

# Making Meaningful Connections

Consultation Technical Report  
Chapters 8 – 12

**East West Rail Consultation:  
31 March – 9 June 2021**

This document contains the full Consultation Technical Report, without the Appendices. To access the Appendices, please visit [www.eastwestrail.co.uk](http://www.eastwestrail.co.uk)



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# Glossary

	Term	Description
A	<b>A428 Improvement Scheme</b>	The scheme promoted by Highways England to upgrade the A428 between Black Cat roundabout east of Bedford and Caxton Gibbet roundabout west of Cambourne
	<b>Air Quality Directive</b>	European Directive 2008/50/EC on ambient air quality and cleaner air for Europe
	<b>Air Quality Management Area</b>	An area designated by a local authority, where it believes the Government's objectives for air quality will not be achieved without additional interventions
	<b>Alternative</b>	In this report, 'alternative' is used when referring to a possible solution that has been considered but has been discounted and is not expected to be taken forward
	<b>Assessment Factors</b>	The factors used to assess and compare different options for the Project
	<b>Oxford-Cambridge Arc (the Arc)</b>	The area between Oxford and Cambridge, incorporating the county areas of Oxfordshire, Buckinghamshire, Bedfordshire, Northamptonshire and Cambridgeshire
	<b>At-grade junction</b>	A railway junction where tracks cross at the same level. Also known as a flat junction
B	<b>Balancing pond</b>	A pond into which water drains, with the intention of ensuring that local watercourses are not overloaded during periods of heavy or prolonged rainfall
	<b>Ballast</b>	Stone or gravel used to form the bed of a railway track
	<b>Biodiversity net gain</b>	An approach to development that leaves biodiversity in a better state than before the development took place
	<b>Blockade</b>	The closure of a rail route for an extended period (typically more than two to three days)
	<b>Bridleway</b>	A route over which the public have rights to pass on foot, cycle and on horseback
	<b>Business case assessment</b>	An assessment to determine the justification for undertaking a project by considering benefits, costs and risks

	Term	Description
C	<b>Cambourne North Station</b>	Option for a new station to the north of Cambourne
	<b>Cambourne South Station</b>	Option for a new station to the south of Cambourne
	<b>Cambridgeshire Autonomous Metro</b>	A proposed transit system connecting Cambridge to Alconbury, St Neots, Mildenhall and Haverhill
	<b>Capital costs</b>	Cost incurred during delivery of a project in purchasing buildings, land, construction works, and equipment as opposed to the costs of operating, maintaining or decommissioning the project
	<b>Clearance</b>	Space available around a moving train
	<b>Clock-face timetable</b>	A timetable arranged so that trains arrive or depart at the same times in the hour, every hour (for instance at 10, 30 and 50 minutes past the hour)
	<b>Code of Construction Practice (COCP)</b>	A public document which will provide contractors and suppliers with details of the measures, controls, and standards of work that they must follow
	<b>Conflicting movements</b>	A movement that requires a train to cross another route on the railway, at the same level, or trains to travel in opposite directions on the same route, in order to continue a journey
	<b>Congested Infrastructure</b>	An element of railway infrastructure for which demand for infrastructure capacity cannot be fully satisfied during certain periods, even after coordination of different requests for capacity. Defined by The Railways (Access Management and Licensing of Railway Undertakings) Regulations 2016
	<b>Connection stage</b>	Work will be divided into three connection stages which relate directly to a full journey and not just a piece of track: Connection Stage 1 (CS1): Oxford - Bletchley and Milton Keynes (services may be first opened to Bletchley in a two-phased approach) Connection Stage 2 (CS2) : Oxford - Bedford Connection Stage 3 (CS3): Oxford - Cambridge

	Term	Description
C	<b>Conservation Area</b>	An area of notable architectural or historic interest or importance in relation to which change is managed by law
	<b>Core Section</b>	The section of the Project between Clapham Green and The Eversdens, also referred to as Project Section D in this report
	<b>Critical path</b>	The longest sequence of activities in a plan or programme which must be completed on time in order to achieve completion of a project on a due date
	<b>Crossovers</b>	A connection between two tracks where points/switches on each track allow trains to pass from one track to the other
	<b>Culvert</b>	A tunnel carrying a stream or open drain
	<b>Cut and cover</b>	Earth and similar material that needs to be excavated as part of construction works (for example to form a cutting)
	<b>Cut</b>	Earth and similar material that needs to be excavated as part of construction works (for example to form a cutting)
D	<b>Development Consent Order (DCO)</b>	Order made by the relevant Secretary of State to authorise the construction, operation and maintenance of a nationally significant infrastructure project (NSIP). In relation to East West Rail, this would be the Secretary of State for Transport
	<b>Department for Transport (DfT)</b>	Government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved
E	<b>Earthworks</b>	General term for the excavation and placement of soil, rock and other material; or for existing cuttings and embankments
	<b>East Coast Main Line (ECML)</b>	Railway line running from London King's Cross to Edinburgh through Sandy and St Neots
	<b>East Midlands Railway (EMR)</b>	Train operator running services between London, the East Midlands and Yorkshire
	<b>East West Rail EWR</b>	A proposed new rail link, which would connect communities between Oxford, Milton Keynes, Bedford and Cambridge

	Term	Description
E	<b>East West Rail Company Ltd (EWR Co)</b>	Company set up by the Secretary of State for Transport to develop East West Rail
	<b>Embankment</b>	An earthwork construction that allows railway lines to pass at an acceptable level and gradient above the surrounding ground that is generally composed of soil and rock
F	<b>Fare revenue</b>	Income generated from passenger fares
	<b>Fill</b>	Earth and similar material that needs to be placed as part of construction works (for example in new embankments)
	<b>First-mile journey</b>	The first part of a journey between the starting point and a railway station, regardless of its actual length
	<b>Flat junction</b>	A railway junction where tracks cross at the same level. Also known as an at-grade junction
	<b>Floodplain</b>	An area of low-lying ground adjacent to a river, which is subject to flooding
	<b>Ftph</b>	Freight trains per hour
G	<b>Gauging analysis</b>	Analysis to determine the space available (clearance) between a moving train and surrounding infrastructure and between two trains on adjacent tracks
	<b>Generalised journey time</b>	A representation of the total time or cost of travelling, taking account of time spent waiting for or interchanging between trains
	<b>Greenhouse gas (GHG)</b>	A gas that contributes to the ‘greenhouse effect’ because it absorbs infra-red radiation (for example, carbon dioxide)
	<b>Grade-separated junction</b>	A railway junction where tracks cross at different levels
	<b>Great Western Main Line (GWML)</b>	The main railway route between London, Didcot, Bristol and South Wales
	<b>Govia Thameslink Railway (GTR)</b>	Govia Thameslink Railway, a train operating company

	Term	Description
H	<b>Headway</b>	The distance, or time, between one train passing a given point and the following train passing the same point.
	<b>High Level Station</b>	Where a station has platforms at different levels, the parts of the station at the higher level
	<b>Highways England (HE)</b>	The Government body responsible for managing the Strategic Road Network in England
	<b>HMT</b>	Her Majesty's Treasury, a Government Department
	<b>Hotspots</b>	Areas where critical engineering or environmental constraints were identified or areas where there were multiple constraints in close proximity to the alignment being developed
	<b>HS2</b>	High Speed 2, the new railway line under construction between London and the West Midlands, and beyond
I	<b>Impact Risk Zone (IRZ)</b>	A zone around a Site of Special Scientific Interest (SSSI) used to make an initial assessment of the potential risks posed to that Site by development proposals
	<b>Indicative Alignment</b>	The indicative, concept alignment within each Route Option used for the comparison of Route Options A to E in the previous stage of design
	<b>Infrastructure Maintenance Depot</b>	A depot at which staff and equipment involved in maintaining rail infrastructure are based and from which maintenance operations are coordinated
	<b>In-service hazards</b>	A potential source of harm arising from the operation of the railway
	<b>Interchange</b>	A station at which passengers may change between trains serving different routes and destinations
	<b>Island platform</b>	A platform between two railway tracks, where passengers may board trains on either track
K	<b>Km</b>	Kilometres
	<b>Kph</b>	Kilometres per hour

	Term	Description
L	<b>Last-mile journey</b>	The last part of a journey, between a railway station and the final destination, regardless of its actual length
	<b>Level crossing</b>	A location at which vehicles and pedestrians may cross railway tracks at grade (at ground level). This definition includes accommodation crossings which provide access to specific properties; and crossings which are operated by their users rather than automatically
	<b>Level crossing Risk Assessment</b>	An assessment undertaken periodically by Network Rail at level crossings to establish risks and measures required to mitigate those risks
	<b>Listed building</b>	A building placed on a statutory list, because of its architectural or historical interest, in relation to which change is managed by law
	<b>London &amp; North Western Railway (LNWR)</b>	Historic British railway company, the original owner and operator of the West Coast Main Line
	<b>Loading gauge</b>	The maximum height and width for railway vehicles and their loads to ensure that they can pass safely through tunnels and under bridges and keep clear of trackside buildings and structures
M	<b>m</b>	metres
	<b>Maintenance Access Plan</b>	A plan identifying how the railway will be accessed by vehicles and staff for maintenance purposes
	<b>Manually Controlled Barrier (MCB)</b>	A barrier at a level crossing whose raising or lowering is controlled by a signaller, rather than occurring automatically
	<b>Marston Vale Line (MVL)</b>	The existing line and services operating between Bletchley and Bedford
	<b>Ministry of Housing, Communities &amp; Local Government (MHCLG)</b>	UK government department responsible for housing, community and local government matters in England
	<b>Midland Main Line (MML)</b>	The main railway route between London St Pancras, Nottingham and Sheffield

	Term	Description
M	<b>Modal shift</b>	Change in travel behaviour that results in a journey being made by a different, usually more sustainable, mode of transport (for example, a car journey that is now made by cycle)
	<b>Mph</b>	Miles per hour
N	<b>National Infrastructure Commission (NIC)</b>	Executive agency responsible for providing the government with impartial, expert advice on major long-term infrastructure challenges facing the UK
	<b>National Policy Statement for National Networks (NNNPS)</b>	Sets out the need for, and the Government's policies to deliver, development of nationally significant infrastructure projects (NSIPs) on the national road and rail networks in England, and is the primary basis against which the Secretary of State for Transport will assess and determine DCO applications for new railways pursuant to section 104 of the 2008 Act
	<b>Nationally Significant Infrastructure Project (NSIP)</b>	A large-scale development (relating to energy, transport, water, or waste) of national significance that meets the thresholds set in Part 3 of the Planning Act 2008
	<b>Network Rail (NR)</b>	Network Rail Infrastructure Limited, the organisation which owns the majority of the railway infrastructure in England
	<b>Net zero carbon</b>	The approach of balancing greenhouse gas emissions, offsets or carbon sequestration (for example tree planting or carbon capture schemes), to achieve a net zero state
	<b>Non-fare revenue</b>	National Infrastructure Commission
	<b>Non-fare revenue</b>	Income from sources other than passenger fares
	<b>Non-motorised users</b>	People travelling on foot, by cycle or on horseback; or by any other means which is not motorised



	Term	Description
O	<b>Office of Rail and Road (ORR)</b>	A non-ministerial Government department which is the economic and safety regulator for Britain's railways
	<b>Off-line alignment</b>	An alignment that does not follow an existing railway or railway corridor, or in the case of a road, that is diverted from the existing alignment of the road
	<b>Overhead Line Equipment (OLE)</b>	The wires, known as catenary, suspended above railway lines to provide electrical power to trains, and their supporting structures
	<b>On-line alignment</b>	An alignment that follows an existing railway or railway corridor or, in the case of a road, the existing alignment of the road
	<b>Operating costs</b>	Costs incurred in the day-to-day running of the railway
	<b>Operational resilience</b>	The ability of the railway to respond to an adverse event (for example flooding or a failure of the infrastructure) while minimising the level of disruption to normal operations
	<b>Option</b>	In this report, 'option' is used to refer to a possible solution that has been considered and is being taken forward for further design and/or assessment
	<b>Oxford Worcester and Wolverhampton Railway (OWWR)</b>	The railway route between Oxford and Wolverhampton, via Worcester
P	<b>PA 2008</b>	Planning Act 2008
	<b>Passing loop</b>	A section of track used to allow one train to be passed by another train travelling behind it in the same direction
	<b>Performance allowances</b>	Extra time allowed within the timetable to provide a margin for late running
	<b>Permitted Development Rights</b>	Development that may be carried out by certain categories of (for example) statutory undertaker (such as Network Rail) under deemed planning permission ("Permitted Development Rights"), for certain types of work. Permitted Development Rights also benefit other statutory undertakers
	<b>Plain line</b>	A section of track without points/switches and crossings
	<b>Points</b>	A junction between two railway lines, that can be set to guide a train to or from either of those lines. Can also be referred to as a switch

	Term	Description
P	<b>Possession</b>	A temporary closure, or partial closure, of the railway to allow construction or maintenance works to be carried out
	<b>Preferred Route Option E</b>	The Route Option previously selected as the preferred area between Bedford and Cambridge in which to seek alignments in this phase of developing the Project
	<b>Preliminary Environmental Information Report (PEIR)</b>	A report which provides information about the expected impacts of the Project on the environment based on information that EWR Co has available to it at the time of the Statutory Consultation
	<b>Programme-Wide Output Specification (PWOS)</b>	A document containing detailed requirements for the Project, agreed with the Department for Transport
	<b>Programme risk</b>	The risk of a delay to the programme for design, procurement, construction and operation for a project
	<b>The Project</b>	The infrastructure, systems, rolling stock and organisational arrangements which need to be created or modified to deliver East West Rail and its intended outcomes
	<b>Project Section</b>	The infrastructure, systems, rolling stock and organisational arrangements which need to be created or modified to deliver East West Rail and its intended outcomes
	<b>Public Rights of Way (PRoWs)</b>	A way over which the public have a right to pass and repass
R	<b>Reference Alignment</b>	The alignment option against which the performance of other alignment options is assessed
	<b>Regionally strategic utilities apparatus</b>	Equipment related to the supply of power, water and telecommunications which has more than local significance – which may include pipelines, cables, overhead electricity transmission lines and substations
	<b>Rolling stock</b>	Any vehicle which can run on a railway track

	Term	Description
R	<b>Route Corridor, Route Option and Route Alignment</b>	<p>Route Corridors are the broad areas within which the new railway might be located, identified as part of the initial ‘sift’ of possibilities in 2016.</p> <p>Within the preferred Route Corridor, several narrower Route Options were identified and a Preferred Route Option was announced in 2020.</p> <p>The Project is now at the stage of selecting a Route Alignment.</p>
S	<b>Safety risk</b>	The risk of unsafe practices or situations occurring on the railway that may lead to accidents
	<b>Scheme</b>	A project or a group of projects being promoted or undertaken by a party or parties other than EWR Co with objectives which do not directly facilitate, but may be related to, East West Rail
	<b>Scheduled monument</b>	A historic building or site considered to be of national importance, placed on a list kept by the Government and requiring Government approvals for any works which might affect the scheduled monument
	<b>Siphon</b>	A pipe or tube that allows water to flow beneath an obstruction then up and out the other side
	<b>Shepreth Branch Royston (SBR) line</b>	The line that connects Cambridge to Hitchin via Shepreth
	<b>Skew</b>	The angle at which a structure passes over or under a railway, road or river
	<b>Source Protection Zone (SPZ)</b>	SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction
	<b>Site of Special Scientific Interest (SSSI)</b>	The land notified as an SSSI under the Wildlife and Countryside Act 1981, as amended. SSSI include the most important sites for wildlife and natural features in England, supporting many characteristic, rare and endangered species, habitats and natural features

	Term	Description
	<b>Stabling point</b>	A place where rolling stock can be stored when not in service
	<b>Statutory Consultation</b>	A stage of consultation which a promoter of a nationally significant infrastructure project is required to undertake, under section 42 the Planning Act 2008
	<b>St Neots South Option A Station</b>	Option for a new station in the St Neots area. Both St Neots station options would be located to the south of St Neots. This would be in addition to the existing St Neots station
	<b>St Neots South Option B Station</b>	Option for a new station in the St Neots area. Both St Neots station options would be located to the south of St Neots. This would be in addition to the existing St Neots station
	<b>Subcatchment divide</b>	Topographic ridge or ridges that separate distinct tributary areas in a river catchment
	<b>Switch</b>	A junction between two railway lines, that can be set to guide a train to or from either of those lines. Can also be referred to as points
T	<b>Tempsford Option A Station</b>	Option for a new station in the Tempsford area. Both Tempsford station options would be located to the north-east of Tempsford
	<b>Tempsford Option B Station</b>	Option for a new station in the Tempsford area. Both Tempsford station options would be located to the north-east of Tempsford
	<b>Thameslink</b>	Train operator running services between the south coast of England, Bedford and Cambridge
	<b>Thameslink Core</b>	The part of the Thameslink route between London St Pancras and London Blackfriars station
	<b>The 2005 Act</b>	The Railways Act 2005
	<b>The 2020 Order</b>	The Network Rail (East West Rail) (Bicester to Bedford Improvements) Order 2020 – a TWAO obtained by Network Rail authorising works to the railway to enable EWR services to run between Oxford and Milton Keynes
	<b>Tph</b>	Trains per hour

	Term	Description
T	<b>Train path</b>	The planned timing and route of a train
	<b>Turn around allowance</b>	Time allowed within the timetable for trains to be prepared after completing one service before commencing another service
	<b>TWA 1992</b>	Transport and Works Act 1992
	<b>Transport and Works Act Order (TWAO)</b>	A Transport and Works Act Order made by the Secretary of State under the TWA 1992 alongside a deemed planning permission, allowing works to a railway or other transport project to be undertaken
U	<b>Utility company</b>	A company that owns equipment which carries and distributes water, electricity, gas or telecommunications. These commodities are collectively known as ‘utilities’
W	<b>West Anglia Main Line (WAML)</b>	The main railway route between London Liverpool Street and Cambridge
	<b>West Coast Main Line (WCML)</b>	The main railway route between London Euston and Glasgow
	<b>WLC</b>	Whole Life Costs
	<b>WTT</b>	Working Timetable

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# 08.

## Project Section C: Bedford

### 8.1 Chapter summary

**8.1.1. This Chapter describes the proposals for the section of the Project between Bedford St Johns station and Clapham Green, where the new railway would connect to the existing Midland Main Line (MML).**

**8.1.2. After introducing the broad scope of the proposals and some of the important challenges in this area, this Chapter explains the proposals in the Bedford St Johns area. Here EWR Co proposes to provide at least two tracks (one in each direction). Two options have been developed, both of which include the relocation of Bedford St Johns station. This Chapter explains those options and how they have been developed. It also provides an initial review of the options based around key Assessment Factors. Both options will be investigated further following consultation feedback.**

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**8.1.3. At Bedford station, new platforms, a new station building and new access works are required to provide the capacity for EWR services in addition to existing services, which may entail reconfiguration of train stabling areas between Bedford St Johns and Bedford stations. This Chapter describes the existing station and its surroundings together with the constraints and opportunities that these present. It explains that EWR Co has considered a number of concepts and describes an emerging preferred option for a station to the north of Ford End Road, which EWR Co considers is deliverable as part of the Project.**

**8.1.4. The Chapter also describes the options which have been considered in the North Bedford area, north of Bedford station, where EWR Co has explored how the existing railway is likely to need to be modified to provide for EWR services. The Chapter explains that options which retain the existing four tracks, or provide one or two additional tracks, have been considered. It sets out a summary of each option and provides a comparison between options using the Assessment Factors. It concludes that the preferred option in this area is to provide two new tracks to the east of the existing four tracks; EWR services would use these two new tracks.**

**8.1.5. The alignment of EWR through Bedford is the result of the need (a) to upgrade the Marston**

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**Vale Line as described in the preceding Chapter of this Report and (b) the selection of Route Option E as the preferred route option for further development. You can read about the selection of Route Option E in the Preferred Route Option Report . This Chapter looks at the way the Project would be developed in Bedford, including impacts on properties which EWR Co has identified as a result of the further work undertaken following selection of the Preferred Route Option.**

**8.1.6. Routing EWR through the centre of Bedford and Bedford station was identified as resulting in greater transport user benefits than Route Options that do not serve Bedford station. However, these routes would require the demolition of a number of residential and commercial properties due to the expansion of the current railway boundary north of Bromham Road (see section 8.4 below). This greater detail has emerged since the decision to select Route Option E as the preferred route option in 2020 - at that time, it was not known that EWR services would require additional tracks north of Bromham Road. Consequently, EWR Co considered whether this indicates that the route option decision remains valid. EWR Co's conclusion is that identifying Preferred Route Option E remains sound because:**



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- i. A route to the South of Bedford would require a combined MML interchange at Wixams on the Route Options passing to the south of Bedford, which would also require the demolition of residential and/or commercial property;**
  - ii. It remains the case that the transport user benefits and connectivity opportunities of a single interchange point between MML, GTR and EWR services at Bedford Midland would not be secured; and**
  - iii. Route Options to the south of Bedford would still encounter a number of significant and complex constraints, such as the former clay and gravel pit workings, floodplains and other sensitive receptors including ecological receptors, whereas Route Options via Bedford Midland do not have these interactions.**

## 8.2. Introduction

8.2.1. The Marston Vale Line approaches Bedford from the southwest, crosses below the MML and passes through Cauldwell before curving north via Bedford St Johns station and connecting into a terminating bay platform on the eastern side of Bedford station.



Figure 8.1: Bedford Section

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- 8.2.2. To meet the Project Objectives, improvements need to be made to the section of the Marston Vale route to the south of Bedford station, to Bedford St Johns and Bedford stations and to the MML to the north of Bedford station, which is shown in Figure 8.1.

## **Benefits**

- 8.2.3. As detailed in Chapter 5, the Secretary of State announced Route Option E as the Preferred Route Option on 30 January 2020. One of the key reasons for this decision was that ‘by serving Bedford station it provides easy connectivity into Bedford town centre and supports plans to regenerate Bedford’. Route Option E could provide greater support for growth and regeneration in Bedford in line with Bedford Borough Council’s aspirations.
- 8.2.4. Bedford station would provide an interchange for EWR services with Thameslink and East Midlands Railway (EMR) services.

## **Challenges**

- 8.2.5. The design of EWR through Bedford is constrained by numerous features including the existing railway, residential and commercial properties, the River Great Ouse, areas of woodland, highways and car parks, utility apparatus and several bridges. Whilst EWR Co is seeking to minimise impacts on communities and the environment, as set out in the Project Objectives, it is likely that there would need to be some impacts to achieve the benefits noted above.
- 8.2.6. The design of EWR through Bedford is constrained by numerous features including the existing railway, residential and commercial properties, the River Great Ouse, areas of woodland, highways and car parks, utility apparatus and several bridges. Whilst EWR Co is seeking to minimise impacts on communities and the environment, as set out in the Project Objectives, it is likely that there would need to be some impacts to achieve the benefits noted above.
- 8.2.7. Within the Bedford Urban Area, it may be necessary to acquire and potentially demolish some residential and commercial properties. The proximity of EWR to buildings could cause potential disturbance effects associated with noise and vibration, and air quality. Bedford town centre Air Quality Management Area is an important consideration in the consenting process if the Project would affect the area’s ability to be compliant with the Air Quality Directive.



8.2.11. The MML Upgrade Project has enabled an increase in EMR services through Bedford from five to six trains per hour in each direction from May 2021<sup>60</sup>. Therefore, the existing passenger service on the MML passing through Bedford when the EWR service is introduced is anticipated to comprise six EMR trains every hour in each direction between Yorkshire, the East Midlands and London. Of these, two trains every hour would stop at Bedford Station. The layout of the current platforms and the tracks to the north and south of the station is such that the two southbound trains stopping at Bedford Station every hour can only access an available platform by changing from the Southbound Fast line to the Northbound or Southbound Slow line about a mile north of the station at Bedford North Junction, using up valuable capacity in doing so.

8.2.12. As part of the MML Upgrade Project, Network Rail has installed an additional track north of Bedford between Sharnbrook Junction and Kettering South Junction. This has increased the capability of the Bedford to Kettering section of the MML to an average of three freight trains per hour in each direction<sup>61</sup> over an 18 hour operating day. Currently there are timetabled paths for two freight trains per hour in each direction in the off-peak and one in the peak.

8.2.13. The majority of the freight demand on the MML is currently heavier, slower Class 6 aggregates traffic rather than lighter, faster Class 4 intermodal traffic. Class 6 aggregate freight trains pose a greater challenge to the ability of the railway to fit freight paths within a reliable passenger service.

<sup>56</sup> <https://www.networkrail.co.uk/wp-content/uploads/2019/11/Network-Statement-2021.pdf>

<sup>57</sup> <https://www.networkrail.co.uk/wp-content/uploads/2020/12/Midland-Main-Line-Congested-Infrastructure-Capacity-Analysis-240315.pdf>

<sup>58</sup> <https://www.networkrail.co.uk/wp-content/uploads/2020/12/Midland-Main-Line-Congested-Infrastructure-Capacity-Enhancement-Plan-240915.pdf>

<sup>59</sup> <https://www.networkrail.co.uk/running-the-railway/our-routes/east-midlands/midland-main-line-upgrade>

<sup>60</sup> <https://www.networkrail.co.uk/running-the-railway/our-routes/east-midlands/midland-main-line-upgrade/midland-main-line-upgrade-plan-bedford-to-kettering/>

<sup>61</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/941566/London-to-Corby-land-acquisition-and-bridge-works-act-order-inspectors-report-accessible.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/941566/London-to-Corby-land-acquisition-and-bridge-works-act-order-inspectors-report-accessible.pdf)

## 8.3. Bedford St Johns

### Introduction

8.3.1. The station at Bedford St Johns is a single platform that is served by a single track. This constrains capacity. The tight curvature to the south and through the station limits train speeds to 15mph. The station itself does not currently offer the customer experience to which EWR aspires, lacking modern facilities and adequate access provisions. These characteristics of the track layout result in a significant limitation on capacity and journey time, which is not consistent with the Project Objectives, which require the provision of a minimum of two tracks between Oxford and Cambridge to achieve the EWR business case outcomes.

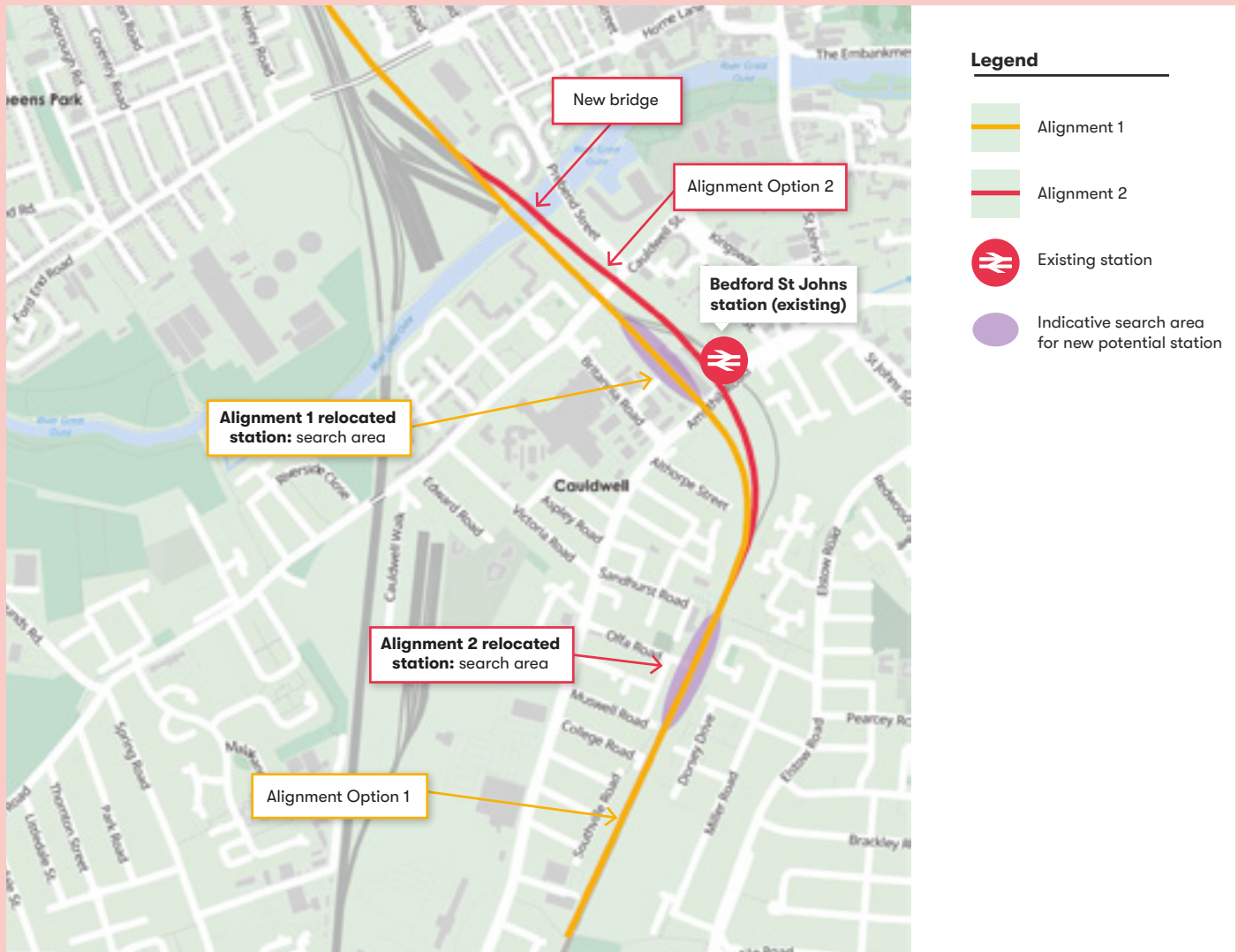


Figure 8.3: Bedford St Johns area

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## Option development

- 8.3.2. Design development work has focused on providing a minimum of a twin track railway through the area between the Ampthill Road – Elstow Road pedestrian link and Cauldwell Street bridge with a minimum line speed of 30mph, which is required to achieve the Project's overall journey time, set out in the PWOS. A twin track railway is needed to avoid conflicting train movements and to ensure that the Project is capable of meeting the Project Objectives. Designs for a future station have also sought to ensure appropriate functionality in line with those Objectives.
- 8.3.3. All options that have been developed require the relocation of Bedford St Johns station and locations close to the existing one have been sought, with a sufficiently long straight section of track required to enable the provision of a new station which meets the Project Objectives. The proposed sites for the relocated station are on straight sections of track to improve boarding and alighting from trains and reduce the risk of accidents when compared to a curved platform.
- 8.3.4. The Assessment Factors that drive the better performing Route Alignment Options include Transport User Benefits and Environmental Impacts (reflected by line speed potential), capital costs (reflected by the ability to utilise existing structures, for example), and Consistency with Local Plans (manifested by station location/opportunities for development). Positions for station locations vary depending on the Route Alignment option.
- 8.3.5. Key considerations in developing solutions are set out below followed by an indicative assessment of the emerging options.

## Alignment and speed

- 8.3.6. In developing options, an attempt has been made to keep the proposed alignment within the corridor bounded by the old railway to Hitchin (currently a car park adjacent to the hospital) and the existing Marston Vale Line alignment. This approach enables a maximum speed of 40mph to be achieved. An alignment which achieves greater speed - up to 60mph - requires a move further east under Cauldwell Street. It should also be noted, however, that the higher speeds may not be achievable by trains needing to stop at Bedford St Johns station.



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## Bridges

- 8.3.7. At this stage of the design, Cauldwell Street Bridge is assumed to require reconstruction in all cases since the clearance under this structure is very limited. Even without any consideration of electrification, clearances are tight and track lowering to achieve non-electrified clearances is unlikely to be practical because track levels are constrained by the need to achieve the same level as the river bridge. In any reconstruction, to meet modern standards, electrical clearances for potential future electrification would require a substantial raising of the road surface.
- 8.3.8. Ampthill Road Bridge (over the old Hitchin rail alignment) comprises several spans currently providing means of access to a car park, which could be used to take an improved EWR alignment through. The current bridge is expected to accommodate the required clearances for any overhead electrification. This will be verified with surveys and clearance assessment. Should the alignment require a new span of the bridge to be constructed, then full electrical clearances to modern standards would be required, and the road profile would have to be raised.
- 8.3.9. Subject to asset condition assessments, the existing bridge over the River Great Ouse could be reused to support the Hitchin Alignment option (40mph). The faster line speed alignment (60mph) would require a new river bridge; such a bridge would need to have a shallow construction depth to maintain a walkway along the north bank of the river and to ensure that the river remains navigable.

## Station locations

- 8.3.10. A number of alignment and station location possibilities were investigated. Some were discounted due to them failing to meet the Project Objectives. These included a station location north of Cauldwell Street on a 55mph alignment, which was concluded to be unaffordable. An option for a fast alignment with no station at Bedford St Johns was also considered but was ultimately felt to be unacceptable because removing the station would degrade public transport services in this part of Bedford. The outline feasibility work resulted in two potentially viable options emerging and the advantages and disadvantages of each are summarised below.
- 8.3.11. A 40mph alignment that follows the old Hitchin railway alignment is compatible with a relocated St Johns station between Cauldwell Street and Ampthill Road. The station would be close to the hospital ("Hospital Station"). It would also maximise the area available for development and could be integrated into new facilities, creating additional development value. This station could provide the opportunity to consolidate the urban structure by providing a focal point for the area, becoming the catalyst for change and placemaking. It would be critical for the success of the area to overcome the severance produced by integrating the access to the platforms with the adjacent development, resulting in wider benefits to the community.
- 8.3.12. A faster alignment would not enable sufficient space between Cauldwell Street



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and Ampthill to allow for platforms that are capable of future extension to accommodate eight-car trains. Relocation to the north under Cauldwell Street and towards the river has been investigated. This location has been concluded to be inappropriate as it is closer to Bedford station (therefore with limited transport benefits), would severely impact Cauldwell Street and a consequent reconstruction of the road junction would be required. The complexity involved in constructing a station in this location would make it very unlikely to be affordable and therefore it could not meet the Project Objectives since it would be unlikely to be constructed. A station at this location would also be less of a catalyst to development, as a larger portion of land would be occupied by the railway and road infrastructure.

- 8.3.13. Alternatively, a station could be located on the straight section of track immediately south of the realignment works, close to the Elstow Road - Ampthill Road pedestrian link over the railway ('St Johns South'). This station would serve a larger existing residential area to the south, between Elstow Road and Ampthill Road. There is an existing pedestrian link between these roads which crosses the railway on a footbridge. This footbridge could be replaced and enhanced to provide access to platforms either side of the track within the existing railway corridor. The site is moderately convenient for the hospital and a pedestrian/cycle link could be provided to any new development in the St Johns area.

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## Options considered

### Bedford St Johns option 1: Hitchin alignment (Hospital station)

#### Summary of option

8.3.14. As shown in Figure 8.4, in this option the alignment would run beneath Ampthill Road and Cauldwell Street, and across the river, all utilising existing bridges (although Cauldwell Street Bridge is likely to need to be reconstructed due to insufficient headroom clearances) and would provide a new station with platforms that can be extended in the future between Ampthill Road and Cauldwell Street.

8.3.15. Key characteristics of this option are that it:

- Achieves a line speed of 40mph, which exceeds the 30mph minimum objective and is a substantial improvement compared to the current maximum speed of 15mph;
- Provides a replacement Bedford St Johns station close to the existing location;
- Enables station access to be accommodated off Britannia Road and/or a new development;
- Offers good land development opportunities north and south of Ampthill Road.

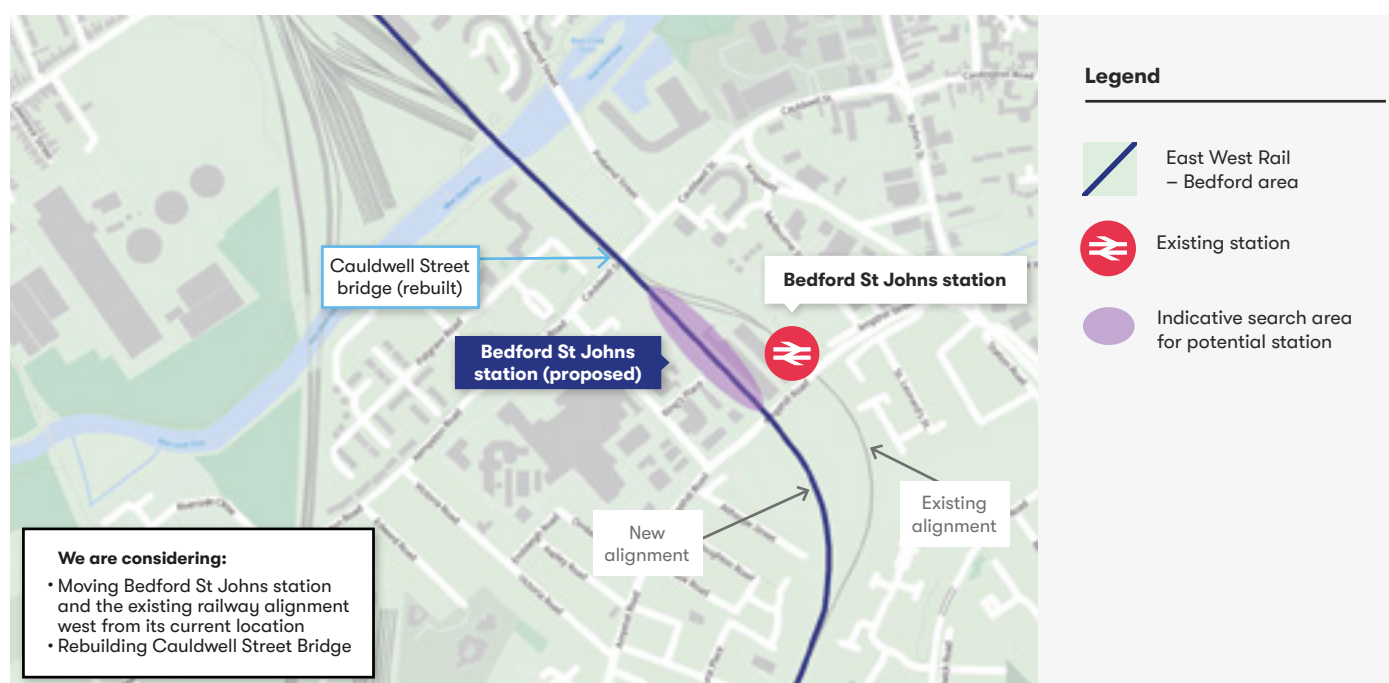
#### Station opportunity

8.3.16. The area south of the River Great Ouse is identified by the Bedford Town Centre Masterplan (Bedford central town masterplan report, Bedford Borough Council June 2020) for intensification, and the proposed new station location is surrounded by areas subject to grant of planning permission(s) for development to take place. This proposed location would also promote the use of public transport to/from the existing hospital, which is adjacent, and help to reduce car dependency. The construction of the new station would also unlock the development potential of the area and become the catalyst to consolidate the existing nature of the urban structure, providing the opportunity to reduce the surface car parking in the area.

8.3.17. The choice of platform types immediately north of Ampthill Road depends on how the station would connect with the local environment. Side platforms would provide a softer barrier between the railway and the surrounding area. On one side there would be access to Bedford Hospital. Further hospital expansion towards the station with the introduction of a multi-storey car park, potentially, could provide a direct linkage between the station and the hospital. On the other side of the railway, the side platform could be integrated into any development proposals, with station access being either at ground level or via a footbridge.

8.3.18. An alternative of an island platform would give the opportunity to provide direct station access off Ampthill Road, only metres away from the access to the existing Bedford St Johns station.

Figure 8.4: Bedford St Johns Option 1 – Hitchin Alignment



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## Development opportunity

- 8.3.19. This alignment opens up the maximum amount of space for development to the east and northeast of the alignment by moving the railway to the western edge of the redevelopment land. However, it should be noted that the northern part of this area is in the flood risk zone for the River Great Ouse.

## Construction issues

- 8.3.20. The alignment would diverge from the existing railway (heading north) into mostly current car parking areas, industrial sites and some wooded areas. The area has been identified in the Local Plan for redevelopment, but some property and existing car parking would be likely to be required to construct the railway.
- 8.3.21. The alignment makes use of the existing Ampthill Road overbridge, which used to pass over the old Hitchin railway. Initial dimensional checks suggest that it should be possible to retain the bridge without any major structural modifications.
- 8.3.22. The alignment would then tie back into the existing railway just south of the Cauldwell Street overbridge. Initial dimensional checks here show that there is insufficient headroom to retain the bridge in its present state to accommodate the required electrical clearances as track lowering would not be feasible due to the proximity of the river, meaning that it would need to be rebuilt at a higher elevation. Reconstruction of the bridge may be possible in phases since it currently has four traffic lanes so it may be possible to demolish and rebuild it in sections and keep a lane open in each direction. However, the significant lift required would affect the Prebend Street and Britannia Road junctions which are only 50m and 70m respectively from the bridge, although the detailed impacts will need to be investigated during the next stage of project development.
- 8.3.23. Site access could be provided by making use of the existing industrial complex access ramp from Ampthill Road, or via Britannia Road, though this latter option may be disruptive to Bedford Hospital. Any car parking lost to the Project could potentially be mitigated by the construction of a multi-storey car park.
- 8.3.24. The works for the new EWR alignment would be largely offline from the existing railway, with the impact on the existing line limited to the location of tie-ins. The programme for this section of works is likely to be driven by the replacement of the Cauldwell Street overbridge, especially if the bridge always needs to have two lanes maintained. There may also be other programme constraints if there are roadworks planned on surrounding roads and the overall traffic management of the area would need to be co-ordinated carefully.

## Summary of option

8.3.26. Key characteristics of this option are that it:

- 8.3.27. This option represents the alignment which can provide the fastest speeds achievable in this area whilst still providing a station close to the existing Bedford St Johns location.

The map displays the Bedford St Johns area with a proposed new railway alignment (blue line) running through it. Key features include:

- New railway bridge:** A blue line crossing the River Great Ouse.
- Cauldwell Street Bridge (rebuilt):** A blue line crossing the River Great Ouse.
- Bedford St Johns station (existing):** A red circle with a white railway symbol.
- New alignment:** A blue line running through the area.
- existing alignment:** A grey line running through the area.
- Bedford St Johns station (proposed):** A blue rectangle with white text.

**We are considering:**

- Moving Bedford St Johns station to the south west of its current location
- Adjusting its existing alignment
- Rebuilding Cauldwell Street Bridge
- Building a new railway bridge over the River Great Ouse

**Legend**

- East West Rail – Bedford area
- Indicative search area for new potential station
- Existing station

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## Station opportunity

- 8.3.28. There is no location on this Route Alignment option between Cauldwell Street and Ampthill Road where a sufficiently long straight section is available to accommodate a platform. A location for the station north of Cauldwell Street would be too complex and challenging to construct. The only place in the area where a station could be located would be on the straight section of railway immediately to the south and west of the realignment, in the more residential area to the south of the existing St Johns station, between Ampthill Road and Elstow Road.
- 8.3.29. Locating the station in this residential area would provide the opportunity to increase the catchment for the population heading towards Bedford, promoting a more sustainable form of travel. However, it is a less convenient location for access to the hospital and, importantly, the proposed development area between Cauldwell Road and Ampthill Road, where there would be the potential for greater integration. It is also located a further distance from the south side of Bedford Town Centre and the local schools, which are currently an important source of traffic for the Marston Vale Line.

## Development opportunity

- 8.3.30. This alignment cuts through the middle of the development area identified between Ampthill Road and Cauldwell Street, which would be further depleted by the need to realign Cauldwell Street well to the south of its current location to accommodate the realigned railway.

## Construction issues

- 8.3.31. As with Option 1, the Option 2 alignment diverges from the existing railway (heading north) into areas currently used for car parking, industrial sites and some wooded areas. The area has been identified in the Local Plan for redevelopment, but some property and existing car parking is likely to be required to construct the railway, although less of the car parking area is expected to be required than for Option 1.
- 8.3.32. The alignment would require a new overbridge to carry Ampthill Road over the railway. Even though Ampthill Road is elevated on an embankment at this location, the road level is likely to need to be lifted substantially to provide modern electrical clearances for any future overhead electrification. In addition, Ampthill Road might be able to be diverted locally around the site of the new bridge, partly through the hospital car park extension to the south, whilst the bridge was constructed. The alternative would be to close Ampthill Road during the works.
- 8.3.33. The alignment also requires a new overbridge to replace Cauldwell Street Bridge. The new alignment is very close to the junction of Cauldwell Street and Prebend Street and the road would not be able to continue on its current alignment. A new alignment would head southeast from the junction – effectively extending Prebend Street – rising until it could cross the new alignment and then drop down to connect back into either Cauldwell Street or Britannia Road. The new alignment

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would involve additional land take and adds significant complexity to the Project.

8.3.34. This alignment crosses the River Great Ouse on what would need to be a new bridge over the river, east of the existing rail bridge, before tying back into an alignment to reach Bedford station. The Bedford Siding Footbridge would also need to be demolished and rebuilt.

8.3.35. Phasing of works for the new alignment would be centred around the three new bridges. The bridge over the river could proceed independently of the two other bridges, which would need to be synchronised with respect to overall traffic flow. There would be impacts on the existing railway line operation at the tie-ins at each end, and where the new alignment crosses the existing railway. The construction of a new station on the existing alignment south of St Johns station would also create some disruption and would be close to residential properties.

### **Comparison of options**

8.3.36. An initial review of the Route Alignment designs for the Bedford St Johns area resulted in two emerging options, that either maximise the use of existing infrastructure and development opportunities (Option 1) or maximise route speed and transport benefits (Option 2). These two options were developed further to enable a more detailed assessment and can be compared as follows in respect of their performance against the Assessment Factors. There are other

variations around these options which will be considered as designs are refined and optimised and a preferred option selected at the next stage of project development.

8.3.37. The following Assessment Factors have been the focus as they are likely to be the principal differentiators between the Bedford St Johns area Options 1 and 2:

- Transport user benefits;
- Capital costs;
- Environmental impacts and opportunities; and
- Consistency with Local Plans.

### **Transport user benefits**

8.3.38. Option 2 offers the potential for higher speeds of 60mph, compared to the maximum 40mph delivered by Option 1 due to the remaining curved track geometry. This would translate into quicker journey times and therefore greater transport benefits, although even the 40mph offered by Option 1 represents a major improvement compared to the existing 15mph speed restriction through the area. Moreover, it is unlikely that the highest speeds would be achievable when trains are required to stop at a station in the area. Therefore, whilst Option 2 performs better in respect of journey times and transport user benefits, both options perform well against this Assessment Factor and need to be considered within the wider context.

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## Capital costs

- 8.3.39. Option 2 would be significantly more complex and disruptive to construct than Option 1 and would therefore incur a higher capital cost. Construction would also be more disruptive to the operation of the railway since most of Option 1 can be built off-line, whereas Option 2 is likely to require more extensive railway closures. Construction would also be more disruptive to the operation of the railway since most of Option 1 can be built off-line, whereas Option 2 is likely to require more extensive railway closures.
- 8.3.40. In Option 2, the Cauldwell Street/Prebend Street junction remodelling would be very challenging and be likely to require road closures during construction. The Ampthill Road works might not be as disruptive if a temporary local realignment of the road could be achieved. In Option 1, Cauldwell Street reconstruction will still be challenging, but there is a little more room for manoeuvre than with Option 2 and it is currently expected that Ampthill Road would be largely unaffected by the works in Option 1.
- 8.3.41. The new bridge over the River Great Ouse would be a challenging and costly element of Option 2 and would not be needed in Option 1.
- 8.3.42. In summary, Option 1 would be a substantially less expensive and more affordable option overall.

