

EXHIBIT LIST

Reference No: HOC/10006

Petitioner: Whitmore_Madeley Tunnel

Published to Collaboration Area: Wednesday 18-Apr-2018

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HS2

Phase 2a – Whitmore Heath to Madeley: Proposed Scheme & the Twin Bored Single Tunnel

April 2018

Proposed Scheme & the Twin Bored Single Tunnel Option – cost comparison

Item	Proposed Scheme (£ million)	The Twin Bored Single Tunnel (£ million)
Tunnels	182.02	369.38
Civil engineering (excluding earthworks)	144.52	50.55
Rail systems	69.66	103.55
Indirect costs	65.37	84.92
Sub-total: Construction & Indirect costs:	461.57	608.39
Sub-total difference:		146.82
Earthworks (reduction against Proposed Scheme)		-8.82
Land & Property (reduction against Proposed Scheme)		-15.94
Efficiency adjustment		5.38
Avoided design improvements required for Proposed Scheme		-1.20
Total Difference:		126.24
Contingency (40%)		50.50
Total cost difference from Proposed Scheme:		176.74

Proposed Scheme & the Twin Bored Single Tunnel – cost comparison notes

1. Tunnel costs include bored tunnels, cross passages, cut & cover tunnels, portals and shafts. The tunnel advancement rate assumed is 90 metres per week.
2. Civil engineering costs include bridges, viaducts & other structures, roads and utility diversions.
3. Indirect Costs include HS2 corporate costs, project management, design development & insurances. They are calculated on a % basis.
4. Earthworks costs represent the cost saving in adopting the single tunnel. The earthworks model considers re-use of excavated material, processing requirements, mass haul, disposal etc. These costs cannot be isolated for a specific section of route.
5. The cost shown for Land & Property illustrates the saving associated with avoided purchases from adopting the Single Tunnel Scheme.
6. The Efficiency Adjustment represents expected opportunity cost savings associated with rail systems and indirect costs and the loss of efficiency opportunity associated with the reduced civil engineering cost.
7. Contingency (40%) is consistent with the Proposed Scheme and is applied to the Total Difference.
8. All costs are stated at base date 1Q 2015.

General Arrangements

	Proposed Scheme	The Twin Bored Single Tunnel Option
General Arrangements	<ul style="list-style-type: none">• Whitmore Heath Tunnel: 690m long twin bore tunnel/238m long cut and cover tunnel/150m long porous portals;• Madeley Tunnel: 670m long twin bore tunnel/150m long porous portals;• A retaining wall 495m long;• Manor Road overbridge;• 785m River Lea Valley viaduct;• Realignment of the A53 and A525;• Stopping up of Snape Hall Road.	<ul style="list-style-type: none">• 6,400m long twin bore tunnel/150m long porous portals;• 2 ventilation and intervention shafts and associated head houses and access roads.

Construction Effects – slide 1 of 2

	Proposed Scheme	The Twin Bored Single Tunnel Option
Method and Duration	<ul style="list-style-type: none"> Whitmore Heath tunnel assumed to be bored by TBM from the Whitmore Heath southern portal. The TBM will break through at the north portal where it will be dismantled and returned to the southern end to drive the second bore; Madeley tunnel assumed to be bored by TBM from the Madeley Tunnel southern portal. The TBM will break through at the north portal where it will be dismantled and returned to the southern end to drive the second bore. Work assumed to commence in Q4 2020 and end Q1 2025, with a duration of 4 years and 6 months. 	<ul style="list-style-type: none"> Twin bores of the single tunnel will be driven by 2 TBMs from the Whitmore Heath southern portal. Work assumed to commence in Q4 2020 and end Q1 2025, with a duration of 4 years and 6 months.
Construction Logistics - Worksites		
Main Tunnel Drive	2	1
Vent Shafts	0	2

Construction Effects – slide 2 of 2

	Proposed Scheme	The Twin Bored Single Tunnel Option
Utilities	<ul style="list-style-type: none">Local diversions of telecommunications assets.	<ul style="list-style-type: none">No diversions required.
Excavated Materials	1,060,000m3	1,280,000m3
Surplus Material	0	680,000m3

Environmental Impacts Comparison

	Proposed Scheme	The Twin Bored Single Tunnel Option
Airborne noise/dwellings potentially eligible for noise insulation	6	1
Ground-borne noise/dwellings potentially eligible for further mitigation	3	0
Loss of woodland Habitat/Ancient Woodland	33.2ha/6.7ha	13.6ha/0.3ha
Listed buildings indirectly affected	6	1
Public Rights of Way stopped up or diverted	11	5
Permanent loss of agricultural land	190ha	46ha
Farm holdings permanently affected	19	10

Construction Impacts Comparison

	Proposed Scheme	The Twin Bored Single Tunnel Option
Dwellings potentially eligible for noise insulation	6	0
Temporary Loss of agricultural land	336ha	216ha
Traffic associated with construction	<ul style="list-style-type: none"> • Temporary diversion of A53 Newcastle Road (and reinstatement), and permanent diversion of the A525 Bar Hill Road and Manor Road. Snape Hall Road permanently closed. • Peak construction HGV traffic on the A53 Newcastle Road (between A5182 Trentham Road and the Proposed Scheme) 706 HGV movements per day. Peak/busy period duration estimated at 10 months (where flows exceed 50% of the peak construction HGV flow). • Peak construction HGV traffic on the A525 Bar Hill Road 522 HGV movements per day. Peak/busy period duration estimated at 4 months (where flows exceed 50% of the peak construction HGV flow). 	<ul style="list-style-type: none"> • No need for these diversions or closure. • Peak construction HGV traffic on the A53 Newcastle Road (between A5182 Trentham Road and the Proposed Scheme) 650 HGV movements per day. Peak/busy period duration estimated to increase to 18 months (where flows exceed 50% of the peak construction HGV flow). • Peak construction HGV traffic on the A525 Bar Hill Road 330 HGV movements per day. Peak/busy period duration estimated to increase to 13 months (where flows exceed 50% of the peak construction HGV flow) • The total HGV construction vehicles through the roadhead located on the A53 Newcastle Road increases by 16% and reduces through the roadhead located on the A525 Bar Hill Road by 30%.

