

High Speed Two Limited

High Speed 2

Infrastructure
Maintenance Depot (IMD)

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March 2011

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

Job number

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1 Introduction

1.1 The December 2009 Report

In December 2009, Arup issued a report to High Speed Two Limited (HS2) presenting the findings of a route engineering and alignment study for a potential new high-speed rail line from London to the West Midlands.

It described the process for generating route options connecting the two locations and the sieving process by which a Preferred Route – Route Number 3 – was chosen by HS2.

1.2 Layout of this Report

The report is laid out as follows:

Section 1, this chapter, is introductory;

Section 2, describes the Scope of Work, Methodology and Deliverables;

Section 3, describes the current and future Rail Operations in the Calvert area;

Section 4, describes the Functional Requirements required for an HS2 Infrastructure Maintenance Depot;

Section 5, describes the site locations assessed during this study;

Section 6, describes the Cost Estimate and contains an initial high level assessment of the potential costs involved in creating the depot;

Section 7, describes the Conclusions and proposes a site to be developed;

Section 8, describes the selected site and option development;

Section 9, describes the Calvert Waste Recycling Site;

Section 10, describes the Potential use of the depot as a Construction depot; and,

Section 11, describes the Bicester MOD depot and its potential use.

2 Scope of Work, Methodology and Deliverables

2.1 Scope of Work

In April 2010, a number of additional tasks were undertaken by Arup (refer to Arup, Technical Financial Proposal, Section 3, dated 31st March 2010), one of which focused on the development of proposals for the siting of the Infrastructure Maintenance Depot (IMD).

This report deals with the siting and specification of the Infrastructure Maintenance Depot. The objective of this report is to provide operational and engineering proposals to assist HS2 to identify the best possible location and the master layout of the depot for the London to West Midlands HS2 route.

The report identifies a suitable site for the IMD and develops a master layout for the site, including both rail infrastructure and ancillary facilities such as office accommodation, services buildings, storage and lay down areas, staff parking, approach roads and other related items.

The report makes proposals for a solution which appears to provide the best combination of facilities and location. It does not make conclusive proposals, and is provided to inform and illustrate. It is expected that the site design will develop over the next period following further consideration by HS2 and discussions with Arup, and meetings with relevant stakeholders such as the East West Rail (EWR) project and Waste Recycling Group (WRG).

2.2 Meeting 1

An initial scoping meeting took place in London on 28th April, attended by – HS2 and Arup. The meeting identified a set of tasks whereby Arup was required to review the following factors relating to the IMD. These are as follows:

- Location;
- Functional Requirements;
- Maintenance Strategy, Size;
- Site Issues, Equipment;
- Visual Impact including simple visualisations;
- Relationship to Calvert Waste Plant;
- Geology/Aquifers, settlement, Constructability;
- Cost, Programme;
- Electricity Supply;
- Liaise with construction logistics; and,
- Environmental issues and constraints.

The deliverables were agreed to be:

- Large scale plan of depot layout , interface with HS2 and the National Rail network, and surrounding area;
- Horizontal alignment drawings of connectivity to HS2 and existing rail line (East-West main line);
- Master plan of depot; and,
- Report.

2.3 Intermediate instructions

In an intermediate discussion between John Castle (HS2 Senior Route Engineer) and Chris Lees (Arup Project Manager) on 14th May, a list of possible sites was agreed, which Arup would scope to provide initial comments on suitability and functionality. These plans were prepared and discussed at Meeting 2.

2.4 Meeting 2

A second meeting took place at Arup's offices on 19th May. At this meeting a number of potential sites were reviewed and their attributes discussed. The HS2 team provided an input on the preferences for each site, and after discussion a refined set of objectives were produced. In addition to the above deliverables these comprised of:

- Development of proposals for sites 2.2 and 3.2, and a new option for a single ended set of sidings inside the chord line (site 2.3);
- Extension of the scope to examine any other possible level sites on HS2 up to 10 km north from Calvert; and,
- Review of options for possible use of Ministry of Defence (MOD) Bicester as an IMD site.

3 Current Rail Operations and Future Developments

3.1 Context

This section discusses the current rail routes in the Claydon area, and summarises proposals for their development in the next 10 years. The possible impact of locating an IMD at Claydon is also discussed.

The current track layout is shown in the diagram below. Track layouts are accurate but in diagrammatic format.

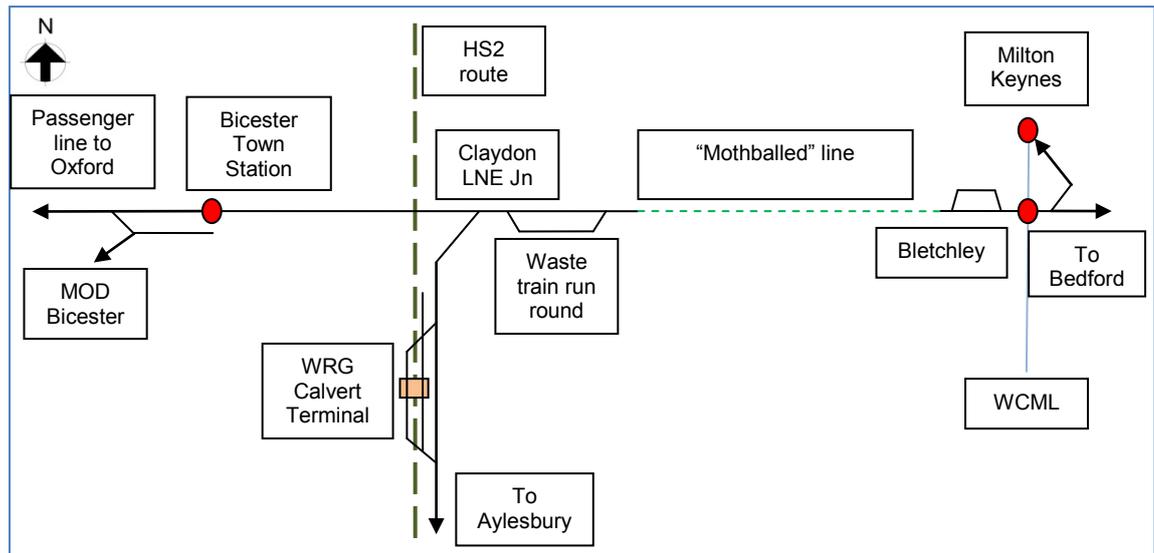


Figure 1 Current track layout

3.2 Oxford - Bletchley

The East-West Line is the former Oxford to Cambridge, via Bletchley and Bedford, line. The status of the route is as follows:

- Oxford to Bicester Town – single track with no passing loops, used by passenger trains from Oxford – Bicester Town, freight trains from Didcot to MOD Bicester, and freight trains from London and Bristol to the WRG Calvert private siding.
- Bicester Town to Claydon Junction - single track with no passing places. Used by freight trains from London and Bristol to the WRG Calvert private siding. At Claydon LNE Junction there is a run round loop where trains bound for Calvert can reverse.
- Claydon London North Eastern (LNE) Junction to Bletchley – the line has been out of use since 1997, though it is officially still operational and only 'mothballed'. Some track sections are missing and the route is unusable at present.
- Bletchley to Bedford – the line is double tracked and used by a passenger service from Bedford to Bletchley, and occasional freight traffic.
- Bletchley to Milton Keynes – a chord line gives access to the West Coast Main Line (WCML) heading north to Milton Keynes. This and the run round loop at the current end of the branch were previously used by engineering trains running from the Network Rail Stewartby Local Distribution Centre (LDC) to the WCML.

3.3 Aylesbury – Claydon Line

The Aylesbury to Claydon line is a remnant of the former Great Central Main Line. The line is single tracked and the only connection is a set of loops to serve the WRG Calvert waste

transfer terminal. This terminal is served by trains of containerised domestic refuse from the London and Bristol areas to the site for landfill, and some bulk trains of low grade hazardous waste. Freight traffic runs to the terminal from both Aylesbury and Claydon directions.

3.4 High Speed 2

HS2 is proposed to run South – North through the area in the diagram on a formation parallel and to the west of the current Aylesbury to Claydon line, continuing north on the former Great Central Main Line trackbed. The current single line would be moved Eastwards within the rail corridor to facilitate this.

3.5 Evergreen 3

Chiltern Railways, the holder of the Department for Transport (DfT) Chiltern franchise, is constructing a new chord line from the Marylebone to Banbury line at Bicester to join the Oxford to Bicester line near Bicester Town station. Some track doubling will be carried out, and a half hourly Oxford to Marylebone service will be run. TWO powers are currently being applied for, and the project is expected to be completed by 2013. Evergreen 3 is a DfT franchise commitment.

3.6 East West Project

East –West Rail (EWR) proposes to refurbish the Oxford – Bedford (and ultimately Cambridge) route, and restore double track on the Oxford to Claydon section. From Claydon to Bletchley a new double track formation will be provided on the existing trackbed, and the section on to Bedford will be upgraded. EWR proposes a linespeed of 90 mph.

The single line from Aylesbury will be retained but upgraded to 90 mph. Comprehensive new signalling facilities will be required to provide sufficient capacity on both routes. The project is intended to be completed by 2017, subject to funding from central government and other sources such as property developers. Once complete the following service pattern is contemplated:

- Hourly Oxford to Milton Keynes;
- Hourly Oxford to Bletchley;
- Hourly fast Oxford to Milton Keynes;
- Hourly freight Oxford to WCML;
- Hourly Milton Keynes to Bedford; and,
- Hourly Aylesbury to Milton Keynes.

No new stations are proposed in the Claydon/Calvert area, with the nearest proposed station being at Winslow.

Provision has been made for one daytime freight train per hour in each direction, but it is not clear how many (if any) of these paths would be available for use by HS2 infrastructure services. Capacity for freight trains to access the intermediate run round siding at Claydon is bound to be restricted. EWR will have to provide a new run round facility at Claydon, at roughly the point identified for run round loops to serve site 2.3, and there may be synergy between the projects here. It is unclear how EWR proposes to manage construction logistics, and whether there is synergy between the project and HS2 for the location of construction and track laying depots. Discussions with EWR would help resolve this.

4 Functional Requirements

Both Arup and HS2 drew up outline specifications of the Functional Requirements for an Infrastructure Maintenance Depot. Arup carried out a comparison of the two documents. There was a large degree of agreement in the requirements specified by both teams, and the results were therefore combined into one master Functional Requirements Specification (FRS). This was debated and agreed at Meeting 2.

At this stage the FRS is intended to be a discussion document, rather than a conclusive statement of needs, and the intention is that this forms the basis of discussions and consultations with stakeholders within HS2 and the wider rail business.

The requirements were slightly revised following the meeting, to reflect emerging thinking by the HS2 team and also to incorporate site development thinking. In particular the following changes were made:

- Storage sidings were allowed to be single ended to allow adoption of a more compact site.
- The range of track materials to be stored at the IMD was increased to include drainage, troughing and other materials.
- The role of Light Maintenance Depots (one of which will be located at the IMD) was clarified to reflect the need for maintenance staff to be based at the IMD site.

The current Functional Requirements Specification (FRS) is included in this document as Appendix A. The FRS has been used in the consideration of the suitability of each site to ensure that the selection process reflects the need to eliminate sites which are functionally unsuitable before consideration of a short list on the grounds of environmental, engineering and financial merit.

5 Site Location Options

5.1 Introduction

To determine suitable site locations, Arup drew up a depot footprint and identified suitable areas where the footprint could be accommodated. The basic criteria for the site footprint (taken from the Functional Requirements Specification) were as follows:

- Level site.
- Straight site.
- Site length of approximately 1 km.
- Capability to connect with both HS2 and the EWR.
- Minimisation of environmental impact by avoiding:
 - Immediate proximity to built up areas;
 - Use of flood plain; and,
 - Areas of high visual impact.

A range of suitable sites was identified, allocated by each quadrant of the two rail routes (HS2/Aylesbury – Calvert line (MCJ¹) and The East West Oxford – Bletchley line (OXD) as shown below:

- Quadrant 1 North West
- Quadrant 2 North East
- Quadrant 3 South East
- Quadrant 4 South West

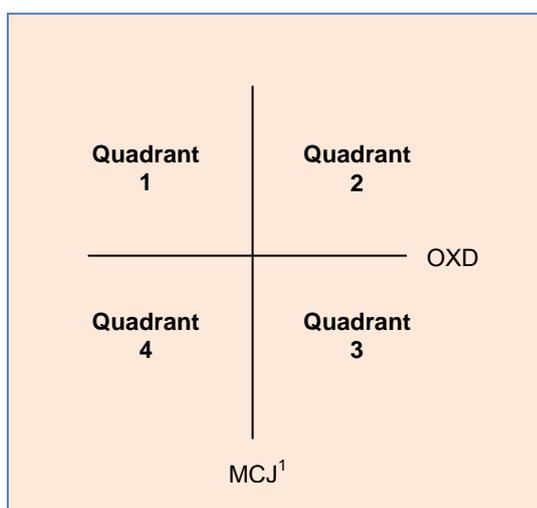


Figure 2 Quadrant locations

A template terminal footprint was drawn up and assessed against Ordnance Survey mapping of the area to identify possible sites. No consideration was given in this initial exercise of specific site suitability. The sites identified as suitable by this process are shown on the following page (Figure 3):

¹ MCJ is the Engineer's Line Reference (ELR) for the line from Aylesbury to Calvert.