## Consistency with local plans

- 8.3.43. By making use of existing bridges, in addition to reducing the capital cost, Option 1 would maximise the size of the development area site to the north east of the alignment that is included in the Local Plan, whilst providing good access from the relocated station to the hospital and offering integration opportunities with future developments. Option 2 performs less well in this regard as the relocation of Cauldwell Street Bridge and realignment of the local roads would reduce the land available for development. Furthermore, a station to the south and in a residential area, would not be as advantageous in supporting development in the Local Plan.

## Environmental impacts and opportunities

- 8.3.44. Both alignments and stations would have limited environmental impacts on the locality in respect of additional noise and visual intrusion. However, Option 1, with a relocated station near the hospital would have the opportunity to be integrated into new developments, which would help to mitigate the impact. Alternatively, a station to the south in Option 2, would require construction within an existing residential area and the construction of a new bridge over the River Great Ouse would be likely to have more of an environmental impact in terms of residential amenity and the river environment respectively.



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## Summary

8.3.45. Option 1 with a station located between Ampthill Road and Cauldwell Street performs better in respect of capital costs, consistency with local plans and environmental impacts, based on the work undertaken to date. It is a more affordable option. However, Option 2, with a station located close to the Ampthill Road – Elstow Road Pedestrian Link bridge also meets the Project Objectives, remains potentially viable, and offers different benefits to the local area.

8.3.46. Option 1 is EWR's emerging preferred option, but further investigation of both options will be undertaken during the next stage of development following consultation feedback and development of the timetable.

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## **8.4. Bedford station**

### **Introduction**

#### **Current situation**

- 8.4.1. After Bedford St Johns station and then crossing the River Great Ouse, the Marston Vale Line presently heads north into Bedford station, weaving as a single track railway between the existing and extensive Thameslink train stabling sidings and a Network Rail Maintenance Delivery Unit (which uses a historic Midland Railway grain store) and then underneath Ford End Road Bridge into a bay terminating platform (Platform 1A) or the southbound MML platform (Platform 1). The railway curvature limits train speeds and the single line constrains capacity, whilst the current railway and platform configuration in the station is limited in flexibility and insufficient to allow an increase in service levels and through service opportunities for EWR.
- 8.4.2. The station itself is located to the west of Bedford town centre, to the west of a low-rise residential area (see Figure 8.6, which depicts a map of the Bedford station area). The station building footprint is limited by the rail corridor to the west, which crosses Bedford in a north-south direction. The station is surrounded by existing roads and properties and further expansion beyond the railway boundary is constrained. South of Ford End Road bridge, the area is dominated by Thameslink sidings and is limited by the River Great Ouse. Between the rail corridor and Ashburnham Road on the eastern side of the station, most of the area is currently occupied by the station, the small transport interchange and both public and rail staff car parks.
- 8.4.3. Nevertheless, the total area occupied by the rail infrastructure and its facilities is significant, as it includes Bedford station, station car parking, Thameslink sidings, the Thameslink staff car park, and the Network Rail Maintenance Delivery Unit and its car parking. This area of land provides significant opportunity for the upgrade of the railway and improvements to the station to enable the implementation and operation of EWR, to improve the connection between the station and the town centre and to improve both east-west and north-south active travel connectivity.

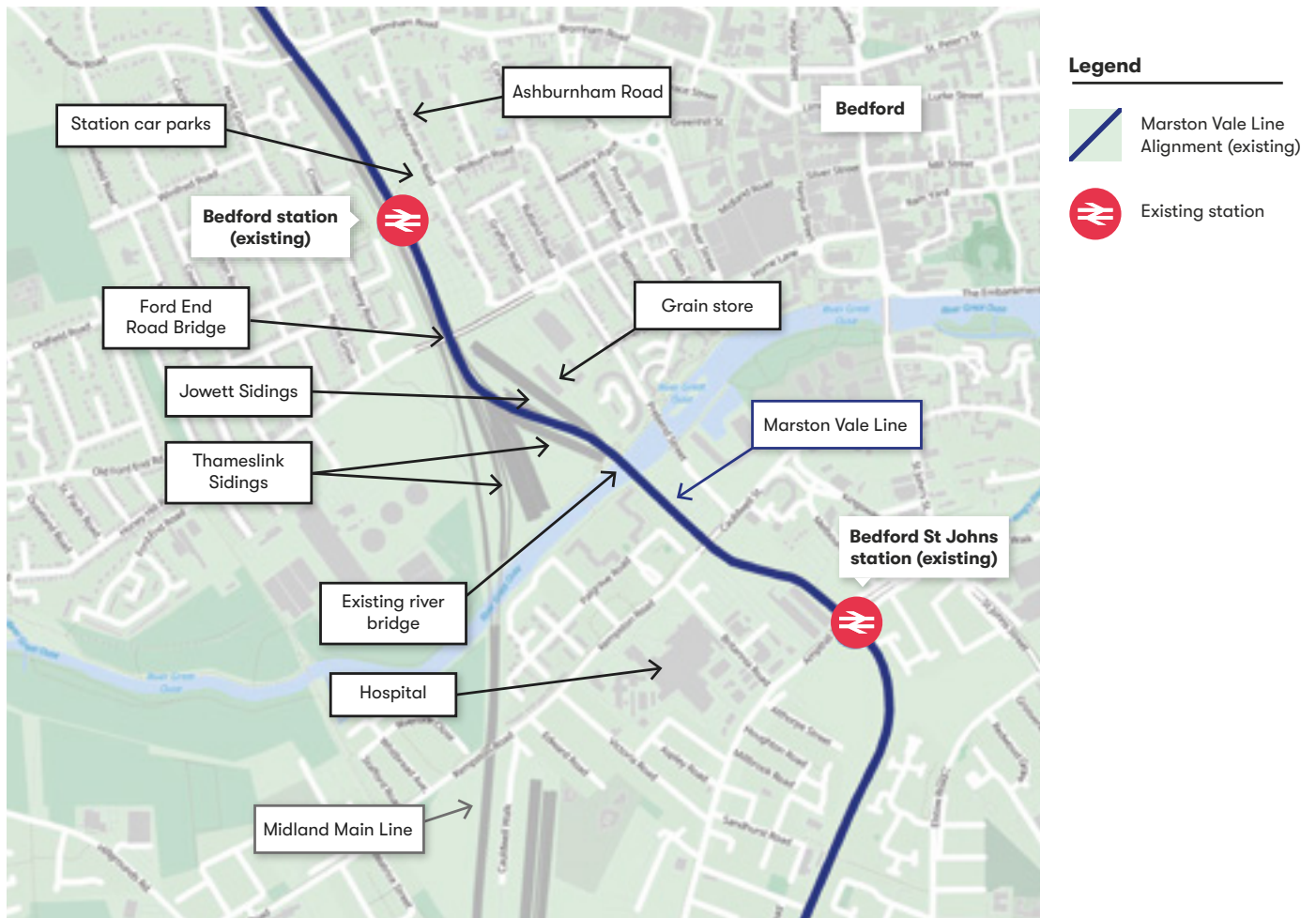


Figure 8.6: Bedford station area

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## **Station context: connectivity, river and town centre relationship**

- 8.4.4. The relationship between the station and the town centre is currently very weak. The station is located off Ashburnham Road, at the back of a low-rise residential area. There is no direct, vibrant and pedestrian-friendly route from the station to the town centre, with the urban fabric acting as a barrier, and most of the public transport network not directly serving the station.
- 8.4.5. Ford End Road Bridge does provide some east-west connectivity, although the bridge is narrow, and a separate pedestrian bridge is provided to the north since the original bridge is not wide enough to accommodate a footpath. The nature of Ford End Road overbridge – a series of brick arches – and the road network configuration around the station, act as a barrier to north-south connectivity in the area. The area surrounding the station is mostly given over to car parking for both passengers and railway staff. All car parking is at surface level which gives the current station area a suburban and vehicle-dominated landscape and character. Changes to the station design could create opportunities for passenger growth through better multimodal integration, but it will be important to ensure that sufficient convenient car parking is provided to facilitate access to the railway.
- 8.4.6. Whilst Network Rail land spans from Bromham Road to the north bank of the River Great Ouse, there is no direct connection to the river from the station as the current rail sidings and Maintenance Delivery Unit block any north-south connectivity. There is an existing east-west cycle and pedestrian route along the north bank of the river that crosses the Thameslink tracks via an underpass, and the Marston Vale Line tracks via an overbridge and a new pedestrian bridge that crosses to the south bank of the river to new developments. The active travel route along the river is part of a network and a priority for Bedford Borough Council. The option of linking it directly to the station would be beneficial for active travel in the area and improve long-term sustainability.
- 8.4.7. Because the existing terminus of services on the Marston Vale Line is at a bay platform, and because the existing station building is located where EWR would pass closest to the MML, it is logical to consider a new station configuration because the existing station configuration would be affected by EWR. In any event, new platforms and a new station building and frontage would be required to provide the capacity for EWR. This creates the opportunity to support the regeneration of the surrounding area and the unlocking of development land that would help to consolidate the expansion of the town centre in its relation to the river front. It would also enable the connectivity of the station area to be improved for public transport, cyclists and pedestrians.
- 8.4.8. The existing alignment and connection of the Marston Vale Line into Bedford station provides several key constraints and opportunities in developing solutions. These are

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summarised as follows:

- Marston Vale Line river bridge;
- Thameslink Sidings and Grain Store;
- Ford End Road Bridge; and
- Other operators' platform requirements.

8.4.9. In considering these constraints and opportunities, a number of concepts have been developed for the Bedford station area, comprising variations on railway alignment and station layout.

8.4.9. In considering these constraints and opportunities, a number of concepts have been developed for the Bedford station area, comprising variations on railway alignment and station layout.

8.4.11. The following section explains how the constraints and opportunities have shaped the two concepts. The proposed North Concept as well as the South Concept one is then presented in further detail.

## **Constraints and opportunities**

### **Marston Vale Line river bridge**

8.4.12. The existing bridge spanning the River Great Ouse carries the Marston Vale Line railway and provides access to the Jowett Sidings, located immediately north of the river crossing on the eastern flank of the railway which provides important stabling for five 12-car Thameslink trains. This means that the bridge carried two railway lines although only one is currently used for Marston Vale Line services.

8.4.13. Reusing the bridge for the double-

track EWR and retaining the Jowett Sidings would compromise the alignment of the EWR tracks, reducing line speed and would also undermine the independence of operations for both EWR and Thameslink, as Thameslink empty coaching stock would have to use the EWR lines to access the sidings and reverse on the running line. EWR Co's preferred alignment for the EWR tracks currently, therefore, cuts through the Jowett Sidings, meaning they must be relocated. EWR Co recognises the impact that this would have on Thameslink operations and will work closely with the Operating Company and Network Rail to find a solution which is acceptable to them. A number of potential possibilities for relocating the sidings have been identified and further development work is required to determine an appropriate solution, which will form part of the EWR Project.

8.4.14. A new bridge to the east of the existing structure would either force the alignment of EWR through the Grain Store, a building of historic interest, and under Ford End Road Bridge, or east of the Grain Store on an alignment that would necessitate the partial or complete demolition and reconstruction of Ford End Road Bridge. Further, construction of a new bridge here would require reconstruction of the existing cycle bridge over the Marston Vale Lines.

8.4.15. If the Jowett Sidings were not available to Thameslink, the provision of a new bridge west of the existing bridge would be possible to enable Thameslink trains to access a small number of sidings on the

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former Hitchin Alignment. However, it is not likely that sufficient 12-car sidings could be provided on this site to replace those lost in the Jowett Sidings. This is therefore unlikely to be an acceptable solution. Additionally, it would force the EWR lines to follow the current alignment south of the river, removing the opportunity of having sufficient straight track for a replacement Bedford St Johns station near its current site.

8.4.16. A fourth option is to construct a new span west of the existing bridge for use by EWR trains. This option also assumes the removal of the Thameslink sidings that are currently located to the west of the Marston Vale Line, and hence the need for their replacement. The new bridge would be a requirement if it was desired to create sufficient space for Bedford station to be relocated with platforms south of Ford End Road, as well as enabling the remainder of the area to be redeveloped.

8.4.17. For a new station with platforms north of Ford End Road, the option to re-use the existing bridge is considered preferable from a railway alignment perspective, although a solution for the replacement of the Jowett Sidings would need to be found. This will entail development of a proposal for this, the identification of a site and its potential inclusion in an application for a DCO. As such, it would be necessary for such a proposal to be included in the forthcoming Statutory Consultation on the Project.

## Thameslink sidings

8.4.18. The Bedford station area is an important location for Thameslink. In addition to the five 12-car Jowett Sidings, the Thameslink train operating company currently has 14 eight-car stabling sidings in the triangle of land between the MML, the Marston Vale Line and the River Great Ouse. Additional 12-car stabling is available in Cauldwell Depot which is located off the MML at Bedford South Junction, to the south of the river. Both the Jowett Sidings and Cauldwell Depot require trains to reverse on their journey between the stabling points and the Bedford station platforms (and vice versa), adding undesirable complexity and time to train operations.

8.4.19. As noted above, if the existing bridge over the River Great Ouse is adopted for the EWR route, this would mean that the Jowett sidings could no longer be used for stabling Thameslink trains if the EWR service is to be operated effectively to meet the Project Objectives. If implemented, the effect would be to reduce stabling capacity at Bedford, particularly for 12-car trains, and a replacement facility would need to be constructed as part of the Project, although it would provide the opportunity to improve upon some of the existing operational constraints.

8.4.20. For the purposes of enabling trains to move between the Marston Vale Line and the MML a connection is currently provided to the south of Bedford station. It is proposed to move this connection to the north of the station to enable freight services

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to operate with a smaller likelihood of disrupting EWR services. This means that in developing a station for EWR north of Ford End Road Bridge, the infrastructure required for the existing junction is no longer required and can be repurposed. This would allow the group of four sidings in the east of the triangle to be removed and replaced with a number of new sidings (as replacements for both these four sidings and the five Jowett sidings), some of which could be 12-car length, although further design work is required to confirm the number and length of such sidings. Potentially this offers a solution to impacts on Jowett Sidings.

8.4.21. If a station option involving relocation of platforms to the south side of Ford End Road bridge was chosen, it would be sited in the area currently occupied by the 14 eight-car sidings, meaning that these too would be lost, in addition to the Jowett sidings. This would require a much more extensive relocation exercise to be undertaken before the main EWR works at Bedford could be constructed, adding time and cost to the Project. At this stage, such an alternative location or solution has not been identified.

8.4.22. Therefore, in determining the best solution for Bedford station the potential impacts on the existing Thameslink sidings, and the potential availability of relocation options, is an important consideration. This is due to the potential impact on existing railway operations and the cost and time involved in providing replacement facilities. There are several potential options for stabling the displaced trains and

these require further investigation, development and assessment, but may themselves be affected by options selected for EWR in the Bedford station area. EWR Co will seek to minimise the impact on existing operations and will work with the Train Operating Company and Network Rail to determine the most appropriate solution.

## **The Grain Store**

8.4.23. Although there are no listed buildings in the vicinity of the station, the former Midland Railway Grain Store is of historic interest and EWR Co aims to preserve it if it does not significantly affect the Project in this location. The Grain Store is situated east of the Marston Vale Line between Ford End Road Bridge and the River Great Ouse Bridge. In 2016, it was incorporated into a Network Rail Maintenance Delivery Unit area when this facility was moved to allow construction of the Jowett Sidings.

8.4.24. Retention of the Grain Store forces the alignment of EWR either through the Jowett Sidings, which would need to be relocated elsewhere, or further east, requiring reconstruction of Ford End Road Bridge.

8.4.25. Careful deconstruction of the building and relocation elsewhere is theoretically possible, but it is unlikely that a heritage railway could make economic use of such a large structure. It would also be difficult to justify the costs of relocation. EWR Co therefore does not propose to relocate the building if it cannot be retained without significantly affecting the Project in this location.

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## Ford End Road

8.4.26. Ford End Road Bridge is a key east-west route providing an important link between the Queens Park and Great Denham suburbs and the town centre. EWR Co's current view is that the existing bridge can be retained, although further design work and surveys may reveal that this is not the case. Notwithstanding this, the bridge is narrow and uninviting, and demolition may provide the opportunity to improve both connectivity and the local environment, although reconstruction to modern standards may present construction challenges that could require a permanent diversion of the road.

## Other operators' platforms

8.4.27. Maintaining independence of Thameslink and MML operations, and therefore supporting operational resilience, is an aim of the Project. However, most of the options for Bedford station would impinge on infrastructure used by Thameslink. Therefore, it is necessary for EWR Co to consider the layout and operations of the Thameslink platforms and how a redesign of the station will ensure there is no detrimental impact on existing operations. A redesign of the station may also enable more efficient operation of the station by solving current operational constraints, including a lack of sufficient slow line platforms and the absence of a "fast" platform in the London direction.

## Concepts considered

8.4.28. Following consideration of these constraints and opportunities, a number of station options were conceptualised and rationalised into two broad approaches. EWR's proposed solution is a station to the north of Ford End Road. An alternative concept for a station to the south of Ford End Road, based on work undertaken by Bedford Borough Council in 2020, was also developed.

8.4.29. The Proposed Concept for a station north of Ford End Road is at an early stage of development at present and there will be variations considered as the design is developed over the coming months. Feedback is therefore sought during this consultation on how the station design could be further developed and optimised.

## Bedford station North Concept – station to the north of Ford End Road

8.4.30. The track layout for EWR Co's North Concept for Bedford station is shown in schematic form in Figure 8.7 and as a plan in Figure 8.8. The concept would take the two tracks for EWR over the existing Marston Vale Line River Great Ouse bridge but instead of swinging west to join the MML Slow Lines at Ford End Road Bridge as at present, the alignment would split into three tracks and continue through the Jowett Sidings site to pass under three separate existing arches of Ford End Road Bridge. This would provide the best opportunity to use the centre of the arches to provide the clearances required for potential electrification. Three new



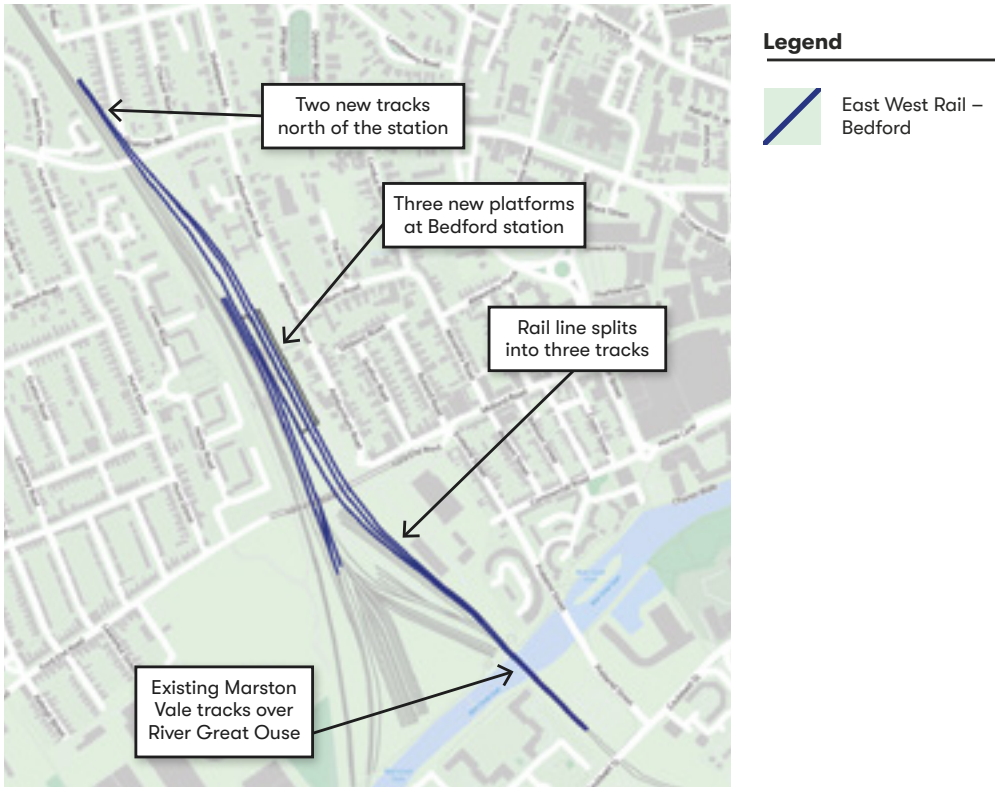


Figure 8.7: Track Schematic: Bedford station North Concept

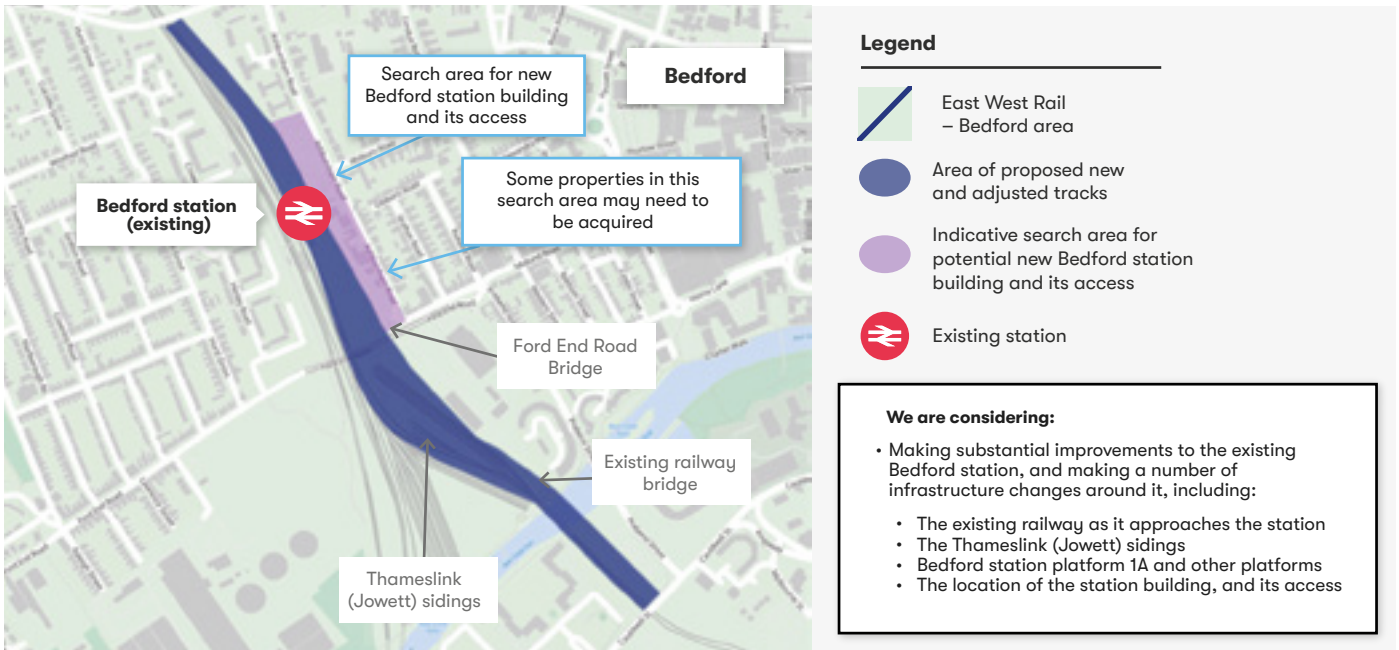


Figure 8.8: Proposed Bedford Station North Concept

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platforms would then be created on the east side of the station close to the existing platforms before the tracks return to two independent EWR tracks passing under a new span of Bromham Road Bridge, north of the station.

8.4.31. This arrangement would mean that the Grain Store would be left intact, but the Jowett Sidings would need to be removed and stabling capacity for five 12-car Thameslink trains provided elsewhere. As indicated above, the removal of the existing Marston Vale Line connection at Ford End Road Bridge would create the opportunity to make some additional provision for Thameslink sidings, whilst other potential alternative locations for stabling would need to be explored during the next stage of design development. Platform 1A, the current Bletchley Bay Platform could be extended through the site of the current station building to create a platform capable of accommodating a 12-car Thameslink train, enabling Network Rail to provide an extra Thameslink platform if desired.

8.4.32. The proposed Bedford station location to the north of Ford End Road would minimise the impact on existing facilities. The majority of existing Thameslink sidings (apart from the Jowett Sidings) would be retained, which opens up the possibility of further developing the land to the south of Ford End Road, independently of the station location, as a related but separate regeneration scheme. The proposed station location would allow for future-proofing connectivity to such a development, without risking significant delays to EWR services

arriving in Bedford or disruption to existing train services.

8.4.33. With the north of Ford End Road station concept there is the opportunity to create a vibrant station place, with the station acting as a gateway into Bedford and as catalyst for the regeneration of the surrounding area by improving the station presence and accessibility from the town centre, with better public transport and intermodal interchange. Designs are not yet sufficiently developed to be able to identify the precise area of land required at this stage. However, some stakeholders around the existing station may be affected by the proposed location for the station and associated facilities.

8.4.34. The North Concept for Bedford station is the emerging preference of EWR Co, and Figure 8.9 illustrates an indicative area of land that may be affected by such a regeneration concept, with a rebuilt station north of Ford End Road. There are several commercial and residential properties in this area with direct links to Ashburnham Road that may be affected and subject to demolition. Properties potentially affected include a doctors' surgery, Pentecostal Church, tyre centre, Polish community centre and some private residences. However, the design is not yet developed to a position where we are able to say which properties in this area would be subject to compulsory acquisition and demolition.

8.4.35. With a North Concept station in this

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location, there would be a potential opportunity to create an attractive urban station forecourt and plaza between Ford End Road Bridge, Ashburnham Road and the station and create an additional enhanced pedestrian connection directly to the town centre. The existing station footbridge could be extended to provide access to all platforms. However, there would also be the opportunity to enhance east-west pedestrian connectivity by providing a new footbridge connection that lands directly in the station plaza and connects to Queen's Park, to the west of the station.

- 8.4.36. One of the challenges of this station location is to be able to provide enough transport interchange, as well as sufficient car parking spaces. A high number of the existing parking spaces would be impacted by the new track alignment and a Multi-Storey Car Park (MSCP) would need to be considered, most likely to the north of the current station area and south of Bromham Road Bridge.
- 8.4.37. Consideration of the future transport trends should be reflected when re-providing the new car parking spaces. Options exist to provide enhanced car parking as a community hub, integrating some of the facilities needed in the community. The MSCP could be a mixed-use facility. Retail or co-working spaces could be provided at street level, together with health and/or education facilities combined to respond to community needs and to generate economic growth.

- 8.4.38. EWR Co will undertake further development work on the proposals for the station following this consultation. This will consider stakeholder feedback and will enable us to understand the implications of the design on the surrounding area. EWR Co will discuss the evolving proposals with affected stakeholders and formally consult on the design at a Statutory Consultation before submitting a Development Consent Order application.

- 8.4.39. It is envisaged that land to the south of Ford End Road down to the riverside will be redeveloped separately by others and does not form part of the Project.

## Bedford station South Concept – platforms south of Ford End Road

8.4.40. EWR Co is aware that Bedford Borough Council has an aspiration for a wider regeneration of the area around the station and has proposed a relocated station south of Ford End Road Bridge, surrounded by a significant amount of new development. The Bedford station South Concept builds on this proposition but it should be noted that third party funding would be required to deliver this alternative, which is beyond the current scope of the Project. However, if it were decided that the ambition was to create a more extensive development of the station, consideration would need to be given to the phasing of this work to enable the Project to be delivered by the end of the decade.

8.4.41. The track layout is shown in schematic form in Figure 8.9 and as a plan in Figure 8.10. In this South Concept, the Marston Vale Line would split into three tracks south of the River Great Ouse Bridge and a new river bridge span would be required for the eastbound EWR track. The three tracks would keep as far west as possible providing three platforms in the relocated Bedford station, before passing under three separate existing arches of Ford End Road bridge, giving the best opportunity to use the centre of the arches to provide the clearances required for potential future electrification. The tracks would then reconverge to two independent EWR tracks before passing under a new span of Bromham Road Bridge.

Figure 8.9: Track Schematic Bedford station South Concept)

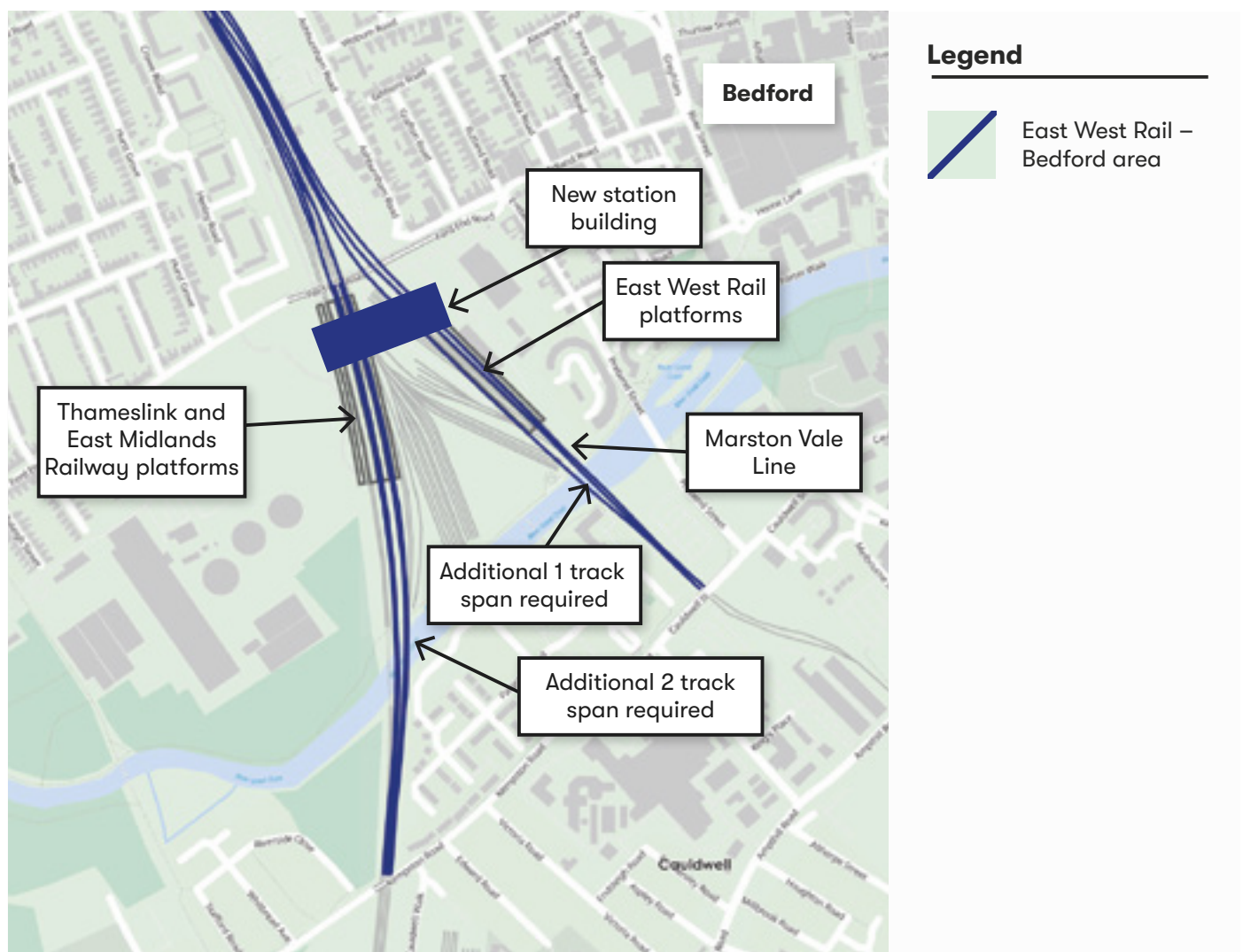


8.4.42. The Grain Store would be left intact, but a solution would need to be identified for the provision of alternatives for the existing Thameslink Sidings. EMR services on the MML would be provided with two Fast Line platforms. Thameslink would be provided with two Slow Line platforms, two 12-car bay platforms and a turnback siding between the Slow Lines north of the platforms. An additional two track span would be required across the River Great Ouse and two additional tracks would need to be provided all the way to Bedford South Junction.

8.4.43. In this South Concept, the track and platform layout would enable two different approaches to be taken with regard to the interaction of the station with its surrounding area. Firstly, a major gateway could be created by building the station with an entrance facing towards Bedford town centre. There is also the potential to repurpose the Grain Store and convert it into part of the new Bedford station building and to build a new overbridge that connects the Thameslink/MML and the EWR platforms.

8.4.44. Alternatively, the requirement to construct a new set of platforms for Thameslink would create the opportunity to provide a new station building above the tracks that would become the connector between the two sides of the railway, and at the same time create a direct access from and to the space in between the two corridors, which could be redeveloped. Figure 8.10 is illustrative of how this could work.

Figure 8.10: Bedford station South Concept



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- 8.4.45. This South Concept would help to improve east-west connectivity in the area, as well as providing a direct connection to the platforms. Further, the more accessible and integrated it is in the area, the more successful the station would become. This approach would need to be carefully considered in conjunction with the necessary intervention to Ford End Road Bridge.
- 8.4.46. It should be noted that the distance between the Thameslink/MML platforms and EWR platforms is significant, especially compared with the Bedford station North Concept, north of Ford End Road, resulting in long interchange distances and substantial disbenefit to passengers, which could act as a disincentive to use the railway. In addition, the provision of platforms in this area would use a considerable amount of footprint, reducing the amount of space available for commercial and community development.
- 8.4.47. For the South Concept with a station south of Ford End Road, the investment required upfront to consolidate the development area would be significantly larger than in the North Concept, which can be delivered with a more modest intervention.
- 8.4.48. The relocation of the sidings and the land available around the site, would provide the opportunity to locate the new station facing a regenerated area with a generous forecourt to facilitate a versatile, flexible and dynamic intermodal space, where different transport modes could be integrated and provide all the necessary facilities for the passenger to choose the most accessible and convenient onward travel. The proximity to the river would further promote the modal shift to active travel, as it would improve the connection to the station from the already existing cycle and pedestrian routes.
- 8.4.49. As with the emerging preference for a North Concept, a multi-storey car park for this area is assumed to be required and it would be important to carefully consider the structure so that it is able to adapt and change over time as community needs and technology evolve. Designing the car park as a mixed-use space, with an entrance floor allocated to retail and other activities and ensuring that it responds to the needs of the local community, would ensure the success of the facility.
- 8.4.50. Figure 8.10 illustrates an indicative plan for a layout and regeneration concept, with a new South Concept station south of Ford End Road Bridge and the area around the station redeveloped down to the riverside, with the station acting as a gateway in this case.



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## **Construction issues**

### **Bedford station North Concept – station to the north of Ford End Road**

8.4.51. A significant benefit of EWR Co's emerging preference for a North Concept is that, depending on the option chosen north of Bromham Road Bridge as discussed in the North Bedford paragraphs below, the existing platforms at Bedford station and their associated tracks would be relatively unimpacted during the works, with the new EWR platforms and tracks being built largely offline, to the east side of the operational railway.

8.4.52. Platform 1A would be extended by demolishing the existing Bedford station entrance and ticket hall (through which footprint it would pass). New Bedford station buildings would be constructed, to serve all train services passing through, during which temporary alternative ticketing and toilets would be provided for passengers. During the works, bicycle rack facilities and the availability of parking bays and the taxi rank would be likely to diminish (Thameslink and Ashburnham Road Car Parks). The present footbridge over the platforms would probably also be replaced or at least extended, these works needing night-time or weekend possessions. The new Bedford station would be substantially larger than the existing one in order to incorporate the additional three new platforms for EWR as well as a higher footfall arising from the increase in train services.

8.4.53. In addition to the Platform 1A extension, new EWR trackwork would be laid between Bromham Road and the River Great Ouse. The alignment is planned to avoid the Marston Vale Line until close to the river which will prevent conflicts with existing services. Some car parking would be lost temporarily during the works in addition to the spaces lost permanently as a consequence of the scheme.

8.4.54. The ambition and expectation is that no significant works will be required to the Ford End Road bridge, under which the new EWR alignment is planned to pass. There should be no need for contractor occupation of land other than that under railway management or required for the works between Bromham Road and the River Great Ouse.

### **Bedford station South Concept – platforms south of Ford End Road**

8.4.55. Works for the Bedford station South Concept are far more extensive than for the North Concept. The most significant elements would be the construction of three new rail bridges/viaducts over the River Great Ouse and the building of a completely new station with multiple new platforms on the south side of Ford End Road. The two existing fast lines would be relatively untouched on the western side but all other tracks would require significant works, which would need careful planning to mitigate disruption to train services.

8.4.56. Construction access to build the

eastern-most of the two new bridges over the river would be disruptive to residents of Palgrave Road on the south side and west of Prebend Street Car Park. Demolition of some existing properties may also be required in this area depending upon the outcome of further design development. On the north side of the river, for the same bridge, there is a spiral footbridge ramp which would need to be demolished and rebuilt. Once the adjacent rail sidings have been decommissioned, construction access to the north riverbank would be straightforward for the new eastern bridge.

8.4.57. For the new western bridges, to connect onto the MML slow lines, construction access would be challenging on the south bank, close to relatively new residential properties along Champion Way. Some of these properties may be impacted to enable the new rail alignment to be built to Bedford South Junction. Access on the north riverbank would be less of a challenge, being a rail sidings area presently.

8.4.58. Construction of the new platforms and combined station to the south of Ford End Road would be a significant challenge and would need to be phased in a manner that would cause least disruption to existing train services.

8.4.59. The need to relocate the Thameslink sidings before significant works can commence could extend the programme by at least two years, impacting on the date by which EWR can open.

## Comparison of concepts

8.4.60. This section of the Chapter explains why a station located north of Ford End Road is EWR's emerging preference for Bedford station. The following Assessment Factors have been the focus of the comparison as they are most likely to provide the principal differentiation between the two Bedford station concepts, including the southern approaches from the River Great Ouse:

- Capital costs;
- Overall affordability;
- Alignment with wider railway strategy / infrastructure;
- Rail passenger connectivity to existing main lines;
- Environmental impacts and opportunities; and
- Consistency with local plans.

### Capital costs and overall affordability

8.4.61. The Bedford station South Concept would involve a substantially higher cost than the North Concept, given the scale and complexity of the required interventions. Additional financial contributions would be needed to make the Project affordable, creating a reliance on funds from other sources, which are not presently available to EWR. This presents a material obstacle to the choice of this solution. The timing of the wider development is also unclear and the additional interdependencies that this creates would be a major risk to the Project.

8.4.62. The South Concept works would also take considerably longer and would add significant risk to the overall Project completion date, which would also affect the cost and affordability



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of the Project. This is in part due to the complexity of the works, and because of the need to relocate all the Thameslink Sidings before any other work could commence.

**Alignment with wider railway strategy / infrastructure and rail passenger connectivity to existing main lines**

8.4.63. For the area between the A4280 Bromham Road and the River Great Ouse there would be substantially more disruption to current train services with the South Concept than with EWR's North Concept. Construction of the new platforms and combined station to the south of Ford End Road in the alternative South Concept would be a major challenge, with a significant impact on the existing MML and Thameslink operations, as well as the Marston Vale Line, and would need to be phased in a manner that would cause least disruption to existing train services.

8.4.64. EWR Co recognises the importance of maintaining existing levels of stabling provision for Thameslink trains and will provide alternative facilities in the area to replace any sidings that need to be removed to accommodate the Project. Both station concepts would require the closure of the Jowett Sidings to the east of the Marston Vale Line, which would result in the loss of five sidings that can accommodate 12-car trains.

8.4.65. However, the South Concept station to the south of Ford End Road has the significant disadvantage of requiring the removal of all the current stabling facilities, including

the further 14 shorter sidings south of the station, which would also need to be removed to accommodate the station platforms. The North Concept would enable EWR to be disconnected from wider decision-making, whilst also having the potential to enhance and extend these sidings to accommodate the longer trains displaced from the Jowett Sidings. Therefore, the loss of the Thameslink sidings with the South Concept is a distinct drawback, since a new, large stabling facility would need to be sourced, designed and constructed before EWR construction could begin at Bedford. Alternatively, in the North Concept, there are a number of opportunities to replace the five sidings that would need to be removed. ings that would need to be removed.

8.4.66. These are important decisions, particularly when considering the wider redevelopment of the area, but are unlikely to be resolved in such a timescale as to enable the earliest possible introduction of EWR services. The North Concept does not preclude the relocation of the Thameslink sidings to enable the redevelopment of the area to the south, but neither does it necessitate it. It could therefore enable timely delivery of EWR services to Bedford as well as preserving the opportunity for the subsequent redevelopment of the railway lands.

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## **Environmental impacts and opportunities and consistency with local plans**

- 8.4.67. Both concepts provide the opportunity to improve the presence of the station in the area, to provide modern new facilities and to improve the relationship with the wider community, including the town centre. However, the South Concept presents the opportunity for a more significant redevelopment of the area with the station acting as a gateway to the town, in line with the ambitions of Bedford Brough Council and the Local Plan. The South Concept though would require additional tracks along the southern approach of the MML to Bedford station, resulting in additional land take and its consequential impacts.
- 8.4.68. Both options enable connectivity to the south of the station towards the riverside, enabling the provision of green space and a link to existing sustainable transport routes. However, the South Concept would enable a more holistic redevelopment of the space between Ford End Road and the river.

## **Compatibility with options to the north and south of Bedford station**

- 8.4.69. Both station concepts are capable of being connected to the options for Bedford St Johns and Bedford North areas, although further design work is required during the next stage of development to confirm the details.
- 8.4.70. For the Bedford St Johns area, the schematics shown in Figure 8.7 and Figure 8.9 tie-in to Bedford St Johns Option 1. For the Bedford St Johns

Option 2, where a new bridge is required east of the current bridge, then it would be feasible to connect back into the current proposed alignment. For this arrangement, however, the curved nature of the alignment may make the placing of switches and crossings more difficult as these should be positioned on straight track.

- 8.4.71. Alternatively, a Bedford St Johns Option 2 alignment could continue east of the Jowett sidings, through the Grain Store, then swinging back under Ford End Road arches. The alignment could also pass east of the Grain Store, but then Ford End Road Bridge would have to be reconstructed as it would not be possible for these alignments to pass through full height arches. The more easterly alignment also reduces the possibility of creating a good north-south connectivity to the river as the alignment would extend close to the railway land boundary particularly close to the river. These options are not currently an emerging preference.
- 8.4.72. At Bromham Road Bridge, the two alignment options have been drawn to match with the emerging preference of the Six Track Eastern option discussed in the North Bedford paragraphs below, with two additional tracks on the east side of the existing MML tracks. The implications of the other options in the North Bedford area are discussed below.

## **Summary**

- 8.4.73. A North Concept station to the north of Ford End Road would enable EWR Co to meet the Project Objectives,

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whilst facilitating the regeneration of the surrounding area and enabling the redevelopment of the railway land to the south in due course, if that were to be viable. It also performs better than the South Concept, with a station south of Ford End Road as the centre of a redevelopment, against the Assessment Factors relating to cost and affordability. It would be more straightforward to construct, have a smaller impact on Network Rail and other users of the railway, make better use of existing infrastructure and would be more likely to be completed to a programme in line with the Project Objectives. It is therefore presented as the EWR Co's emerging preference for a new Bedford station.

- 8.4.74. The South Concept would provide the opportunity for a wider redevelopment of the area with a new station at its centre, and it is recognised that this is an aspiration of Bedford Borough Council as part of a broader development plan. However, this alternative is not the emerging preference of EWR Co because of the costs, challenges and risks involved. Instead, a station to the north of Ford End Road can be built within current budgets and aspired timescales, independently of a major redevelopment, yet acting as a catalyst for regeneration, whilst maximising the amount of railway land available for subsequent development.
- 8.4.75. Nevertheless, EWR recognises the aspirations of key stakeholders, including Bedford Borough Council, for the regeneration of the area to the south of Ford End Road with a new station at its heart, and remains open to considering such a solution. EWR will continue to engage with stakeholders on the South Concept. However, to take such a scheme forward, additional funding or new funding mechanisms would need to be provided as well as clarity and Government agreement on delivery timescales. The scheme would also need to perform at least as well as the emerging preference of the North Concept and meet the Project Objectives.
- 8.4.76. Further design work is required on the emerging preference of the North Concept during the next stage of development, considering feedback from this consultation, to ensure that it meets the operational needs of the railway, delivers a solution that supports the changing needs of the wider community, and enables the regeneration of the surrounding area.

