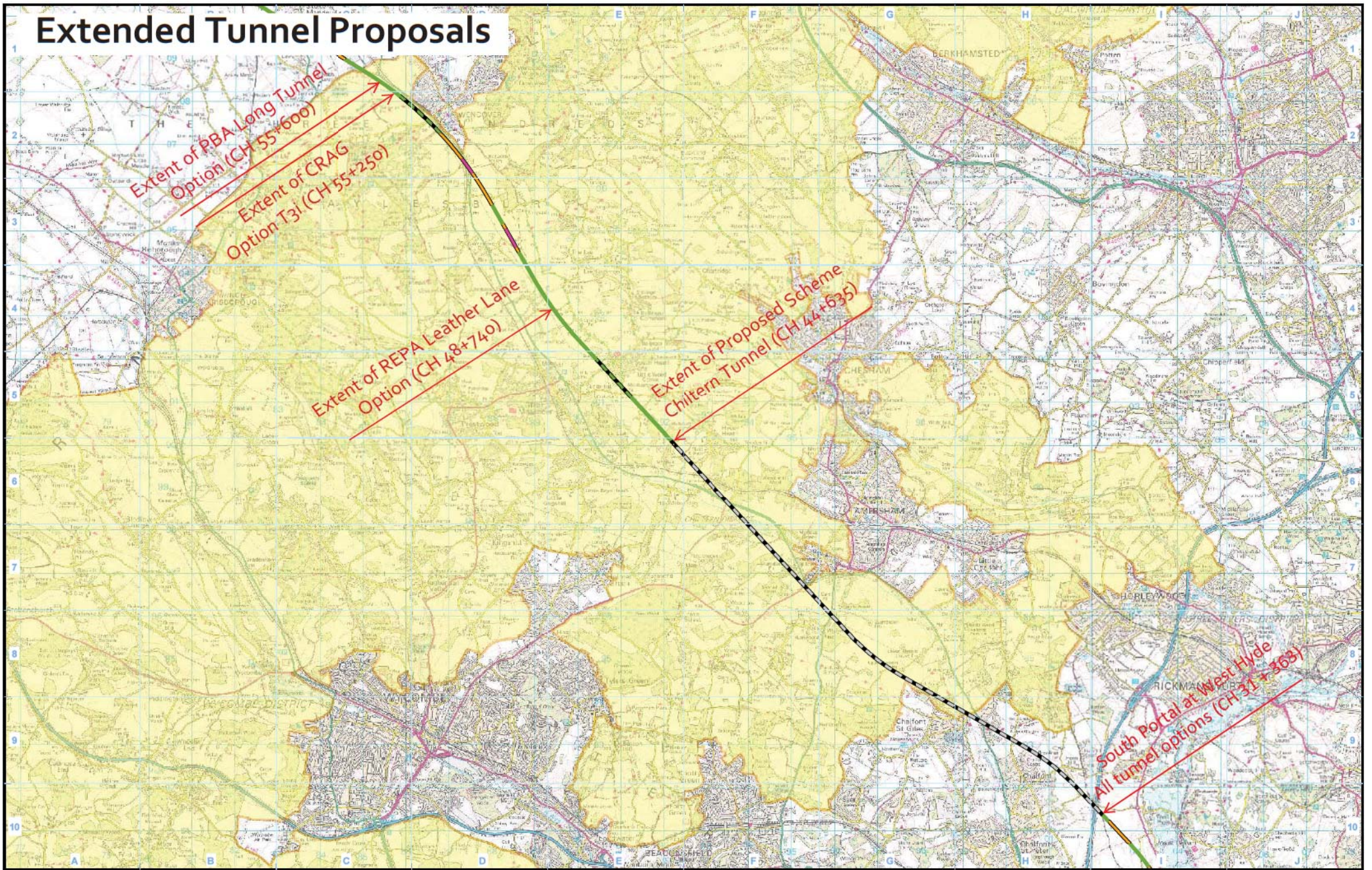


## EXHIBIT LIST

Page 1 of 70

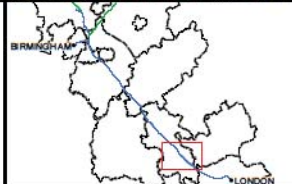
No	Exhibit Name	Page
1	<a href="#"><u>P7543 Map showing the extended tunnel proposals</u></a>	2
2	<a href="#"><u>P7544 Regional baseline map through the Chilterns AONB</u></a>	3
3	<a href="#"><u>P7545 Construction Plan (Hybrid Bill): Chalfont St Peter and Chalfont St Giles</u></a>	4
4	<a href="#"><u>P7546 Construction Plan (AP2): Amersham and Little Missenden</u></a>	5
5	<a href="#"><u>P7547 Construction Plan (AP2): South Heath and Wendover Dean Viaduct</u></a>	6
6	<a href="#"><u>P7548 Construction Plan (AP2): Wendover Green and Stoke Mandeville</u></a>	7
7	<a href="#"><u>P7549 Operation Plan (Hybrid Bill): Chalfont St Peter and Chalfont St Giles</u></a>	8
8	<a href="#"><u>P7550 Operation Plan (AP2): Amersham and Little Missenden</u></a>	9
9	<a href="#"><u>P7551 Operation Plan (AP2): South Heath and Wendover Dean Viaduct</u></a>	10
10	<a href="#"><u>P7552 Operation Plan (AP2): Wendover Green and Stoke Mandeville</u></a>	11
11	<a href="#"><u>P7553 Construction Plan for Hybrid Bill Scheme</u></a>	12 – 13
12	<a href="#"><u>P7554 Chiltern Long Tunnel Option</u></a>	14 – 15
13	<a href="#"><u>P7555 CRAG Tunnel Option</u></a>	16 – 17
14	<a href="#"><u>P7556 REPA Tunnel Option</u></a>	18 – 19
15	<a href="#"><u>P7557 Presentation on Bill scheme v Chiltern Long Tunnel</u></a>	20 – 32
16	<a href="#"><u>P7558 Presentation on Bill Scheme v CRAG</u></a>	33 – 45
17	<a href="#"><u>P7559 Presentation on Bill Scheme v REPA</u></a>	46 – 58
18	<a href="#"><u>P7560 Cost Comparison table</u></a>	59
19	<a href="#"><u>P7561 Presentation on alignment through the AONB - potential constraints by location</u></a>	60 – 66
20	<a href="#"><u>P7562 Presentation on intervention gaps in Chilterns</u></a>	67 – 69
21	<a href="#"><u>P7563 CRAG Option – excavated material volume and removal</u></a>	70

# Extended Tunnel Proposals



## Legend

- |   |               |   |
|---|---------------|---|
| Phase One hybrid Bill alignment November 2013 | Green Tunnel  | Chilterns Area of Outstanding Natural Beauty (AONB) |
| Bored Tunnel                                  | Tunnel Portal | Viaduct   |
| Cutting                                       | Embankment    |   |



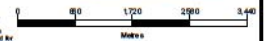
High Speed Two  
Country South Petitioner Location Plan  
Reference Drawing  
Chiltern Tunnel Petitioners



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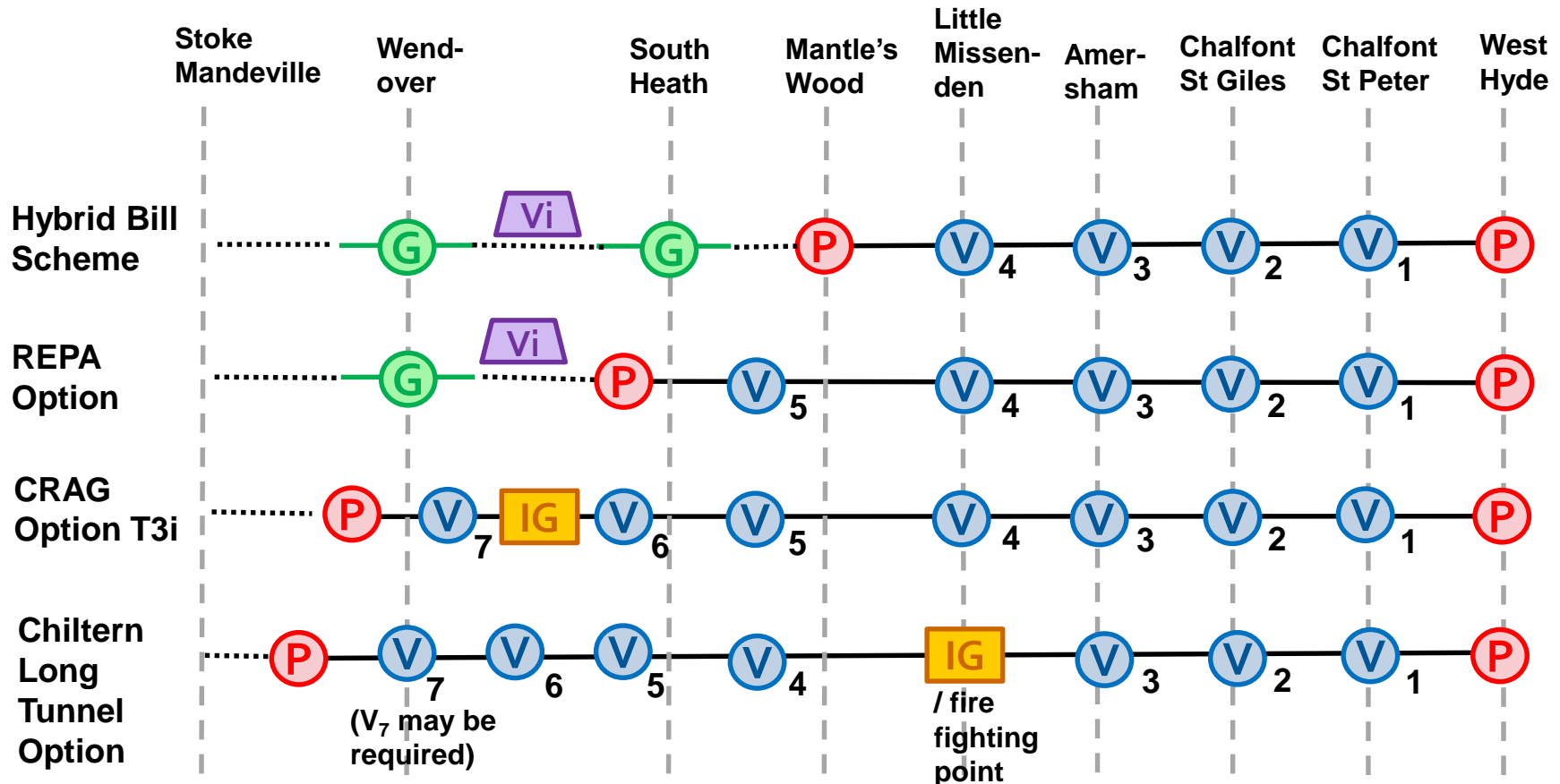
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P7543

HOC/0518/0003

Note: Schematic illustration not drawn to scale

# Tunnel Extension Options – Schematic Overview

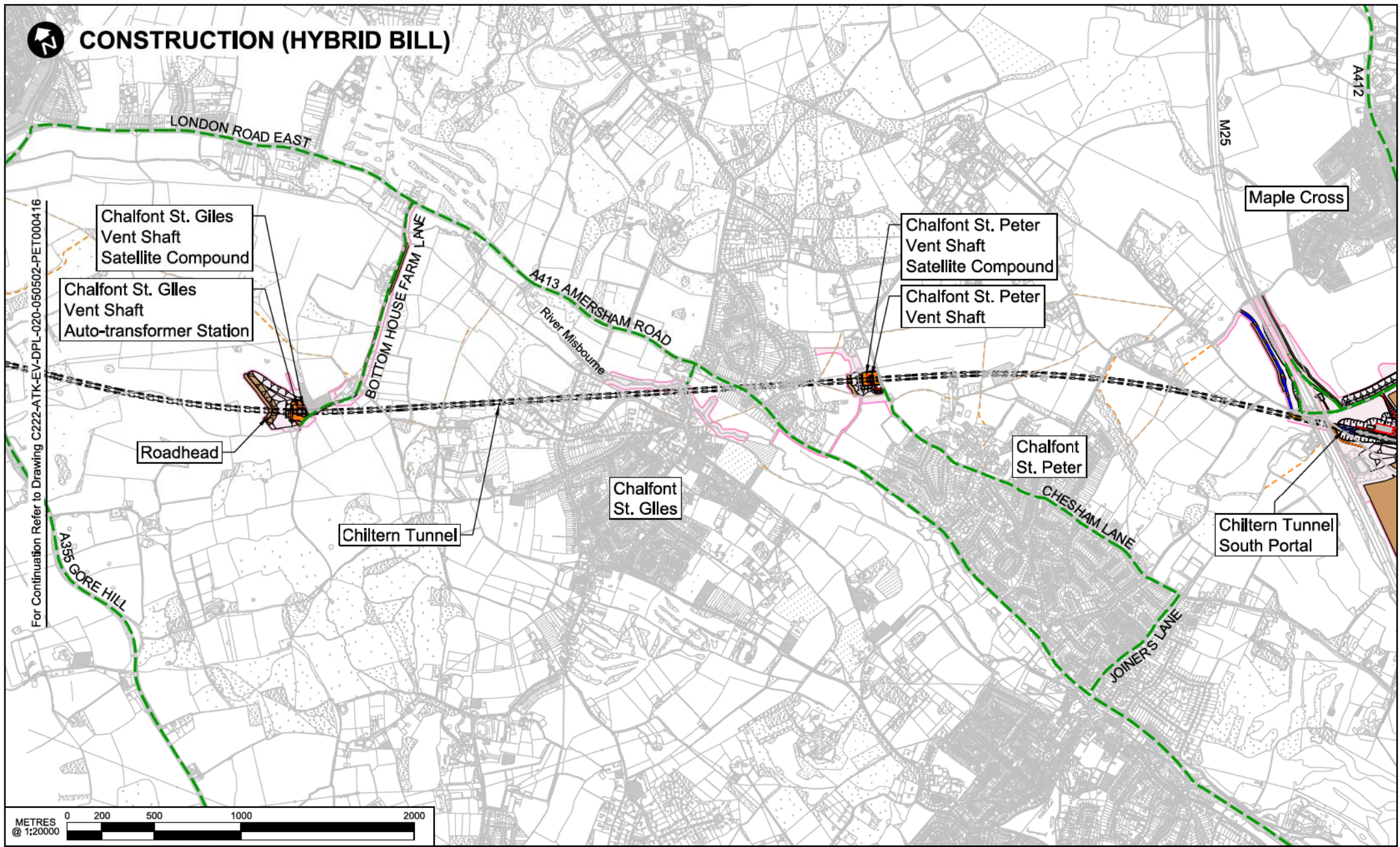


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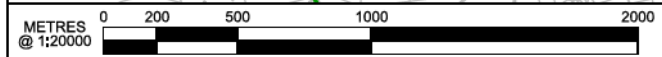
- Bored Tunnel
- Green Tunnel
- ⊙ Tunnel Portal
- ⊙ Tunnel Vent Shaft
- ⊠ Tunnel Intervention Gap
- ⋯ Surface Route
- ⊞ Viaduct(s)



# CONSTRUCTION (HYBRID BILL)



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Satellite construction compound	Temporary site access route / haul route
Main construction compound	Construction traffic route
Tunnel portal	Existing public right of way (PRoW)
Rail alignment formation	New, diverted or realigned PRoW
Tunnels external extent	Stopped-up PRoW
Rail alignment	Temporary PRoW
Engineering earthworks	Temporary material stockpile
Landscape earthworks	
Land potentially required during construction	

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Atkins

Zone	Country South
Design Stage	DESIGN-FOR-PETITION
Drawing Title	Chiltern District Council Petition 0416 Construction Phase - Sheet 1 of 3

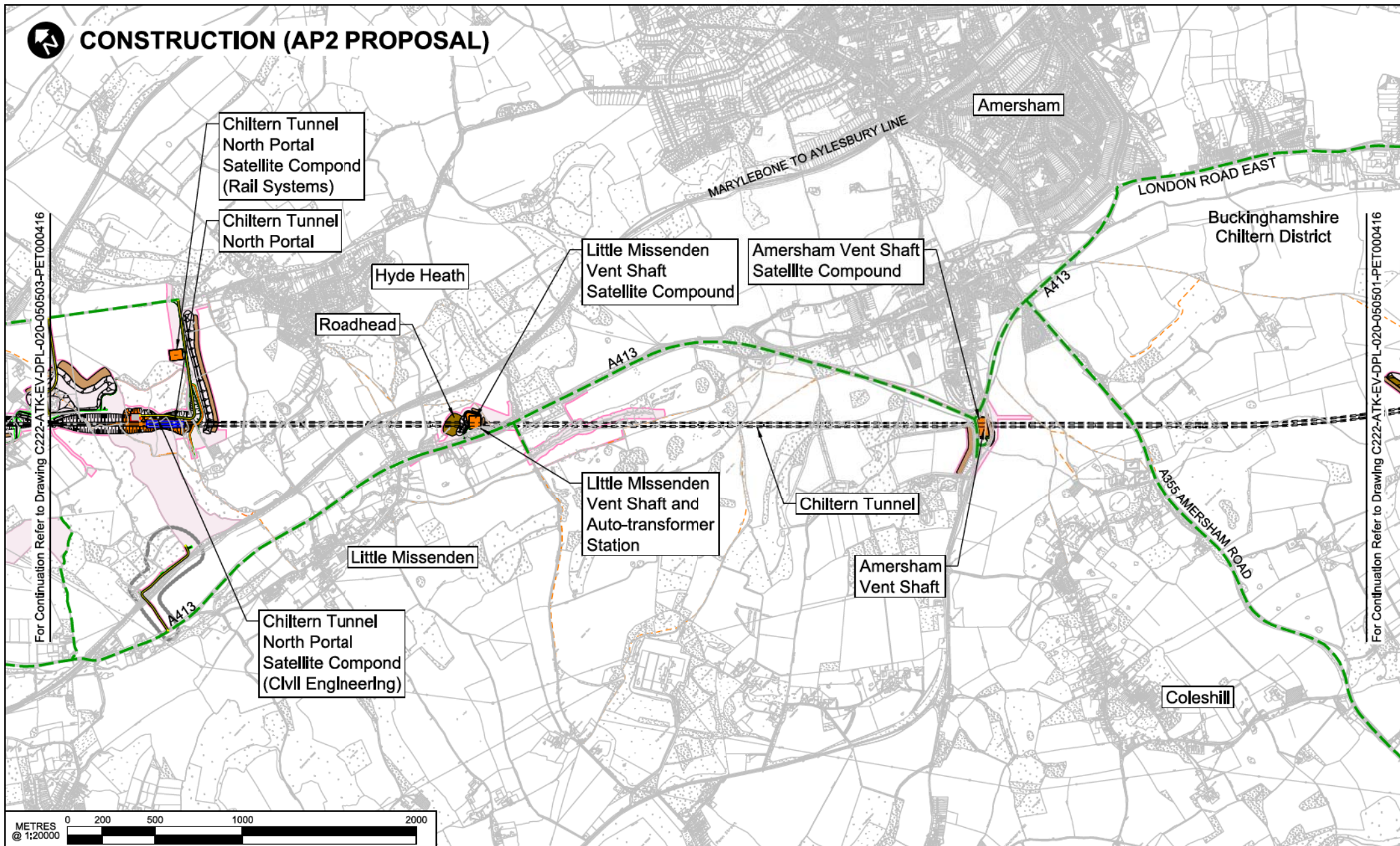
Project/Contract	Country South Design		
Discipline/Function	Environmental		
Drawn	TB	Checked	Approved
Date	03/07/2015	Scale	AS SHOWN
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P7545

HOC/10518/0005

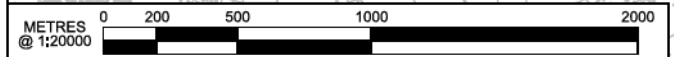


# CONSTRUCTION (AP2 PROPOSAL)



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Legend/Notes	
	Satellite construction compound
	Main construction compound
	Tunnel portal
	Rail alignment formation
	Tunnels external extent
	Rail alignment
	Engineering earthworks
	Landscape earthworks
	Land potentially required during construction
	Temporary site access route / haul route
	Construction traffic route
	Existing public right of way (PRoW)
	New, diverted or realigned PRoW
	Stopped-up PRoW
	Temporary PRoW
	Temporary material stockpile

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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Environmental
Drawing Title	Chiltern District Council Petition 0416	Drawn	TB
	Construction Phase - Sheet 2 of 4	Checked	Approved
		Date	03/07/2015
		Scale	AS SHOWN
		Sheet	A1
		Drawing No.	C222-ATK-E
		Rev.	

Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Environmental
Drawing Title	Chiltern District Council Petition 0416	Drawn	TB
	Construction Phase - Sheet 2 of 4	Checked	Approved
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		Sheet	A1
		Drawing No.	C222-ATK-E
		Rev.	

P7546

HOC/10518/0006



# CONSTRUCTION (AP2 PROPOSAL)

Buckinghamshire  
Chiltern District

Bowood Lane  
Overbridge  
Satellite Compound

Leather Lane  
Overbridge Satellite  
Compound

Chiltern Tunnel  
North Portal  
Satellite Compound  
(Rail Systems)

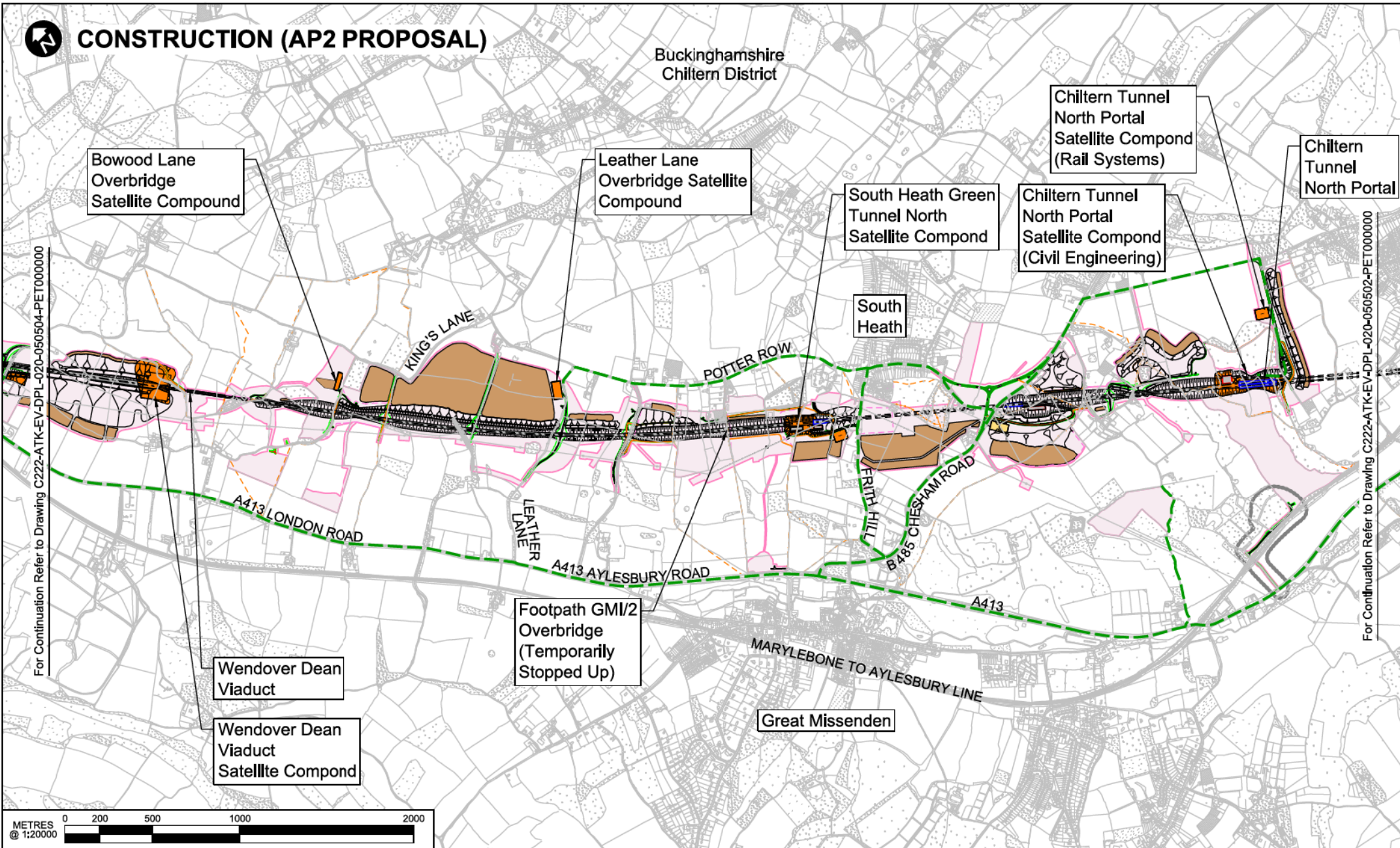
Chiltern  
Tunnel  
North Portal

South Heath Green  
Tunnel North  
Satellite Compound

Chiltern Tunnel  
North Portal  
Satellite Compound  
(Civil Engineering)

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For Continuation Refer to Drawing C222-ATK-EV-DPL-020-050502-PET000000

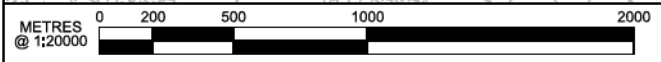


Wendover Dean  
Viaduct

Wendover Dean  
Viaduct  
Satellite Compound


Footpath GMI/2  
Overbridge  
(Temporarily  
Stopped Up)

Great Missenden



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Description	Drawn	Checked	Con App	HS2 App				

	Satellite construction compound		Temporary site access route / haul route
	Main construction compound		Construction traffic route
	Tunnel portal		Existing public right of way (PRoW)
	Rail alignment formation		New, diverted or realigned PRoW
	Tunnels external extent		Stopped-up PRoW
	Rail alignment		Temporary PRoW
	Engineering earthworks		Temporary material stockpile
	Landscape earthworks		
	Land potentially required during construction		



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Creator/Originator: Atkins

Zone	Country South		
Design Stage	DESIGN-FOR-PETITION		
Drawing Title	Chiltern District Council Petition 0416 Construction Phase - Sheet 3 of 4		

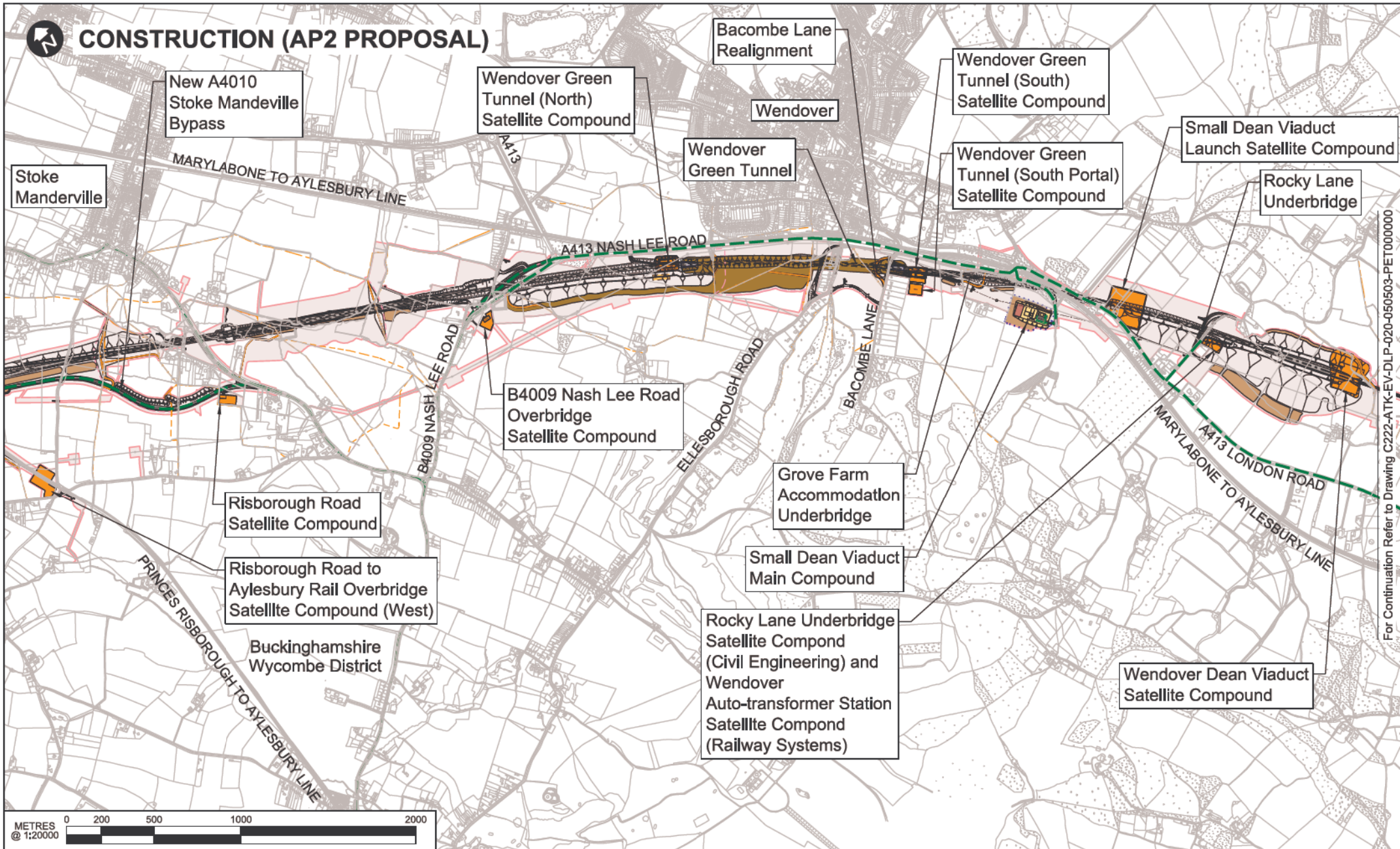
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Discipline/Function	Environmental		
Drawn	TB	Checked	Approved
Date	03/07/2015	Scale	AS SHOWN
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P7547

HOC/10518/0007



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- Legends/Notes**
- Satellite construction compound
  - Main construction compound
  - Tunnel portal
  - Rail alignment formation
  - Tunnels external extent
  - Rail alignment
  - Engineering earthworks
  - Landscape earthworks
  - Land potentially required during construction

- Temporary site access route / haul route
- Construction traffic route
- Existing public right of way (PRoW)
- New, diverted or realigned PRoW
- Stopped-up PRoW
- Temporary PRoW
- Temporary material stockpile

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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Environmental
Drawing Title	Chiltern District Council Petition 0416	Drawn	TB
	Construction Phase - Sheet 4 of 4	Checked	Approved
		Date	03/07/2015
		Scale	AS SHOWN
		Sheet	A1
		Drawing No.	C222-ATK-E
		Rev.	


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# OPERATION (HYBRID BILL)

Buckinghamshire  
Chiltern District

A412

M25

LONDON ROAD EAST

Maple Cross

Scottish &  
Southern Energy  
Substation

Chalfont St. Peter  
Vent Shaft

Chalfont St. Giles  
Vent Shaft  
Auto-transformer Station

A413 AMERSHAM ROAD

BOTTOM HOUSE FARM LANE

Chalfont  
St. Peter

River Misbourne

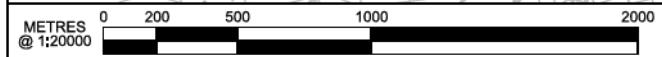
Chalfont  
St. Giles

CHESHAM LANE

Chiltern Tunnel

Chiltern Tunnel  
South Portal

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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

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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Environmental
Drawing Title	Chiltern District Council Petition 0416 Proposed Scheme - Sheet 1 of 4	Drawn	TB
		Checked	Approved
		Date	03/07/2015
		Scale	AS SHOWN
		Sheet	A3
		Drawing No.	C222-ATK-E
		Rev.	

Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Environmental
Drawing Title	Chiltern District Council Petition 0416 Proposed Scheme - Sheet 1 of 4	Drawn	TB
		Checked	Approved
		Date	03/07/2015
		Scale	AS SHOWN
		Sheet	A3
		Drawing No.	C222-ATK-E
		Rev.	

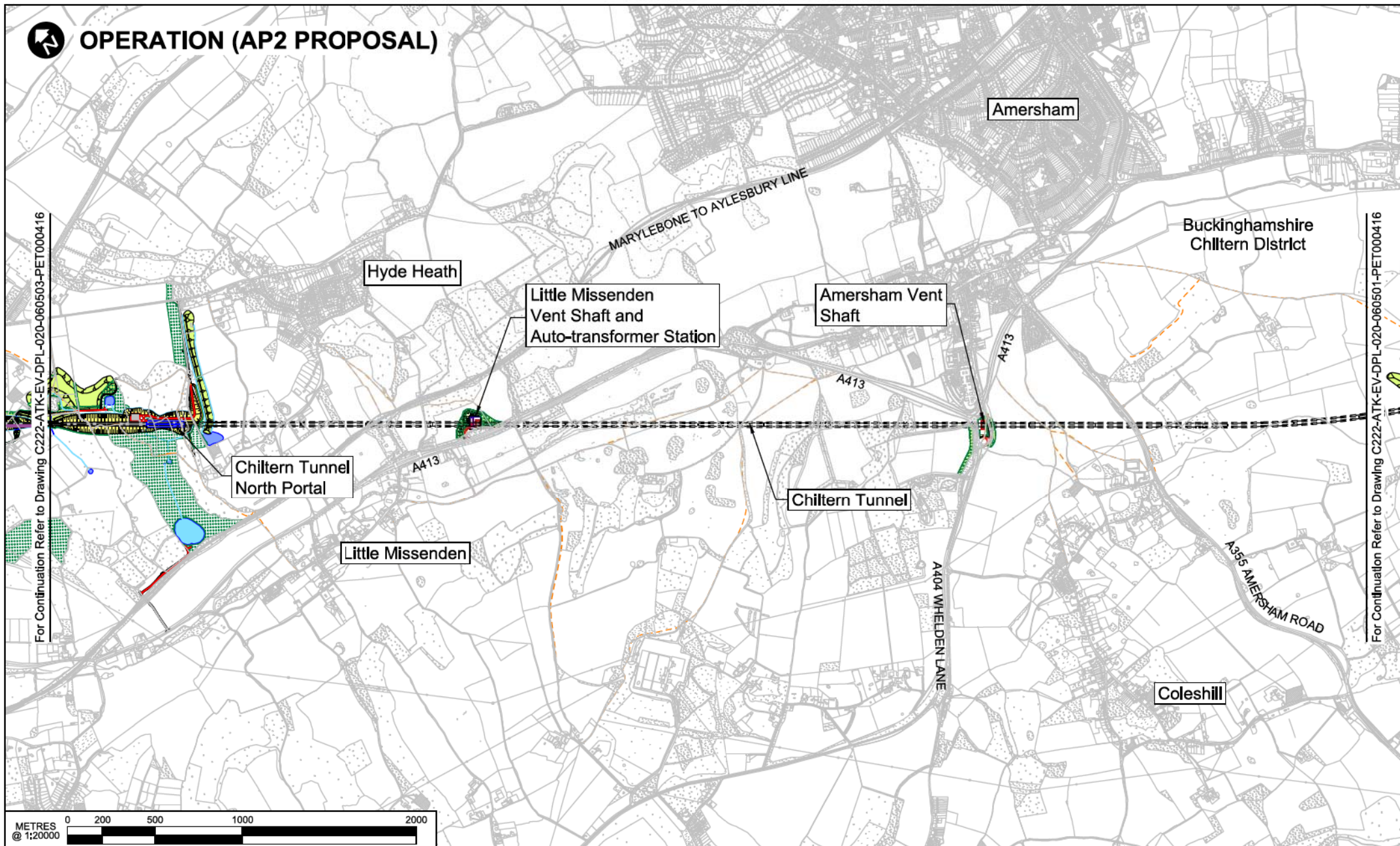
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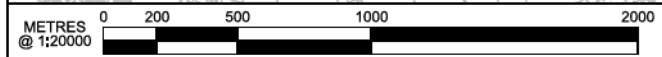


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	Tunnel portal
	Balancing pond
	Land drainage area
	Replacement floodplain storage
	Landscape mitigation planting (scrub / woodland)
	Grassed areas
	Engineering earthworks
	Landscape earthworks
	Rail alignment formation
	Grassland habitat creation
	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
	Main utility works



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Drawing Title	Chiltern District Council Petition 0416 Proposed Scheme - Sheet 2 of 4

