A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010059

GS.1 Appendices to PSSR WQ GS.1.6

AFPF Regulation Rule 8(1)(b)

Planning Act 2008

Infrastructure Planning (Prescribed Forms and Procedure) Regulations 2009

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Infrastructure Planning

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A1 in Northumberland Morpeth to Felton

Preliminary Sources Study Report

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1 Introduction

In 2016, Jacobs were employed by Highways England (HE) to take the design of the Upgrade to the A1 to a continuous dual carriageway between Morpeth and Ellingham, Northumberland according to the Project Control Framework (PCF) Stage 2 Option development.

The A1 Northumberland is the main link road through Northumberland to the North East of Newcastle, connecting England to Scotland and forms part of the Department for Transport's (DfT) Roads Investment Strategy (RIS). The purpose of the scheme is to address key issues with the existing arrangements that affect the performance of the A1 north of Newcastle Upon Tyne and its ability to perform as a 'Route of Strategic National Importance'.

Figure 1-1 Northumberland location

As part of the DfT First Roads Investment Strategy, options are being considered and developed for the following programme of improvements:

- **A1 Morpeth to Ellingham** – thirteen miles of upgrade to dual the carriageway linking the Morpeth and Alnwick bypasses with the dual carriageway near Ellingham, to create a continuous, high-quality dual carriageway from Newcastle to Ellingham. This involves:
  - Morpeth to Felton offline and online dualling options.
  - Alnwick to Ellingham online dualling option.
- **A1 North of Ellingham enhancements** – a set of measures to enhance the performance and safety of the A1 north of Ellingham, including:
  - Three stretches of climbing lanes totalling 2.5 miles.
  - Five junctions enhanced with right turning refuges.
  - Better crossing facilities for pedestrians and cyclists.

This programme will involve the preparation of three 'Preliminary Sources Study Reports' (PSSR). These are in accordance with HD22/08, as described in the Statement of Intent, as follows;

- **Section A – Morpeth to Felton.**
- Section B – Alnwick to Ellingham.
- Section C – North of Ellingham.

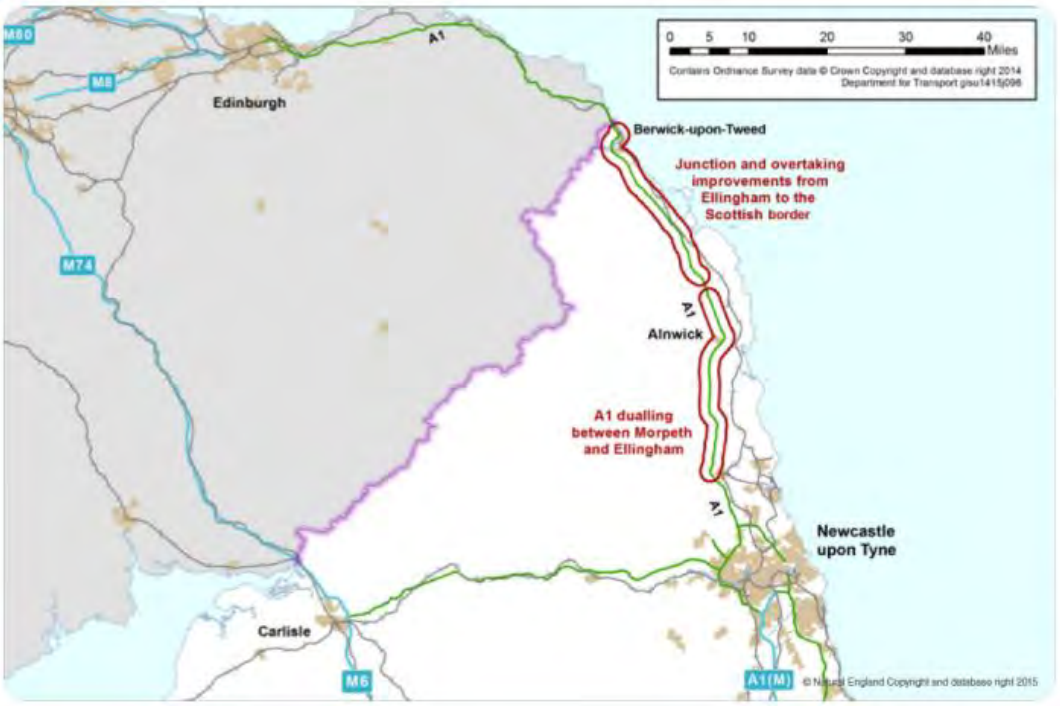

Plate 1-2 Location of improvements From Newcastle to Berwick (DFT)

This PSSR is for the southern section **Morpeth to Felton, Section A**.