Southwards extension of Whitmore Heath Tunnel

Southwards extension of Whitmore Heath Tunnel would;

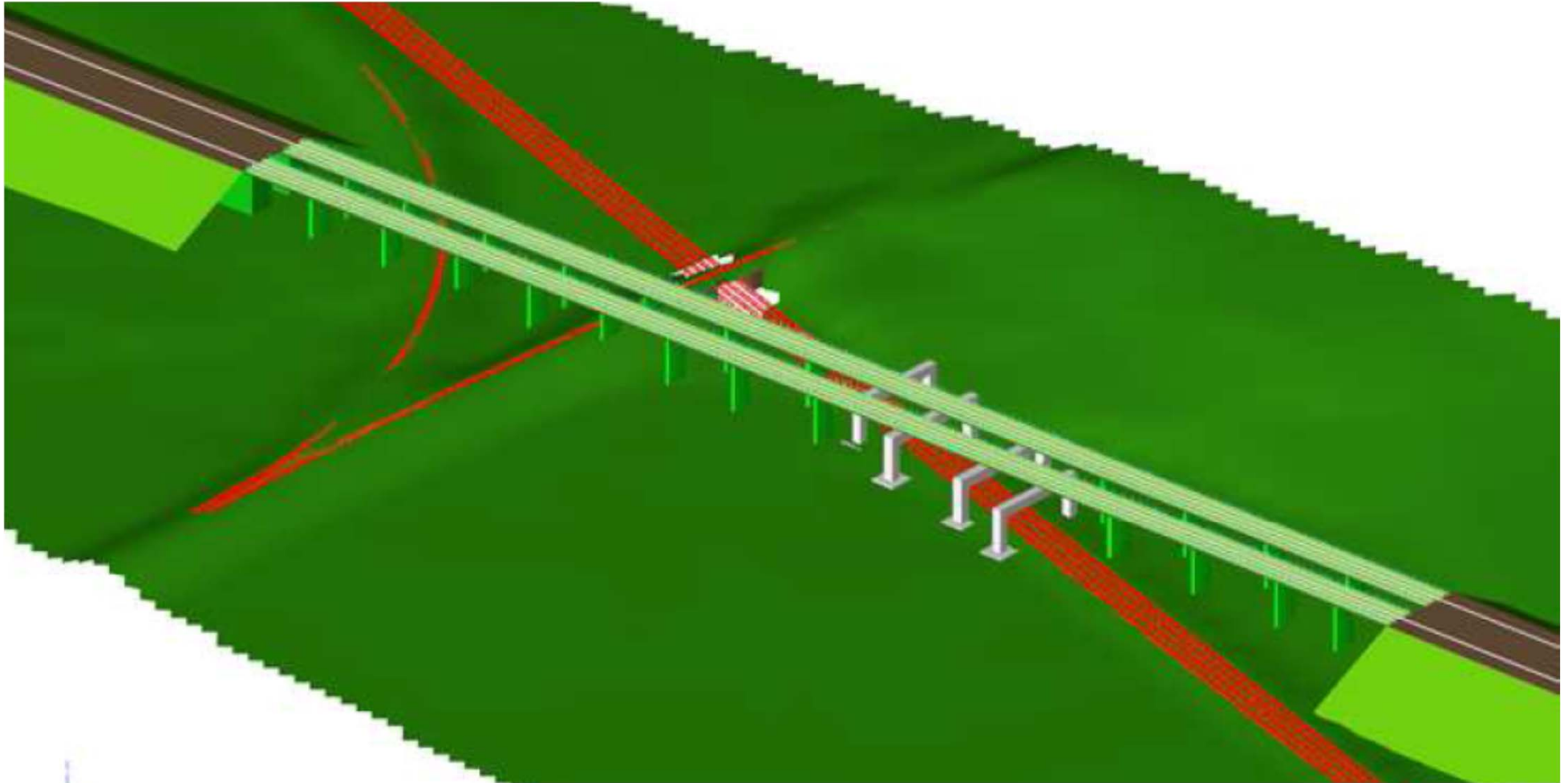
- Remove need for cut and cover section;
- Remove need for temporary diversion of A53 Newcastle Road;
- Avoid significant groundborne noise effects to 3 dwellings at Whitmore Heath;
- Reduce visual impact at Meece Brook Viaduct and Meece Embankment;
- Reduce impact on Whitmore Wood by 0.5ha;
- Simplify construction by removing need to reinstate A53 over tunnel portal;
- Reduce the cost of the Phase 2a project by approximately £12.8m.

River Lea Viaduct

During detailed design, it would be possible to lower the River Lea viaduct by up to 3.4m, at its highest point, and by an average of 1.5m. This can be achieved without affecting the operation of the West Coast Mainline. This change could result in a potential cost saving of approximately £1 million.