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## **8.5 North Bedford**

### **Introduction**

- 8.5.1. The North Bedford area discussed in this section of the Chapter extends from Bromham Road Bridge on the MML to a location north of Carriage Drive near Clapham Green where the alignment options diverge in Project Section D. It extends over approximately 3.3km of proposed railway. The area is shown in Figure 8.11.
- 8.5.2. All options in this area follow the MML corridor from Bedford station to approximately 800m north of Bromham Road. North of this point the EWR alignment rises and curves eastwards, passing under The Great Ouse Way and spanning over the River Great Ouse, Paula Radcliffe Way and Clapham Road on a single viaduct before entering a cutting to pass under Carriage Drive.
- 8.5.3. North of Bedford, consideration has been given to the impact which the EWR scheme might have on Midland Mainline operations and the longer-term resilience and reliability of the EWR service. Sharing the existing four track railway with MML would reduce the resilience of both services and reduce the capacity for freight traffic on the EWR lines. Providing segregated tracks for EWR is therefore beneficial but will require the acquisition of certain residential properties and other land.
- 8.5.4. The existing infrastructure in this area will be subject to additional demand due to the EWR services. The options generated for appraisal considered using the existing infrastructure (4-track railway) or progressively augmenting it with one or two additional tracks. The additional tracks have been considered either side of the existing ones. Five options, each with variations, have been considered and are described in the following paragraphs:
- Four Track
  - Five Track Eastern
  - Five Track Western
  - Six Track Eastern
  - Six Track Western

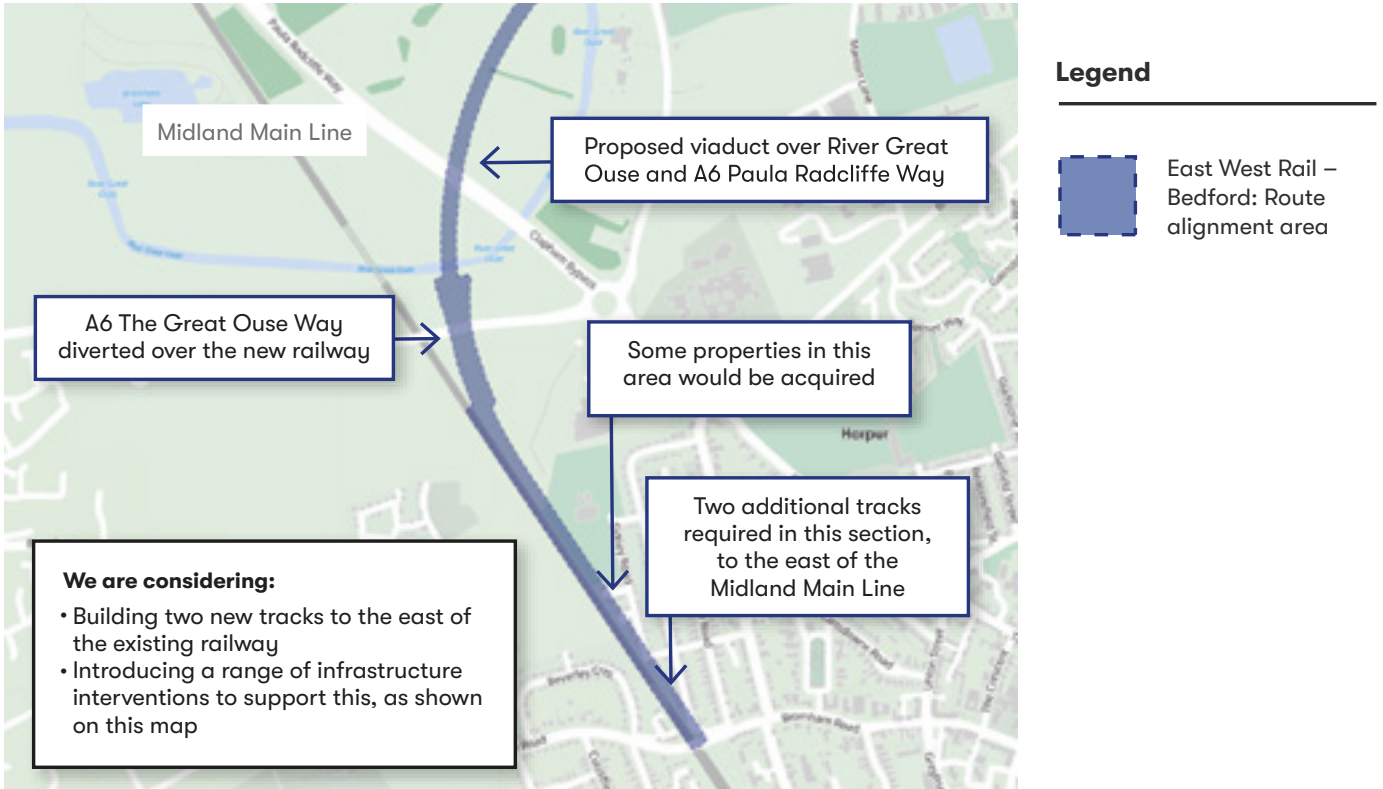


Figure 8.11: North Bedford area

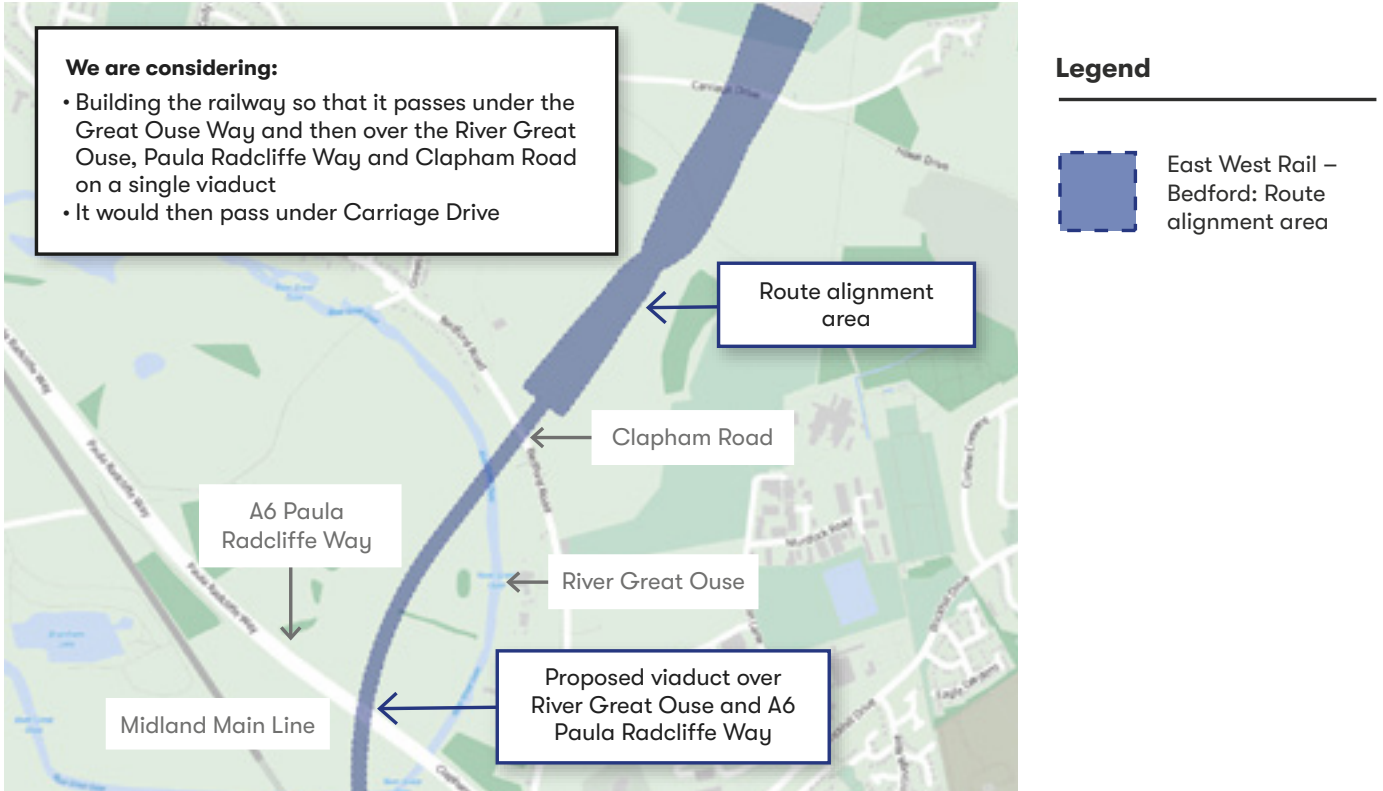


Figure 8.12: Six Track Eastern

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8.5.5. The key considerations in this area include:

- The twin track connection between the new platforms on the eastern side of Bedford station (associated with a North Concept design for the station) and the alignment north of Bromham Road;
- The capacity of the MML infrastructure to support current and future passenger train services, plus freight demand;
- The risk of EWR passengers being affected by delays on the MML and vice versa;
- The ability of Network Rail and EWR to keep trains running when needing to do work on the infrastructure and when there is an unplanned incident;
- The potential disruption to MML services during construction of EWR;
- The recently reconstructed Bromham Road Bridge and the potential impact of needing to modify it to accommodate new infrastructure;
- The potential need to acquire domestic properties where land is needed for EWR;
- The potential impact of construction and operation on residents located near to the MML;
- The potential impact on the Bedford town centre Air Quality Management Area during construction and operation;
- The potential impact on the UK Power Networks Substation at Fairhill, which is close to the railway boundary, and overhead electricity lines through this area;
- The potential impact on the Brewpoint facility and on potential future development of other plots in the Fairhill Development Site;
- The potential disruption to users of The Great Ouse Way, Paula Radcliffe Way, Clapham Road and Carriage Drive during construction;
- The potential impact on the River Great Ouse and its floodplain, including ecology and amenity;
- The visual impact of an elevated railway;
- The potential impact on the proposed Anglian Water Solar Farm;
- The potential impact on residents and businesses in Clapham; and
- The ancient woodlands of Crabtree Spinney and Helen's Wood.

8.5.6. The Six Track Eastern option is the emerging preferred option for this area as it is the best performing option using the Assessment Factors. The Six Track options ensure that the Project Objectives can be met, in particular those relating to provision of a reliable, resilient and attractive passenger train service and maintaining current capacity for freight. The Six Track Western option is likely to be substantially more expensive, pose a significant risk of substantial increases in the duration of the overall Project and require frequent and lengthy closures of the MML to construct, when compared with the Six Track Eastern option.

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## Options considered

### Overview

- 8.5.7. A range of options has been considered which aimed to achieve the Project Objectives whilst minimising impacts. In the Four Track option, no new tracks would be provided alongside the MML so EWR trains would share two of the existing four tracks with other trains using the MML. EWR require use of two tracks, one for each direction, to be able to provide the reliable and attractive passenger service as set out in the Project Objectives. The Five Track options provide one new track dedicated to EWR and the sharing of one or more MML tracks. The Six Track options provide two new tracks dedicated to EWR alongside the MML.
- 8.5.8. New track(s) could be constructed to the east or west of the MML. The new EWR platforms at Bedford station would need to be on the eastern side as explained above. Therefore, should any new track(s) be constructed to the west it would be necessary for Network Rail operations to move over to these new tracks to avoid conflicts between trains. The MML infrastructure would need to be reconfigured to achieve this.
- 8.5.9. For the Five Track and Six Track options the following ‘reasonable worst-case’ railway corridor width has been taken as the starting point for design:
- 5.5m separation (rail to rail) between the tracks used by EWR and the tracks not used by EWR, to ensure a safe space for railway staff to walk without disruption to train services and to ensure that trains are sufficiently clear of any structures, where retained or added, to support the overhead electric lines;
  - 2m separation (rail to rail) between each track used by EWR to ensure EWR trains pass each other safely;
  - 5m between the permanent boundary and the nearest rail to ensure sufficient space for staff to walk and work safely, for drainage to prevent flooding, for equipment cabinets to be safely positioned and for structures, where required, to support the overhead electric lines; and
  - 4m between the permanent boundary and a temporary boundary to ensure sufficient space for construction activities and any works necessary to ensure that adjacent properties are not undermined.
- 8.5.10. It may be possible to reduce the corridor width once more detailed surveys and design are undertaken. Therefore, the areas and number of properties affected by each option are only indicative at this stage.
- 8.5.11. All options avoid the Wells & Co. Brewpoint brewery but would reduce the size of some of the other plots in the Fairhill Development Site. The Great Ouse Way would need to be lifted between the Clapham Road roundabout at a point approximately 650m to the east of the roundabout to ensure the tracks are sufficiently high above the River Great Ouse and the Paula

Radcliffe Way. A new bridge would be provided over EWR and a modified or replacement bridge would be needed over the MML to avoid a severe hump and dip in the road between the two bridges. The balancing pond to the north of The Great Ouse Way would need to be relocated.

8.5.12. The Paula Radcliffe Way has been treated as a constraint as it would not be possible to raise or lower it to be clear of the tracks due to the river and the connecting roads. It is not expected that Clapham Road would need to be raised or lowered.

8.5.13. In all options the new railway would enter a cutting as it passes between the ancient woodlands of Crabtree Spinney and Helen's Wood. A bridge would be provided where the railway passes under Carriage Drive and The John Bunyan Trail.

## Four Track

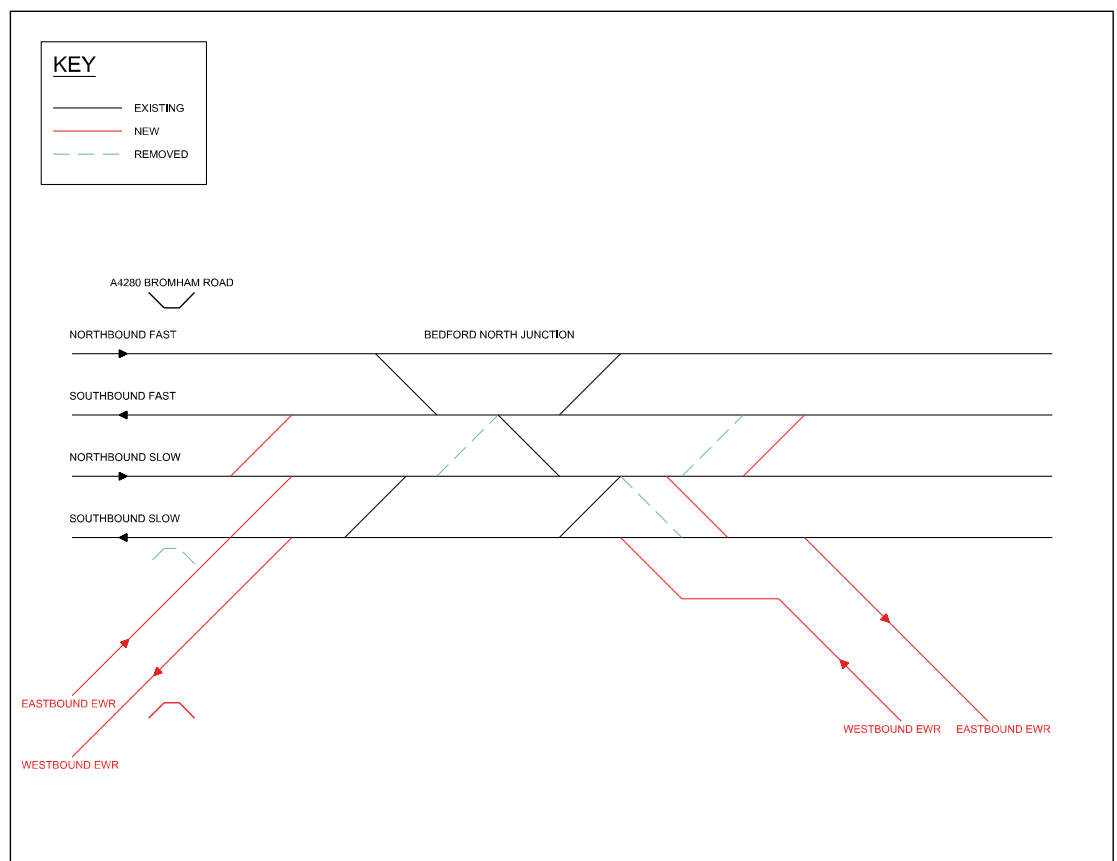


Figure 8.13: Four Track schematic

8.5.14. In this option the new EWR lines connect to the existing Slow Lines. The Slow Lines must remain connected to the rest of the MML as it is not possible to fit all the non-EWR trains which would use the MML on the two Fast Lines. In addition, the capacity provided by the Slow Lines is vital in keeping trains running during maintenance and minimising delay when the unexpected happens.



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- 8.5.15. It would not be possible for eastbound EWR trains to share the Northbound Slow line with freight and southbound EMR stopping trains because there would be too many trains going in the opposite direction to each other along the same track for the railway to operate safely and reliably. To avoid this conflict either Bedford station would need to be reconfigured to provide an additional platform on the Fast Lines for the southbound stopping trains or, if the station remains in its current location as per the Bedford station North Concept, an alternative set of points would be needed closer to the station for these trains to access Platform 3. Providing an alternative set of points south of Bromham Road Bridge would require a reduction in the speed limit of the Southbound Fast line from 125mph to at best 110mph. The track curves through the station and a faster speed requires a more tilted track to reduce the sideways forces on passengers. The higher the tilt the more difficult it is to include points. Providing an alternative set of points north of Bromham Road Bridge where the tracks are straighter would require reconstruction of the bridge to remove the central pier and to move the Slow Lines further east. The implications of these solutions are discussed in paragraphs 8.5.44 to 8.5.98.
- 8.5.16. The space between the existing station, if retained in its current location as per the Bedford station North Concept, and Bromham Road Bridge is such that to avoid modifying the bridge EWR trains would be limited to 25mph until they have joined the existing four tracks. Moving the points northwards and replacing the bridge, or moving the station south, would enable a higher speed limit of 40mph. The existing Slow Lines have a speed limit of 50mph, but it may be possible to increase this to 75mph.
- 8.5.17. The current Bedford North Junction would need to be modified to allow EWR trains to diverge eastwards, including relocation of existing points.
- 8.5.18. Connecting to the existing Slow Lines imposes a constraint on where EWR trains can begin their rise and curve over the River Great Ouse and Paula Radcliffe Way. The further north the points are the steeper the gradient. The further south the points are the greater the area of land that would need to be acquired. The Four Track option starts to diverge from the MML just south of the UK Power Networks Substation, which may need to be modified. It rises at a gradient of 1 in 75 which is steeper than the limit set out in the Project Objectives and may restrict the accessibility of EWR to some freight trains that may otherwise be able to use the railway.
- 8.5.19. In the Four Track option the viaduct is immediately adjacent to a residential property on Clapham Road. To keep the viaduct as far as possible from this property and Woodlands Lodge, a Grade II listed building, the curve of the railway would have a radius of at best 850m. This means that the speed of trains would be limited to at best 80mph until the northern end of the viaduct, approximately 2.4km from Bromham Road Bridge, before they can accelerate to the full line speed of 100mph.

## Five Track Eastern

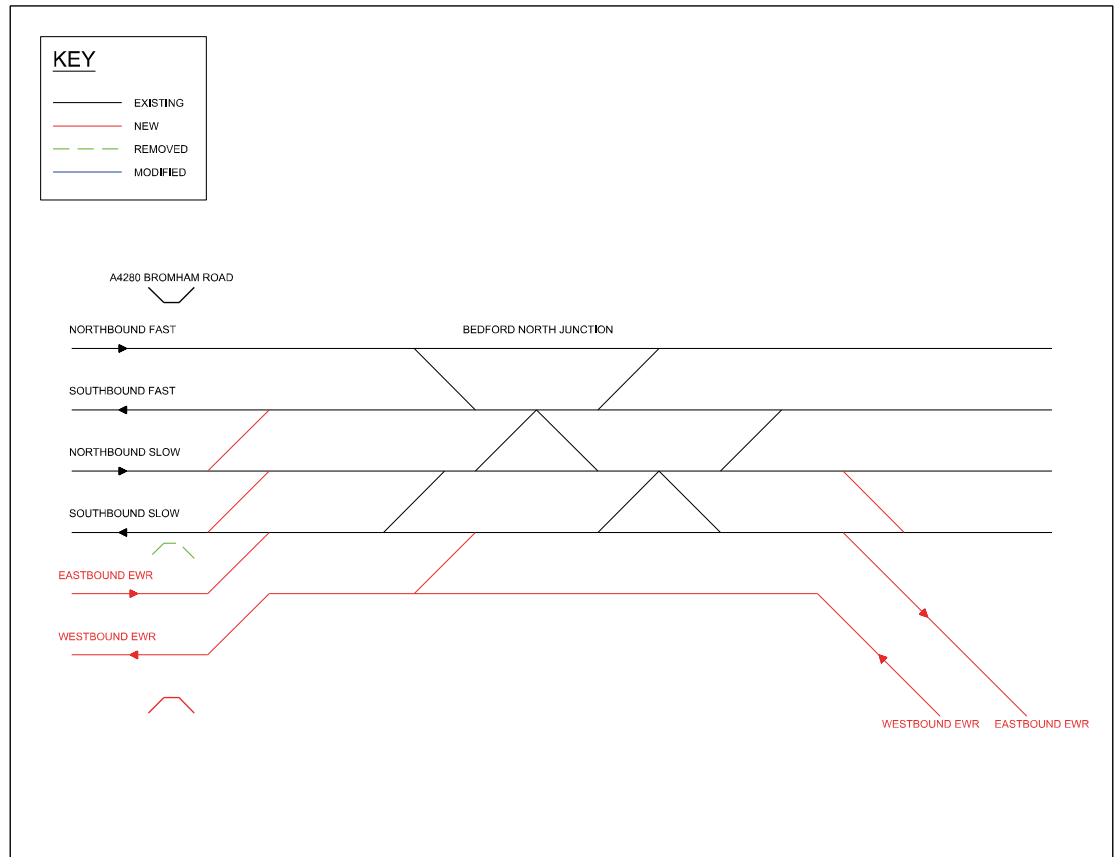


Figure 8.14: Five Track Eastern schematic

8.5.20. In this option a new track is provided to the east of the existing Southbound Slow line for use by westbound EWR trains.

8.5.21. It is likely to be necessary to acquire land alongside the existing railway corridor for this option. This includes residential and business properties on Spenser Road, Milton Road, Sidney Road, Milne Row and Chesterton Mews. The number of properties affected in this option, based on the 'reasonable worst-case' railway corridor width described in paragraph 8.5.8 is as follows:

- 17 properties are likely to require demolition;
- 28 properties may need to be acquired and/or demolished because they are attached to properties which are likely to require demolition;
- 51 properties may lose part of their garden or parking area.

8.5.22. Bromham Road Bridge would need to be extended eastwards to accommodate the new EWR track. The A4280 Bromham Road rises over the railway so it would need to begin its rise further from the railway to accommodate the extension, potentially requiring modification between the junctions with Ashburnham Road and Hurst Grove/Beverley Crescent. The access to properties on Bromham Road may need to be modified accordingly. Retaining walls or similar structures may be necessary in some locations to support its elevated position.

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- 8.5.23. It is likely to be necessary to acquire part of the Alexander Sports Centre playing fields and to modify or relocate the UK Power Networks Substation because land acquisition for EWR would remove parts of the substation compound.
- 8.5.24. There are multiple variations of how the railway might be configured and trains timetabled in this option; with either two tracks dedicated to EWR services or shared use of one or both Slow lines. As per the Four Track option, the Southbound Slow line would need to remain connected to the north and south of where EWR connects to the MML, which would constrain the speed of EWR trains. In all variations it would be necessary to run passenger and freight trains in the opposite direction to each other along the same tracks, which limits the number of trains that can be accommodated.
- 8.5.25. The current Bedford North Junction would need to be modified to allow EWR trains to diverge eastwards, including relocation of existing points. If Bedford station remains in its current location as per the North Concept, an alternative connection between the Northbound Slow Line and Platform 1 would be needed to the south of the junction to ensure that freight trains can pass through the station when Thameslink trains occupy Platforms 2 & 3 and eastbound EWR trains occupy the Southbound Slow Line. In addition, it may not be possible for all freight trains to share the Northbound Slow line with southbound EMR trains, necessitating the engineering solutions to this problem as described for the Four Track option in paragraphs 8.5.13 to 8.5.18. Both these constraints mean that a six-track railway may be needed under Bromham Road Bridge, increasing its extension eastwards.

## Five Track Western

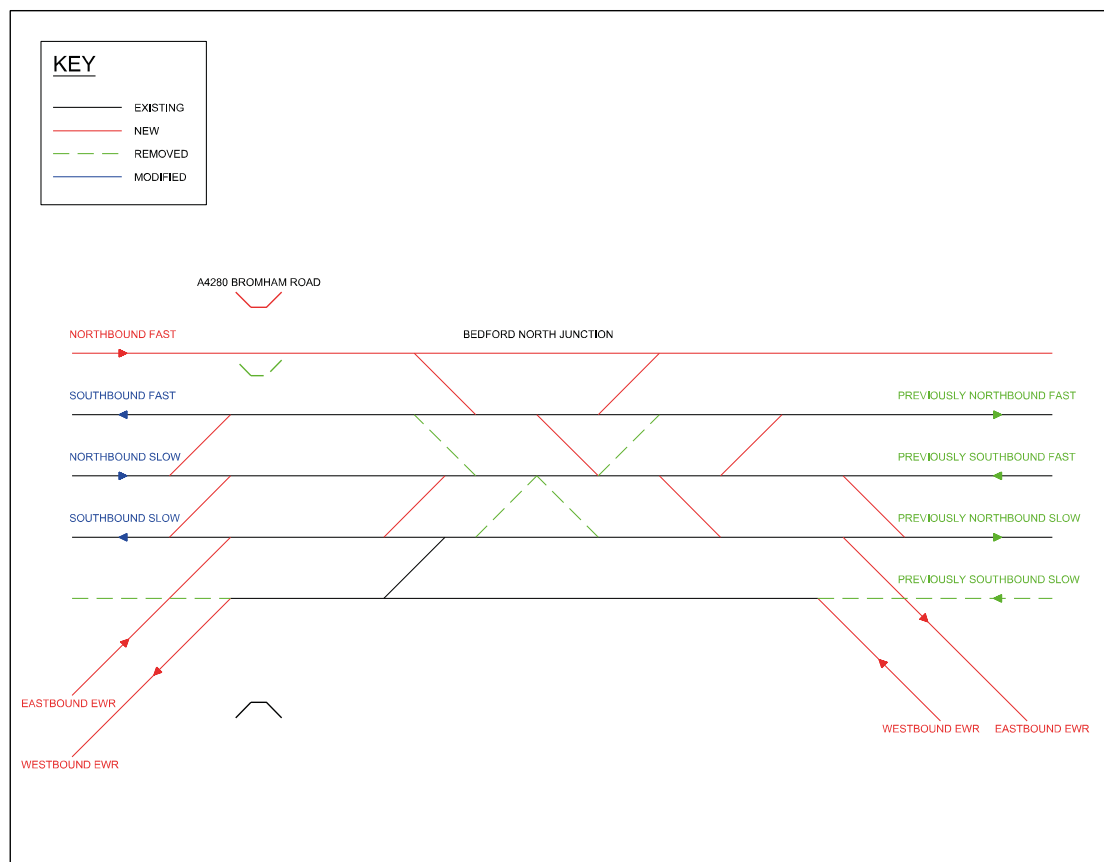


Figure 8.15: Five Track Western schematic

8.5.26. In this option a new Northbound Fast line is provided to the west of the existing four tracks. The existing Slow Lines are repurposed for EWR and stay in their current position between where they diverge into the new platforms at Bedford station and where they diverge eastwards towards Cambridge. Bedford North Junction is moved westwards to maintain the current functionality for MML operations.

8.5.27. It is likely to be necessary to acquire land alongside the existing railway corridor for this option. This includes residential properties on Granet Close and partial loss of gardens or parking areas to residential properties on Beverley Crescent and Queensbury Close. The number of properties affected in this option, based on the 'reasonable worst-case' railway corridor width described in the paragraph 8.5.8, is as follows:

- 11 properties would be likely to require demolition;
- 16 properties may need to be acquired and/or demolished because they are attached to properties which would be likely to require demolition;
- 14 properties may lose part of their garden or parking area.

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8.5.28. Bromham Road Bridge would need to be extended westwards to accommodate the new EWR track. The A4280 Bromham Road rises over the railway so it would need to begin its rise further from the railway to accommodate the extension, potentially requiring modification between the junctions with Ashburnham Road and Hurst Grove/Beverley Crescent. Retaining walls or similar structures may be necessary in some locations to support its elevated position.

8.5.29. The track layout south of Bromham Road Bridge would need to be reconfigured including Bedford station. If the station remains in its current location as per the North Concept, Platform 4 would need to be moved westwards and the station footbridge extended, to avoid putting a curve in the Fast Lines and substantially reducing the speed that trains would be able to pass through Bedford.

8.5.30. As for the Four Track option, the Northbound Slow line would need to remain connected to the north and south of where EWR connects to the MML, which would constrain the speed of EWR trains.

## Six Track Eastern

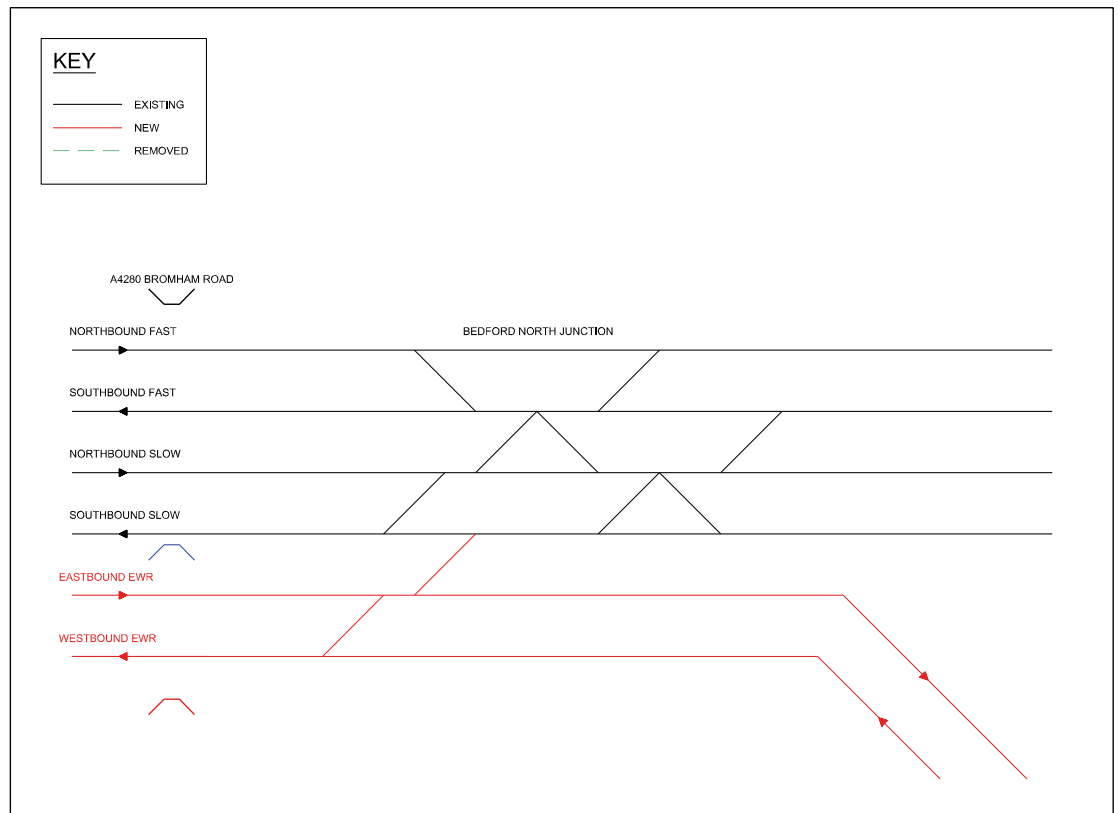


Figure 8.16: Six Track Eastern schematic

8.5.31. In this option two new tracks are provided to the east of the existing Southbound Slow line for EWR. EWR trains would only use the new tracks, maintaining the existing capacity of the MML for other trains.

8.5.32. It would be necessary to acquire land alongside the existing railway corridor for this option. This includes residential and business properties on Spenser Road, Milton Road, Sidney Road, Milne Row and Chesterton Mews. The number of properties affected in this option, based on the 'reasonable worst-case' railway corridor width described in the paragraph 8.5.8, is as follows:

- 28 properties are likely to require demolition;
- 25 properties may need to be acquired and/or demolished because they are attached to properties which are likely to require demolition;
- 44 properties may lose part of their garden or parking area.

Figure 8.17: Six Track Eastern properties affected in reasonable worst-case railway corridor width scenario

8.5.33. Refer to Figure 8.17 for details of which properties might be affected.



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8.5.34. Bromham Road Bridge would need to be extended eastwards to accommodate the new EWR tracks. The A4280 Bromham Road rises over the railway so it would need to begin its rise further from the railway to accommodate the extension, potentially requiring modification between the junctions with Ashburnham Road and Hurst Grove/Beverley Crescent. The access to properties on Bromham Road may need to be modified accordingly. Retaining walls or similar structures may be necessary in some locations to support its elevated position.

8.5.35. Permanent closure and demolition of Bromham Road Bridge is not proposed due to the increase in congestion on alternative routes for traffic and the loss of an important pedestrian, bus and cycle route.

8.5.36. It would be necessary to acquire part of the Alexander Sports Centre playing fields and to modify or relocate the UK Power Networks Substation because land acquisition for EWR would remove parts of the substation compound.

8.5.37. As the new tracks would not be as constrained by the existing tracks as they would be in the Four Track and Five Track options, the Six Track Eastern option would enable EWR trains to accelerate to 80mph shortly after leaving the station and 100mph when approximately 1.9km from Bromham Road Bridge. The gradient could be at or shallower than the 1 in 80 limit set out in the Project Objectives and therefore not preclude freight from using EWR. The curve radius would be 900m and the alignment would be approximately 130m from the nearest residential property on Clapham Road.



## Six Track Eastern – northern variant

8.5.38. Where the Six Track Eastern alignment curves eastwards there is an alternative to go slightly further to the north on a sharper curve with radius 800m. Paula Radcliffe Way slopes downhill in the northbound direction so the further the alignment is to the north the lower the viaduct can be, potentially reducing its visual impact and capital cost. It may also reduce the extent to which The Great Ouse Way needs to be raised. However, these benefits are negligible whilst the alignment would be approximately 50m closer to the residents of Clapham, increasing the potential for impacts such as noise, and the whole life cost of the railway would be worsened as sharper curves require more maintenance. Therefore, this variation has not been pursued.

## Six Track Western

8.5.39. In this option two new tracks are provided to the west of the existing four tracks. They become the new Fast Lines. The existing Slow Lines are repurposed for EWR and stay in their current position between where they diverge into the new platforms at Bedford station and where they diverge eastwards towards Cambridge. Bedford North Junction is moved westwards to maintain the current functionality for MML operations.

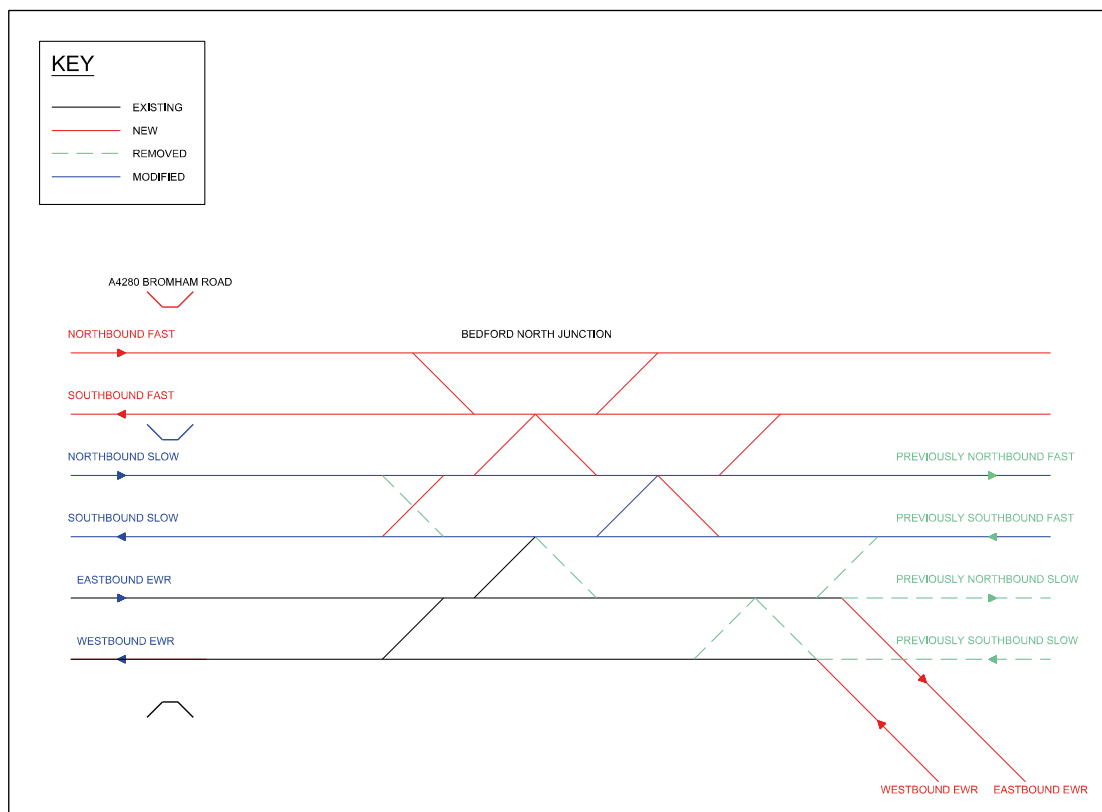


Figure 8.18: Six Track Western schematic



Figure 8.19: Six Track Western indicative track positions in reasonable worst-case railway corridor width

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8.5.40. It would be necessary to acquire land alongside the existing railway corridor for this option. This includes residential properties on Granet Close and partial loss of gardens or parking areas to residential properties on Beverley Crescent and Queensbury Close. The number of properties affected in this option, based on the 'reasonable worst-case' railway corridor width described in paragraph 8.5.8, is as follows:

- 21 properties would be likely to require demolition;
- 6 properties may need to be acquired and/or demolished because they are attached to properties which would be likely to require demolition;
- 27 properties may lose part of their garden or parking area.

8.5.41. Bromham Road Bridge would need to be extended westwards to accommodate the new Fast Lines. The A4280 Bromham Road rises over the railway so it would need to begin its rise further from the railway to accommodate the extension, potentially requiring modification between the junctions with Ashburnham Road and Hurst Grove/ Beverley Crescent. Retaining walls or similar structures may be necessary in some locations to support its elevated position.

8.5.42. Bedford station Platform 4 would need to be moved westwards but further than for the Five Track Western option. It is likely that the new tracks would need to extend as far south as Kempston Road with modifications required to Ford End Road bridge and the southern bridge over the River Great Ouse. The northern bridge over the River Great Ouse may also need to be modified or replaced.

8.5.43. The following variations on the Six Track Western option have been considered, in which the existing Slow Line(s) would be moved eastwards to provide 5.5m separation from EWR as described in the 'reasonable worst-case' railway corridor width:

- A. A: adding two new tracks to the west but with the existing Fast Lines staying on their current alignment (see Figure 8.20), or
- B. B: adding one track to the west and one to the east (see Figure 8.21).



- Legend**
- East West Rail – track centrelines\* (connections between tracks not shown)
  - New railway boundary\*
  - Construction boundary\*
  - Midland Main Line – track centrelines (connections between tracks not shown)

\*based on reasonable worst-case railway corridor width

Figure 8.20: Six Track Western Variation A indicative track positions in reasonable worst-case railway corridor width



- Legend**
- East West Rail – track centrelines\* (connections between tracks not shown)
  - New railway boundary\*
  - Construction boundary\*
  - Midland Main Line – track centrelines (connections between tracks not shown)

\*based on reasonable worst-case railway corridor width

Figure 8.21: Six Track Western Variation B indicative track positions in reasonable worst-case railway corridor width

8.5.44. These variations result in a greater number of properties being affected as additional land would be required on both sides of the MML (see Table 8.1). Bromham Road Bridge would require a new span on the western side as well as the east with marginal, if any, reduction in the extent of work required to Bromham Road compared to the Six Track Western option. Therefore, these variations have not been pursued.

	Six Track Western	Variation A	Variation B
Residential demolition	21	30	26
Residential at-risk	6	29	36
Residential land loss	27	75	59
Business demolition	0	1	1

Table 8.1: Number of properties affected by the Six Track Western option and its variations

## Comparison of options

8.5.45. The following Assessment Factors from the list agreed with the Department for Transport (DfT) are those most likely to differentiate between the North Bedford options and therefore have been the focus of the comparison:

- Transport user benefit;
- Capital costs;
- Overall affordability;
- Short-distance passenger services and connectivity to support commuting travel into key employment hubs (current and future);
- Long distance passenger services;
- Satisfying existing and future freight demand;
- Performance;
- Alignment with wider railway strategy / infrastructure;
- Environmental impacts and opportunities.

8.5.46. The following 'Network Capability' Assessment Factors are discussed together:

- Short distance passenger services and connectivity to support commuting travel into key employment hubs (current and future);
- Long distance passenger services;
- Satisfying existing and future freight demand.

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## Network capability

8.5.47. An essential test for each of the options is whether they provide enough capacity to meet demand, that is whether the number of tracks is enough for the number of trains needed to satisfy all the passengers and freight customers wishing to use the railway. The capability of the railway to accommodate these trains depends on several other considerations including the time at which they need to pass through Bedford and the track they need to use, to avoid conflicts between trains at Bedford station and elsewhere on their journey.

8.5.48. The Six Track options provide enough capacity to meet demand as the existing MML capacity would not be affected. Given that the MML is Congested Infrastructure, as explained in the introduction to this Chapter, a capacity analysis has been undertaken to assess the likelihood of the Four Track and Five Track options being able to provide enough capacity to meet demand. To be certain on the capability of the network to accommodate EWR services a full and definitive timetable including EWR services will be necessary. This will be developed later in the design process, considering the Preferred Route Alignment, station locations and interactions between EWR and Network Rail elsewhere in the Project.

8.5.49. At this stage EWR Co has considered Network Rail's draft timetable for the recently upgraded MML which introduces a sixth EMR train through Bedford to London, as detailed in the introduction to this Chapter.

This assumes that service provision returns to its pre-Covid levels, but that there is no further growth, before EWR services commence. Therefore, the anticipated existing passenger service to be accommodated through North Bedford is six EMR trains per hour in each direction. The EWR service to be accommodated is four trains per hour in a 'clock-face' regular interval pattern, as explained in the Project Objectives. The ability of the Four Track and Five Track options to accommodate these passenger services has been tested with either two or three freight trains per hour in each direction, as detailed in the introduction to this Chapter.

8.5.50. EWR Co has also considered two scenarios for southbound EMR stopping trains; the current scenario in which they use the Northbound Slow Line to access Platform 3, limiting the number of trains that can use that track, and the alternative scenario in which they remain on the Southbound Fast Line, providing more capacity on the Slow Lines but necessitating one of the infrastructure solutions described with the Four Track option.

8.5.51. For the Four Track option, EWR Co's analysis has concluded that, even with southbound EMR stopping trains remaining on the Fast Lines and no growth in demand, it is unlikely to be possible to accommodate two freight trains per hour in any hour and it would not be possible to accommodate three freight trains per hour in any hour.

8.5.52. For the Five Track options the analysis has concluded that it may

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be possible to accommodate two freight trains per hour if they can share tracks with EWR trains or if southbound EMR stopping trains remain on the Fast Lines. If both these conditions are applied, it would be possible to accommodate two freight trains per hour and it may be possible to accommodate three freight trains per hour. However, delays would become more likely on the MML as discussed for the Performance Assessment Factor.

8.5.53. It would only be possible to satisfy future freight demand beyond three freight trains per hour by delivering the Six Track options. Similarly, it would only be possible to accommodate an increase in EWR services beyond four trains per hour, extension of Thameslink services north of Bedford or more frequent EMR services in the Six Track options.

8.5.54. As the Four Track and Five Track options include connections to the existing tracks, the gradient of the new EWR tracks would be constrained which may limit the accessibility of EWR to freight trains. The Five Track options are less constrained than the Four Track option, but the Six Track options provide the most flexibility to allow for freight trains. The objectives for freight are detailed in Chapter 3.

8.5.55. Therefore, the Network Capability Assessment Factors all favour the Six Track options.

## Performance

8.5.56. If EWR services are disrupted it is important to ensure they do not cause delay to other users of the

railway network because of shared track, junctions or platforms. Even if it were possible to resolve the capacity challenges discussed above the addition of EWR services to the existing network would increase the risk of delay to existing services on the MML and negatively impact network performance. If an unplanned incident requires the closure of one or more of the existing tracks the other tracks are currently used to minimise the impact on customer service. The addition of EWR services would reduce this operational resilience and delay recovery would become longer and more problematic.

8.5.57. Similarly, EWR Co needs to ensure that it can provide a reliable service to its passengers. Other cross-country routes across the UK experience performance issues due to the interaction with arterial routes to and from London. EWR Co aims to avoid this as far as it can. Given that the MML is 'Congested Infrastructure' a passenger holding a door on a Thameslink or EMR train for a few seconds in Brighton or Corby could delay EWR trains by several minutes. This could be significantly more if a freight train must clear the platforms and Bedford North Junction before the EWR train can proceed.

8.5.58. Even if EMR and EWR trains operated on separate tracks, delays can be passed from one to the other through freight unless EWR and freight are also separated. This is not possible in the Four Track option. It is only likely to be possible in the Five Track options if freight is limited to two tph in each direction and a Fast Lines solution is provided.



8.5.59. However, there would still be an increase in risk of delay on the MML in the Five Track options with EWR and freight separated due to the interaction between freight, EMR and Thameslink trains at the station. A contributing factor to this is that there is no capacity south of the station to hold a delayed northbound freight train, which must pass all the way through the Bedford area without stopping to minimise the impact of the delay on other trains.

8.5.60. It is theoretically possible to take an approach that EWR trains wait for freight trains to pass every time there is a delay, but this would have knock-on consequences elsewhere on EWR and is not compatible with the Project Objective of providing a reliable service.

8.5.61. The only way to meet the EWR service as set out in the Project Objectives in the Five Track options whilst maintaining the performance of the MML is to:

- reconfigure Bedford station including more platforms, which would be likely to require the Bedford station South Concept of new platforms south of Ford End Road and relocation of all the existing sidings for Thameslink trains; and
- provide a passing loop to hold northbound freight in or south of the station, which would be likely to require acquisition of additional properties to those required for the Five Track options and the reconfigured station; and
- limit freight to two tph in each direction, which would negate a benefit of Network Rail's MML Upgrade Project; and

- not allow for any further growth in passenger demand beyond that provided for by EMR six tph and Thameslink eight tph terminating at Bedford.

8.5.62. When Network Rail needs to undertake maintenance on or in the vicinity of the shared MML infrastructure in the Four or Five Track options it is likely that this would have a detrimental impact on EWR services. Similarly, maintenance work required to the EWR infrastructure in the vicinity of the shared section is likely to have a detrimental impact on services on the MML.

8.5.63. Therefore, this Assessment Factor favours the Six Track options.

## Transport user benefit

8.5.64. As detailed for the Network Capability Assessment Factors, it is likely that for there to be enough capacity in the Five Track options it would be necessary for southbound EMR stopping trains to remain on the Southbound Fast Line rather than crossing over to the Northbound Slow Line as they do today. The importance of ensuring that southbound EMR trains are still able to stop at Bedford station is emphasised by Bedford Borough Council's Rail Strategy<sup>62</sup>.

8.5.65. As detailed for the Four Track option, one of the solutions to make this possible would involve reducing the speed limit for southbound non-stopping trains from 125mph to at best 110mph. This would increase journey times and have a disbenefit to users of EMR services and

<sup>62</sup> <https://bbcdevwebfiles.blob.core.windows.net/webfiles/Parking Roads and Travel/Strategies and projects/Bedford Rail Strategy - December 2019.pdf>



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undermine one of the key objectives of Network Rail's MML Upgrade Project which is making line speed improvements at other locations such as Market Harborough. To avoid this disbenefit, the Five Track option would need to include an additional platform on the Fast Lines or a sixth track under Bromham Road Bridge.

electric lines over the existing four tracks, with the associated disruption to MML services and risk to cost and programme. The Six Track Eastern option also avoids the need for complex integration of signalling and train control systems in this area with the associated risk to cost and programme.

8.5.66. The new EWR tracks need to connect to the existing Slow Lines in the Four Track and Five Track options. These place a constraint on the speed of EWR trains north of the station. The difference in speed restriction between the options results in a journey time saving of approximately one minute in the Six Track options compared with the Four Track and Five Track options. EWR Co expects this contribution to shorter journey times between key centres of the Oxford - Cambridge Arc to have a marginal but positive impact on the overall demand for EWR services, resulting in higher transport user benefits including more people changing from other modes of transport to rail.

8.5.69. The direct costs of construction are approximately 8% higher for the Six Track Eastern option compared to the Four Track option. This includes the cost of acquiring property but excludes the cost of obtaining and managing closures of the MML and risk. At the current level of accuracy, EWR Co does not consider this cost difference to be significant. The risk of cost increase and programme delay due to the difficulty of obtaining closures of the MML and the complexity of system integration favour the Six Track Eastern option. In addition, it is likely that the Four Track option would require expansion of the existing infrastructure south of Bromham Road to mitigate some of the impact on Network Capability and Performance, such as a passing loop to hold northbound freight.

