

EXHIBIT LIST

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Chiltern Tunnel Extension

1 Executive Summary

- 1.1.1 HS2 Ltd has now completed an assessment of a Chiltern tunnel extension as requested by the Select Committee. The proposed amendment is for a 2.6km extension of the Chiltern bored tunnel from Mantle's Wood to the current north portal of the South Heath green tunnel (at Ch47+205 excluding the portal hood structure).
- 1.1.2 This proposal would increase the depth and width of the South Heath cutting between the portal and running westwards towards Leather lane.
- 1.1.3 The assessment indicates that the revised cutting would not require additional residential property acquisition and that it would continue to avoid the Jenkin's Wood area of ancient woodland near the portal.
- 1.1.4 With the inclusion of a dedicated construction access route up from the A413 to the tunnel portal, construction lorries would be removed from Frith Hill, Potter Row, King's Lane, Hyde Lane and Hyde Heath Lane. Some construction lorries on the B485 Chesham Road would remain for the construction and fit-out of the new Chesham Road vent shaft. Frith Hill would no longer require temporary closure with the associated temporary traffic diversions. The roundabout and realignment associated with the B485 Chesham Road and King's Lane junction in the Proposed Scheme would also no longer be required.
- 1.1.5 The noise assessment indicates that the deeper cutting and associated noise fence barriers to be placed within the cutting at track level would provide significant noise benefits to the local area over the Proposed Scheme. In particular:
- The significant adverse noise effect on a community basis forecast in the main ES along Potter Row would no longer be likely;

- The extension to the Chiltern Tunnel will also remove the likely noise insulation qualifier at Sheepcotts Cottage on Hyde Lane and the likely community significant effect at Hyde End from the environmental assessment; and
 - The assessment indicates that of the properties which were to be demolished but which will now be retained, none are likely to experience a ground-borne noise or vibration impact.
- 1.1.6 Further work will continue to consider improvements to the mitigation in line with Information Paper E20: Control of airborne noise from altered roads and the operational railway that requires HS2 Ltd to take all reasonable steps to design, construct, operate and maintain the operational railway so that airborne noise does not exceed the lowest observed adverse effect level.

2 Introduction

- 2.1.1 On 21st July the Chair of the HS2 Select Committee, Rt. Hon. Mr Robert Syms MP, made the following statement regarding interim Chilterns tunnel decisions:

'We heard argument and submissions this week and last week in relation to options for further Chilterns tunnelling. Our views are as follows.

First—on the long tunnel options, we have kept in mind the potential non-quantifiable effects of the project on the Chilterns Area of Outstanding Natural Beauty. On the evidence heard we are strongly of the view that the case for a long tunnel is not made out. Without prejudging the arguments we may hear from future petitioners we believe it is unlikely that an overwhelming case will be made out for the long tunnel options as we move forward into further hearings.

Secondly, we believe that the case has been made for an extension of the bored tunnel to the northern end of the South Heath green tunnel. This would not cause an overall delay to the scheme. We want reassurance on how far that option will result in a deepened cutting laterally to the west of the portal, and we want HS2 to evaluate the effects of a deepened cutting on the local area. Provided that review is satisfactory, we will direct the promoter to work up that proposal as an additional provision.....'

- 2.1.2 The Secretary of State has since confirmed that the extended tunnel favoured by the Select Committee will be proposed. HS2 Ltd. has now completed an assessment of the scheme alignment in the local area of the tunnel portal north of South Heath in the vicinity of Potter Row and in particular the effects of the deepened cutting on the local area as required by the Select Committee. The following sections of this report describe these impacts.

3 Description of the Chiltern tunnel extension

- 3.1.1 The proposed amendment is for a 2.6km extension of the Chiltern bored tunnel from Mantle's Wood to the current north portal of the South Heath green tunnel (at Ch47+205 excluding the portal hood structure). This would remove the need for the cuttings between South Heath and Mantle's Wood and the South Heath green tunnel currently shown in the Proposed Scheme.
- 3.1.2 There would be no change to the horizontal alignment of the railway but the vertical alignment would be lower through the tunnel extension than the Proposed Scheme by up to 30m. At the new north portal the tracks would be approximately 17m below existing ground level, with the deeper and wider cutting required by the tunnel bore separation and the depth gradually reducing to match the Proposed Scheme profile before Leather Lane. Earthworks around the tunnel portal would integrate with the surrounding landform.
- 3.1.3 Due to the longer tunnel length an additional vent shaft would be required adjacent to the former Annie Bailey's public house, accessed off the B485 Chesham Road. Minor changes would also be required to the Chalfont St Giles vent shaft to allow for enhanced tunnel cooling equipment.
- 3.1.4 A permanent access road to the northern portal for maintenance and emergency access during operation would be provided from Frith Hill. This would be in broadly the same location as the access road in the Proposed Scheme for the South Heath green tunnel northern portal.
- 3.1.5 Noise fence barriers within the South Heath cutting and landscape mitigation bunds north of Mulberry Park Farm would continue to be used to improve noise and visual screening in this location.
- 3.1.6 A plan and profile drawing of the Chiltern tunnel extension is included in Appendix A, illustrating the revised scheme alignment. The appendix also includes typical cross sections through the deeper cutting.
- 3.1.7 Appendix B includes revised construction (CT-05) drawings and operation (CT-06) drawings to illustrate the revised land that would be required during construction and operation of the scheme westwards from the tunnel portal by Frith Hill.

4 Construction

- 4.1.1 A new construction compound adjacent to the A413 and a temporary access road would be provided from the A413 roundabout with the A4128 at Great Missenden to the new northern portal site (see Appendix 2, drawing CT-050034a). A new significant temporary visual effect on one property has been identified from the temporary construction works at the new compound.
- 4.1.2 In addition, provision would be included for construction lorries to travel along the trace between the temporary access road and the Leather Lane compound, instead of using Frith Hill and Potter Row as assessed in the Proposed Scheme. These measures would remove all construction lorries from Frith Hill and Potter Row. Frith Hill would not require temporary closure. Some construction traffic would need to continue to use the B485 Chesham Road for access from the A413 for construction of the Chesham Road vent shaft but would not need to access King's Lane or Hyde Heath Road. The roundabout and realignment associated with the B485 Chesham Road and King's Lane junction in the Proposed Scheme would also no longer be required.
- 4.1.3 The temporary access road from the A413 would be removed on completion of the construction works and the land reinstated.

5 Route alignment west of the new tunnel portal

- 5.1.1 The horizontal alignment of the railway would remain unaltered from the Proposed Scheme alignment although the track separation would be wider to suit the tunnel bore separation at the portal.
- 5.1.2 The vertical alignment of the railway would be lower at the tunnel portal compared to the Proposed Scheme green tunnel portal due to the need to provide sufficient cover over the tunnel bores approaching the portal. The proposed revised vertical alignment is shown on the Plan and Profile drawing and typical cross sections included in Appendix A. This shows that at the north portal the new alignment would be approximately 10m deeper than the current Proposed Scheme, giving an overall cutting depth of approximately 17m. It is considered that this will provide the minimum necessary safe cover over the tunnel drives, whilst ensuring that the cutting depth is not excessive.

- 5.1.3 The deeper and wider width of the cutting at rail level will increase the overall width of the cutting, westwards from the tunnel portal compared to the Proposed Scheme. With cutting side slopes currently assumed to require a 1:3 slope in this area (subject to ground investigation results) the 10m increase in cutting depth would increase the overall width of the cutting by up to 30m on each side near the portal, reducing as the rail level rises back to that in the Proposed Scheme. Actual cutting width and slopes would be subject to information from the ground investigation to be undertaken and subsequent detailed design.
- 5.1.4 The proposed changed vertical alignment is considered to provide an appropriate balance between the impacts of a wider cutting and the increased noise benefit of the deeper alignment. From the plan and profile drawing it can be seen that the revised vertical alignment would re-join the existing alignment of the Proposed Scheme approximately 600m west of the tunnel portal end or approximately half-way between the portal and Leather Lane, where the cutting depth would be approximately 9m.

6 Noise assessment

6.1 Mitigation proposed

- 6.1.1 A noise assessment has been undertaken of the proposed revised alignment and compared with the impacts identified for the current Proposed Scheme. This is fully reported in Appendix 3.
- 6.1.2 The deeper cutting would itself provide some additional reduction in noise but this benefit would reduce as the cutting depth decreases westwards. As such, additional lengths of noise fence are proposed to deliver enhanced noise protection. The scheme has thus been assessed assuming the inclusion of up to 6m high noise fence barriers placed within the cutting along the northern side of the railway at track level.
- 6.1.3 A 3m barrier positioned at the top of the cutting was also assessed in Appendix 3 but was rejected due to the potential additional landscape and visual effect this could have.
- 6.1.4 In addition, properties along Potter Row, Frith Hill and King's Lane will benefit from the proposed use of the trace for construction lorries, rather than using these roads as construction access routes. This would reduce construction traffic noise for properties along them.

6.2 Assessment of noise impact

- 6.2.1 The change in noise impact resulting from the inclusion of the deeper cutting and associated noise fence barriers in the cutting have been assessed and Appendix 3 provides more detail on the noise assessment and impacts associated with this change along the section from Frith Hill to Leather Lane.
- 6.2.2 Under the Proposed Scheme the noise assessment along Potter Row indicated that there would be a significant residual adverse noise effect when assessed on a community basis. Sixteen properties were forecast to experience a moderate adverse impact from operational noise.
- 6.2.3 The assessment of the proposed deeper cutting and associated noise fence barrier indicates that:
- The operational noise effects along Potter Row would no longer be considered significant when assessed on a community basis;
 - Noise levels at all dwellings along Potter Row would be reduced from those forecast in the main ES;
 - In particular, the deeper cutting and noise fence mitigation proposed is forecast to result in a reduction from 16 moderate and 5 minor residual noise impacts assessed in the ES to 3 moderate and 5 minor noise impacts under the proposed change;
 - The extension to the Chiltern Tunnel will also remove the likely noise insulation qualifier at Sheepcotts Cottage on Hyde Lane and the likely community significant effect at Hyde End from the environmental assessment; and
 - The assessment indicates that of the properties which were to be demolished but which will now be retained, none are likely to experience a ground-borne noise or vibration impact.
- 6.2.4 The proposed change is thus considered to provide effective noise mitigation to properties in the vicinity of Potter Row through lowering the alignment and providing track side noise barriers in the deep cutting. Construction traffic impacts would also be reduced. The provision of a longer bored tunnel to replace the cutting in this area would add significantly to construction costs and is not considered justified for the noise benefit at the small number of properties that remain affected.