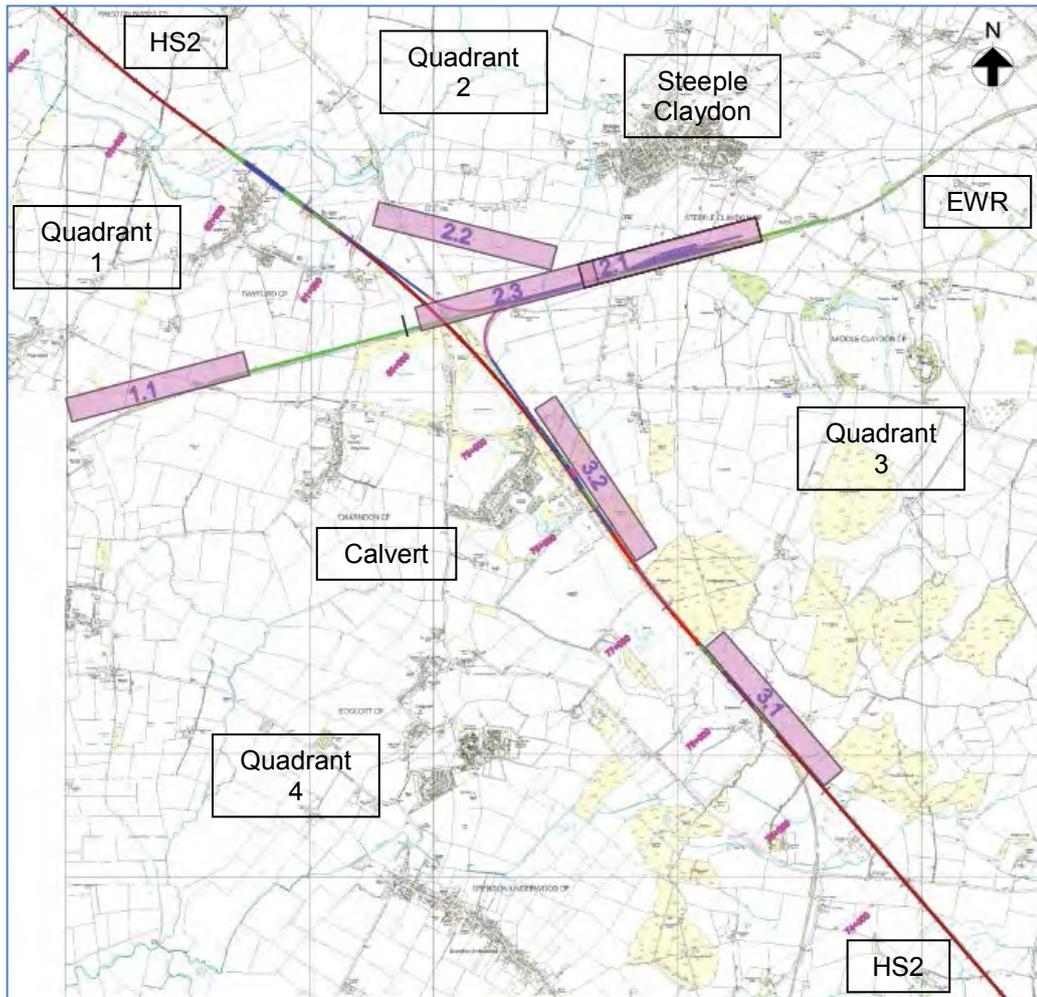


Figure 3 Initial Site Identification

The sites were then reviewed in detail for suitability against the requirements of the FRS and for the means of linkage with both HS2 and the national rail network. Conclusions were drawn for each site as a result of this exercise.

Sites are defined by using the following nomenclature: the first number refers to the quadrant they are located in, and the second number is the individual site identifier.

Site location plans contain directional arrows relating to the direction of site photographs.

E.g. 

5.2 Quadrant 1

5.2.1 Site 1.1 Twyford Lodge



Figure 4 Location plan – Site 1.1



Photograph 1



Photograph 2

Description

The site lies to the north of the EWR line between the villages of Poundon and Twyford. The EWR line at this point is straight which allows for a straight site. The EWR line rises at approximately 1 in 1430 in this area. This means that a level site can be created; however the site is in direct view of the village of Twyford, and due to the topography, slightly elevated in open fields.

Connections to HS2

It is not possible to build a West to South chord line to access HS2. It is also not possible to build a West to North chord to access HS2 without going very near to the village of Twyford and going through Portway Farm. The only way to access HS2 is to use a run round loop to the East of HS2 (shared with the waste trains to Calvert) to access it from the opposite direction.

5.3 Quadrant 2

5.3.1 Site 2.1 Pond Road

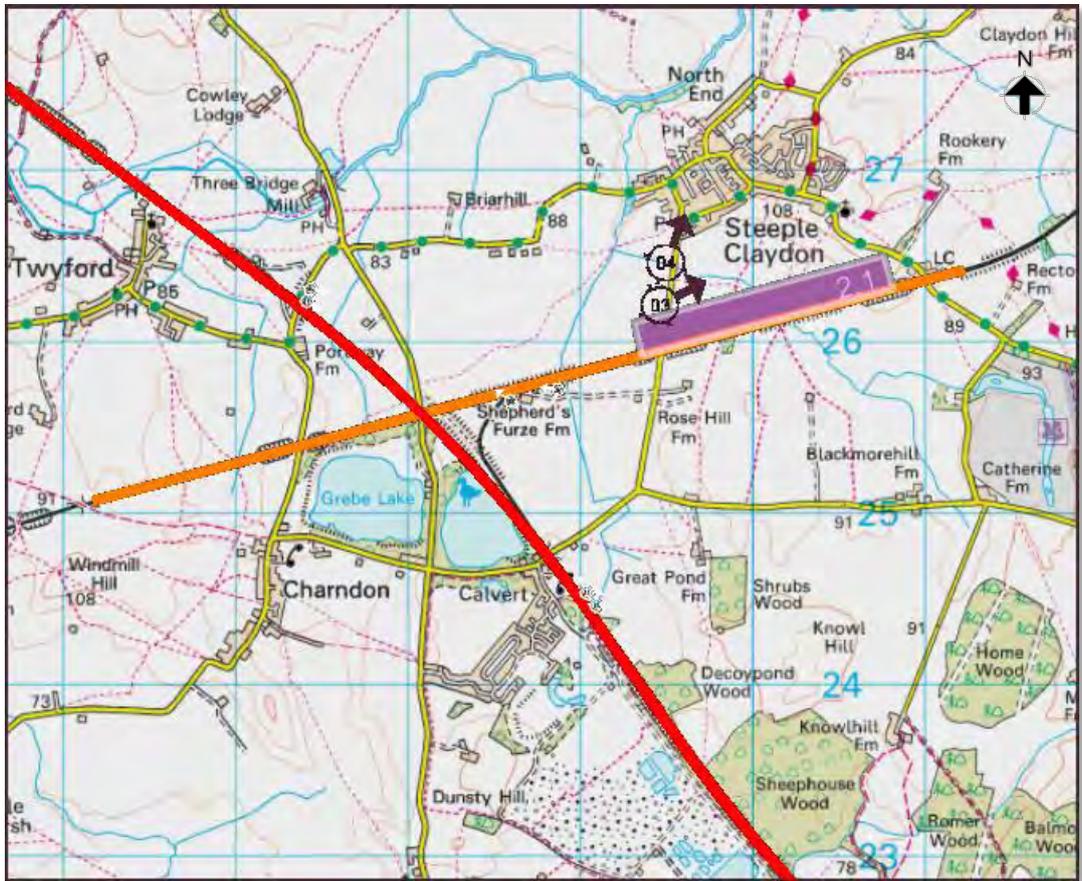


Figure 5 Location plan – Site 2.1



Photograph 3



Photograph 4

Description

The site lies to the North of the EWR line adjacent to the village of Steeple Claydon. The site is bisected by Pond Road, an unclassified road running from Steeple Claydon to Calvert. The EWR line is straight at this point which allows for a straight site. The EWR line rises at approximately 1 in 209 in this area, which means that significant earthworks would be required to create a level site. In addition, this would mean that the viable site would be

near to the existing Claydon London North Eastern (LNE) Junction. Although the site is below the village of Steeple Claydon it would be within 500 metres of it. The Eastern end of the site lies on flood plain.

Connections to HS2

There is already a chord line running from East to South that accesses the HS2 route which is used by the waste train running from the Bristol area to Calvert. It is possible to build an East to North chord to access HS2.

5.3.2 Site 2.2 Claydon Junction

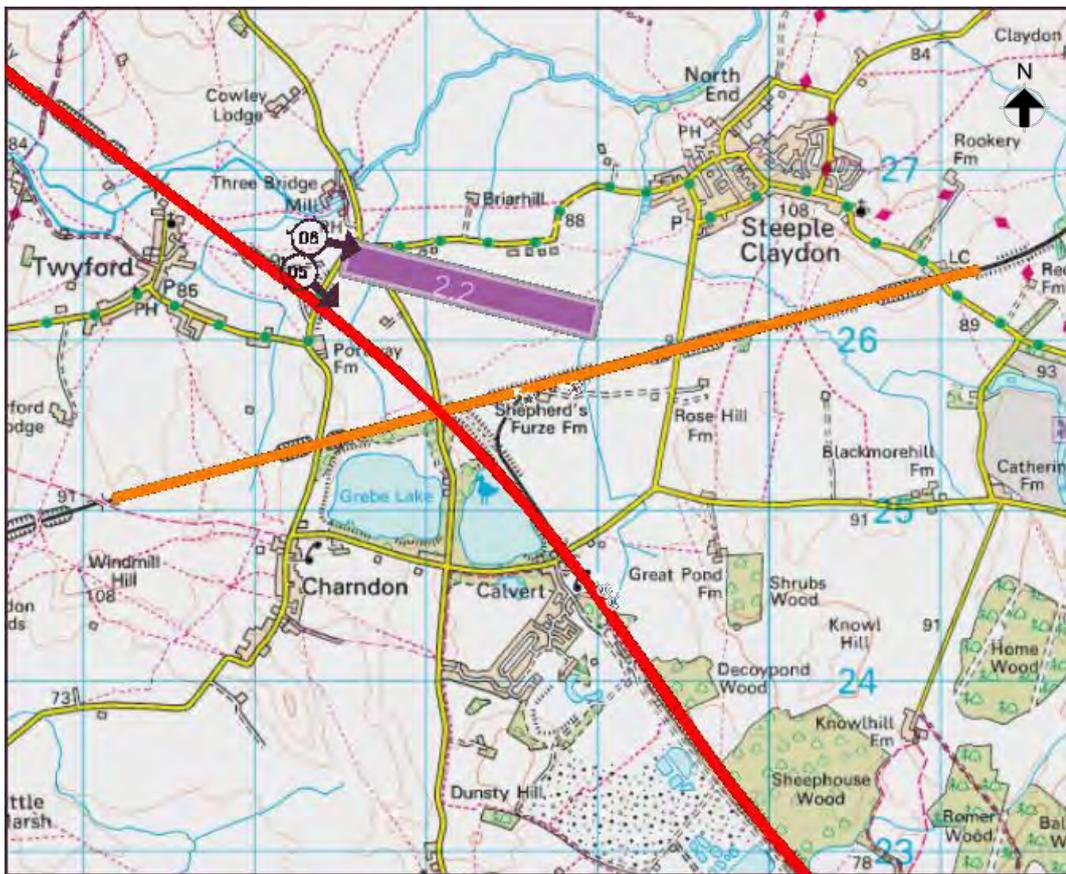


Figure 6 Location plan – Site 2.2



Photograph 5



Photograph 6

Description

The site lies on the track of an East to North chord line running from the EWR line to the HS2 North section heading towards Birmingham. The site would have to be curved to follow the route of the chord. The level of HS2 in this area is not finalised, but it is intended that it will run at level and the EWR line will be raised to run over it. This assumption means that the site could be level with relatively minor earthworks. Land take would be considerable though, using relatively open farmland. The site would be close to two relatively isolated houses, but not near significant habitation and not within the view of nearby villages.

Connections to HS2

The site lies on the chord line to HS2. Access to the site from the Oxford direction would be via a run round also required for waste trains from Bristol to Calvert. Access to HS2 South would be via run round loops alongside HS2 opposite the village of Twyford.