Sections B and C are reported separately. This report is concerned with:

- Section A – Orange online option
- Section A – Blue Route hybrid (mainly online with some offline) option
- Section A – Green offline option

An overview of the scheme is provided in Appendix A including site location maps for each section, Figure A1, A26, A27 and A28.

The route passes through predominantly agricultural land with significant past mining activity to the east of the options. This project aims to increase capacity, reduce journey times, improve safety, facilitate future economic growth in Northumberland and improve local access junctions and interchanges along the A1.

1.1. Document Purpose and Structure

This report presents the PSSR for Section A - A1 in Northumberland, Morpeth to Felton improvements, and has been produced for HE in accordance with the Design Manual for Roads and Bridges Vol 4 Section 1 Part 2, HD22/08, Managing Geotechnical Risks.

The report contains a description of the site based upon site visits, historical mapping and published information followed by a description of the engineering proposals for the route options culminating in a ground model and risk register based upon published historical information.

Annex A to the PSSR is present separately to this document (HAGDMS No. 29387).

2 Sources of Information

Table 2-1 Sources of Information

Source	Description	Provenance
Online	DiGMapGB – 10, superficial and bedrock geological maps (Reference 3)	Unverified
Online	DiGMapGB – 50, superficial and bedrock geological maps (Reference 3)	Unverified
British Geological Survey	Solid Geology 1:63,360 scale Map 9 – Rothbury (1966) (Reference 4)	BGS publication
	Solid and Drift Geology 1:50,000 scale Map 9 – Rothbury (2003) (Reference 5)	BGS Revision
	Geology of the Country around Rothbury, Amble and Ashington (1935). Geological Memoir. (Reference 6)	BGS publication
Environment Agency On line	What's in my backyard? – Online database and mapping (Accessed October 2016). (Reference 7)	EA free to view
Zetica Ltd.	Pre Desk Study Assessment Ordnance database – October 2016. (Reference 8)	Commercial Database
Zetica Ltd.	Detailed Desk Study Assessment Ordnance Report – November 2016. (Reference 8)	Commercial Assessment
Coal Authority	Mine Risk Assessment Coal Authority desk study (CON 29M). (Appendix I)	Statutory Authority Report
Groundsure Ltd	Digital Mapping and reporting GIS data obtained for Figures in Appendix A and Appendix B.	Commercial mapping
Highways Agency Geotechnical Data Management System (HAGDMS)	Bullen Consultants PSSR A1 Morpeth to Felton (2004). (Reference 9) (HAGDMS No. 19699)	Geotechnical Certification
	Laing O Rourke / WYG PSSR A1 Morpeth to Felton Dualling (2006). (Reference 10) (HAGDMS No. 20917)	Geotechnical Certification
	Halcrow (2007) A1 Alnwick to Morpeth Defect report. (HAGDMS No. 21674)	Independent Report
	Halcrow (2008) Geotechnical Asset Management Plan. (HAGDMS 21876)	Independent Report
	Norwest Holst (NHSED) (2006) Stage 1 Ground Investigation NOTE: Detailed in Table 3.1. (HAGDMS No. 20918)	Geotechnical Certification
	Halcrow (2010) Statement of Intent, A1(T) Morpeth Bypass, Detailed in Table 3.1. (HAGDMS No. 25181)	Unknown
	AOne+ Integrated Highway Services (2014) Geotechnical Report, A1 Morpeth to Alnwick PTI Phase 2 – Tritlington SB Lay-by Improvements. (HAGDMS No. 28140) (Reference 14)	Geotechnical Report
AOne+ Integrated Highway Services	Asset Management Data (see Table 4.1)	Work in progress
Scott Doherty Associates	A1 South-East Northumberland Link Road, A1 Interchange to How Burn Crossing, Interpretive Report (1997).	Geotechnical Certification
Jacobs	Jacobs, A1 in Northumberland Statement of Intent (2015). (Reference 2) (HAGDMS No. 28835)	Geotechnical Certification
Site Investigation River Coquet, Felton	Tarmac Construction Limited Central, 1974. Detailed in Table 3.1. (HAGDMS No. 3378). (Reference 13)	Pre-Geotechnical Certification
Google	Google Earth satellite view for current conditions from 2002 to 2015 (Accessed 2016). (Reference 14)	Photograph Free to view