7 Land & Property impact

- 7.1.1 The wider cutting would require additional permanent land take. However, by adopting the vertical profile proposed there would be no additional residential property acquisition from properties along Potter Row. One additional outbuilding (stables) would be acquired and demolished.
- 7.1.2 With the exception of the pylon work close to South Heath, none of the buildings required for demolition identified in the ES between Mantle's Wood and Frith Hill (including those immediately accessed from Frith Hill such as the Weights and Measures Gym) will now be demolished under the Chiltern tunnel extension.
- 7.1.3 The depth of the cutting has been designed to ensure that the associated cutting slopes would avoid land take from the Jenkin's Wood area of ancient woodland, lying adjacent to the tunnel portal.
- 7.1.4 Permanent access to the tunnel portal and associated portal buildings would be accessed off Frith Hill at the same location as in the Proposed Scheme for the green tunnel portal.

8 Traffic Movements

- 8.1.1 As noted above, the proposed Chiltern Tunnel extension would remove construction lorries from most local roads in South Heath and Hyde Heath. Construction lorries would be removed from Hyde Heath Road, King's Lane, Hyde Lane, Frith Hill and Potter Row with reduced construction traffic on the B485 Chesham Road for the vent shaft construction only.
- 8.1.2 The need to provide diversions around South Heath and a new roundabout junction for Chesham Road and King's Lane would be avoided.
- 8.1.3 A temporary junction would be provided off the A413 Great Missenden roundabout with the A4128 to enable access up to the trace for construction works west of the tunnel portal. Mass haul movement of excavated material from the South Heath cutting would be both along the trace (similar to AP2 proposals) but also using the temporary access road to the A413 for some material removal. This allows greater flexibility in the management of material and the flow of traffic in this area and reduces the traffic effects at Rocky Lane.

9 Costs

- 9.1.1 The cost estimate for the Extended Chiltern tunnel has been reviewed with a current revised cost estimate of £46.54m, inclusive of land cost savings, now considered to represent the net additional cost compared to the Proposed Scheme.

10 Conclusions

- 10.1.1 The deeper cutting adjacent to Potter Row associated with the longer bored tunnel and the associated enhanced (6m above rail) trackside noise fence mitigation along the eastern side of the railway would achieve a notable reductions in noise. The residual adverse noise effects would no longer be considered significant when assessed on a community basis.
- 10.1.2 The cutting alongside Potter Row and associated landscape works would be similar to those in the Proposed Scheme and no new significant impacts would be introduced in this area, with the exception of a temporary visual effect on Bury Field House from the north portal access road satellite compound during construction. In particular the wider cutting would avoid impact on the Jenkin's Wood ancient woodland.

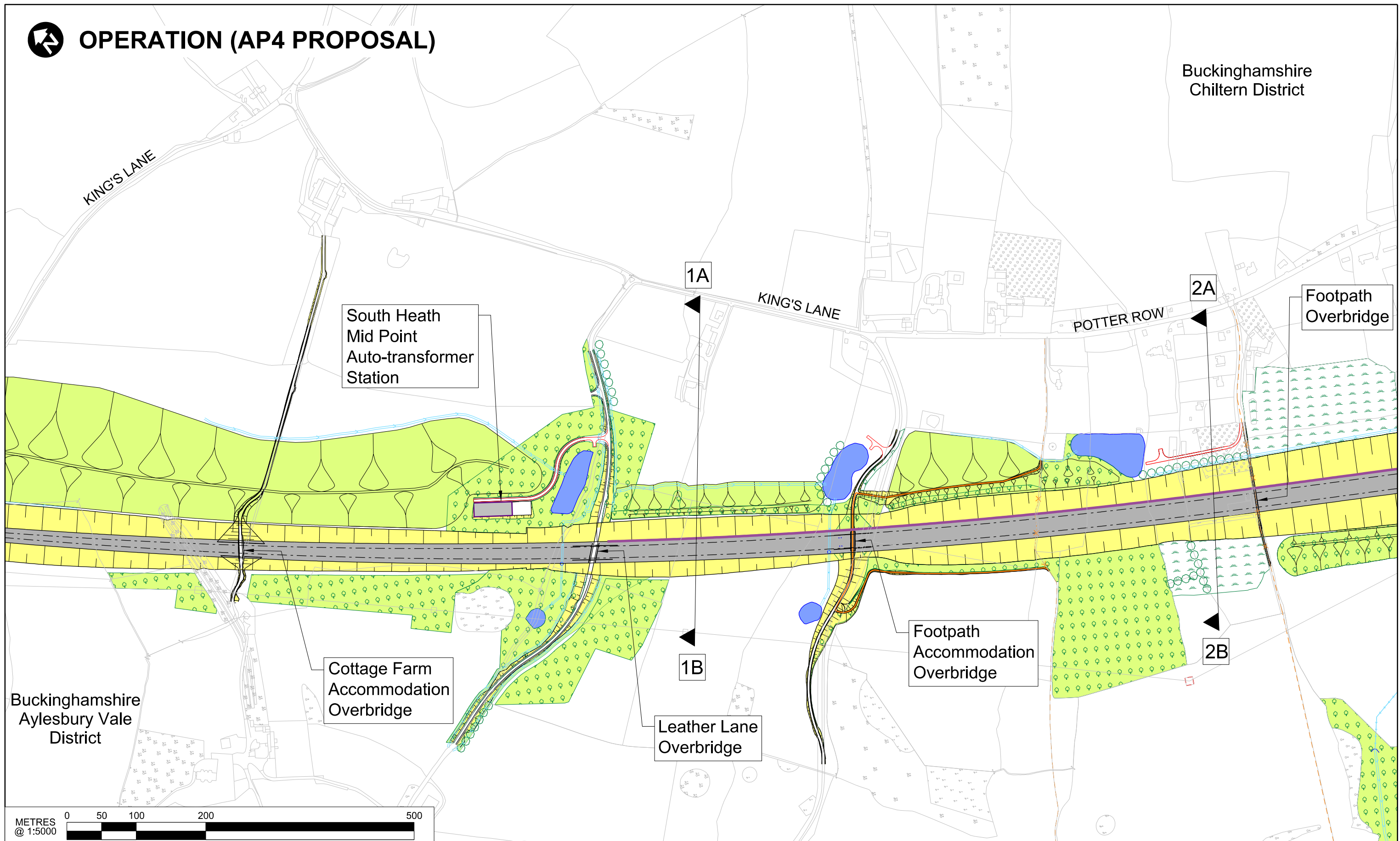
Appendix 1

Plan & profile

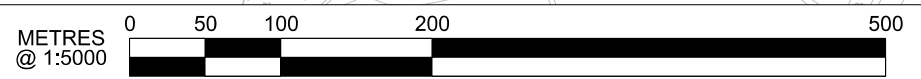
Typical cross-sections

OPERATION (AP4 PROPOSAL)

Buckinghamshire
Chiltern District



Buckinghamshire
Aylesbury Vale
District



P00.1					

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- Legends/Notes:
- Depot, station, headhouse or portal building
 - Tunnel portal
 - Balancing pond
 - Land drainage area
 - Replacement floodplain storage
 - Landscape mitigation planting (scrub / woodland)
 - Grassed areas
 - Engineering earthworks
 - Landscape earthworks
 - Rail alignment formation
 - Grassland habitat creation
 - Tunnels external extent
 - Rail alignment
 - Noise fence barrier
 - Ditches - new
 - Hedgerow habitat creation
 - HS2 Access road
 - Existing public right of way (PRoW)
 - New, diverted or realigned PRoW
 - Stopped-up PRoW
 - UT - Main utility works

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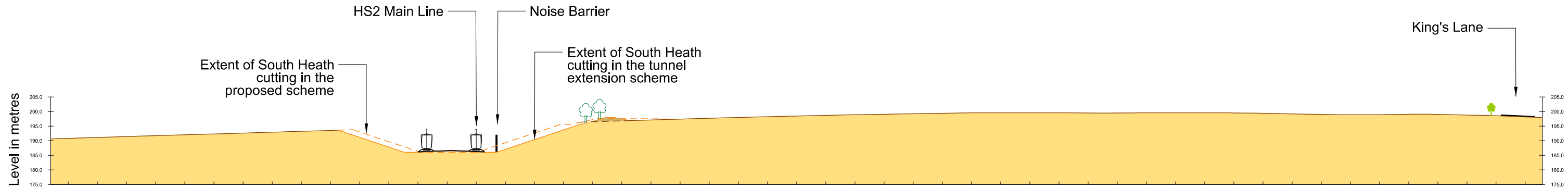
Creator/Originator
Atkins

Zone	Country South	
Design Stage	DESIGN-FOR-PETITION	
Drawing Title	Proposed Scheme. Cross Section Plan.	