5.3.3 Site 2.3 Thame Road



Figure 7 Location plan – Site 2.3

**Photograph 7****Photograph 8**

Description

In agreeing that this could be a possible location, the requirement for all storage sidings to be double ended was relaxed. The site lies to the immediate East of HS2 and within the East to North chord line, bounded to the South by the EWR line, to the West by HS2, and to the North East by the chord line. The level of HS2 in this area is not finalised, but it is intended that it will run at level and the EWR line will be raised over it. This assumption means that the site could be level with relatively minor earthworks, though the former Great Central Main Line embankment would need to be removed.

Land take would be relatively modest, and would maximise use of land already sterilised by the construction of the chord line. The site could be accessed from the Northern section of the existing unclassified "Thame Road", which in any case will require to be diverted because it crosses the EWR line at almost exactly the point where HS2 will intersect it.

The site is not adjacent to any properties. It appears that almost all the site could be constructed in one field running in an L shape from Claydon Junction to the HS2 route, though land ownership has not been researched. In the South West corner of the site between the East West "Thame Road" overbridge and the GC embankment there is a gas Pressure Reducing Station on the national gas network, owned by Scotia Networks Ltd. There does not appear to be a difficulty in designing a site layout that preserves this. However the location of the associated gas pipelines has not yet been ascertained in a services search and this may present a project risk if the pipeline is found to restrict site layout options or operations.

One public footpath runs across the site, which will require closure or diversion.

Connections to HS2

Access to HS2 would be via the run round loop also required for waste trains from Bristol to Calvert, which would also act as headshunt for the site. A chord line would be constructed to the HS2 north, and trains to HS2 south could either use this chord and run round at the loops near Twyford village, or could use the existing east to south chord and access HS2 opposite the waste terminal.

5.4 Quadrant 3

5.4.1 Site 3.1 Greatmoor



Figure 8 Location plan – Site 3.1

Description

The site lies to the East of the former Great Central Aylesbury – Claydon Junction line, and just to the North of the former Grendon Underwood Junction. The Line falls at approximately 1 in 176 to the North to an underbridge over a small drain near to Sheephouse Wood. There is a 5 metre difference in line height from one end of the site to the other, which means that a level site could only be created with considerable earthworks. It is understood that the site is owned by Waste Recycling Group (WRG). There is no road access to this area, though there is a proposal by WRG to construct an access on the former Grendon Underwood – Ashendon Junction line trackbed.

The site is bounded to the North by Sheephouse Wood, which is a Site of Special Scientific Interest (SSSI). The site is not overlooked by any significant residential areas.

Connections to HS2

The site is alongside the HS2 route, and accessed from the EWR line via the existing chord line. A West to South chord is not possible because of a nature reserve and lakes which lie on the route. The only way to access HS2 from the Oxford direction is to use a run round loop to the East of HS2 (shared with the WRG waste trains to Calvert). If the East West proposals are implemented, it is understood that there is likely to be an hourly service in each direction along the existing single line. There would be capacity to access HS2 from the site with appropriate signalling.

Site 3.2 Great Pond

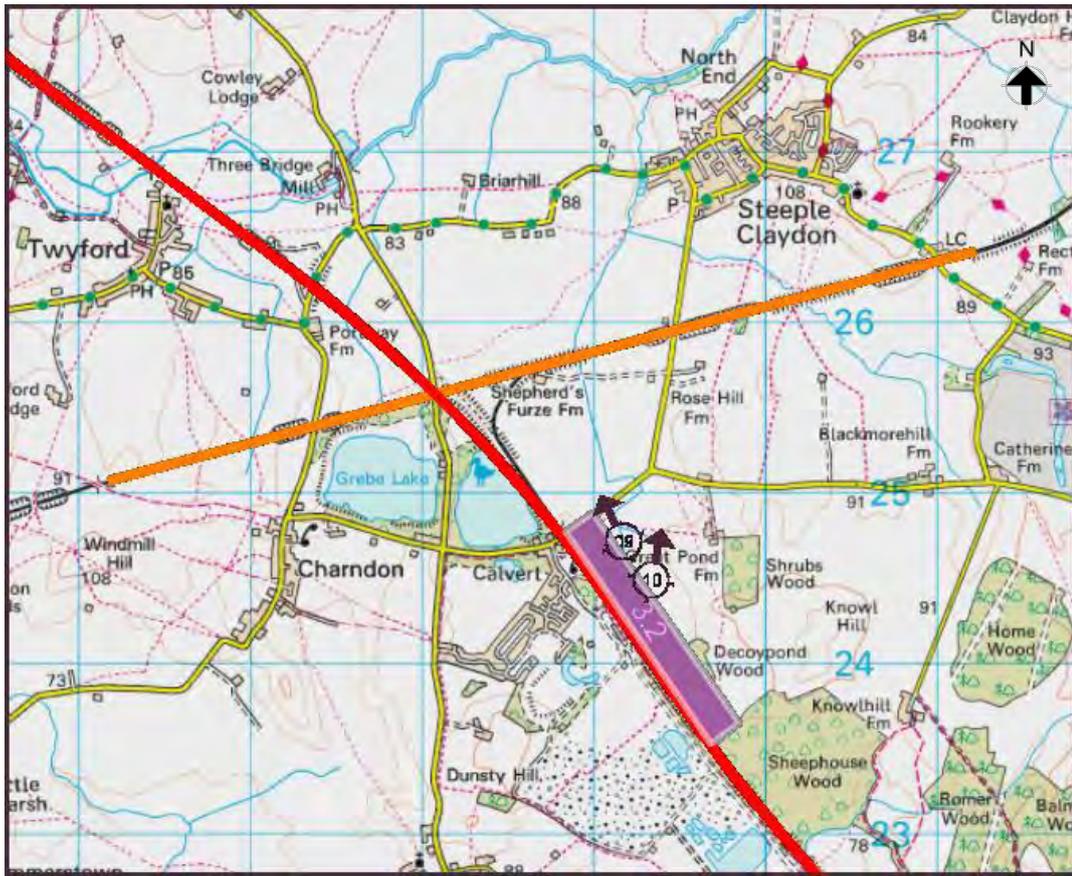


Figure 9 Location plan – Site 3.2



Photograph 9



Photograph 10

Description

The site lies to the East of the former Great Central Aylesbury – Claydon Junction line, and opposite the current WRG waste transfer terminal. The Line falls at approximately 1 in 330 to the North to the former station site, which is level, and then rises at approximately 1 in 176. This means that a level site could be created with modest earthworks. The site is on agricultural land with no immediate housing overlooking it, though it is opposite Calvert village. The site would be alongside the proposed relocated WRG transfer station which would add considerably to the land take, as the WRG site will require reasonable road vehicle circulating areas, and road access requirements would potentially conflict with rail access routes. It can only be created with considerable earthworks.

The site is bounded to the South by Decoypond Wood. The site is overlooked from across the railway line by the edge of Calvert village, though there is some tree screening

Connections to HS2

The site is alongside the HS2 route, and accessed from the EWR line via the existing chord line. A West to South chord is not possible because of a nature reserve and lakes which lie on the route. The only way to access HS2 from the Oxford direction is to use a run round loop to the east of HS2 (shared with the WRG waste trains to Calvert). If the EWR proposals are implemented, it is understood that there is likely to be an hourly service in each direction along the existing single line. There would be capacity to access HS2 from the site with appropriate signalling.

5.5 Quadrant 4

No suitable sites were identified in Quadrant 4, as this area is occupied by Calvert and Charndon villages, and the former Calvert brick pits (which are now used for landfill).

5.6 Sites on HS2 (north)

5.6.1 Site 4.0 Mixbury

At the meeting on 19th May HS2 asked Arup to widen its consideration of sites to include any level site on the HS2 alignment North of Calvert and within 10 km of the junction with the EWR line. A search on the proposed HS2 route revealed only one potential site which met the required attributes of length and level at Mixbury, just on the 10 km boundary. The site lies on the West of the HS2 route, to the South West of Mixbury village. While the HS2 formation is level at this point the adjacent land rises to the North West, which means that substantial earthworks would be required. The land is in agricultural use and is directly overlooked only by Mixbury Lodge. A public footpath runs across the site.