8.5.67. Therefore, this Assessment Factor favours the Six Track options.

### **Capital costs**

8.5.68. The Four Track option avoids the cost of acquiring and clearing land adjacent to the existing Network Rail corridor between Bromham Road Bridge and the UK Power Networks substation. The Six Track Eastern option avoids the need to replace, relocate or enhance existing MML infrastructure, such as track junctions and the recently installed structures supporting the overhead

8.5.70. The Five Track options are likely to be more expensive than both the Four Track and Six Track options as they would incur the cost of modifying the existing MML infrastructure both north and south of Bromham Road as well as the cost of acquiring and clearing land adjacent to the existing Network Rail corridor.

8.5.71. For the Western Options a complex construction strategy would need to be agreed with Network Rail. The modifications to the existing

track and overhead line equipment (OLE), which supports the overhead electric lines, within the North Bedford area would require the MML to be closed to most if not all trains for approximately 32 weekends for the Six Track Western option and approximately 24 weekends for the Five Track Western option. This compares to approximately 12 weekends for the Four Track and Five Track Eastern options, and potentially only one weekend closure for the Six Track Eastern option. Additional closures would be required for works to the bridges, signalling and other railway infrastructure. It is not possible to close the MML at this location every weekend and it is likely that there would need to be additional temporary works to enable existing services to keep running between the periods of work, potentially with restrictions imposed on the number and speed of trains that can run.

8.5.72. The Western Options would require tracks and platforms at Bedford station to be moved westward. As well as land acquisition, the Six Track Western option would necessitate a new bridge over the River Great Ouse south of the station, which would require closure of the MML during construction.

8.5.73. Therefore, the Western options are likely to be substantially more expensive and pose a significant risk of substantial increases in the duration of the overall Project and the associated costs and disbenefits of delay, when compared to the Eastern options. The disruption to MML services would be frequent and lengthy, resulting in customer

dissatisfaction and substantial compensation costs to be paid to train operators.

8.5.74. The cost of extending Bromham Road Bridge and modifying the highway are likely to be broadly similar in all options. As detailed above, the Four Track and Five Track options are likely to require an additional track under the bridge to accommodate an alternative crossover to Platform 3 for southbound EMR stopping trains, unless the station were to be reconfigured and moved south at substantially greater cost.

8.5.75. Therefore, this Assessment Factor is likely to favour the Six Track Eastern option.

### **Overall affordability**

8.5.76. The choice of option is not expected to make a difference to revenue or the potential for third party funding contributions.

8.5.77. Wider costs and incomes beyond EWR, such as the revenue of existing Train and Freight Operating Companies, would be affected by the choice of option if the existing number of trains on the MML were to be reduced to make space for EWR in the Four or Five Track Options. This would be contrary to the Project Objectives and would be likely to have a net negative impact on overall transport user benefit.

8.5.78. As detailed for the Capital Cost Assessment Factor, the Four Track option may have a lower up-front cost than the Six Track Eastern option, depending on the compensation costs payable to train

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operators and the works required south of Bromham Road. The Five Track and Six Track Western options would be more expensive than the Six Track Eastern option.

8.5.79. Considering Whole Life Cost, the Six Track options would have lower maintenance and renewal costs than the alternatives. Curved track, points and crossings cause more wear and tear than straight track without points or crossings. More wear and tear means more frequent maintenance and renewal. The Four Track and Five Track options are constrained by needing to connect to the existing tracks therefore have a sharper curve over the River Great Ouse and more points and crossings due to the connections. The difference in maintenance and renewal costs between the Six Track options is likely to be marginal. However, trains would accelerate and brake on straighter track in the Six Track Eastern option which would result in less wear and tear.

8.5.80. Therefore, this Assessment Factor is likely to favour the Six Track Eastern option.

## Environmental impacts and opportunities

8.5.81. The primary benefit of the Four Track option is that it avoids the need to demolish any residential and business properties adjacent to the existing MML. The number of properties which may be affected by each option is detailed in paragraphs 8.5.6 to 8.5.43 and summarised in Table 8.1.

8.5.82. In the Four Track option the increase in train frequency on the existing MML tracks is likely to produce a minor increase in noise levels on both sides of the line. The demolition of properties in the Five or Six Track options would increase noise for the remaining properties in two ways: a) for some residential properties, opening up line-of-sight to the MML and b) introducing a railway noise source closer to the properties than was previously the case. The provision of a noise barrier would mitigate this increase.

8.5.83. The Five and Six Track options bring rail emissions closer to residential properties which has the potential for adverse air quality impacts and the Eastern options bring the railway within the Bedford town centre Air Quality Management Area.

8.5.84. In the Eastern options two trees with preservation orders are likely to need to be removed from Spenser Road as shown in Figure 8.24. In the Western options, at least thirteen trees with preservation orders may need to be removed based on the reasonable worst-case corridor width as detailed in paragraph 8.5.8. The loss of a tree with a Tree Preservation Order (TPO) would be mitigated through the provision of tree planting as part of the wider habitat compensation of the Project.

Figure 8.22: TPOs impacted by North Bedford Eastern options



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8.5.85. In all options the railway would cross the River Great Ouse, which is a County Wildlife Site at this location, on a viaduct. The viaduct would be supported on piers located in the floodplain grassland habitat. The further north the alignment is, the less the impact on the river and its floodplain, albeit a marginal difference. This favours the Four Track option over the Six Track Eastern option with other options in between.

Water solar farm when compared to the Six Track Eastern option. In the Four Track option the viaduct is immediately adjacent to a residential property on Clapham Road. The distance from the Grade II listed Woodlands Lodge is approximately 100m in the Six Track Eastern option and approximately 30m in the Four Track option. The Five Track and Six Track Western options are likely to be between these two extents.

8.5.86. Two areas of lowland deciduous woodland habitat would be affected: one on the Fairhill Development Site and adjacent to the River Great Ouse, and one adjacent to Carriage Drive. There is no difference between the options in the area of woodland habitat affected, noting that much of this habitat has already been cleared as part of the Fairhill Development Site.

8.5.89. In all options the railway would pass between but more than 50m from two areas of potential ancient woodland: Crabtree Spinney and Helen's Wood.

8.5.90. Overall this Assessment Factor favours the Four Track option.

8.5.87. The viaduct would have a potential visual impact on residents in Clapham and users of the public right of way which crosses the river at The Ford. All options are similar in terms of alignment and elevation. The further north the alignment is the lower the viaduct is likely to need to be, due to the downhill gradient of the northbound Paula Radcliffe Way, but the difference is marginal. The further north the alignment is the closer it would be to Clapham.

8.5.88. The railway is closest to Clapham in the Four Track option and furthest away in the Six Track Eastern option, due to the constraints imposed by connecting to the existing railway. As the Four Track option is further to the north, it may have a lower impact on the potential Anglian

Option	Western			Eastern	
Number of Tracks	Six	Five	Four	Five	Six
Residential demolition*	21	11	0	17	28
Residential at-risk*	6	16	1	28	25
Residential land loss*	27	14	0	51	44
Business demolition*	0	0	0	1	1
Bromham Road raised between junctions	Required		Likely	Required	
Air Quality Management Area	Increase in adjacent train frequency			Railway within Area	
Tree Preservation Orders impacted*	14	13	0	2	2
River Great Ouse impact			Lowest		Highest
Proximity to Clapham (Woodlands Lodge)			30m		100m

Table 8.2: Differentiating Environmental Impacts of North Bedford Options

\*Indicative numbers based on reasonable worst-case corridor width as detailed in the paragraphs 8.5.6 to 8.5.12.

### Alignment with wider railway strategy / infrastructure

8.5.91. Operating on separate tracks means that strategies and new technologies could be deployed independently between the new and existing services as may be required to meet separate operational and customer expectations. The opportunity to do this may be limited where tracks are shared.

8.5.92. The provision of two additional tracks provides flexibility to adapt to future changes in passenger and freight demand if these are different to the projections used during the design of the railway.

8.5.93. Therefore, this Assessment Factor favours the Six Track options.

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## Summary

8.5.94. The Four Track option almost avoids the need to acquire any residential property. Therefore, even with consideration of other environmental pros and cons, it is likely to represent a major improvement on the other options in terms of environmental impacts and opportunities. However, it would not meet the Project Objectives and poses major challenges in terms of railway capacity, operational performance and delivery.

8.5.95. Whilst the Five Track options give the potential for a lower number of property acquisitions, this is outweighed by the potential impacts on the capacity and performance of the railway.

8.5.96. The National Policy Statement for National Networks states that ‘In the short to medium term, the Government’s policy is to improve the capacity, capability, reliability and resilience of the rail network at key locations for both passenger and freight movements to reflect growth in demand, reduce crowding, improve journey times, maintain or improve operational performance and facilitate modal shift from road to rail’. The Four Track and Five Track Options would not accord with this policy.

8.5.97. Whilst the Western options give the potential for a lower toll in terms of property acquisition, this is outweighed by the potential impacts on delivery of the Project as a whole and on MML operations during construction.

8.5.98. Whilst the Six Track Eastern option results in the loss of property and changes to access to property, with consequent effects upon residents in the area, it is the preferred option as it:

- Ensures that EWR Co can provide a frequent and regular service to meet initial forecast passenger demand;
- Ensures that EWR services do not constrain existing freight demand on the MML;
- Provides confidence in being able to accommodate longer-term increases in passenger demand for services on EWR or MML;
- Provides potential to meet future freight demand on EWR or MML;
- Ensures that EWR trains are not slowed down or delayed by sharing the same track as passenger and freight trains on the busy main line north from Bedford station, thus helping to provide a reliable service to EWR customers;
- Ensures no detrimental effect on the performance of existing services using the MML;
- Maintains and enhances the ability of the railway network as a whole to respond to unplanned events;
- Ensures that each party would be able to undertake routine maintenance and inspections of their infrastructure safely without affecting the other, for example a closure of the MML would not mean that EWR would also need to close and vice versa;

- 
- Avoids the need to replace, relocate or enhance existing MML infrastructure (such as track junctions and the recently installed structures supporting the OLE over the existing four tracks) with the associated disruption to MML services and risk to cost and programme;
  - Avoids the need for complex integration of signalling and train control systems in this area with the associated risk to cost and programme; and
  - Avoids a constraint on EWR and Network Rail being able to independently deploy strategies and new technologies as required to meet EWR Co's operations and customer expectations.



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## Conclusion

- 8.6.1. EWR Co is investigating options to reconfigure the Bedford railway infrastructure to meet the EWR Project Objectives. This involves proposals being developed for the three broad areas of Bedford St Johns, Bedford station and North Bedford.
- 8.6.2. In the **Bedford St Johns** area EWR Co proposes to provide at least two tracks (one in each direction). Two options have been developed, which include the relocation of Bedford St Johns station.
- 8.6.3. Option 1 has an alignment running beneath Ampthill Road and Cauldwell Street, and across the river, utilising existing bridges (although Cauldwell Street Bridge is likely to need to be reconstructed due to insufficient headroom clearances). It would provide a new station between Ampthill Road and Cauldwell Street with platforms that can be extended in the future. The alignment achieves a line speed of 40mph.
- 8.6.4. Option 2 would have a faster, 60mph alignment, running beneath Ampthill Road and Cauldwell Street, under new road bridges, before crossing the river on a new bridge, and would provide a new station with side platforms to accommodate four-car trains (with provision for eight-car trains in the future) close to the Ampthill Road – Elstow Road Pedestrian Link bridge, to the south-west of the current Bedford St Johns station.
- 8.6.5. EWR Co carried out an initial review of the options based around differentiating Assessment Factors. Option 1 with a station located between Ampthill Road and Cauldwell Street performs better in respect of capital costs, consistency with local plans and environmental impacts, based on the work undertaken to date. It is a more affordable option. However, Option 2, with a station located close to the Ampthill Road – Elstow Road Pedestrian Link bridge also meets the Project Objectives, remains potentially viable, and offers different benefits to the local area.
- 8.6.6. Option 1 is EWR's emerging preferred option, but further investigation of both options will be undertaken during the next stage of development following consultation feedback and development of the timetable. We will also assess the environmental impacts of the preferred option and report on its impacts at the next stage of consultation.

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- 8.6.7. At **Bedford station**, new platforms and significant modifications to the existing station are required to provide the capacity for EWR services in addition to existing services. EWR Co has considered a number of concepts for the approach to the station from the River Great Ouse through to the existing station.
- 8.6.8. The North Concept, with a station to the north of Ford End Road would provide an option that would meet the Project Objectives. It also performs better than the South Concept (a station south of Ford End Road) when considered against the Assessment Factors relating to cost and affordability. It would be more straightforward to construct, have a smaller impact on Network Rail, Thameslink (and its stabling) and other users of the railway, make better use of existing infrastructure and would be more likely to be completed to a programme in line with the Project Objectives. It is therefore presented as the emerging preference for a new Bedford station
- 8.6.9. The South Concept would provide the opportunity for a wider redevelopment of the area and it is recognised that this has been recommended in previous work undertaken by Bedford Borough Council as part of a broader development plan. However, this alternative has been discounted as an option for EWR to promote because of the costs, challenges and risks involved.
- 8.6.10. Nevertheless, EWR recognises the aspirations of key stakeholders, including Bedford Borough Council, for the regeneration of the area to the south of Ford End Road with a new station at its heart, and remains open to considering such a solution. EWR will continue to engage with stakeholders on the South Concept. However, to take such a scheme forward, additional funding would need to be provided as well as clarity and Government agreement on delivery timescales. The scheme would also need to perform at least as well as the North Concept and meet the Project Objectives.
- 8.6.11. Further design work is required on the North Concept during the next stage of development, considering feedback from this consultation, to ensure that it meets the operational needs of the railway and delivers a solution that supports the changing needs of the wider community. In developing the design, EWR will seek opportunities to facilitate the regeneration of the area surrounding the station and to integrate with the wider development aspirations of Bedford Borough Council. We will also assess the environmental impacts and report on them at the next stage of consultation.
- 8.6.12. In the **North Bedford** area, north of Bedford station, EWR Co has explored how the existing railway might need to be modified to provide for EWR services. Options which retain the existing four tracks, or provide one or two additional tracks, have been considered.

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- 8.6.13. The Four Track option minimises the need to acquire any residential property. Therefore, even with consideration of other environmental benefits and disbenefits, it is likely to represent a major improvement on the other options in terms of environmental impacts and opportunities. However, it would not meet the Project Objectives and poses major challenges in terms of railway capacity, operational performance and delivery.
- 8.6.14. Whilst the Five Track options give the potential for a lower number of property acquisitions compared to the Six Track options, this is outweighed by the potential impacts on the capacity and performance of the railway. The National Policy Statement for National Networks states that “In the short to medium term, the Government’s policy is to improve the capacity, capability, reliability and resilience of the rail network at key locations for both passenger and freight movements to reflect growth in demand, reduce crowding, improve journey times, maintain or improve operational performance and facilitate modal shift from road to rail”. The Four Track and Five Track options would not accord with this policy.
- 8.6.15. The options with additional tracks to the west potentially require less land to be acquired, but this is outweighed by the potential impacts on delivery of the Project as a whole and on MML operations during construction.
- 8.6.16. The Six Track Eastern Option results in the loss of property and changes to access to property, with consequent effects upon residents in the area, but it is the emerging preferred option as it ensures that EWR Co can provide a frequent, regular and reliable service to meet initial forecast passenger demand and it does not constrain existing freight demand on the MML. The option also provides confidence in being able to accommodate longer-term increases in passenger demand for services on EWR or MML as well as potential to meet future freight demand on EWR or MML. As it allows separation of EWR and MML operations, it ensures that each party would be able to undertake routine maintenance and inspections of their infrastructure safely without affecting the other; and it avoids the need to replace, relocate or enhance existing MML infrastructure (such as track junctions and the recently installed structures supporting the OLE over the existing four tracks) with the associated disruption to MML services and risk to cost and programme. Finally, it avoids the need for complex integration of signalling and train control systems in this area with the associated risk to cost and programme and avoids a constraint on EWR and Network Rail being able to independently deploy strategies and new technologies as required to meet EWR Co’s operations and customer expectations. The Six Track Eastern option is therefore proposed to be taken forward as the emerging preferred option.

# 09.

## Project Section D: Clapham Green to The Eversdens



Figure 9.1: Project Section D

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9.1. Chapter summary

**9.1.1. This Chapter describes the proposals for the section of the Project between Clapham Green (north of Bedford) and The Eversdens (northwest of Harlton). This section of the Project will be a new railway.**

**9.1.2. The Chapter explains the process of option development for this section of the Project. This generated a number of possible Route Alignments for the new railway, within the area identified for Preferred Route Option E (the route announced by the Secretary of State in 2020). EWR Co also considered possible Route Alignments located partially outside that area, recognising the potential to serve a station north of Cambourne and/or to follow the route of the A428 Improvement Scheme being promoted by Highways England.**

**9.1.3. The Chapter describes the options considered for station locations on the new railway. There would be two new stations between Bedford and Cambridge. One would be in the Tempsford / St Neots area, to the south of St Neots, where four potential locations have been considered. This new EWR station would be distinct from the existing St Neots station on the East Coast Main Line (EMCL, the line between London, York and Edinburgh). The other new EWR station would be either to the north or to the south of Cambourne.**

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- 9.1.4. The Chapter goes on to explain that nine options were considered for the alignment of the new railway. It describes each of these options briefly. All Route Alignment Options included one of the station locations at Tempsford / St Neots and one of the station locations at Cambourne.
- 9.1.5. The Chapter explains the assessment and comparison of the nine Route Alignment Options and the performance of each option against the Assessment Factors, particularly focussing on those Factors where differences between options were most likely to arise. These include consideration of transport user benefits; enabling housing and growth; capital expenditure; performance; safety risk; and environmental impacts and opportunities.
- 9.1.6. Five of the nine Route Alignment Options, across the four possible station combinations, were identified as performing particularly well. These are the best performing options for each station combination (and two for St Neots North to Cambourne South which were close). They therefore form the **alignment shortlist for consultation**. The remaining four Route Alignment Options were not taken forward. The five shortlisted Route Alignment Options were:
- Alignment 1: St Neots South Option A to Cambourne North via the A428 Improvement Scheme corridor;
  - Alignment 2: St Neots South Option A to Cambourne South via the A428 Improvement Scheme corridor;
  - Alignment 6: St Neots South Option B to Cambourne South;
  - Alignment 8: Tempsford to Cambourne South; and
  - Alignment 9: Tempsford to Cambourne North via the A428 Improvement Scheme corridor.
- 9.1.7. Of the five shortlisted Route Alignment Options, two are considered to be the **emerging preferred options**, which are:
- Alignment 1 from St Neots South Option A to Cambourne North via the A428 Improvement Scheme; and
  - Alignment 9 from Tempsford to Cambourne North via the A428 Improvement Scheme.

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## **9.2. Introduction**

- 9.2.1. Project Section D, also referred to as the Core Section, extends from Clapham Green, north of Carriage Drive, to The Eversdens, west of the location where the EWR alignment crosses the Cambridge Road (A603). Project Section C (Bedford) is located to the west and Project Section E (Harlton to Hauxton) is located to the east.
- 9.2.2. In the Core Section, the new railway would cross the River Great Ouse and the ECML in the vicinity of Tempsford/ St Neots.
- 9.2.3. There are several major highway routes in this area which interface with the Route Alignment Options presented in this Chapter. The A1 runs approximately north to south between Sandy and St Neots. The A421 joins the A1 at Black Cat roundabout South of St Neots and the existing A428 runs approximately east to west connecting Wyboston with Cambridge.
- 9.2.4. Highways England, the Government's arms-length body responsible for managing the Strategic Road network in England, is proposing to upgrade the A428 between Black Cat roundabout on the A1 and the existing A428 at Caxton Gibbet to the west of Cambourne and include new junctions. The preferred alignment for the A428 was confirmed by Highways England in February 2019, part way through EWR Co's 2019 consultation on the Route Options, and it is located just north of the Preferred Route Corridor. A Development Consent Order application for the proposed A428 Black Cat to Caxton Gibbett Improvement Scheme (A428 Improvement Scheme) was submitted to the Planning Inspectorate in February 2021. The proposed alignment for this scheme is shown in Figure 9.2. In light of the new information from Highways England and following comments received from respondents during the 2019 consultation regarding the A428 Scheme, EWR Co has considered how potential alignments in this area might perform compared to alignments wholly within the Preferred Route Option area.







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Scheme. The Route Alignment Options present two possible station locations within this area.

- 9.2.7. The EWR alignment would cross the ECML on a viaduct. A high-level station would be located on the EWR alignment with a potential corresponding low-level station on the ECML. A potential station on the ECML would allow passenger interchange between the two lines.
- 9.2.8. A second new station would be located in the vicinity of Cambourne. This could be located:
- South of Cambourne, near Caxton;
  - North of Cambourne, north of the A428.
- 9.2.9. Passing loops (additional tracks to allow faster trains to overtake slower trains) may be provided at two locations within Project Section D for operations and maintenance of the railway. The number and precise location of loops, within the areas described below, will be determined at the next stage of design and may also depend on the capacity and anticipated demand for freight, as discussed in Chapter 3. The reasonable worst-case scenario is:
- Two passing loops located to the east of the village of Ravensden, between Bedford and the St Neots/ Tempsford station. One would be located either side of the main route. Crossovers would enable resilience in the network allowing bi-directional operations.
  - Two passing loops located to the north or west of Cambourne, between the St Neots/ Tempsford stations and Cambourne stations. One would be located either side of the main route. Crossovers would enable resilience in the network allowing bi-directional operations.
- 9.2.10. At the eastern end of Section D, the Mullard Radio Astronomy Observatory (MRAO) is located on the A603, east of the Eversdens. Conversations between EWR Co and the University of Cambridge and the MRAO are ongoing to identify any impacts the railway might have on the observatory. Following this, EWR Co expects to secure and mitigation required and include it in the proposed DCO application.

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### **9.3. Option development**

- 9.3.1. Chapter 5 of this Technical Report describes the identification of the Route Option E Indicative Alignment and its refinement.
- 9.3.2. Following the refinement of the Route Option E Indicative Alignment, additional potential alignments were identified where they might provide better performance against the Assessment Factors than the Indicative Alignment. Initially these were limited to the Preferred Route Option E area.
- 9.3.3. The possibility of developing alignments outside the Preferred Route Option E, but within the same general area, was considered as a result of stakeholder feedback and of the preferred alignment for the A428 confirmed by Highways England in February 2019. Consequently, alignments were identified and developed to the same level of detail as alignment options within Preferred Route Option E where there was a prospect that they might offer better performance against the Assessment Factors. The alignments outside Preferred Route Option E can be characterised as follows:
- **Alignments with a station at Cambourne North.** Although an alignment via this location does tend to be longer with extended journey times than alignments with a station to the south of Cambourne, preliminary investigation suggested several opportunities. These included an increased opportunity to enable economic and housing development, fewer demolitions of private property, less drainage infrastructure, and shorter lengths in floodplain. Consequently, alignment options to the north of Cambourne were included in the identification of options.
  - **Alignments following the route of the proposed A428 Improvement Scheme.** The preferred alignment for the A428 Improvement Scheme had not been published when the Preferred Route Corridor was selected. It is not within Route Corridor C or Route Option E. When the proposed A428 alignment became clear, preliminary investigation suggested an alignment in this area could have benefits including avoiding an area of weaker geology and fewer additional setting impacts to listed buildings and scheduled monuments. Alignments which follow the route of the proposed A428 Improvement Scheme are also more compatible with a station located to the north of Cambourne because route lengths are comparable to other alignments, already under consideration, that serve Cambourne North station.
- 9.3.4. Given these opportunities - associated with alignments serving a station north of Cambourne and alignments following the A428 Improvement Scheme - EWR Co has taken forward those options in the analysis of Assessment Factors, even though they include areas outside Preferred Route Option E. Consequently, these alignments are described in this Technical Report and compared with alignments wholly within Route Option E.

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- 9.3.5. Bearing in mind that alignments outside Preferred Route Option E affect land that had not been identified in the Preferred Route Option, EWR Co considered whether it should revisit the Route Options considered. However, EWR Co is only considering Route Alignment Options outside the Preferred Route Option E area where there is a strong possibility these would deliver better outcomes against the Assessment Factors than alignments within Preferred Route Option E. The alignments within the Preferred Route Option can be assumed to out-perform alignments in the other Route Options not preferred in 2020, because Route Option E out-performed the other Route Options. Therefore, there is no need to consider the discarded Route Options afresh since an alignment in another route option would neither be likely to out-perform an alignment in the Preferred Route Option or the prospective alignments outside but adjacent to Route Option E. As such, the additional Route Alignment Options under consideration, that are outside the Preferred Route Option, do not affect the selection of Route Option E as the Preferred Route Option.
- 9.3.6. In the consultation in relation to Route Options, an emerging preference was expressed for an option that would access the centre of Cambridge from the south. Nevertheless, EWR Co and the Secretary of State were open-minded as to whether there would be advantage in accessing Cambridge from the north. This was explained in the consultation. Having considered this alternative, and taking account of the responses to that consultation, it was decided that a northern access would not be preferred.
- 9.3.7. Given the potential for a station at Cambourne North there remain potential alternative alignment options for accessing Cambridge from the North. For completeness, further information about the relative performance of a northern access to Cambridge has been compiled and can be found in Appendix F (See also Chapter 5).

9.3.8. The Route Alignment Options and the Preferred Route Option E area are shown in Figure 9.3 below (blue shows the Preferred Route Option E area).

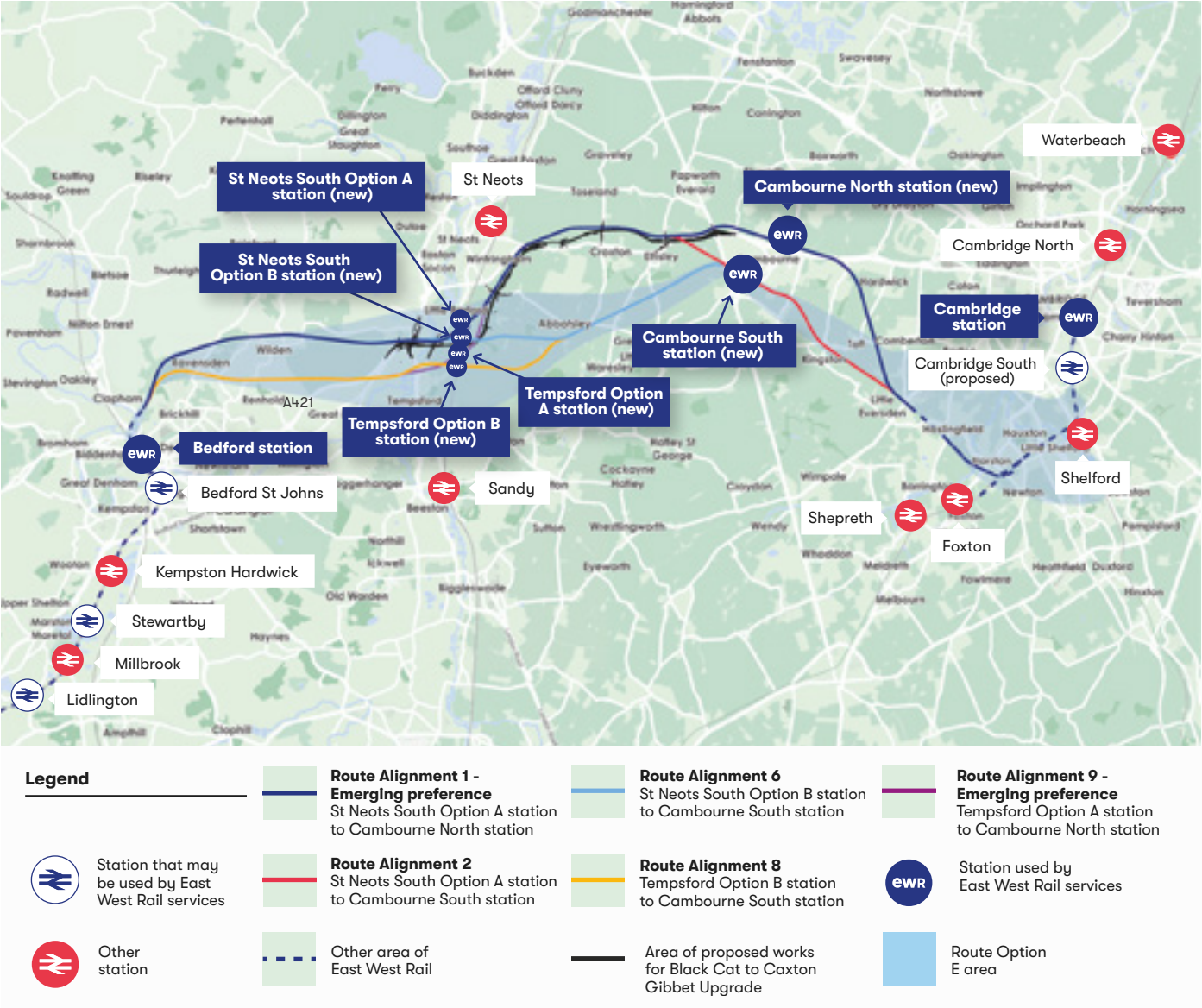


Figure 9.3: Route Option E and the Route Alignment Options Being Considered

9.3.9. Alignments were developed and considered both within Preferred Route Option E (including a connection to Cambourne North) and the A428 Improvement Scheme. Nine Route Alignment Options were developed that served the different combinations of station locations for assessment. Following the application of the Assessment Factors, described in this report, four alignments were discounted and a shortlist of five alignments was identified for consultation.

9.3.10. The full list of Route Alignment Options identified for assessment is included below. The shortlisted alignments are in bold:

- Core Section Alignment 1 - St Neots South Option A to Cambourne North station via A428 Improvement Scheme corridor
- Core Section Alignment 2 - St Neots South Option A to Cambourne South station via A428 Improvement Scheme corridor
- Core Section Alignment 3 –St Neots South Option A to Cambourne North station
- Core Section Alignment 4 - St Neots South Option A to Cambourne South station
- Core Section Alignment 5 - St Neots South Option B to Cambourne North station
- Core Section Alignment 6 - St Neots South Option B to Cambourne South station
- Core Section Alignment 7 - Tempsford Option B to Cambourne North station
- Core Section Alignment 8 - Tempsford Option B to Cambourne South station
- Core Section Alignment 9 - Tempsford Option A to Cambourne North station via A428 Improvement Scheme corridor

9.3.11. The following paragraphs discuss the comparison and analysis of the nine Route Alignment Options that informed the alignment shortlist. Two alignments are also identified as emerging preferred options in the conclusion.

9.3.12. Alignment 8 is the value engineered Route Option E Indicative Alignment and provides the Reference Alignment against which the performance of other alignments is assessed.

Route Alignment Option	Colour
Core Section Alignment 1 - St Neots South Option A to Cambourne North station via A428 Improvement Scheme corridor	Dark blue
Core Section Alignment 2 - St Neots South Option A to Cambourne South station via A428 Improvement Scheme corridor	Red
Core Section Alignment 3 –St Neots South Option A to Cambourne North station	Emerald
Core Section Alignment 4 - St Neots South Option A to Cambourne South station	Pink
Core Section Alignment 5 - St Neots South Option B to Cambourne North station	Bright yellow

Table 9.1: Route Alignment Options and designated colour

Route Alignment Option	Colour
Core Section Alignment 6 - St Neots South Option B to Cambourne South station	Light blue
Core Section Alignment 7 - Tempsford Option B to Cambourne North station	Brown
Core Section Alignment 8 - Tempsford Option B to Cambourne South station	Yellow
Core Section Alignment 9 - Tempsford Option A to Cambourne North station via A428 Improvement Scheme corridor	Purple

#### **9.4. Options considered – station locations**

- 9.4.1. Each of the nine Route Alignment Options that have been assessed would have two new stations. One would be in the Tempsford / St Neots area where there are four possible locations, two at Tempsford and two to the south of St Neots. The other would be in the Cambourne area where there are two possible locations, one to the south and one to the north of Cambourne. This section of the Chapter discusses each of the locations before Route Alignment Options are presented in the next section. EWR Co will consider options for connecting the stations to the existing transport network and sustainable transport modes as part of our preparation for Statutory Consultation.
- 9.4.2. Route Alignment Options which serve all station combinations were included in the alignment shortlist for consultation. The selection of the alignment shortlist is discussed in greater detail in the conclusions, from paragraph 9.7.1 onwards.
- 9.4.3. Analysis so far has identified potential housing delivery estimates for each location, as well as a qualitative summary of potential housing deliverability challenges. This is discussed in the evaluation of the Assessment Factor 'Contribution to enabling housing and economic growth' including best serving areas benefitting from developable land in paragraphs 9.6.17 to 9.6.20.



## Tempsford station

9.4.4. A new Tempsford station would be located to the north east of Tempsford and east of Roxton. It would be south of the proposed A428 Improvement Scheme. The station would have a platform on each side of the alignment. Depending on the alignment, there are two possible station locations:

- Tempsford Option A (Alignment 9)
- Tempsford Option B (Alignment 7 and 8)



Figure 9.4: Tempsford Station area

9.4.5. Both station options would be located to the north east of Tempsford. Tempsford Option B would be closer to the existing community than Tempsford Option A station, but it is located within a flood zone requiring flood compensation at this location and flood protection measures. Flood compensation may require additional land take to manage displaced flood waters and ensure adverse flooding impacts to third party stakeholders are mitigated. Protecting critical station infrastructure might include locating plant equipment at higher elevations above the flood level or installation of flood defences. Tempsford Option A station would be located outside the flood zone. The Environment Agency is considering the modelled flood zone extents in the area of Tempsford in order to ensure they are accurate and up to date, and plans to undertake flood modelling in this area, which may affect the area of land available for housing.

9.4.6. For both options the structure over the ECML would be complex, with the station platforms located above the ECML at a high level. The structural complexity for the Tempsford Option A station would be greater than Tempsford Option B because the EWR alignment for the Tempsford Option A Station crosses the ECML at a greater skew angle.

## St Neots station

9.4.7. A new station would be located to the south of St Neots town and north east of Roxton. It would be north of the proposed A428 Improvement Scheme. This would be in addition to the existing St Neots station further north on the ECML. The station would have a platform on each side of the alignment. There are two possible station locations:

- St Neots South Option A (Alignment 1, 2, 3 and 4)
- St Neots South Option B (Alignment 5 and 6)

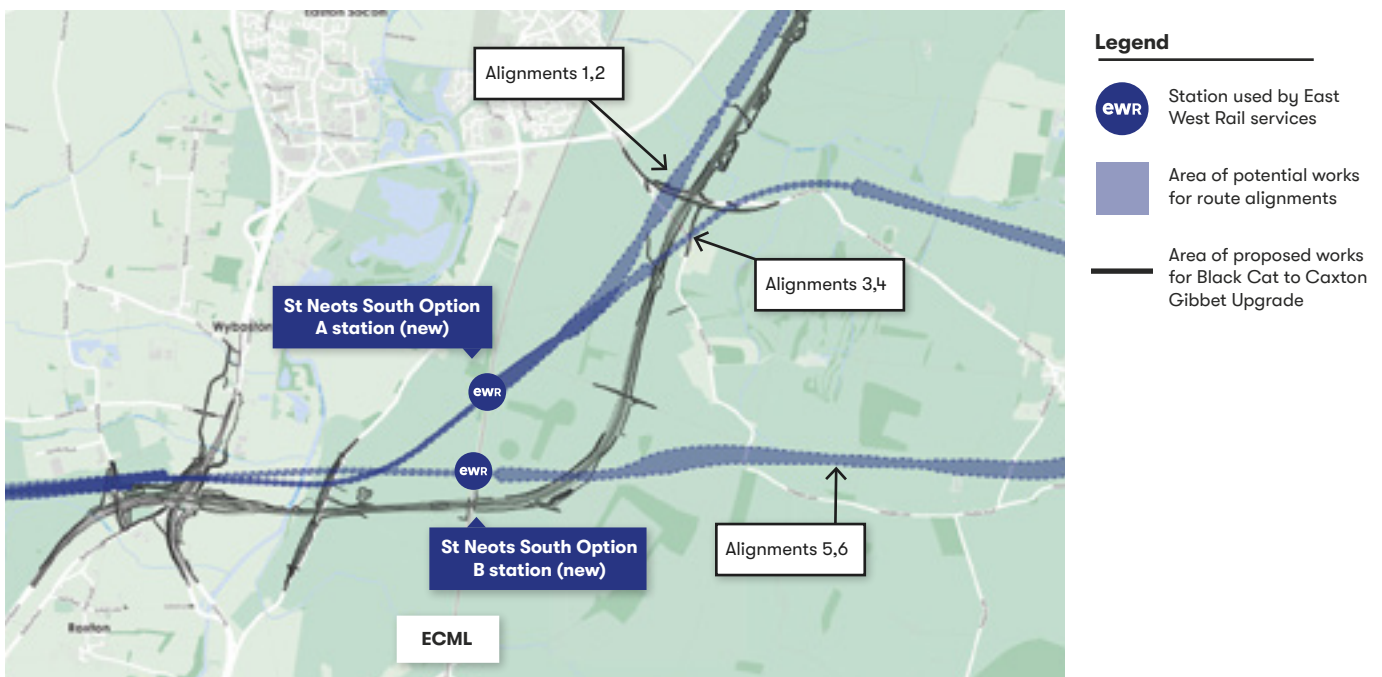


Figure 9.5: St Neots Station area

- 9.4.8. Both St Neots station options would be located outside the River Great Ouse floodplain. St Neots and Tempsford stations are located close to their respective communities but St Neots stations are closer to a larger number of existing properties overall. St. Neots stations also have slightly better connectivity to the proposed A428 Improvement Scheme as there would be a shorter access by road.
- 9.4.9. For both St Neots station options, the structure over the ECML would be complex, with the station platforms located above the ECML at a high level. The complexity of the St Neots South Option A station would be greater than the St Neots South Option B station because the northern option crosses the ECML at a greater skew angle.



## EWR passenger interchange to ECML station

- 9.4.10. Provision has been assumed for a prospective station on the ECML with a passenger interchange with EWR. This would be at the same location as the EWR station, where the alignment crosses the ECML. A high-level station would be located on the EWR alignment (at Tempsford or St Neots) and a potential corresponding low-level station located on the existing ECML.
- 9.4.11. The potential ECML station, and passenger interchange with EWR, is at an early development stage. Further work is required to establish whether the level of usage and consequential effects upon the ECML would justify an interchange station and following that, to develop the design. The differentiators identified between ECML station locations at this stage are not sufficiently large to influence the assessment of the final alignment.

## Cambourne station

- 9.4.12. There are two possible Cambourne station locations, both of which would have platforms either side of the new railway:

- Cambourne North (Alignment 1, 3, 5, 7 and 9)
- Cambourne South (Alignment 2, 4, 6 and 8)

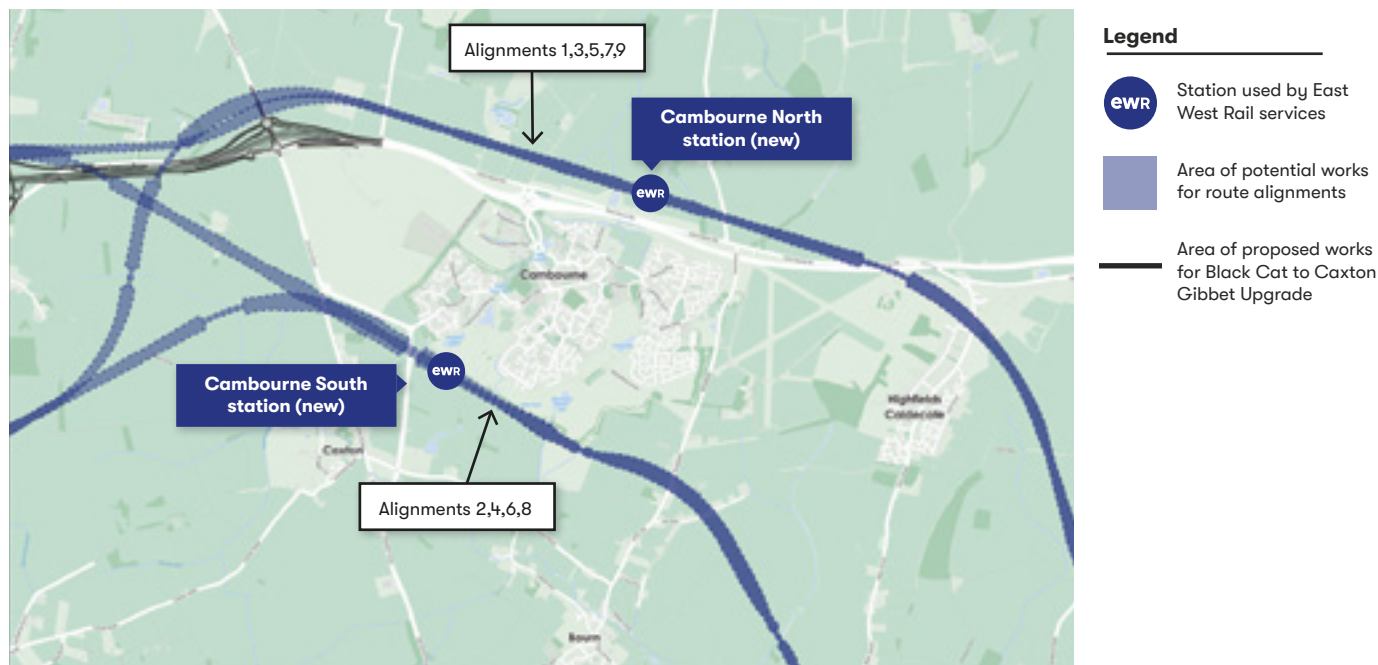


Figure 9.6: Cambourne Station options

- 9.4.13. All proposed station options in Cambourne would be located close to existing communities. Cambourne North station is separated from Cambourne by the A428 which may slightly reduce connectivity to the existing settlement, compared to Cambourne South, particularly for active travel options such as walking and cycling. It also positions the station further from Caxton.

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## **9.5. Options considered – nine alignment options**

- 9.5.1. This section of the Chapter describes each of the nine Route Alignment Options that have been assessed in turn. Afterwards, the potential benefit of synergies with the A428 improvement is discussed.
- 9.5.2. Four of the nine alignments were discounted following the assessment, which is described from paragraph 9.7.1 onwards. The remaining five shortlisted alignments which are included in this consultation are:
- Core Section Alignment 1 - St Neots South Option A to Cambourne North station via A428 Improvement Scheme corridor
  - Core Section Alignment 2 - St Neots South Option A to Cambourne South station via A428 Improvement Scheme corridor
  - Core Section Alignment 6 - St Neots South Option B to Cambourne South station
  - Core Section Alignment 8 - Tempsford Option B to Cambourne South station
  - Core Section Alignment 9 - Tempsford Option A to Cambourne North station via A428 Improvement Scheme corridor

## Core Section Alignment 1 - St Neots South Option A to Cambourne North via A428 Improvement Scheme corridor



Figure 9.7:  
Core Section Alignment 1

- 9.5.3. From Clapham Green, north of Carriage Drive, the alignment curves east and passes north of Ravensden and Roxton. A viaduct is currently proposed to the south of St Neots between the A1 Black Cat Junction and the ECML. This includes viaduct crossings of the A1 and the River Great Ouse. A new St Neots South station would be provided where the alignment crosses the ECML.
- 9.5.4. The alignment follows the same corridor as the proposed A428 Improvement Scheme, running to the north of the new dual carriageway and continuing to the north of Cambourne. The alignment impacts the Papworth Inn to the north west of Cambourne. The alignment does not cross the proposed A428 between the ECML and Cambourne, but it does cross the side roads which intersect the proposed A428. There is an opportunity to simplify some of these crossings through coordination with the A428 Improvement Scheme, thereby reducing capital expenditure and the extent of disruption during construction if the two schemes are built with each taking due cognisance of the other scheme.

- 9.5.5. A station would be provided to the north of Cambourne. The alignment curves south, to the east of Cambourne, crossing the existing A428 on a viaduct. It passes east of Caldecote and west of Hardwick and then east of Toft and west of Comberton, crossing part of Cambridge Meridian Golf Club, before converging with the other alignment options at the A603 (to the north east of The Eversdens).

### Core Section Alignment 2 - St Neots South Option A to Cambourne South via A428 Improvement Scheme corridor



Figure 9.8: Core Section Alignment 2

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- 9.5.6. From Clapham Green, north of Carriage Drive, the alignment curves east and passes north of Ravensden and Roxton. A viaduct is currently proposed to the south of St Neots between the A1 Black Cat Junction and the ECML. This includes viaduct crossings of the A1 and the River Great Ouse. A new St Neots South Option A station would be provided where the alignment crosses the ECML.
- 9.5.7. The alignment follows the same corridor as the proposed A428 Improvement Scheme, running to the north of the new dual carriageway, before turning south to cross the A428 Improvement Scheme on a viaduct to the west of Cambourne. The alignment also crosses the side roads which intersect the proposed A428. There is an opportunity to simplify some of these crossings through coordination with the A428 Improvement Scheme, thereby reducing capital expenditure and the extent of disruption during construction.
- 9.5.8. The alignment passes between Caxton and Cambourne and a station would be located south of Cambourne. To the south of Cambourne the alignment runs between a solar farm and Cambourne nature reserve. The alignment crosses land on the edges of both sites whilst seeking to minimise the land take.
- 9.5.9. The alignment passes east of Bourn and west of Caldecote and then east of Kingston and west of Toft before converging with the other alignments at the A603 (to the north east of The Eversdens).



## Core Section Alignment 3 – St Neots South Option A to Cambourne North



Figure 9.9: Core Section Alignment 3

- 9.5.10. From Clapham Green, north of Carriage Drive, the alignment curves east and passes north of Ravensden and Roxton. A viaduct is currently proposed to the south of St Neots between the A1 Black Cat Junction and the ECML. This includes viaduct crossings of the A1 and the River Great Ouse. A new St Neots South Option A station would be provided where the alignment crosses the ECML.
- 9.5.11. The alignment then proceeds in a north-easterly direction, crossing the A428 Improvement Scheme on a viaduct to the north of Abbotsley Golf course, where the alignment curves to the east. It passes to the north of Abbotsley before curving northwards to the east of Caxton. The alignment passes east of Eltisley, crosses the A428 Improvement Scheme on a viaduct structure and curves to the east to follow the A428, providing a station to the north of Cambourne.
- 9.5.12. The alignment then curves south, to the east of Cambourne, crossing the existing A428 on a viaduct. It passes east of Caldecote and west of Hardwick and then east of Toft and west of Comberton, crossing part of Cambridge Meridian Golf Club, before converging with the other alignment options at the A603 (to the north east of The Eversdens).

## Core Section Alignment 4 - St Neots South Option A to Cambourne South



Figure 9.10: Core Section Alignment 4

- 9.5.13. From Clapham Green, north of Carriage Drive, the alignment curves east and passes north of Ravensden and Roxton. A viaduct is currently proposed to the south of St Neots between the A1 Black Cat Junction and the ECML. This includes viaduct crossings of the A1 and the River Great Ouse. A new St Neots South Option A station would be provided where the alignment crosses the ECML.
- 9.5.14. The alignment then proceeds in a north-easterly direction, crossing the A428 Improvement Scheme on a viaduct to the north of Abbotsley Golf course, where the alignment curves to the east. It passes to the north of Abbotsley, between South Great Gransden and Eltisley and curves to the south to pass between Caxton and Cambourne. A station would be located south of Cambourne. To the south of Cambourne the alignment runs between a solar farm and Cambourne nature reserve. The alignment crosses land on the edges of both sites whilst seeking to minimise the land take.
- 9.5.15. The alignment passes east of Bourn and west of Caldecote and then east of Kingston and west of Toft before converging with the other alignments at the A603 (to the north east of The Eversdens).