Project/Contract	Country South Design		
Discipline/Function	Environmental		
Drawn	Checked	Approved	
IE			
Date	Scale	Size	
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Drawing No.	Rev.		
C222-ATK-EV-DPL-020-761907-PET000000	P00.1		

1B

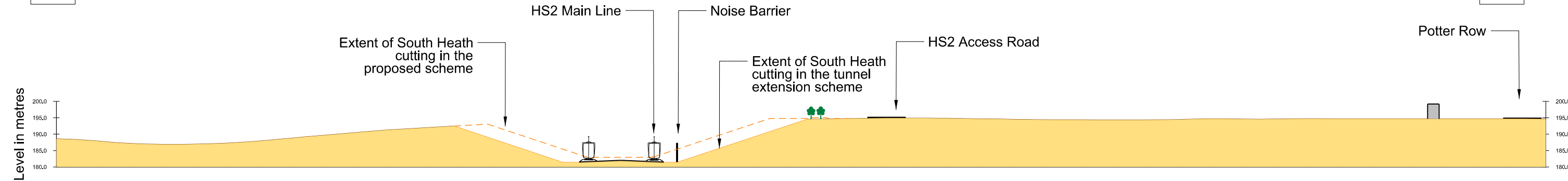
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Section 1A-1B (year 15)
Scale as shown

2B

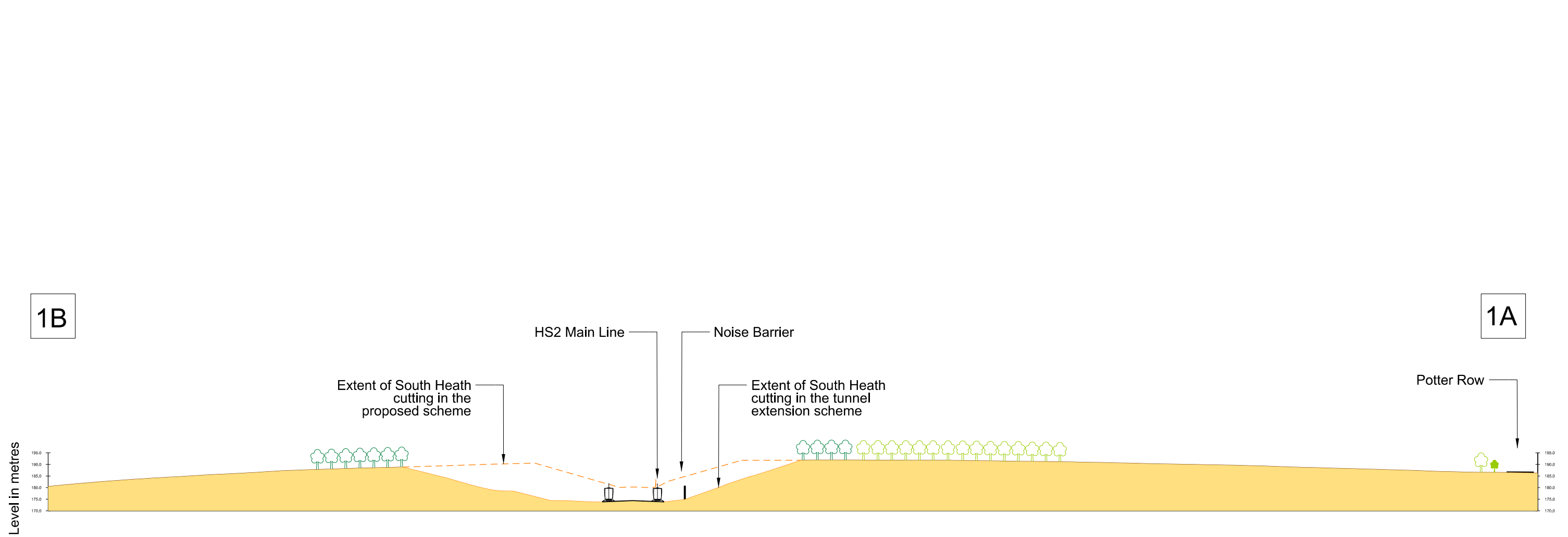
2A



Section 2A-2B (year 15)
Scale as shown

For Location Of Sections Refer To Drawing No. C222-ATK-EV-DPL-020-761907-PET000000

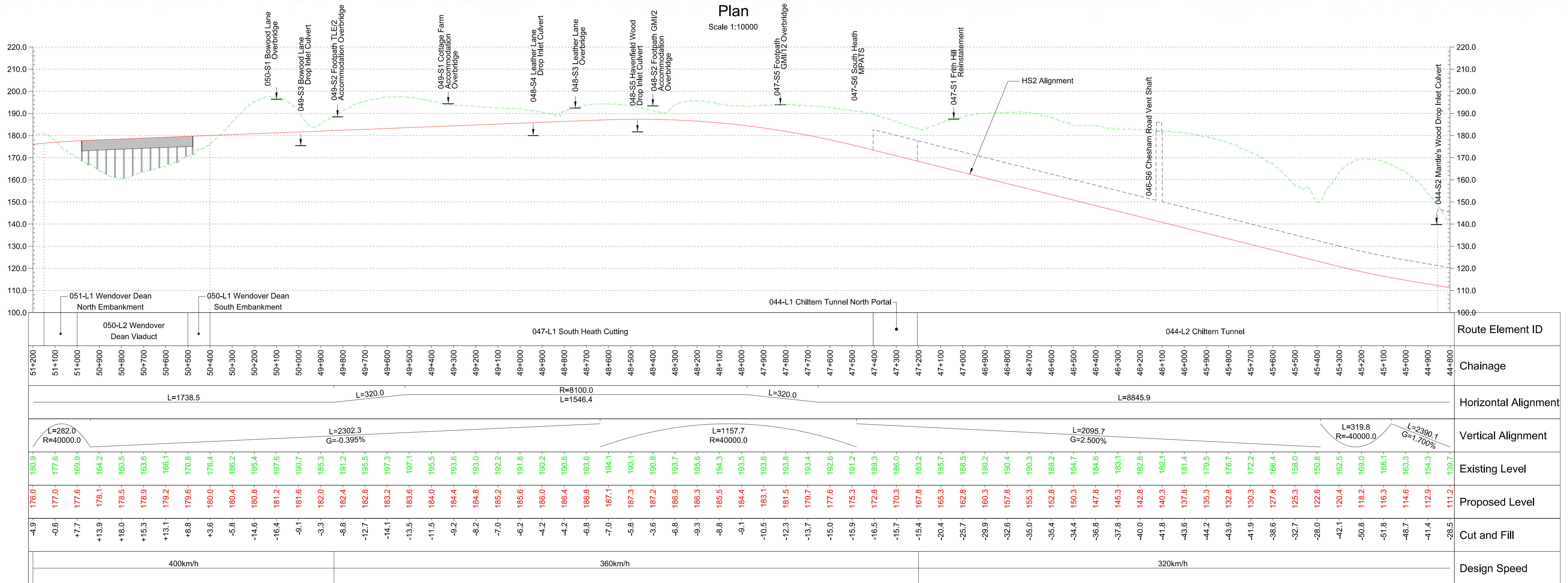
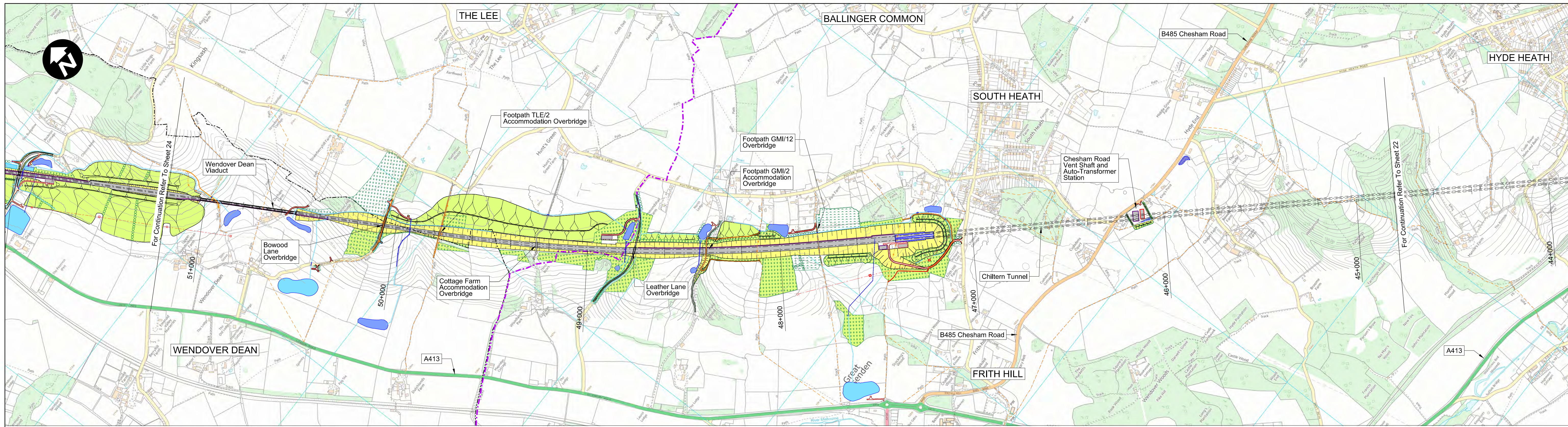
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	© Crown Copyright and database right 2014. All rights reserved. Ordnance Survey Licence number 100049190					Design Stage DESIGN-FOR-PETITION		Discipline/Function Environmental			
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	Scale with caution as distortion can occur.					Date 11/08/2015		Scale AS SHOWN		Size A1	
						Drawing No. C222-ATK-EV-DSE-020-761907-PET000000		Rev. P00.1			



Section 1A-1B (year 15)
Scale as shown

For Location Of Sections Refer To Drawing No. C222-ATK-EV-DPL-020-763906-PET000000

