnel

Twin tunnel – two tunnels constructed side by side spaced slightly apart, one of which will take the northbound track and one the southbound track

West Coast Main Line (WCML) – Intercity railway route in the UK connecting London, Birmingham, Manchester, Liverpool and Glasgow.