## Core Section Alignment 5 - St Neots South Option B to Cambourne North



Figure 9.11: Core Section Alignment 5

- 9.5.16. From Clapham Green, north of Carriage Drive, the alignment curves east and passes north of Ravensden and Roxton. A viaduct is currently proposed to the south of St Neots between the A1 Black Cat Junction and the ECML. This includes viaduct crossings of the A1 and the River Great Ouse. A new St Neots South Option B station would be provided where the alignment crosses the ECML.
- 9.5.17. The alignment crosses under the A428 Improvement Scheme and passes to the south of Abbotsley. Alignment options with a crossing under the proposed A428 Improvement Scheme could be more disruptive than alignments with viaduct crossings over the proposed A428 from the perspective of impacts on traffic, assuming there will be no integration between the A428 Improvement Scheme and EWR. There is an opportunity to reduce the impact of this crossing through integration with the proposed A428 Improvement Scheme and EWR Co is collaborating with Highways England.



9.5.18. East of Caxton the alignment curves to the north. The alignment passes east of Eltisley, crosses the proposed A428 Improvement Scheme on a viaduct structure and curves to the east to follow the existing A428 with a station being provided to the north of Cambourne.

9.5.19. The alignment curves south to the east of Cambourne crossing the existing A428 on a viaduct. It passes east of Caldecote and west of Hardwick and then east of Toft and west of Comberton, crossing part of Cambridge Meridian Golf Club, before converging with the other alignments near The Eversdens.

### Core Section Alignment 6 - St Neots South Option B to Cambourne South



Figure 9.12: Core Section Alignment 6

9.5.20. From Clapham Green, north of Carriage Drive, the alignment curves east and passes north of Ravensden and Roxton. A viaduct is currently proposed to the south of St Neots between the A1 Black Cat Junction and the ECML. This includes viaduct crossings of the A1 and the River Great Ouse. A new St Neots South Option B station would be provided where the alignment crosses the ECML.

9.5.21. The alignment crosses under the A428 Improvement Scheme and passes to the south of Abbotsley. Alignment options with a crossing under the proposed A428 Improvement Scheme could be more disruptive than alignments with viaduct crossings over the proposed A428 from the perspective of impacts on traffic, assuming there will be no integration between the A428 Improvement Scheme and EWR. There is an opportunity to reduce the impact of this crossing through integration with the proposed A428 Improvement Scheme and EWR Co is collaborating with Highways England.

9.5.22. The alignment passes between Great Gransden and Eltisley and curves to the south to pass between Caxton and Cambourne. A station would be located south of Cambourne. To the south of Cambourne the alignment runs between a solar farm and Cambourne nature reserve. The alignment crosses land on the edges of both sites whilst seeking to minimise the land take.

9.5.23. The alignment passes east of Bourn and west of Caldecote and then east of Kingston and west of Toft before converging with the other alignments near The Eversdens.

## Core Section Alignment 7 - Tempsford Option B to Cambourne North



Figure 9.13: Core Section Alignment 7

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- 9.5.24. From Clapham Green, north of Carriage Drive, the alignment curves east and passes south of Ravensden and Roxton with viaducts over the A421 and A1 roads and the River Great Ouse. The alignment passes Brickhill Country park and affects Willow Cottage Cattery. North of Tempsford the alignment passes near to a sewage treatment works before crossing the ECML on a viaduct, where a new station would be provided. The alignment curves to pass south of Abbotsley and north of Great Gransden.
- 9.5.25. East of Caxton the alignment curves to the north. The alignment passes east of Eltisley, crosses the A428 Improvement Scheme on a viaduct structure and curves to the east to follow the existing A428 with a station being provided to the north of Cambourne.
- 9.5.26. The alignment curves south to the east of Cambourne crossing the existing A428 on a viaduct. It passes east of Caldecote and west of Hardwick and then east of Toft and west of Comberton, crossing part of Cambridge Meridian Golf Club, before converging with the other alignments near The Eversdens.

## Core Section Alignment 8 - Tempsford Option B to Cambourne South



Figure 9.14: Core Section Alignment 8

- 9.5.27. From Clapham Green, north of Carriage Drive, the alignment curves east and passes south of Ravensden and Roxton with viaducts over the A421 and A1 roads and the River Great Ouse. The alignment passes Brickhill Country park and affects Willow Cottage Cattery. North of Tempsford the alignment passes near to a sewage treatment works before crossing the ECML on a viaduct where a new station would be provided. The alignment curves to pass south of Abbotsley and passes between Great Gransden and Eltisle.
- 9.5.28. The alignment curves to the south to pass between Caxton and Cambourne. A station would be located south of Cambourne. To the south of Cambourne the alignment runs between a solar farm and Cambourne nature reserve. The alignment crosses land on the edges of both sites whilst seeking to minimise the land take.
- 9.5.29. The alignment passes east of Bourn and west of Caldecote and then east of Kingston and west of Toft before converging with the other alignments near The Eversdens.




## Core Section Alignment 9 - Tempsford Option A to Cambourne North via A428 Improvement Scheme corridor





### Legend

 Route Alignment 9

 Other station

 Proposed A428 Alignment

 Station used by East West Rail services

 Station that may be used by East West Rail services


 Other area of East West Rail

Figure 9.15: Core  
Section Alignment 9

9.5.30. From Clapham Green, north of Carriage Drive, the alignment curves east and passes south of Ravensden and Roxton with viaducts over the A421 and A1 roads and the River Great Ouse. The alignment passes Brickhill Country park and affects Willow Cottage Cattery. North of Tempsford the alignment curves to the north and crosses the ECML on a viaduct, where a new station would be provided.

9.5.31. The alignment crosses under the proposed A428 Improvement Scheme and under the B1046. The B1046 is a side road which intersects with the A428 and is part of the A428 Improvement Scheme. Alignment options with crossings under roads could be more disruptive than alignments with viaduct crossings over roads from the perspective of impacts on traffic. There is an opportunity to reduce the impact of these crossings through integration with the A428 Improvement Scheme and EWR Co is collaborating with Highways England.

9.5.32. Pumped drainage may be required at the structure under the proposed A428 due to a low point in the proposed rail alignment. Further design development is needed to confirm whether this can be removed through design refinement or through combining design elements with the A428 Improvement Scheme and EWR Co is collaborating with Highways England. At this stage pumped drainage is included in the assessment.

9.5.33. The alignment follows the same corridor as the A428 Improvement Scheme, running to the north of the new dual carriageway and continuing to the north of Cambourne. The alignment impacts the Papworth Inn to the north west of Cambourne. A station would be provided to the north of Cambourne. The alignment curves south to the east of Cambourne crossing the existing A428 on a viaduct. It passes east of Caldecote and west of Hardwick and then east of Toft and west of Comberton, crossing part of Cambridge Meridian Golf Club, before converging with the other alignment options near The Eversdens.

### **A428 Improvement Scheme synergies**

9.5.34. In parallel to the development of the EWR Project by EWR Co, Highways England (HE) is developing the A428 Black Cat to Caxton Gibbet Improvement Scheme, which provides 16km (ten miles) of new dual carriageway between A1 (Black Cat Roundabout) and Cambourne (Caxton Gibbet).

9.5.35. All of the Route Alignment Options being considered by EWR Co, with the exception of Alignment 8 (Tempsford to Cambourne South), which is entirely to the south of the new road, have some degree of interaction with the A428 Improvement Scheme:

- Alignments 1, 2, 3, 4, 5 and 6 would pass in close proximity to the A428 works at Black Cat roundabout
- Alignments 2, 3, 4, 5, 6, 7 and 9 would require a bridge under or over the A428 Improvement Scheme.
- Alignments 1, 2 and 9 run parallel and in close proximity to the A428 Improvement Scheme for approximately 12km.

9.5.36. The EWR Project is at an earlier stage of development than the A428 Improvement Scheme. So, to facilitate the application of the Assessment Factors, for option selection, a consistent approach to how the EWR Project would affect the A428 Improvement Scheme was adopted. This assumed that no integration would be possible due to the more advanced stage of the A428 Improvement Scheme. This provided a worst-case scenario for the delivery of EWR.

9.5.37. However, in coordination with Highways England and the Department for Transport (DfT), EWR has completed some initial reviews to consider the extent to which construction, operational and environmental synergies can be created by working together. This process has identified a number of potential benefits, and disbenefits, that could be achieved through integrating the two transport

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schemes to varying degrees. The possible impacts of A428 Improvement Scheme synergies have been considered, outside the Assessment Factors, when shortlisting Route Alignment Options as described in paragraphs 9.7.1 to 9.7.24.

9.5.38. There is an opportunity, by working with Highways England, to modify the design of the A428 Improvement Scheme to better accommodate the new railway. This opportunity could:

- Allow the railway to run closer to ground level, particularly in the areas around the proposed A428 Improvement Scheme junctions and reduce the volume of earthworks and number / length of structures required for EWR.
- Allow EWR to consider moving the railway closer (horizontally) to the road alignment where possible which may have benefits for construction and reduce overall impacts of the Project.
- Allow integration of the construction programme for both schemes, to be more efficient and minimise the overall period of time for which residents are affected by construction.
- Create efficiencies arising from joint arrangements to divert underground and overhead utility services.

9.5.39. While some impacts, such as those listed above, could be reduced, others may be increased as a result of the two schemes being located closer together. These will be evaluated as part of the design process and both benefits and disbenefits will be considered together to determine the most appropriate solution.

9.5.40. The work to quantify and assess the engineering changes required, possible impacts, and benefits and disbenefits of this integration is ongoing. The potential areas of change, and possible impacts are described in Appendix D.

### **Value Management opportunities**

9.5.41. A Value Management exercise will be completed at the next design stage. During this, the design of the preferred alignments will be assessed, developed and refined to improve their design. Refinements could have several benefits including reducing cost, reducing environmental impacts and improving constructability. A number of potential opportunities have been identified which will be investigated at the next design stage. These have been logged for all the alignments under consideration.

9.5.42. An initial list of Value Management opportunities has been identified which are described in Appendix D. This list is not definitive, as further opportunities may be identified through the consultation process and ongoing design development. At this stage, Value Management opportunities are not expected to differentiate between options, except in relation to the potential synergies with the A428 Improvement Scheme.

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## **9.6. Comparison of nine Route Alignment Options**

### **Approach**

- 9.6.1. The nine Route Alignment Options were assessed using the Assessment Factors with the aim of identifying a short list of options for consultation and an emerging preferred option or options. This section of the Chapter describes that assessment. The shortlisted alignments identified by that process for this consultation are:
- Core Section Alignment 1 - St Neots South Option A to Cambourne North station via A428 Improvement Scheme corridor
  - Core Section Alignment 2 - St Neots South Option A to Cambourne South station via A428 Improvement Scheme corridor
  - Core Section Alignment 6 - St Neots South Option B to Cambourne South station
  - Core Section Alignment 8 - Tempsford Option B to Cambourne South station
  - Core Section Alignment 9 - Tempsford Option A to Cambourne North station via A428 Improvement Scheme corridor.
- 9.6.2. Each Route Alignment option is compared against the Reference Alignment, provided by Alignment 8, for each Assessment Factor (and Considerations supporting the Assessment Factors). This shows if the alignment option is an improvement on, the same as, or a worsening from, the Reference Alignment. This then gives an indication of the relative performance of each option compared to the Reference Alignment.
- 9.6.3. Alignment 8 has been chosen as the Reference Alignment because it is a version of the Route Option E Indicative Alignment which has undergone design development as described in Chapter 5. It serves the same stations as the Route Option E Indicative Alignment and is within the Preferred Route Option E boundary.
- 9.6.4. The designs have been assessed on the basis of EWR and the A428 Improvement Scheme being two separate independent projects. This assumed that no integration would be possible due to the more advanced stage of the A428 Improvement Scheme. However, opportunities presented by synergy with the A428 Improvement Scheme have been considered in the shortlisting of alignments in terms of whether they would be likely to favour one alignment over another.
- 9.6.5. With the exception of the A428 Improvement Scheme synergy, the Value Management opportunities have not been included in the selection of the alignment short list. No Value Management opportunities were included in the application of Assessment Factors. Opportunities have been identified on all alignments and subsequently Value Management activities are not expected to disproportionately benefit one alignment over another. At this stage the Value Management opportunities have not been investigated to determine their feasibility or quantify their benefits.



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9.6.6. Train stabling and depot facilities may be required in Project Section D to facilitate the maintenance and storage of infrastructure and rolling stock. Further description of the function of such facilities are provided in Chapter 3. Work to identify the preferred location(s) for train stabling and depot facilities is ongoing and details will be shared at the Statutory Consultation. It is possible to provide facilities on all Route Alignment Options and it is not expected to be a determinant when short listing alignments. Consequently, depot and stabling locations have not been included in the assessment of alignments.

### Summary of assessment

9.6.7. As set out in Chapter 5, a series of factors has been agreed with DfT that reflect the Project Objectives and are used to assess options and arrive at a short list and/or preferred option. All Assessment Factors have been considered in the assessment but those that differentiate between Core Section options at this stage are presented as the focus here. These are the factors that differentiate between Route Alignment Options in the Core Section and therefore have helped to identify the short list:

- Transport User Benefits (journey time and modal shift) together with short distance passenger services;
- Contribution to enabling housing and economic growth including best serving areas benefiting from developable land;
- Capital Cost (including programme risk);
- Overall affordability (maintenance and renewal);
- Performance (infrastructure reliability, and resilience);
- Safety risk (operations and maintenance); and
- Environmental impacts and opportunities.

9.6.8. Table 9.2 presents the outcomes of assessments against the **differentiating** Assessment Factors (and Considerations that support the Assessment Factors). Differentiating Considerations for each Assessment Factor are shown directly underneath the relevant Assessment Factor in the table. The assessment for the capital cost factor has been combined with the overall affordability factor as the dominant factor in both these assessments is the cost to implement the Project. This is described in greater detail in the following sections of this Chapter below.

**Table 9.2: Project Section D Options Assessment Outcomes**

Assessment Factors		Tempsford to Cambourne South	Tempsford to Cambourne North	
		Alignment 8 (Benchmark)	Alignment 9 (A428)	Alignment 7
<b>Assessment Factor</b>	<b>Transport user benefits</b>	<b>Neutral</b>	<b>Minor Worsening</b>	<b>Minor Worsening</b>
<i>Consideration</i>	<i>Journey time</i>	<i>Neutral</i>	<i>East +01:52 West +01:52</i>	<i>East +01:53 West +01:36</i>
<i>Consideration</i>	<i>Modal shift</i>	<i>Neutral</i>	<i>Minor Worsening</i>	<i>Minor Worsening</i>
<b>Assessment Factor</b>	<b>Housing and Growth</b>	<b>Neutral</b>	<b>Minor Improve</b>	<b>Minor Improve</b>
<b>Assessment Factor</b>	<b>Capex (coresection)</b>	<b>Neutral</b>	<b>Neutral</b>	<b>Neutral</b>
<i>Consideration</i>	<i>Up front cost £bn (2019 prices)</i>	<i>£2.3bn - £2.5bn</i>	<i>£120m to £130m less -5%</i>	<i>Circa £50m more +2%</i>
<i>Consideration</i>	<i>Programme risk</i>	<i>Neutral</i>	<i>Minor Worsening</i>	<i>Minor Worsening</i>
<i>Consideration</i>	<i>Maintenance cost</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
<i>Consideration</i>	<i>Renewal cost</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
<b>Assessment Factor</b>	<b>Performance</b>	<b>Neutral</b>	<b>Neutral</b>	<b>Neutral</b>
<i>Consideration</i>	<i>Inf reliability</i>	<i>Neutral</i>	<i>Minor Improve</i>	<i>Neutral</i>
<i>Consideration</i>	<i>Resilience</i>	<i>Neutral</i>	<i>Minor Worsening</i>	<i>Neutral</i>
<b>Assessment Factor</b>	<b>Safety Risk</b>	<b>Neutral</b>	<b>Neutral</b>	<b>Neutral</b>
<i>Consideration</i>	<i>Construction</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
<i>Consideration</i>	<i>O&amp;M</i>	<i>Neutral</i>	<i>Minor Improve</i>	<i>Neutral</i>
<b>Assessment Factor</b>	<b>Environmental</b>	<b>Neutral</b>	<b>Minor Improve</b>	<b>Minor Improve</b>

St Neots to Cambourne North			St Neots to Cambourne South		
Alignment 1 (A428)	Alignment 3	Alignment 5	Alignment 2 (A428)	Alignment 4	Alignment 6
Minor Worsening	Minor Worsening	Minor Worsening	Neutral	Neutral	Neutral
<i>East +01:38</i> <i>West +01:36</i>	<i>East +01:50</i> <i>West +02:09</i>	<i>East +01:51</i> <i>West +01:40</i>	<i>East +00:25</i> <i>West +00:43</i>	<i>East -00:01</i> <i>West +00:07</i>	<i>East +00:01</i> <i>West -00:02</i>
<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
Minor Improve	Minor Improve	Minor Improve	Neutral	Neutral	Neutral
Minor Improve	Neutral	Neutral	Neutral	Neutral	Minor Improve
<i>£310m to £340m</i> <i>less -14%</i>	<i>£160m to £170m</i> <i>less -7%</i>	<i>£200m to £230m</i> <i>less -9%</i>	<i>£210m to £230m</i> <i>less -9</i>	<i>£190m to £200m</i> <i>less -8%</i>	<i>£270m to £300m</i> <i>less -12%</i>
<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
Minor Improve	Neutral	Neutral	Minor Improve	Neutral	Neutral
<i>Minor Improve</i>	<i>Neutral</i>	<i>Neutral</i>	<i>Minor Improve</i>	<i>Neutral</i>	<i>Neutral</i>
<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
Minor Improve	Neutral	Minor Improve	Minor Improve	Minor Improve	Minor Improve
<i>Minor Improve</i>	<i>Neutral</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
Major Improve	Major Improve	Major Improve	Major Improve	Major Improve	Major Improve

Improve = Improvement; Italics = a Consideration that feeds into the assessment of an Assessment Factor. The estimated cost ranges represent the capital cost order of magnitude costs for the core section. This is based upon the engineering design for non-statutory consultation. Excluded from these figures are operation & maintenance costs, land and property, and any inflation beyond 2019.

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## Commentary

- 9.6.9. The following sections of this Chapter discuss the performance of the nine Route Alignment Options against each of the differentiating Assessment Factors and Considerations in turn.

### Transport user benefits

- 9.6.10. Journey time (one of the considerations within the transport user benefits Assessment Factor) was the most helpful Consideration in the assessment of the overall transport user benefits when differentiating between alignments. EWR Co expects journey times to influence demand take-up and deliver benefits in the form of journey time savings, revenues and modal shift to rail away from less sustainable modes of transport, such as private vehicles. The assessment also reflects the differences in short distance connectivity to support commuting travel, and short distance passenger services, for each alignment.
- 9.6.11. The alignments which serve a Cambourne North station (Alignments 1, 3, 7 and 9) are longer than those which serve a Cambourne South station and consequently have longer journey times, compared to the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). Overall, Alignment 3 has the longest journey time out of the options that serve a Cambourne North station. Longer journey times result in lower modelled transport user benefits.
- 9.6.12. Alignments which serve a station at Cambourne South (Alignments 2, 4 and 6) have lengths, and subsequently journey times, that are more closely comparable to the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). Alignment 2 has the longest journey time out of the options that serve a Cambourne South station.
- 9.6.13. Modal shift benefits (the other differentiating Consideration contributing to the transport user benefits Assessment Factor) were considered for existing residents of the corridor (which excludes benefits from future demand generated from new developments, which are captured in the housing and economic growth Assessment Factor) were based on a high-level qualitative assessment of the proximity to existing users to capture the ability of the station to attract new local patronage.
- 9.6.14. Performance of the different station locations for modal shift benefits is as follows:
- Cambourne South (Alignment 8, 2, 4 and 6) stations perform slightly better than Cambourne North (Alignment 9, 7, 1, 3 and 5) stations. Cambourne North station is separated from Cambourne by the A428 which may slightly

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reduce connectivity, especially for active travel options. This could be mitigated in part through the provision of new foot and cycle crossings over the A428. Cambourne North also positions the station much further from Caxton, discouraging this existing community from active travel to the station.

- St Neots station (Alignments 1-6) options perform better than Tempsford station (Alignment 7-9) options. Both are close to their respective existing community, but St Neots stations are closer to a larger number of existing properties overall.
- St Neots South Option A station alignments (Alignments 1-4) perform slightly better than St Neots South Option B alignments (Alignments 5 and 6) as they are closer to the existing community, and a slightly larger number of properties overall.

9.6.15. Overall, alignments which serve the combination of St Neots and Cambourne South stations (Alignments 2, 4 and 6) are a minor improvement to the Reference Alignment (which serves Tempsford and Cambourne South). Alignments which serve both Tempsford and Cambourne North (Alignment 7 and 9) are a minor worsening.

9.6.16. In the overall assessment of transport user benefits, alignments connecting a St Neots station to Cambourne South (Alignments 2, 4 and 6) perform slightly better than the Reference Alignment (Alignment 8 – Tempsford to Cambourne South) when combining journey time and modal shift Considerations. Those connecting St Neots to Cambourne North (Alignments 1, 3 and 5) and Tempsford to Cambourne North (Alignments 7 and 9) were considered to perform slightly worse than the Reference Alignment. The overall time saving Consideration was determined to be the most important Consideration in the assessment of the transport user benefits at this design stage.

### **Contribution to enabling housing and economic growth including best serving areas benefitting from developable land**

9.6.17. Stimulating economic growth, housing and employment across the Oxford-Cambridge Arc is a key Project Objective. Therefore, understanding how station location options might influence the development potential of their surrounding areas is vital when comparing the Route Alignment Options.

9.6.18. On this section of EWR, the locations for the new stations are yet to be decided. These are: a station close to the ECML, where options are at Tempsford and St Neots; and the Cambourne station, where the options are Cambourne North (north of the A428) and Cambourne South (to the south of the existing built-up area). The relative performance of each station location option will affect its performance in relation to this Assessment Factor.

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9.6.19. To understand the potential of each station location for housing development and economic growth, EWR Co has undertaken a high-level assessment of the following:

- The availability and suitability for development of land within close proximity to potential station locations and any constraints (for instance environmental considerations such as flooding or heritage assets);
- Placemaking opportunities and constraints;
- Relevant information from local plans and related local planning documents; and
- Socio-economic factors.

9.6.20. The high-level findings for each location decision point are set out below.

## **Cambourne**

### **Land availability and suitability**

9.6.21. There are several environmental and local heritage areas that have been identified in the vicinity of Cambourne South that would require appropriate mitigation to protect them. These are:

- Scheduled monuments and listed buildings;
- Areas of woodland, priority habitat, and county wildlife sites; and
- Cambourne Local Nature Reserve.

9.6.22. From a planning perspective, EWR Co expects that this would place greater constraints upon development at Cambourne South, which is likely to result in a reduction in the amount of development that could be delivered. Impacts at Cambourne North are expected to be limited to significantly fewer environmental and heritage assets and therefore would not result in as many constraints as at Cambourne South.

9.6.23. There is the potential for development at Cambourne North to have a visual impact on historic buildings such as Childerly Hall, due to the relatively elevated location of developable land within the existing rural landscape, but EWR Co does not expect that to be a major constraint to development.

9.6.24. Hydrological mitigation, such as areas for water run-off, will need to be integrated into both Cambourne North and Cambourne South, helping to support sensitive hydrological management. This is not expected to have a significant impact on the delivery of development at either location.

9.6.25. Development at Cambourne North would need to provide mitigation for the local electricity lines that run across the site, which would be likely to reduce the area of land available for development. Such mitigation is not expected to be necessary at the Cambourne South location.

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## Placemaking

- 9.6.26. Cambourne North development would lie north of the A428, which would result in severance between the existing village of Cambourne and Cambourne North development, but would not constrain development north of the A428.
- 9.6.27. For Cambourne South, the A1198 would cause severance between the east and west of the area that could be developed, which would require mitigation. As this is a single carriageway, the mitigation is not expected to impact greatly on the scale of development that might be realised.
- 9.6.28. Housing development at Cambourne North is expected to be able to retain separation from and between existing settlements such as Papworth Everard, Knapwell and Elsworth. However, the amount of new housing provided at Cambourne South is expected to be less than at Cambourne North in order to overcome the concerns regarding the coalescence of smaller villages including Caxton, Caxton End and Crow End.

## Planning

- 9.6.29. A site in the vicinity of the Cambourne North location has already been identified for development as part of a consultation upon the emerging Greater Cambridge Local Plan, although the local planning authority has yet to publish an updated development plan that would either accept or reject this site. No such site has been identified in the vicinity of the Cambourne South location
- 9.6.30. At either location, the existing highway network would need to be upgraded to support development of significant scale.
- 9.6.31. Land at the Cambourne South site is in multiple ownerships, which would present challenges to delivering large scale development at speed. In contrast, land ownership around Cambourne North is generally consolidated, which would provide better opportunity to deliver the proposed development. However, in March 2020 the Government committed to developing the case for a development corporation at Cambourne to “accelerate new housing and infrastructure development”<sup>63</sup>. Should a development corporation come forward, land consolidation in the vicinity of each site would not impact on deliverability of the proposed development, therefore should not be a distinguishing factor between the two locations.

## Socio-economic factors

- 9.6.32. Socio-economic factors are finely balanced between Cambourne North and South.

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<sup>63</sup> [www.gov.uk/government/publications/budget-2020-documents/budget-2020](https://www.gov.uk/government/publications/budget-2020-documents/budget-2020)

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9.6.33. For Cambourne North new employment uses could be expected to be located close to the existing employment centre of Cambourne Business Park. In contrast, at Cambourne South any new employment cluster would be in a location where no such use currently exists and could potentially be incompatible with the adjacent residential uses. Cambourne Business Park and its planned expansion as part of Cambourne South would help to mitigate this risk.

9.6.34. There are limited employment opportunities within Cambourne and the surrounding area. Proposed development at either Cambourne North or Cambourne South is therefore likely to result in increased out-commuting, but the railway would provide the connectivity needed to do this.

9.6.35. Existing and planned social infrastructure provision around the Cambourne area will not be sufficient to support the proposed developments at either Cambourne North or South. Wider government investment will therefore be needed in the area to support any future development.

## **Summary**

9.6.36. Although EWR Co is still developing its analysis of each station option's potential for housing development, the evidence reviewed so far suggests that, on balance, development around the Cambourne North station would require fewer, or less significant, mitigation measures than around Cambourne South.

9.6.37. Alignments serving Cambourne North are therefore currently assessed as being likely to perform better in relation to housing and economic growth than those serving Cambourne South. Further analysis will be developed to support this ahead of selecting a Preferred Route Alignment.

9.6.38. Combining these Considerations, alignments with a station at Cambourne North (Alignments 1, 3, 5, 7 and 9) are likely to offer greater potential for growth.

## **Tempsford / St Neots**

### **Land availability and suitability**

9.6.39. Development in the vicinity of Tempsford would need to avoid the surface water flood zone located in the area identified in current modelling by the Environment Agency. This could potentially reduce the size of developable area at this location. There would also need to be mitigation in the St Neots area to avoid these surface flood risk zones, but this would be somewhat less significant than at Tempsford, based on outputs from current models.



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9.6.40. There are several environmental and local heritage areas that have been identified in the vicinity of both the Tempsford site and the St Neots site that would require appropriate mitigations to protect. These are:

- Scheduled monuments and listed buildings, particularly around the Tempsford Church End Conservation Area; and
- Areas of ancient woodland, priority habitat, and county wildlife sites.

9.6.41. The area in the vicinity of the St Neots station option is on lower ground, rising to a ridge line. This will require appropriate integration with any development on the site but is not expected to affect the size of a potential development.

9.6.42. Both Tempsford and St Neots station sites could be negatively affected by noise and pollution issues due to their geographic relationship with the A428 Improvement Scheme, and those effects would require mitigation. The A428 Improvement Scheme would be situated closer to the proposed station at St Neots than to Tempsford, therefore negatively affecting potential development at St Neots more than it would at Tempsford, where the proposed station would be situated further away from the road.

9.6.43. Hydrological mitigations, such as areas for water run-off, would need to be integrated into both Tempsford and St Neots development proposals, helping to support sensitive hydrological management. This is not expected to have a significant impact on the delivery of either option.

9.6.44. High voltage overhead electricity lines would affect both options and there would be a choice of whether to avoid developing around those lines, which would constrain the developable areas of land at each location, or to funding an alternative solution such as re-routing or ‘undergrounding’ of the lines, which would be costly.

## **Placemaking**

9.6.45. There would be a risk of new development coalescing with existing villages at both St Neots and Tempsford. Around the site of the St Neots station options, new development would risk coalescence with the existing St Neots built up area. Furthermore, there is outline planning permission for south-easterly expansion of existing St Neots and the existing industrial estate south of the A428, which would reduce the ability to integrate development with existing settlements at a St Neots station location. At Tempsford, there would be a risk of coalescence with existing settlements including Tempsford, Everton, Little Barford and potentially Sandy.

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- 9.6.46. The proposed sites both interact with the A428 Improvement Scheme, which would create severance between settlements within the proposed sites. The A428 Improvement Scheme would run closer to the proposed St Neots station than the proposed Tempsford station, and through a larger area of the proposed St Neots site than the proposed Tempsford site. This would potentially cause a greater severance impact in the St Neots station options than in those for Tempsford. This would reduce the attractiveness of development at St Neots compared with Tempsford.

## Planning

- 9.6.47. Much development potential around Tempsford has already been identified as part of an opportunity area within Central Bedfordshire's draft local development plan (albeit with no allocation). In contrast, most potential development around a St Neots station has not yet been identified within local development plans.
- 9.6.48. Land ownership in the area around the St Neots station options is disjointed, which would present challenges to delivering large scale development. In contrast, land ownership around the Tempsford station options is generally consolidated, which would provide better opportunity to deliver development. Nevertheless, as with the Cambourne location, in March 2020 the Government committed to developing the case for a development corporation at St Neots / Sandy to "accelerate new housing and infrastructure development"<sup>64</sup>. Should a development corporation come forward, land consolidation in the vicinity of each site would not impact on deliverability of the proposed development therefore should not be a distinguishing feature between the two locations.

## Socio-economic factors

- 9.6.49. Socio-economic factors are finely balanced between Tempsford and St Neots.
- 9.6.50. There are limited employment opportunities within St Neots and the surrounding area. Proposed development at either St Neots or Tempsford is therefore likely to result in increased out-commuting initially at least, but the railway provides the connectivity needed to do this.
- 9.6.51. Existing and planned social infrastructure provision around the St Neots area will not be enough to support the proposed developments at either St Neots or Tempsford. Wider government investment may be needed in the area to support any future development.

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<sup>64</sup> [www.gov.uk/government/publications/budget-2020-documents/budget-2020](https://www.gov.uk/government/publications/budget-2020-documents/budget-2020)

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## Summary

- 9.6.52. Evaluating the Tempsford and St Neots station location options using the high-level approach set out indicates that potential housing growth opportunities for Tempsford and St Neots could be more finely balanced than at the Cambourne locations. The constraints associated with the St Neots options, particularly those related to coalescence with the existing St Neots area, and severance problems caused by the A428 Improvement Scheme, appear to be more severe than those around Tempsford, since they relate to placemaking and the attractiveness of future development around the station, but it is difficult to conclude this with certainty at this stage. This means that while it would not be appropriate at this stage to show a clear preference for either St Neots or Tempsford as a station location, it may be possible to do so in the future with additional evidence and feedback from this consultation.
- 9.6.53. Further analysis will be undertaken to draw firmer conclusions on the potential for housing and growth across both these locations, which will allow us to select a preferred station location in time for the Statutory Consultation.

## Capital costs

- 9.6.54. Cost differences, whilst significant in absolute terms, are small when considered relative to the overall capital cost of the Project. The key drivers of the capital cost at this stage of scheme development are the length of the alignment, the total length of structures, the total quantity of earthworks and the amount of imported fill material required. The potential cost savings compared to the Reference Alignment are included in Table 9.2. The estimated cost ranges represent the capital cost order of magnitude costs for the Core Section only. This is based upon the engineering designs presented at the non-Statutory Consultation and described in this technical report. Excluded from these figures are costs attributable to operation and maintenance of the railway, land and property and any inflation beyond 2019. This is an estimate of the Project's cost to complete to inform comparison of the alignments.
- 9.6.55. Alignments that serve a Tempsford station location (Alignment 8 and Alignments 7 and 9) are expected to have greater capital costs than alignments with a station at St Neots. Tempsford alignments have the longest lengths of structures and require a larger quantity of imported earthworks fill material. The Reference Alignment (Alignment 8 – Tempsford to Cambourne South) and Alignment 7 have comparable costs and are expected to have the largest capital cost. Alignment 9 is expected to be slightly less expensive than the Reference Alignment, despite it being a longer alignment, because it has a shorter length of structures and a smaller requirement for imported fill.

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- 9.6.56. Alignments 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme) and 6 (St Neots South Option B to Cambourne South) are expected to provide the greatest capital cost saving compared to the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). Alignment 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme) is expected to provide one of the greatest capital cost savings compared to the Reference Alignment, despite being one of the longer routes, because it requires a smaller quantity of imported fill than the Reference Alignment, has a smaller total volume of earthworks and has one of the shortest total lengths of structures. Alignment 6 is also expected to offer cost savings because a shorter total length of structures is required and lower quantities of imported fill material compared to the Reference Alignment.
- 9.6.57. Alignments 2 (St Neots South Option A to Cambourne South via A428 Improvement Scheme), 3 (St Neots South Option A to Cambourne North), 4 (St Neots South Option A to Cambourne South) and 5 (St Neots South Option B to Cambourne North) are also expected to offer capital cost savings compared to the Reference Alignment. The cost of these four options is expected to be comparable.
- 9.6.58. Programme risk (level of confidence in estimate of delivery time and scale of potential impact on entry into service date) is a smaller but still important Consideration within the capital cost Assessment Factor. Alignments serving Tempsford (Alignment 8, Alignment 7 and Alignment 9) and those serving Cambourne North (Alignments 1, 3 and 5) have large differences between earthworks cut and fill volumes which creates programme risk related to the sourcing and transport of fill material to site.
- 9.6.59. The amount of structural work is also a factor in the programme risk. The Reference Alignment (Alignment 8 – Tempsford to Cambourne South) has the longest length of structures overall. Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme) and alignments serving St Neots South Option B (Alignments 5 and 6) have a structure under the proposed A428 which requires traffic management to avoid closure of the proposed A428. If this can be built at the same time as the A428 Improvement Scheme it would reduce the programme and cost risk for these alignments. EWR Co is collaborating with Highways England to establish the level of integration possible between the two schemes, but in this appraisal this is acknowledged as a particular worst reasonable case risk.
- 9.6.60. Combining these Considerations, capital cost was considered the most helpful differentiating factor in the overall judgement. Programme risk will be further understood as the construction programme is developed. Although there are instances of worsening in programme risk, this is not deemed significant enough to change the relative performance of the alignments in this factor. Alignments 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme) and 6 (St Neots South Option B to Cambourne South) perform better than the other options.

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9.6.61. If the opportunity for synergy with the A428 Improvement Scheme is realised it could potentially reduce the capital costs for Alignments 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme), 2 (St Neots South Option A to Cambourne South via A428 Improvement Scheme) and 9 (Temsford to Cambourne North via A428 Improvement Scheme). This would increase the differentiation between Alignment 1 and the other alignments for capital cost and could make the capital cost for Alignment 2 comparable to Alignment 6. The cost of Alignment 9 could decrease making it more comparable to the cost of the alignments serving St Neots stations. However, this opportunity for synergy is considered separately below.

## **Overall affordability**

9.6.62. The differentiating Considerations within the overall affordability Assessment Factor are capital cost, maintenance cost and renewal cost.

9.6.63. Capital cost has been discussed in the previous paragraphs. Alignments 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme) and 6 (St Neots South Option B to Cambourne South) are expected to provide the greatest capital cost saving compared to the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). A428 Improvement Scheme synergy could potentially make the capital cost for Alignment 2 (St Neots South Option A to Cambourne South via A428 Improvement Scheme) comparable to Alignment 6.

9.6.64. At this stage of design, a full Whole Life Cost (WLC) model has not been produced, and there is no absolute WLC estimate for each of the options considered. Whole life cost is the total cost over the lifetime of an asset which includes capital, renewal, maintenance and operating costs. In order to contribute to the maintenance and renewal Considerations in the assessment of options, a qualitative judgement was made on the basis of quantitative indicators.

9.6.65. Track length and track geometry were identified as the biggest differentiators between alignments in relation to maintenance cost. A longer total length of track or an alignment with greater curvature would have a higher maintenance requirement. All alignments have the same number of switches / points and the track geometry is within desirable values. Although there is some differentiation at this stage differences in maintenance cost are not expected to be a significant differentiator. Costs differences are expected to be less than £100m based on an assumed split between capital cost, operating cost, and maintenance and renewal cost of 70%, 15% and 15% respectively. At the current level of accuracy, EWR Co does not believe this to be a differentiating Consideration.

9.6.66. The length of structure was identified as the biggest differentiator between alignments for renewal costs. As for maintenance costs, renewal costs are not expected to be a significant differentiator at this stage.

9.6.67. Operating costs is its own factor. The total length of the rail alignment is expected to be the biggest differentiator at this stage and, as for maintenance and renewal costs, operating costs are not expected to be a significant differentiator at this time.

9.6.68. The overall affordability Assessment Factor combines these Considerations. In this case the dominant Consideration is capital cost. The best performing alignments for capital cost are discussed under the capital cost factor above.

## Performance

9.6.69. The performance Assessment Factor considers infrastructure reliability (likelihood of a failure occurring, not including unplanned events), maintainability and resilience (ability of the railway to avoid or withstand unplanned events and its ability to respond and recover) as the main differentiating Considerations for the assessment of options in the Core Section.

9.6.70. The ability to maintain infrastructure was considered comparable for all alignments. Although maintenance access plans have not been completed at this stage, no major obstacles to accessing the railway have been identified. Siphons, pumps and balancing ponds have been identified as assets requiring

access and a higher frequency of maintenance. Some of these features may be designed out at the next stage.

9.6.71. At this stage of design, the key differentiator in infrastructure reliability was considered to be geology. Alignments that follow the A428 Improvement Scheme (Alignment 1, 2 and 9) avoid an area of weaker geology, where there is exposed Amphill clay. Measures could be taken to mitigate some of the risks of crossing the weaker geology, e.g. shallower earthwork side slopes, but in the weaker geology, small ground movements would still be more likely. More significant mitigation at design stage would need to be undertaken and more frequent inspection and maintenance of the track and track geometry would be required.

9.6.72. Other considerations on infrastructure reliability were:

- Siphons - as these require more maintenance and have a higher likelihood of failure than other cross drainage structures. Alignments following the A428 Improvement Scheme corridor (Alignments 1, 2 and 9) and Alignment 6 (St Neots South Option B to Cambourne South) require more siphons than other alignments.
- Pumping - if pumped drainage fails the water would be trapped on the alignment. Alignment 9 (Temptford to Cambourne North via A428 Improvement Scheme) may require pumped drainage at one location.
- Track characteristics, such as curvature, could increase the likelihood of failure. This is considered neutral at this stage.

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9.6.73. At this stage of design, the key differentiators in resilience were the length of floodplain crossed, pumped drainage and geology. The length in floodplain was considered in resilience and not reliability as resilience considers unplanned events. This may prevent access to some assets in a flood event and an unplanned event could stop railway services. Alignments serving Tempsford, which do not follow the A428 Improvement Scheme corridor (Alignment 7 and Alignment 8), cross the longest length of floodplain of all the alignments. Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme) was considered a minor worsening for resilience, despite it having a shorter length in floodplain than the Reference Alignment, because it may require pumped drainage at one location.

9.6.74. Overall, within the performance Assessment Factor, alignments serving St Neots which follow the A428 Improvement Scheme corridor (Alignments 1 and 2) perform better than the other options for both resilience and reliability Considerations. All St Neots alignments (Alignments 1 to 6) also perform better than the Reference Alignment in the resilience Consideration.

### **Safety risk (construction and operation)**

9.6.75. No significant safety risks have been identified that would prevent any of the Route Alignment Options from progressing. The construction activities identified are not unsafe and risks can be mitigated. However, some activities associated with construction and operation have safety risks associated with them (for example, working at height) and the extent to which such activities are required can provide differentiation between alignment options.

9.6.76. Three main elements were identified to have the biggest influence on construction risk. These were:

- The volume of imported earthwork fill material and the total volume of earthworks. A greater fill import would require more vehicle movements, some of which could be on the public road network. The total volume of earthworks is a significant indicator in the amount of construction work required.
- The total number and length of structures and their complexity. Working at height is inherently riskier than working at ground level. Structures also require lifting movements and components must be brought to site on the public road network. Structural complexity increases construction safety risk as it requires construction activities that are done less frequently.
- The overall length of the route. The total route length is a significant indicator in the amount of construction work required.

9.6.77. Under the elements discussed above the difference in risk is related to the amount of construction work required. The more times an activity is done the higher the likelihood of a hazard associated with that activity being realised, and subsequently the higher the risk.

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- 9.6.78. Alignments serving Tempsford (Alignments 7 and 9) and Alignment 3 (St Neots South Option A to Cambourne North) were identified to have a safety risk during construction comparable to that for the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). The other alignments performed better than the Reference Alignment in relation to construction risk.
- 9.6.79. The main elements identified to have the biggest impact on the risk to operation in the Core Section, at this stage, were the length in a flood zone and the geology. Risks within a flood zone include the undermining of track by flood water, maintenance access across flood zones and evacuation into flood areas. In the weaker geology small ground movements are more likely. More significant mitigation at design stage would need to be undertaken and more frequent inspection and maintenance of the track and track geometry would be required.
- 9.6.80. Alignment 7 (Tempsford to Cambourne North) is expected to have a comparable level of operational safety risk to that for the Reference Alignment (Alignment 8 – Tempsford to Cambourne South) as both alignments have the longest lengths in floodplain and follow the same alignment over the Ampthill Clay, identified as high-risk low strength geology. Operational safety risk for all other alignments is expected to be lower than for the Reference Alignment because they have shorter lengths in floodplain. In addition, alignments following the A428 Improvement Scheme (Alignment 1, 2 and 9) avoid an area of weaker geology.
- 9.6.81. Overall, for this Assessment Factor, all alignments, other than Alignment 7 (Tempsford to Cambourne North), Alignment 3 (St Neots South Option A to Cambourne North) and Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme) are expected to perform slightly better than the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). Alignment 3 (St Neots South Option A to Cambourne North) and Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme) do perform better than the Reference Alignment in the operational risk Consideration but are comparable in construction risk.

## **Environmental impacts and opportunities**

- 9.6.82. The following section of this Chapter sets out the review of the alignments in relation to potential environmental impacts. A high-level environmental appraisal has been undertaken at this stage to give an indication of potential environmental impacts. This is in advance of full survey data and environmental assessment (which would be undertaken as part of the process to produce the Environmental Impact Assessment which will support the Development Consent Order application). Potential environmental impacts of the Reference Alignment are presented first, followed by the environmental impacts of each of the alternative alignment options.



9.6.83. In each case, consideration is given to whether the alternative alignments would have a greater or lesser environmental impact than the Reference Alignment and would therefore perform better or worse. In considering potential environmental impacts, all environmental topics outlined in Table 9.3 have been taken into account. However, only those topics where there is a potential differentiation between the alternative alignment considered and the Reference Alignment are reported (i.e. a worsening or improvement). Whilst there may be impacts on receptors relevant to other topics including socio-economics, health and waste, at this stage these have not been assessed in detail as this is not considered to differentiate materially between alignments. Table 9.3 provides a summarised outcome of the ratings concluded from the environmental appraisal of the alignments.

9.6.84. Potential environmental impacts identified from the appraisal and reported in the below include:

- Air quality – adverse air quality impacts could be caused by dust arising from construction works and from construction vehicles and plant. During operation, emissions from trains and an increase in traffic around stations would cause adverse air quality impacts.
- Noise and vibration – adverse noise impacts would be caused by construction vehicles and plant. During operation, train movement (wheel noise etc) and an increase in traffic around stations would cause adverse noise impacts.
- Community – adverse community impacts during construction would be caused by the requirement for residential, commercial and/or community facilities demolitions and the loss of open space and private land. Adverse amenity impacts would also be caused by a combination of adverse noise, air quality and visual impacts as a result of construction works, including presence of construction vehicles, and operation of the railway.
- Agriculture – adverse impacts on farm holdings would result from the loss or severance of land and disruption to farming practices as a result of construction or operation of the railway.
- Cultural heritage – adverse impacts on heritage assets would be caused by the loss of buried archaeological features, where there is a need to disturb land during construction, and where construction works and/or the operation of the railway is in close proximity to listed buildings, scheduled monuments or Conservation Areas resulting in an impact on the setting of these assets.
- Ecology – adverse impacts on ecology and biodiversity during construction would be caused by the loss of habitat and/or severance and fragmentation of habitat. Loss, severance or fragmentation of habitats could impact on the species they support. There could also be indirect impacts on Ancient Woodland and ecological designated sites, including the Impact Risk Zone (IPZ)<sup>62</sup> of a Site of Special Scientific Interest (SSSI)<sup>63</sup>. Adverse impacts on the movement of species, particularly those species which would cross the alignment (such as bats and birds), could occur as a result of the operation of the railway.

<sup>62</sup> A SSSI IRZ is a defined area around a SSSI which reflects the sensitivities for which the SSSI has been designated for.

<sup>63</sup> Site of Special Scientific Interest (SSSI) is the land notified as an SSSI under the Wildlife and Countryside Act (1981), as amended. SSSIs are the finest sites for wildlife and natural features in England, supporting many characteristic, rare and endangered species, habitats and natural features.

<sup>64</sup> Source Protection Zones (SPZs) are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

- Landscape and visual – adverse impacts on views, including those from residential properties and Public Rights of Ways, would be caused by presence of construction activity and movement of construction vehicles. During operation, the adverse landscape impacts result from the presence of infrastructure (such as viaducts and stations), movement of trains and the increase in traffic around stations.
- Water resources – adverse impacts on water resources would be caused by the degradation of the floodplain and the potential for contamination of the Source Protect Zone (SPZ)<sup>64</sup> as a result of construction of the railway.

9.6.85. International and/or European sites have been considered as part of the assessment and no such sites are to be directly impacted by any of the alignment options. The closest site to the options is the Wimpole and Eversden Woods Special Area of Conservation (SAC), which is designated for the population of barbastelle bats that it supports. Surveys are ongoing to determine the potential for indirect impacts to the bat populations present, such as the possible severance of flight paths, which would then be mitigated through design, if required. As design progresses, EWR Co will also have regard to Fenland SAC, Portholme SAC and the Ouse Washes SAC, SPA and Ramsar Site, which are remote from route alignments, but on watercourses that they cross. At this stage, there are no clear differentiators between the alignment options with respect to potential indirect impacts that may result. Furthermore, we are confident that in the detailed design of the railway, impacts on the Wimpole and Eversden Woods SAC will be capable of mitigation.