P00.1	-				HS2 accepts no responsibility for any circumstances which arise from the reproduction of this document after alteration, amendment or abbreviation or if it is issued in part or issued incompletely in any way.	Proposed mitigation tree planting Existing trees Existing ground Proposed hedgerow planting Existing hedgerow Filtered views Proposed HS2 embankment/landscape earthworks	 Registered in England Registration No. 06791686 Registered office: One Canada Square, London, E14 5AB	Zone	Country South		Project/Contract		Country South Design				
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	Scale with caution as distortion can occur.							Date	11/08/2015	Scale	AS SHOWN	Size	A1				
	P8120 (13)							Creator/Originator	Atkins		Drawing No.	C222-ATK-EV-DSE-020-763906-PET000000		Rev.	P00.1		



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- Depot, station, headhouse or portal building
- Tunnel portal
- Electricity substation
- Land drainage area
- Ecological mitigation pond
- Balancing pond
- Replacement floodplain storage or portal building
- Woodland habitat creation
- Wetland habitat creation
- Grassland habitat creation
- Landscape mitigation planting (scrub / woodland)
- Grassed areas
- Sustainable placement
- Public realm
- Engineering earthworks
- Landscape earthworks
- Rail alignment formation
- Returned to suitable development use
- County boundary
- Borough / District boundary
- Community forum boundary
- Watercourse diversion
- Existing watercourse
- Ditches - new
- Hedgerow habitat creation
- Main utility works
- Existing public right of way (PRoW)
- New, diverted or realigned PRoW
- Stopped-up PRoW
- Tunnels external extent
- Rail alignment
- HS2 Access road
- Noise fence barrier
- Chainage (e.g. 10+000)

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Creator/Originator
Atkins

Zone	Country South	Project/Contract	Country South Design
Design Stage	INTERIM PRELIMINARY DESIGN AP04	Discipline/Function	Civil
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		Scale	AS SHOWN
		Size	A1
		Drawing No.	C222-ATK-CV-DPP-020-000004-AP04
		Rev.	P00.1

Work-in-progress

Appendix 2

CT-05-033 Construction Phase SES₃ and AP₄ ES

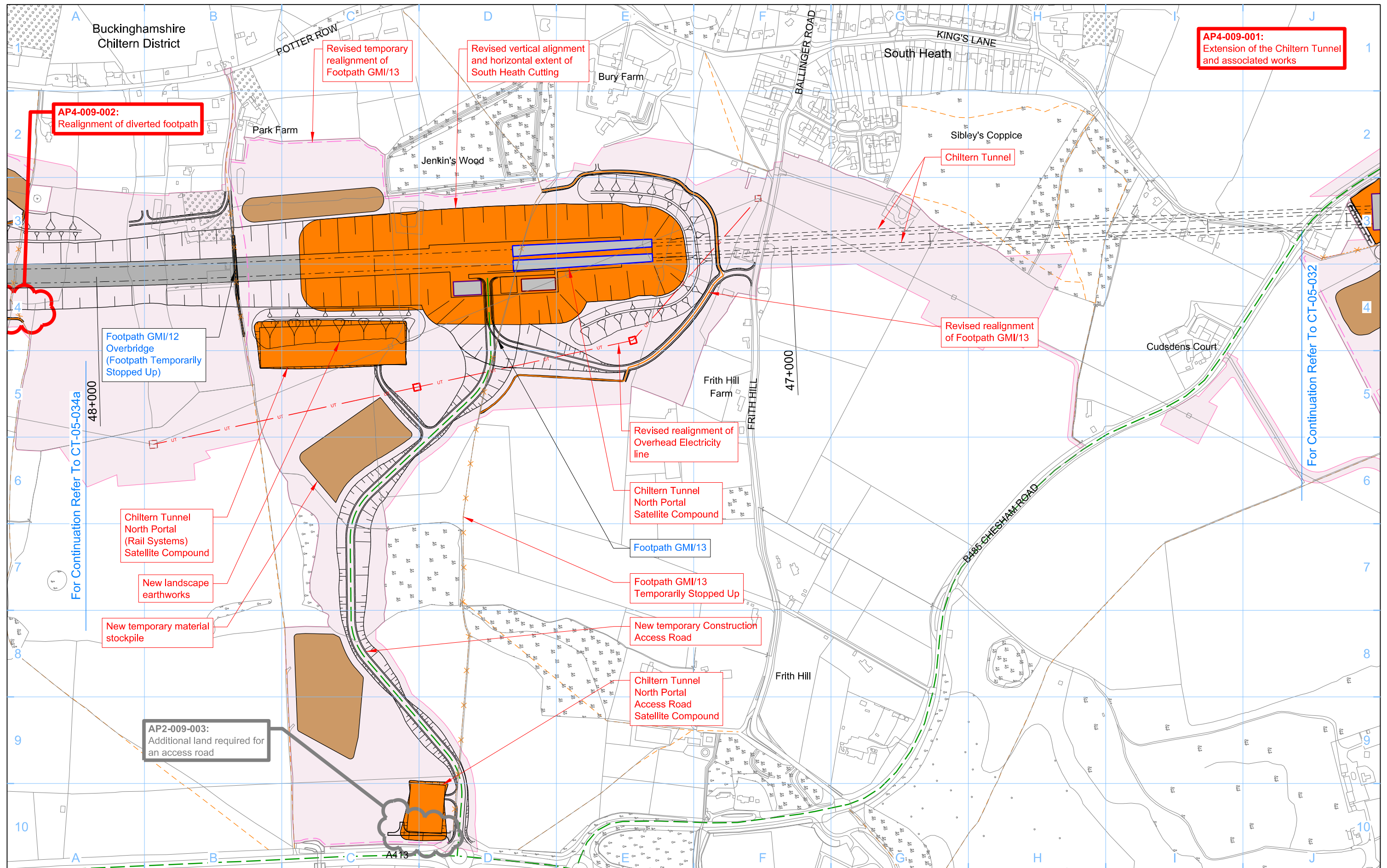
CT-05-034a Construction Phase SES₃ and AP₄ ES

CT-05-035 Construction Phase SES₃ and AP₄ ES

CT-06-033 Proposed Scheme SES₃ and AP₄ ES

CT-06-034a Proposed Scheme SES₃ and AP₄ ES

CT-06-035 Proposed Scheme SES₃ and AP₄ ES



AP4-009-001:
Extension of the Chiltern Tunnel and associated works

AP4-009-002:
Realignment of diverted footpath

Revised temporary realignment of Footpath GMI/13

Revised vertical alignment and horizontal extent of South Heath Cutting

Chiltern Tunnel

Revised realignment of Footpath GMI/13

Footpath GMI/12 Overbridge (Footpath Temporarily Stopped Up)

Revised realignment of Overhead Electricity line

Chiltern Tunnel North Portal Satellite Compound

Footpath GMI/13

Footpath GMI/13 Temporarily Stopped Up

New temporary Construction Access Road

Chiltern Tunnel North Portal Access Road Satellite Compound

Chiltern Tunnel North Portal (Rail Systems) Satellite Compound

New landscape earthworks

New temporary material stockpile

AP2-009-003:
Additional land required for an access road

Legend		New, diverted or realigned PRoW		Chainage (e.g. 10+000)	
	Depot, station, headhouse or portal building		Temporary replacement community facility		Stopped-up PRoW
	Tunnel portal		Community forum boundary		Temporary PRoW diversion / realignment
	Main construction compound		Existing watercourse		Temporary highway diversion / realignment
	Satellite construction compound		Tunnels external extent		Main utility works
	Temporary material stockpile		Construction traffic route		
	Rail alignment formation		Existing public right of way (PRoW)		
	Landscape earthworks				
	Engineering earthworks				
	County boundary				
	Borough / District boundary				
	Land potentially required during construction				

Map Number: **CT-05-033**

Map Name: **Construction Phase SES3 and AP4 ES**

Community Forum Area: **CFA09 Central Chilterns**

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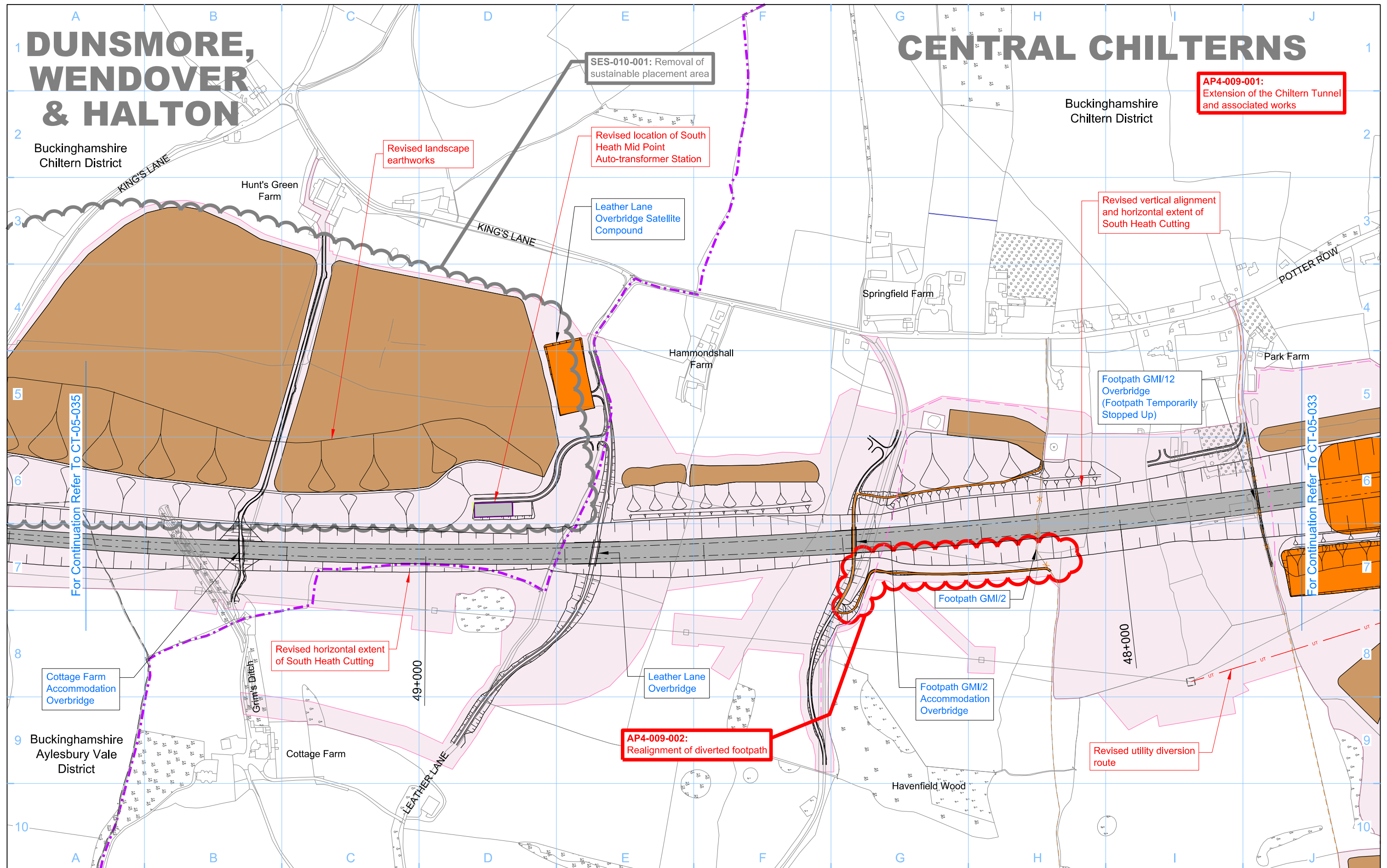
DUNSMORE, WENDOVER & HALTON