Project/Contract	Country South Design		
Discipline/Function	Environmental		
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Date	03/07/2015	Scale	AS SHOWN
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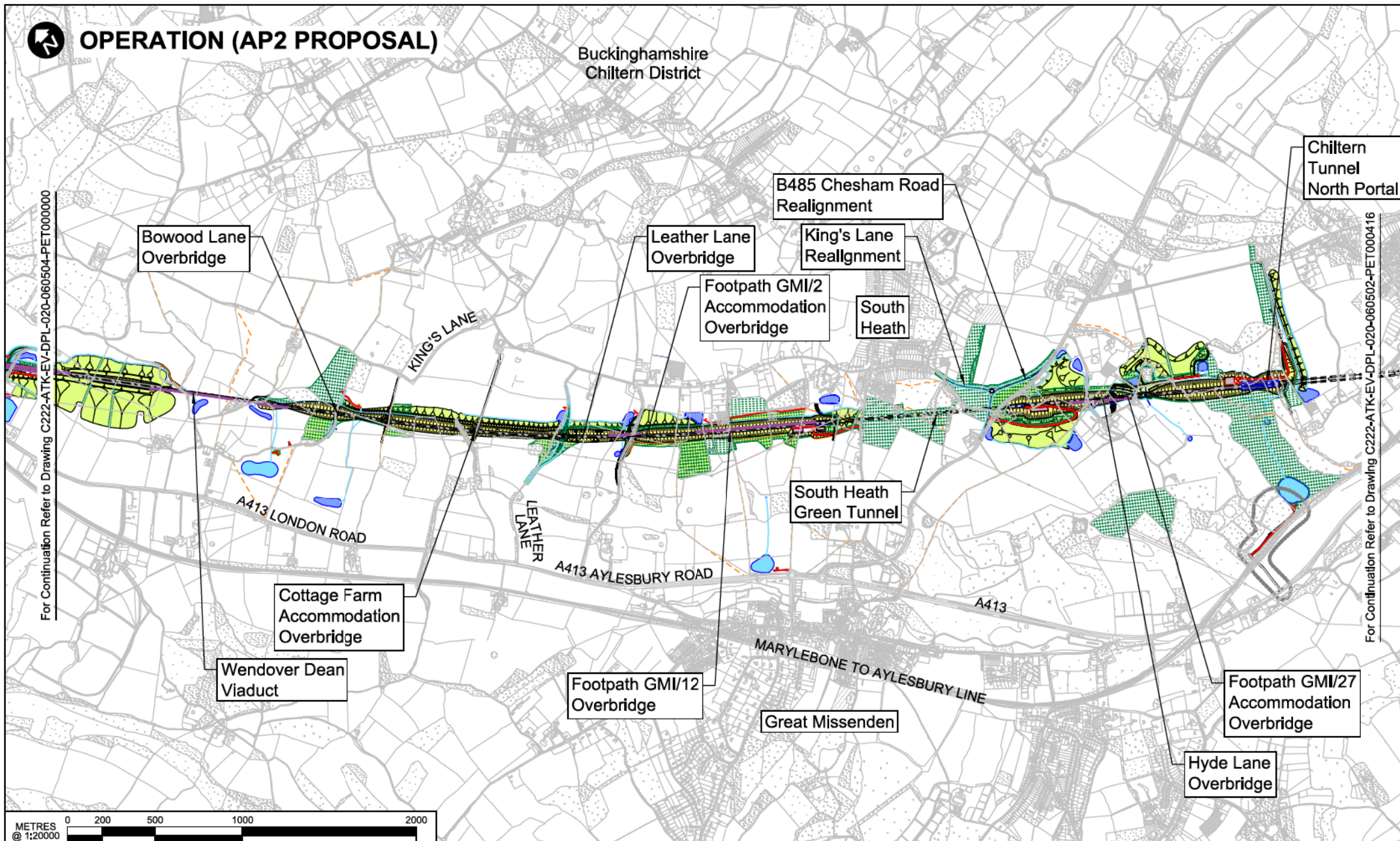
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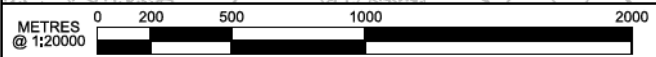
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Buckinghamshire  
Chiltern District



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	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
	Sustainable placement



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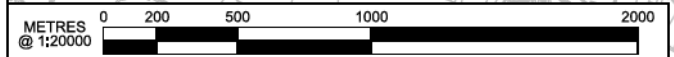
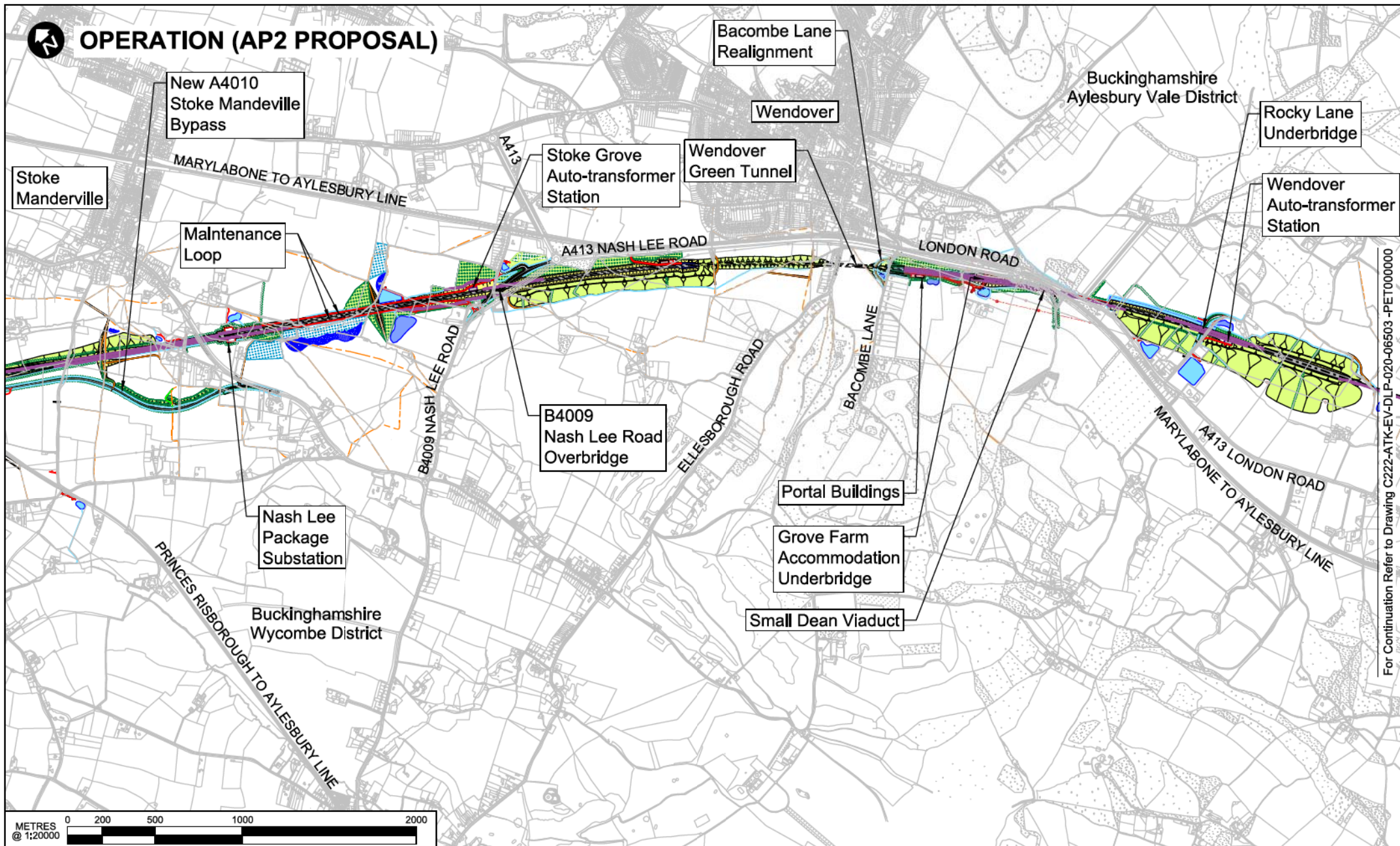
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Design Stage	DESIGN-FOR-PETITION
Drawing Title	Chiltern District Council Petition 0416 Proposed Scheme - Sheet 3 of 4

Project/Contract	Country South Design		
Discipline/Function	Environmental		
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Legend/Notes	
	Depot, station, headhouse or portal building
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	Balancing pond
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	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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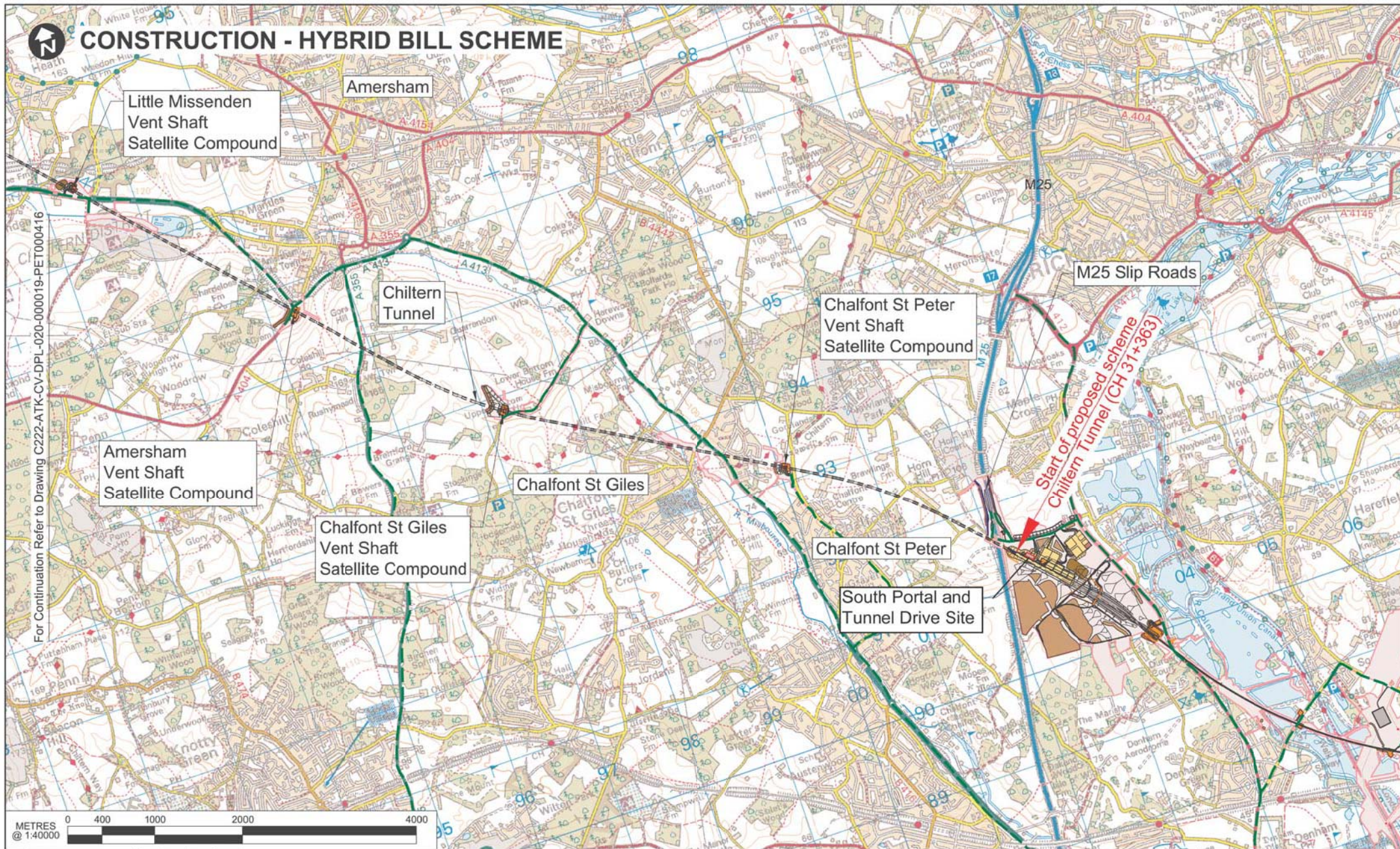
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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Environmental
Drawing Title	Chiltern District Council Petition 0416 Proposed Scheme - Sheet 4 of 4	Drawn	TB
		Checked	Approved
		Date	03/07/2015
		Scale	AS SHOWN
		Rev	A1
		Drawing No.	C222-ATK-E
		Rev.	

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P7552

HOC/10518/0012

# CONSTRUCTION - HYBRID BILL SCHEME



For Continuation Refer to Drawing C222-ATK-CV-DPL-020-000019-PET000416

**P7553 (1)**

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Rail alignment	Temporary PRoW
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Landscape earthworks	
Land potentially required during construction	

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Alkins

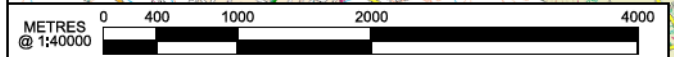
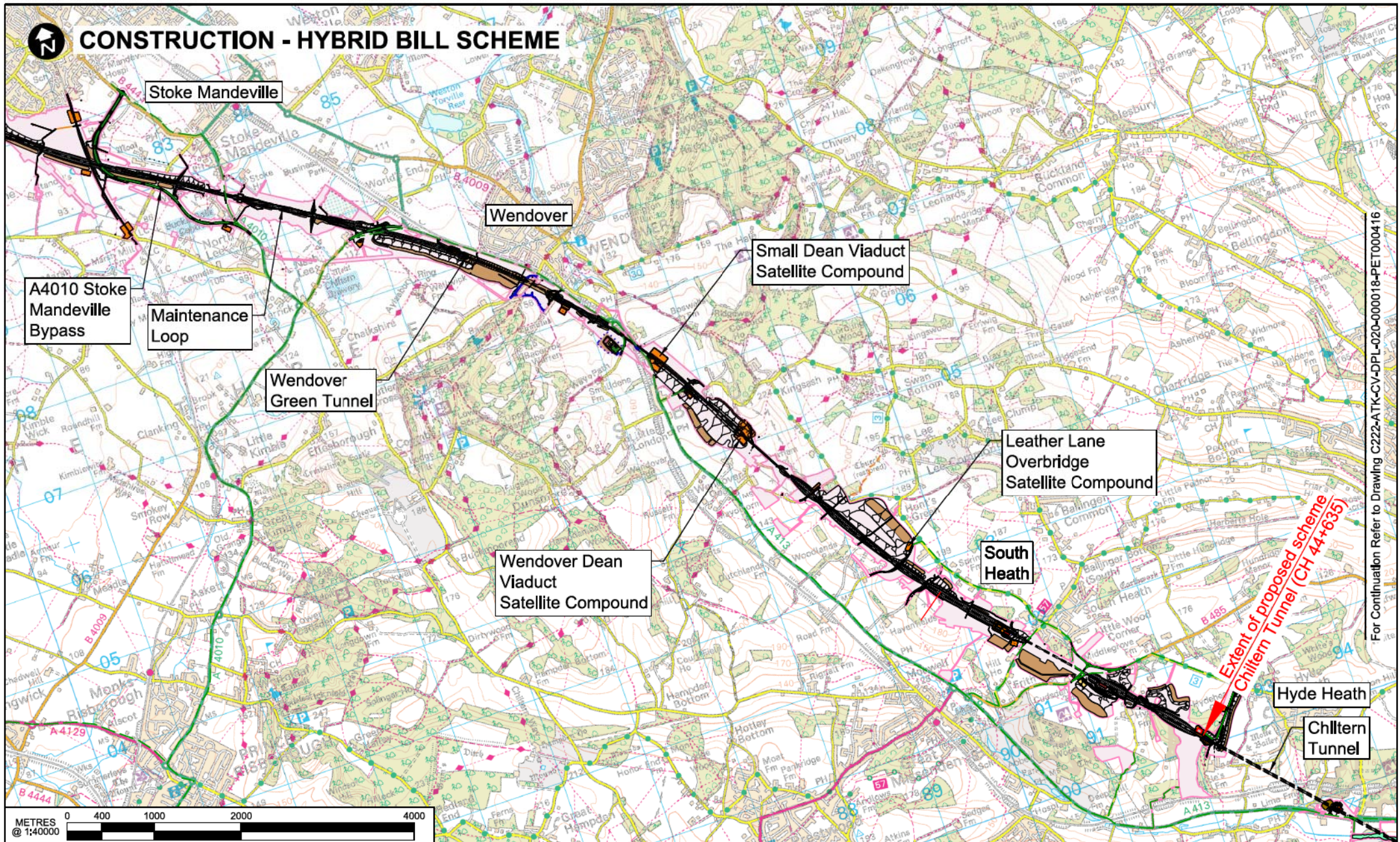
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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Civil
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension Hybrid Bill Scheme - Sheet 1 of 2	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Size	A3
		Drawing No.	C222-ATK-C
		Rev.	

Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Civil
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension Hybrid Bill Scheme - Sheet 1 of 2	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Size	A3
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HOC/10518/0013



# CONSTRUCTION - HYBRID BILL SCHEME



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Legend/Notes	
	Satellite construction compound
	Main construction compound
	Tunnel portal
	Rail alignment formation
	Tunnels external extent
	Rail alignment
	Engineering earthworks
	Landscape earthworks
	Land potentially required during construction
	Temporary site access route / haul route
	Construction traffic route
	Existing public right of way (PRoW)
	New, diverted or realigned PRoW
	Stopped-up PRoW
	Temporary PRoW
	Temporary material stockpile

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Creator/Author  
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Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	CM1
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Sheet	A3
		Drawing No.	C222-ATK-C
		Rev.	

Country South Design			
Discipline/Function	CM1		
Drawn	TB	Checked	Approved
Date	06/07/2015	Scale	AS SHOWN
Sheet		Rev.	
Drawing No.	C222-ATK-C		

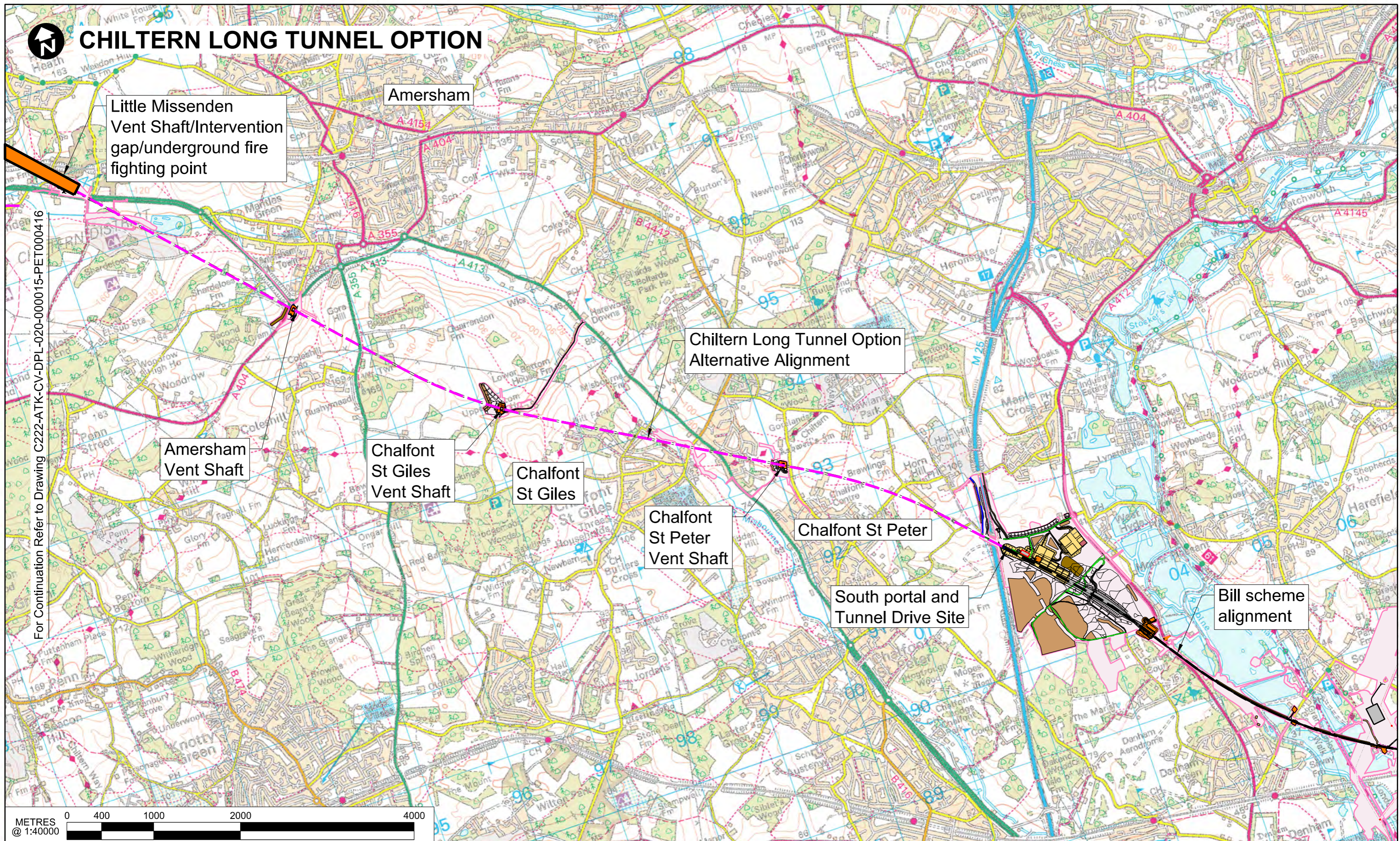
P7553 (2)