Any further lowering of the River Lea viaduct (of up to 1.5m) would require works to the West Coast Mainline, involve additional disruption to services and involve significant additional cost of approximately £5.5m.

River Lea Viaduct



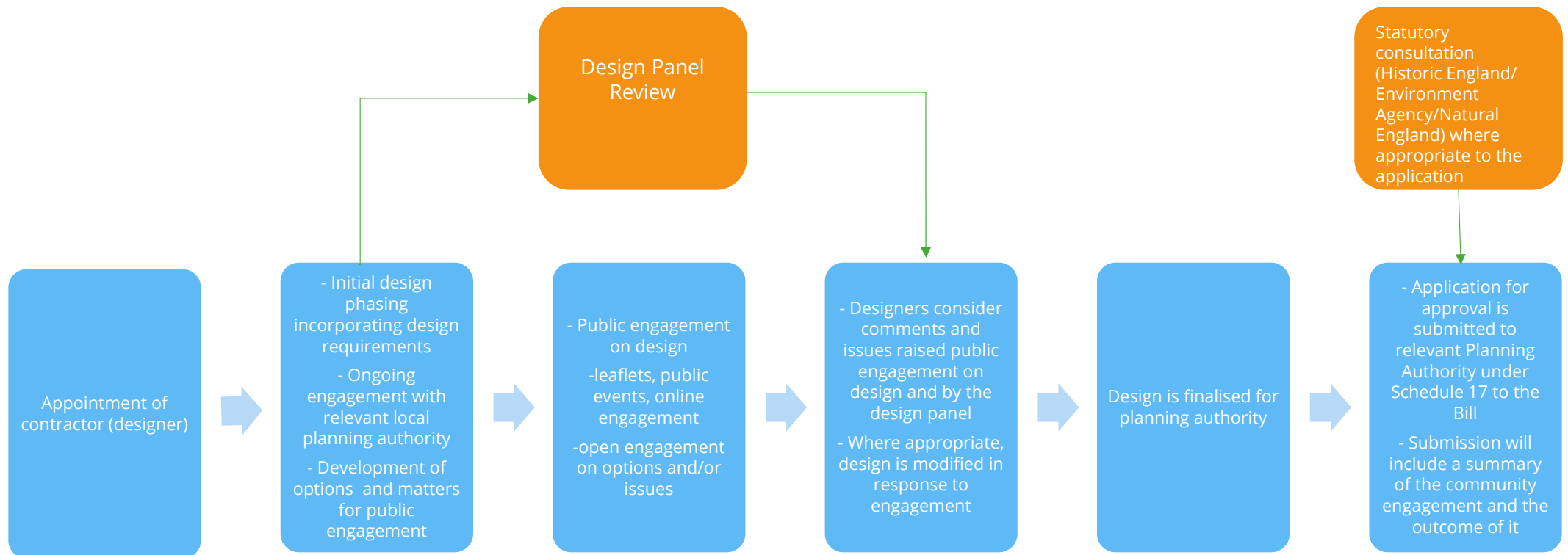
Key Design Elements - engagement

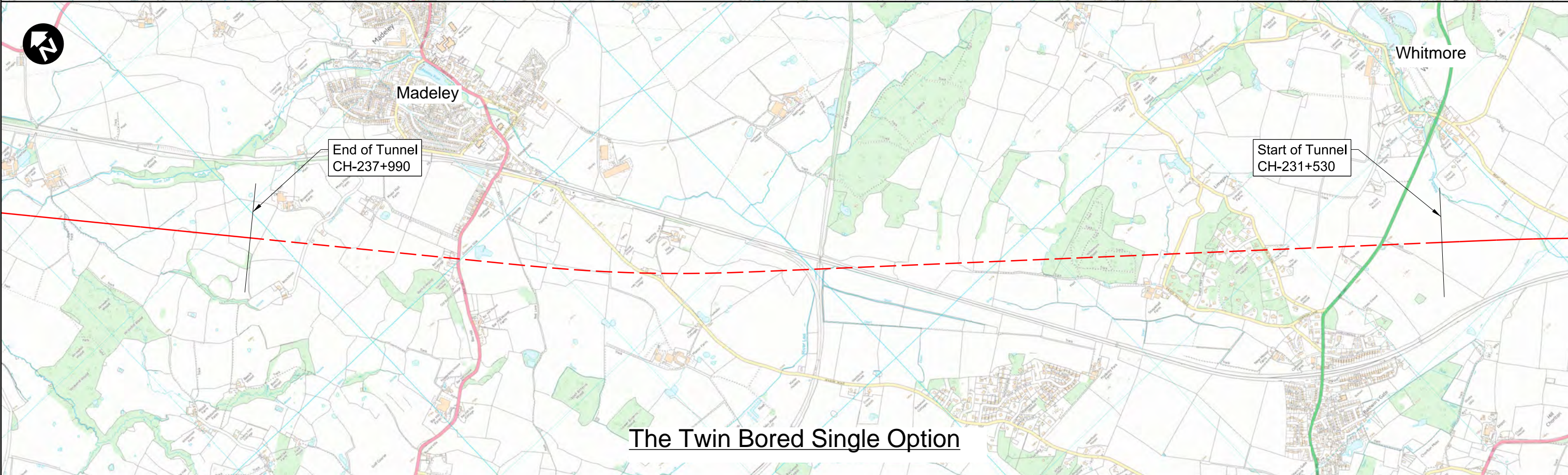
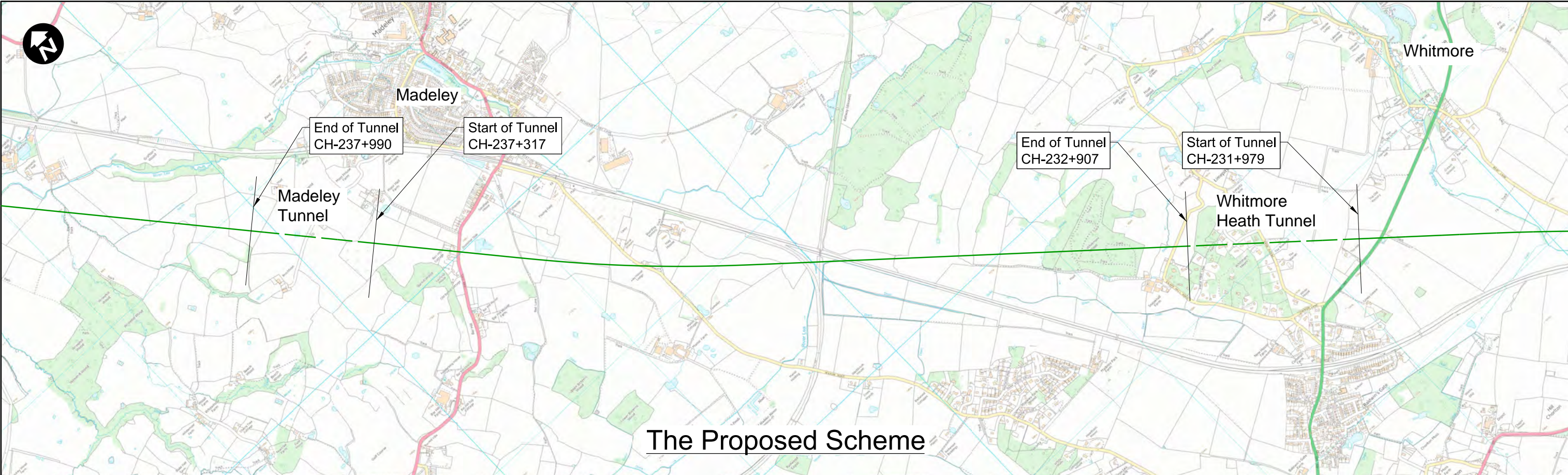
The nominated undertaker will carry out community engagement on the detailed design of key design elements. Such community