3 Field Studies

3.1 Site Walkover

A site walkover of the A1 Section A, Morpeth to Felton route was conducted on Tuesday 25th October 2016. The aims of the visit were to observe the local topography and geomorphology, the ground conditions and the existing structures and assess site constraints that may influence the geotechnical risks identified in the Geotechnical Risk Register from Statement of Intent, PCF Stage 1. The walkover considered the site constraints for the online and offline options.

For health and safety reasons the site was accessed by car to drive between 16No. stopping points located on the northbound and southbound sides of the A1 and on side roads between Morpeth and Felton. Stopping points positions are shown in Figure 3-1. A summary is present here with a more detailed observation in Appendix H.

3.2 Site Observations

Land adjacent to the carriageway is arable farmland for most of the route. Where residential, educational and commercial properties occur, they are commonly at junctions with side roads. The carriageway follows the undulating topography and the alignment is at grade with the adjacent land (Plate 3-1) as far as can be discerned on account of thick vegetation including mature trees.

Plate 3.1 Stop 1 (approx. Ch. 1500m) looking south from a lay-by on the west of the road.

Hedgerows and crops with occasional trees line the road. All options pass through woodland near Floodgate Burn (Stop 3, Plate 3.2), Long dike Burn and the River Coquet (Stop 11, Plate 3.3).

Plate 3.2 Stop 3 (approx. Ch. 3600m) looking south the lay-by on the west on the carriageway.

Plate 3.3 Stop 11 (approx. Ch. 12800m) View from the footpath north bank, River Coquet looking south underneath the bridge.

Stop 5 is located on Fenrother Lane at the location of the proposed offline option, approximately 0.5km west of the A1. The topography is undulating and falls to the south (Plate 3.4). The proposed junction between the offline option and Fenrother Lane will require earthworks to accommodate the overbridge.

Plate 3.4 Stop 5 (approx. Ch. 5000m) looking east on Fenrother Lane. Topography is undulating and falls to the south.

The River Coquet is in a steep sided valley and a new bridge is required to accommodate the dualling of the A1. All options are online at this location. A visual inspection of the valley slopes was made from the footpath on the northern slope of the river between Felton and the A1.

Slopes are densely vegetated which limits the inspection area to the slopes close to the footpath. Several slips were observed parallel to the footpath at the top of the valley in the superficial glacial deposits. Scarp features and slumped blocks are observed on the southern edge of the footpath (Plate 3.5).

The gradient of the northern slope is approximately 1V:2H about 100m east of the River Coquet Bridge, as shown in Plate 3.6.

Plate 3.5 Stop 11 (approx. Ch. 12800m) View from the footpath on the north side of the River Coquet looking south east.

Plate 3.6 Stop 11 (approx. Ch. 12800m) View from the footpath on the north side of the River Coquet looking west to the River Coquet bridge.

Slopes have been re-graded and dense vegetation has been removed to accommodate the existing bridge piers and abutments (Plate 3.7). No signs of instability were observed on the slopes next to the bridge.

Plate 3.7 Stop 11 (approx. Ch. 12800m) View of the east side of River Coquet Bridge abutment on the north slope.

Plate 3.8 Stop 11 (approx. Ch. 12800m) View south of the River Coquet Bridge piers from the footpath on the North Slope.