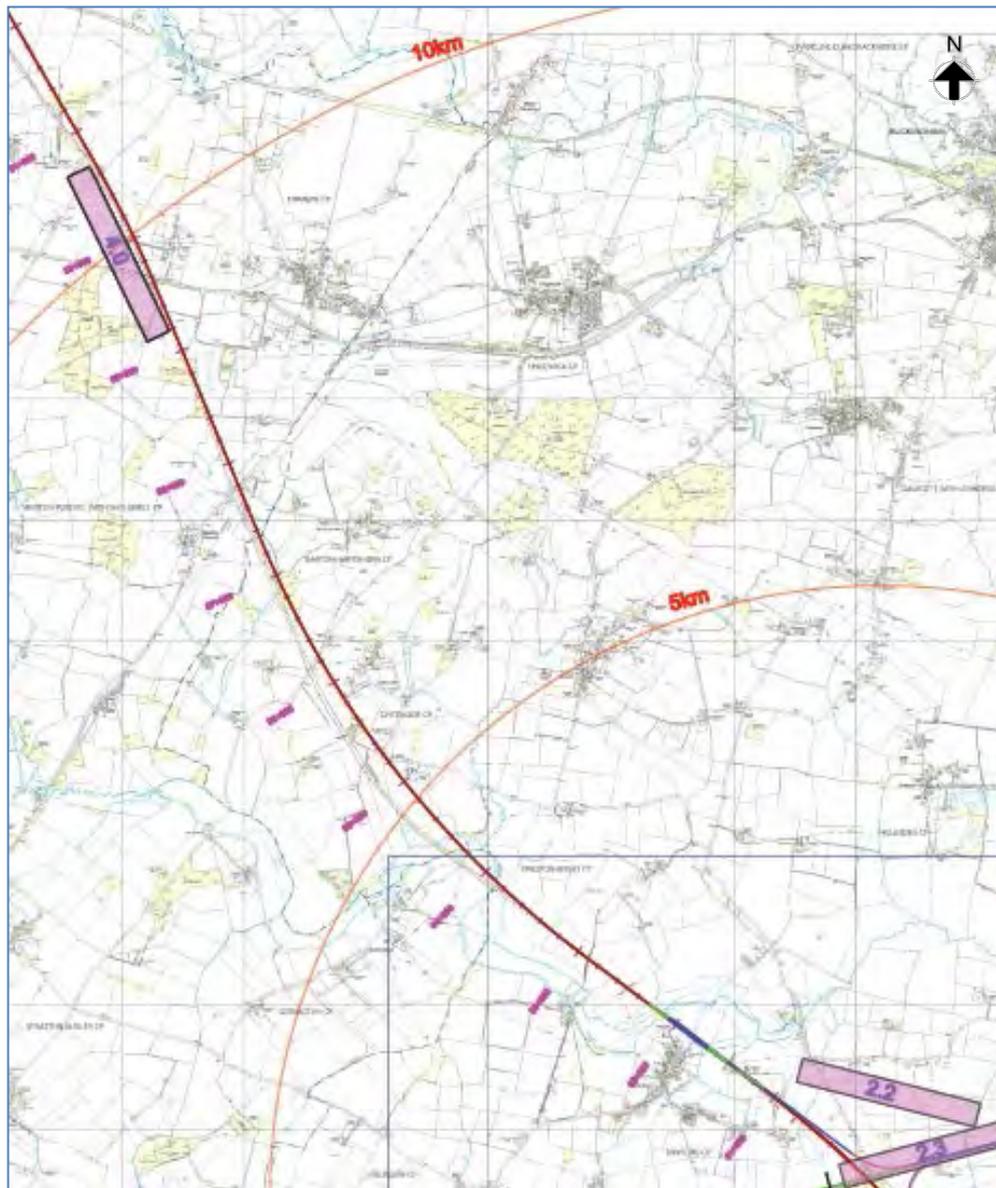


Figure 10 Mixbury Site Location

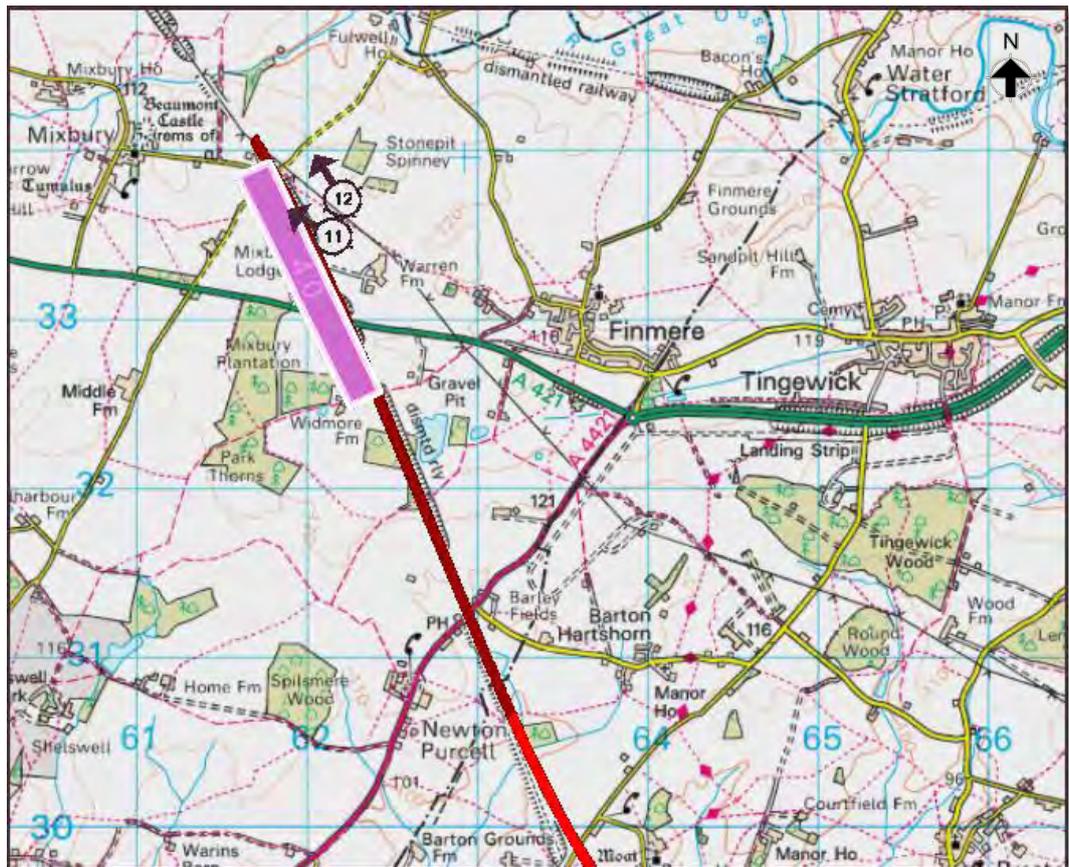


Figure 11 Location plan – Site 4.0



Photograph 11



Photograph 12

5.6.2 Connections to HS2

The site is alongside the HS2 route, and would have to be reached by construction of a new 10 km single line from Claydon, which would need to cross the HS2 formation at some point by either an overbridge or underbridge, depending on the vertical alignment. Access from the EWR line would be via a new East to North chord line. Access from the Oxford direction would be via a run round loop to the East of HS2 (shared with the waste trains to Calvert).

6 Cost Estimates

We have carried out an initial high level assessment of the potential costs involved in creating the depot. This is based on compilation of an outline bill of quantities for each of the sites, using standard assumptions on track layout and required facilities, but customised for each site to reflect specific attributes.

The bill of quantities has been priced using unit costs based on Arup rate and experiences on recent similar projects with similar attributes. The costs should be treated as indicative, and demonstrating in relative terms the respective costs of each of the options considered. The summary of the cost estimates is shown in the table below.

Site	Low	High	Average	add 20% Project Management +overhead	add 15% Risk	Total	£(M)
Site 1.1	£31,060,540	£38,222,010	£34,641,275	£6,928,255	£5,196,191	£46,765,721	46.7
Site 2.1	£33,531,540	£42,366,010	£37,948,775	£7,589,755	£5,692,316	£51,230,846	51.2
Site 2.2	£31,041,540	£38,115,010	£34,578,275	£6,915,655	£5,186,741	£46,680,671	46.7
Site 2.3	£30,409,540	£37,109,010	£33,759,275	£6,751,855	£5,063,891	£45,575,021	45.6
Site 3.1	£33,767,540	£42,697,010	£38,232,275	£7,646,455	£5,734,841	£51,613,571	51.6
Site 3.2	£31,672,540	£39,185,010	£35,428,775	£7,085,755	£5,314,316	£47,828,846	47.8
Site 4.0	£35,713,540	£42,587,010	£39,150,275	£7,830,055	£5,872,541	£52,852,871	52.9

Figure 12 Cost Estimate

6.1 Matrix table for all Site options

The sites were reviewed to identify whether their specific attributes against a list of key requirements as set out in the Functional Requirements Specification, and other key requirements which have been identified during project development.

Each site was scored in a range of 1 (poor) to 3 (good) for each of the requirements, and then the scores were totalled. Although a relatively crude measure, this provides an easily understood guide to the relative merits of the various sites. The matrix should therefore be read as providing a guide rather than as being a definitive sift process.

The evaluation for each site is shown plotted on the matrix below:

Score	
1	High risk/problematic
2	Medium
3	Low/ OK

Matrix table for IMD		Site 1.1	Site 2.1	Site 2.2	Site 2.3	Site 3.1	Site 3.2	Site 4.0
Railway issues	Sufficient area for depot layout	3	3	3	3	3	3	3
	HS2 connection - direct connection	1	3	3	3	3	3	2
	Amount of shunt moves required	1	3	3	2	3	3	3
	Level site	2	2	3	3	1	2	3
	East-West line connection	3	3	3	3	2	2	1
Environmental impact to surrounding area	Potential Visual Intrusion	1	1	2	3	3	2	1
	Potential Noise level	1	1	2	3	3	2	1
	Impact on Flood Plain	3	1	3	3	3	3	3
Geographical issues	Undulated terrain	3	3	3	3	3	3	3
	No conflicting land use	3	3	2	3	3	1	3
	Services	3	3	2	2	3	3	3
	flat/even terrain	3	2	3	3	1	2	3
Logistics	Road access	3	3	3	3	1	2	3
	potential construction site	1	1	1	3	2	1	2
Cost		2	1	2	3	1	2	1
	Score	33	33	38	43	35	34	35
	Worst possible score	15						
	Best possible score	45						

Figure 13 Matrix table

7 Conclusion

Following assessment of the sites, we have drawn up conclusions of the suitability of each location, including the results of the matrix assessment above, and other more qualitative factors which apply specifically to certain sites. The conclusions of this exercise are summarised below.

7.1.1 Site 1.1 Twyford Lodge

The site would be very visible from the village of Twyford and relatively inaccessible from HS2. A new west to north chord line would be relatively intrusive because of the angle of the lines in this area. It is recommended that this site option is not developed.

7.1.2 Site 2.1 Pond Road

The topography of the land in this area would make connections difficult without substantial earthworks. The site is considered to be too close to the village of Steeple Claydon and interferes with the flood plain. It would also require Pond Lane to be diverted or closed. It is recommended that this site option is not developed.

7.1.3 Site 2.2 Claydon Junction

The site would be viable, but requires relatively large agricultural land take and is closer to Steeple Claydon than option 2.3. Given that option 2.3 appears to offer reduced land take, a more compact site and is further from neighbouring residential properties it is recommended that this site option is not developed.

7.1.4 Site 2.3 Thame Road

It is recommended that this site is developed in detail, as it offers the best option of minimised land take and minimised environmental impact. However in view of the potential risk to site use posed by the gas pipeline, other sites should be kept under review in case significant issues are identified.

7.1.5 Site 3.1 Greatmoor

While it would be technically possible to construct an IMD on this site it would require major earthworks to create a level site. The site is environmentally sensitive, with an SSSI immediately to the North. There is also no road access to this site. It is therefore not recommended that this site should be developed.

7.1.6 Site 3.2 Great Pond

It is technically possible to construct an IMD on this site, though it is close to Calvert village. The site would be complicated by the presence of the relocated WRG waste transfer terminal whose road access requirements potentially complicate the site layout. For this reason it is recommended that the site be considered further, but not as a development priority.

7.1.7 Site 4.0 Mixbury

It is technically possible to construct an IMD on this site, but the length of new branch line required in parallel to the HS2 formation would only be justified if the site chosen was substantially more suitable than others. This is not the case, as site levels would require major alteration, while the site itself is in a prime rural setting. It is not recommended that this option is developed.

7.1.8 Overall Conclusion

The overall conclusion of the exercise is that the site which best meets the criteria laid down in the Functional Requirements Specification is site 2.3 – Thame Road. Although of all the options, this alone requires engineering train storage to be in single ended sidings (therefore requires increased shunting moves,) the site has the advantage of remoteness from local communities, and is contained within the overall rail footprint.

Site 3.2 – Great Pond also appears to have some suitable attributes, but is compromised by the WRG discharge terminal and proximity to Calvert village, and therefore should be only examined further if Thame Road appears to have major problems.

8 Selected Option Development

8.1 General layout

The overall conclusion of the exercise is that the site which best fits the criteria laid down in the Functional requirements specification is site 2.3 – Thame Road

To demonstrate the potential layout of the site a series of concept layout drawings were created, illustrating possible options. The overall location of the site relative to the rail connections and the concept layout are shown on the following three pages:

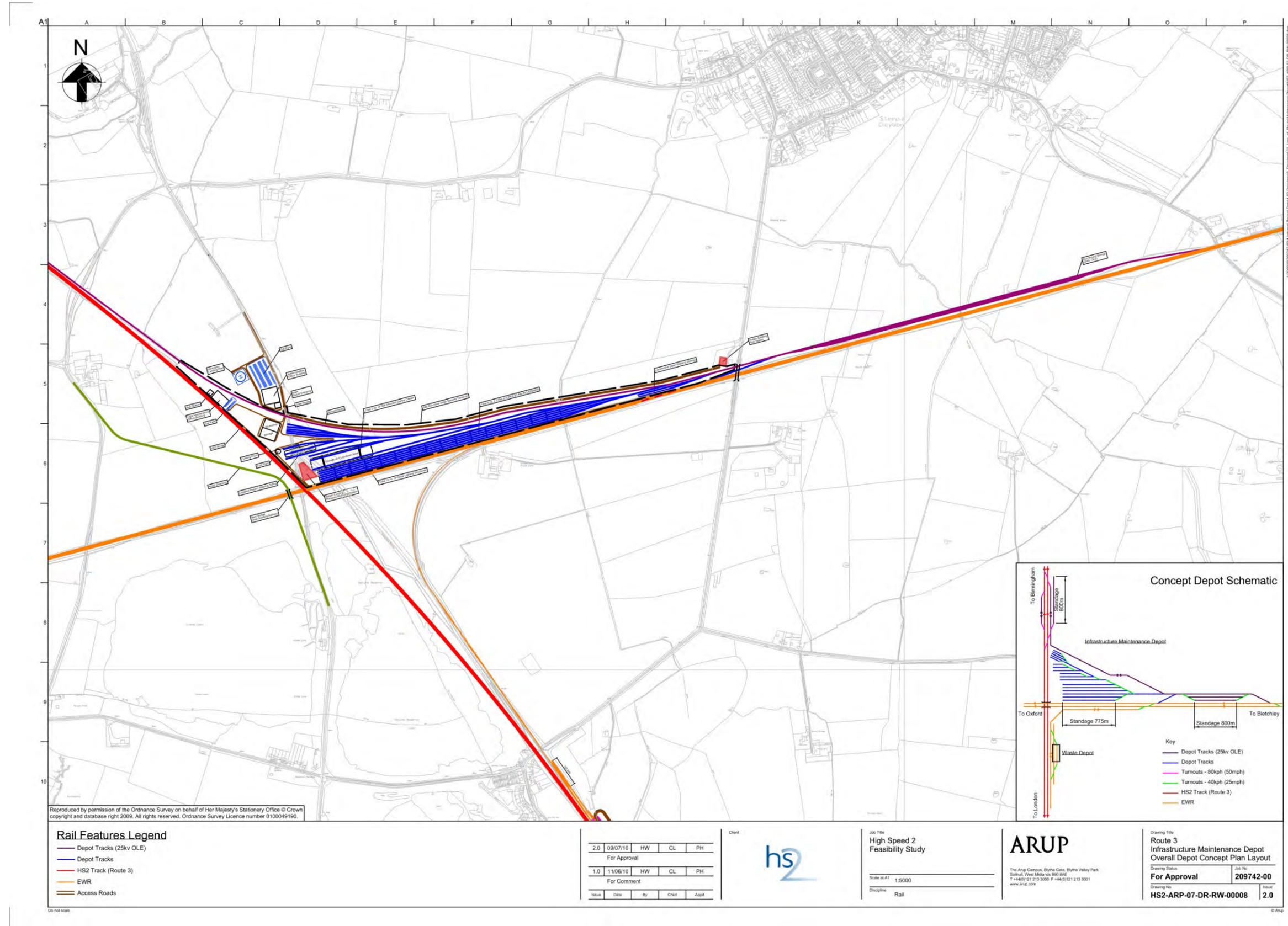


Figure 14 Depot Layout

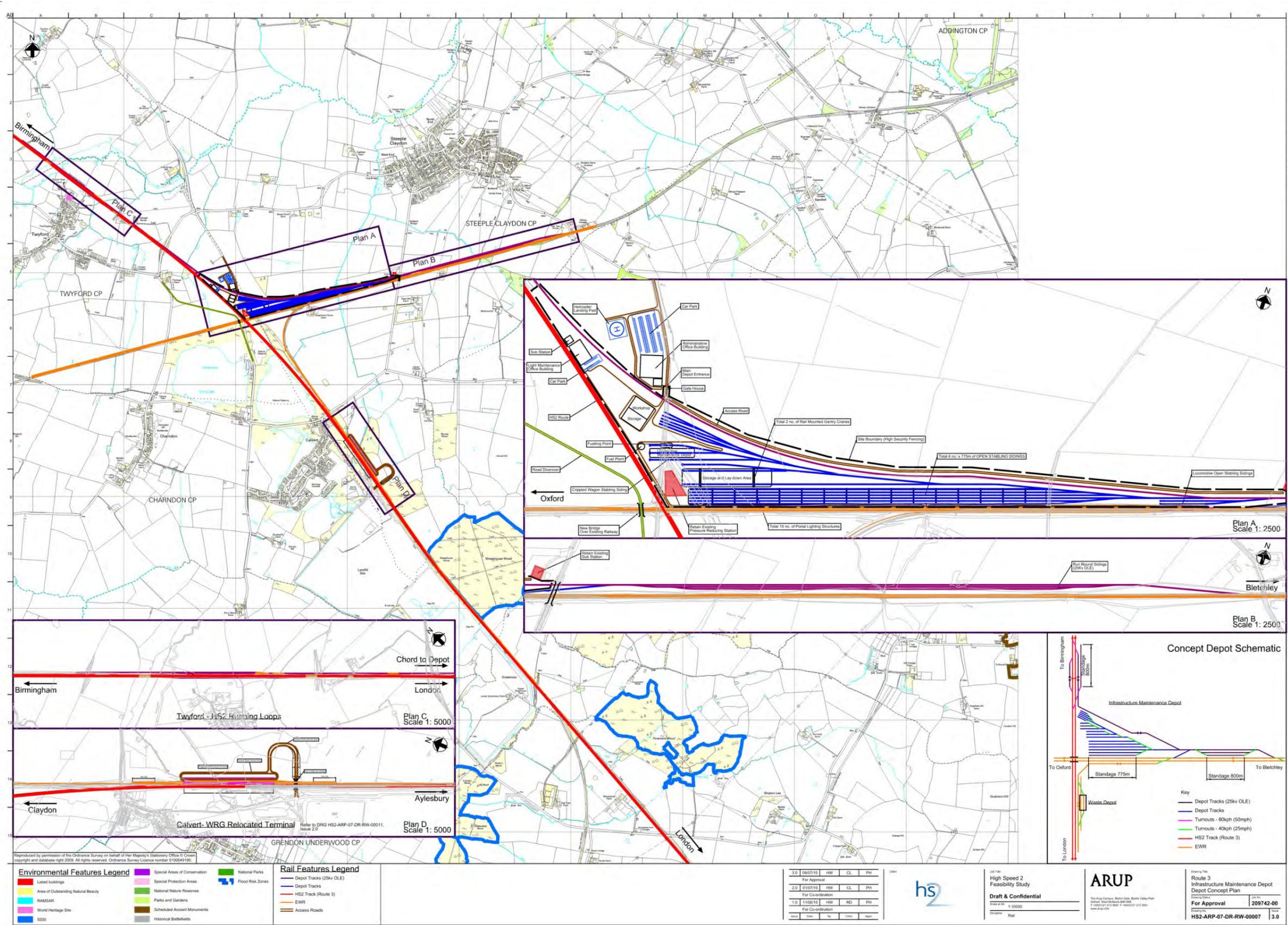


Figure 15 Concept Plan

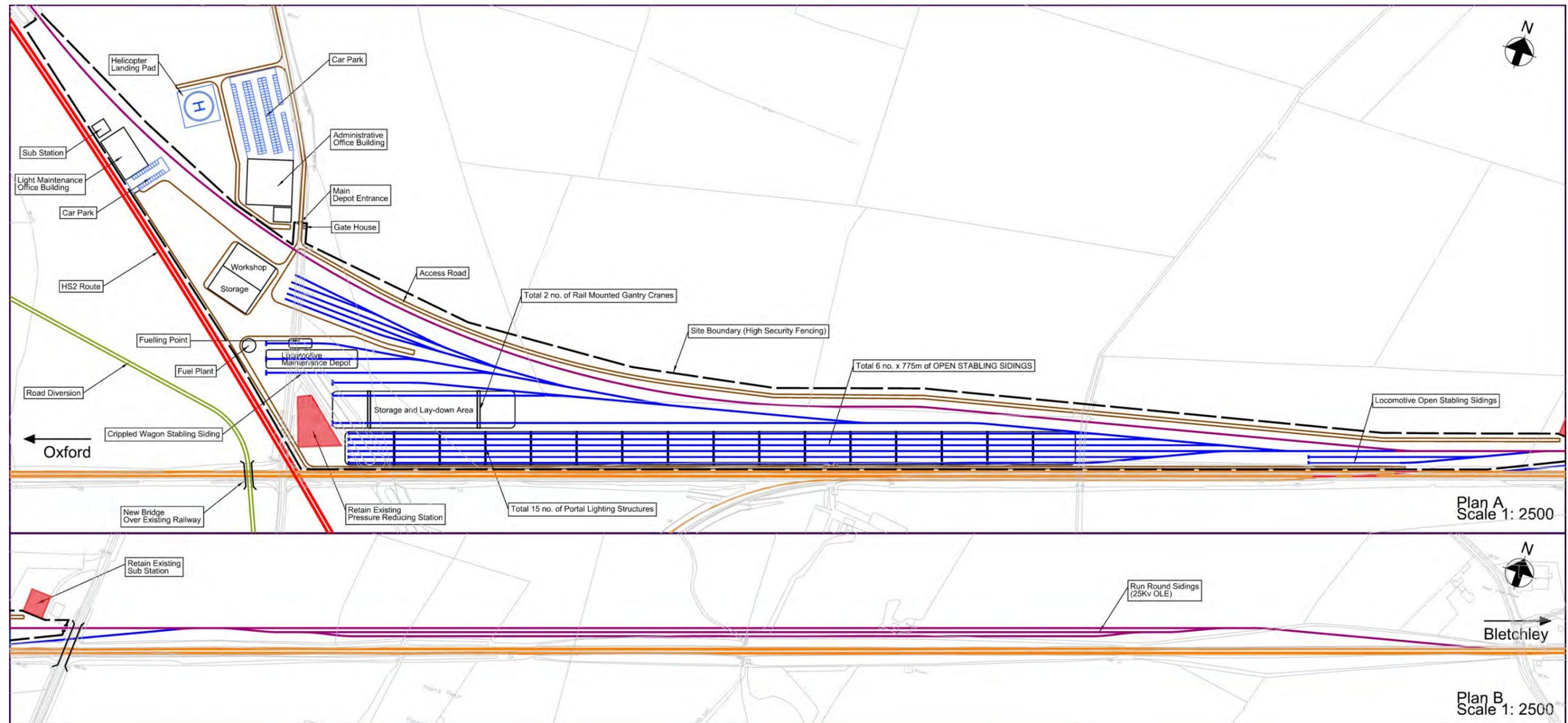


Figure 16 Concept Plan – Plan A and Plan B

8.2 Specific site details

The site has the following features:

- On the assumption that the Thame Road is diverted or closed, the former road formation is used as an access road to the IMD.
- A concept road diversion option is shown, though other work packages are dealing with this.
- A new East to North chord line is constructed to give access to HS2.
- To minimise the HS2 main line connection S&C it is intended that this chord is the only access to HS2, and that the East to South chord is retained as now purely as an access to the Aylesbury route and waste terminal, though HS2 connections could be included without major impact.
- Three run round sidings (all signalled for normal speed (30 mph) entry and exit) are created at the East end of the site, for both HS2 engineering trains and for trains accessing the Calvert waste site and Aylesbury line.
- The sidings will be in cutting at lower level than the surrounding fields, and will be screened by this level difference from Steeple Claydon village.
- An additional loop is created alongside HS2 at Tyford to provide route access for engineering trains.
- The chord line and run round sidings are overhead wired, but not the depot itself.
- The chord line, run round sidings and depot are all constructed to UIC GC gauge.
- The chord line forms the railway boundary and all sidings are contained within it.
- Six single ended engineering train storage sidings are created inside the depot.
- A 200 metre x 40 metre equipment storage and laydown site is provided in the depot and handling will be by 2 gantry cranes spanning the storage area.
- Where feasible overhead lighting will be provided by portals over the tracks to minimise light spillage outside the site.
- The run round sidings will be lit at low level by walkway lights to minimise visual impact.
- Locomotive and yellow plant stabling sidings, a maintenance depot and fuelling point, and wagon cripple sidings are all provided in line with the requirements of the FRS.
- Access to the depot is via a barrier controlled level crossing, but the office buildings and car parking are situated outside the rail boundary to minimise movements across the crossing.
- The rail site will be a high security site with access controlled by gate (incorporating the level crossing). The general administration offices and car parking will be outside this high security area to ensure that only authorised personnel enter it.
- Almost all the site footprint appears to be within one common field boundary, minimising land take and site acquisition.
- The existing gas feeder station is safeguarded and retained on its current footprint.

8.3 Site operation

The schematic track layout is shown below.

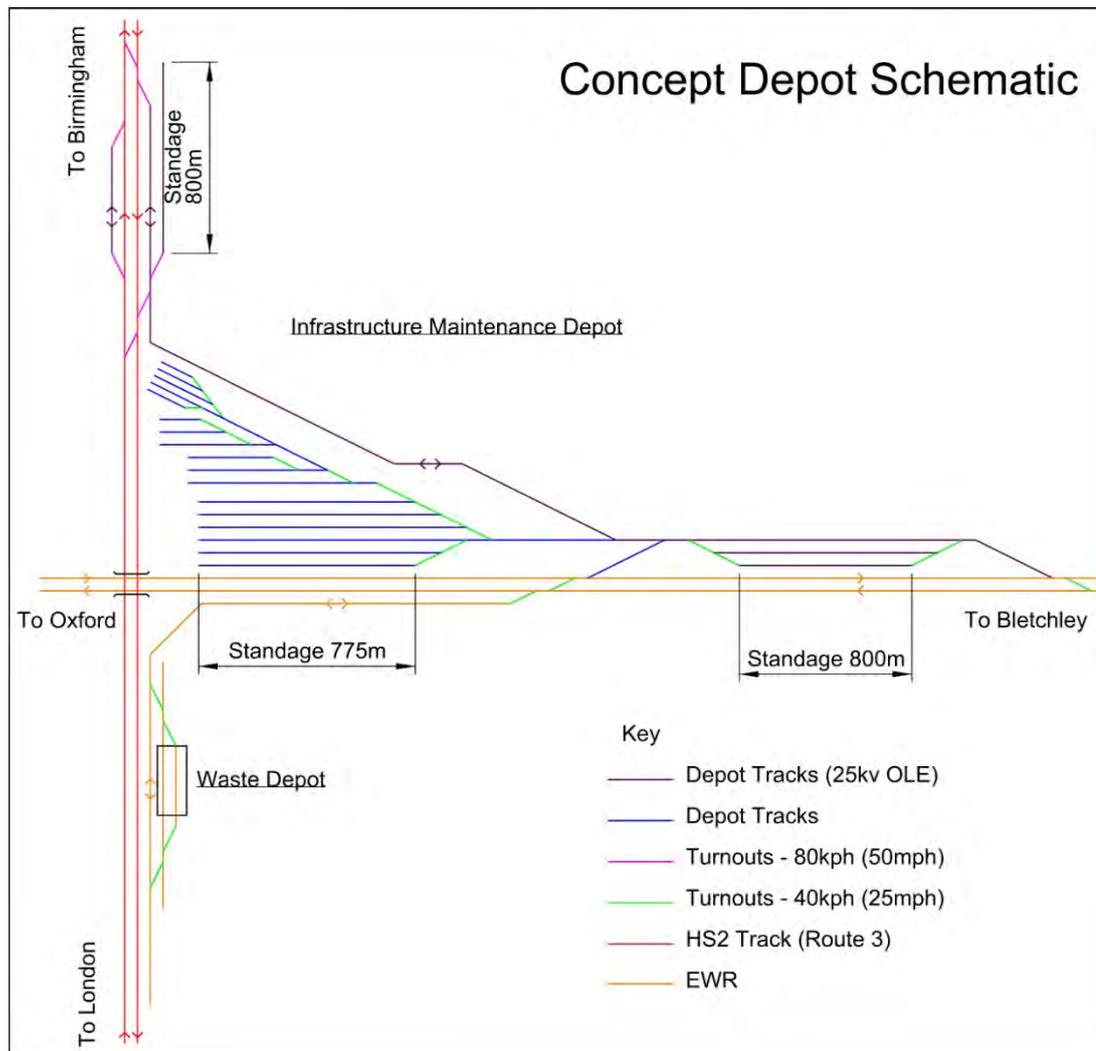


Figure 17 Concept Depot Schematic

It is intended that trains or railborne plant arriving at the IMD will run into the run round sidings. Where appropriate, trains could be taken from here direct to HS2. Other trains will be shunted into the storage sidings to be held ready to go on to possessions later. Trains with materials for the storage area (S&C components, sleepers etc.) will be shunted into the storage yard for unloading. It is envisaged that the depot will require one shunting locomotive to perform these functions.