engagement is likely to be directed at the members of the public in the area where each key design element is located. The exact scope and nature of public engagement will depend on the key design element in question.






The following are key design elements:

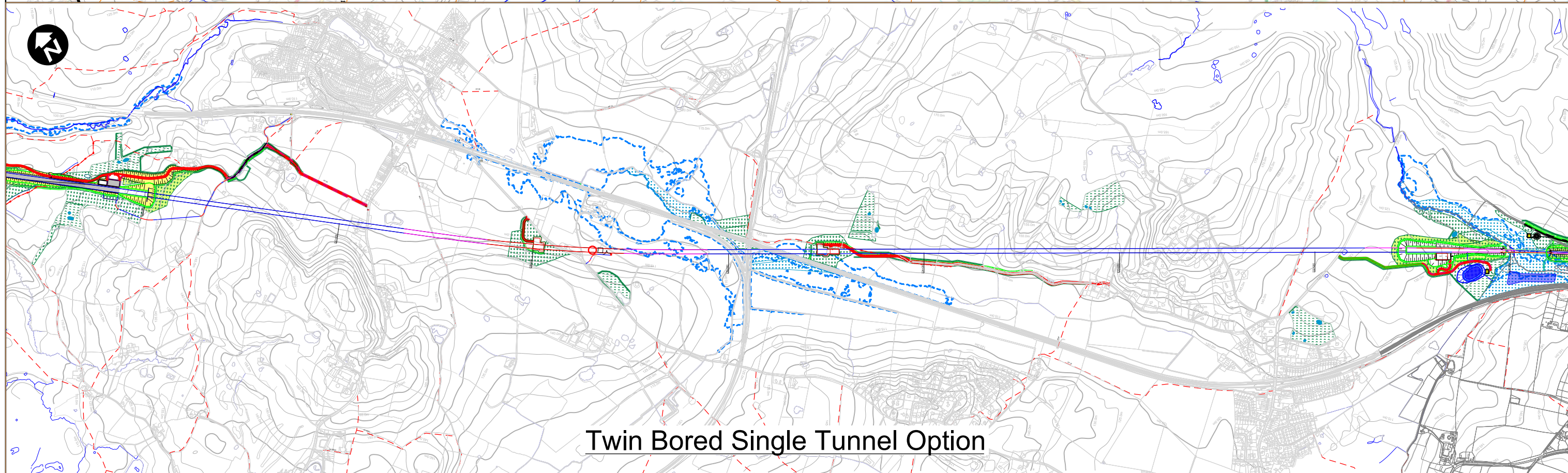
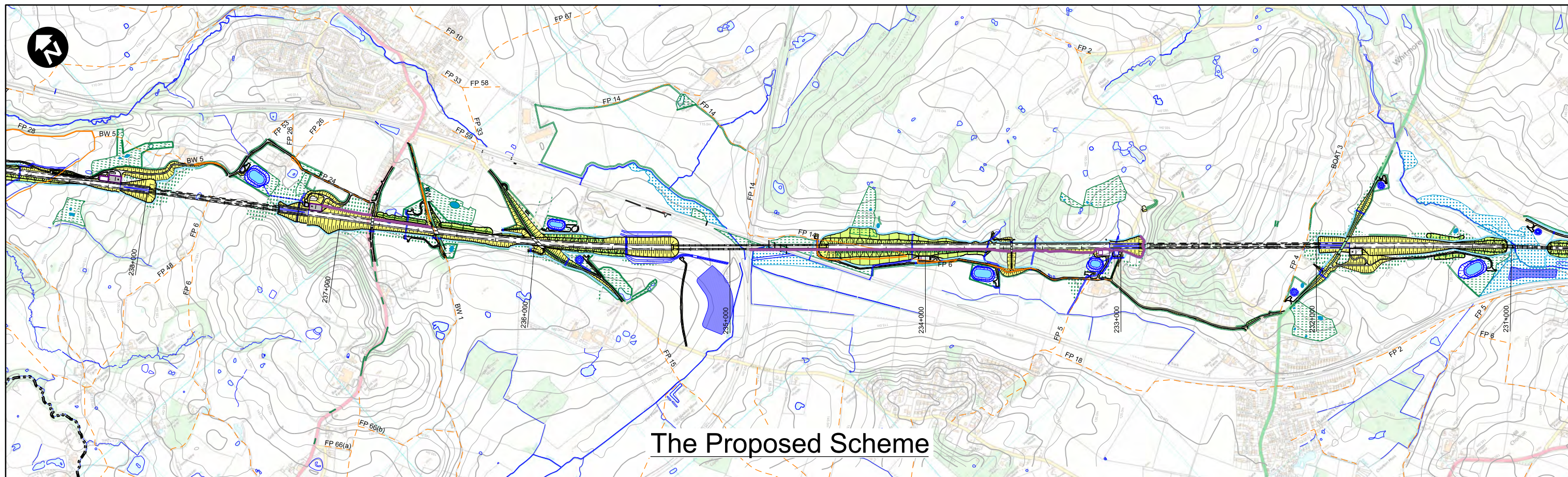
- Whitmore Heath Tunnel – South Portal;
- Whitmore Heath Tunnel – North Portal;
- River Lea Viaduct;
- Madeley Tunnel South Portal; and
- Madeley Tunnel North Portal.