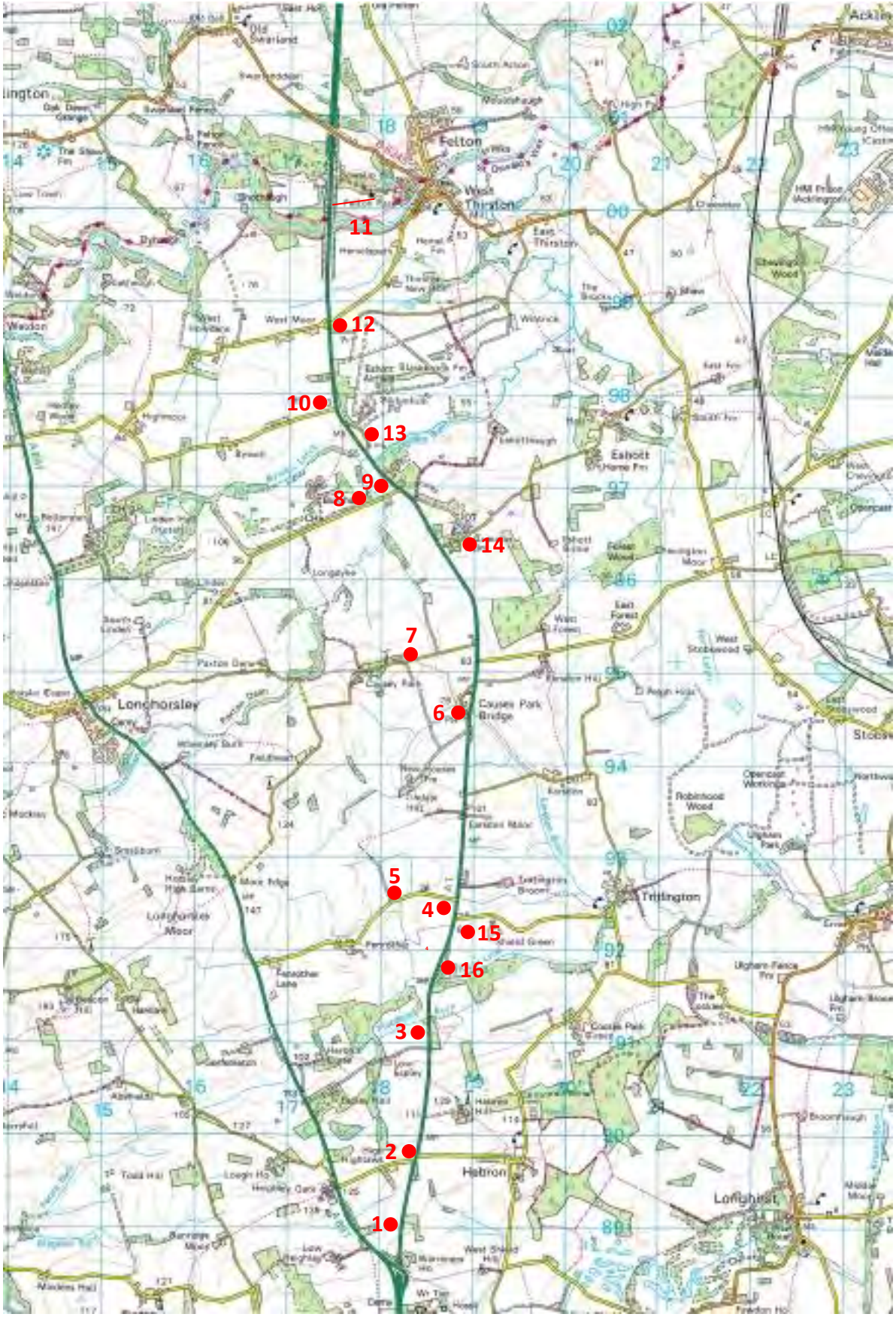

Figure 3-1 Site walkover stopping locations. Ordnance Survey ©.

Limited geomorphological observations were noted within the site walkover survey.

Geomorphological mapping was completed as part of the 2006 PSSR. A review has been undertaken and particular account is taken to the section considering the risks identified in relation to the northern bank-seat of the River Coquet Bridge. The geomorphological map is presented as Appendix D.

No drainage studies have been completed as part of the fieldwork for this PSSR.

No geophysical surveys have been completed as part of the fieldwork for this PSSR. As part of previous investigations magnetic gradiometer surveys have been completed by Durham University Archaeological Services. These totalled 37 hectares completed to identify archaeological features. The locations of these features form part of a different report that has not been available.

Photographs were taken as part of the walkover survey to emphasise particular features relevant to the geotechnical aspects of the scheme. These are presented for completeness in Appendix H) and may be of value, e.g. visual record of field access and routes required to undertake ground investigation fieldwork, in the future.

Aerial photographs have not been obtained directly for this PSSR. Satellite imagery from Google Earth has been used to inspect the area and note any changes evident between the dates of the most recent OS published plan and the imagery.