CENTRAL CHILTERN

Buckinghamshire Chiltern District

Buckinghamshire Chiltern District

AP4-009-001:
Extension of the Chiltern Tunnel and associated works

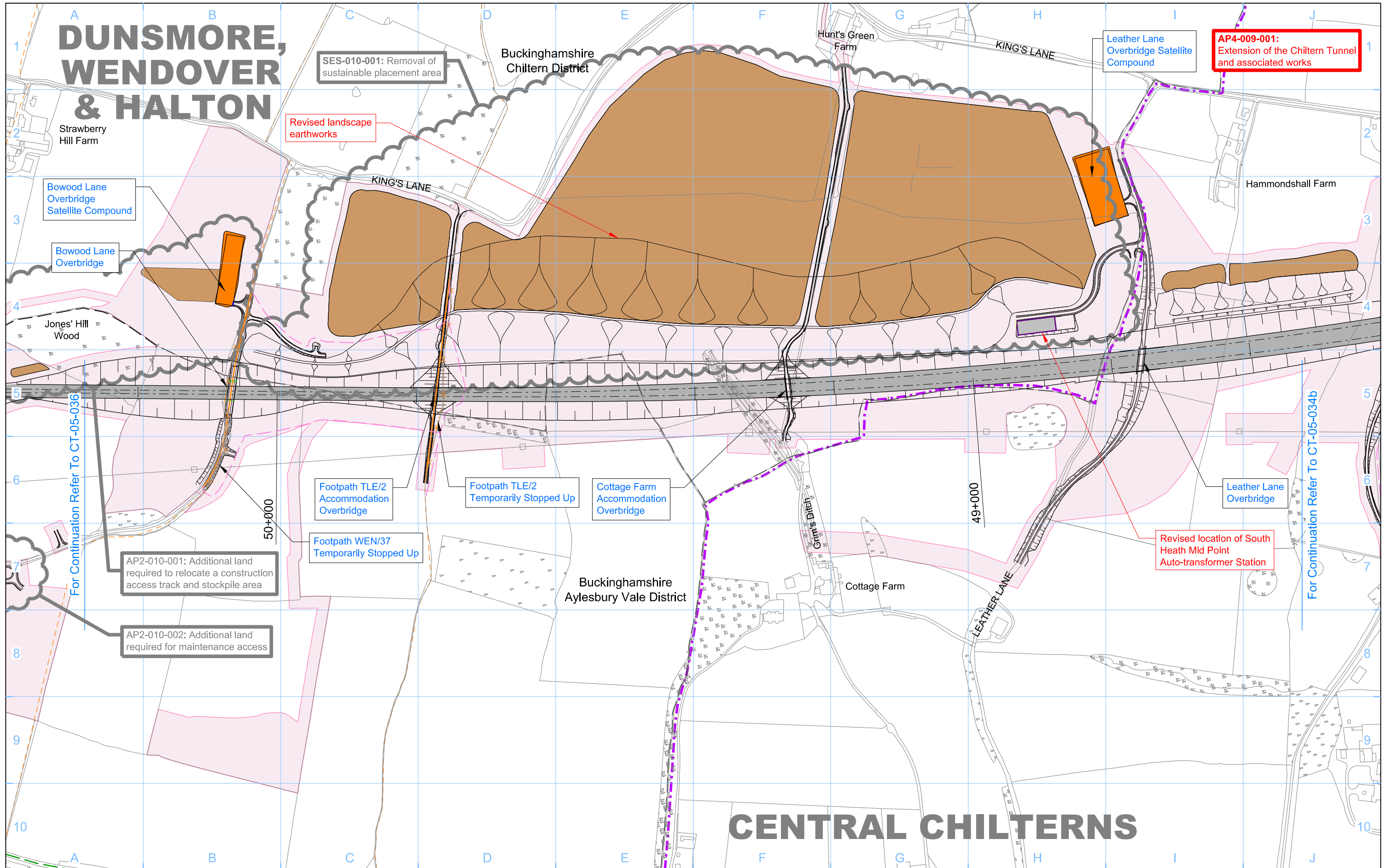


For Continuation Refer To CT-05-035

For Continuation Refer To CT-05-033

Legend <ul style="list-style-type: none"> Depot, station, headhouse or portal building Tunnel portal Main construction compound Satellite construction compound Temporary material stockpile Rail alignment formation Landscape earthworks Engineering earthworks County boundary Borough / District boundary Land potentially required during construction Temporary replacement community facility Community forum boundary Existing watercourse Tunnels external extent Construction traffic route Existing public right of way (PRoW) New, diverted or realigned PRoW Stopped-up PRoW Temporary PRoW diversion / realignment Temporary highway diversion / realignment Main utility works 		<ul style="list-style-type: none"> Chainage (e.g. 10+000) Rail alignment 	<p>Map Number CT-05-034a</p> <p>Map Name Construction Phase SES3 and AP4 ES</p> <p>Community Forum Area CFA09 Central Chilterns</p>	<p>hs2</p> <p>Registered in England, Registration number 06791686 Registered office: One Canada Square, London, E14 5AB</p> <p>Scale at A3: 1:5,000</p> <p>© Crown copyright and database rights 2015, Ordnance Survey Licence Number 100049190.</p> <p>Doc Number: C222-ATK-EV-DPL-020-050907-AP04</p>	<p>HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way.</p> <p>Scale at A3: 1:5,000</p> <p>0 50 100 150 200 250 Metres</p> <p>© Crown copyright and database rights 2015, Ordnance Survey Licence Number 100049190.</p> <p>Doc Number: C222-ATK-EV-DPL-020-050907-AP04</p> <p>P00.3 Date: HOC/10518/0018</p>
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DUNSMORE, WENDOVER & HALTON



SES-010-001: Removal of sustainable placement area

Revised landscape earthworks

AP4-009-001: Extension of the Chiltern Tunnel and associated works

Bowood Lane Overbridge Satellite Compound

Bowood Lane Overbridge

Jones' Hill Wood

Footpath TLE/2 Accommodation Overbridge

Footpath TLE/2 Temporarily Stopped Up

Cottage Farm Accommodation Overbridge

Footpath WEN/37 Temporarily Stopped Up

AP2-010-001: Additional land required to relocate a construction access track and stockpile area

AP2-010-002: Additional land required for maintenance access

Revised location of South Heath Mid Point Auto-transformer Station

Buckinghamshire Aylesbury Vale District

CENTRAL CHILTERN

Legend	
	Depot, station, headhouse or portal building
	Tunnel portal
	Main construction compound
	Satellite construction compound
	Temporary material stockpile
	Rail alignment formation
	Landscape earthworks
	Engineering earthworks
	County boundary
	Borough / District boundary
	Land potentially required during construction
	Temporary replacement community facility
	Community forum boundary
	Existing watercourse
	Tunnels external extent
	Construction traffic route
	Existing public right of way (PRoW)
	New, diverted or realigned PRoW
	Stopped-up PRoW
	Temporary PRoW diversion / realignment
	Temporary highway diversion / realignment
	UT - Main utility works