Design - Engagement

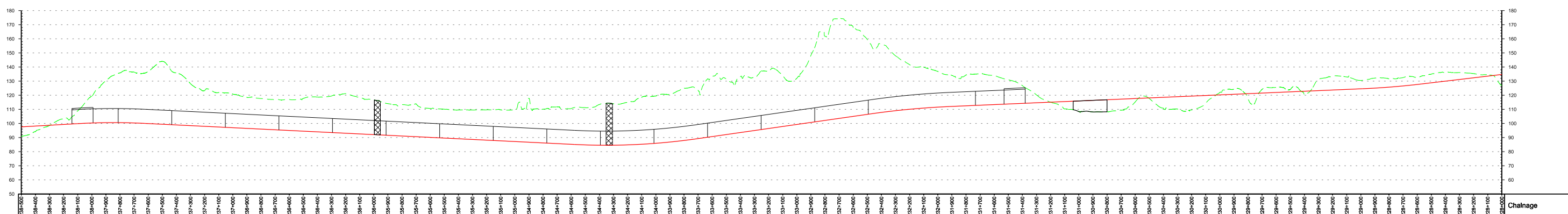
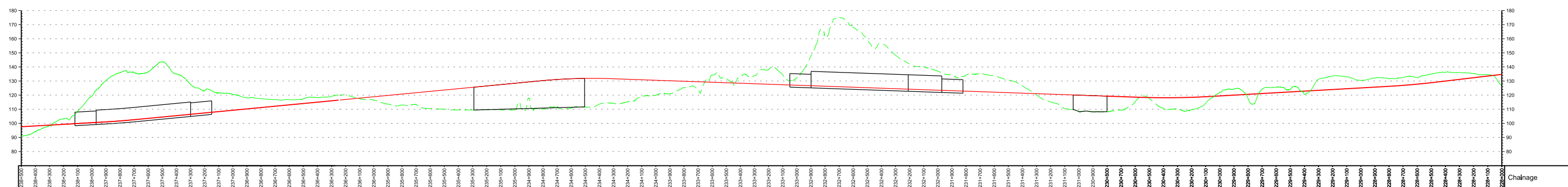