No significant discernible geo-hazards are identified although thick vegetation along the route makes such observation difficult.

4 Site Description

4.1 Scheme Description

The Morpeth to Felton improvement, Section A, consists of upgrading the single carriageway to a two lane dual carriageway. The options presented at PCF Stage 2 consist of three alternative alignments as follows:

- Online widening, Orange route
- Offline widening, Green route
- A combination of both online and offline widening, Blue route.

The options are shown in Appendix A on Figures A1 – A3 with summaries of the routes shown on the geotechnical aspects plan in Figure A4. Detailed engineering description of the options is presented in the PCF Phase 1, Technical Appraisal Report. Within the confines of the existing route the majority of the road is at grade consisting of minor earthworks. There are a number of stream crossings including the deeply incised River Coquet (Ch. 12750m).

The existing highway asset categorisation follows the guidance presented in HMRB HD 41/15 defining earthworks as minor to a maximum vertical height of less than 2.5m and major earthworks are to a height greater than or equal to 2.5m.

The scheme is within the Highways Maintenance Area 14, currently managed by AOne+ plus on behalf of the HE. Part of their role is to inspect, categorise in terms of asset condition and maintain the earthworks (cuttings and embankments).

The risk rating methodology is described within Plate 4-1.

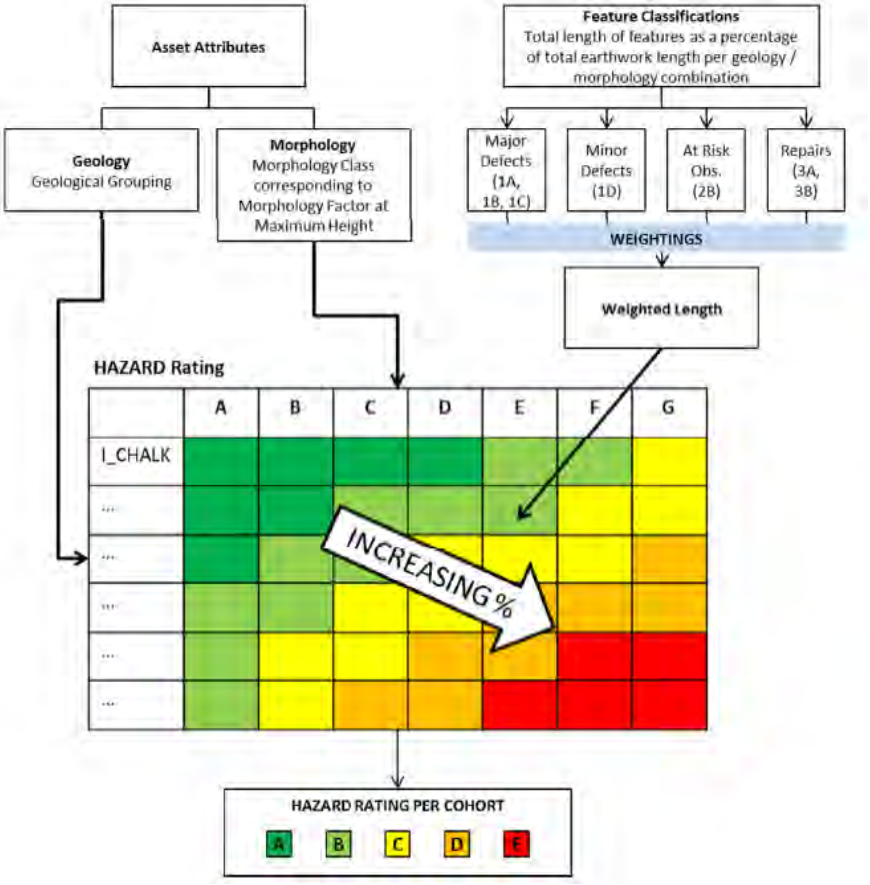

Plate 4-1 - Risk classification for earthworks within Highways England

The current category (obtained from HAGDMS) is summarised in Table 4-1.

The scheme extends from Chainage 0m, at National Grid Reference (NGR) 418198E, 587649N to Chainage 13700m, at NGR 417480E, 600753N.