	Chainage (e.g. 10+000)
	Rail alignment

Map Number	CT-05-035
Map Name	Construction Phase SES3 and AP4 ES
Community Forum Area	CFA10 Dunsmore, Wendover and Halton

hs2

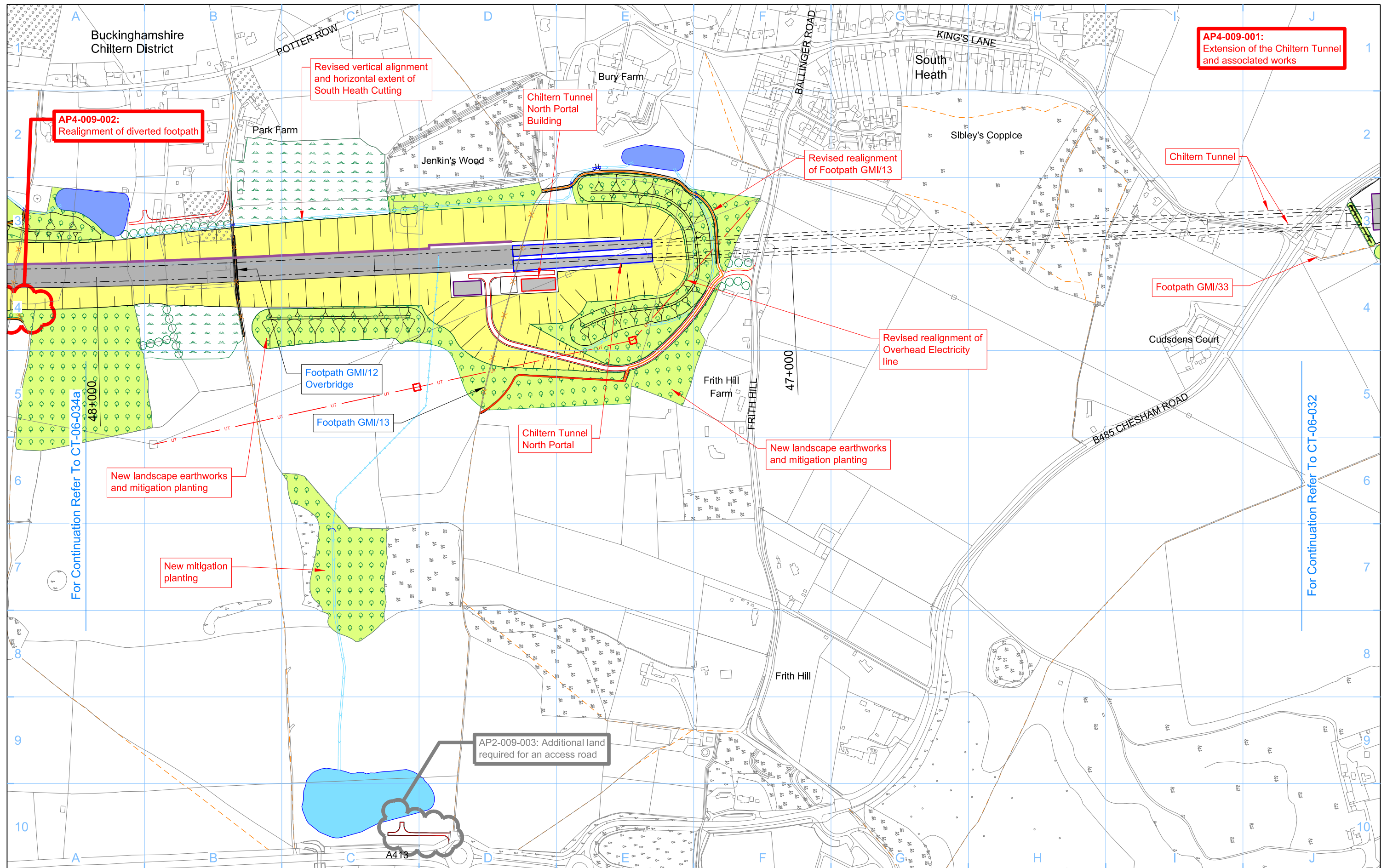
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AP4-009-001:
Extension of the Chiltern Tunnel
and associated works

AP4-009-002:
Realignment of diverted footpath

AP2-009-003: Additional land
required for an access road

Revised vertical alignment
and horizontal extent of
South Heath Cutting

Chiltern Tunnel
North Portal
Building

Revised realignment
of Footpath GMI/13

Revised realignment of
Overhead Electricity
line

New landscape earthworks
and mitigation planting

New landscape earthworks
and mitigation planting

New mitigation
planting

Footpath GMI/12
Overbridge

Footpath GMI/13

Chiltern Tunnel
North Portal

Frith Hill
Farm

Frith Hill

South
Heath

Sibley's Coppice

Cudsdens Court

B485 CHESHAM ROAD

FRITH HILL

POTTER ROW

KING'S LANE

BALLINGER ROAD

Park Farm

Jenkin's Wood

Bury Farm

A413

- Legend**
- Depot, station, headhouse or portal building
 - Tunnel portal
 - Electricity substation
 - Land drainage area
 - Ecological mitigation pond
 - Replacement floodplain storage
 - Woodland habitat creation
 - Wetland habitat creation
 - Grassland habitat creation
 - Landscape mitigation planting (scrub / woodland)
 - Grassed areas
 - Sustainable placement
 - Public realm/Replacement community facility
 - Engineering earthworks
 - Landscape earthworks
 - Rail alignment formation
 - Returned to suitable development use
 - County boundary
 - Borough / District boundary
 - Community forum boundary
 - Watercourse diversion
 - Existing watercourse
 - Ditches - new
 - Hedgerow habitat creation
 - Main utility works
 - Existing public right of way (PRoW)
 - New, diverted or realigned PRoW
 - Stopped-up PRoW
 - Tunnels external extent
 - Rail alignment
 - HS2 Access road
 - Noise fence barrier
 - Chainage (e.g. 10+000)

Map Number
CT-06-033

Map Name
**Proposed Scheme
SES3 and AP4 ES**

Community Forum Area
CFA09
Central Chilterns

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0 50 100 150 200 250
Metres

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HOC/10518/0020

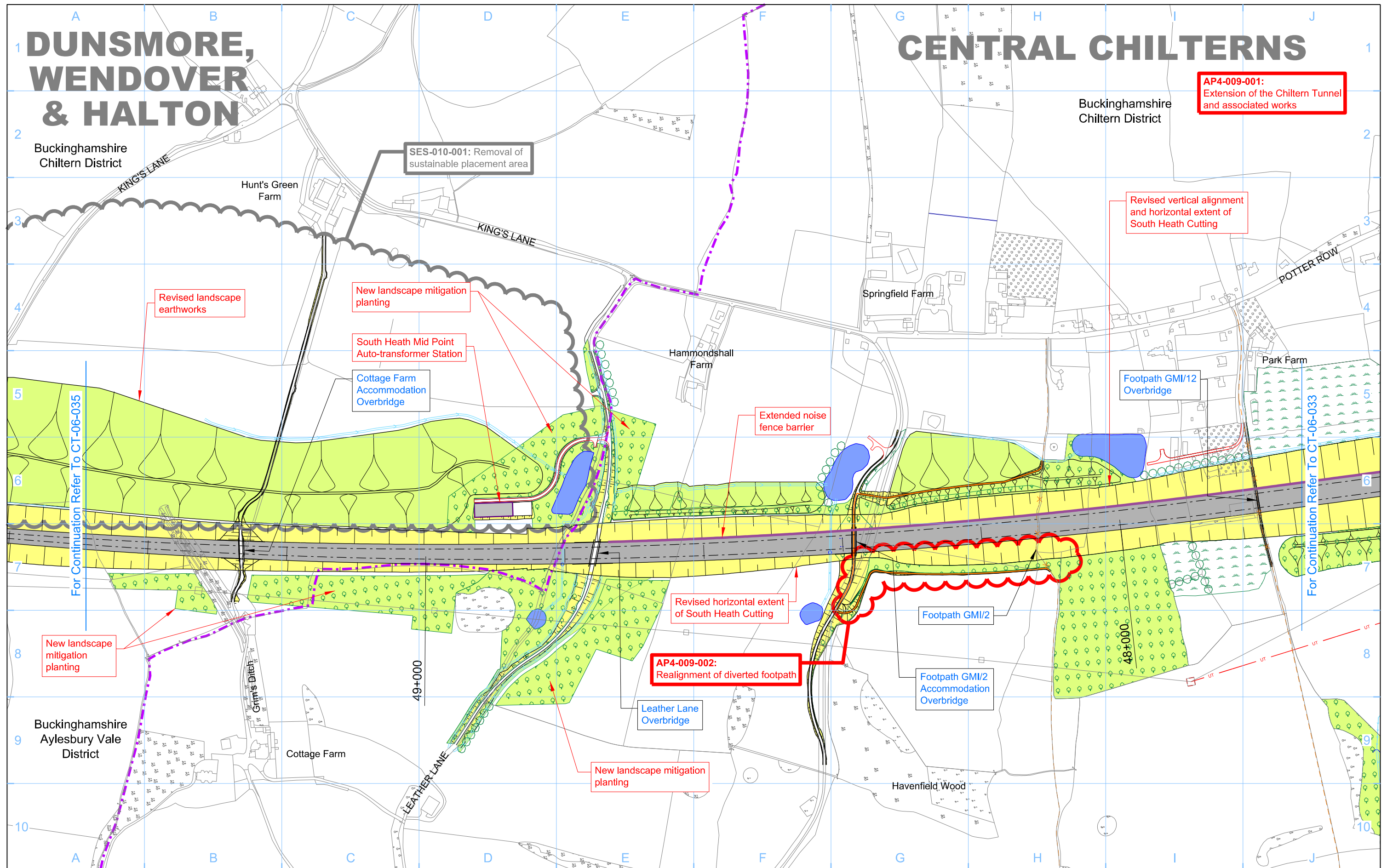
DUNSMORE, WENDOVER & HALTON

CENTRAL CHILTERN

Buckinghamshire Chiltern District

Buckinghamshire Chiltern District

AP4-009-001:
Extension of the Chiltern Tunnel and associated works



For Continuation Refer To CT-06-035

For Continuation Refer To CT-06-033

Buckinghamshire Aylesbury Vale District

Legend	
	Depot, station, headhouse or portal building
	Tunnel portal
	Electricity substation
	Land drainage area
	Ecological mitigation pond
	Replacement floodplain storage
	Woodland habitat creation
	Wetland habitat creation
	Grassland habitat creation
	Landscape mitigation planting (scrub / woodland)
	Grassed areas
	Sustainable placement
	Public realm/Replacement community facility
	Engineering earthworks
	Landscape earthworks
	Rail alignment formation
	Returned to suitable development use
	County boundary
	Borough / District boundary
	Community forum boundary
	Watercourse diversion
	Existing watercourse
	Ditches - new
	Hedgerow habitat creation
	Main utility works
	Existing public right of way (PRoW)
	New, diverted or realigned PRoW
	Stopped-up PRoW
	Tunnels external extent
	Rail alignment
	HS2 Access road
	Noise fence barrier
	Chainage (e.g. 10+000)