Yellow plant, 'thunderbird' locomotives and other HS2 on track equipment will be maintained and fuelled at the maintenance depot in the North corner of the site, and storage sidings are also provided to stable locomotives while waiting for duty at the neck of the yard.

Covered materials stores will also be within the rail area. The chord line and other rail routes (EWR and HS2) will provide natural security, but the rail site will be fenced with security fencing, and access will be strictly controlled. The only road access will be via a level crossing. Other site activities (offices, car parking, non essential stores and the Light Maintenance Depot) will be located outside this security area on land to the North of the site.

Trains being prepared to go onto possession sites on HS2 will be formed on the storage sidings, either from incoming trains or from wagons loaded in the storage area within the depot. Trains will be pulled out into the run round sidings and taken down to Twyford loop

ready for despatch onto HS2. It is envisaged that propelling movements will be minimised, and that in normal service only trains being shunted into the depot will be propelled. It is envisaged that the majority of possession trains on HS2 will be ‘top and tailed’, which minimises the number of run round moves which are required at the IMD or at Twyford.

8.4 West end connections

A sub option of the depot design has been examined, to provide connections between the stabling sidings at the Western buffer stop end, to allow locomotives to run round incoming trains. Connection to the EWR line is not possible at this point, due to the line being carried over HS2 on an overbridge. The location of the headshunt is constrained by the need to avoid the Pressure Reducing Station.

The connections for this sub option shown in the diagram, below.

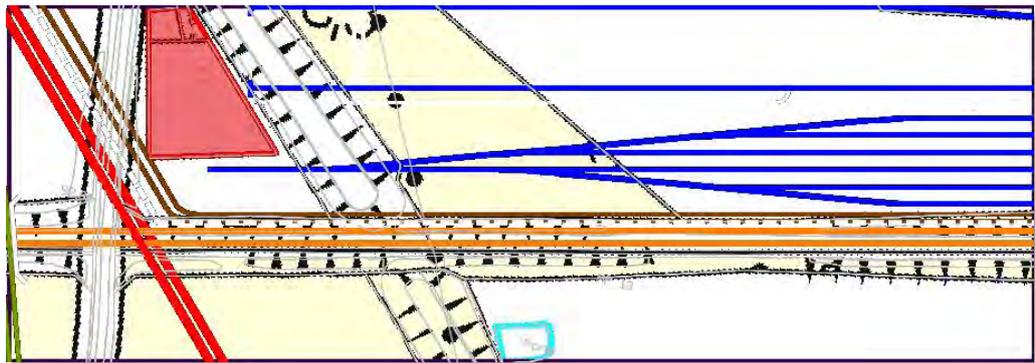


Figure 18 West end connection sub option

The effect of the sub option is to reduce the length of the stabling sidings, as demonstrated in the table below:

Usable standage on siding		
	Single Ended Option	Double Ended Option
Siding No. 01	775m	537m
Siding No. 02	775m	572m
Siding No. 03	775m	678m
Siding No. 04	775m	678m
Siding No. 05	775m	607m
Siding No. 06	775m	537m

Figure 19 Comparison of siding lengths: single and double ended

There is limited opportunity to move the yard neck eastwards, because of the tie-in with the chord line and the EWR line. The trade off between maximising the length of storage and increasing operational flexibility is therefore clear. Our conclusion is that the additional operational functionality offered by this sub option is outweighed by the loss of siding length, and therefore the run round option should not be adopted.

9 Calvert Waste Plant

9.1 Rail Access

This report has not reviewed, in detail, the facilities to be provided for WRG at a relocated Calvert terminal site. It is understood that this will be on the east of the Aylesbury – Claydon line parallel to the existing sidings and near the footprint of site 3.2. It is proposed that the existing sharply curved chord line from Claydon London North Eastern (LNE) Junction will be retained in its current location to minimise environmental impact, and that HS2 formation will be adjusted to provide space for this.

The proposed depot location means that the new shallower curved east to north chord can be used for HS2 access, and it is proposed that no use is made of the existing chord, which will only carry Aylesbury - Milton Keynes passenger trains and freight services. Therefore no connections have been proposed between the Network Rail line and HS2 at Calvert, though this could be provided if desired. In concept, we believe that the waste depot will require two sidings at least 800 metres in length (to provide movement of the train under a static gantry site as at present) or 2 x 400 metre sidings with full Rail Mounted Gantry (RMG) access to the length of the train.

Road access to the site will be via a new overbridge to a new circulating area on the east side of the terminal, which is one of the reasons why site 3.2 is not considered suitable for the IMG.

Drawing number HS2-ARP-07-DR-RW-00011 Issue 1.0 shows an indicative layout for the WRG, shown on the following page.

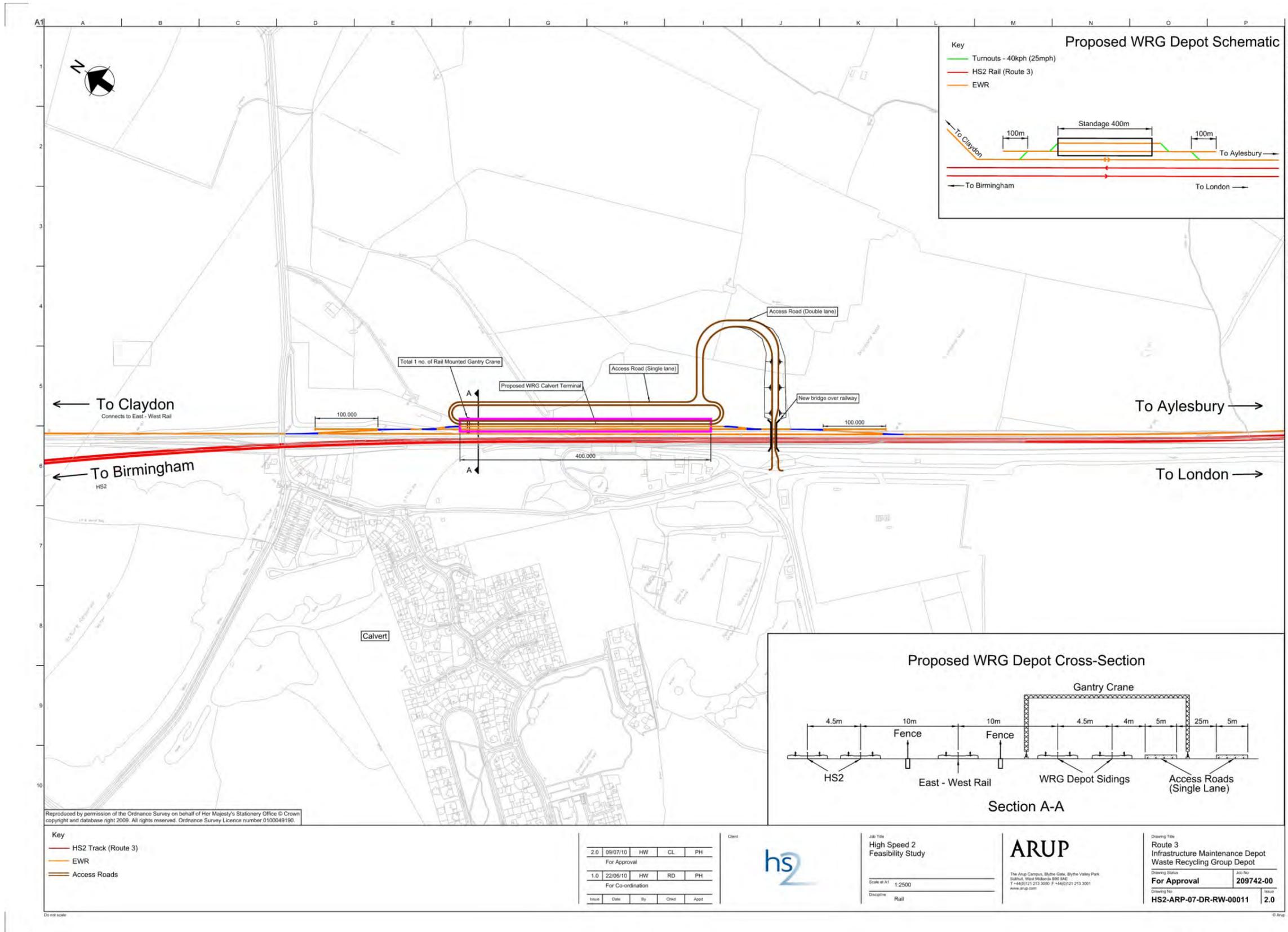


Figure 20 WRG Depot

9.2 Heat and power generation

The Calvert WRG plant already runs a local power station, fed by methane generated from the landfill area. The landfill will continue to generate methane through the life of the IMD project, and it would appear appropriate to consider using this as a source of fuel for heat and power generation purposes, possibly through a small combined heat and power plant, located alongside the IMD.

This would potentially allow the IMD to become independent of grid power and gas supplies and would be an appropriate exploitation of an available carbon neutral energy source. Further development of this option in conjunction with WRG would be appropriate.

10 Use of site as a potential construction depot

As part of this project, discussions have been held with the Arup team reviewing construction logistics, and options for supplying track materials to HS2. In principle the IMD could provide all or part of this function, though the site is probably too small to handle all the trains required for the two year construction phase. There appear to be two options to supplement capacity.

10.1 Additional land take

It would be possible to provide additional sidings on a short term basis, with restoration of the additional site after construction had been completed (as happened on the HS1 Beechbrook Farm depot). This would be possible, and such sidings could be to the north of the chord line on an adjacent agricultural land. Some of the other sites considered in this report (and specifically site 3.2) may also be suitable for temporary use.

10.2 Use of other supplementary depots

There are two other sites which are located on the East-West route, and which may have capacity to act as secondary materials supply depots. Neither of these sites could support GC gauge traffic, and their remoteness from the HS2 connections and route access limitations may restrict their usefulness. However they both have the capability of providing the required additional capacity for a short period at minimal capital cost and environmental impact.

The MOD site at Bicester is described below, and may have the capability to handle trains for HS2 track laying, though access to the site may be difficult.

Network Rail established a site to supply West Coast Route Modernisation (WCRM) requirements at the WRG Stewartby terminal, near Bedford on the EWR line (some 17 miles away). The depot performed the role of a classic Local Distribution Centre (LDC), and had ballast stockpiling and spoil disposal facilities, as well as engineering train storage. There were however problems with operating long (600 metres+) trains because of an automatic half barrier crossing to the east of the site.

The terminal is now out of use following the completion of WCRM, and could therefore be adapted for use as a secondary stocking option for HS2 track laying.

Because of the distance from the HS2 route this depot has not been evaluated for suitability as an IMD.

11 Bicester MOD Depot

As part of this review, Arup suggested and HS2 agreed that consideration should be given to the possibility of use of land at the MOD depot at Bicester to perform the functions of an IMD. No discussions have been held with MOD.

The Bicester depot is a massive complex which controls most of the stores for the British Army. It is administered by the Defence Storage and Distribution Agency (DSDA), and the rail operation is managed by DSDA Rail and Container Services (DRCS). There are over 30 miles of track on the 1,500 acre site which dispatches traffic by rail over a connection with EWR line at Bicester Town station. DRCS owns its own locomotive fleet and rail operational personnel. The rail connection and exchange sidings face towards Oxford.

DB Schenker has a contract with DSDA to move equipment around the country and through the Channel Tunnel, and operates at least one train per day between Didcot and Bicester. The maximum train length that currently can be accommodated into the site is approximately 500 metres, though this could be increased with track alterations.

MOD has been seeking to open the site to commercial use (initially in the distribution sector) which would be compatible with the current site uses. An open day was held in 2009 to canvas possible private sector support, though to date no firm plans have emerged. The site has the benefits of high security, available development land with good rail access and limited planning restrictions, and very good road access to the A41 and M40.

However the site is 8 miles from Claydon Junction, and is only cleared to Network Rail W8 gauge (though there are indications that DfT may consider funding an increase to W10 gauge for 9'6" containers as part of the EWR project). There are 6 overbridges on the route which may limit the options for greater gauge clearance (one of these overbridges is the Chiltern Line Princes Risborough – Aynho Junction route) to permit the passage of GC gauge vehicles. The connections at Bicester face the wrong direction, while in future the EWR and Chiltern Bicester – Oxford service proposals may limit access options between Bicester and Claydon.