Table 4-1 Current Earthwork condition relating to defined hazard scores from HAGDMS

Chainage from (m)	Chainage to (m)	Hazard Rating	Location and type of earthworks
0	1000	N/A	Outside proposed design
1000	2000	A	Minor, Northbound & Southbound
2000	3000	A	Minor, Northbound & Southbound
3000	4000	A	Minor, Northbound & Southbound
4000	5000	A	Minor, Northbound & Southbound
5000	6000	A	Minor, Northbound & Southbound
6000	6800	A	Minor, Northbound & Southbound
6800	7000	Bridge	Cutting Northbound & Southbound
7000	8000	A	Minor, Northbound & Southbound
8000	9000	A	Minor, Northbound & Southbound
9000	10000	A	Minor, Northbound & Southbound
10000	11000	A	Minor, Northbound & Southbound
11000	12000	A	Minor, Northbound & Southbound
12000	12650	B/C	Cutting Northbound / Southbound
12650	12720	Bridge	Minor, Northbound & Southbound
12720	13200	C/B	Cutting Northbound / Southbound
13200	13500	A/B	Embankment Northbound / Southbound
13500	13800	B/C	Cutting Northbound / Southbound

The north and south sides of the River Coquet Bridge are the poorest quality earthworks within the whole route but are themselves of moderate concern (Class C).

A geotechnical aspects plan showing the alignment of the three route options is provided in Appendix A.

4.2 Topography

The route traverses the gently undulating coastal plateau of eastern Northumberland with the southern section, at the Morpeth Bypass, at an approximate elevation of 105mAOD. Extending northwards the route falls to attain an elevation in the order of 50mAOD to the north of the River Coquet valley. The steeply incised river is at an elevation of approximately 30m AOD at river bed. Minor watercourses identified in Section 4.4 create steep sided incised slopes that trend east –west and flow generally perpendicular to the route. Minor bridges and culverts are present where the watercourses cross the existing road.

The coastal plateau extending to the North Sea to the east is designated an area of outstanding natural beauty (AONB). A significant intrusion of igneous rock traverses the route in the area of Causey Park. This feature forms a south-west by north- east trending hill.

The Coquet Valley is a biological SSSI (salmon, lamprey, otter, flowing waters and woodland) and requires special consideration.

To the east of the route and especially north east of Morpeth, local topographical expression is influenced by abandoned colliery waste tips and opencast coal mining restoration profiles, see Section 4.9 for further detail.

4.3 Geology

4.3.1 Top Soil and Subsoil

A review of the top/sub soil properties within the study area has been undertaken using the Cranfield University Soilscapes map (Reference 18), a summary of which is presented in Table 4-2 below.

Table 4-2 Soil properties within the study area

Chainage	240-12550	13300-13980	12550-13300
Soil Description	Soilscape 18: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.		Soilscape 6: Freely draining slightly acid loamy soils.
Drainage	Impeded drainage.		Freely draining.
Fertility	Moderate.		Low.
Habitats	Seasonally wet pastures and woodlands.		Neutral and acid pastures and deciduous woodlands; acid communities such as bracken and gorse in the uplands
Land Cover	Grassland and arable; some woodland.		Arable and grassland.
Water Protection	Main risks are associated with overland flow from compacted or poached fields. Organic slurry, dirty water, fertiliser, pathogens and fine sediment can all move in suspension or solution with overland flow or drain water.		Groundwater contamination with nitrate; siltation and nutrient enrichment of streams from soil erosion is certain from these soils.

4.3.2 Made Ground

Made ground present at the surface and often above a clearly defined former top soil layer, formed as a result of localised road building, mining and quarrying, can be expected as a thin to moderate layer of broken mudstone, sandstone in isolated areas. A more intensive area of industrial activity is in the Causey Park area where mining, quarrying and aggregate preparation continue to this day.

Existing current and superseded OS mapping and Groundsure data shows that there have been a number of ponds in the vicinity of the proposed route options that are no longer present. This could be due to natural sedimentation or infilling with soil or waste material. The composition of made ground is further elaborated upon in Section 5.2.