HOC/10518/0014

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# CHILTERN LONG TUNNEL OPTION



Little Missenden Vent Shaft/Intervention gap/underground fire fighting point

Amersham

Chiltern Long Tunnel Option Alternative Alignment

Amersham Vent Shaft

Chalfont St Giles Vent Shaft

Chalfont St Giles

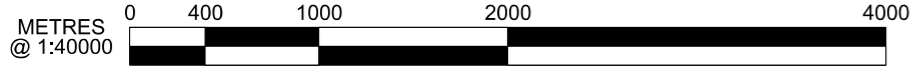
Chalfont St Peter Vent Shaft

Chalfont St Peter

South portal and Tunnel Drive Site

Bill scheme alignment

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P00.1	FIRST DRAWN	-			

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Legends/Notes:

— — — — — Proposed scheme alignment

--- --- --- Chiltern long Tunnel Option

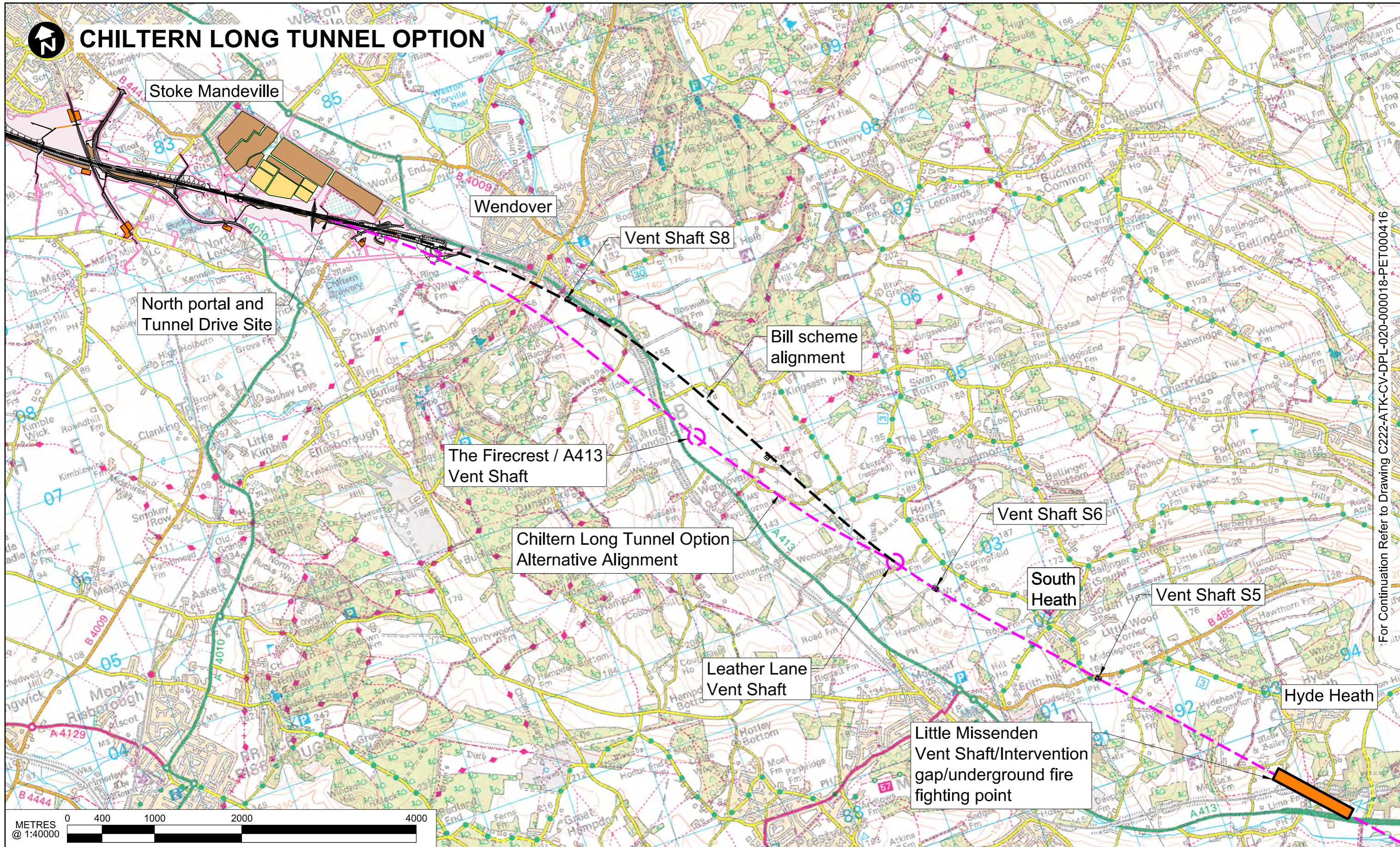
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Atkins

Zone	Country South	
Design Stage	DESIGN-FOR-PETITION	
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension	
	Chiltern Long Tunnel Option - Sheet 1 of 2	

Project/Contract	Country South Design		
Discipline/Function	Civil		
Drawn	Checked	Approved	
TB			
Date	Scale	Size	
06/07/2015	AS SHOWN	A3	
Drawing No.	Rev.		
C222-ATK-CV-DPL-020-000014-PET000416	P00.1		

# CHILTERN LONG TUNNEL OPTION



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Legends/Notes:

— — — — — Proposed scheme alignment

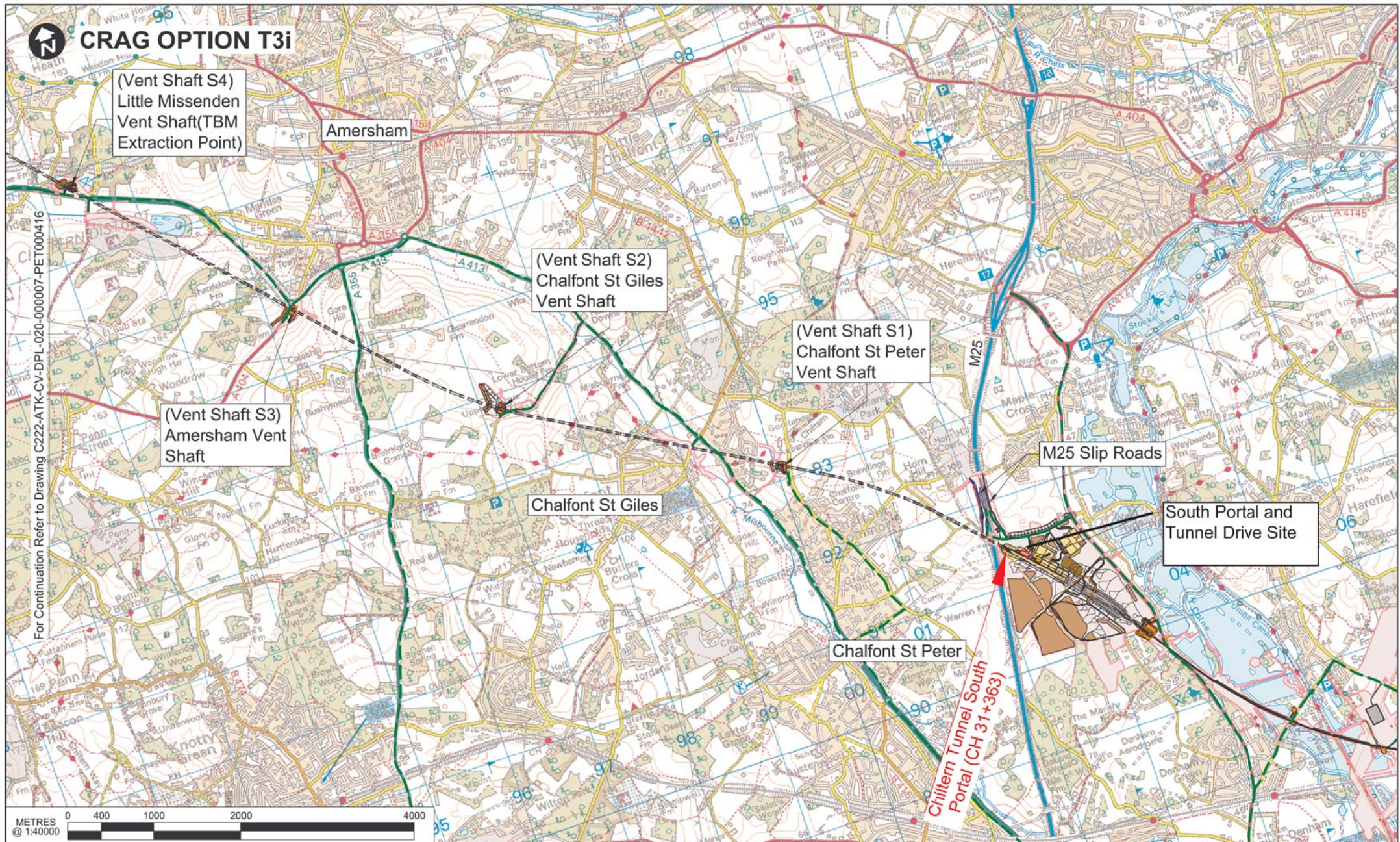
— — — — — Chiltern long Tunnel Option

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Zone	Country South		
Design Stage	DESIGN-FOR-PETITION		
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension		
	Chiltern Long Tunnel Option - Sheet 2 of 2		

Project/Contract	Country South Design		
Discipline/Function	Civil		
Drawn	Checked	Approved	
TB			
Date	Scale	Size	
06/07/2015	AS SHOWN	A3	
Drawing No.	Rev.		
C222-ATK-CV-DPL-020-000015-PET000416	P00.1		



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# CRAG OPTION T3i

(Vent Shaft S4)  
Little Missenden  
Vent Shaft(TBM  
Extraction Point)

Amersham

(Vent Shaft S2)  
Chalfont St Giles  
Vent Shaft

(Vent Shaft S1)  
Chalfont St Peter  
Vent Shaft

(Vent Shaft S3)  
Amersham Vent  
Shaft

Chalfont St Giles

M25 Slip Roads

South Portal and  
Tunnel Drive Site

Chalfont St Peter

Chiltern Tunnel South  
Portal (CH 31+363)



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Satellite construction compound	Temporary site access route / haul route
Main construction compound	Construction traffic route
Tunnel portal	Existing public right of way (PRoW)
Rail alignment formation	New, diverted or realigned PRoW
Tunnels external extent	Stopped-up PRoW
Rail alignment	Temporary PRoW
Engineering earthworks	Temporary material stockpile
Landscape earthworks	
Land potentially required during construction	

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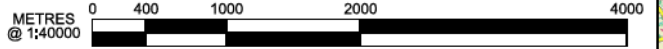
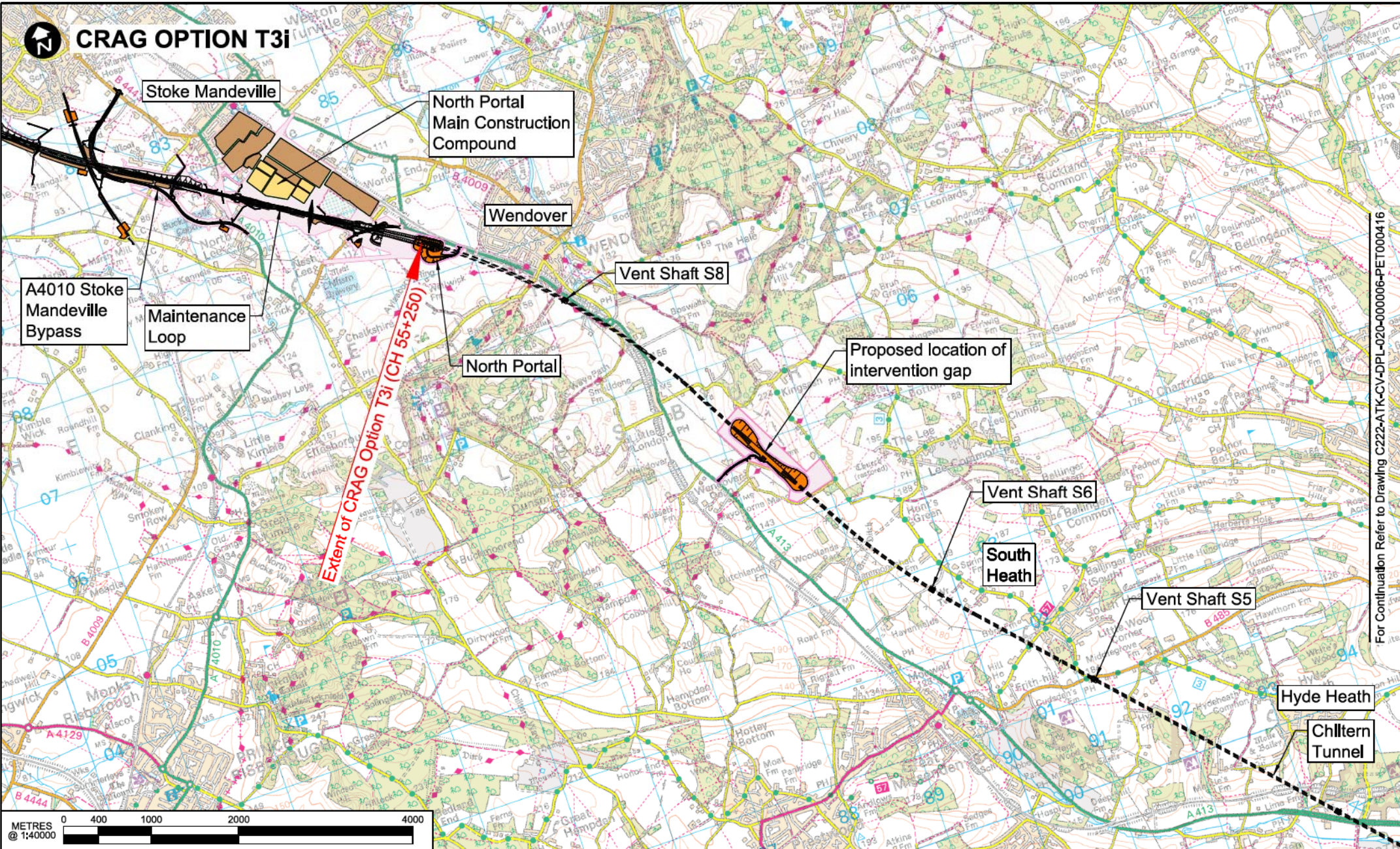
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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Civil
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension CRAG Option T3i - Sheet 1 of 2	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Size	A3
		Drawing No.	C222-ATK-C
		Rev.	

Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Civil
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension CRAG Option T3i - Sheet 1 of 2	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Size	A3
		Drawing No.	C222-ATK-C
		Rev.	

P7555 (1)

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**Legends/Notes**

- Orange box: Satellite construction compound
- Yellow box: Main construction compound
- Blue box: Tunnel portal
- Black line: Rail alignment formation
- Black dashed line: Tunnels external extent
- Black dotted line: Rail alignment
- Red hatched box: Engineering earthworks
- Green hatched box: Landscape earthworks
- Pink hatched box: Land potentially required during construction

- Yellow line: Temporary site access route / haul route
- Green line: Construction traffic route
- Black dashed line: Existing public right of way (PRoW)
- Red dashed line: New, diverted or realigned PRoW
- Orange X: Stopped-up PRoW
- Pink dashed line: Temporary PRoW
- Orange box: Temporary material stockpile

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Atkins

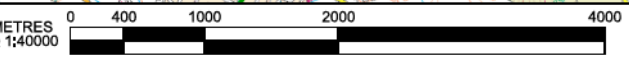
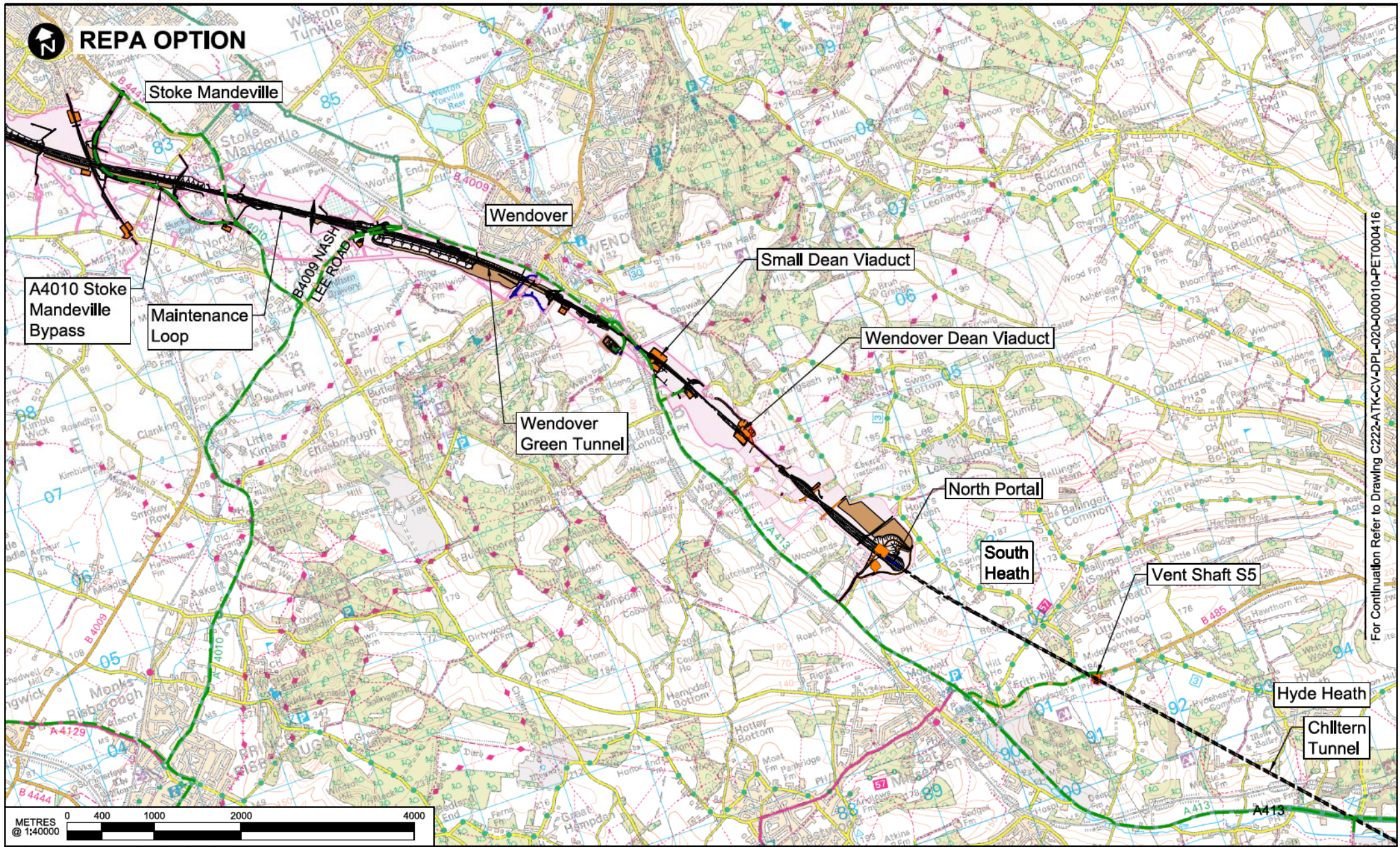
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Design Stage	DESIGN-FOR-PETITION	Discipline/Function	CMI	
Drawing Title	Chiltern Tunnel	Drawn	TB	Checked
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	CRAG Option T3i - Sheet 2 of 2	Approved	A1	Rev.
		Drawing No.	C222-ATK-C	10010151/001B