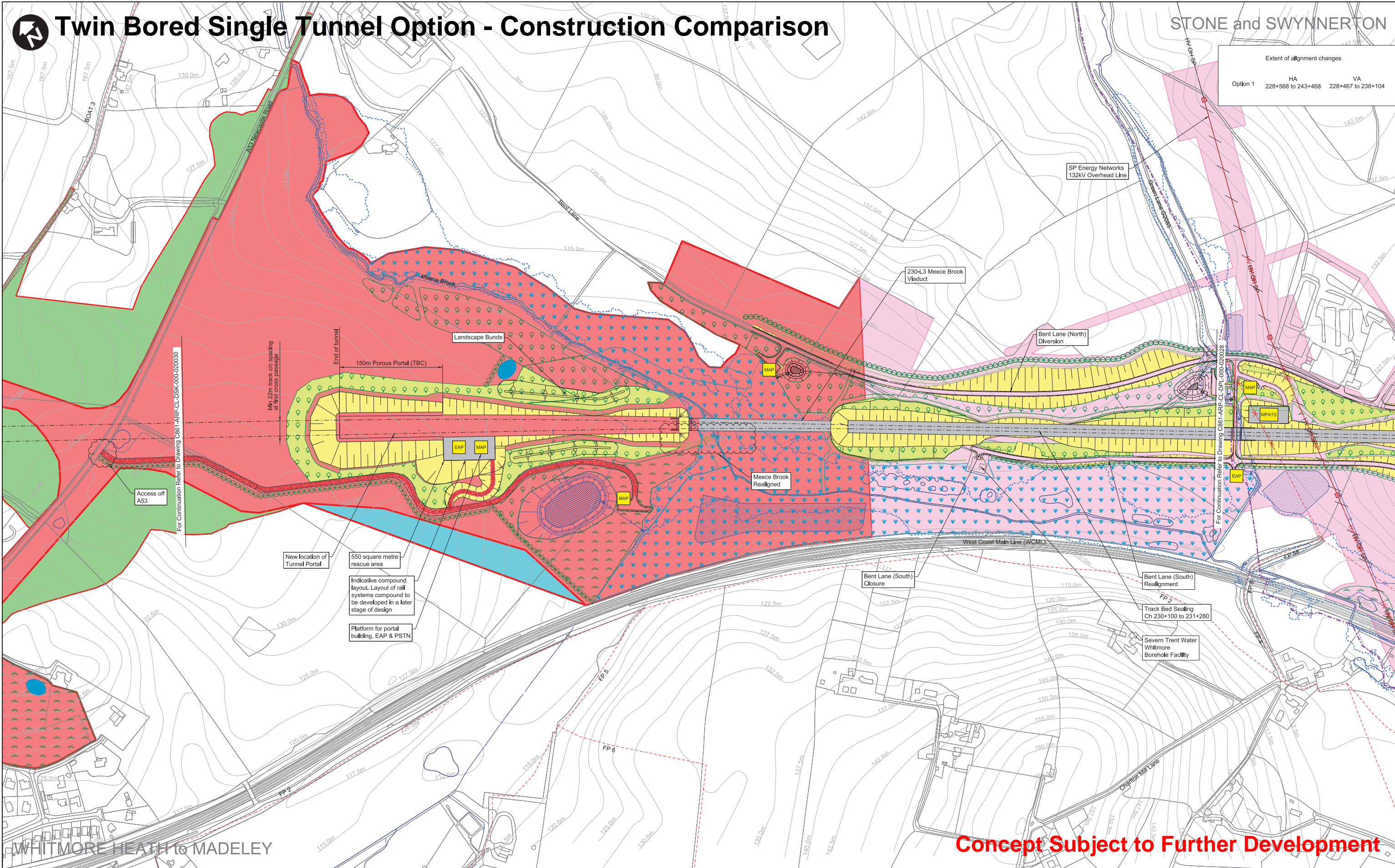
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										Drawing No. C861-ARP-PT-DSK-000-100651			Rev. P01		
								Creator/Originator Ove Arup & Partners International Ltd				HOC/10006/00			
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										<div>Drawing No. C861-ARP-PT-DSK-000-100652</div> <div>Rev. P01</div>
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										Proposed Scheme and			Date	Scale	Size
										Twin Bored Single Tunnel Option			17/04/18	NTS	A3
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											Date	21/07/2017	Scale	AS SHOWN	Size	A1

6 (1)

Description

Drawn

Checked

Con App

HS2 App

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Sheet 29

C861-ARP-CL-DPL-000-020029

HOC/10006/0018

Rev. P03

	HA	VA
Option 1	228+568 to 243+468	228+467 to 238+104

For Continuation Refer to Drawing C861-ARP-CL-DSK-000-020031

For Continuation Refer to Drawing C861-ARP-CL-DSK-000-020029

Access off
A53 as per
CP3 design

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Legends/Notes:

- Consolidated Construction Boundary (CCB) for Published Scheme based on Drawing C861-ARP-CL-DPL-000-021030 - P05
- CCB for Long Tunnel Concept Layout

Key:

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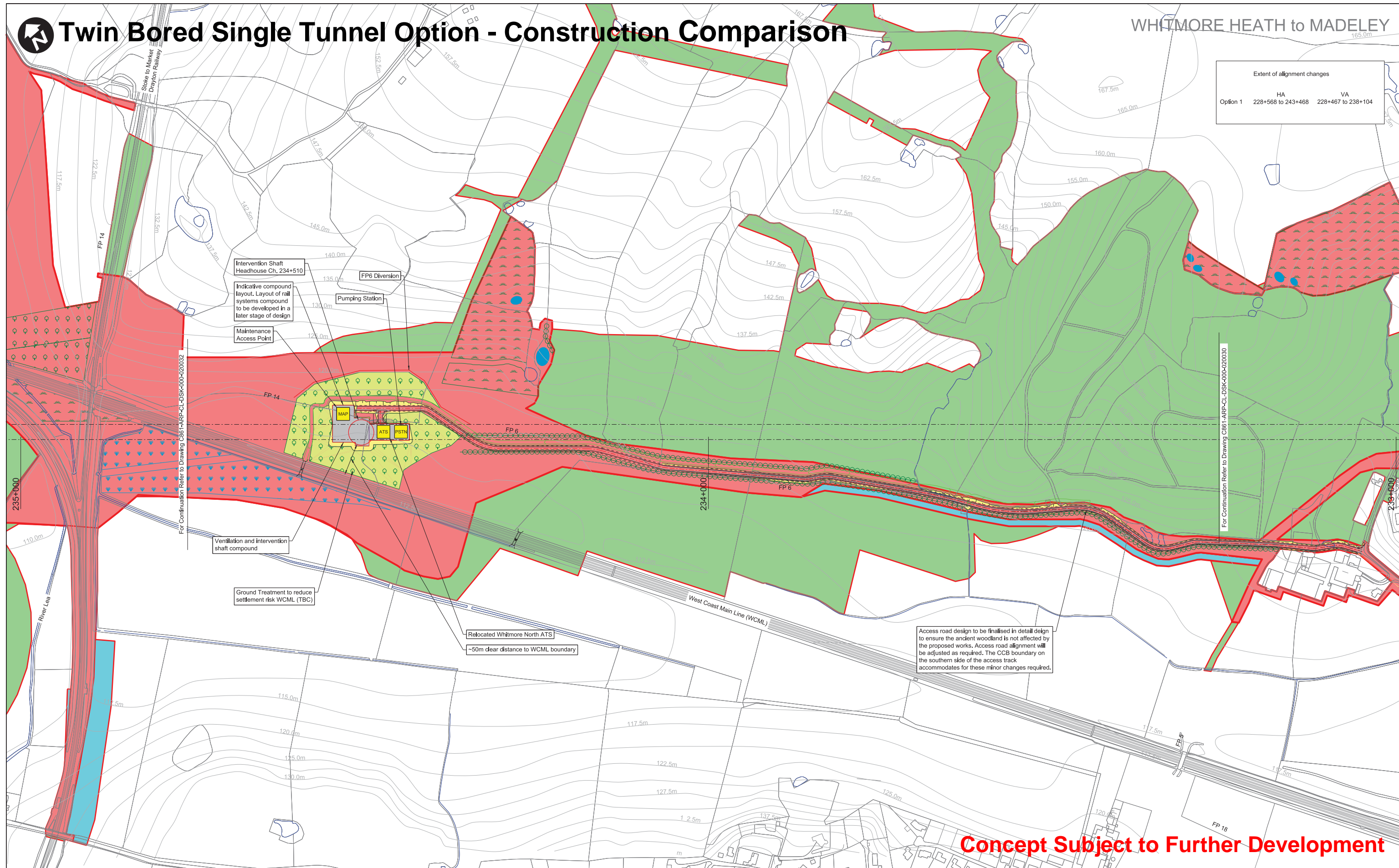
Creator/Originator
Ove Arup & Partners International Ltd

Zone		Project/Contract	
Route Wide		P2A CIVILS Design & Environmental Services	
Design Stage		Discipline/Function	
Preliminary Concept Design		Construction and Logistics	
Drawing Title		Drawn	Checked
Twin Bored Single Tunnel Option		PN	AG
		TE	
Preliminary Concept Revised CCB		Date	Scale
		06/09/2017	AS SHOWN
		A1	
Sheet 30		Rev.	
		C861-ARP-CL-000-020030	P03

HOC/10006/000

WHITMORE HEATH to MADELEY 165.0m

	Extent of alignment changes	
	HA	VA
Option 1	228+568 to 243+468	228+467 to 238+104



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										Preliminary Concept Revised CCB		Date	Scale	Size	06/09/2017	AS SHOWN	A1	
												Drawing No.			C861-ARP-CL-DPL-000-021031		P03	
															HOC/10006/002			
Description		Drawn	Checked	Con App	HS2 App	Scale with caution as distortion can occur.	Sheet 31											

Twin Bored Single Tunnel Option - Construction Comparison

WHITMORE HEATH to MADELEY

Extent of alignment changes

	HA	VA
Option 1	228+568 to 243+468	228+467 to 238+104

WCML Modifications to Accomodate HS2 Connection (See Note 1) may not be required for Long Tunnel 1 options (TBC)

CCB for Borrow Pit Extent
TBC for Long Tunnel Options:

Ventilation and Intervention shaft compound

Intervention
shaft headhouse
Ch. 235+974

Indicative compound layout.
Layout of rail systems
compound to be developed
in a later stage of design

For Continuation Refer to Drawing C861-ARP-CL-DSK-000-020033

Emergency access point

Manor Road remain
as existing

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WHITMORE HEATH to MADELEY

	HA	VA
Option 1	228+568 to 243+468	228+467 to 238+104

WCML Modifications to Accomodate HS2 Connection (See Note 3) may not be required for Long Tunnel options (TBC)

Temporary Roundabout to Control Vehicles at Site Road Crossing

A525 Bar Hill Road,
remain as existing

Number of children	Frequency
0	10
1	25
2	85
3	65
4	45
5	35
6	25
7	15
8	10
9	5
10	5