4.3.3 Recent and Glacial Deposits

The geological sequence between Morpeth and Felton comprises localised deposits of Recent alluvium (sand, silt, clay, peat), river terrace sands and gravels adjacent to the River Coquet in the extreme northern part of the route, above extensive deposits of Devensian, glacial till

(stoney clay), glacio-lacustrine (laminated clays) and glacio-fluvial (sand and gravel). The glacial deposits are encountered extensively at the surface and attain, in places, thicknesses in excess of 25m. Glacial till is sandy or gravelly clay and clayey silt. Cobbles are frequently observed. Gravel and cobbles are sub-angular to sub-rounded clasts of sandstone, mudstone and quartzite. The strength of the unit is variable, with deposits less than 4m below ground level ranging from soft (as a result of reworking) to firm, and deposits deeper than 4m below ground level firm to very stiff. Northumberland Till has been divided into Upper and Lower units characterised, amongst other things, by colour. The Upper Till being light brown and mottled blue/grey and the Lower Till dark grey. This is thought to be a feature of post-depositional weathering of lodgement tills deposited during the Devensian period and not a stratigraphic boundary.

Laminated clays occur within the glacial deposits along the route. These are observed around Low Espley at local Ch.2000m where all options are online; Causey Park at local Ch. 7500-8000m of Offline Option A; and west of Eshott around local Ch. 9500-10000m of Online Option A and Online Option C.

Granular glacial deposits within the glacial till form layers of loose to medium dense, silty sand with gravel. Material is noted as well graded, with sand grains dominant over gravel. The thickness of these layers varies from 1m to 5m.

The fabric and composition of the main glacial units controls engineering performance and is a significant defining factor. Glacial deposits are known to have experienced rotational failures north of the River Coquet between local Ch. 13000-13500m of Online Option A and Online Option C, and between local Ch. 12700-13200m of Offline Option A.

4.3.4 Bedrock Geology

Underlying superficial deposits is a succession of Carboniferous rocks that were deposited in a coastal and shallow marine environment. Rock head elevation is variable along the route and coincides with changes in the thickness of glacial till. The Stainmore Formation underlies the superficial deposits for the majority of the route. This Formation comprises an interbedded sequence of mudstones, siltstones and sandstones. Mudstones are carbonaceous and form thinly laminated beds. Siltstones are light grey to brown, with some beds containing discontinuities that are planar and undulating and very close to medium-spaced. Sandstones are light grey to dark grey. The Corbridge Limestone is a shelly unit within the Stainmore Formation that occurs in the vicinity of the River Coquet. Minor coal seams occur within the sequence.

Coal Measures occur above the Stainmore Formation cropping into the base of the glacial till to the east of the route. Lower Coal Measures and are a sequence of mudstones, shales, siltstones, sandstones and coal. The Victoria Seam was worked at Causey Park Mine. Seatearth associated with coal seams are known to have been worked in the region for use as refractory brick manufacturing. Section 4.9 expands on the known mining activity and an assessment of the mining risk is made in the risk register in Section 7.

Coal seams up to 0.5m thick occur between 13m to 17m below ground level (bgl) at Offline Option A at Causey Park.

Thin coal seams (less than 0.1m) are observed between 30-35m bgl south of Felton at local Ch. 10900m of Online Option A and Online Option C, and local Ch. 10700m of Offline Option A where all options are online.

The Causey Park Dyke is a tholeiitic discordant intrusion crossing the route, west to east, at approximate Ch. 8000m. This has not been intersected in any boreholes available on the BGS website but consists of dark green, fine grained very strong quartz-micro-gabbro and is quarried as a road stone (wearing course) at Causey Park.

The regional stratigraphy is presented in Table 4.3 and the units highlighted have been identified between Morpeth and Felton.

Table 4-3 - Geological Succession (Adapted from Reference 5 and http://www.bgs.ac.uk)