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**P7555 (2)**

10010151/001B

**REPA OPTION**



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**Legends/Notes**

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- Rail alignment formation
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- Rail alignment
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- Landscape earthworks
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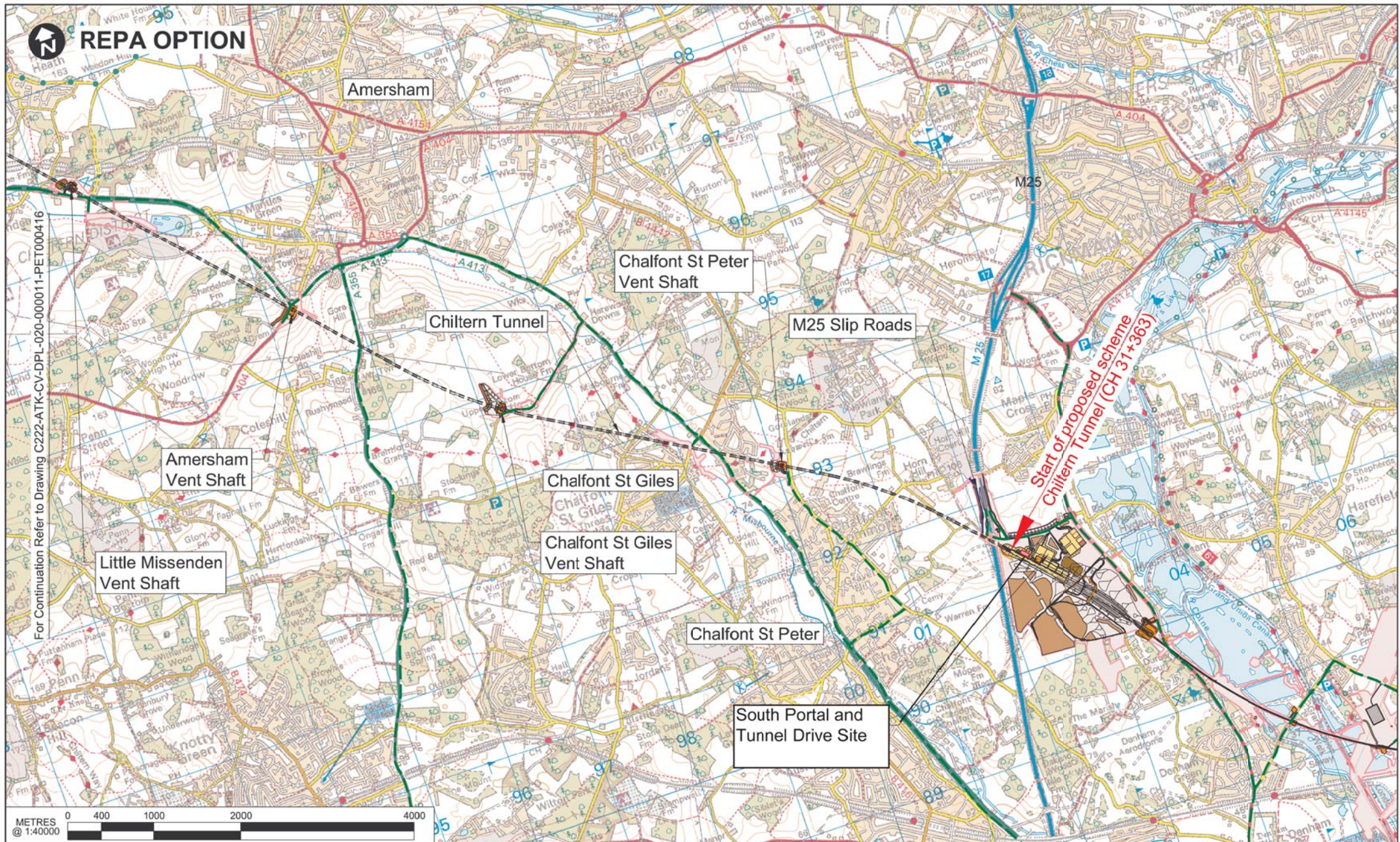
Creator/Author: Atkins

Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	CM1
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension REPA Option - Sheet 2 of 2	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Rev.	A3
		Drawing No.	C222-ATK-C


For Continuation Refer to Drawing C222-ATK-CV-DPL-020-000010-PET000416

P7556 (1)

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Tunnels external extent	Stopped-up PRoW
Rail alignment	Temporary PRoW
Engineering earthworks	Temporary material stockpile
Landscape earthworks	
Land potentially required during construction	

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Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Civil
Drawing Title	Chiltern Tunnel Petitioned Tunnel Extension REPA Option - Sheet 1 of 2	Drawn	TB
		Checked	Approved
		Date	06/07/2015
		Scale	AS SHOWN
		Size	A3
		Drawing No.	C222-ATK-C
		Rev.	

Zone	Country South	Project/Contract	Country South Design
Design Stage	DESIGN-FOR-PETITION	Discipline/Function	Civil
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		Drawing No.	C222-ATK-C
		Rev.	

**P7556 (2)**

HOC/10518/0020

# Chiltern Tunnel Extension – Chiltern Long Tunnel General Arrangement

	<b>Bill scheme</b>	<b>Chiltern Long Tunnel</b>
<b>General Arrangement</b>	<ul style="list-style-type: none"> <li>• 13.272km tunnel length</li> <li>• Four intervention and ventilation shafts</li> <li>• North portal located at Mantle’s Wood</li> <li>• Green Tunnels at South Heath and Wendover</li> <li>• Viaducts at Wendover Dean and Small Dean</li> </ul>	<ul style="list-style-type: none"> <li>• 29.137km tunnel length</li> <li>• Seven intervention and ventilation shafts with associated construction compounds.</li> <li>• One underground firefighting point</li> <li>• North portal at Stoke Mandeville</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Construction effects – slide 1 of 3

	Bill scheme	Chiltern Long Tunnel
<b>Programme</b>	<ul style="list-style-type: none"> <li>Tunnels bored concurrently from southern portal</li> </ul>	<ul style="list-style-type: none"> <li>Tunnels bored concurrently from both southern and northern portals</li> </ul>
<b>TBM Power Supply</b>	<ul style="list-style-type: none"> <li>Power supply provided for 2 TBMs included in Bill</li> </ul>	<ul style="list-style-type: none"> <li>Additional power supply required for TBMs in northern drive. National Grid advise that this supply needs to run from the vicinity of Amersham</li> <li>Route of power supply either above or below ground to be determined but construction would need to coincide with planned National Grid outages which have a 3-5 year lead time.</li> </ul>
<b>Construction Logistics - Worksites</b>		
<b>Main tunnel drive</b>	<ul style="list-style-type: none"> <li>one</li> </ul>	<ul style="list-style-type: none"> <li>Two. Bored tunnel north portal compound will be very large to accommodate TBMs, excavated material handling and possible pre-casting yard</li> </ul>
<b>TBM recovery</b>	<ul style="list-style-type: none"> <li>one</li> </ul>	<ul style="list-style-type: none"> <li>one</li> </ul>
<b>Vent shaft</b>	<ul style="list-style-type: none"> <li>four</li> </ul>	<ul style="list-style-type: none"> <li>seven</li> </ul>
<b>Other</b>	<ul style="list-style-type: none"> <li>thirteen</li> </ul>	<ul style="list-style-type: none"> <li>One (underground firefighting point)</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Construction effects – slide 2 of 3

	Bill scheme	Chiltern Long Tunnel
<b>Utilities</b>	<ul style="list-style-type: none"> <li>Local diversion of National Grid overhead electricity cables required at South Heath and Wendover</li> </ul>	<ul style="list-style-type: none"> <li>No diversions of National Grid overhead electricity cables required. This is subject to agreement with National Grid about power supply for TBMs at north portal.</li> </ul>
<b>Excavated material Management</b>		
<b>Bored tunnels</b>	<ul style="list-style-type: none"> <li>2,000,000 m<sup>3</sup> arising at south portal. All to be used as environmental mitigation on site.</li> </ul>	<ul style="list-style-type: none"> <li>1,730,000 m<sup>3</sup> arising at south portal. All to be used locally as environmental mitigation, moved on site.</li> <li>1,900,000 m<sup>3</sup> arising at north portal. Approx. 800,000 m<sup>3</sup> to be used in environmental mitigation north of Stoke Mandeville, moved on site.</li> </ul>
<b>Green tunnels / vent shafts / firefighting point/ cuttings</b>	<ul style="list-style-type: none"> <li>177,622 m<sup>3</sup> arising at vent shafts with surplus of 105,083 m<sup>3</sup> to be transported away by road</li> <li>1,242,818 m<sup>3</sup> arising at South Heath and Wendover Green Tunnels</li> <li>3,180,616 m<sup>3</sup> arising from cuttings</li> </ul>	<ul style="list-style-type: none"> <li>274,745 m<sup>3</sup> arising at vent shafts</li> <li>Arisings from underground firefighting point have not been assessed due to insufficient information in petitioner's alternative proposal</li> </ul>
<b>Additional mass haul movements</b>	<ul style="list-style-type: none"> <li>210,307 m<sup>3</sup> transported by road from B485 Chesham Road roadhead to disposal</li> <li>649,140 m<sup>3</sup> transported by road from Rocky Lane roadhead to B4009 Nash Lee Road roadhead</li> <li>Balance of material arising is transported within the site.</li> </ul>	<ul style="list-style-type: none"> <li>1,100,000 m<sup>3</sup> transported by road from north portal to disposal</li> <li>270,000 m<sup>3</sup> imported by road for use as environmental mitigation at south portal</li> <li>274,745 m<sup>3</sup> arising at vent shafts to be transported away by road to disposal.</li> <li>Arisings from underground firefighting point will be transported by road to disposal.</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Construction effects – slide 3 of 3

	Bill scheme	Chiltern Long Tunnel
<b>Traffic associated with excavated material</b>		
<b>Bored tunnels</b>	<ul style="list-style-type: none"> <li>No material transported by road</li> </ul>	<ul style="list-style-type: none"> <li>258,825 two-way lorry trips to dispose of surplus material from north portal</li> </ul>
<b>Green tunnels / vent shafts / firefighting point/ cuttings</b>	<ul style="list-style-type: none"> <li>24,628 two-way lorry trips to dispose of surplus from material from vent shafts</li> </ul>	<ul style="list-style-type: none"> <li>64,645 two-way lorry trips to dispose of surplus from material from vent shafts</li> <li>Lorry trips to dispose of arisings from intervention gap have not been assessed due to insufficient information in petitioner’s alternative proposal</li> </ul>
<b>Movement of material by road</b>	<ul style="list-style-type: none"> <li>49,484 two-way lorry movements from B485 Chesham Road roadhead to disposal</li> <li>152,739 two-way lorry movements from Rocky Lane roadhead to b4009 Nash Lee Road roadhead</li> </ul>	

# Chiltern Tunnel Extension – Chiltern Long Tunnel Operation and Maintenance – slide 1 of 2

	Bill scheme	Chiltern Long Tunnel
<b>Smoke control / ventilation</b>	<ul style="list-style-type: none"> <li>Ventilation fans at portals and vent shafts</li> </ul>	<ul style="list-style-type: none"> <li>Increased requirement for tunnel ventilation equipment and maintenance due to long tunnel length.</li> <li>similar sized and capacity ventilation fans and shafts as the Bill scheme</li> </ul>
<b>cooling equipment</b>	<ul style="list-style-type: none"> <li>No cooling required</li> </ul>	<ul style="list-style-type: none"> <li>Greater tunnel length will increase heat generation and will need addition of cooling equipment including chillers at vent shafts.</li> </ul>
<b>passenger air quality</b>	<ul style="list-style-type: none"> <li>No requirement for additional measures</li> </ul>	<ul style="list-style-type: none"> <li>Additional measures required to maintain passenger air quality through longer tunnel.</li> </ul>



# Chiltern Tunnel Extension – Chiltern Long Tunnel Operation and Maintenance – slide 2 of 2

	Bill scheme	Chiltern Long Tunnel
<b>Operating speed</b>	<ul style="list-style-type: none"> <li>Open section beyond north portal allows higher operating speed</li> </ul>	<ul style="list-style-type: none"> <li>Longer tunnel will restrict train speeds, marginally increasing journey times</li> </ul>
<b>Power supply</b>	<ul style="list-style-type: none"> <li>No increase in power supply</li> </ul>	<ul style="list-style-type: none"> <li>Increased power requirement increases operating costs.</li> </ul>
<b>Maintenance sidings</b>	<ul style="list-style-type: none"> <li>Maintenance sidings included in Proposed Scheme to south of Stoke Mandeville</li> </ul>	<ul style="list-style-type: none"> <li>Location of north portal prevents inclusion of maintenance sidings to south of Stoke Mandeville.</li> <li>No alternative location of maintenance sidings has been identified. Re-location would require changes to alignment elsewhere to accommodate.</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Main environmental effects – Construction - slide 1 of 4

Bill scheme	Chiltern Long Tunnel Extension
<ul style="list-style-type: none"><li>• Permanent loss of approximately 10ha of ancient woodland</li></ul>	<ul style="list-style-type: none"><li>• Permanent loss of approximately 0.05ha of ancient woodland.</li></ul>
<ul style="list-style-type: none"><li>• 16 residential demolitions</li></ul>	<ul style="list-style-type: none"><li>• 2 residential demolitions.</li></ul>
<ul style="list-style-type: none"><li>• Loss of 30m section of Grim's Ditch scheduled monument.</li></ul>	<ul style="list-style-type: none"><li>• None</li></ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Main environmental effects – Construction - slide 2 of 4

Bill scheme	Chiltern Long Tunnel Extension
<ul style="list-style-type: none"> <li>• Temporary PRow diversions required.</li> <li>• Temporary closure of Frith Hill, Bowood Lane and Ellesborough Road. Diversions to Chesham Road, King's Lane, Leather Lane, Rocky Lane, Bacombe Lane.</li> </ul>	<ul style="list-style-type: none"> <li>• Temporary diversions required around vent shafts, intervention gap and north portal.</li> <li>• No road diversions required.</li> </ul>
<ul style="list-style-type: none"> <li>• Loss of agricultural land permanently from Mantle's Wood to edge of AONB. Restored land over green tunnels at Wendover and planted over South Heath.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction to number of affected holdings and severance of agricultural land.</li> <li>• Loss of agricultural land localised to at vent shaft locations, intervention gap and north portal.</li> <li>• Approximately 10 ha BMV land required west of Nash Lee Road.</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Main Environmental effects – Construction - slide 3 of 4

Bill scheme	Chiltern Long Tunnel Extension
<ul style="list-style-type: none"> <li>Setting of several heritage assets impacted : Hyde Farm, Sheepcotts Cottage, Wendover southern focus, Wendover Dean Farm, Upper Wendoverdean Farm and Old Mill House.</li> </ul>	<ul style="list-style-type: none"> <li>Setting of heritage assets likely to permanently change close to surface elements at vent shafts, intervention gap and portals including to Wendover Dean Farm and Upper Wendoverdean Farm.</li> </ul>
<ul style="list-style-type: none"> <li>Visual impact of construction activities along the Bill scheme including South Heath (green tunnel and cutting), Wendover Dean (viaducts, and Wendover (green tunnel).</li> </ul>	<ul style="list-style-type: none"> <li>Visual impacts limited to receptors along Hyde Lane, Chesham Road, King’s Lane, Frith Hill, Potter Row and the settlement of South Heath.</li> <li>Construction of additional vent shafts and gap structure would have local adverse visual impacts .</li> <li>Visual impacts from the north portal construction site on receptors on the edge of Stoke Mandeville.</li> </ul>
<ul style="list-style-type: none"> <li>There will be adverse landscape impacts during construction on The Lee Undulating Valley Slopes, Wendover Gap, Settlement (Wendover), Wendover Foothills and South Vale LCA’s.</li> </ul>	<ul style="list-style-type: none"> <li>Construction impacts in Hyde Heath North, Lee and Buckland Common Farmland and Lee Undulating Valley Slopes LCA’s.</li> <li>Construction impacts from vent shaft and intervention gap construction sites and the north portal tunnel drive and construction site on the edge of Stoke Mandeville.</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Main Environmental effects – Construction - slide 4 of 4

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Bill scheme	Chiltern Long Tunnel Extension
<ul style="list-style-type: none"><li>• Noise impacts from construction of South Heath green tunnel (South Heath along Sibleys Rise, Bayleys Hatch and Frith Hill) and from construction traffic on King's Lane is likely to cause significant noise effects on adjacent residential receptors where it passes through South Heath.</li><li>• Noise impacts from Wendover green tunnel construction and earthworks and Ellesborough Road.</li></ul>	<ul style="list-style-type: none"><li>• Limited noise impacts at vent shaft and intervention gap construction sites .</li><li>• North tunnel portal drive and construction site on the southern edge of Stoke Mandeville would require 24 hour operation and may result in new construction noise impacts arising at sensitive receptors within Stoke Mandeville and other surrounding receptors.</li></ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Main Environmental effects – Operation - slide 1 of 2

Bill scheme	Chiltern Long Tunnel Extension
<ul style="list-style-type: none"> <li>• Visual impact of open cuttings and viaducts, and adjacent infrastructure within AONB.</li> <li>• Adverse visual impacts from scheme elements on receptors including those on Hyde Lane, King’s Lane, Hyde End and Frith Hill. Also those at South Heath, Wendover Dean and Wendover.</li> <li>• Visual impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>	<ul style="list-style-type: none"> <li>• Visual impact restricted to locations of above ground infrastructure (i.e. vent shafts and gap structure).</li> </ul>
<ul style="list-style-type: none"> <li>• Adverse landscape impacts from scheme elements experienced by Wendover Gap and Wendover Foothills LCA’s.</li> <li>• Landscape impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>	<ul style="list-style-type: none"> <li>• Local impacts in Hyde Heath North, Lee and Buckland Common Farmland and Lee Undulating Valley Slopes LCA’s</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel

## Main Environmental effects – Operation - slide 2 of 2

Bill scheme	Chiltern Long Tunnel Extension
<ul style="list-style-type: none"> <li>Noise impact at South Heath (Hyde End and South Heath) and Wendover Dean south (Bowood Lane and London Road), Wendover Dean north (Rocky Lane and Chesham Lane), Wendover south (Bacombe Lane) and Nash Lee Lane.</li> </ul>	<ul style="list-style-type: none"> <li>Noise effects identified to properties on Nash Lee Lane.</li> </ul>
<ul style="list-style-type: none"> <li>Risks to bats and barn owls due to collision impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Risks to bats and barn owls reduced.</li> </ul>

# Chiltern Tunnel Extension – Chiltern Long Tunnel Costs

Item	Bill scheme (£ million)	Chiltern Long Tunnel (£ million)
Tunnels	£845.8	£1460.3
Civil Engineering	£296.5	£111.4
Rail Systems	£149.1	£213.6
<b>Sub-total: Construction</b>	<b>£1291.4</b>	<b>£1785.3</b>
Land and Property	£51.1	£4.0
<i>Difference</i>		<b>£446.8</b>
Time-related costs; indirect costs; Value Engineering and efficiency savings	£111.1	£149.4
<b>Total cost difference of Bill Scheme</b>		<b>£485.1</b>

**Notes:**

1. Costs are inclusive of all works required between the Proposed Scheme Chiltern Tunnel south portal and Stoke Mandeville
2. Land and Property costs represent only the costs of acquisition for land north of the Bill Scheme Chiltern Tunnel north portal
3. Costs above are based on inclusion of underground firefighting point. Substitution of this with an intervention gap could lead to a potential saving of approximately £40 million.