For Continuation Refer to Drawing C861-ARP-CL-DSK-000-020034

For Continuation Refer to Drawing C861-ARP-CL-DPL-000-020133

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Zone
Route Wide

Design Stage
Preliminary Concept Design

Drawing Title
Twin Bored Single Tunnel Option
Preliminary Concept Revised CCB

Sheet 33

Project/Contract
P2A CwIs Design & Environmental Services

Discipline/Function
Construction and Logistics

Drawn
EW

Checked
AG

Approved
TE

Date
21/07/2017

Scale
AS SHOWN

Size
A1

Drawing No.
C861-ARP-CL-DPL-000-021033

Rev.
PO

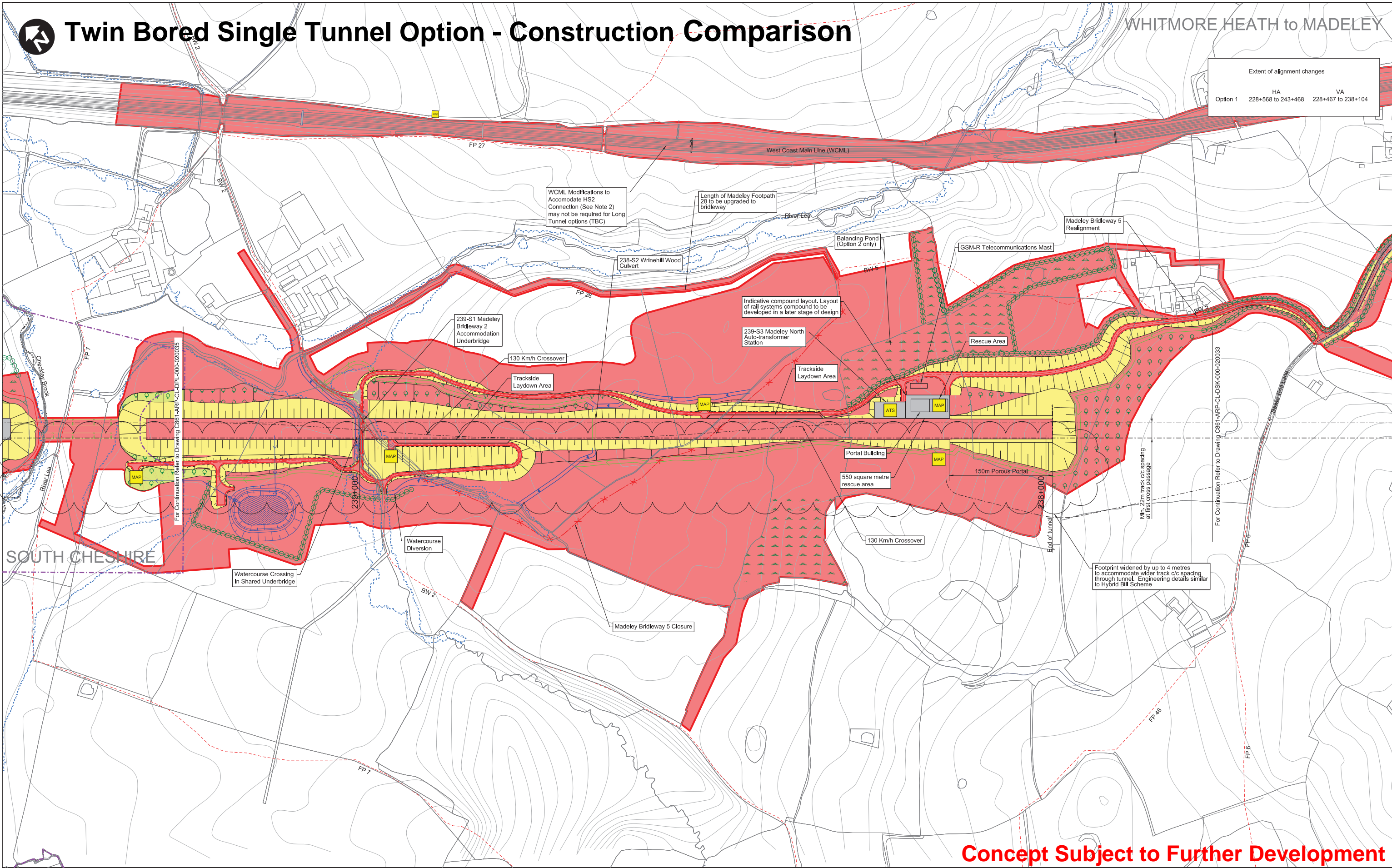
HC210005/001



Twin Bored Single Tunnel Option - Construction Comparison

WHITMORE HEATH to MADELEY

Extent of alignment changes		
	HA	VA
Option 1	228+568 to 243+468	228+467 to 238+104



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Legends/Notes:

- Consolidated Construction Boundary (CCB) for Published Scheme based on Drawing C861-ARP-CL-DPL-000-021034 - P05
- CCB for Long Terminal Options proposed for Options S&T September 2017
- For Network Rail on-network works to WCML refer to drawings C862-PBR-RT-DPL-WS09-100000 to 100009

Key:

- Land to be acquired / CCB unchanged from Published Scheme and not part of the Long Tunnel Option Study
- Land to be acquired / CCB unchanged from Published Scheme and required for Long Tunnel Options
- Land to be acquired / CCB additional to Published Scheme and required for Long Tunnel Options
- Land to be acquired / CCB contained in Published Scheme and no longer required for Long Tunnel Options (but note that access may still be required in order to monitor settlements or noise and vibration during construction)

METRES @ 1:2500

0 20 50 100 250



Registered In England
Registration No. 06791686
Registered office:
2 Snow Hill,
Queensway,
Birmingham, B4 6GA

Creator/Originator
Ove Arup & Partners International Ltd

Zone		Project/Contract		
Route Wide		P2A Civils Design & Environmental Services		
Design Stage		Discipline/Function		
Hybrid Bill - Draft Initial Preliminary Design		Construction and Logistics		
Drawing Title		Drawn	Checked	Approved
Twin Bored Single Tunnel Option		EW	AG	TE
Revised CCB		Date	Scale	Size
Sheet 34		21/07/2017	AS SHOWN	A1
		Drawing No.	Rev.	
		C861-ARP-CL-000-020034	P02	

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