9.6.86. The ratings in Table 9.3 represent an appraisal based on an unmitigated proposal relative to the Reference Alignment and impacts presented are prior to mitigation measures being applied to avoid or reduce the impact. Measures could be applied to improve the performance of the alignments, in full or in part. However, it is not possible to mitigate some impacts, such as impacts on Ancient Woodland. The following represents an example of control measures that could be applied to the impacts identified from the appraisal. These will be considered as part of future design development:

- Air quality – construction activities that result in an increase in dust can be mitigated through the use of wheel washing and water suppression. Other measures include the use of clean vehicles and electric plant.
- Noise and vibration – the use of insulated plant for construction activities and siting of plant away from sensitive noise receptors would minimise noise impacts as would temporary screening. Further design development could also mitigate adverse operational noise impacts through measures such as noise barriers.

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- Community – compensation for loss of residential and commercial property could be provided and amenity impacts could be mitigated through the measures applied to control air quality and noise and screening views of construction activities and operation of the railway.
  - Agriculture – compensation for the temporary or permanent loss of agricultural land could be provided.
  - Cultural heritage – in some cases (for example milestones), non-designated assets could be removed in advance of construction, to allow for conservation and storage and, where feasible, relocation as close to their original position as possible. Further design development could also mitigate adverse operational setting impacts through the use of planting to screen the movement of trains and noise barriers.
  - Ecology – the provision of habitat replacement within the Project would compensate for the loss of habitat. Sensitive design within the SSSI IRZ, protection of areas around Ancient Woodland and the provision of habitat to enhance connectivity could all be developed.
  - Landscape and visual – further design development could mitigate adverse construction and operational landscape and visual impacts through the use of planting for screening.
  - Water resources – further design development could mitigate adverse impacts on water resources through flood compensation and the protection of groundwater and surface water features. The impacts on the SPZ could be mitigated by lining the cutting.

Consideration	Reference Alignment			
	Tempsford to Cambourne South	Tempsford to Cambourne North		
	Alignment 8 (Benchmark)	Alignment 9 (A428)	Alignment 7	Alignment 1 (A428)
<b>Overall Score</b>	Neutral	Minor improvement	Minor improvement	Major improvement
<b>Agriculture, Forestry and Soils</b>	Neutral	Neutral	Neutral	Neutral
<b>Air Quality</b>	Neutral	Neutral	Minor improvement	Major improvement
<b>Climate</b>	Neutral	Minor improvement	Minor improvement	Major improvement
<b>Community</b>	Neutral	Minor improvement	Minor improvement	Minor improvement
<b>Ecology and Biodiversity</b>	Neutral	Minor worsening	Minor worsening	Minor improvement
<b>Historic Environment</b>	Neutral	Major improvement	Minor improvement	Major improvement
<b>Land Quality</b>	Neutral	Neutral	Neutral	Neutral
<b>Landscape and Visual</b>	Neutral	Neutral	Neutral	Minor improvement
<b>Noise and Vibration</b>	Neutral	Neutral	Neutral	Minor improvement
<b>Planning</b>	Neutral	Neutral	Neutral	Neutral
<b>Water Resources and Flooding</b>	Neutral	Minor improvement	Minor improvement	Major improvement

Table 9.3 Project Section D – Summary of environmental impacts by topic for each alignment (unmitigated)

Judgement				
St Neots to Cambourne North		St Neots to Cambourne South		
Alignment 3	Alignment 5	Alignment 2 (A428)	Alignment 4 SNN-SC	Alignment 6 SNS-SC
Major improvement	Major improvement	Major improvement	Major improvement	Major improvement
Neutral	Neutral	Minor improvement	Minor improvement	Minor improvement
Major improvement	Minor improvement	Minor improvement	Major improvement	Minor improvement
Major improvement	Major improvement	Major improvement	Major improvement	Major improvement
Minor improvement	Minor improvement	Neutral	Neutral	Neutral
Minor improvement	Neutral	Major improvement	Major improvement	Major improvement
Minor improvement	Major improvement	Minor improvement	Minor improvement	Minor improvement
Neutral	Neutral	Neutral	Neutral	Neutral
Major improvement	Major improvement	Neutral	Minor improvement	Minor improvement
Minor improvement	Minor improvement	Minor improvement	Minor improvement	Minor improvement
Neutral	Neutral	Neutral	Neutral	Neutral
Minor improvement	Major improvement	Minor improvement	Minor improvement	Minor improvement

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## Reference Alignment - Tempsford to Cambourne South – Alignment 8

- 9.6.87. The Reference Alignment would be likely to result in the need to demolish eight residential properties; seven properties are located around Broadway, Bourn and one property is located near Sandy. This alignment would also be likely to result in amenity or isolation impacts on the Disabilities Trust care home on Graze Hill. This care home is particularly sensitive to amenity impacts as it provides care for adults with autism and learning disabilities. Amenity impacts occur as a combination of adverse air quality and noise from construction and views of construction sites and traffic. Isolation would be likely to occur where routes are diverted leaving communities or individual properties severed from services. This alignment would be likely to result in adverse construction and/or operation air quality impacts for residential properties in Roxton, Tempsford, Abbotsley, Caxton, Great Cambourne and Crow End and residual noise impacts for residential properties in Ravensden Church End, Woodend Lane, Bedford Road and Crow End.
- 9.6.88 Based on available information the Reference Alignment would be likely to adversely impact approximately 50 farm holdings, of which two would be likely to experience a major impact from the construction of the Project.
- 9.6.89. The Reference Alignment is located in close proximity to the greatest number of designated assets in comparison to all other alignments. It passes within 250m of three scheduled monuments and earthworks would be located in an archaeologically sensitive area at Tempsford. The alignment comes within 500 m of ten conservation areas. This includes Bourn – Village & Hall, Caldecote, Harlton, Kingston, Toft, Bedford, Roxton, Great Barford, Tempsford and Abbotsley. Concentrations of listed buildings are focused in these areas. This alignment would pass through the complex heritage resource area of the Bourn Valley, which includes buried archaeology, built heritage and the Conservation Areas of Bourn, Caldecote and Kingston.
- 9.6.90. The Reference Alignment would be likely to have relatively high adverse impacts upon landscape character, due to impacts on woodland and changes to the character of Brickhill Country Park, the River Great Ouse valley and Roxton Park. This alignment would also be likely to result in very high visual impacts on residential properties in Renhold, Roxton and Crow End and high/moderate visual impacts on residential properties including those in Caxton, Caldecote, Great Cambourne, Lower Cambourne and Kingston. In the construction phase these are likely to relate to view of construction activities, movement of construction vehicles and temporary features (e.g., compounds and stockpiles). During operation these are likely to relate to views of the operation of the railway.

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<sup>65</sup> Designated heritage assets are World Heritage Sites, Scheduled Monuments, Listed Buildings, Protected Wreck Sites, Registered Parks and Gardens, Registered Battlefields or Conservation Areas designated under the relevant legislation. In this area, there are no World Heritage Sites or Protected Wreck Sites.

- 9.6.91. The Reference Alignment would pass through the Impact Risk Zone (IRZ) of the Weaveley and Sand Woods Site of Special Scientific Interest (SSSI), resulting in the potential for indirect impacts to the features of the SSSI. The alignment is also likely to result in indirect impacts to eight confirmed or potential Ancient Woodland sites (where these woodlands are within 50m of the alignment)<sup>69</sup>. In comparison with other alignments, this alignment results in a relatively low loss of mapped priority habitat areas<sup>70</sup>, both in terms of extent of impact and number of sites.
- 9.6.92. The Reference Alignment would be likely to result in several adverse impacts on water resources. This alignment has a relatively long crossing of the River Great Ouse floodplain, crosses an area of flood risk at Tempsford and crosses a groundwater Source Protection Zone (SPZ) south of Cambourne.

### **Tempsford to Cambourne North - A428 Improvement Scheme – Alignment 9**

- 9.6.93. Alignment 9 would be likely to result in the need to demolish three properties; two properties at Two Potts Farm and one property near Eynesbury Hardwick. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill.
- 9.6.94. Alignment 9 is in close proximity to significantly fewer listed buildings and scheduled monuments than the Reference Alignment and would avoid the complex heritage resource area of the Bourn Valley. As this alignment is north of, and in parallel to, the A428 Improvement Scheme there would be fewer additional setting impacts to listed buildings and scheduled monuments in the vicinity. The alignment passes within 500m of six conservation areas. This includes Harlton, Toft, Bedford, Roxton, Great Barford, Tempsford. The earthworks associated with this alignment would also avoid the archaeologically sensitive area north of Tempsford.
- 9.6.95. Alignment 9 would not encroach into the Weaveley and Sand Woods SSSI IRZ and would result in lower indirect impacts to confirmed and potential Ancient Woodland, five sites (where these woodlands are within 50m of the alignment). This alignment would, however, result in a greater loss of mapped priority habitat areas, including impacts to the highest number of priority areas of all alignments.
- 9.6.96. Alignment 9 has a similar alignment to the Reference Alignment at the River Great Ouse crossing and Tempsford but by routing via the A428 Improvement Scheme and Cambourne North it avoids the groundwater SPZ south of Cambourne.
- 9.6.97. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

<sup>68</sup> Designated heritage assets are World Heritage Sites, scheduled monuments, listed buildings, Protected Wreck Sites, Registered Parks and Gardens, Registered Battlefields or Conservation Areas designated under the relevant legislation. In this area, there are no World Heritage Sites or Protected Wreck Sites.

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## Summary

9.6.98. Compared to the Reference Alignment, Alignment 9 would be closer to fewer residential properties. Alignment 9 would also result in fewer residential property demolitions and a smaller impact on heritage assets. There would be a smaller indirect impact on confirmed and potential Ancient Woodland, however there would be a greater loss of priority habitats. There is a decrease in number of structures associated with Alignment 9 and therefore a lower carbon footprint. On balance it is considered that Alignment 9 represents a minor improvement compared to the Reference Alignment.

## Tempsford to Cambourne North – Alignment 7

9.6.99. Alignment 7 would be likely to result in the need to demolish three residential properties: two properties at Two Potts Farm and one property near Sandy. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Highfields, but overall fewer properties would experience adverse air quality impacts from this alignment than with the Reference Alignment.

9.6.100. Alignment 7 would be in close proximity to fewer listed buildings and scheduled monuments than the Reference Alignment and would avoid the complex heritage resource area of the Bourn Valley, however earthworks would be located in an archaeologically sensitive area at Tempsford. The alignment passes within 500 m of seven conservation areas. This includes Harlton, Toft, Bedford, Roxton, Great Barford, Tempsford, and Abbotsley.

9.6.101. Alignment 7 encroaches into the Weaveley and Sand Woods SSSI IRZ to the same extent as the Reference Alignment and has the potential to result in indirect impacts to eight confirmed and potential Ancient Woodland sites (where these woodlands are within 50m of the alignment). There would also be a greater loss of mapped priority habitat with this alignment compared to the Reference Alignment.

9.6.102. Alignment 7 would avoid the groundwater SPZ south of Cambourne. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

## Summary

9.6.103. Compared to the Reference Alignment, Alignment 7 would be closer to fewer residential properties and therefore there would be lower air quality impacts. Alignment 7 would also result in a reduced number of residential property demolitions and reduces impacts on known heritage assets. Alignment 7 is likely to result in a smaller indirect impact on confirmed and potential



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Ancient Woodland. However, it would result in a greater loss of priority habitats. There is a decrease in number of structures associated with Alignment 7 and therefore a lower carbon footprint. On balance it is considered that Alignment 7 represents a minor improvement compared to the Reference Alignment.

### **St Neots South Option A to Cambourne North – A428 Improvement Scheme – Alignment 1**

- 9.6.104. Alignment 1 would be likely to result in the need to demolish four properties: two properties at Two Potts Farm, one property to the south of Little Barford and one property near Eynesbury Hardwick. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Highfields and Chawston, but overall fewer properties would experience adverse air quality impacts from this alignment than with the Reference Alignment. Residual noise impacts would be limited to residential properties in Graze Hill, Lower Grange / Sunderland Hill, Colesden, Spinney Road, Chawston, Wintringham Hall, Highfields and Highfields Court.
- 9.6.105. Alignment 1 is in close proximity to significantly fewer listed buildings and Schedule Monuments than the Reference Alignment and would avoid the complex heritage resource area of the Bourn Valley. The alignment passes within 500m

of three conservation areas. These conservation areas are Harlton, Toft and Bedford. In addition, as this alignment is north of, and parallel to, the A428 Improvement Scheme there would be fewer additional setting impacts to listed buildings and scheduled monuments in the vicinity. .

- 9.6.106 Alignment 1 also has fewer landscape impacts compared to the Reference Alignment. This alignment would avoid impacts on the character of Brickhill Country Park, the River Great Ouse valley and Roxton Park. However, this alignment results in greater areas of woodland loss than the Reference Alignment. This would adversely impact on the landscape character of the area. This alignment would be likely to result in very high visual impacts on residential properties in Chawston.
- 9.6.107. Alignment 1 would not encroach into the Weaveley and Sand Woods SSSI IRZ and would not result in impacts to confirmed and potential Ancient Woodland sites (where these woodlands are within 50m of the alignment). This alignment would, however, result in a greater loss of mapped priority habitat areas compared to the Reference Alignment.
- 9.6.108 Alignment 1 comprises a shorter crossing of the River Great Ouse floodplain and routes via St Neots South Option B and then via the A428 Improvement Scheme lowering flood risk by being located nearer the sub catchment divide. There is a lower risk of flooding when crossing watercourses in the upper

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part of a river catchment near the catchment or sub-catchment divide where the watercourses are smaller and the severity for flooding is generally less. This alignment would avoid the groundwater SPZ south of Cambourne. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

## Summary

9.6.109. Compared to the Reference Alignment, Alignment 1 would be closer to fewer residential properties and therefore there would be fewer adverse air quality and noise impacts. Alignment 1 would also result in fewer residential property demolitions and a smaller impact on known heritage assets. Alignment 1 avoids the Bourn Valley and the majority of Conservation Areas and as the alignment avoids designated landscape assets there are fewer impacts on landscape character. However as with the Reference Alignment there would be high visual impacts and, in addition, a greater loss of priority habitats. There is a decrease in number of structures associated with Alignment 1 and therefore a lower carbon footprint. On balance it is considered that Alignment 1 represents a major improvement compared to the Reference Alignment.

## St Neots South Option A to Cambourne North – Alignment 3

9.6.110. Alignment 3 would be likely to result in the need to demolish

three residential properties: two properties at Two Potts Farm and one property in Wilden. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Highfields and Chawston, but overall there would be fewer properties experiencing adverse air quality impacts from this alignment than with the Reference Alignment. Residual noise impacts would be limited to residential properties in Graze Hill, Lower Grange / Sunderland Hill, Colesden, Spinney Road, Chawston, Highfields and Highfields Court.

9.6.111. Alignment 3 is in close proximity to significantly fewer listed buildings and scheduled monuments than the Reference Alignment and would avoid the complex heritage resource area of the Bourn Valley. The alignment passes within 500m of three conservation areas. This includes Harlton, Toft and Bedford. However, this alignment could also result in some setting impacts to Abbotsley Conservation Area.

9.6.112. Alignment 3 also has fewer landscape impacts compared to the Reference Alignment. This alignment would avoid impacts on the character of Brickhill Country Park, the River Great Ouse valley and Roxton Park. However, this alignment results in a greater area of woodland loss than the Reference Alignment. This would adversely

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impact on the landscape character of the area. This alignment is likely to result in very high visual impacts on residential properties in Chawston and Highfields Caldecote.

- 9.6.113. Alignment 3 would not encroach into the Weaveley and Sand Woods SSSI IRZ and would result in potential indirect impacts to only one confirmed and potential Ancient Woodland site (where these woodlands are within 50m of the alignment). This alignment would, however, result in a greater loss of mapped priority habitat areas.
- 9.6.114. Alignment 3 includes a shorter crossing of the River Great Ouse floodplain. However, it also includes a 4km section adjacent to flood zone 2 and 3 of Abbotsley Brook, including multiple crossings of tributaries. The proximity to the flood zone and the number of tributary crossings is negative as these are likely to require mitigation. This alignment would avoid the groundwater SPZ south of Cambourne. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

## Summary

- 9.6.115. Compared to the Reference Alignment, Alignment 3 would be closer to fewer residential properties and therefore there would be likely to be fewer air quality and noise impacts. Alignment 3 would also

result in fewer residential property demolitions and a smaller impact on heritage assets. Alignment 3 also avoids the Bourn Valley and the majority of Conservation Areas and as the alignment avoids designated landscape assets there are fewer impacts on landscape character, however as with the Reference Alignment there would be high visual impacts. There is a decrease in number of structures associated with Alignment 3 and therefore a lower carbon footprint. On balance it is considered that Alignment 3 represents a major improvement compared to the Reference Alignment.

## St Neots South Option B to Cambourne North – Alignment 5

- 9.6.116. Alignment 5 would be likely to result in the need to demolish four residential properties: two properties at Two Potts Farm, one property in Wilden and one property to the south of Little Barford. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Highfields and Chawston, but overall there would be fewer properties experiencing air quality impacts from this alignment than with the Reference Alignment. Residual noise impacts would be limited to residential properties in Graze Hill, Lower Grange / Sunderland Hill, Colesden, Spinney Road, Chawston, Highfields and Highfields Court

9.6.117 Alignment 5 is in close proximity to significantly fewer listed buildings and scheduled monuments than the Reference Alignment and would avoid the complex heritage resource area of the Bourn Valley. The alignment passes within 500m of four conservation areas. This includes: Harlton, Toft, Abbotsley and Bedford but avoids Roxton and Tempsford Conservation Areas which the Reference Alignment passes through.

9.6.118. Alignment 5 also has fewer landscape impacts compared to the Reference Alignment. This alignment would avoid impacts on the character of Brickhill Country Park, the River Great Ouse valley and Roxton Park. However, this alignment results in greater areas of woodland loss than the Reference Alignment. This would adversely impact on the landscape character of the area. This alignment is likely to result in very high visual impacts on residential properties in Chawston and Highfields Caldecote.

9.6.119. Alignment 5 comprises of a shorter crossing of the River Great Ouse floodplain and routes via St Neots South Option B lowering flood risk by being located nearer the sub catchment divide. This alignment would avoid the groundwater SPZ south of Cambourne. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

## Summary

9.6.120. Compared to the Reference Alignment, Alignment 5 would be closer to fewer residential properties and therefore there would be likely to be fewer air quality and noise impacts. Alignment 5 would also result in fewer residential property demolitions and a smaller impact on heritage assets. Alignment 5 also avoids the Bourn Valley and the majority of Conservation Areas and as the alignment avoids designated landscape assets there are fewer impacts on landscape character, however as with the Reference Alignment there would be high visual impacts. There is a decrease in the number of structures associated with Alignment 5 and therefore a lower carbon footprint. On balance it is considered that Alignment 5 represents a major improvement compared to the Reference Alignment.

## St Neots South Option A to Cambourne South – A428 Improvement Scheme – Alignment 2

9.6.121. Alignment 2 would be likely to result in the need to demolish nine residential properties: seven properties are located around Broadway, Bourn, one property in Wilden and one property is located near Eynesbury Hardwick. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Chawston, but overall fewer properties would experience

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adverse air quality impacts from this alignment than with the Reference Alignment. Residual noise impacts would be limited to residential properties in Graze Hill, Lower Grange / Sunderland Hill, Colesden, Spinney Road, Chawston, Wintringham Hall and Crow End.

9.6.122. Alignment 2 would be likely to impact approximately 40 farm holdings (based on available information), of which two would be likely to experience a major impact from the construction of the Project.

9.6.123. Alignment 2 is in close proximity to fewer listed buildings and schedule monument than the Reference Alignment. This alignment avoids the heritage sensitive areas at Tempsford and Roxton. However, to the south of Cambourne, the alignment would pass through the complex heritage resource area of the Bourn Valley and, east of Eltisley, comes in close proximity to a scheduled monument and associated listed building ("Pastures Farm – Moated site at Pastures Farm" and "Dovecote to the North East of Caxton Pastures Farmhouse") which is likely to result in adverse setting impacts to the designated assets. The alignment passes within 500m of six conservation areas. This includes Bourn – Village & Hall, Caldecote, Harlton, Kingston, Toft and Bedford.

9.6.124. Alignment 2 would not encroach into the Weaveley and Sand Woods SSSI IRZ and would not result in impacts to confirmed and potential Ancient Woodland sites (where these woodlands are within 50m of the alignment). This alignment

would also result in fewer losses of mapped priority habitat areas. This alignment would, however, be likely to result in minor adverse impacts to the boundary of the Cambourne Nature Reserve. 9.6.125 Alignment 2 comprises a shorter crossing of the River Great Ouse floodplain and routes via St Neots South Option B and then via the A428 Improvement Scheme lowering flood risk by being located nearer the sub catchment divide. This alignment routes south of Cambourne and crosses a groundwater SPZ. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

## Summary

9.6.126. Compared to the Reference Alignment, Alignment 2 would be closer to fewer residential properties and therefore there would be lower air quality and noise impacts. Alignment 2 would also result in fewer residential property demolitions and a smaller impact on heritage assets. However, at Eltisley there is the potential for an indirect impact on a scheduled monument. There would be a lower impact on farm holdings and fewer losses of priority habitats. There is a decrease in number of structures associated with Alignment 2 and therefore likely to result in a lower carbon footprint. As with the Reference Alignment, Alignment 2 would cross the Bourn Valley, cross a groundwater SPZ and result in high visual impacts. On balance it is considered that Alignment 2 represents a major improvement compared to the Reference Alignment.

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## **St Neots South Option A to Cambourne South – Alignment 4**

- 9.6.127. Alignment 4 would be likely to result in the need to demolish eight residential properties: 7 properties located around Broadway, Bourn and one property in Wilden. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Chawston, but overall there would be fewer properties experiencing adverse air quality impacts from this alignment than with the Reference Alignment. Residual noise impacts would be limited to residential properties in Graze Hill, Lower Grange / Sunderland Hill, Colesden, Spinney Road, Chawston and Crow End.
- 9.6.128. Alignment 4 would be likely to impact approximately 39 farm holdings (based on available information), of which two would be likely to experience a major impact from the construction of the Project.
- 9.6.129. Alignment 4 is in close proximity to fewer listed buildings and schedule monument than the Reference Alignment, however it would pass through the complex heritage resource area of the Bourn Valley. The alignment passes within 500m of six conservation areas. This includes Bourn – Village & Hall, Caldecote, Harlton, Kingston, Toft and Bedford. This alignment also has fewer landscape impacts compared to the Reference Alignment. Alignment 4 would avoid impacts on the character of Brickhill Country Park, the River Great Ouse valley and Roxton Park. However, this alignment would be likely to result in very high visual impacts on residential properties in Chawston and Crows End.
- 9.6.130. Alignment 4 would not encroach into the Weaveley and Sand Woods SSSI IRZ and would result in potential indirect impacts to only one confirmed and potential Ancient Woodland site (where these woodlands are within 50m of the alignment) and lower loss of mapped priority habitat areas. This alignment would, however, be likely to result in minor adverse impacts to the boundary of the Cambourne Nature Reserve.
- 9.6.131. Alignment 4 comprises a shorter crossing of the River Great Ouse floodplain. This alignment routes via St Neots North, avoiding the flood risk of the alignments that go via Tempsford. It then continues on the northern side of Abbotsley where it runs adjacent to Abbotsley Brook, crossing multiple tributaries. This alignment routes south of Cambourne and crosses a groundwater SPZ. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

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## Summary

9.6.132. Compared to the Reference Alignment, Alignment 4 would be closer to fewer residential properties and therefore there would be reduced air quality and noise impacts. Alignment 4 would also result in fewer residential property demolitions and a smaller impact on heritage assets. There would be likely to be a lower impact on farm holdings, a smaller indirect impact on confirmed and potential Ancient Woodland sites and fewer losses of priority habitats. There is a decrease in number of structures associated with Alignment 4 and therefore a lower carbon footprint. As with the Reference Alignment, Alignment 4 would cross the Bourn Valley, cross a groundwater SPZ and result in high visual impacts. On balance it is considered that Alignment 4 represents a major improvement compared to the Reference Alignment.

### St Neots South Option B to Cambourne South – Alignment 6

9.6.133. Alignment 6 would be likely to result in the need to demolish nine residential properties: seven properties located around Broadway, Bourn, one property in Wilden and one property to the south of Little Barford. This alignment would also be likely to result in amenity or isolation impacts on the very sensitive Disabilities Trust care home on Graze Hill. This alignment would be closer to residential properties in Chawston, but overall there would be fewer properties experiencing adverse air quality impacts from this alignment than with the Reference Alignment. Residual noise impacts would be limited to residential properties in Graze Hill, Lower Grange / Sunderland Hill, Colesden, Spinney Road, Chawston and Crow End.

9.6.134. Based on available information Alignment 6 would be likely to impact approximately 40 farm holdings (based on available information), of which two would be likely to experience a major impact from the construction of the Project.

9.6.135. Alignment 6 is in close proximity to fewer listed buildings and scheduled monuments than the Reference Alignment, however it would pass through the complex heritage resource area of the Bourn Valley. The alignment passes within 500m of seven conservation areas. This includes Bourn – Village & Hall, Caldecote, Harlton, Kingston, Toft, Abbotsley and Bedford. This alignment also has fewer landscape impacts compared to the Reference Alignment. Alignment 6 would avoid impacts on the character of Brickhill Country Park, the River Great Ouse valley and Roxton Park. However, this alignment would be likely to result in very high visual impacts on residential properties in Chawston and Crows End.

9.6.136. Alignment 6 encroaches less into the Weaveley and Sand Woods SSSI IRZ, reducing the potential for indirect impacts to the features of the SSSI compared to the Reference Alignment. This alignment would result in potential indirect impacts to two confirmed and potential Ancient Woodland

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sites (where these woodlands are within 50m of the alignment) and a lower loss of mapped priority habitat areas. This alignment would, however, be likely to result in minor adverse impacts to the boundary of the Cambourne Nature Reserve.

9.6.137. Alignment 6 comprises a shorter bridge span of the River Great Ouse and routes via St Neots South Option B reducing flood risk by being located nearer the sub catchment divide. The alignment also crosses water courses which are significantly smaller than those associated with the Reference Alignment. This alignment routes south of Cambourne and crosses a groundwater SPZ. This alignment would be likely to result in a lower carbon footprint than the Reference Alignment, predominantly due to a decrease in the number of viaducts and bridges required.

## **Summary**

9.6.138. Compared to the Reference Alignment, Alignment 6 would be closer to fewer residential properties and therefore there would be lower air quality and noise impacts. Alignment 6 would also result in fewer residential property demolitions and reduces impacts on heritage assets. There would be a lower impact on farm holdings, a smaller indirect impact on confirmed and potential Ancient Woodland and the SSSI IRZ, and fewer losses of priority habitat. There is a decrease in number of structures associated with Alignment 6 and therefore a lower carbon footprint. As with the Reference Alignment, Alignment 6 would cross the Bourn Valley, cross a groundwater SPZ and result in high visual impacts. On balance it is considered that Alignment 6 represents a major improvement compared to the Reference Alignment.

## **9.7. Conclusions - alignment short-list for Consultation**

9.7.1. The performance of options against Assessment Factors and Considerations discussed in the previous section of this Chapter has been used to prepare a shortlist of Route Alignment Options for this consultation.

9.7.2. The differentiating Assessment Factors identified for the Core Section of EWR are:

- Transport User Benefits;
- Contribution to enabling housing and economic growth;
- Capital Cost;
- Overall affordability;
- Performance;
- Safety risk; and
- Environmental impacts and opportunities.



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- 9.7.3. The amount of differentiation within each factor differs, and some overlap, so the relative importance of each Factor needs to be considered in deciding on options to be taken forward.
- 9.7.4. The nine shortlisted alignment options provided EWR Co with multiple solutions to connect each combination of station locations (i.e. connecting St Neots / Tempsford with Cambourne North / Cambourne South). Each of these alignments was evaluated using the Assessment Factors mentioned above and was compared with a Reference Alignment. The shortlisting process considered the best performing option for each station combination from the nine alignments assessed.
- 9.7.5. Within each station combination comparison (i.e. each alignment serving the same station locations) there was similar overall performance shown by the environmental appraisal overall (judged using comparison to the Reference Alignment) and all options are at least as good as the Reference Alignment in the round. At this stage of environmental appraisal (in advance of surveys and environmental assessment) further comparisons would not differentiate between options. Housing and economic growth is the same within the station pair comparisons as the same stations are served, and therefore it is not relevant in deciding which alignment is best for a given station pair. The other Assessment Factors (and Considerations and the drivers of them) were considered in order to identify the best performing option for each station pair.

## **Comparison of station combinations**

### **St Neots to Cambourne North**

- 9.7.6. Three alignment options serve the St Neots to Cambourne North station combination:
- Alignment 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme corridor);
  - Alignment 3 (St Neots South Option A to Cambourne North); and
  - Alignment 5 (St Neots South Option B to Cambourne North).
- 9.7.7. Alignment 1 was selected as the preferred alignment for the St Neots to Cambourne North station combination. Alignment 1 is expected to perform better than Alignment 3 in terms of cost, journey time, performance and safety risk Assessment Factors as it has a shorter total length of structures, fewer complex structures, a smaller fill import requirement and a shorter length on weaker geology.

- 9.7.8. Alignment 1 has similar performance to Alignment 5, but it performs better in terms of the performance Assessment Factor as it has a shorter length on weaker geology. In addition, Alignment 1 could provide increased benefits if the opportunity for synergy with the A428 Improvement Scheme is realised.

### **St Neots to Cambourne South**

- 9.7.9. Three alignment options serve the St Neots to Cambourne South station combination:
- Alignment 2 (St Neots South Option A to Cambourne South via A428 Improvement Scheme corridor);
  - Alignment 4 (St Neots South Option A to Cambourne South); and
  - Alignment 6 (St Neots South Option B to Cambourne South).
- 9.7.10. Alignments 2 and 6 were selected as preferred alignments for the St Neots to Cambourne North station combination. Alignment 6 is expected to perform better than Alignment 4 and Alignment 2 in terms of cost and safety Assessment Factors as it has a shorter total length of structures and smaller imported fill requirements. Potential synergy with the A428 Improvement Scheme might reduce the expected cost for Alignment 2.
- 9.7.11. Alignment 2 performs better than Alignment 4 and Alignment 6 in the performance Assessment Factor as it has a shorter length on weaker geology. Alignment 2 is expected to have a longer journey time than alignments 4 and 6, however the difference is relatively small.

- 9.7.12. When opportunities associated with the A428 Improvement Scheme synergy were considered, the performance of Alignments 2 and 6 was comparable and both were therefore included in the shortlist.

### **Tempsford to Cambourne North**

- 9.7.13. Two alignment options serve the St Neots to Cambourne South station combination:
- Alignment 7 (Tempsford to Cambourne North); and
  - Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme corridor).
- 9.7.14. Alignment 9 was selected as the preferred alignment for the Tempsford to Cambourne North station combination. Alignment 9 is expected to perform better than Alignment 7 in terms of cost. Alignment 9 has a shorter total length of structure, a shorter length in floodplain, a shorter length on weaker geology and a smaller imported fill requirement than Alignment 7. It also could offer further potential benefits, beyond those reported, through synergy with the A428 Improvement Scheme.
- 9.7.15. Alignment 9 is slightly worse in relation to programme risk and resilience due to pumped drainage and the requirement to provide crossing structures under the A428 Improvement Scheme and B1040, though this could potentially be improved by working with the Highways England design team for the A428 Improvement Scheme.

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## Tempsford to Cambourne South

- 9.7.16. There is one alignment option that serves the Tempsford to Cambourne South station combination, Alignment 8 (Tempsford to Cambourne South). Other alignments were not developed because it was expected that any other variations around this would perform less well.

### Alignment shortlist for Consultation

- 9.7.17. Five of the nine Route Alignment Options, across the four possible station combinations, have been identified as the best performing options for each station combination, as described above. These are being consulted upon as a short list. The following Route Alignment Options are short-listed.

- Alignment 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme corridor);
- Alignment 2 (St Neots South Option A to Cambourne South via A428 Improvement Scheme corridor);
- Alignment 6 (St Neots South Option B to Cambourne South);
- Alignment 8 (Tempsford to Cambourne South); and
- Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme corridor).

### Summary of assessment of shortlisted options

- 9.7.18. **Alignment 1 (St Neots South Option A to Cambourne North via A428 Improvement Scheme corridor)** serves the St Neots

and Cambourne North station combination. It performs strongly in relation to enabling housing and economic growth, with a greater certainty of development potential around Cambourne North. It has one of the shortest total lengths of structures and one of the shortest lengths of floodplain crossed of any of the alignments and it also has a smaller requirement for imported fill material than some of the shortlisted options. These aspects mean that it is expected to have one of the lowest capital costs of any of the alignments and better overall affordability than the Reference Alignment (Alignment 8 – Tempsford to Cambourne South). If the opportunity for synergy with the A428 Improvement Scheme is realised the capital cost might reduce further. It also shows better overall performance in relation to reliability and resilience, overall environmental considerations and a slightly better safety risk than the Reference Alignment. It is a longer alignment than the Reference Alignment, Alignment 2 and Alignment 6, because it serves Cambourne North, which would lead to additional journey time although this is expected to be less than two minutes.

- 9.7.19. **Alignment 2 (St Neots South Option A to Cambourne South via A428 Improvement Scheme corridor)** is one of the shortlisted alignments which serve the St Neots and Cambourne South station combination. There would only be a small increase in journey times compared to the Reference Alignment and in this respect Alignment 2 performs better

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than Alignment 1 and Alignment 9. Alignment 2 is expected to show cost savings compared to the Reference Alignment with improved programme risk resulting from a shorter length of structures and reduced requirement for imported fill material. These cost savings could be comparable to Alignment 6 and Alignment 1 if the opportunity for synergy with the A428 Improvement Scheme is realised. It also shows better performance than the Reference Alignment in relation to reliability, resilience, environmental considerations and safety risk. Alignment 2 does not perform as strongly in relation to enabling housing and growth as Alignment 1 and Alignment 9 because potential at Cambourne South is expected to be more limited than at Cambourne North. The potential for housing and economic growth is comparable to the Reference Alignment and Alignment 6.

9.7.20. **Alignment 6 (St Neots South Option B to Cambourne South)** is one of the shortlisted alignments which serve the St Neots and Cambourne South station combination. It shows very similar performance to that for Alignment 2. The only notable difference from the Assessment Factor outcomes is in relation to the performance Assessment Factor. Alignment 2 performs better than Alignment 6 for performance because the latter crosses an area of weaker geology. However, Alignment 6 performs better than Alignment 2 for journey times and capital cost due to the track length, imported fill requirement and total length of structures. Nevertheless, both Alignment 2 and Alignment 6 perform well in relation to the Reference Alignment (Alignment 8 – Tempsford to Cambourne South).

9.7.21. **Alignment 9 (Tempsford to Cambourne North via A428 Improvement Scheme corridor)** is the best performing Tempsford to Cambourne North station option. It shows better potential than the Reference Alignment, Alignment 2 and Alignment 6 in terms of enabling housing and economic growth, resulting from larger expected potential around Cambourne North. It also performs better than the Reference Alignment (Alignment 8 – Tempsford to Cambourne South) in the overall environmental Assessment Factor. However, Alignments 2, 4 and 6 perform better in the overall environmental Assessment Factor than Alignment 9. As one of the longer alignments an increase in journey times is anticipated although this is expected to be less than two minutes compared to the Reference Alignment. Alignment 9 is expected to show a cost saving compared to the Reference Alignment but it is expected to cost more than Alignments 2, 4 and 6. However, the cost saving could increase if the opportunity for synergy with the A428 Improvement Scheme is realised. Alignment 9 shows a slight worsening in programme risk and resilience compared to the Reference Alignment due to pumped drainage and the requirement to provide crossing structures under the A428 Improvement Scheme and B1040, though this could potentially be improved by working with the Highways England design team for the A428 Improvement Scheme. Despite having more complex structures, Alignment 9 has a shorter total length of structure, a shorter length in floodplain, a shorter length on weaker geology and a smaller imported fill requirement

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than the Reference Alignment. Alignment 9 is expected to perform worse than Alignments 1 and 2 for the performance Assessment Factor and Alignments 1, 2 and 6 for the safety Assessment Factor. This is due to pumped drainage, a longer overall length of structures and a larger overall imported fill requirement.

9.7.22. The Reference Alignment - **Alignment 8 (Tempsford to Cambourne South)** serves the Tempsford and Cambourne South stations. It has the shortest journey time of all the alignments (comparable to Alignment 6) and the fewest complex structures. It is the only alignment that does not interact with the A428 Improvement Scheme. The Reference Alignment is expected to have the highest cost, the longest length of structures, the longest length in floodplain and the greatest fill import requirement of the shortlisted options. It also performs worse than the other shortlisted options in the environmental assessment.

9.7.23. Table 9.4 shows the relative performance of the five shortlisted Route Alignment Options in relation to the Assessment Factors.

Assessment Factors		Reference Alignment	Tempsford to Cambourne North
Assessment Factors		Alignment 8 (Benchmark)	Alignment 9 (A428)
<b>Assessment Factors</b>	<b>Transport User Benefits</b>	<b>Neutral</b>	<b>Minor Worsening</b>
Consideration	Journey time	Neutral	East +01:52 West +01:52
Consideration	Modal shift	Neutral	Minor Worsening
<b>Assessment Factor</b>	<b>Housing and growth</b>	<b>Neutral</b>	<b>Minor Improve</b>
<b>Assessment Factor</b>	<b>Capex (core section)</b>	<b>Neutral</b>	<b>Neutral</b>
Consideration	Up front cost £bn (2019 prices)	£2.3bn - £2.5bn	£120m to £130m less -5%
Consideration	Programme risk	Neutral	Minor Worsening
Consideration	Maintenance cost	Neutral	Neutral
Consideration	Renewal cost	Neutral	Neutral
<b>Assessment Factor</b>	<b>Performance</b>	<b>Neutral</b>	<b>Neutral</b>
Consideration	Inf reliability	Neutral	Minor Improve
Consideration	Resilience	Neutral	Minor Worsening
<b>Assessment Factor</b>	<b>Safety Risk</b>	<b>Neutral</b>	<b>Neutral</b>
Consideration	Construction	Neutral	Neutral
Consideration	O&M	Neutral	Minor Improve
<b>Assessment Factor</b>	<b>Environmental</b>	<b>Neutral</b>	<b>Minor Improve</b>

Table 9.4: Shortlisted Route Alignment Options – Assessment Outcomes

St Neots to Cambourne North	St Neots to Cambourne South	
Alignment 1 (A428)	Alignment 2 (A428)	Alignment 6
<b>Minor Worsening</b>	<b>Neutral</b>	<b>Neutral</b>
<i>East +01:38</i> <i>West +01:36</i>	<i>East +00:25</i> <i>West +00:43</i>	<i>East +00:01</i> <i>West -00:02</i>
<i>Neutral</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<b>Minor Improve</b>	<b>Neutral</b>	<b>Neutral</b>
<b>Minor Improve</b>	<b>Neutral</b>	<b>Minor Improve</b>
£310m to £340m less -14%	£210m to £230m less -9%	£270m to £300m less -12%
<i>Neutral</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
<i>Neutral</i>	<i>Neutral</i>	<i>Neutral</i>
<b>Minor Improve</b>	<b>Minor Improve</b>	<b>Neutral</b>
<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Neutral</i>
<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<b>Minor Improve</b>	<b>Minor Improve</b>	<b>Minor Improve</b>
<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<i>Minor Improve</i>	<i>Minor Improve</i>	<i>Minor Improve</i>
<b>Major Improve</b>	<b>Minor Improve</b>	<b>Major Improve</b>

Improve = Improvement; Italics = a Consideration that feeds into the assessment of a Factor. The estimated cost ranges represent the capital cost order of magnitude costs for the core section. This is based upon the engineering design for non-statutory consultation. Excluded from these figures are operation & maintenance costs, land and property and any inflation beyond 2019.

9.7.24. Figure 9.16 shows the Route Alignment Options which have been shortlisted.

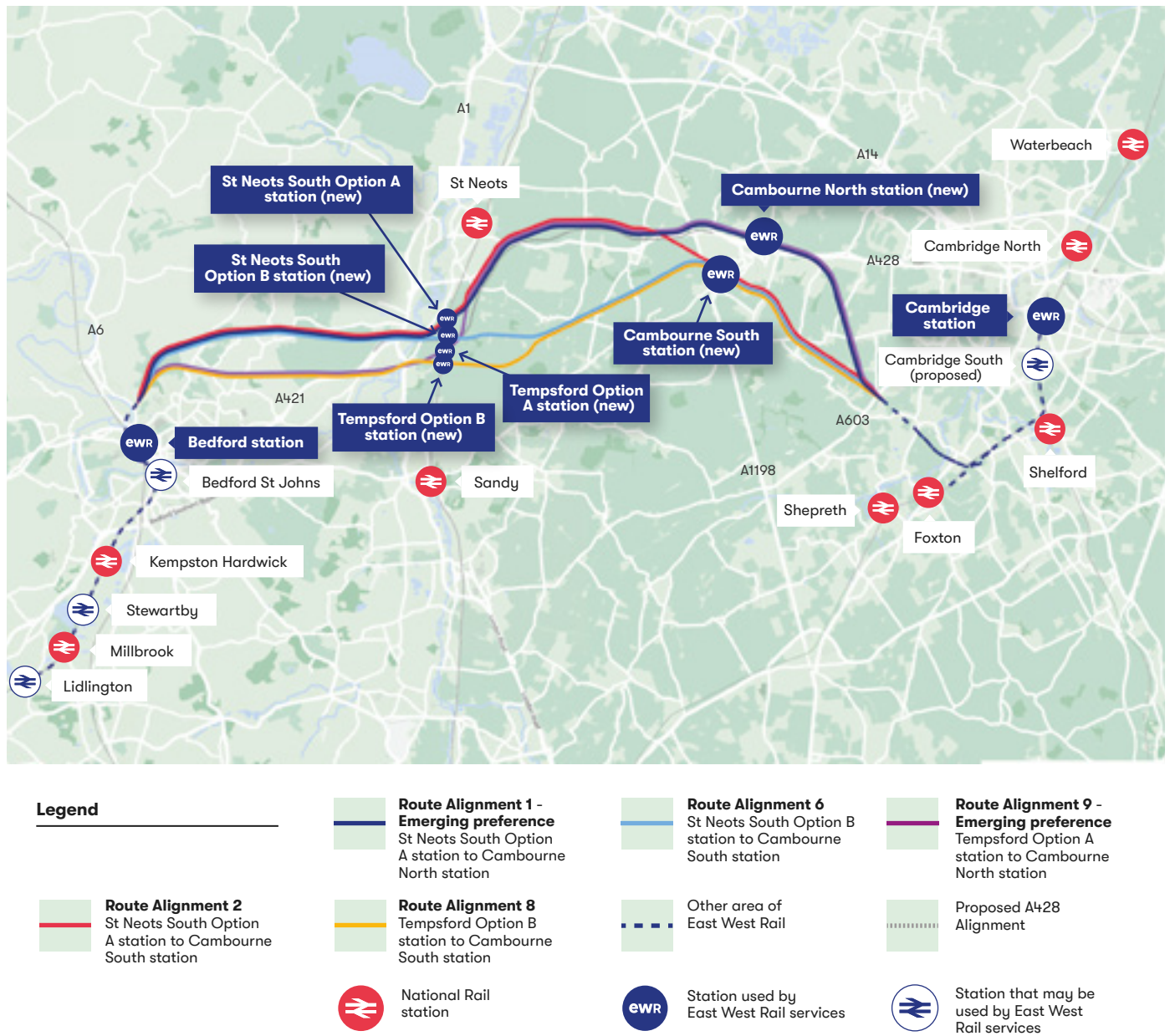


Figure 9.16: Core Section  
Shortlisted Five Route  
Alignment Options



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## **9.8. Conclusions - Emerging Preferred Options**

### **Summary**

- 9.8.1. Having considered the performance of the nine identified Route Alignment Options and the appraisals of their performance against the various Assessment Factors, particularly those most likely to assist in differentiating between them, EWR Co has considered whether it is possible to identify an emerging preference or preferences from among the short list. It should be noted that these emerging preferred alignment options are subject to change, for example should further evidence come to light.
- 9.8.2. Since the Route Alignment Options perform very similarly in many respects, but not consistently across all Assessment Factors, it is necessary to decide which Assessment Factors are the most important. This means favouring Route Alignment Options which perform well in some Assessment Factors more than in others – those Assessment Factors to which the greatest weight should be given at this point in the decision-making process.
- 9.8.3. As stimulating economic growth, housing and employment across the Oxford – Cambridge Arc is a key Project Objective, EWR Co believes that the potential for supporting housing and economic growth is a key driver for option selection and should attract particular weight. This is supported by the fact that some differences between the performance of Route Alignment Options, as outlined in the previous section of this Chapter, could be strongly influenced by the potential housing development and economic growth benefits that a particular station location might bring. Therefore, although the following Assessment Factors are important, they are not the principal driver of the choice of an emerging preferred option from the shortlisted five if potential for housing and economic growth would be stronger for another alignment. The rationale for this is that:
- 9.8.4. **Transport User Benefits** - EWR is a new railway which is already significantly improving transport opportunities and journey times. Given the Project Objectives for EWR, it is important to prioritise serving locations that could support growth and new homes over faster end-to-end journey times. Furthermore, unlocking housing development would drive up Transport User Benefits, as there would be additional residents to utilise the railway, which has the potential to offset any differences between options currently.
- 9.8.5. **Capital cost** – the differences between the option cost ranges, according to EWR Co's current estimates, are small when considered relative to the overall capital cost of the Project and the level of accuracy of cost estimates which can be achieved at this stage in project development. EWR Co believes that the differences between options, when it comes to the potential benefits from housing and economic growth, could be substantial enough to offset the expected capital cost differences.

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9.8.6. Therefore, the most important differentiating factors that remain when comparing the five shortlisted options are:

- **Safety and Performance** – this is an important Assessment Factor, but the differentiation between options is very small and therefore it does not assist in choosing a Preferred Route Alignment Option. No significant safety risks have been identified that would prevent any of the Route Alignment Options from progressing.
- **Environment** – there is differentiation between the relative performance of Route Alignment Options. However, all options perform better from an environmental perspective than the baseline Reference Alignment - Alignment 8. Alignments 1, 2 and 6 perform slightly better than Alignments 8 and 9 in terms of this Assessment Factor, but it is also important to consider this performance in the context of housing as explained in paragraphs 9.6.17 to 9.6.20.
- Ability to unlock **housing and wider economic growth**. Stimulating economic growth, housing and employment across the Oxford-Cambridge Arc is a key Project Objective for the scheme and EWR Co believes that the high level differences identified in the housing potential associated with station options enables us able to identify one or more emerging preferences at this stage. Further more detailed analysis will be undertaken to draw firmer conclusions around each location's potential for housing and growth before selecting a final Preferred route alignment.

9.8.7. The evidence EWR Co has used in relation to the comparison of Route Alignment Options above so far suggests that options serving Cambourne North are likely to deliver housing and economic growth advantages that would outweigh factors in favour of other Route Alignment Options. The reasons for this are explained below. Therefore, **given the importance of housing and wider economic growth to the Project, EWR Co has identified Alignment 1 and Alignment 9 as potential emerging preferences from the shortlisted Route Alignment Options.**

## Emerging preferred options

9.8.8. Taking the housing considerations into account in particular, when assessing the five shortlisted Route Alignment Options, EWR Co has come to the following emerging conclusions:

- Alignment 1. St Neots South Option B to Cambourne North (via A428 Improvement Scheme corridor). This option includes Cambourne North which has been identified as the emerging preferred Cambourne option. The alignment performs well across the Assessment Factors, apart from journey time, but as locations that could support growth and new homes should be prioritised over faster end-to-end journey times, this has been identified as an emerging preferred option.