# Chiltern Tunnel Extension – CRAG T3i

## General Arrangement

	Bill scheme	CRAG Option T3i
<b>General Arrangement</b>	<ul style="list-style-type: none"> <li>• 13.272km tunnel length</li> <li>• Four intervention and ventilation shafts</li> <li>• North portal located at Mantle’s Wood</li> <li>• Green Tunnels at South Heath and Wendover</li> <li>• Viaducts at Wendover Dean and Small Dean</li> </ul>	<ul style="list-style-type: none"> <li>• 28.887km tunnel length</li> <li>• Seven intervention and ventilation shafts with associated construction compounds.</li> <li>• One intervention gap</li> <li>• North portal at Nash Lee Road</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Construction effects – slide 1 of 3

	Bill scheme	CRAG Option T3i
<b>Programme</b>	<ul style="list-style-type: none"> <li>Tunnels bored concurrently from southern portal</li> </ul>	<ul style="list-style-type: none"> <li>Tunnels bored concurrently from both southern and northern portals</li> </ul>
<b>TBM Power Supply</b>	<ul style="list-style-type: none"> <li>Power supply provided for 2 TBMs included in Bill</li> </ul>	<ul style="list-style-type: none"> <li>Additional power supply required for TBMs in northern drive. National Grid advise that this supply needs to run from the vicinity of Amersham</li> <li>Route of power supply either above or below ground to be determined but construction would need to coincide with planned National Grid outages which have a 3-5 year lead time.</li> </ul>
<b>Construction Logistics - Worksites</b>		
<b>Main tunnel drive</b>	<ul style="list-style-type: none"> <li>one</li> </ul>	<ul style="list-style-type: none"> <li>Two. Bored tunnel north portal compound will be very large to accommodate TBMs, excavated material handling and possible pre-casting yard</li> </ul>
<b>TBM recovery</b>	<ul style="list-style-type: none"> <li>one</li> </ul>	<ul style="list-style-type: none"> <li>one</li> </ul>
<b>Vent shaft</b>	<ul style="list-style-type: none"> <li>four</li> </ul>	<ul style="list-style-type: none"> <li>seven</li> </ul>
<b>Other</b>	<ul style="list-style-type: none"> <li>twelve</li> </ul>	<ul style="list-style-type: none"> <li>one</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Construction effects – slide 2 of 3

	Bill scheme	CRAG Option T3i
<b>Utilities</b>	<ul style="list-style-type: none"> <li>Local diversion of National Grid overhead electricity cables required at South Heath and Wendover</li> </ul>	<ul style="list-style-type: none"> <li>No diversions of National Grid overhead electricity cables required. This is subject to agreement with National Grid about power supply for TBMs at north portal.</li> </ul>
<b>Excavated material Management</b>		
<b>Bored tunnels</b>	<ul style="list-style-type: none"> <li>2,000,000 m3 arising at south portal. All to be used as environmental mitigation on site.</li> </ul>	<ul style="list-style-type: none"> <li>1,700,000 m3 arising at south portal. All to be used locally as environmental mitigation, moved on site.</li> <li>1,700,000 m3 arising at north portal. Approx. 800,000 m3 to be used in environmental mitigation north of Stoke Mandeville, moved on site.</li> </ul>
<b>Green tunnels / vent shafts / intervention gap / cuttings</b>	<ul style="list-style-type: none"> <li>177,622 m3 arising at vent shafts</li> <li>1,242,818 m3 arising at South Heath and Wendover Green Tunnels</li> <li>3,048,284 m3 arising from cuttings</li> </ul>	<ul style="list-style-type: none"> <li>214,208 m3 arising at vent shafts</li> <li>1,350,000 m3 arising at intervention gap</li> <li>All to be transported away by road</li> </ul>
<b>Additional mass haul movements</b>	<ul style="list-style-type: none"> <li>210,307 m3 transported by road from B485 Chesham Road roadhead to disposal</li> <li>649,140 m3 transported by road from Rocky Lane roadhead to B4009 Nash Lee Road roadhead</li> <li>Balance of material arising is transported within the site.</li> </ul>	<ul style="list-style-type: none"> <li>300,000 m3 imported by road for use as environmental mitigation at south portal.</li> <li>900,000 m3 transported by road from north portal to disposal</li> <li>1,564,208 m3 from vent shafts and intervention gap to be transported by road to disposal</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Construction effects – slide 3 of 3

	Bill scheme	CRAG Option T3i
<b>Traffic associated with excavated material</b>		
<b>Bored tunnels</b>	<ul style="list-style-type: none"> <li>No material transported by road</li> </ul>	<ul style="list-style-type: none"> <li>70,000 two-way lorry trips to import material to south portal for environmental mitigation</li> <li>211,765 two-way lorry trips to dispose of surplus material from north portal</li> </ul>
<b>Green tunnels / vent shafts / intervention gap / cuttings</b>	<ul style="list-style-type: none"> <li>24,628 two-way lorry trips to dispose of surplus from material from vent shafts</li> </ul>	<ul style="list-style-type: none"> <li>368,049 two-way lorry movements to transport material from vent shafts and intervention gap to disposal</li> </ul>
<b>Movement of material by road</b>	<ul style="list-style-type: none"> <li>49,484 two-way lorry movements from B485 Chesham Road roadhead to disposal</li> <li>152,739 two-way lorry movements from Rocky Lane roadhead to b4009 Nash Lee Road roadhead</li> </ul>	

# Chiltern Tunnel Extension – CRAG T3i

## Operation and Maintenance – slide 1 of 2

	Bill scheme	CRAG Option T3i
<b>Smoke control / ventilation</b>	<ul style="list-style-type: none"> <li>• Ventilation fans at portals and vent shafts</li> </ul>	<ul style="list-style-type: none"> <li>• Increased requirement for tunnel ventilation equipment and maintenance due to long tunnel length.</li> <li>• similar sized and capacity ventilation fans and shafts as the Bill scheme</li> </ul>
<b>cooling equipment</b>	<ul style="list-style-type: none"> <li>• No cooling required</li> </ul>	<ul style="list-style-type: none"> <li>• Greater tunnel length will increase heat generation and will need addition of cooling equipment including chillers at vent shafts.</li> </ul>
<b>passenger air quality</b>	<ul style="list-style-type: none"> <li>• No requirement for additional measures</li> </ul>	<ul style="list-style-type: none"> <li>• Additional measures required to maintain passenger air quality through longer tunnel.</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Operation and Maintenance – slide 2 of 2

	Bill scheme	CRAG Option T3i
<b>Operating speed</b>	<ul style="list-style-type: none"> <li>Open section beyond north portal allows higher operating speed</li> </ul>	<ul style="list-style-type: none"> <li>Longer tunnel will restrict train speeds, marginally increasing journey times</li> <li>Assessment of journey time identifies that there is a slight increase in journey time in the range of 10 to 15 seconds</li> </ul>
<b>Power supply</b>	<ul style="list-style-type: none"> <li>No increase in power supply</li> </ul>	<ul style="list-style-type: none"> <li>Increased power requirement for tunnel cooling equipment increases operating costs.</li> </ul>
<b>Maintenance sidings</b>	<ul style="list-style-type: none"> <li>Maintenance siding included in Proposed Scheme to south of Stoke Mandeville</li> </ul>	<ul style="list-style-type: none"> <li>As Bill scheme.</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Main environmental effects – Construction - slide 1 of 4

Bill scheme	CRAG T3i
<ul style="list-style-type: none"><li>Permanent loss of approximately 10ha of ancient woodland.</li></ul>	<ul style="list-style-type: none"><li>No loss of ancient woodland.</li><li>Adverse impacts limited to loss of habitat near Durham Farm and Hartley Farm .</li></ul>
<ul style="list-style-type: none"><li>16 residential demolitions.</li></ul>	<ul style="list-style-type: none"><li>Two residential demolitions required.</li></ul>
<ul style="list-style-type: none"><li>Loss of 30m section of Grim’s Ditch scheduled monument.</li></ul>	<ul style="list-style-type: none"><li>None</li></ul>

# Chiltern Tunnel Extension – CRAG T3i

## Main environmental effects – Construction - slide 2 of 4

Bill scheme	CRAG T3i
<ul style="list-style-type: none"> <li>• Temporary PRow diversions required.</li> <li>• Temporary closure of Frith Hill, Bowood Lane and Ellesborough Road. Diversions to Chesham Road, King's Lane, Leather Lane, Rocky Lane, Bacombe Lane.</li> </ul>	<ul style="list-style-type: none"> <li>• Temporary diversions only required around vent shafts, intervention gap and north portal.</li> </ul>
<ul style="list-style-type: none"> <li>• Permanent loss of agricultural land from Mantle's Wood to edge of AONB. Restored land over green tunnels at Wendover and planted over South Heath.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction to number of affected holdings and severance of agricultural land.</li> <li>• Loss of agricultural land localised to at vent shaft locations, intervention gap and north portal.</li> <li>• Approximately 10 ha BMV land required west of Nash Lee Road.</li> </ul>



# Chiltern Tunnel Extension – CRAG T3i

## Main Environmental effects – Construction - slide 3 of 4

Bill scheme	CRAG T3i
<ul style="list-style-type: none"> <li>Settings of several heritage assets impacted including Hyde Farm, Sheepcotts Cottage, Wendover southern focus, Wendover Dean Farm, Upper Wendoverdean Farm and Old Mill House.</li> </ul>	<ul style="list-style-type: none"> <li>Impacts associated with intervention structure and proposed storage facility including impact to the setting of Wendover Dean Farm and second to the Upper Wendoverdean Farmhouse.</li> <li>Two moderate adverse impacts from the demolition of Durham Farm and loss of archaeology at Upper Wendoverdean Farmhouse.</li> </ul>
<ul style="list-style-type: none"> <li>Visual impact of construction activities along the Bill scheme including South Heath (green tunnel and cutting), Wendover Dean (viaducts), and Wendover (green tunnel).</li> </ul>	<ul style="list-style-type: none"> <li>Visual impacts limited to receptors along Hyde Lane, Chesham Road, King’s Lane, Frith Hill, Potter Row and the settlement of South Heath.</li> <li>Construction of additional vent shafts and gap structure would have local adverse visual impacts .</li> <li>Visual impacts from the north portal construction site on receptors on the edge of Stoke Mandeville.</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Main Environmental effects – Construction - slide 4 of 4

hybrid Bill scheme	CRAG T3i
<ul style="list-style-type: none"> <li>• There will be adverse landscape impacts during construction on The Lee Undulating Valley Slopes, Wendover Gap, Settlement (Wendover), Wendover Foothills and South Vale LCA's</li> </ul>	<ul style="list-style-type: none"> <li>• Construction impacts in Hyde Heath North, Lee and Buckland Common Farmland and Lee Undulating Valley Slopes LCA's.</li> <li>• Construction impacts from vent shaft and intervention gap construction sites and the north portal tunnel drive and construction site on the edge of Stoke Mandeville.</li> </ul>
<ul style="list-style-type: none"> <li>• Noise impacts from construction of South Heath green tunnel (South Heath along Sibley's Rise, Bayleys Hatch and Frith Hill) and from construction traffic on King's Lane is likely to cause significant noise effects on adjacent residential receptors where it passes through South Heath.</li> <li>• Noise impacts from Wendover green tunnel construction and earthworks and Ellesborough Road.</li> </ul>	<ul style="list-style-type: none"> <li>• Limited noise impacts at vent shaft and intervention gap construction sites .</li> <li>• North tunnel portal drive and construction site on the southern edge of Stoke Mandeville would require 24 hour operation and may result in new construction noise impacts arising at sensitive receptors within Stoke Mandeville and other surrounding receptors.</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Main Environmental effects – Operation - slide 1 of 2

Bill scheme	CRAG T3i
<ul style="list-style-type: none"> <li>• Visual impact of cuttings and viaducts, and adjacent infrastructure within AONB.</li> <li>• Visual impacts from scheme elements on receptors including those on Hyde Lane, King’s Lane, Hyde End and Frith Hill. Also those at South Heath, Wendover Dean and Wendover.</li> <li>• Visual impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>	<ul style="list-style-type: none"> <li>• Visual impact restricted to locations of above ground infrastructure (i.e. vent shafts and gap structure).</li> </ul>
<ul style="list-style-type: none"> <li>• Landscape impacts from scheme elements experienced by Wendover Gap and Wendover Foothills LCA’s.</li> <li>• Landscape impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>	<ul style="list-style-type: none"> <li>• Local impacts in Hyde Heath North, Lee and Buckland Common Farmland and Lee Undulating Valley Slopes LCA’s.</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i

## Main Environmental effects – Operation - slide 2 of 2

hybrid Bill scheme	CRAG T3i
<ul style="list-style-type: none"> <li>Noise impact at South Heath (Hyde End and South Heath) and Wendover Dean south (Bowood Lane and London Road), Wendover Dean north (Rocky Lane and Chesham Lane), Wendover south (Bacombe Lane) and Nash Lee Lane.</li> </ul>	<ul style="list-style-type: none"> <li>Noise effects identified to properties on Nash Lee Lane.</li> </ul>
<ul style="list-style-type: none"> <li>Risks to bats and barn owls due to collision impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Risks to bats and barn owls reduced.</li> </ul>

# Chiltern Tunnel Extension – CRAG T3i Costs

Item	Bill scheme (£ million)	CRAG Option T3i (£ million)
Tunnels	£864.6	£1336.7
Civil Engineering	£240.8	£82.4
Rail Systems	£149.0	£201.8
<b>Sub-total: Construction</b>	<b>£1254.4</b>	<b>£1620.9</b>
Land and Property	£51.1	£4.3
<i>Difference</i>		£319.7
Time-related costs; indirect costs; Value Engineering and efficiency savings	£107.5	£137.0
<b>Total cost difference of Bill Scheme</b>		<b>£349.2</b>

**Notes:**

1. Costs are inclusive of all works required between the Proposed Scheme Chiltern Tunnel south portal and Nash Lee Road
2. Land and Property costs represent only the costs of acquisition for land north of the Bill Scheme Chiltern Tunnel north portal

# Chiltern Tunnel Extension – REPA

## General Arrangement

The extent of this option is from Ch.31+363 to Ch.48+740

	Bill scheme	REPA
<b>General Arrangement</b>	<ul style="list-style-type: none"> <li>• 13.272km tunnel length</li> <li>• Four intervention and ventilation shafts</li> <li>• North portal located at Mantle’s Wood</li> <li>• Green Tunnel at South Heath</li> </ul>	<ul style="list-style-type: none"> <li>• 17.377km tunnel length</li> <li>• Five intervention and ventilation shafts with associated construction compounds.</li> <li>• North portal at Leather Lane</li> </ul>

# Chiltern Tunnel Extension – REPA

## Construction effects – slide 1 of 3

	Bill scheme	REPA
<b>Programme</b>	<ul style="list-style-type: none"> <li>Tunnels bored concurrently from southern portal</li> </ul>	<ul style="list-style-type: none"> <li>As Bill scheme</li> </ul>
<b>TBM Power Supply</b>	<ul style="list-style-type: none"> <li>Power supply provided for 2 TBMs included in Bill</li> </ul>	<ul style="list-style-type: none"> <li>As Bill scheme</li> </ul>
<b>Construction Logistics - Worksites</b>		
<b>Main tunnel drive</b>	<ul style="list-style-type: none"> <li>one</li> </ul>	<ul style="list-style-type: none"> <li>one</li> </ul>
<b>TBM recovery</b>	<ul style="list-style-type: none"> <li>one</li> </ul>	<ul style="list-style-type: none"> <li>one</li> </ul>
<b>Vent shaft</b>	<ul style="list-style-type: none"> <li>four</li> </ul>	<ul style="list-style-type: none"> <li>five</li> </ul>
<b>Other</b>	<ul style="list-style-type: none"> <li>four</li> </ul>	<ul style="list-style-type: none"> <li>none</li> </ul>

# Chiltern Tunnel Extension – REPA

## Construction effects – slide 2 of 3

	Bill scheme	REPA
<b>Utilities</b>	<ul style="list-style-type: none"> <li>Local diversion of National Grid overhead electricity cables required at South Heath and Wendover</li> </ul>	<ul style="list-style-type: none"> <li>Local diversion of National Grid overhead electricity cables required at Wendover</li> </ul>
<b>Excavated material Management</b>		
<b>Bored tunnels</b>	<ul style="list-style-type: none"> <li>2,000,000 m3 arising at south portal. All to be used as environmental mitigation on site.</li> </ul>	<ul style="list-style-type: none"> <li>2,610,000 m3 arising at south portal. 2,000,000 m3 used as environmental mitigation on site.</li> <li>320,500 m3 surplus to be transported to disposal and 289,500m3 transported north to part address engineering fill shortfall.</li> </ul>
<b>Green tunnels / vent shafts / intervention gap / cuttings</b>	<ul style="list-style-type: none"> <li>177,622 m3 arising at vent shafts.</li> <li>703,586 m3 arising at South Heath Green Tunnel</li> <li>2,072,083 m3 arising from cuttings</li> </ul>	<ul style="list-style-type: none"> <li>222,622 m3 arising at vent shafts.</li> </ul>
<b>Movement of material by road</b>	<ul style="list-style-type: none"> <li>210,307 m3 transported by road from B485 Chesham Road roadhead to disposal</li> <li>649,140 m3 transported by road from Rocky Lane roadhead to b4009 Nash Lee Road roadhead</li> <li>Balance of material arising is transported within the site.</li> </ul>	<ul style="list-style-type: none"> <li>shortfall of engineering fill occurs between Leather Lane and Small Dean Viaduct made up of 289,500 m3 from south portal and 140,500 m3 from vent shafts.</li> <li>649,140 m3 required to be imported for use in scheme in vicinity of Nash Lee Road</li> </ul>



# Chiltern Tunnel Extension – REPA

## Construction effects – slide 3 of 3

	Bill scheme	REPA
<b>Traffic associated with excavated material</b>		
<b>Bored tunnels</b>	<ul style="list-style-type: none"> <li>No material transported by road</li> </ul>	<ul style="list-style-type: none"> <li>143,530 two-way lorry trips to dispose of surplus material</li> </ul>
<b>Green tunnels / vent shafts / intervention gap / cuttings</b>	<ul style="list-style-type: none"> <li>24,628 two-way lorry trips to dispose of surplus from material from vent shafts</li> </ul>	<ul style="list-style-type: none"> <li>35,228 two-way lorry trips to dispose of surplus from material from vent shafts</li> </ul>
<b>Additional mass haul movements</b>	<ul style="list-style-type: none"> <li>49,484 two-way lorry movements from B485 Chesham Road roadhead to disposal</li> <li>152,739 two-way lorry movements from Rocky Lane roadhead to b4009 Nash Lee Road roadhead</li> </ul>	<ul style="list-style-type: none"> <li>shortfall of engineering fill between Leather Lane and Small Dean Viaduct and requires 68,118 two-way lorry movements from south portal and 33,059 two-way lorry movements from vent shafts.</li> <li>152,739 two-way lorry movements from Rocky Lane roadhead to B4009 Nash Lee Road roadhead</li> </ul>