Map Number: **CT-06-034a**

Map Name: **Proposed Scheme SES3 and AP4 ES**

Community Forum Area: **CFA09 Central Chilterns**

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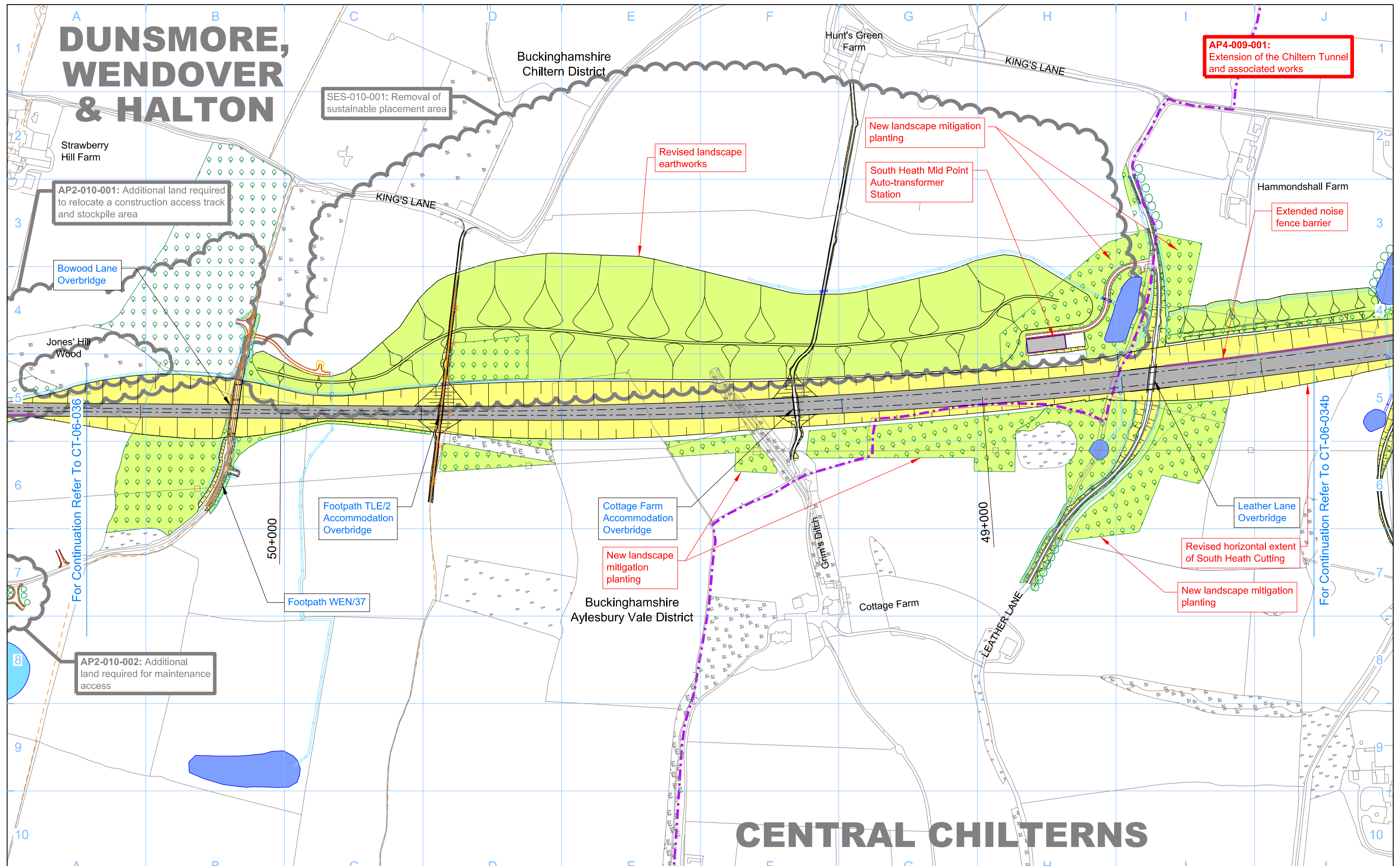
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Doc Number: C222-ATK-EV-DPL-020-060907-AP04

P00.3 Date: 17/04/15

HOC/10518/0021

DUNSMORE, WENDOVER & HALTON



AP4-009-001:
Extension of the Chiltern Tunnel and associated works

SES-010-001: Removal of sustainable placement area

AP2-010-001: Additional land required to relocate a construction access track and stockpile area

Bowood Lane Overbridge

Revised landscape earthworks

New landscape mitigation planting

South Heath Mid Point Auto-transformer Station

Extended noise fence barrier

Footpath TLE/2 Accommodation Overbridge

Cottage Farm Accommodation Overbridge

New landscape mitigation planting

49+000

Revised horizontal extent of South Heath Cutting

New landscape mitigation planting

Footpath WEN/37

50+000

AP2-010-002: Additional land required for maintenance access

Leather Lane Overbridge

For Continuation Refer To CT-06-034b

CENTRAL CHILTERNES

Legend <ul style="list-style-type: none"> Depot, station, headhouse or portal building Tunnel portal Electricity substation Land drainage area Ecological mitigation pond Replacement floodplain storage Woodland habitat creation Wetland habitat creation Grassland habitat creation Landscape mitigation planting (scrub / woodland) Grassed areas Sustainable placement Public realm/Replacement community facility Engineering earthworks Landscape earthworks Rail alignment formation Returned to suitable development use County boundary Borough / District boundary Community forum boundary Watercourse diversion Existing watercourse Ditches - new Hedgerow habitat creation Main utility works Existing public right of way (PRoW) New, diverted or realigned PRoW Stopped-up PRoW Tunnels external extent Rail alignment HS2 Access road Noise fence barrier Chainage (e.g. 10+000) 		Map Number CT-06-035 Map Name Proposed Scheme SES3 and AP4 ES Community Forum Area CFA10 Dunsmore, Wendover and Halton	HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way. Registered in England, Registration number 06791686 Registered office: One Canada Square, London, E14 5AB Scale at A3: 1:5,000 © Crown copyright and database rights 2015, Ordnance Survey Licence Number 100049190. Doc Number: C222-ATK-EV-DPL-020-061001-AP04 P00.3 Date: 17/09/15
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Appendix 3

Operational noise mitigation review – Chiltern tunnel extension - Potter Row

Operational noise mitigation review – Chiltern Tunnel – Potters Row

A3 Introduction

A3.1.1 The aim of this review is to provide analysis of the extent of potential operational noise mitigation measures that would remove the likely significant adverse effects identified in the main Environmental Statement (ES) at South Heath (Potter Row) and Hyde End.

A3.2 Main ES

Source mitigation assumptions

A3.2.2 HS2 trains will be specified to be quieter than the relevant current European Union specifications. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 300kph (186mph) with current pantograph designs, drawing on proven technology in use in East Asia. The track will be specified to reduce noise, as will the maintenance regime. Overall these measures would reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train operating on the new track. Further information is provided in main ES, Volume 5: Appendix SV-001-000.

Trackside mitigation

A3.2.3 The main ES scheme incorporates a bored tunnel which has a north portal at Mantle's Wood and a green tunnel wholly within CFA9 from just before Chesham Road to north of Frith Hill and adjacent to Potter Row.

A3.2.4 In the Hyde End area a noise fence barrier with a top level 3m above the top of the rail, which is acoustically absorbent on the railway side and which is located 5m from the outer rail on the south side of the route.

- A3.2.5 In the Potter Row area the Bill scheme includes a noise fence barrier alternately at the bottom and top of the cutting, either 3m high above the local ground level or, when the barrier is at the bottom of the cutting, 3m above the local rail level.
- A3.2.6 Taking account of all of the envisaged mitigation, the main ES identified the following likely operational noise significant effects in CFA9:
- The assessment identified one residential dwelling, Sheepcotts Cottage on Hyde Lane, Hyde End (reference OSV09-Do1) located close to the Proposed Scheme, where noise would exceed the daytime trigger threshold set in the Noise Insulation (Railways and other guided systems) Regulations 1996.
 - Hyde End, reference OSV09-Co1. A significant (on a community basis) operational airborne noise effect was identified around approximately 5 dwellings in the vicinity of Hyde Lane where the forecast increases in sound from the railway are likely to cause major adverse effect on the acoustic character of the area around the closest two properties. The effect on the acoustic character around the other three that are located further from the railway would be moderate.
 - South Heath, reference OSV09-Co2. A significant (on a community basis) operational airborne noise effect was identified around approximately 10¹ dwellings in the vicinity of Potter Row where the forecast increases in sound from the railway are likely to cause moderate adverse effect on the acoustic character of the area.
- A3.2.7 In addition to those properties in the community areas identified above, the main ES identifies 5 residential properties on Potter Row, represented by assessment location 375322, that are forecast to experience operational noise greater than the lowest observed adverse effect level but at which the adverse noise effects are not considered significant when assessed on a community basis, taking into account local context.
- A3.2.8 The main ES did not identify any operational groundborne noise or vibration effects in this community area.

¹ The actual number in the main ES was 16.

A3.3 **Post-Bill submission**

A3.3.1 Since submission of the Bill, the decision has been made to extend the Chiltern Tunnel north portal to South Heath. This will result in Sheepcotts Cottage no longer being likely to qualify for noise insulation and the significant effect (on a community basis) at Hyde End no longer being likely.