For this reason it appears unlikely that a site at Bicester could fulfil the function of an IMD and provide strategic access to HS2 on a daily basis, because of its distance from the route. There could however be considerable merit in considering locating additional temporary facilities here for the track laying phase of the project, and it would be worth conducting at least an initial conversation with DSDA to understand what potential facilities could be offered.

Appendix A

**Functional
Requirements
Specifications**

A1 Introduction

This Functional Requirements Specification sets out the key requirements for an HS2 Infrastructure maintenance depot (IMD). It is the result of discussion between the HS2 and Arup teams. Any design for an IMD must confirm to the requirements of this specification. This document is intended at this stage to be a discussion document, rather than a conclusive statement of needs, and the intention is that this forms the basis of discussions and consultations with stakeholders within HS2 and the wider rail business.

A1.1 Purpose

There will be three light maintenance depots on HS1, where track and infrastructure maintenance gangs will be located, and travel to worksite by road transport. Stocks of consumable spares will be kept on site. One of these three depots will be in the London area, one near Birmingham, and the third will be located at the IMD.

In the case of major infrastructure work, involving heavy maintenance and renewals, and rail delivery of replacement track materials will be supplied from a central Infrastructure Maintenance Depot (IMD). The prime functions of the IMD are:

- Provide a base from which all rail based infrastructure maintenance activities are resourced and materials supplied for the whole of the southern trunk section of HS2 (Euston – Birmingham inclusive).
- A central supply point for all engineering (track & OLE) material that requires to be delivered to site by rail plus strategic materials stocks
- A fuelling, servicing and stabling facility for:
 - HS2 rescue and recovery locomotives
 - HS2 on track plant (including GC gauge vehicles not able to travel on the National Rail network)

A1.2 Assumptions

This document makes the following assumptions:

- Standard track materials common across the high speed and classic rail networks will be supplied by Network Rail from their own Local Distribution Centre (LDC) and transferred to HS2 via the IMD, which will act as the storage and interface point. Track components specific to HS2 will be stored at the IMD, which will act as the strategic supply point for the line.
- Excluding yellow plant moves, the maximum number of possessions to be supplied from the IMD is 2 on any working night, and the maximum number of possession train to be supplied onto HS2 is 4 on any working night.
- Track materials supplied by the IMD will be limited principally to ballast, spoil, rail, sleepers, S&C, and OLE (masts and wiring). It is assumed that materials for purely road based maintenance operations would be held at the Light Maintenance depots, and not normally be handled by the IMD (except for those items held by the local depot).
- Except where specifically stated in this document all materials wagons used to supply HS2 will be built to a gauge compatible with their movement on the National Rail network (maximum Network Rail W8 gauge).
- Ballasted track will be the usual specification for open air sections.

A1.3 Ballast

The ballast for HS2 will conform to the normal UK Network Rail track ballast specification. Ballast will be supplied by Network Rail, either in standard NR/HS2 ballast wagons (hoppers or side tippers) or in High Output Ballast Cleaners. Rolling Stock would probably be owned by a 3rd party. All track ballast will be loaded at Network Rail sites, and there will be no ballast stockpiling at the IMD. The following requirements are identified for track ballast:

- The minimum ballast stabling siding length is 400m. At least one siding must be 775 metres in length to allow for storage of an HOBC.
- The HOBC will be serviced and restocked at another site and not at the IMD.
- The number of ballast stabling sidings provided must be equal to the maximum number of ballast trains planned to be supplied to all sites on HS2 on one working night, plus 50% for contingency.
- Passive provision will be made for a temporary ballast stock pile of 10,000 tonnes of ballast.

A1.4 Rail

HS2 will be laid with UIC 60 specification rail. Rail will be supplied by Network Rail, normally in 216 metre strings on Long Welded Rail (LWR) sets or in single 20 metre length on conventional wagons. Rolling Stock would probably be owned by a 3rd party. All rail will be loaded at manufacturing points (Corus Scunthorpe or NR Eastleigh plant) and will not be unloaded at the IMD. The wagons used to bring materials from the National Rail; network will be used to drop rail on the HS2 trackbed. Where appropriate scrap rail will be reloaded to these wagons and returned to Network Rail for disposal or reuse.

The Track Renewal Train (TRT) does not form part of this section (see sleepers below). The following requirements are identified for handling rail:

- The minimum rail stabling siding length is 400m.
- One line will be provided for stabling rail wagons (LWR sets or individual wagons).

A1.5 Spoil

Spoil (used ballast) will be brought from possession site to the IMD, and handed on to Network Rail for disposal at an LDC. Rolling Stock would be owned by a 3rd party. Spoil will not constitute hazardous waste. No spoil will be unloaded or handled at the IMD

The following requirements are identified for handling rail:

- The minimum ballast stabling siding length is 400m. At least one siding must be 775 metres in length to allow for storage of an HOBC.(see section A1.4 'ballast' above).
- the number of spoil wagon stabling sidings provided must be equal to the maximum number of spoil trains planned to be supplied to all sites on HS2 on one working night, plus 50% for contingency.

A1.6 Sleepers

Sleepers specified on HS2 will be monoblock or twin block concrete bearers with a maximum width of 2,500 mm. Sleepers will be supplied from the National Rail network, either on 20 metre wagons (Salmons) or as part of the Track Renewal Train (TRT), where scrap sleepers are recovered from the trackbed in a possession they will return to the IMD on the wagons and will be sent on to a Network Rail LDC for recycling. Sleepers will not be stored on site at the IMD.

The following requirements are identified for handling sleepers:

- The minimum sleeper stabling siding length is 400m.
- At least one siding must be 775 metres in length to allow for storage of the Track Renewal Train (TRT).
- The TRT will be serviced and restocked at another site and not at the IMD.

A1.7 Switches & Crossings (S&C)

It is assumed that S&C will be specific to HS2 and will not be comparable to Network Rail units. Components (switches, crossings, bearers, point motors, stock rails etc.) will be stored at the IMD. The IMD will also act as an initial build up area for new S&C units, and transportation to site may be carried out by rail (using GC gauge sleeper carriers along the pattern of similar units being introduced by Network Rail).

The following requirements are identified for handling S&C:

- New build up area required for S&C units – 150m x 20m.
- At least one dead ended siding required with a usable length of at least 200 metres, and access by crane or forklift from both sides of the track.
- build up area to have rail access for loading possession wagons.
- build up area to have road access for material deliveries.
- Component stock area required.
- stock area to have rail access for loading possession wagons.
- Stock area to have road access for material deliveries.
- S&C handling to be by overhead crane (2 heads).

A1.8 OLE

It is assumed that OLE materials will be specific to HS2 and will not be comparable to Network Rail equipment. Components (masts, insulators, registration arms, droppers, catenary wire, contact wire etc.) will be stored at the IMD. Transportation to site may be carried out by rail (using a specific wiring train) on rail or road/rail equipment, or by road.

The following requirements are identified for handling OLE materials:

- Component stock area required.
- stock area to have rail access for loading possession wagons.
- Stock area to have road access for material deliveries.
- stock area to have road access for road or road/rail vehicles.
- At least one dead ended siding required with a usable length of at least 200 metres, and access by crane or forklift from both sides of the track.
- handling to be by forklift truck.

A1.9 Miscellaneous

In addition to the above items, the IMD will also stock standard components for the following systems:

- Track drainage.
- Cable troughing.
- Consumables for track treatment such as de icing fluid, sandite etc.

A1.10 Fuelling and servicing

On track plant and rescue locomotives will require fuelling, servicing and light maintenance facilities. It is assumed that heavy maintenance (including tyre turning) will be undertaken elsewhere, but it is possible that G C gauge equipment will not be able to access other depots off the network, and road movement may have to be considered.

The following requirements are identified for fuelling and servicing:

- Fuelling facilities for two locomotives or on track vehicles at a time.
- Fuel storage tanks of at least 100,000 litres capacity.
- Full fuel spill recovery facilities to be provided.
- Gas oil to be delivered by road.
- Fuelling siding to be double ended and at least 100 metres length.
- servicing shed to be provided with:
 - Single road.
 - Covered shed with lighting, heating and closable end doors.
 - Fitted with fume extraction equipment.
 - Provided with under floor pit.

A1.11 Crippled wagon facilities

The IMD will be provided with a separate siding where crippled or defective wagons can be repaired and returned to use or moved off site.

The following requirements are identified for cripple facilities:

- One dead ended siding of at least 100 metres length with the means to isolate the points to prevent unauthorised shunt moves into the siding.
- Lighting.
- Under floor inspection pit.
- Road access for a heavy lift (45 tonnes) crane or low loader to remove wagons from site.
- Full concrete apron capable of 25 tonne point loads for wagon jacks.

A2 General Requirements

The following requirements have been identified for the IMD:

A2.1 General

- The IMD will be located approximately midway along the HS2 route with the objective that engineering possession trains can reach any worksite along the route within one hour (assuming 100 kph running).
- The IMD will be operational and accessible by rail at all times. Capable of 24 hours operation 7 days per week.
- The site will be lit throughout, but mindful of avoiding energy waste and light pollution to the vicinity of the area.

- The majority of materials will arrive by rail, with access road being used only for light equipment or as a last resort.
- The site shall be made available from an early stage, and it can be considered for use as a construction site/depot for HS2 during construction stage.
- The site will be practically level throughout.

A2.2 Rail

- A connection will be provided onto the classic network, so that trains can access/ egress the maintenance depot without having to go onto the HS network.
- Where possible the IMD should be capable of direct access from both directions of the neighbouring National Rail route.
- The IMD must be capable of providing direct access to HS2 in both directions.
- Speed - minimum 25 mph connections from East-West Railway mainline to at least 1 Reception Line. Other connections can be low speed (nominal 5 mph).
- Minimum curve radius for connecting tracks will be R=400m, for sidings will be R=200m. Sidings to be as straight as possible.
- All track to be specified for RA10 loads.
- All IMD lines, including Reception Sidings and link lines connecting the IMD with HS2, will be cleared to GC gauge.
- The maximum length trains that will be handled at the IMD and onto and off HS2 will be 750 metres.
- Shunting necks will be provided to allow repositioning of 750m trains without occupying the main running-line.
- The depot reception lines and all running loops shall be electrified at 25kV AC (and be capable of local isolation), all other lines within the depot shall not be electrified.
- There should be a minimum of 6m between the running edge of the main lines, and any depot facilities.
- Provision will be made for stabling one or more diesel "Thunderbird" rescue / recovery locomotives. These locos would also work engineering trains on HS2 (as they will be fitted with all the necessary cab signalling, whereas locomotives arriving at the depot off the classic network will probably not be so equipped).
- Track spacing within depot layout will be based on 5m running edge to running edge to permit safe staff access to all tracks.
- The IMD will be signalled on Network Rail standard principles to allow access by non HS2 locomotives and trains.
- A number of sidings shall be provided immediately adjacent to the HS line as an emergency recess facility in the event of failures, in addition to provide a recess / round facility for engineering trains.
- HS2 shall not prevent the introduction of a full range of services on the Aylesbury – Claydon and Oxford – Bletchley routes, as proposed by the East West Rail Consortium.

A2.3 Depot

- The IMD will be securely fenced on all sides (with lockable gates at the rail entrances interlocked with depot signalling).

- Road access will be provided.
- Depot facilities shall include the following:
 - Office accommodation.
 - Shower block and mess room for maintenance staff.
 - Stores.
 - First aid room and facilities.
 - Car parking.
 - Separate workshops for electrical plant & mechanical equipment.
 - Gantry crane accessing road rail.
 - Storage areas.
 - Access road direct from the depot to the HS2 trackside.
 - Helicopter landing pad.
 - Depot to be provided with a backup power supply.