# Chiltern Tunnel Extension – REPA

## Operation and Maintenance – slide 1 of 2

	Bill scheme	REPA
Smoke control / ventilation	<ul style="list-style-type: none"> <li>Ventilation fans at portals and vent shafts</li> </ul>	<ul style="list-style-type: none"> <li>Increased requirement for tunnel ventilation equipment and maintenance due to long tunnel length.</li> <li>similar sized and capacity ventilation fans and shafts as the Bill scheme</li> </ul>
cooling equipment	<ul style="list-style-type: none"> <li>No cooling required</li> </ul>	<ul style="list-style-type: none"> <li>Greater tunnel length will increase heat generation and will need addition of cooling equipment including chillers at vent shafts.</li> </ul>
passenger air quality	<ul style="list-style-type: none"> <li>No requirement for additional measures</li> </ul>	<ul style="list-style-type: none"> <li>Additional measures required to maintain passenger air quality through longer tunnel.</li> </ul>

# Chiltern Tunnel Extension – REPA

## Operation and Maintenance – slide 2 of 2

	Bill scheme	REPA
<b>Operating speed</b>	<ul style="list-style-type: none"> <li>Open section beyond north portal allows higher operating speed</li> </ul>	<ul style="list-style-type: none"> <li>Longer tunnel will restrict train speeds, marginally increasing journey times</li> <li>Assessment of journey time identifies that there is a slight increase in journey time in the range of 4 seconds</li> </ul>
<b>Power supply</b>	<ul style="list-style-type: none"> <li>No increase in power supply</li> </ul>	<ul style="list-style-type: none"> <li>Increased power requirement for tunnel cooling equipment increases operating costs.</li> </ul>
<b>Maintenance sidings</b>	<ul style="list-style-type: none"> <li>Maintenance siding included in Proposed Scheme to south of Stoke Mandeville</li> </ul>	<ul style="list-style-type: none"> <li>As Bill scheme.</li> </ul>

# Chiltern Tunnel Extension – REPA

## Main environmental effects – Construction - slide 1 of 4

Bill scheme	REPA
<ul style="list-style-type: none"> <li>Loss of approximately 10ha of ancient woodland.</li> </ul>	<ul style="list-style-type: none"> <li>Loss of 0.7ha of ancient woodland.</li> </ul>
<ul style="list-style-type: none"> <li>16 residential demolitions.</li> </ul>	<ul style="list-style-type: none"> <li>8 residential demolitions.</li> </ul>
<ul style="list-style-type: none"> <li>Loss of 30m section of Grim’s Ditch scheduled monument.</li> </ul>	<ul style="list-style-type: none"> <li>Loss of 30m section of Grim’s Ditch scheduled monument.</li> </ul>

# Chiltern Tunnel Extension – REPA

## Main environmental effects – Construction - slide 2 of 4

Bill scheme	REPA
<ul style="list-style-type: none"> <li>• Temporary PRow diversions required.</li> <li>• Temporary closure of Frith Hill, Bowood Lane and Ellesborough Road. Diversions to Chesham Road, King’s Lane, Leather Lane, Rocky Lane, Bacombe Lane.</li> </ul>	<ul style="list-style-type: none"> <li>• Avoids road closures, diversions and PRow diversions around South Heath. Remaining closures and diversions the same as the hybrid Bill after Liberty Lane.</li> </ul>
<ul style="list-style-type: none"> <li>• Permanent loss of agricultural land from Mantle’s Wood to edge of AONB. Restored land over green tunnels at Wendover and planted over South Heath.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in number of affected holdings and reduced severance of agricultural land between Mantle’s Wood and Liberty Lane.</li> <li>• Loss of agricultural land exactly as Bill scheme from Liberty Lane to edge of AONB.</li> <li>• Restored land over green tunnel at Wendover.</li> </ul>

# Chiltern Tunnel Extension – REPA

## Main Environmental effects – Construction - slide 3 of 4

Bill scheme	REPA
<ul style="list-style-type: none"> <li>Setting of heritage assets impacted : Hyde Farm, Sheepcotts Cottage, Wendover southern focus, Wendover Dean Farm, Upper Wendoverdean Farm and Old Mill House.</li> </ul>	<ul style="list-style-type: none"> <li>Reduced impact on heritage assets at South Heath – Hyde Heath and Sheepcotts Cottage.</li> <li>Setting impacts remain at Wendover southern focus, Wendover Dean Farm, Upper Wendoverdean Farm and Old Mill House.</li> </ul>
<ul style="list-style-type: none"> <li>Visual impact of construction activities along the Bill scheme including South Heath (green tunnel and cutting), Wendover Dean (viaducts), and Wendover (green tunnel).</li> </ul>	<ul style="list-style-type: none"> <li>Reduced visual impacts experienced by receptors along Hyde Lane, Chesham Road, King’s Lane, Frith Hill, Potter Row and the settlement of South Heath.</li> <li>Construction of additional vent shafts would have local adverse visual impacts .</li> </ul>
<ul style="list-style-type: none"> <li>There will be adverse landscape impacts during construction on The Lee Undulating Valley Slopes, Wendover Gap, Settlement (Wendover), Wendover Foothills and South Vale LCA’s.</li> </ul>	<ul style="list-style-type: none"> <li>Reduced construction impacts in Hyde Heath North.</li> <li>No impact relating to the removal of woodland on Mantle’s Wood, Farthings Wood and Sibley’s Coppice.</li> </ul>

# Chiltern Tunnel Extension – REPA

## Main Environmental effects – Construction - slide 4 of 4

Bill scheme	REPA
<ul style="list-style-type: none"><li>• Noise impacts from construction of South Heath green tunnel (South Heath along Sibleys Rise, Bayleys Hatch and Frith Hill) and from construction traffic on King's Lane is likely to cause significant noise effects on adjacent residential receptors where it passes through South Heath.</li><li>• Noise impacts from Wendover green tunnel construction and earthworks and Ellesborough Road.</li></ul>	<ul style="list-style-type: none"><li>• Overall reduced noise impacts from construction of South Heath green tunnel (South Heath along Sibleys Rise, Bayleys Hatch and Frith Hill) and from construction traffic on King's Lane. Removes likely significant noise effects on adjacent residential receptors where it passes through South Heath.</li><li>• Noise impacts around surface elements including from Wendover green tunnel construction and earthworks and Ellesborough Road.</li></ul>

# Chiltern Tunnel Extension – REPA

## Main Environmental effects – Operation - slide 1 of 2

Bill scheme	REPA
<ul style="list-style-type: none"> <li>• Visual impact of cuttings and viaducts, and adjacent infrastructure within AONB.</li> <li>• Visual impacts from scheme elements on receptors including those on Hyde Lane, King’s Lane, Hyde End and Frith Hill. Also those at South Heath, Wendover Dean and Wendover.</li> <li>• Visual impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>	<ul style="list-style-type: none"> <li>• Removes visual impacts from scheme elements on receptors including those on Hyde Lane, King’s Lane, Hyde End and Frith Hill. Also those at South Heath.</li> <li>• Visual impact of open cuttings and viaducts, and adjacent infrastructure within AONB.</li> <li>• Visual impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>
<ul style="list-style-type: none"> <li>• Landscape impacts from scheme elements experienced by Wendover Gap and Wendover Foothills LCA’s.</li> <li>• Landscape impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>	<ul style="list-style-type: none"> <li>• Landscape impacts from scheme elements experienced by Wendover Gap and Wendover Foothills LCA’s.</li> <li>• Landscape impacts will reduce over time as mitigation planting becomes established and residual effects become more localised.</li> </ul>



# Chiltern Tunnel Extension – REPA

## Main Environmental effects – Operation - slide 2 of 2

Bill scheme	REPA
<ul style="list-style-type: none"> <li>Noise impact at South Heath (Hyde End and South Heath) and Wendover Dean south (Bowood Lane and London Road), Wendover Dean north (Rocky Lane and Chesham Lane), Wendover south (Bacombe Lane) and Nash Lee Lane.</li> </ul>	<ul style="list-style-type: none"> <li>Removes noise impact at South Heath (Hyde End and South Heath).</li> <li>Noise impacts at Wendover Dean south (Bowood Lane and London Road), Wendover Dean north (Rocky Lane and Chesham Lane), Wendover south (Bacombe Lane) and Nash Lee Lane will remain.</li> </ul>
<ul style="list-style-type: none"> <li>Risks to bats and barn owls due to collision impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Risks to bats and barn owls reduced.</li> </ul>

# Chiltern Tunnel Extension – REPA Costs

The table shows the cost differences of the extensions compared to the Proposed Scheme

Item	Bill scheme (£ million)	REPA (£ million)
Tunnels	£797.9	£932.5
Civil Engineering	£125.5	£74.7
Rail Systems	£149.0	£170.7
<b>Sub-total: Construction</b>	<b>£1072.4</b>	<b>£1177.9</b>
Land and Property	£32.8	£0.1
<i>Difference</i>		£72.8
Time-related costs; indirect costs; Value Engineering and efficiency savings	£76.0	£85.9
<b>Total cost difference of Bill Scheme</b>		<b>£82.7</b>

**Notes:**

1. Costs are inclusive of all works required between the Proposed Scheme Chiltern Tunnel south portal and Leather Lane
2. Land and Property costs represent only the costs of acquisition for land north of the Bill Scheme Chiltern Tunnel north portal

# Chiltern Tunnel Extension – All options

## Cost comparison

The table shows the cost differences of the extensions compared to the Proposed Scheme

Item	REPA Option C5 (£ million)	CRAG Option T3i (£ million)	Chiltern Long Tunnel (£ million)
Tunnels	£134.6	£472.1	£614.5
Civil Engineering	-£50.8	-£158.4	-£185.1
Rail Systems	£21.7	£52.8	£64.5
Sub-total: Construction	£105.5	£366.5	£493.9
Land and Property	-£32.7	-£46.8	-£47.1
Time-related costs; indirect costs; Value Engineering and efficiency savings	£9.9	£29.5	£38.3
<b>Total cost difference of hybrid Bill Scheme</b>	<b>£82.7</b>	<b>£349.2</b>	<b>£485.1</b>

**Notes:**

1. Costs are inclusive of all works required between the Proposed Scheme Chiltern Tunnel south portal and the terminal points of each tunnel option
2. Land and Property costs represent only the costs of acquisition for land north of the Bill Scheme Chiltern Tunnel north portal



## **Alignment through the Chilterns AONB - Potential constraints by location**

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# Chalfont St Peter / Chalfont St Giles

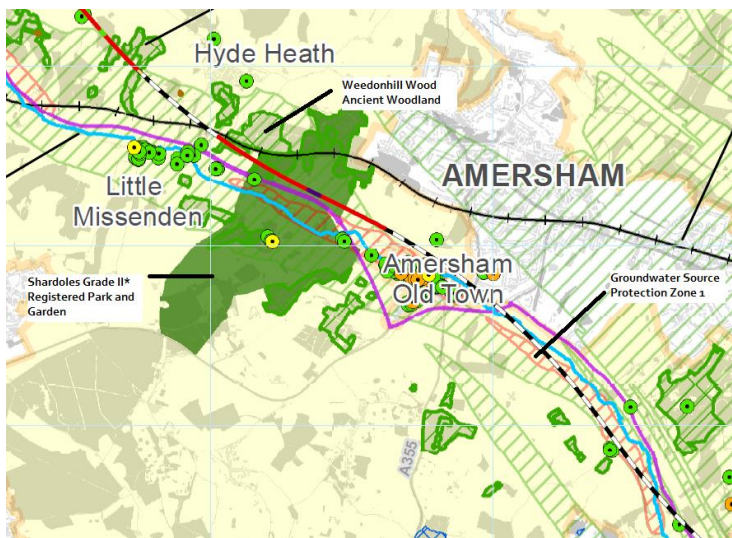
Although outside of the AONB, the alignment coming out of London is designed to avoid the communities of Harefield, on the east side of the Colne Valley, and Denham Green, on the west side.

Passing through the area entirely in deep twin-bore tunnels with three associated ventilation and intervention shafts (vent shafts), the alignment will run 180m to the north of Chalfont St Peter and will pass under the outskirts of Chalfont St Giles at two points.

The vertical and horizontal alignments at this point were constrained by these communities, the desire to reduce the numbers of properties directly overlying the tunnel sections and the need to reduce risks to the River Misbourne.



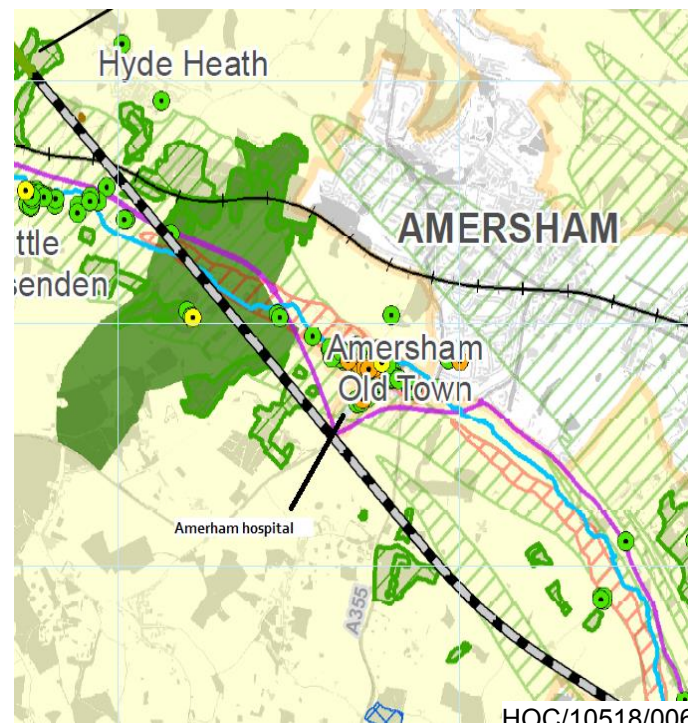
# Amersham



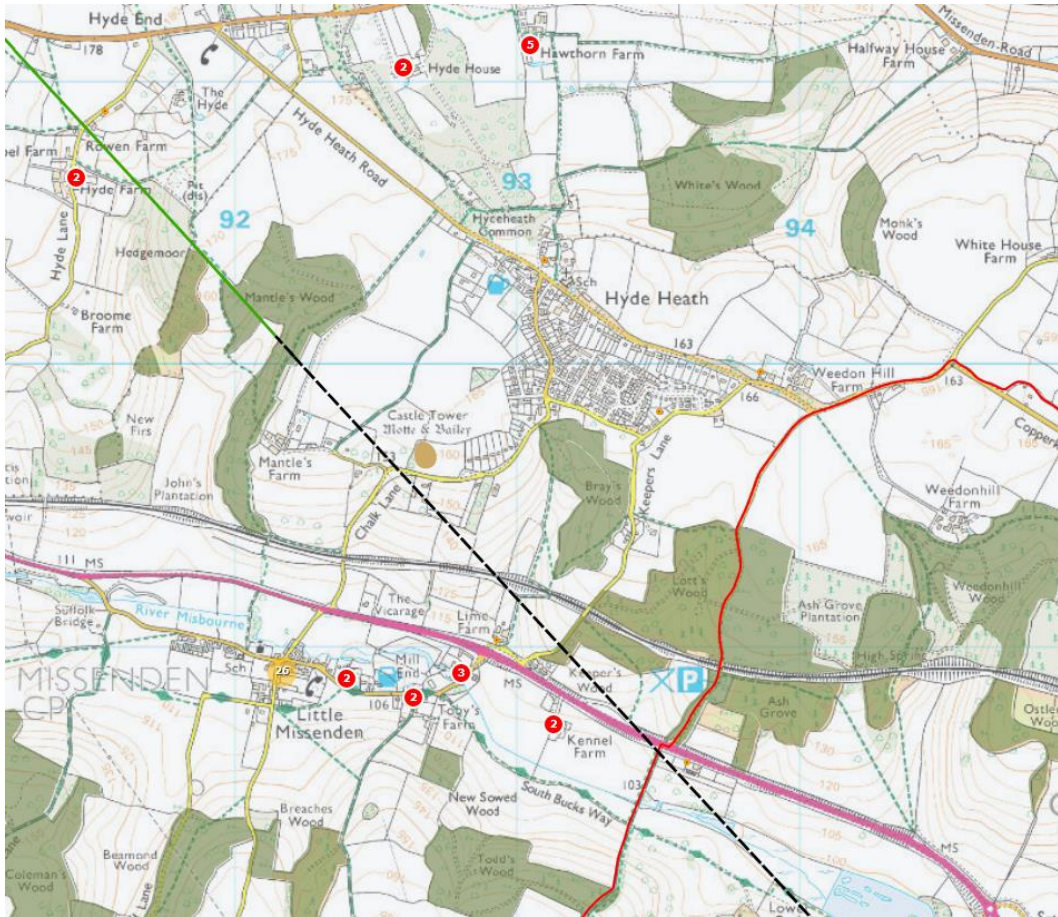
The 2011 Consultation Route passed to the east of Amersham Old Town in tunnel before surfacing to the north. The surface section ran through Shardloes Grade II\* Registered Park and Garden and through Weedonhill Wood ancient woodland. The tunnel section also had the potential to impact the integrity of an important aquifer (SPZ1). Following recommendations the alignment was realigned to the west side of Amersham Old Town and the tunnel merged and extended up to Little Missenden.

By modifying the vertical alignment of the tunnel and extending the Chilterns tunnel to Mantles Wood, the landtake impacts associated with the very deep cuttings north of Amersham could be avoided, together with the associated movement of excavated materials through the AONB.

It also avoided the surface impacts to the Grade I listed Shardloes and its Grade II\* Registered Park and Garden, the loss of over 4ha of ancient woodland associated with the complex of ancient and replanted woodland at Weedonhill Wood, High Spring and Ostlers Woods and increased the depth of cover for the crossing of the River Misbourne.