A3.3.2 This review consequently only considers potential improvements to the South Heath (Potter Row) area.

A3.4 **Analysis**

A3.4.1 In order to inform discussions regarding potential improvements to noise levels at Potter Row, the following enhanced mitigation measures have been considered:

- 3m above local ground level noise fence barrier placed at the top of the cutting, from the portal to Leather Lane (approximately 1.4km); and
- 6m above rail level noise fence barrier placed at the bottom of the cutting, extending from the portal to Leather Lane (approximately 1.4km).

A3.5 **Assessment**

A3.5.1 Assessment has been undertaken at locations representative of residential and non-residential properties in Potter Row forecast in the Bill scheme to experience sound levels greater than LOAEL. The results are presented in Table 1 for the Bill design, as reported in the main ES.

Table 1 – Operational airborne noise impacts, effects and significant effects in the South Heath area – Main ES

Assessment Location		Impact criteria										Significance criteria							Significant effect	
ID	Area represented	Proposed Scheme only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts represented	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact		Mitigation of effect
		Day ²	Night ³	Max ⁴	Day ¹	Night ²	Max ³	Day ¹	Night ²	Day ¹	Night ²									
355317	Potter Row, Great Missenden	51	42	64/66	46	43	68	52	45	6	2	A	1	R	T	-	-	-	-	OSV09-Co2
355352	Potter Row, Great Missenden	53	44	63/66	46	39	68	54	45	8	6	A	2	R	T	-	-	-	-	OSV09-Co2
375322	Potter Row, Great Missenden	49	40	67/69	44	39	46	50	42	6	3	A	5	R	T	-	-	-	-	⁵
375485	Potter Row, Great Missenden	54	44	67/70	50	45	51	55	48	5	3	A	3	R	T	-	-	-	-	OSV09-Co2
375495	Potter Row, Great Missenden	51	42	64/66	44	39	45	52	44	8	5	A	1	R	T	-	-	-	-	OSV09-Co2
375508	Potter Row, Great Missenden	49	40	64/66	46	36	47	51	41	5	5	A	3	R	T	-	-	-	-	OSV09-Co2

² Day - L_{pAeq,07:00-23:00}

³ Night - L_{pAeq,23:00-07:00}

⁴ Max - L_{pAFmax}. In the Proposed Scheme only column, two values are presented. The first is the value for the HS2 mitigated train and the second is the value for the TSI compliant train. For further information refer to main ES, Volume 5: Appendix SV-001-000.

⁵ The forecast adverse effects are not considered to be significant on a community basis (further information on methodology is provided in Volume 5: Appendix SV-001-000).

Assessment Location		Impact criteria										Significance criteria							Significant effect	
ID	Area represented	Proposed Scheme only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts represented	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact		Mitigation of effect
		Day ²	Night ³	Max ⁴	Day ¹	Night ²	Max ³	Day ¹	Night ²	Day ¹	Night ²									
355317	Potter Row, Great Missenden	51	42	64/66	46	43	68	52	45	6	2	A	1	R	T	-	-	-	-	OSV09-Co2
355352	Potter Row, Great Missenden	53	44	63/66	46	39	68	54	45	8	6	A	2	R	T	-	-	-	-	OSV09-Co2
375630	Potter Row, Great Missenden	53	44	65/67	44	39	46	53	45	9	6	A	1	R	T	-	-	-	-	OSV09-Co2
375648	Potter Row, Great Missenden	50	40	62/65	46	36	47	51	42	5	6	A	4	R	T	-	-	-	-	OSV09-Co2
700360	Potter Row, Great Missenden	51	41	64/67	44	39	46	52	43	7	4	A	1	R	T	-	-	-	-	OSV09-Co2

A3.5.2 The results for those properties presented in Table 1, with the noise barrier located at 3m above local ground at the top of the cutting are presented in Table 2. The change in the LOAEL and SOAEL contours with this mitigation compared to the main ES contours are presented in Figure 1.

Table 2 – Operational airborne noise impacts, effects and significant effects in the South Heath area – 3m noise fence barrier at the top of the cutting

Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	Proposed Scheme only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts represented	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day	Night ³	Max ⁴	Day ₂	Night ³	Max ⁴	Day ₂	Night ³	Day ₂	Night ³									
355317	Potter Row, Great Missenden	49	40	64/67	46	43	68	51	45	5	2	NA	1	R	T	-	-	-	-	5
355352	Potter Row, Great Missenden	51	42	63/66	46	39	68	52	44	6	5	A	2	R	T	-	-	-	-	5
375322	Potter Row, Great Missenden	43	35	59/61	44	39	46	46	40	2	1	NA	5	R	T	-	-	-	-	
375485	Potter Row, Great Missenden	51	42	65/67	50	45	51	54	47	4	2	A	3	R	T	-	-	-	-	5
375495	Potter Row, Great Missenden	49	40	61/64	44	39	45	50	42	6	3	A	1	R	T	-	-	-	-	5
375508	Potter Row, Great Missenden	47	37	59/62	46	36	47	49	40	3	4	NA	3	R	T	-	-	-	-	6
375630	Potter Row, Great Missenden	51	42	63/65	44	39	46	52	44	8	5	A	1	R	T	-	-	-	-	5
375648	Potter Row, Great Missenden	48	38	59/62	46	36	47	50	40	4	4	NA	4	R	T	-	-	-	-	5
700360	Potter Row, Great Missenden	48	39	62/65	44	39	46	50	42	6	3	NA	1	R	T	-	-	-	-	5

⁶ A change of 3dB or greater has been identified however, the assessment methodology only defines an impact where the absolute sound level from the Proposed Scheme is greater or equal to 50 dB L_{pAeq, 23:00-07:00} during the daytime or 40 dB L_{pAeq, 07:00-23:00} at night. At the receptor denoted the absolute level condition is not met and therefore no impact is identified.

A3.5.3 The results for those properties presented in Table 1, with the noise barrier located at 6m above rail level at the bottom of the cutting are presented in Table 3. The change in the LOAEL and SOAEL contours with this mitigation compared to the main ES contours are presented in Figure 2.

Table 3 – Operational airborne noise impacts, effects and significant effects in the South Heath area – 6m above rail barriers at the bottom of the cutting

Assessment Location		Impact criteria										Significance criteria								
ID	Area represented	Proposed Scheme only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts represented	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	Significant effect
		Day ²	Night ³	MaxE rror! Book mark not defin ed.	Day ²	Night ₃	Max ⁴	Day ²	Night ₃	Day ²	Night ₃									
355317	Potter Row, Great Missenden	49	39	61/64	46	43	68	51	45	5	2	NA	1	R	T	-	-	-	-	5
355352	Potter Row, Great Missenden	51	41	63/66	46	39	68	52	43	6	4	A	2	R	T	-	-	-	-	5
375322	Potter Row, Great Missenden	42	33	59/61	44	39	46	46	40	2	1	NA	5	R	T	-	-	-	-	
375485	Potter Row, Great Missenden	52	43	64/67	50	45	51	54	47	4	2	A	3	R	T	-	-	-	-	5
375495	Potter Row, Great Missenden	49	40	62/65	44	39	45	51	43	7	4	A	1	R	T	-	-	-	-	4

Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	Proposed Scheme only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts represented	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day ²	Night ³	MaxE rror! Book mark not defin ed.	Day ²	Night ₃	Max ⁴	Day ²	Night ₃	Day ²	Night ₃									
375508	Potter Row, Great Missenden	47	38	59/62	46	36	47	50	40	4	4	NA	3	R	T	-	-	-	-	5
375630	Potter Row, Great Missenden	51	42	64/66	44	39	46	52	44	8	5	A	1	R	T	-	-	-	-	5
375648	Potter Row, Great Missenden	48	39	60/63	46	36	47	50	40	4	4	NA	4	R	T	-	-	-	-	5
700360	Potter Row, Great Missenden	49	40	61/64	44	39	46	50	42	6	3	A	1	R	T	-	-	-	-	4

A3.5.4 A 3m noise fence barrier at the top of the cutting is forecast to result in 3 moderate and 4 minor noise impacts. When considering on a community basis the number and grouping of adversely effected dwellings, the magnitude of the adverse effects identified (based on noise change) and the overall level of noise exposure once the scheme is in operation, the effects identified are not considered to be significant. Therefore the mitigation would remove the likely significant effect at South Heath (reference OSV09-Co2) identified in the main ES.

A3.5.5 A 6m noise fence barrier at the bottom of the cutting is forecast to result in a 3 moderate and 5 minor noise impacts. When considering on a community basis the number and grouping of adversely effected dwellings, the magnitude of the adverse effects identified (based on noise change) and the overall level of noise exposure once the scheme is in operation, the effects identified are not considered significant. Therefore the mitigation would remove the likely significant effect at South Heath (reference OSV09-Co2) identified in the main ES.

A3.6 **Groundborne noise and vibration assessment**

A3.6.1 A number of properties, in the Hyde End area and above the previous green tunnel, to be demolished as part of the main ES will now be retained. Predictions of groundborne noise and vibration have been made to these properties. The assessment indicates that none of these retained properties will be subject to a groundborne noise or vibration impact and therefore no likely significant effects are identified.

A3 Summary

A3.1.1 The extension to the Chiltern Tunnel will remove the likely noise insulation qualifier at Sheepcotts Cottage and the likely community significant effect at Hyde End from the environmental assessment.

A3.1.2 The provision of either a 3m noise fence barrier at the top of the cutting, or a 6m noise fence barrier at the bottom of the cutting is forecast to remove the likely significant effect identified in the main ES at South Heath.

A3.1.3 The assessment indicates that none of the properties which were to be demolished but will now be retained, are not likely to experience a ground-borne noise or vibration impact.

Figure 2 – Operational airborne noise impacts, effects and significant effects in the South Heath area – 6m above rail barriers at the bottom of the cutting