Appendix B

Drawings

B1 General Site Layout Concept Plans

Drawing Numbers:

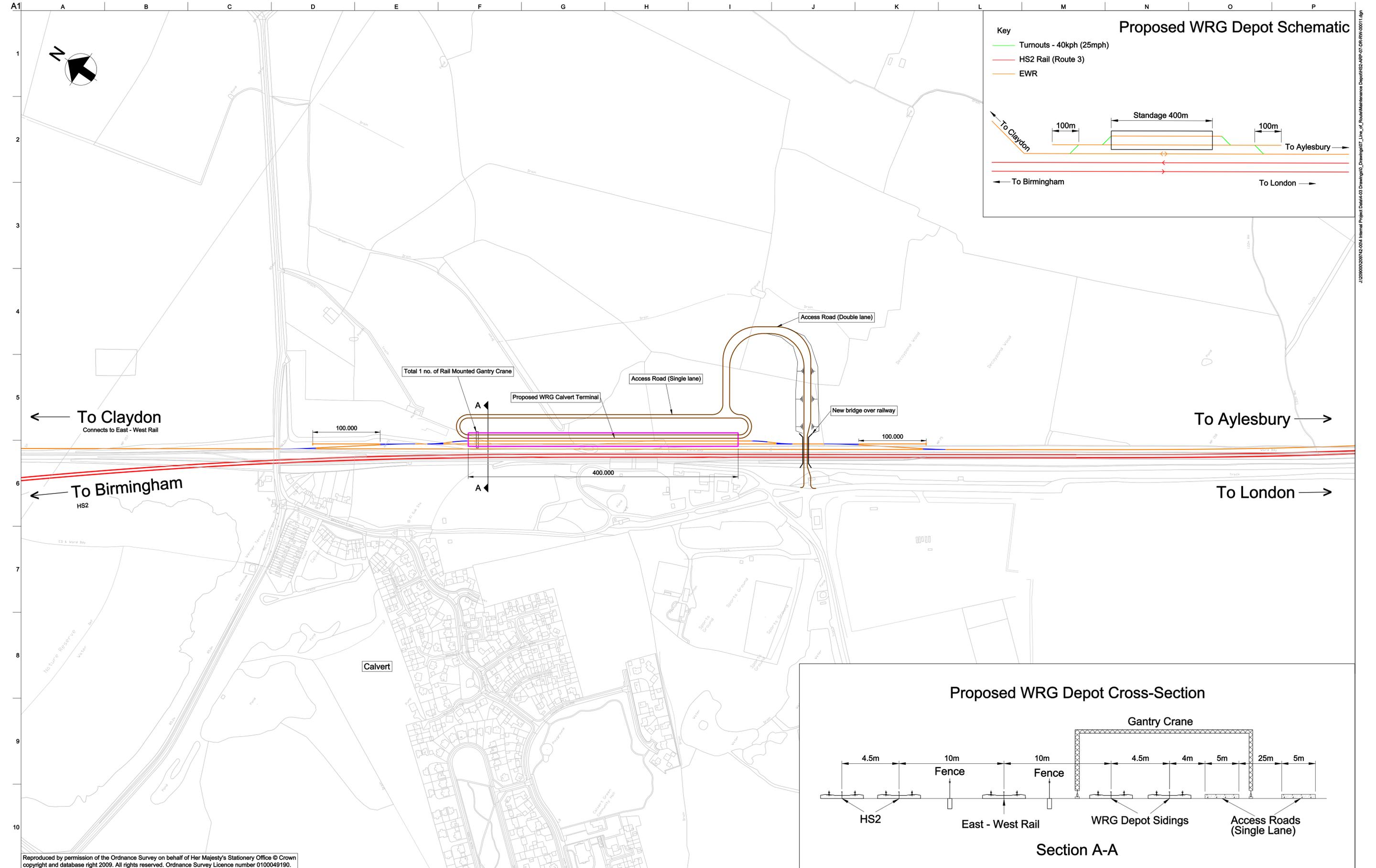
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HS2-ARP-07-DR-RW-00008

HS2-ARP-07-DR-RW-00009

HS2-ARP-07-DR-RW-00010

HS2-ARP-07-DR-RW-00011



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Key

- HS2 Track (Route 3)
- EW
- Access Roads

2.0	09/07/10	HW	CL	PH
For Approval				
1.0	22/06/10	HW	RD	PH
For Co-ordination				
Issue	Date	By	Chkd	Appd



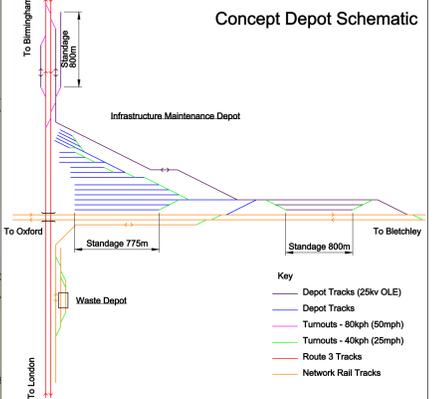
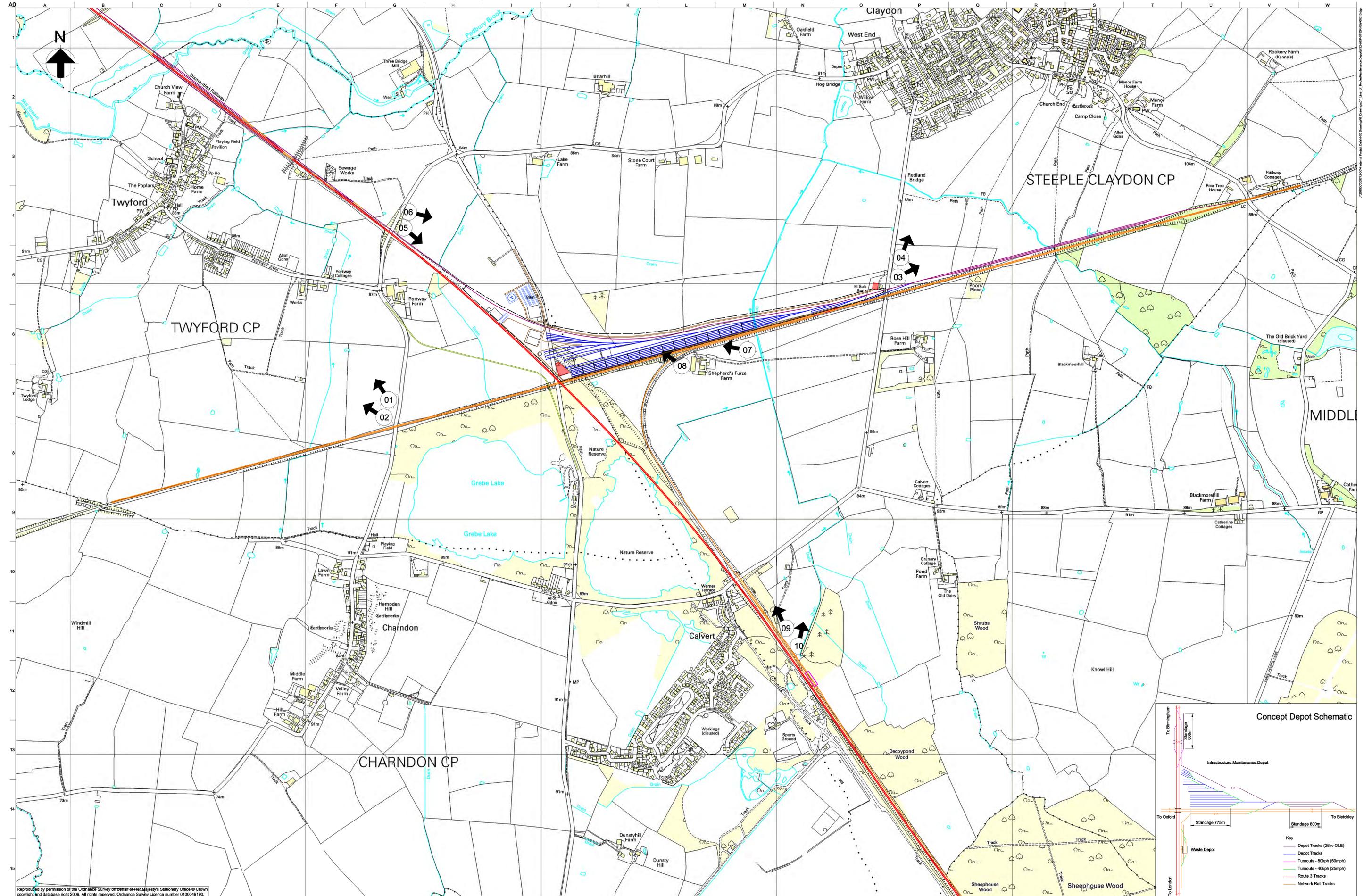
Client
High Speed 2
Feasibility Study

Scale at A1
1:2500

Discipline
Rail



Drawing Title Route 3 Infrastructure Maintenance Depot Waste Recycling Group Depot	
Drawing Status For Approval	Job No 209742-00
Drawing No HS2-ARP-07-DR-RW-00011	Issue 2.0



Concept Depot Schematic

- Key
- Depot Tracks (25kV OLE)
 - Depot Tracks
 - Turnouts - 80kph (50mph)
 - Turnouts - 40kph (25mph)
 - Route 3 Tracks
 - Network Rail Tracks

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2.0	09/07/10	HW	CL	PH
For Approval				
1.0	16/06/10	HW	CL	PH
For Co-ordination				
Issue	Date	By	Chk'd	App'd



Job Title
High Speed 2
Feasibility Study
Draft & Confidential
Scale of A0
1:5000
Client
Rail

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Drawing Title
Route 3
Infrastructure Maintenance Depot
Interactive Map
Drawing No
For Approval
209742-00
Issue
HS2-ARP-07-DR-RW-00010
2.0





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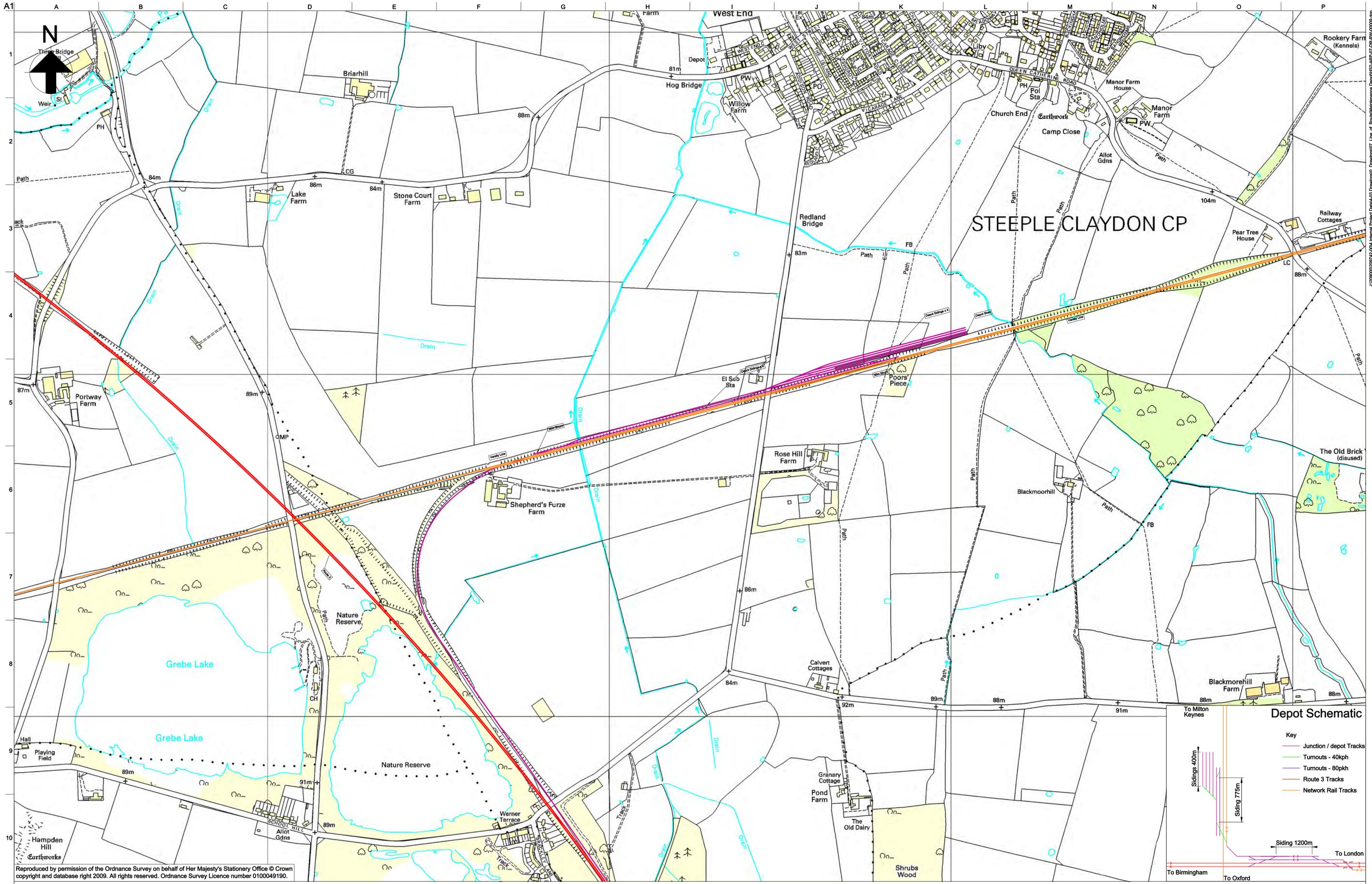
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Rail Features Legend

- Junction/Depot Tracks
- HS2 Track (Route 3)
- EWR

2.0	09/07/10	HW	CL	PH
For Approval				
1.0	11/06/10	HW	CL	PH
For Comment				
Issue	Date	By	Chkd	Appd



Client
High Speed 2
Feasibility Study

Scale at A1 1:5000
Discipline Rail



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Job Title
Route 3
Infrastructure Maintenance Depot
Initial Depot Layout

Drawing Status
For Approval

Job No
209742-00
Issue
2.0