- Alignment 2: St Neots South Option A to Cambourne South (via A428 Improvement Scheme corridor). Performs similarly to Alignment 1, with better journey time but includes Cambourne South, which has less favourable housing potential. Given the high importance of housing, this option is not preferred.
- Alignment 6: St Neots South Option B to Cambourne South. Performs well across Assessment Factors, but includes Cambourne South, which has less favourable housing potential. Given the high importance of housing, this option is not preferred.
- Alignment 8: Tempsford - Cambourne South. Several options perform better than this option (the Reference Alignment), and it also includes Cambourne South, therefore this alignment is not preferred.
- Alignment 9: Tempsford - Cambourne North (via A428 Improvement Scheme corridor). This option includes Cambourne North which has been identified as the emerging preferred Cambourne option. Although this alignment does not perform as well as others across Considerations such as capital costs, environment and journey time, there is the potential that Tempsford could better support growth and new homes by a substantial margin and therefore this has been identified as an emerging preferred option.

9.8.9. In light of this approach, the emerging preferences are **Route Alignment 1 and Route Alignment 9**.

9.8.10. It should be noted that these are emerging preferred options, which are subject to change should further evidence come to light that concludes that Cambourne South would be a better location for delivering against housing delivery objectives. None of the five shortlisted options are being discounted at this stage.

9.8.11. Identifying two options, Alignment 1 and Alignment 9, means that both St Neots and Tempsford options can be left open for the purposes of this consultation. Further work is underway to identify an emerging preferred ECML option.

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# 10.

## Project Section E: Harlton to Hauxton

### 10.1. Chapter summary

**10.1.1. This Chapter describes the proposals for the section of the Project between Harlton, near the A603 Cambridge Road, and Hauxton, to the west of the M11. It includes the connection between the new railway and the Shepreth Branch Royston (SBR) line (the line between Cambridge and Hitchin via Shepreth).**

**10.1.2. This Chapter explains the development of the options to connect the new railway to the existing railway network. EWR Co has concluded that this should be by a connection to the (SBR) line, rather than a direct connection to the West Anglian Main Line (WAML, the line between London Liverpool Street and Cambridge).**

**10.1.3. Four options for the new junction have been considered. This Chapter describes and compares those options together with their assessment using the Assessment Factors. It concludes that the emerging preferred option for the connection is a grade-separated junction (where one line passes over or under another) which would be constructed offline (which means it would involve works outside the existing railway corridor).**

## 10.2. Introduction

10.2.1. This section discusses the proposed East West Rail (EWR) connection to the existing railway within Project Section E, Harlton to Hauxton, as shown in Figure 10.1 below.

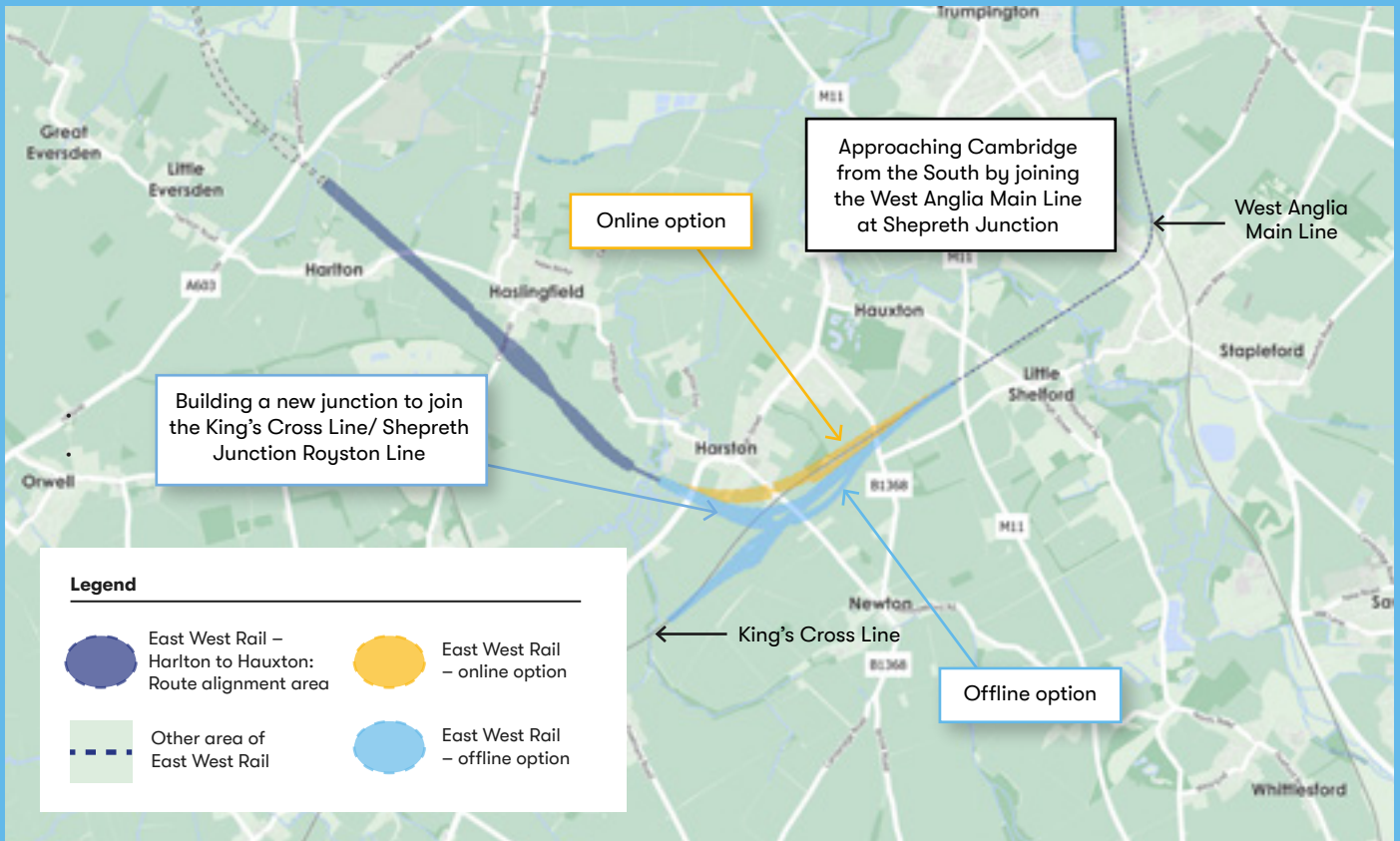


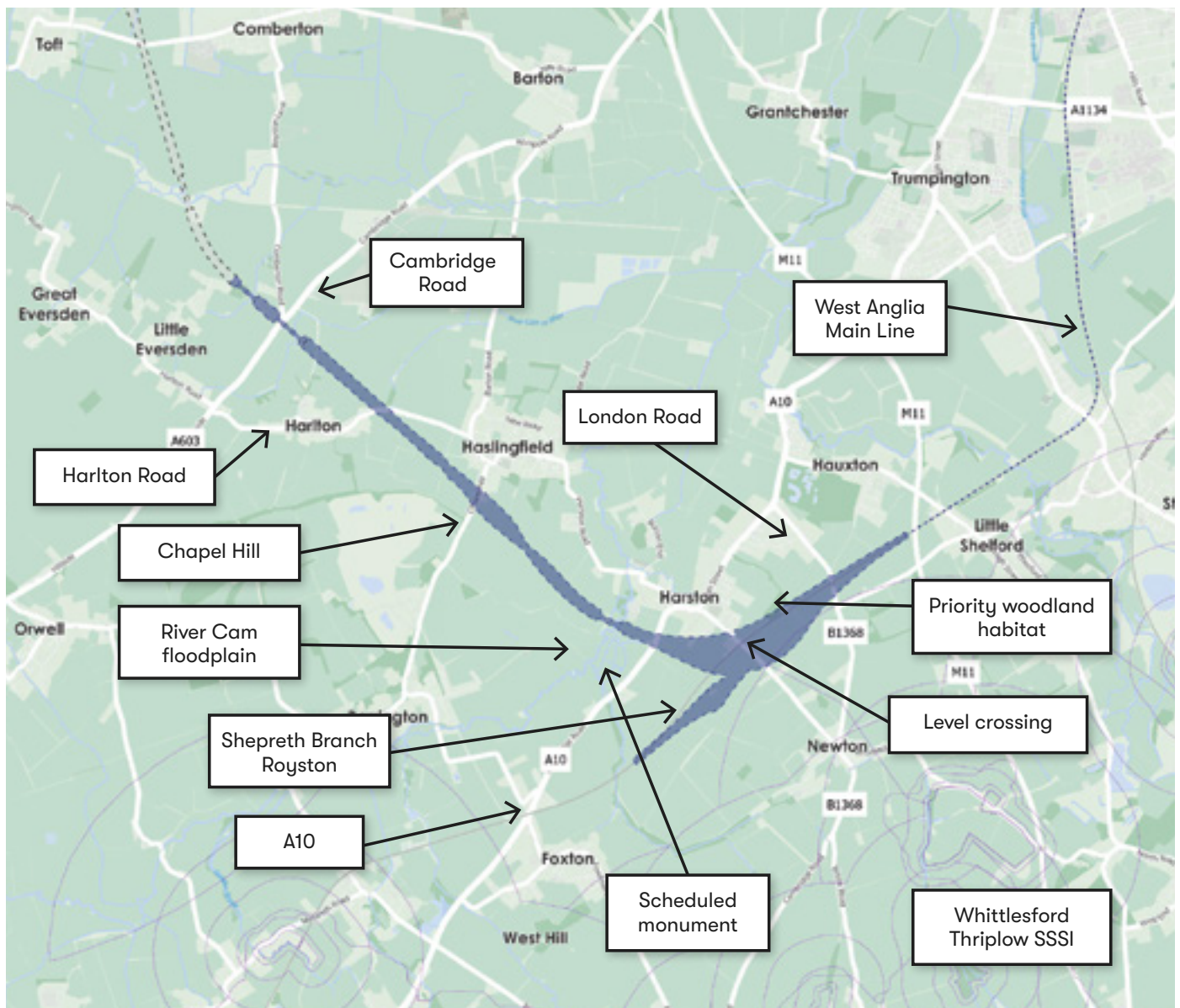
Figure 10.1: Project Section E: Harlton to Hauxton

10.2.2. Project Section E covers approximately 8km of proposed railway between:

- The eastern end of Project Section D, where the alignment options in that Project Section converge to the west of Cambridge Road (A603), and
- The connection to the existing SBR Line, located south of the M11.

10.2.3. The SBR, also known as the Cambridge Line, is the section of railway that runs from Cambridge Junction on the East Coast Main Line (ECML) to the Shepreth Branch Junction on the WAML. It forms part of the London King's Cross and East Anglia route between Hitchin and Cambridge.

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- 10.2.4. A six trains per hour (6tph) Govia Thameslink Railway (GTR) service operates on the SBR all day. The GTR service then joins the WAML at Shepreth Branch Junction, located to the northeast of Project Section E. EWR must develop its timetable around the WAML route to and from Cambridge due to the constraints resulting from the need to coexist with GTR services.
- 10.2.5. The Route Option E Indicative Alignment was developed as described in Chapter 5. This proposed joining the WAML indirectly by connecting EWR to the SBR south of the M11. However, the Route Option E area is sufficiently broad to allow the possibility of a connection to the WAML directly, in which case the connection would be provided either north or south of Shepreth Junction. As such, EWR Co conducted an initial assessment to ascertain the viability of the options to connect to the WAML directly, alongside the Route E Indicative Alignment. EWR Co determined that connecting to the SBR is preferred because it is likely to meet the Project Objectives and provide a sustainable and value for money transport solution, when compared to options for connecting to the WAML directly. The section on option development below (paragraph 10.3.1) discusses this in more detail.
- 10.2.6. Based on these initial assessment recommendations, EWR Co considered options that connect EWR to the SBR for further development. Four alignment options were developed taking into consideration the key constraints in the area, as shown in Figure 10.2 and listed below. The section on options considered below (paragraph 10.4.1) discusses this in more detail.



## Legend



-  East West Rail – Harlton to Hauxton
-  Other area of East West Rail

Figure 10.2: Project Section E: key constraints

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10.2.7. The key constraints in the area that EWR Co has considered include:

- The need to cross the River Cam and its floodplain, Cambridge Road, Harlton Road, Chapel Hill, and the A10;
- The location of Station Road, which is one of two key connections between Harston and Newton and is located almost directly at the point where the new railway would cross the SBR;
- The location of London Road, which is the second key connection between Harston and Newton and is located almost directly at the point where the new railway would join the SBR;
- The need to avoid affecting the M11, such as requiring any alterations to the existing bridge abutments or foundations, which would negatively impact the construction programme and increase the cost risk and disruption to road users during construction;
- The current limitations on the capacity of the SBR and the need to avoid constraining the introduction of new services in the future;
- The potential for disruption to existing train services on the SBR during construction;
- Visual impacts as a result of the new railway for the residents of Harston, Newton, and Little Shelford;
- The potential impact from severing or diverting existing connections between Harston and Newton, in particular Station Road and London Road;
- Setting impacts for the historic environment, in particular the settlement site at Manor Farm, which is a scheduled monument;
- The direct impacts to the unnamed rectangular woodland located southeast of Harston. (EWR Co is treating this as potential ancient woodland, and has assumed that as a minimum, it is a priority woodland habitat); and
- The potential impacts to known and unknown buried archaeology and the chalk aquifer.



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### **10.3. WAML / SBR connection**

10.3.1. The area identified in preferred Route Option E included the possibility of connecting to the WAML directly, either north or south of Shepreth Junction, or joining the WAML indirectly via a connection to the SBR, southwest of the M11.

10.3.2. EWR Co assessed the direct WAML connection options at a high-level to test whether they could meet the Project Objectives, as outlined in Chapter 3.

10.3.3. EWR Co found the option to join the WAML north of Shepreth Junction, between Addenbrooke's Road Bridge and Shepreth Junction, to have the following key impacts identified:

- Joining the WAML at this location would require the purchase and demolition of several properties, including potentially Shelford Rugby Club, several houses on Cambridge Road, and the Scotsdales garden centre and cafe;
- This option would significantly disrupt the scheduled monument located in the field to the west of the existing WAML opposite Nine Wells; and
- Grade separation (where one track passes over or under another to avoid train movement conflicts) would be required, either now or in the future, to locate the EWR lines on the east side of the WAML in this option. With grade separation, the EWR lines would need to be located on the east side to ensure that the potential future extension of services east of Cambridge is feasible. However, the distance available in this area to achieve grade separation is insufficient. The railway constraints for maintaining track gradients suitable for freight services mean that tracks would not return to ground level before Addenbrooke's Road bridge and, more crucially, Cambridge South station.

10.3.4. Therefore, the option to join the WAML north of Shepreth Junction is highly unlikely to meet the Project Objectives, particularly when considering and planning future passenger demand and making provision for that where it is affordable. This option would create obstacles in the future. Consequently, EWR Co has discounted this option and will not take this option forward.

10.3.5. The option of a connection to the WAML south of Shepreth Junction would entail a railway passing west of Harston and Newton, passing over the SBR and beneath the M11 motorway and then crossing the floodplain of the River Cam to join the WAML south of Great Shelford. Crossing the M11 motorway would require construction of a new underbridge, potentially affecting the M11. From the point at which EWR joined the WAML it is likely that four-tracking of the WAML would be required in order to provide separation for EWR services and sufficient capacity for existing WAML services. Four-tracking would need to extend from this point northwards through Great Shelford, resulting in the acquisition of land – including residential property – to construct the new lines and the reconstruction of the existing Great Shelford Railway Station in the Great Shelford conservation area.

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10.3.6. The option to join the WAML south of Shepreth Junction and south of Great Shelford has particular environmental problems, with the following key impacts identified:

- Joining the WAML at this location would require providing a junction within a Flood zone area, resulting in additional infrastructure to mitigate against the risk of flooding and potentially flood zone compensation;
- The EWR alignment would clash with several environmental assets, including Priority Habitats and Site of Special Scientific Interest (SSSI) Impact Risk Zones (IRZ), which can be avoided altogether by a SBR connection;
- EWR Co may require four tracking of the WAML in this location to add the EWR services. Providing a four-track railway would mean a widening of the existing railway corridor resulting in land and potential property take in Great Shelford and expansion to the current station; and
- When compared to the SBR option, this option would represent an increase of approximately 1.8km in journey length to Shepreth Junction, resulting in additional tracks needing to be constructed, maintained, and operated.

10.3.7. The option of a connection to the SBR would entail a railway crossing the floodplain of the River Cam before passing to the south of Harston and the west of Newton before merging with the SBR before the M11 motorway crossing. Any construction work would not impact the M11 and it is not envisaged that the existing two track SBR line requires widening. The alignment avoids impacting the scheduled monument to the south of Harston and would seek to avoid impacting the SSSI and unknown buried archaeology located to the east of Harston.

10.3.8. The option to join the SBR, when compared to the option to join the WAML south of Shepreth Junction, has the following key advantages identified:

- Reduced whole life costs and increased journey time as a result of approximately 1.8km shorter route alignment;
- The alignment can pass to the south of Harston village reducing impact on residential properties and therefore requiring less land and property take;
- While the alignment passes on the periphery of a SSSI Impact Risk Zone, careful design is expected to be able to ensure impacting this zone is avoided;
- The alignment uses the existing M11 crossing on the SBR, by providing a junction to the south, thus avoiding any additional structures required or impacting the M11;
- This option should not require widening of the existing two track corridor beyond the junction resulting in a smaller footprint and acquisition of fewer properties;
- Opportunity to remove existing level crossings in the area and provide alternative connectivity thus reducing the risks to road users.

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10.3.9. The option to join the WAML, south of Shepreth Junction, is likely to be capable of meeting the Project Objectives, provided that the additional infrastructure described above is put in place. However, compared to the SBR option, as a result of environmental impacts; additional works in sensitive areas; the likely need for acquisition of domestic property in Great Shelford that could be avoided with the SBR option; the increased journey time; and increased capital and whole life costs, this option does not provide a sustainable and value for money transport solution. Therefore, EWR Co has discounted this option and will not take this option forward.

10.3.10. The option to join the SBR is likely to meet the Project Objectives and provide a sustainable and value for money transport solution. Therefore, EWR Co has determined that connecting to the SBR is preferred to connecting to the WAML directly.

## **10.4. Options development**

### **Overview**

10.4.1. By addressing the key constraints outlined in the previous paragraphs, EWR Co has developed the options for connecting to the SBR by considering two key aspects, the type of junction and the construction approach.

10.4.2. By addressing the key constraints outlined in the previous paragraphs, EWR Co has developed the options for connecting to the SBR by considering two key aspects, the type of junction and the construction approach.

10.4.3. Two types of junctions have been considered: grade-separated, where individual tracks rise to pass over other tracks, and at-grade, which is a railway junction where tracks cross at the same level. These options differ in terms of impacts during the works, impacts of the permanent infrastructure, and level of service that can be achieved with the new infrastructure.

10.4.4. Two types of construction have been considered: online construction, in which works are carried out on or adjacent to the existing railway, and offline construction, in which works are carried out ensuring separation of the operating railway services and construction work. These options differ in terms of impacts during the works and impacts of the permanent infrastructure, although they will provide the same level of service at completion of the works.

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## Types of junction

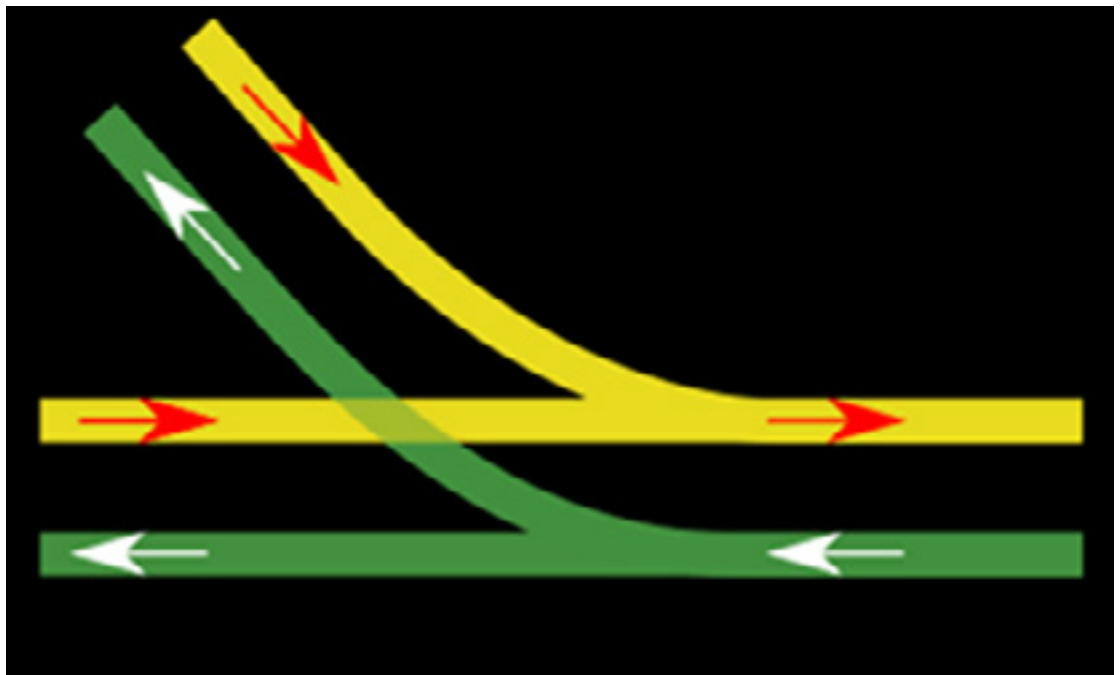
10.4.5. For the development of options for Project Section E, EWR Co has considered two types of junction to connect to the SBR which are illustrated in Figure 10.3 and Figure 10.4:

- A grade-separated junction, also known as a flying junction or flyover, which is a railway junction where individual tracks rise to pass over other tracks to avoid conflict with other train movements; and
- An at-grade junction, also known as a level or flat junction, which is a railway junction where tracks cross at the same level, introducing conflict with other train movements.



Figure 10.3: Typical grade-separated junction arrangement

Figure 10.4: Typical at-grade junction arrangement



- 10.4.6. Grade separation of railway tracks allows for the railway's capacity to be increased. Grade-separated junctions generally enable trains to be less restricted within the timetable, with fewer interruptions and shorter journey times than can be achieved with at-grade junctions. However, grade-separated junctions are typically space-intensive and more costly than at-grade junctions due to the need for large structures such as ramps and bridges.
- 10.4.7. The type of connection to the SBR must ensure that it can satisfy proposed passenger service demands as described in Chapter 3, initially a 4tph service in each direction, while not prejudicing existing operations on the SBR or precluding the introduction of future services.
- 10.4.8. Analysis indicates that while it would be feasible to run the 4tph service using an at-grade junction, this would restrict future new services from operating on the SBR line, particularly any planned increase in the number of GTR trains. Therefore, since an at-grade junction would fail to meet the Project Objectives requiring appropriate provision for anticipated growth, the preferred option is for a grade-separated junction.

## Types of construction

10.4.9. Preventing interruptions to passenger and freight services during construction works near the track is essential to maintaining a safe and efficient railway. During the design phase of a project, it is necessary to carefully consider any potential impact on the supporting ground conditions around rail infrastructure. Therefore, appropriate construction techniques need to be selected to minimise any impact.

10.4.10. For the development of options for Project Section E, EWR Co has considered two types of approaches to construction:

- Offline construction, in which works are carried out where the proximity of the existing railway has the least impact, ensuring separation of the operating railway services and construction work; and
- Online construction, in which works are carried out on or adjacent to the existing railway.

10.4.11. Therefore, four options were developed and assessed for connecting to the SBR:

- Offline construction of a grade-separated junction (Figure 10.5).
- Offline construction of an at-grade junction (Figure 10.6).
- Online construction of a grade-separated junction (Figure 10.7).
- Online construction of an at-grade junction (Figure 10.8).

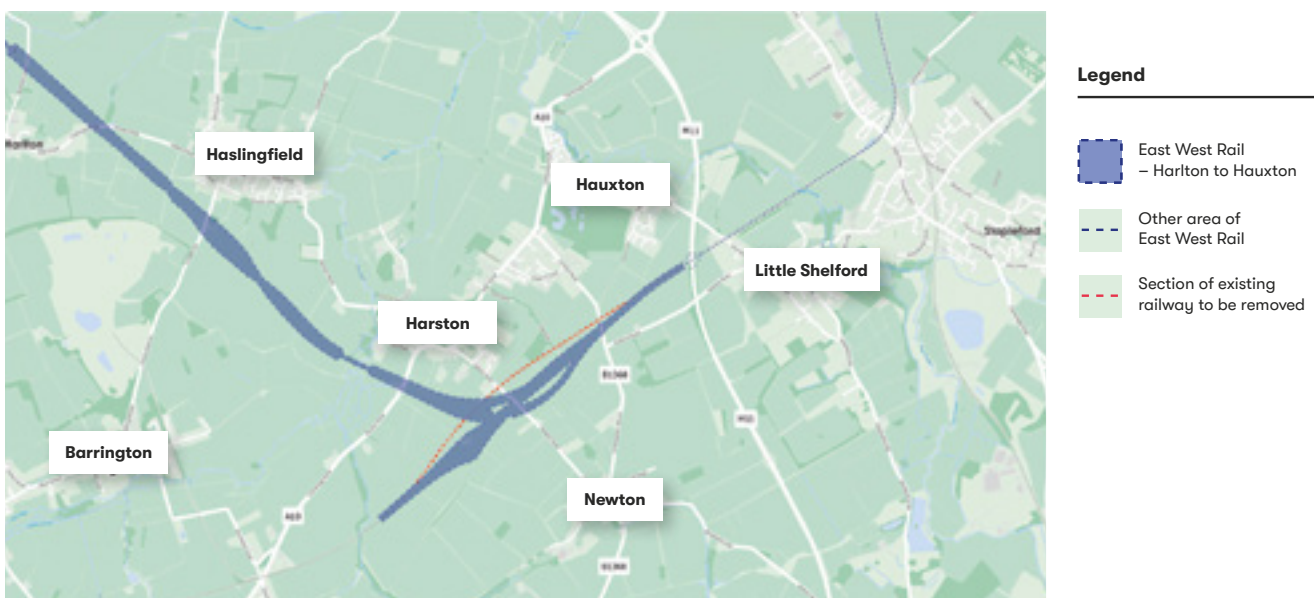


Figure 10.5: Offline construction: grade-separated junction option



Figure 10.6: Offline construction: at-grade junction option

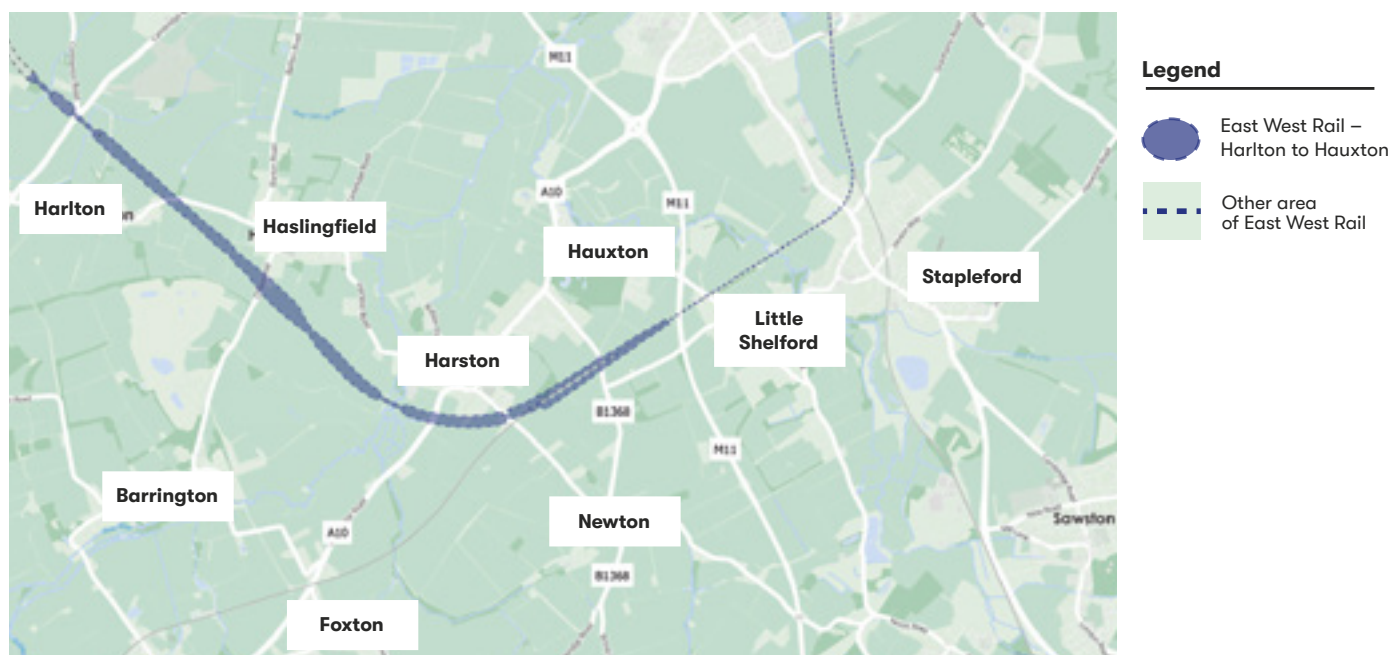


Figure 10.7: Online construction: grade-separated junction option



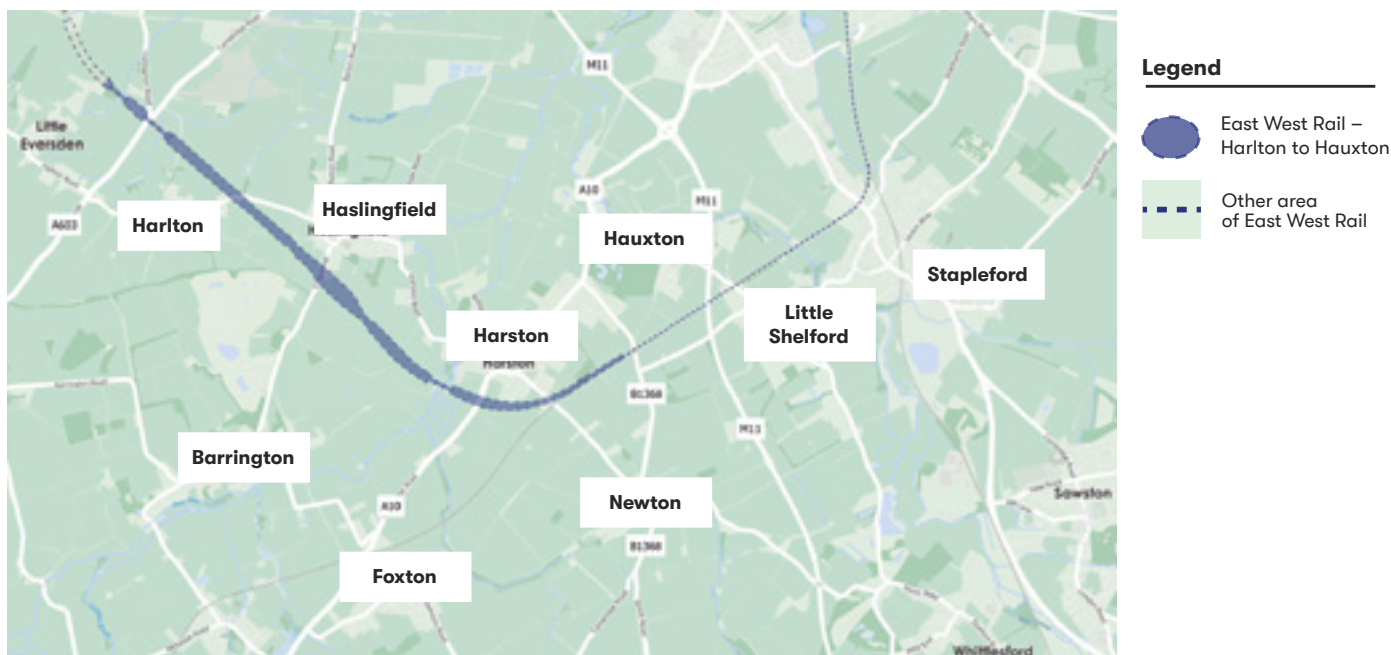


Figure 10.8: Online construction: at-grade junction option

10.4.12. All four options follow the same alignment from the western end of Project Section E, where the alignment options of Project Section D converge to the west of Cambridge Road (A603), to where the alignment options cross the A10.

10.4.13. The alignment runs southeast on an embankment, crossing over Cambridge Road and Harlington Road before entering into open cutting and crossing under Chapel Hill. The alignment then returns to an embankment on its approach to Harston. The alignment crosses over the River Cam and floodplain on a viaduct of approximately 240m in length. The alignment continues on an embankment, crossing over the A10 and requiring the demolition of New Farm, before curving to the northeast, passing between the scheduled monument settlement site at Manor Farm and south of Harston, and crossing Station Road at the old station yard, affecting buildings and operations there.

10.4.14. From the A10 to the connection to the SBR, the design considers the four options under two key aspects: junction type and construction approach. The following sections expand on the impacts and benefits of each of these aspects of the options below. The following paragraphs describe each of the options in more detail.



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## Analysis of junction types

10.4.15. This part of the Technical Report analyses whether the at-grade or grade-separated junction options are capable of meeting the Project Objectives. This is because, in order to be considered, an option must achieve sufficient functionality, whilst providing an element of future-proofing.

### At-grade junction

10.4.16. EWR Co has identified that it is feasible to plan an EWR 4tph service onto the SBR, amongst the existing GTR timetable, with an at-grade junction. However, this is based on providing no more than four EWR services per hour in each direction. Effectively, the capacity of the SBR would be capped as a result of an at-grade junction and there would be no flexibility to absorb any future increase in demand.

10.4.17. The route between Shepreth Branch Junction and Cambridge would then require widening of the railway corridor to four tracks (it is currently a two-track railway), with an at-grade junction at Shepreth Branch Junction, allowing EWR and GTR services to run generally conflict-free alongside WAML services.

10.4.18. Scheduling of trains into the Working Timetable is enabled by regulating the standard timings between stations and junctions, together with other allowances, as outlined by the Timetable Planning Rules (TPR). EWR Co has used the TPR to assess the utilisation impacts to provide a high-level indication of an at-grade junction's capability.

10.4.19. The at-grade junction introduces conflicting train movements between GTR services towards Cambridge and westbound EWR services. The analysis has indicated that an at-grade junction would vary between 54 and 63% utilisation, meaning that in an hour a minimum of 37%, or 21 minutes, of headway (the time between trains) would be available. Extrapolating the timings suggests that westbound EWR services would have four windows available between GTR services towards Cambridge to cross the track for the conflicting move within the new at-grade junction. These windows would consist of three, four, five and nine--minute headways (based on a three-minute junction margin each way). Therefore, any potential delays to either the GTR services towards Cambridge or the westbound EWR services, of three minutes or more, would be likely to impact the opposing service's performance.

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10.4.20. Performance allowances would support the recovery of lateness for the westbound EWR service. However, the potential performance impact in linking GTR services to and from Cambridge would reduce any benefit these services may have in the turnaround allowance (time allowed within the timetable for trains to be prepared after completing one service before commencing another service) at Cambridge. GTR services, particularly towards Hitchin, are on critical paths into the Thameslink core (the Thameslink route through central London), requiring robust train paths. An at-grade junction puts the robustness of these paths at greater risk.

### **Grade-separated junction**

10.4.21. A grade-separated junction would increase flexibility by removing some conflicts between train movements, leading to a greater chance of a feasible combined EWR and GTR timetable to and from Cambridge. Analysis has indicated that a grade-separated junction would vary between 40 and 50% utilisation, meaning that in an hour a minimum of 50%, or 30 minutes, of headway would be available. The additional available headway and removal of the westbound EWR service's conflicting move across the GTR services towards Cambridge would offer both performance and capacity mitigations.

10.4.22. When considering and planning future passenger demand and making provision where it is affordable, providing an at-grade junction would create obstacles in the future. EWR services would require a grade-separated junction for any increase in the number of trains per hour due to the reduced service interval for EWR and GTR services on the SBR. The same applies when considering future passenger demand on the SBR. The reduced interval for GTR services would conflict with the 4tph EWR service.

10.4.23. Therefore, EWR Co considers that providing a connection to the SBR with a grade-separated junction should be the emerging preferred option. So far as the Project Objectives include consideration, where value for money and affordable, for future growth, it would not be possible to meet that objective by providing an at-grade junction, since any future increase in demand could only be met by provision of a grade-separated junction. Accordingly, an at-grade junction is not considered further in this Chapter.

### **Construction approach options considered**

10.4.24. Working on, or adjacent to, an existing railway can be a safety and performance risk to EWR Co's works and Network Rail's (NR) infrastructure. Any such works are subject to an extensive set of rules designed to ensure workers' safety, protect the general public and safeguard railway operators and equipment.

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10.4.25. Working with any lines open to traffic should only be undertaken as a last resort, based on the prevention principles included in the Health and Safety at Work Act 1974 (HSWA) and the Management of Health and Safety at Work Regulations 1999 (MHSWR). EWR Co would carry out any works on or adjacent to the railway under planned possessions (when the railway is closed to fit construction work around existing train services) in consultation with NR. For the development of options for Project Section E, EWR Co has considered both offline and online construction approaches.

### **Offline construction option**

10.4.26. Taking an offline construction approach would reduce the risks associated with working on or adjacent to the existing railway. Construction worksites would be in the contractor's control, which would reduce the number of consents required from NR and the number of planned possessions.

10.4.27. Reducing the need to carry out works under planned possessions would also reduce the need for planning contingencies. Undertaking commissioning and hand-back testing would not be time constraints. Possession planning would no longer drive the construction programme. Therefore, the works would be delivered more quickly, allowing the transfer of services to the new infrastructure earlier.

10.4.28. Carrying out the works where the proximity of the existing railway has the least effect would reduce the risk to NR's infrastructure due to vibration during construction. Using offline construction eliminates the hazards associated with working over and adjacent to a railway that would need to be mitigated in an online option. Overall, this would minimise the impact on the operational railway.

10.4.29. Using an offline construction approach is more likely to deliver the Project quickly and safely, allowing the transfer of services to the new infrastructure earlier, in addition to environmental benefits. These are important considerations and therefore EWR Co has determined that this approach is the emerging preferred option.

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## Online construction option

- 10.4.30. A key benefit of carrying out the works using online construction is that this minimises the junction's overall footprint.
- 10.4.31. Achieving the time frames set out in a construction programme is significantly more complicated when taking an online construction approach as works must be carried out during planned possessions.
- 10.4.32. Enabling a planned possession is dependent on the booked time a train service passes the site of works. As a result, the complexities of coordination between EWR, NR and the train operators, for both the planning of possessions and planning for contingencies, results in a risk of delaying the construction programme.
- 10.4.33. The longer the construction programme takes, the more significant the impact on the operational railway and the general public. A more extended construction programme would delay the transfer of services to the new infrastructure.
- 10.4.34. Working on, or adjacent to, an existing railway would represent a greater risk to NR's infrastructure due to the effects of vibration during construction. Monitoring can mitigate these risks; however, this adds another level of complexity to planning the works. Time-constrained arrangements associated with possessions also make commissioning and hand-back testing more difficult. There is a significant increase in safety risk to the construction workers working on, or adjacent to, an existing railway under possession arrangements when compared with offline construction.

## Environmental considerations

- 10.4.35. This section discusses the grade-separated junction option only as the at-grade junction option has been identified as not being able to achieve the Project Objectives. Providing a grade-separated junction in either the offline or the online construction approach results in some environmental considerations that would be common to both options, whilst some impacts favour one option or the other.
- 10.4.36. The area within and surrounding the offline option is highly sensitive in terms of the potential for buried archaeology. Moving the railway further away from Harston increases the risk of potential impacts on known and unknown buried archaeology within this area. Whilst both options would take the alignment further to the southwest, the offline option affects more of this area.

10.4.37. The grade-separated junction would be likely to result in a very high visual impact (forming a visual hotspot) upon Harston residents due to the height and extent of structures and road realignments required in proximity to the settlement.

10.4.38. There are some scheduled monuments in the area, which would be likely to suffer setting impacts in relation to a grade-separated junction. Any impact would be the same with both construction options. The two assets of concern are:

- The Settlement Site at Manor Farm (NLHE: 1006809), which abuts the footprint of both routes southwest of Harston and would be likely to suffer direct impacts; and
- The Moated complex, which is located 260m northwest of Fryers Cottage (NLHE: 1019179).

10.4.39. There are some listed buildings in the area, primarily in the village of Harston, the closest being approximately 300m from both options. While both options could cause some setting impacts, the grade-separated junction could result in a slight increase in potential setting impacts, most notably at Baggot Hall (NLHE: 1331081), which is a Grade II listed building.

10.4.40. Both options are likely to require the demolition of two properties at New Farm off the A10 Royston Road as a result of the alignment and associated earthworks.

10.4.41. Both options would cross two Public Rights of Way (PRoW), which are assumed to be diverted. These are

Barrington Footpath 4 and Harston Footpath 4. However, it has no direct impact on community and recreational facilities, or known public open spaces.

10.4.42. Both options intersect a localised historical landfill (0.5ha) at Chapel Hill, Haslingfield, likely to be a clay or chalk pit. Backfill is unknown. Remediation of contaminated land (if required) would be a benefit with both options.

10.4.43. Both options would result in impacts to woodland to the north of Little Eversden and the River Rhee County Wildlife Site (including priority floodplain grazing marsh and woodland habitats) to the southwest of Harston. Through further design development, impacts should be avoided or minimised (and restoration and enhancement opportunities sought).

10.4.44. The shallow cutting between Newton Road and London Road is in a lower-lying area likely to have a near-surface groundwater table. Groundwater inflow would be likely for both options.

10.4.45. The valley of the River Cam provides local recreation and an ecological corridor whilst also including the watercourse of the River Cam itself. Both options would cross the valley on a viaduct at the same point and would therefore have similar impacts in relation to their footprint in Flood Risk Zone 2.

10.4.46. Both options are located within the green belt and would impact openness and the separation of settlements. Station Road is designated as an 'Important Countryside Frontage' in the Local Plan, which may be more sensitive in planning terms than other edges of the settlement facing the alignments. The grade-separated junction would have a high elevation, with the online construction being closer to the settlement.

10.4.47. The considerations relevant to the individual options are discussed below.

### **Offline construction option**

10.4.48. Carrying out works using offline construction would avoid directly impacting an unnamed rectangular woodland located southeast of Harston. EWR Co is treating this as potential ancient woodland and has assumed that, as a minimum, it is a priority woodland habitat.

10.4.49. The offline construction option would take the alignment further away from residential properties in Harston. This would result in minor improvements to community, air quality and noise compared to the online construction option. Conversely, the offline construction option would be closer to Newton, but the distance between the railway and Newton would still be greater than the distance between the railway and Harston.

10.4.50. As a result of moving the alignment, the offline construction option is likely to have less potential direct impact on residential properties, with no more than two residential

properties identified to require demolition at paragraph 10.4.37 above, compared to the online construction option which would require the demolition of eight additional properties.

10.4.51. The offline alignment would result in cutting into the peak of Rowley's Hill due to the existing railway's realignment. The hill is a local landform providing the setting to the south of Harston and this would impact upon local landscape character.

10.4.52. The offline construction approach would encroach slightly into the IRZ for the Whittlesford Thriplow SSSI. Any development within the IRZ would need to consider the potential for indirect impacts to the SSSI through, for example, altering groundwater flows to that area. Data is not available at this stage to support any further understanding of expected impacts. However, EWR Co currently expects that by providing a small realignment of the railway, at the next design stage, it would be possible for impact to this risk zone to be avoided by moving the alignment clear.

10.4.53. The offline option would have deep cuttings in chalk north of the River Cam at Chapel Hill and a shallow cutting south of the River Cam between Newton Road and London Road. Based on preliminary data from the Environmental Appraisal (EA), the deep cutting below Chapel Hill appears to be above the groundwater table and, as such, is not anticipated to require dewatering or groundwater management.

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## **Online construction option**

- 10.4.54. The online construction option requires a smaller additional footprint than the offline construction option. This would decrease the risk of potential impacts on known and unknown buried archaeology.
- 10.4.55. Carrying out works using offline construction would directly impact the priority woodland habitat located southeast of Harston.
- 10.4.56. The online construction option would take the alignment closer to residential properties in Harston. It would, therefore, have the potential for minor worsening to community, air quality and noise compared to the offline construction option.
- 10.4.57. The proposed railway would cross the SBR at its highest point adjacent to the residential properties at The Paddock and Lawrance Lea, along Station Road. As Station Road is designated as an 'Important Countryside Frontage' in the Local Plan, which is more sensitive in planning terms than other edges of the settlement facing the alignments, the online option would have a greater impact when compared to the offline option which is approximately 360m further away. In addition the alignment of the route through this area results in an additional eight properties that would likely require demolition when compared to the offline option.
- 10.4.58. The online construction option would require a greater length of bridge and retaining structures which would result in a slight increase to greenhouse gas emissions compared to the offline option.
- 10.4.59. In addition to crossing two PRow, which may require diversion, the online option would additionally sever Harston Byway 6 which links to the London Road at Harston.

## **Offline construction options**

- 10.4.60. Having identified that an at-grade junction will not achieve the Project Objectives, the two options which are taken forward for consideration are an offline grade-separated junction and an online grade-separated junction. An offline grade-separated option would be more straightforward and safer to construct, as well as affording greater certainty as to delivery timing. It would perform better overall in environmental terms and have fewer direct impacts on residential properties. However, an online option would have a smaller footprint, would not impact on the existing Harston to Newton connection, and would perform better than the offline option in relation to the water environment and landscape setting.

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## **Offline construction of a grade-separated junction**

10.4.61. A connection to the SBR with a grade-separated junction, using an offline construction approach that ties into the existing SBR southwest of the M11, is shown in Figure 10.5..

10.4.62. During construction, EWR Co would build a new section of alignment for the SBR using an offline construction approach in cutting to the southeast and parallel to the current alignment, moving both the existing and proposed railway further away from the residential properties at Harston. This would perform better in terms of air quality, noise and vibration and community benefit. The existing SBR alignment would continue to function as normal during construction. Once construction is complete, EWR Co would then connect each end of the new alignment to the existing SBR. In realigning the SBR, the railway corridor would be relocated further away from the residential properties in Harston but would be slightly closer to Newton.

10.4.63. The westbound EWR line would cross over the new SBR line on a new viaduct, with the eastbound EWR line running parallel to, and to the north of, the SBR line, at-grade. Due to different levels when crossing Station Road, the alignment would be likely to impact upon the existing connection between Harston and Newton in its current arrangement. This would be the result of moving the alignment further away from the residential properties in Harston, in particular those located along Station Road, where the highest point of the crossing would be located approximately 360m further away when compared with the online option. Key constraints, shown in Figure 10.9 below, were considered.