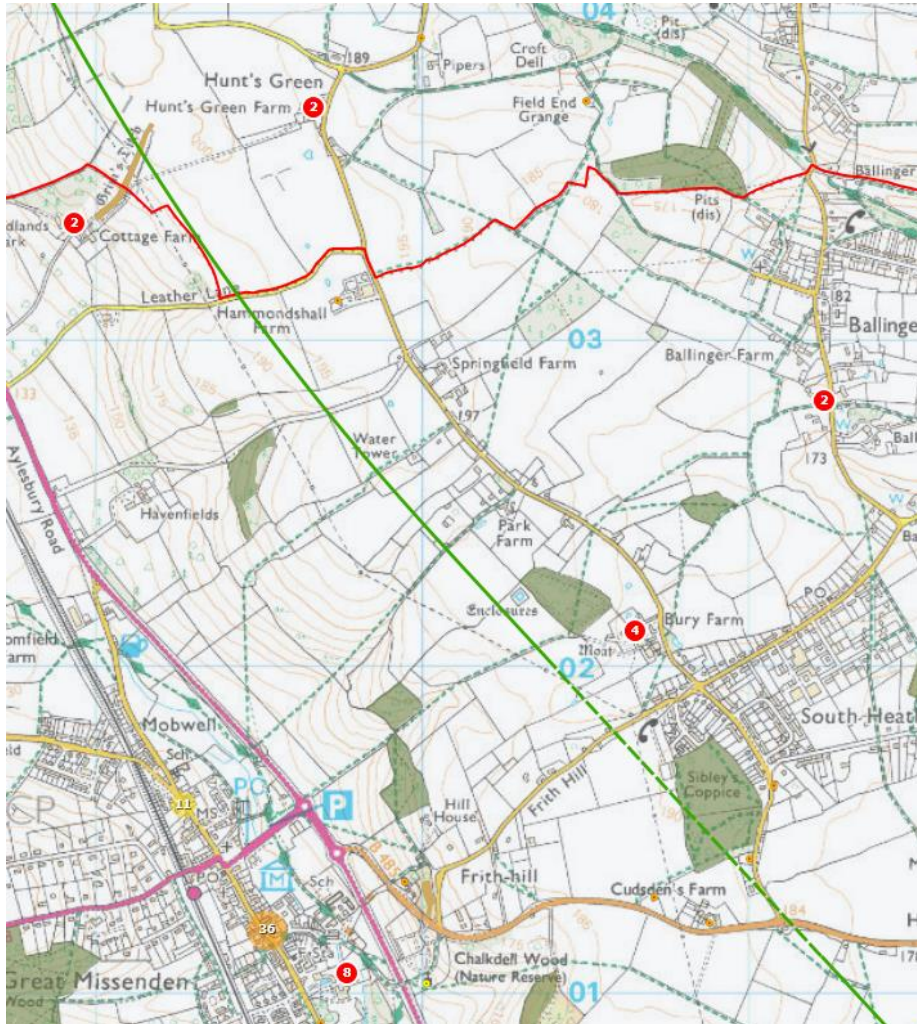
# Little Missenden / Hyde Heath and Mantles Wood



Continuing north from Amersham, the alignment continues northwards in twin-bored tunnel between the communities of Little Missenden to the west and Hyde Heath to the east. A deviation eastwards would bring the alignment closer to the outlying properties at Hyde Heath and the Castle Tower Motte and Bailey scheduled monument west of Hyde Heath. It would also involve substantially more landtake to Mantles Wood once the alignment makes its transition to surface and bring the route closer to South Heath.

A shift westwards would require additional landtake to Farthings Wood and potentially require the demolition of listed buildings and other residential properties at Hyde Farm and Chapel Farm respectively. It would also conflict with the Chilterns escarpment and sequence of dry valleys that are a key characteristic of the landscape.

# South Heath



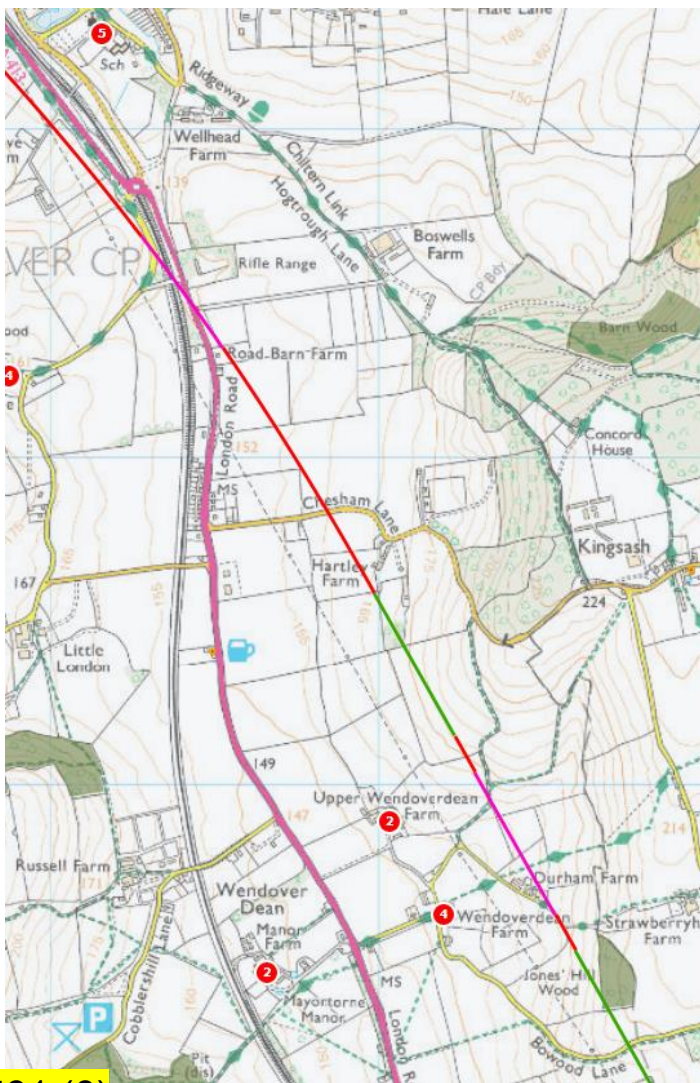
The alignment in this section broadly follows the plateau along the top of the chalk escarpment of the Chiltern Hills, which poses an important constraint immediately to the west of the alignment.

A key consideration in this area was also to achieve a route alignment that minimised property demolitions and landtake to properties on the east side of the alignment at South Heath and minimised landtake to Grim's Ditch scheduled monument on the west side.

A further consideration in this area was to confirm the extent of green tunnel that would mitigate potential noise and visual impacts for the communities of South Heath, Frith Hill and Cudsden's Court, provide an opportunity for the local re-use of excavated material and maintain access via the B485 during construction. An extended green tunnel at this location also provided opportunities for landscape reinstatement and planting that would help offset the permanent loss of ancient woodland at Sibley's Coppice.



# Wendover Dean



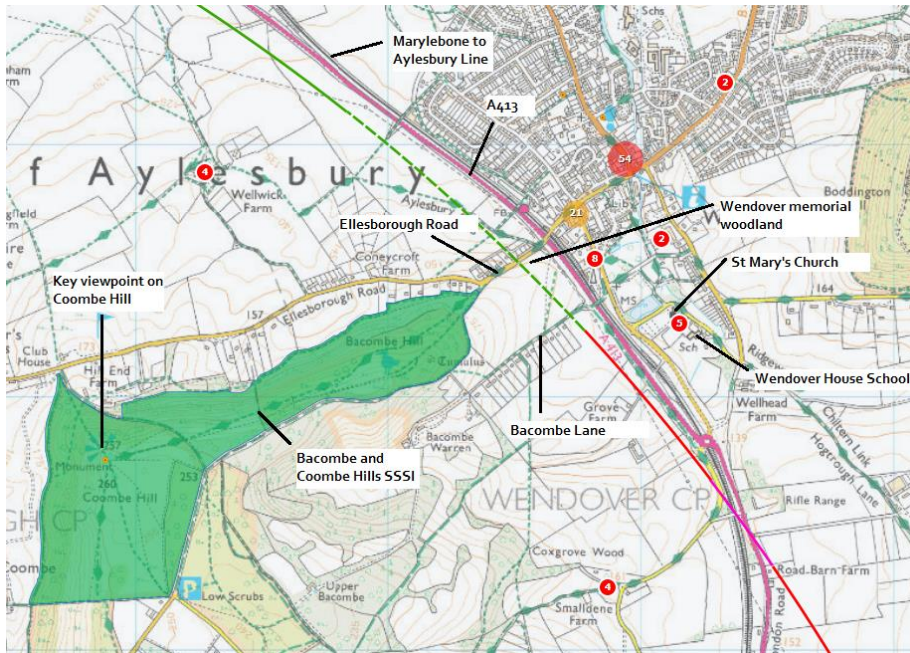
The alignment continues along the top of the chalk escarpment before crossing Wendover Dean on a viaduct, approximately 500m long and up to 18m high. It then passes on an embankment prior to crossing over the A413 London Road and Marylebone to Aylesbury Line on a viaduct.

Constraints driving the alignment in this area include the topography, listed buildings, ancient woodland, a dry valley, properties and the crossing of the transport corridor within the valley bottom.

An alternative option was considered at Wendover Dean, which would have replaced the viaduct with a lower alignment on embankment. However, this alteration would require considerably deeper cuttings either side of the dry valley, and would increase the loss of ancient woodland at Jones' Hill Wood and potentially increased land take to Grim's Ditch.

Moving the alignment further down the escarpment would require the potential demolition of six listed buildings at Upper Wendover Dean Farm and Wendover Dean Farm and the potential loss of properties on both Rocky Lane and the A413 London Road in order to span the A413 and existing railway line. There would also be downstream effects including further loss of Grim's Ditch and listed buildings to the west of this Scheduled Monument. A more easterly alignment would result in increased landtake to Jones' Hill Wood, an area of ancient woodland, properties on Rocky Lane and would have required the introduction of a long and oblique crossing over the A413 London Road and Chilterns Railway.

# Wendover



At the northern end of the AONB the Proposed Scheme passes to the west of Wendover in a series of embankment, green tunnel and cuttings. The rationale for the alignment shown considered the following constraints:

- Wendover – the urban community of Wendover prevents any realignment to the east including the constraints of the transport corridor of the A413 Nash Lee Road and Marylebone to Aylesbury Line;
  - Loss of all or part of the Wendover Memorial Woodland;
  - Residential properties – six properties would be demolished on Ellesborough Road. Moving the alignment would introduce additional demolitions on Bacombe The alignment chosen seeks to minimise the overall numbers of demolitions on these two roads.
- 
- The rising topography associated with Bacombe and Coombe Hills, which are also designated as an SSSI, serves to restrict any further shift in alignment westwards.

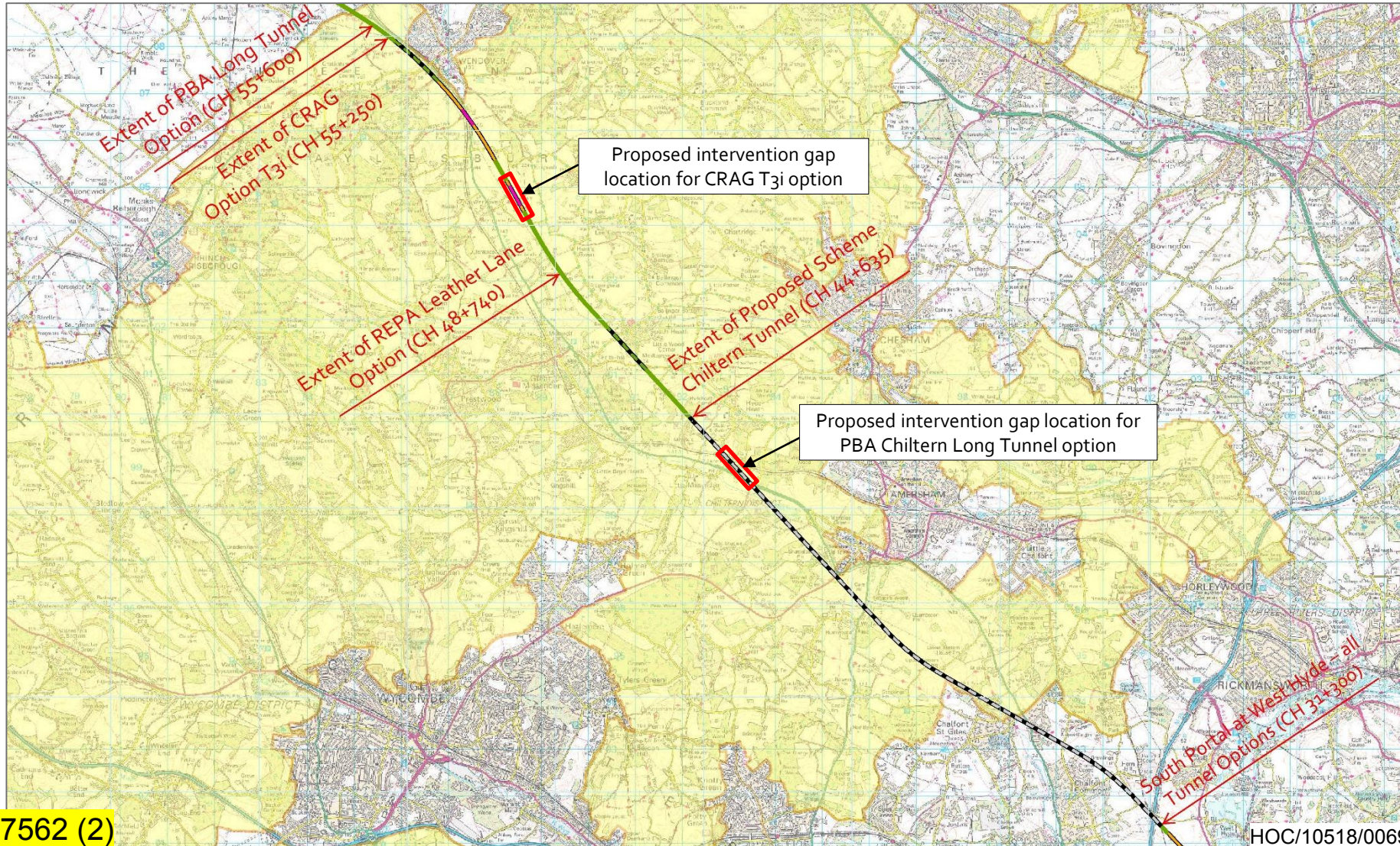
The 2012 Post Consultation route shifted the alignment 50m further away from Wendover, which provided for better integration with the existing landform and more space for visual and noise screening, while a slight lowering of the alignment allowed existing green tunnel to be extended by a further 800m northwards. The lowered alignment would also allow existing road infrastructure to be reinstated following construction, thereby avoiding permanent road

# Extended Chilterns Tunnel – Intervention Gap

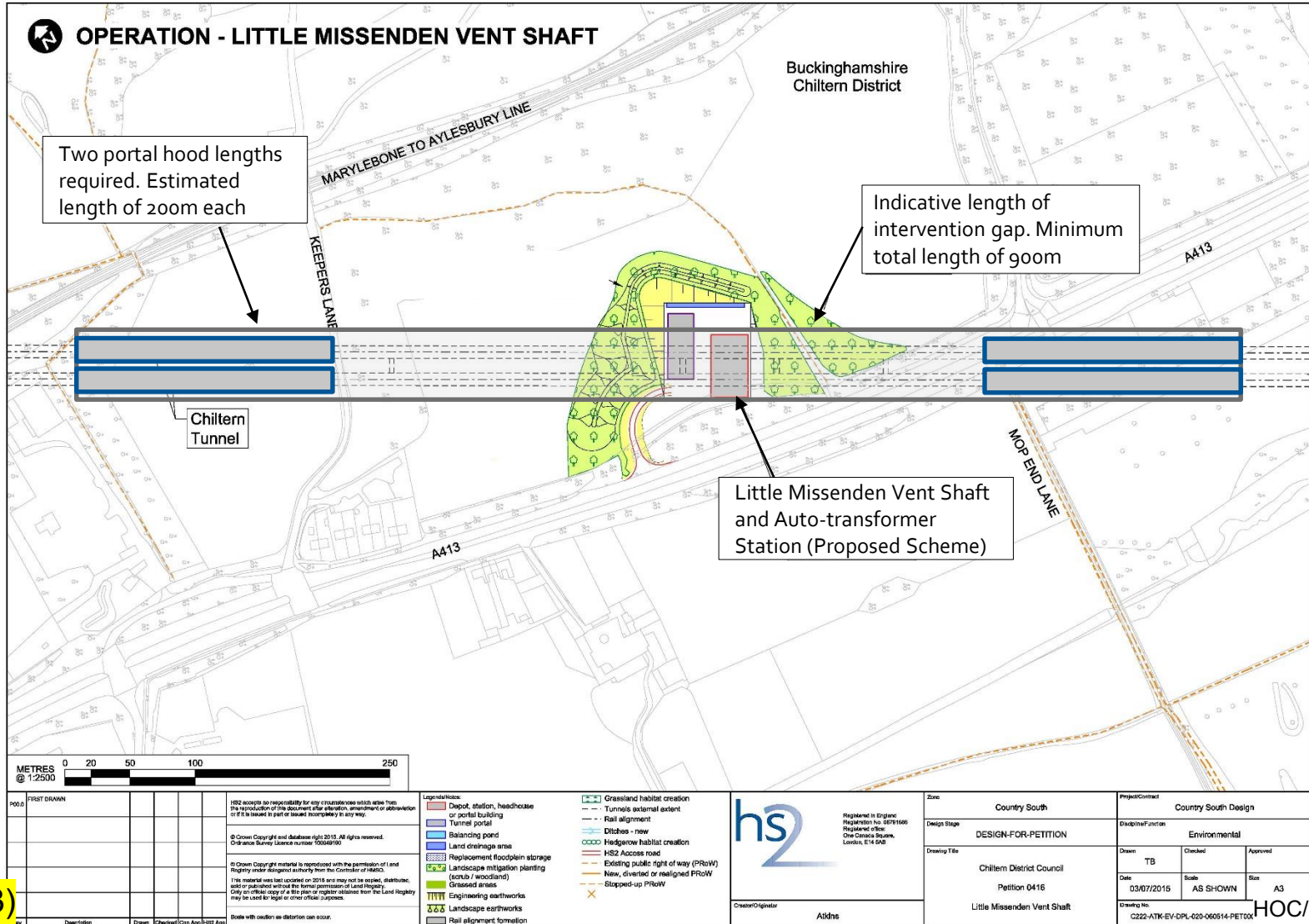
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- The CRAG T3i option includes an intervention gap at Wendover Dean.
- The Chiltern Long Tunnel proposal includes an intervention gap at the location of the Little Missenden vent shaft.
- The minimum length of the gap between successive sections of tunnel is set at train length plus 100m. Two portal hood lengths (currently estimated at 200m each) must be added, giving a minimum 900m length of gap between the tunnel drives
- To function as a Firefighting Point, the intervention gap would also need to comply with the following HS2 requirements:
  - Inclusion of lifts and stairs to allow passenger egress from track level to the ground surface
  - Vehicular access to track level;
  - Access for emergency vehicles to track level with passing bay provision to allow for passage and parking of emergency vehicles alongside the train;
  - Access from public roads; and
  - Provision of storage facilities for firefighting apparatus and water supply.
- The choice of construction type would depend on the location of the gap structure and would determine the land take required.

# Extended Chilterns Tunnel – Intervention Gap



# Chiltern Long Tunnel - Little Missenden Intervention Gap Schematic



P7562 (3)

# CRAG T3i Tunnel Option

## Excavated Material volume and removal

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In this option the bored Chiltern tunnel would be extended to chainage 55+250:

- Volume of spoil generated at the northern portal – 1,700,000m<sup>3</sup> (excluding material generated from the construction of ventilation gaps)
- Number of 2-way lorry trips – 400,000
- Volume of spoil generated at the Intervention Point (gap structure) at Durham Farm – 1,350,000m<sup>3</sup>
- Number of 2-way lorry trips – 318,000
- The destination of where material generated from the bored tunnel and gap structure would be taken for reuse or disposal is unknown at this stage. The public highway routes that would be used for removal are:
  - A413, B4009 Nash Lee Road, A4010 Risborough Road and the M40;
  - A413, A355, A40 and the M40; and
  - A413, A40 and the M40/M25.
- It may be possible to reuse 800,000m<sup>3</sup> of the spoil generated at the northern portal for mitigation earthworks at Aylesbury. The spoil would be transported along site haul roads.
- There would be a shortage of material generated at the southern portal compared to the Proposed Scheme. Importation of material would be required via the M25 slip roads to account for the shortage.