Figure 10.9: Highway constraints map

10.4.64. EWR Co is currently exploring different connectivity options, shown in Figure 10.10, which include:

- Maintaining the existing Harston to Newton connection for use by pedestrians and cyclists only, with provision of a new grade-separated crossing of the SBR and removal of the existing level crossing offering significant safety benefit to the road users;
- Re-purposing the old section of the SBR, which would be decommissioned from service, as a greenway for cyclists and pedestrians;
- Permanent road traffic diversions along the B1368 to the A10;
- Re-purposing the existing SBR railway corridor as a new road and pedestrian/cycleway connecting the B1368 with Station Road, offering a permanent road traffic diversion that does not increase traffic flow along the A10; and
- Providing a new road connecting Newton Road to the A10 at a new junction along Royston Road as a permanent road traffic diversionary route.



Figure 10.10: Alternative highway diversion options

10.4.65. EWR Co will consult on further details of the solution selected as the preferred option following this consultation at the forthcoming Statutory Consultation and will need to consider:

- Cost;
- Engineering feasibility;
- The impact of increased traffic on the diversionary routes;
- The impact of diversions on bus routes;
- Increased journey times; and
- Community considerations collated through consultation and engagement feedback.

10.4.66. As a result of providing a permanent road traffic diversion for Station Road, EWR Co would propose to close the existing level crossing and replace it with a grade-separated crossing for use by pedestrians and cyclists. This would improve the current pedestrian and cycle route, which is currently closed by the level crossing when trains pass.

10.4.67. The alignment would keep the existing connection along London Road. However, it would require a small realignment to accommodate the new track alignment. A new bridge over the railway would be provided on London Road.

## Potential option refinement: partial offline construction

10.4.68. Although the offline grade-separated junction would offer significant benefit in avoiding sensitive receptors in Harston, it does present a broad footprint in terms of land required. EWR Co has explored alternative ways to reduce this requirement while still providing a grade-separated junction at Hauxton.

10.4.69. Figure 10.11 shows a Partial Offline Construction Alignment Option 1. A new section of the Up Cambridge Line (towards Hitchin) would use an offline construction approach to provide a grade-separated junction. The Down Cambridge Line (towards Cambridge) would use an online construction approach to construct the EWR connection, keeping the existing Down Cambridge Line in its current location. EWR would connect to the outside SBR Lines.

10.4.70. The existing connection between Harston and Newton along Station Road is likely to remain in the current arrangement, with the new Up Cambridge Line and EWR Lines crossing over on a new bridge. The level crossing on Station Road would remain in place for the Down Cambridge Line. The impact on London Road would also be likely to be reduced. However, a new bridge and some realignment of the road would be required.

10.4.71. Figure 10.12 shows a Partial Offline Construction Alignment Option 2. A new section of the Up Cambridge Line (towards Hitchin) would use an offline construction approach to provide a grade-separated junction. The Down Cambridge Line (towards Cambridge) would use an online construction approach to construct the EWR connection, keeping the existing Down Cambridge Line in its current location. EWR would connect to both the Up and Down Cambridge Lines between the SBR Lines.

Figure 10.11: Partial  
Offline Construction  
Alignment Option 1



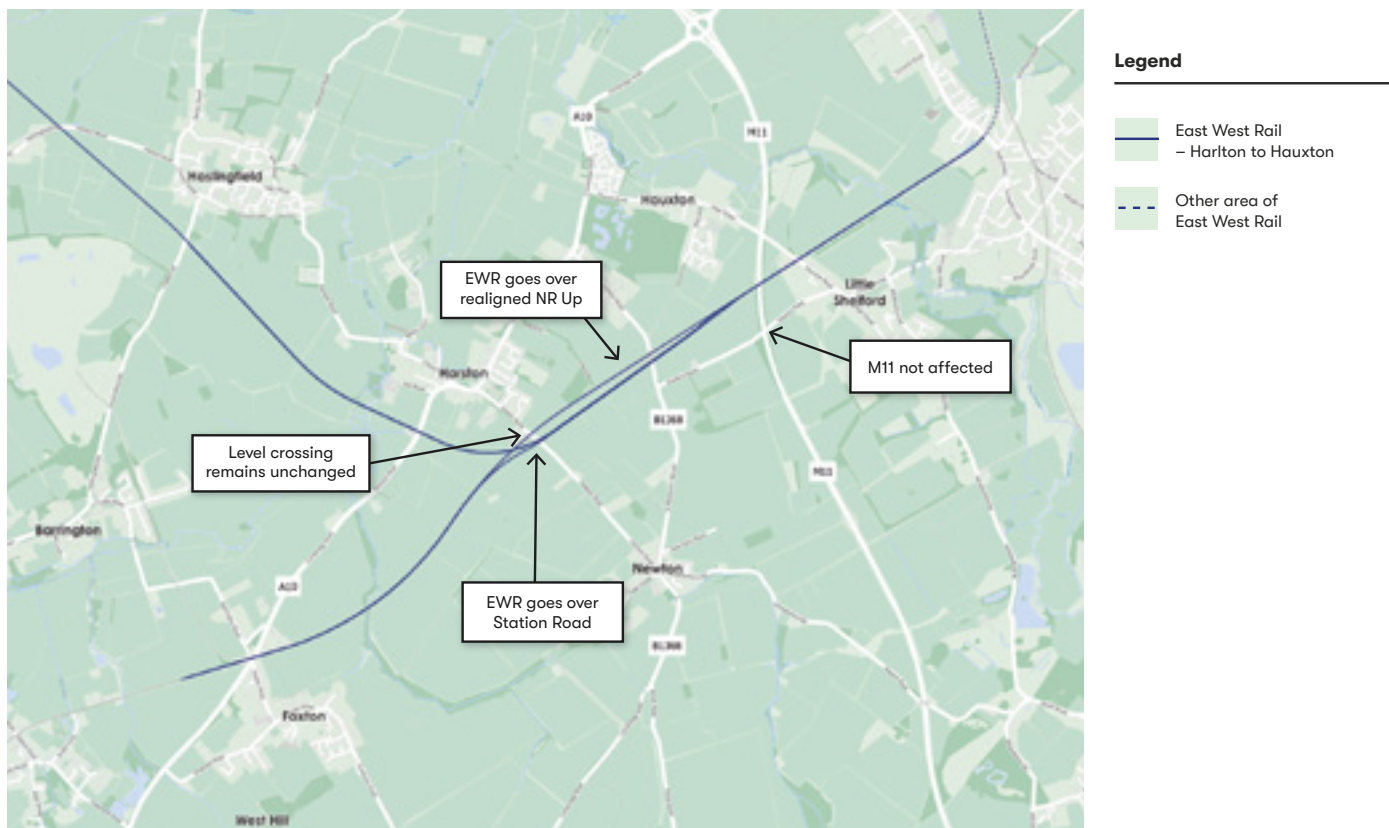


Figure 10.12: Partial Offline Construction Alignment Option 2

10.4.72. The existing connection between Harston and Newton along Station Road is likely to remain in the current arrangement, with the EWR Lines crossing over on a new bridge. The level crossing on Station Road would remain in place. The impact on London Road would be likely to be increased. A new bridge and more significant realignment of the road would be required.

10.4.73. Based on the emerging information at this stage of design, the partial offline construction would reduce the junction's overall footprint compared with full offline construction. However, it would increase visual impact in Harston compared to the offline grade-separated junction.

10.4.74. EWR Co will need to develop these option refinements further to determine the feasibility of the design, particularly the vertical clearances between the road and the railway, and the gradients of the track.

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## **Online construction of a grade-separated junction**

- 10.4.75. This option proposes a connection to the SBR with a grade-separated junction using an online construction approach and would tie into the existing SBR southwest of the M11, as shown in Figure 10.7 above.
- 10.4.76. During construction, EWR Co would require possessions on the SBR line to carry out the works over the existing railway. Line blockades would result in service disruption to transport users on the SBR. The SBR would remain in its existing alignment, resulting in the proposed railway being located closer to the residential properties in Harston, but further from those in Newton.
- 10.4.77. Also, by providing the online construction of the SBR, the priority woodland habitat located to the southwest of Harston, adjacent to the existing railway corridor, would be likely to be directly affected.
- 10.4.78. As part of this option, EWR Co would propose to keep the existing level crossing on Station Road, which would maintain the existing connection between Newton and Harston. The proposed railway would be crossing over the road, and the SBR would remain on its current alignment.
- 10.4.79. The alignment would keep the existing connection along London Road. However, it would require a small realignment to accommodate the new track alignment. London Road would need a new bridge over the railway.

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## Comparison of Options

10.4.80. EWR Co has agreed Assessment Factors with the DfT (as set out in Chapter 5) that reflect the Project Objectives. These are used to assess options and arrive at a shortlist and preferred option.

10.4.81. EWR Co assessed the options based on the construction approach, either offline or online. EWR Co has considered the application of all Assessment Factors. However, this section only discusses those that assist in differentiating between the options at this stage.

10.4.82. The following Assessment Factors from the list agreed with DfT differentiate between the online and offline options considered in Project Section E, and therefore were the focus of the comparison:

- Environmental impacts and opportunities;
- Safety risk (construction and operation)
- Capital costs; and
- Overall affordability.

10.4.83. The following Assessment Factors were considered to be neutral and would not assist in differentiating between alignments in this Project Section:

- Transport User Benefits: this Assessment Factor does not particularly influence online or offline construction options as there is little operational difference between the two options;
- Contribution to enabling housing and economic growth, including best serving areas benefitting from developable land: this is not a differentiating factor for these options;
- Operating costs: this is not a differentiating factor for these options;
- Network Capability (covering short distance passenger services and connectivity to support commuting travel into key employment hubs (current and future); long distance passenger services; and satisfying existing and future freight demand). Once it had been determined that a grade-separated option is to be preferred, this Assessment Factor does not assist in differentiating further between online and offline;
- Rail passenger connectivity to existing mainlines: is not a differentiating factor for these options;
- Performance: An increase in the bridge deck length/area would be required with an online construction approach to providing a grade-separated junction. An increased length of retaining structure would also be required, which would be more challenging to maintain than an offline construction approach. A grade-separated junction option, constructed offline, would provide a more maintainable solution, and offer better performance and capacity mitigations than when constructed online. Therefore, this Assessment Factor favours a grade-separated junction option using an offline construction approach. However, in comparison to other Assessment

- Factors, the differences are marginal and other factors will be of greater assistance in differentiating between options;
- Alignment with wider Railway Strategy / Infrastructure (this Assessment Factor does not assist in differentiating between online or offline options); and
  - Consistency with Local Plans is not a differentiator for either the type of junction or the online or offline construction.

## Environmental impacts and opportunities

10.4.84. The Environmental Impacts and Opportunities Assessment Factor does provide value in differentiating between options for grade-separated junctions.

10.4.85. An online construction option would involve direct impacts to an unnamed rectangular woodland located southeast of Harston. This woodland contains indicator species that suggest it could be ancient woodland and, as such, in this assessment it is treated as potential ancient woodland. The offline construction option would move the alignment away from this potential impact area and is therefore a major improvement compared to the online construction option.

10.4.86. The offline construction option would take the alignment further away from residential properties in Harston. It would, therefore, have the potential to perform slightly better than the online option in respect of community, air quality and noise. Conversely, the offline construction option would be closer

to Newton, but the distance from the settlement would still be further than for Harston. This favours the offline option.

10.4.87. The online option would cross at its highest point adjacent to the residential properties at The Paddock and Lawrance Lea along Station Road. As Station Road is designated as an 'Important Countryside Frontage' in the Local Plan, which may be more sensitive in planning terms than other edges of the settlement facing the alignments, the online option would have a greater impact when compared to the offline option which is approximately 360m further away. However, the offline construction option would result in cutting into the peak of Rowley's Hill due to the existing railway's realignment. The hill is a local landform providing the setting to the south of Harston and would impact upon local landscape character. This favours the offline option.

10.4.88. Noise mitigation would be needed to protect communities. With this in place, the number of houses affected in either of the options would be very low. The online construction option would be located closer to Harston than the offline construction option and represents a minor worsening in performance compared with the offline option. This marginally favours the offline option.

10.4.89. The online grade-separated junction has the highest potential for indirect impact on amenity at residential properties, with nearly double the number of properties (around 740) within 500m of the route than the offline option. This favours the offline option.



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10.4.90. The online construction option is likely to have a greater potential direct impact on residential properties, with ten residential properties identified to require demolition, compared to the offline construction option which would require the demolition of two properties. This favours the offline option.

10.4.91. The area within and surrounding both options is highly sensitive in terms of buried archaeology (some cropmark enclosures date from as far back as the Iron Age in the immediate vicinity of both options). The online construction option would require a smaller additional footprint than the offline construction option, decreasing the risk of potential impacts on known and unknown buried archaeology. This favours the online option.

10.4.92. All options would have a chalk cutting at the western end. However, the offline construction option would also have a chalk cutting at the eastern end, compared to the online construction option, which would be at ground level in this location. This favours the online option.

10.4.93. Due to different levels when crossing Station Road, the offline option would be likely to impact upon the existing connection between Harston and Newton in its current arrangement. As a result of providing a permanent road traffic diversion for Station Road, EWR Co would propose to close the existing level crossing and replace it with a grade-separated crossing for use by pedestrians and cyclists. This option favours the online option.

10.4.94. The offline option would encroach slightly into the IRZ for the Whittlesford Thriplow SSSI. However, EWR Co currently expects that by providing a small realignment of the railway, at the next design stage, it would be possible for impact to this risk zone to be avoided by moving the alignment clear. This marginally favours the online option.

10.4.95. Overall, this Assessment Factor favours an offline construction because:

- It avoids impact on the priority woodland habitat;
- It reduces the impact on Station Road which is designated as an 'Important Countryside Frontage' in the Local Plan, which may be more sensitive in planning terms than other edges of the settlement facing the alignments;
- It requires the demolition of eight fewer properties;
- It provides improvements to community, air quality and noise by moving the railway further away from the residential properties in Harston; and
- It would close the existing level crossing and providing a grade-separated crossing for pedestrian and cyclists for the Harston-Newton connection.

10.4.96. However, it is noted that consideration must be given to selecting the correct connectivity option for the permanent road traffic diversion.



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## **Safety risk (construction and operation)**

- 10.4.97. Neither online nor offline construction options are inherently unsafe. Nevertheless, working over a railway is significantly more complex and introduces a set of additional hazards that need to be mitigated and controlled.
- 10.4.98. Close coordination between EWR Co, NR, and the train operators, for both the planning of possessions and planning for contingencies, would be required for either construction approach to avoid resulting in a risk of delaying the construction programme.
- 10.4.99. However, the complexities of managing NR interfaces mean that there are greater challenges in relation to an online option. The longer the construction programme takes, the more significant the impact on the operational railway and its customers. Also, the more extended construction programme would delay the transfer of services to the new infrastructure.
- 10.4.100. Working on or adjacent to an existing railway represents a greater risk to NR's infrastructure due to the effects of vibration during construction. Monitoring can mitigate these risks; however, this adds another level of complexity to planning the works.
- 10.4.101. Time-constrained arrangements associated with possessions also make commissioning and hand-back testing more difficult.
- 10.4.102. Taking an offline construction approach would reduce the risks identified with online construction. Construction worksites would be in the contractor's control, which would reduce the number of consents required from NR and the number of planned possessions.
- 10.4.103. Reducing the need to carry out works under planned possessions would also reduce the need for planning contingencies. Undertaking commissioning and hand-back testing would not be time-constraints. Possession planning would no longer drive the construction programme. Therefore, the works would be delivered quicker, allowing the transfer of services to the new infrastructure earlier.
- 10.4.104. Mitigation of the principal hazards is more straightforward to apply when not having to consider works on, or adjacent to, the existing railway. Carrying out the works where the proximity of the existing railway would have the least effect would reduce the risk to NR's infrastructure due to vibration during construction. Overall, this would minimise the impact on the operational railway.

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10.4.105. Using an offline construction approach would be more likely to deliver the Project quicker and more safely, allowing the transfer of services to the new infrastructure earlier. Providing a grade-separated junction would offer more robust operational resilience when compared to an at-grade junction. Therefore, this Assessment Factor favours a grade-separated junction option using an offline construction approach.

### **Capital costs**

10.4.106. Upfront costs used in this assessment are high-level and indicative, incorporating around 80% of the key cost drivers of upfront capital cost and not including the full delivery costs. The key drivers of the capital cost at this stage of project development are:

- The length of the alignment;
- The total length of structures;
- The total quantity of earthworks; and
- The amount of imported fill required.

10.4.107. Using an online construction approach to the grade-separated junction would result in a 5% increase in upfront costs compared to an offline construction option (for base construction works excluding contractors and possession costs in this Project Section).

10.4.108. The offline construction options would reduce the need to carry out works under planned possessions and also reduces the need for planning contingencies. Possession planning would no longer drive the construction programme. Therefore, the works could be delivered more quickly, allowing the transfer of services to the new infrastructure earlier, resulting in minor improvements in programme risk when compared against the online construction options.

10.4.109. Therefore, this Assessment Factor is likely to favour the offline construction of a grade-separated junction over online construction.

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## Overall affordability

10.4.110. The overall affordability Assessment Factor considers capital cost, maintenance cost, and renewal cost. In this case, the dominant consideration is the capital cost. However, in this section, the anticipated difference in maintenance and renewal costs is discussed; the capital cost element of affordability is addressed in the previous paragraphs.

10.4.111. At this stage of design, EWR Co has not produced a full Whole Life Cost (WLC) model, and there is no absolute WLC estimate for each of the options considered. To contribute to the WLC Factor in assessing options, EWR Co has made a qualitative judgement based on quantitative indicators that drive Whole Life Cost.

10.4.112. Track length and track geometry drive the biggest differentiators in maintenance costs between alignments. A longer total length of the track or an alignment with greater curvature would have a higher maintenance requirement. However, when a grade-separated solution is proposed, there is little to differentiate between options.

10.4.113. Structure length drives the biggest differentiators in renewal costs between alignments. Due to the increased length of bridge and retaining structure required for an online construction option, an offline construction approach is favoured.

## Summary

10.4.114. An offline grade-separated option would be more straightforward and safer to construct, as well as affording greater certainty as to delivery timing, thus reducing the cost and programme risks to the Project.

10.4.115. The offline grade-separated option would result in lower upfront costs and better overall affordability due to less length of structures required.

10.4.116. The offline grade-separated option would perform better overall in environmental terms and has fewer direct impacts on residential properties and significantly less visual impact along Station Road.

10.4.117. The offline option would remove the existing level crossing on Station Road and provide a new grade-separated crossing for pedestrian and cyclists on the Harston-Newton Connection. A permanent diversion would be required for road traffic.

10.4.118. However, an online option would have a smaller footprint, would not impact on the existing Harston to Newton connection, and would perform slightly better in relation to the water environment and landscape setting.

10.4.119. EWR Co has concluded from applying the Assessment Factors that, overall, a grade-separated junction using offline construction methods performs most favourably

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## **10.5. Conclusions**

10.5.1. The Route Option E Indicative Alignment proposed joining the WAML indirectly by connecting EWR to the SBR south of the M11. However, the Route Option E area included the possibility of testing whether a connection to the WAML directly would be feasible by providing the connection either north or south of Shepreth Junction. As such, EWR Co conducted an initial assessment to ascertain the viability of the options to connect to the WAML directly, alongside the Route E Indicative Alignment.

10.5.2. EWR Co determined that connecting to the SBR is preferred to connecting to the WAML directly for the reasons listed below:

- The option to join the WAML, north of Shepreth Junction, is highly unlikely to meet the Project Objectives, particularly when considering and planning future passenger demand and making provision where it is affordable;
- The option to join the WAML, south of Shepreth Junction, is likely to be capable of meeting the Project Objectives. However, compared to the SBR option, as a result of environmental impacts; additional works in sensitive areas; the need to acquire property in Great Shelford that could be avoided with the SBR option; the increased journey time; and increased capital and whole life costs, this option does not provide a sustainable and value for money transport solution. The solution would also involve additional engineering interventions; and
- The option to join the SBR is likely

to meet the Project Objectives and provide a sustainable and value for money transport solution.

10.5.3. Therefore, EWR Co determined that options to join the WAML directly, either north or south of Shepreth Junction, should be discounted; and that connecting to the SBR is preferred to connecting to the WAML directly.

10.5.4. EWR Co initially considered both at-grade and grade-separated junctions for the connection to the SBR. However, at-grade junction alternatives were discounted for the following reasons:

- Analysis has indicated that it is feasible to plan an EWR 4tph service onto the SBR, amongst the current GTR timetable, with an at-grade junction. However, this is based on providing no more than four EWR services per hour in each direction and does not include any future increases in demand on either EWR or the SBR; and
- When considering and planning future passenger demand and making provision that it is affordable, providing an at-grade junction would create obstacles in the future. EWR services would require a grade-separated junction for any increase in the number of trains per hour due to the reduced service interval for EWR and GTR services on the SBR. The same applies to considering future demand on the SBR. The reduced interval for GTR services would conflict with the 4tph EWR service.

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10.5.5. EWR Co considers that providing a connection to the SBR with a grade-separated junction using an offline construction approach should be the emerging preferred option. The reasons for discounting options that consider an online construction approach are listed below:

- The direct impacts to the priority woodland habitat, which EWR Co has treated as potential ancient woodland, should be avoided. The offline construction options would move the alignment away from this potential impact area and are therefore performs better in this respect compared to the online construction options.
- By taking the alignment further away from the residential properties in Harston, the offline construction option would have the potential to perform better in relation to community, air quality and noise compared to the online construction options. The offline construction option would be closer to Newton, but the distance from the settlement would still be further than for Harston.
- The grade-separated online junction would be likely to have a slightly greater potential direct impact on residential properties, with nine residential properties within 100m of the route, compared to the offline construction option junction within 100m of two properties. The grade-separated online junction would also have the highest potential for indirect impact on amenity at residential properties, with nearly double the number of properties within 500m of the route than the offline option. The online option would additionally sever Harston byway 6 which links to the London Road at Harston.
- The online option would cross the SBR at the highest point of the alignment adjacent to the residential properties at The Paddock and Lawrance Lea along Station Road. As Station Road is designated as an 'Important Countryside Frontage' in the Local Plan, which may be more sensitive in planning terms than other edges of the settlement facing the alignments, the online option would have a greater impact when compared to the offline option which is approximately 360m further away.
- In relation to construction and safety impacts, mitigation of the principal hazards listed above is more straightforward to apply using an offline construction approach. Carrying out the works where the proximity of the existing railway has the least effect reduces the risk to NR's infrastructure due to vibration during construction. Overall, this minimises the impact on the operational railway.
- The offline construction options could be delivered more quickly, allowing the transfer of services to the new infrastructure earlier, resulting in better performance in relation to programme risk when compared to the online construction options. The offline construction options would reduce the need to carry out works under planned possessions also reduces the need for planning contingencies. Possession planning would no longer drive the construction programme.

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10.5.6. In the offline grade-separated junction option, due to different levels when crossing Station Road, the alignment would be likely to impact upon the existing connection between Harston and Newton in its current arrangement. This is a result of moving the alignment further away from the residential properties in Harston, in particular those located along Station Road. EWR Co is currently exploring different connectivity options which include:

- Maintaining the existing Harston to Newton connection for use by pedestrians and cyclists only, with provision of a new grade-separated crossing of the SBR and removal of the existing level crossing offering significant safety benefit to the road users;
- Re-purposing the old section of the SBR as a greenway for cyclists and pedestrians;
- Permanent road traffic diversions along the B1368 to the A10;
- Re-purposing the existing SBR railway corridor as a new road and pedestrian/cycleway connecting the B1368 with Station Road, offering a permanent road traffic diversion that does not increase traffic flow along the A10; and
- Providing a new road connecting Newton Road to the A10 at a new junction along Royston Road as a permanent road traffic diversionary route.

10.5.7. EWR Co will consult on further details of the proposed solution at Statutory Consultation and will need to consider:

- Cost;
- Engineering feasibility;
- The impact of increased traffic on the diversionary routes;
- The impact of diversions on bus routes;
- Increased journey times; and
- Community considerations collated through consultation and engagement feedback.

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10.5.8. The impact of an offline option on the existing connection between Harston and Newton is unfavourable and therefore mitigation must be considered. However, EWR Co considers that the assessment of construction options favours the emerging preferred option of a grade-separated junction, using offline construction option due to:

- The network capability of the junction to meet the Project Objectives;
- Safety in construction;
- Greater certainty as to delivery timing, thus reducing the cost and programme risks to the Project;
- Allowing transfer of services earlier;
- Avoidance of impacts to the priority woodland habitat;
- Better overall performance in environmental terms and has fewer direct impacts on residential properties and significantly less visual impact along Station Road; and
- Removal of the existing level crossing on Station Road and provision of a new grade-separated crossing for pedestrian and cyclists on the Harston-Newton Connection which improves on current provision.

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# 11.

## Project Section F: The Shelfords to Cambridge Station

### 11.1. Chapter summary

**11.1.1. This Chapter describes the proposals for the section of the Project between the M11 motorway and Cambridge station. This section comprises existing railway. Proposals are still at a very early stage of design.**

**11.1.2. Between Hauxton and the junction with the West Anglia Main Line (WAML, the line between London Liverpool Street and Cambridge), EWR Co currently considers that there is no need to provide additional tracks, but this needs further investigation in the coming design phases.**

**11.1.3. At Hauxton Road level crossing, the increase in train service created by EWR means that the crossing needs to undergo further risk assessment to determine whether it needs to be closed. The Chapter explains the types of option and contributing factors that EWR Co will consider, should closure be needed.**



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**11.1.4. The Chapter also explains that additional tracks would be needed between Shepreth Branch Junction (where the line connecting Cambridge and Hitchin joins the WAML) and Cambridge station, increasing provision from two to four tracks. Modifications to Shepreth Branch Junction would also be needed as a result. The Chapter sets out the factors and considerations that will be taken into account in the next phase of design development.**

**11.1.5. Two new platforms would be required at Cambridge station and the Chapter describes the principles of what is needed, which will be developed further in the next stage of design.**

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## **11.2. Introduction**

11.2.1. This Chapter covers the area of existing Network Rail infrastructure that EWR would be using to reach Cambridge station. Key considerations for this Project Section are what the current infrastructure layouts would be at the start of EWR construction, what the timetable requirements are for the various services that call at Cambridge and what the performance requirements of those services are so that the infrastructure modifications needed to meet the new levels of service are identified and scoped.

11.2.2. For the existing railway between the new Hauxton Junction on the SBR and Cambridge station the proposals are at a very early stage of design. In order to identify the areas where a solution needs to be developed, EWR Co has examined the capabilities of the existing railway and its surrounding infrastructure to meet the Project Objectives. The aim of this work is to ensure that:

- The existing railway has adequate capacity for the additional services;
- The new services can operate reliably and minimise interference with other services already operating (or proposed to operate) at key points;
- The new railway will be of benefit to the communities that EWR will serve between Oxford and Cambridge;
- The new services offer attractive journey times consistent with the wider aims of the Project; and
- Stations provide the correct level of facilities for the numbers of people that are expected to use them and the types of journeys those people are expected to make.

11.2.3. The work that EWR Co has undertaken to achieve the above aims has included:

- Modelling of how the existing railway operates;
- Developing a plan for how the railway will operate once the new works are complete;
- Reviewing the condition of the existing infrastructure;
- Understanding and integrating with other schemes;
- Undertaking safety risk assessments;
- Reviewing how the railway is currently used and how it could be used in the future; and
- Considering planned housing and other developments in the area served by the existing railway.

11.2.4. The responses to this consultation will provide more information that will inform the next stage of design for the works.

### 11.3. Proposed work in the Cambridge area



Figure 11.1: Map of proposed work in the Cambridge area

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#### **11.4. Hauxton Junction to Shepreth Branch Junction**

- 11.4.1. The current SBR arrangement is a twin track railway from new Hauxton Junction to Shepreth Branch Junction. This line is currently used by GTR services from King's Cross with six trains per hour. Analysis undertaken by EWR Co has shown that it is most likely that the SBR can remain as a twin track railway as there is sufficient existing capacity to be able to add the EWR services required to achieve the Project Objectives and leave spare capacity for an increase in services in the future. This also means that it would not be necessary to make significant alterations to the existing bridges where the SBR crosses under the M11 and under the A1301 at Shelford.
- 11.4.2. The working assumption for the operational timetable will be assessed further in the next design phase to confirm that it is correct. The focus will be on timetable and performance modelling of the SBR to ensure that both the EWR and GTR services can run as required with suitable resilience to allow for delay, disruption, and updates to service patterns.

## 11.5. Hauxton Road level crossing



Figure 11.2: Map of proposed changes to Hauxton Road level crossing

- 11.5.1. Within the Hauxton Junction to Shepreth Branch Junction section of the railway, there is an existing Level Crossing at Hauxton Road.
- 11.5.2. Hauxton Road provides a link between the villages of Hauxton and Little Shelford, with two bus routes (Route 31 & 32) currently operating, suggesting that this is an important link for public transport, active travel users and pedestrians.
- 11.5.3. The level crossing is passed by 166 trains per day consisting of passenger and freight. This equates to approximately 11 trains per hour (five minutes per train). EWR would introduce an additional four trains per hour in each direction, five trains every 15 minutes (three minutes per train), resulting in an increase in barrier down time.
- 11.5.4. EWR Co has identified a need for Hauxton Road level crossing to be further risk assessed as a result of increased train services being introduced by EWR, which needs to be done for all options considered. It has also been identified by NR for assessment in its current arrangement in any event, due to be carried out in April 2021.

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11.5.5. Closure of the level crossing could result in extended journey times and reduce the opportunities for active travel between Hauxton and The Shelfords. In addition, there are residential properties which would be affected by closure of the level crossing. If the crossing is identified for closure, there are a number of options that EWR Co will consider:

- grade separation;
- closure with provision of a pedestrian/cycle bridge;
- permanent diversion either with provision of a new highway or along other existing local roads.

11.5.6. For any of these solutions, EWR Co will consider:

- impact of increased traffic on the diversionary routes;
- impact of diversions on bus routes;
- increased journey times;
- cost, engineering feasibility;
- community considerations collated through consultation.

11.5.7. Further details of the proposed solution, along with impacts on other Private User Worked Crossings in the area, will be provided and consulted on at the Statutory Consultation.

## 11.6. New Shepreth Branch Junction



Figure 11.3: Map of proposed changes to Shepreth Branch Junction

- 11.6.1. Currently, Shepreth Branch Junction is the meeting point of the twin track SBR and the twin track WAML, resulting in four tracks becoming two as they head into Cambridge.
- 11.6.2. Analysis has shown that the existing twin track WAML into Cambridge from Shepreth Branch Junction is insufficient to allow all the current and planned operations required in the area. As such, the line from Shepreth Branch Junction into Cambridge would need to be four tracked. This results in the need to modify Shepreth Branch Junction.
- 11.6.3. Two options for revisions to the Junction have been identified from the operations work: either 'at-grade' or 'grade-separated'. There are two key points that will drive the decision on whether an at-grade solution or grade-separated solution is required.
- 11.6.4. The first point is regarding the positioning of the tracks so that segregated EWR services, with GTR, would be able to get to the correct platforms at Cambridge station: an at-grade solution would lead to EWR services using platforms on the west side of the station and grade separation would mean using platforms on the east side. The second point is regarding capacity of the lines.

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- 11.6.5. The at-grade solution would remove the junction and segregate the EWR and GTR services entering the junction from the SBR on the two western-most lines with WAML services using the eastern-most pair of tracks.
  - 11.6.6. The grade-separated solution would require a flyover to get allow EWR services from the SBR to reach the east side of the WAML lines. EWR services would then use eastern-most pair of tracks.
  - 11.6.7. Further design is required to understand the design of the grade-separating structure that would be needed, identify the relevant land boundaries, and confirm the most appropriate solution. In both options Shepreth Junction would remain in its current location, however land may need to be acquired for the construction and permanent operation of either option. We do not currently envisage that this would require the acquisition of residential properties. This will be done during the next design phase.



## 11.7. Four tracking from Shepreth Branch Junction to Addenbrooke's Road bridge

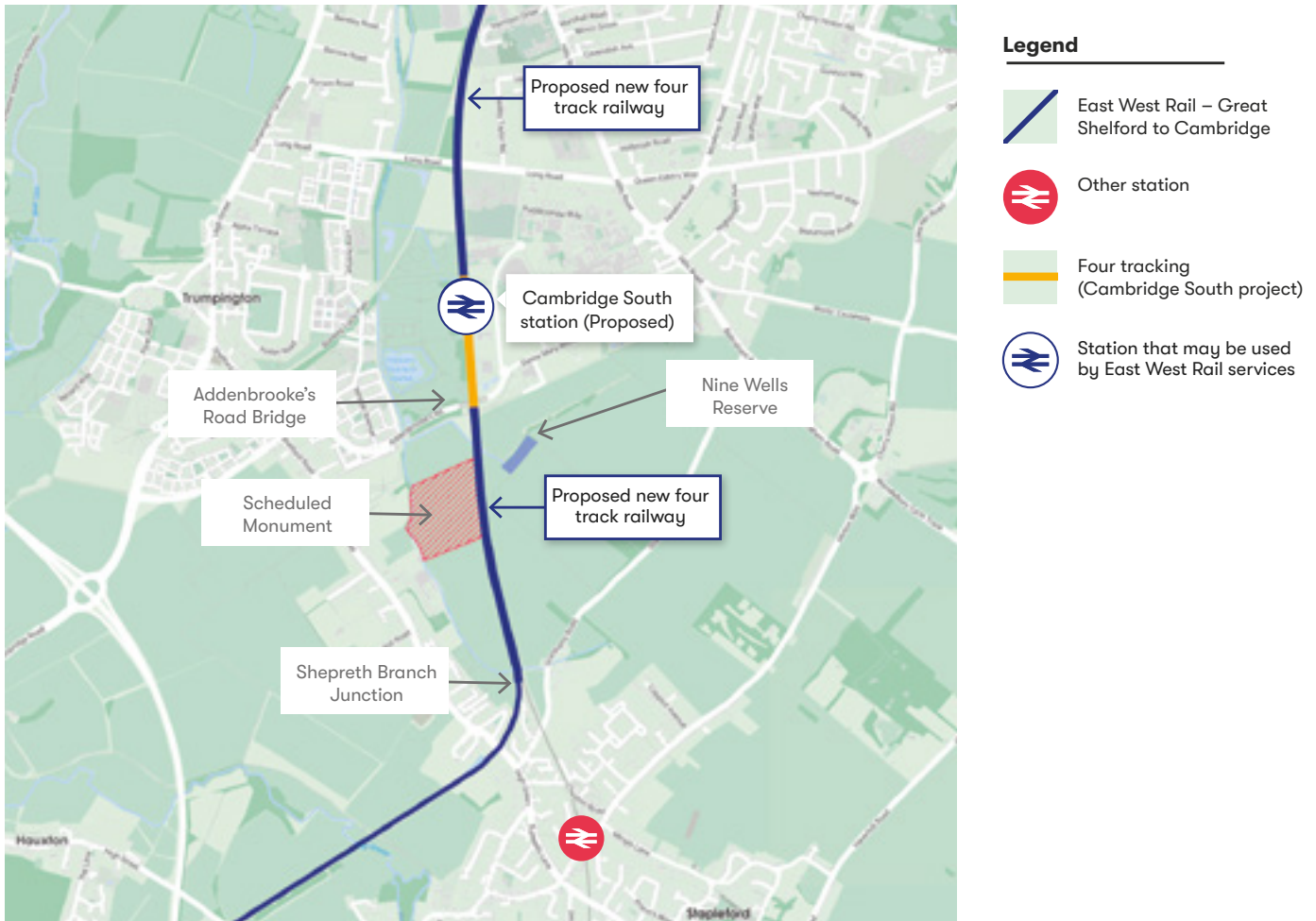


Figure 11.4: Map of proposed four tracking from Shepreth Branch Junction to Addenbrooke's Road Bridge

- 11.7.1. The new four tracking continues from the segregated Shepreth Branch Junction to Addenbrooke's Road bridge.
- 11.7.2. The length of this section requiring four tracking is approximately 1.3km.
- 11.7.3. Addenbrooke's Road bridge is the point where the two new lines would join the new four tracking that the Cambridge South Station scheme would have already built, as shown on their latest consultation designs. In preparing the designs for EWR, EWR Co has made a working assumption that the Cambridge South four tracking would be implemented. This means that NR would have already provided the four tracking between Addenbrooke's Road bridge and around Long Road Sixth Form College area. Cambridge South station would also be built ready for EWR services so no modifications would be required.

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- 11.7.4. Further design is required in the next phase to determine the location of the two new tracks and how they tie in with the Cambridge South four tracking. This design will be developed closely with Network Rail.
  - 11.7.5. Two key environment and heritage sites have been identified in the area: first, Nine Wells Reserve, and the water source to it (Hobson's Brook), on the east side and secondly, a scheduled monument on the west side. The designs will take these into account and avoid impacts wherever possible and minimize impacts where total avoidance is not possible.
  - 11.7.6. The Addenbrookes-Great Shelford Cycleway, known as "The DNA Path", currently runs on the east side of the WAML. This may have to be moved from its current location, but the link would be maintained.
  - 11.7.7. EWR Co and NR have been working closely together so far and will continue to do so in the next design phase in order to maximise the ability to get things right first time, minimize disruption and maximise value for money for the taxpayer.
  - 11.7.8. The Cambridge South East Transport (CSET) scheme is also planning to build a section of the new Cambridge Autonomous Metro in the same area, with a part of that route proposed to run close to the existing WAML. Coordination meetings have been taking place and will continue going forward so that integration risks can be minimised and opportunities maximised, including the possible ability to be able to transfer between EWR and CSET services at Cambridge South station.

**11.8. Four tracking from Long Road Sixth Form College area to Cambridge station and Cambridge station alterations**



Figure 11.5 Map of four tracking from Long Road Sixth Form College area

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- 11.8.1. The Cambridge South scheme four tracking ends in the area next to Long Road Sixth Form College. This four tracking would need to be extended through to Cambridge Station to allow for EWR services, and the other services calling into Cambridge.
  - 11.8.2. The A1134 overbridge is currently only built to cross a twin track railway. This bridge would, therefore, have to be replaced and temporary traffic diversions put in place during the construction works. The designs for this solution will be produced in the next design phase.
  - 11.8.3. Just north of the A1134, the WAML becomes a three-track railway. This third track may need renewing. As such, only one additional new track is needed from this point on into Cambridge Station. It is highly likely that this new fourth track would be able to be built entirely within existing NR land boundaries; this will be confirmed in the next design phase.
  - 11.8.4. The length of the new four tracking in this section is approximately 1.5km.
  - 11.8.5. Hills Road overbridge currently accommodates four electrified tracks and EWR Co's current assessment is that no alterations would be required. This will be confirmed when the design is produced in the next phase of developing the Project.
  - 11.8.6. The southern throat of Cambridge station would need remodelling. This would change the position and number of switches and crossings that would allow all services that call at or pass through Cambridge station to be on the correct line and platform and deliver the timetable. This work would require possessions to deliver. The design for this, which would include an outline construction plan, will be produced in the next phase of project development and will confirm the possessions required to carry out this work.

## 11.9. Cambridge station



Figure 11.6 Map of proposed station works at Cambridge station

- 11.9.1. Cambridge is an important national station. It is estimated that in 2018/19 a total of 10.95 million journeys started or finished at Cambridge Station. In addition, a further 0.56 million journeys involved a change of trains at Cambridge Station.
- 11.9.2. Cambridge station currently features four terminating (or bay) platforms (two approached from the north – numbered 5 and 6 – and two approached from the south – numbered 2 and 3) and four through platforms (two of which – numbered 1 and 4 – are joined together end-to-end as part of a single long platform face next to the main station building). The additional EWR services would mean that there would be insufficient platform space in the current arrangement. As such, two new through platforms would be required.
- 11.9.3. The two new through platforms are most likely to be located on the east side, where the current sidings are located. The facilities that these sidings provide would need to be provided in another location on the network. This is to be designed in the next phase of developing the Project.

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- 11.9.4. EWR services would call into different platforms depending upon whether the EWR and GTR tracks are on the west side of the four tracking (if the new Shepreth Branch Junction is at-grade) or on the east side (if Shepreth Branch Junction is grade-separated). A possible third new platform may be required if EWR services call into the east side of Cambridge station. This is due to the need for EWR services terminating at Cambridge not to block the through platforms. This will be confirmed in the next stage of design.
- 11.9.5. As well as additional platforms, facilities need to be provided for the additional passengers that would use these services.
- 11.9.6. This work would be in addition to other enhancements that Network Rail is considering at Cambridge station. The next stage of design will develop the items already identified and EWR Co will continue to work closely with Network Rail to find the optimum solution. All works in the Cambridge area have been and will be coordinated with NR and will seek to align with their future plans as set out in the Cambridgeshire Corridor Study 2019.
- 11.9.7. This consultation will help to establish whether there are any other issues EWR Co should consider when designing the additions to Cambridge station and the upgrade to the railway to the south of it.
- 11.9.8. Preliminary designs and solutions for this section of the Project are being developed and will be introduced as part of a further, Statutory Consultation exercise in due course.



Cambridge street

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# 12.

## Next steps and ongoing work

### 12.1. Chapter summary

**12.1.1. All of the feedback received through this consultation will be carefully considered and taken into account as EWR Co continues to progress designs.**

**12.1.2. The next stage is to confirm a Preferred Route Alignment option in relation to:**

- **Project Section C – North Bedford**
- **Project Section D – Clapham Green to The Eversdens**
- **Project Section E – Harlton to Hauxton**

**12.1.3. For some Project elements presented here that are at an earlier stage of development, further progression of designs and assessment is needed before options can be ruled out. In relation to these, EWR Co expects to take account of feedback received during consultation when it produces designs, and to consult in respect of options when it undertakes the Statutory Consultation. This relates in particular to:**



- 
- **Project Section A – Oxford to Bicester**
  - **Project Section B – Bletchley and the Marston Vale Line**
  - **Project Section C – Bedford St Johns and Bedford station**
  - **Project Section F – The Shelfords to Cambridge Station**

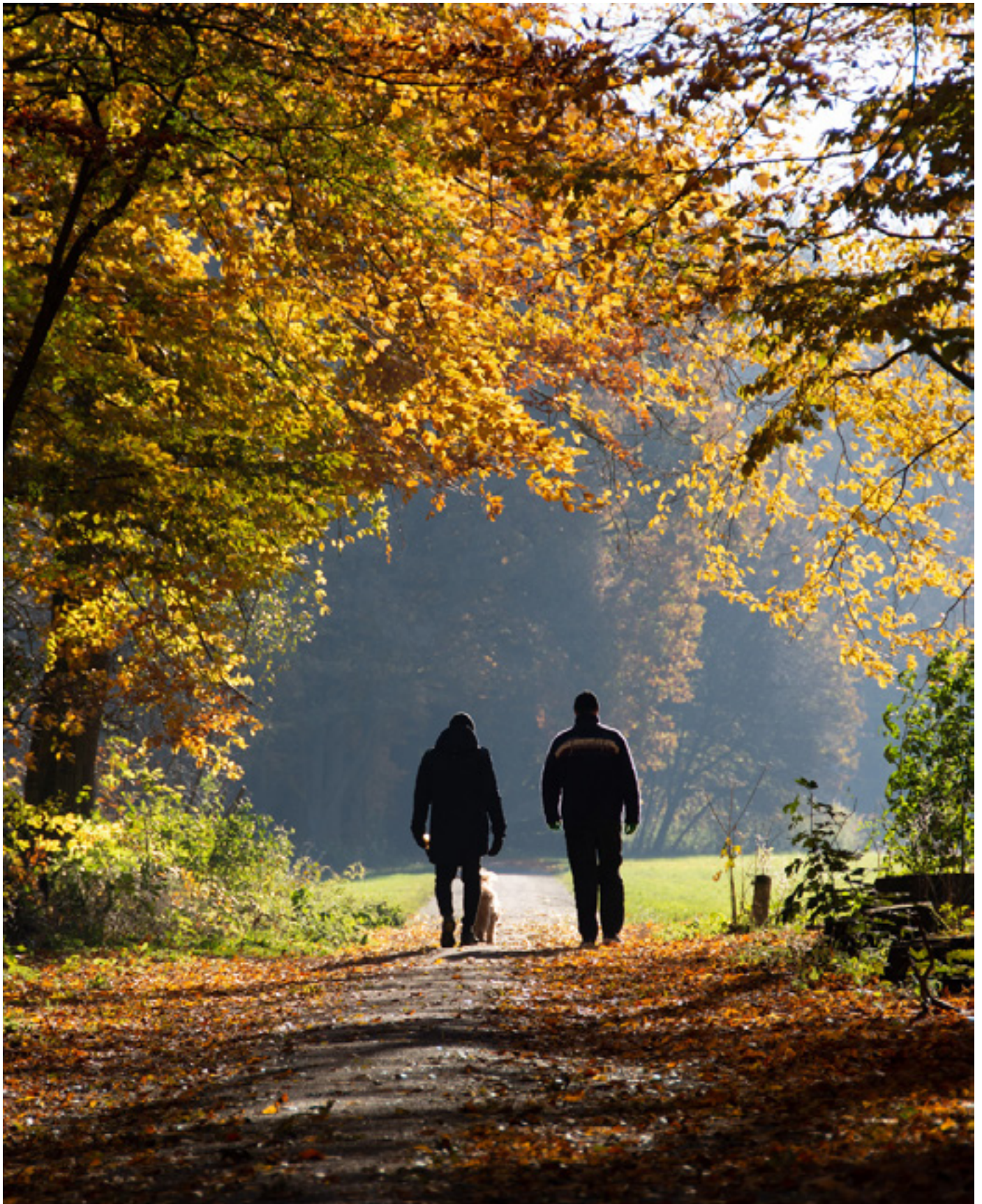
**12.1.4. Designs, including environmental mitigation, and approaches to land and construction for the preferred options continue to be progressed alongside the use of survey data and modelling as it becomes available, to enhance the robustness and detail of the designs.**

**12.1.5. Outputs from this consultation together with business case assessment will then be used to determine and to enable EWR Co to recommend a Preferred Route Alignment option, which will include identification of preferred engineering solutions for all of the Project sections.**

**12.1.6. The outcome of the optioneering process and business case analysis will be presented in the Outline Business Case to be put forward to the Government to gain funding approval, and the Secretary of State will – subject to funding approval – select a Preferred Route Alignment and other options in the various Project Sections having considered EWR Co's recommendation.**

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- 12.1.7. A more detailed design of the EWR Preferred Route Alignment and a Preliminary Environmental Information Report (PEIR) will be presented at the Statutory Consultation. The PEIR will provide information about the expected impacts of the Project on the environment based on information that EWR Co has available to it at the time it is preparing the PEIR.**
- 12.1.8. EWR Co and the Secretary of State will consider feedback provided during the Statutory Consultation in deciding whether to proceed to apply for a DCO to authorise the Project within the Preferred Route Alignment, which will be subject to funding considerations amongst other matters.**
- 12.1.9. EWR Co will carry out an environmental impact assessment of the likely significant effects of the Project on the environment and will present the results in an Environmental Statement which will be submitted as one of the documents to support the DCO application.**
- 12.1.10. The feedback received from all rounds of consultation will be summarised in a Consultation Report which will also be submitted as part of the DCO application.**





Couple out walking  
with their dog