Quaternary	**Holocene**	Peat		South Charlton
		Alluvium		
		River Terrace Deposits		
	Devensian	Glacio-fluvial Deposits		
		Till		Morpeth to Berwick-upon-Tweed
Palaeo-gene		Northern England Late Carboniferous Tholeiitic Dyke-swarm	Quartz-microgabbro formed approximately 299 to 326 million years ago in the Carboniferous Period.	Causey Park (Morpeth to Felton)
Early Permian		Great Whin Sill	Quartz-microgabbro formed approximately 271 to 326 million years ago in the Permian and Carboniferous Periods.	Occurs around Middleston, south of Alnwick.
Upper Carboniferous	**Pennine Coal Measures Group**	Pennine Middle Coal Measures Formation	Mudstone and siltstone with locally thick sandstone beds and coal seams up to 375m thick. Thickest Coal below Maltby (High Main) Marine Band (MTMG).	
		Pennine Lower Coal Measures Formation	Mudstone, siltstone and sandstone 175-205m thick formed approximately 312 to 313 million years ago. Local environment previously dominated by swamps, estuaries and deltas.	North of Causey Park (Morpeth to Felton)
	Yoredale Group	Stainmore Formation (formerly Millstone Grit and Upper Limestone)	Mudstone, sandstone and limestone 390-530m thick formed approximately 313 to 326 million years ago. Local environment previously dominated by swamps, estuaries and deltas.	Occurs south of Newton-on-the-Moor ie Morpeth to Felton, Haggerston
			Great Limestone Member Limestone formed approximately 322 to 326 million years ago. Local environment previously dominated by shallow carbonate seas.	
Lower Carboniferous		Alston Formation	Limestone, sandstone, siltstone and mudstone400-415m thick formed approximately 322 to 335 million years ago. Local environment previously dominated by shallow carbonate seas.	Scremerston to Newton on the Moor
		Tyne Limestone Formation	Limestone, sandstone, siltstone and mudstone up to 550m thick formed approximately 331 to 339 million years ago. Local environment previously dominated by shallow carbonate seas.	Scremerston to Newton on the Moor
		Scremerston Coal Member	Sandstone, siltstone and mudstone formed approximately 331 to 339 million years ago. Local environment previously dominated by swamps, estuaries and deltas.	Forms rock head beneath A1 in Nothern half of Alnwich to Ellingham route at South Charton, North Charlton, Brownieside. North of Ellingham beneath Climbing Lane Option 0 1250M North-bound
	Border Group	Fell Sandstone Formation	Sandstone. Sedimentary bedrock formed approximately 335 to 352 million years ago in the Carboniferous period. Local environment previously dominated by rivers.	

4.4 Hydrology

A number of watercourses are present within the study area, some of which cross the alignment of the current carriageway and proposed future route options. These watercourses (from south to north) are described in Table 4-4, while their locations are indicated on Figure 5 in Appendix B. It should be noted, however, that existing unmapped watercourses could be present within the study area. Watercourses greater than 100m from a proposed route option have not been included in Table 4-4.

Table 4-4 Watercourses within the study area

Name	Route Option Intersection Chainages (m)			Existing A1 Carriageway Crossing Type	Tributary of
	Green	Blue	Orange		
Unnamed watercourse	350	350	350	Culvert	Benridge Burn
Cotting Burn	20m E of 775	20m E of 775	20m E of 775	N/A	Shieldhill Burn
Shieldhill Burn	1800	1800	1800	Culvert	Cotting Burn
Floodgate Burn	3665	3665	3665	Culvert	River Lyne
River Lyne	4045	4010	4010	Bridge	N/A
Unnamed watercourse	N/A	30m E of 5000	30m E of 5000	N/A	Earsdon Burn
Fenrother Burn	4955 and 5400	N/A	N/A	N/A	Earsdon Burn
Unnamed watercourse	N/A	20m E of 5540	20m E of 5540	N/A	Earsdon Burn
Earsdon Burn	7050	6950	7000	Bridge	River Lyne
Unnamed watercourse	7280	N/A	N/A	N/A	Earsdon Burn
Unnamed watercourse	N/A	70m E of 7850	N/A	N/A	Eshott Burn
Eshott Burn	N/A	5m E of 8280	30m E of 8235	N/A	Thirston Burn
Unnamed watercourse	3100m NE of 9600	60m NE of 9850	30m NE of 9820	N/A	Longdike Burn
Longdike Burn	9980	1210	1170	Bridge	Thirston Burn
Bywell Letch	70m W of 9960	90m W of 10150	100 W of 10180	N/A	Longdike Burn
Unnamed watercourse	10850	11100	11050	Culvert	Unknown
Unnamed watercourse	11850	12090	12050	Culvert	Thirston Burn
River Coquet	12545	12780	12745	Bridge	N/A
Unnamed watercourse	13140	13380	13340	Culvert	Back Burn
Minto's Dean	13680	13930	13880	Culvert	Back Burn

Of the watercourses listed above, there are currently three being monitored as part of the EU Water Framework Directive (WFD) (Reference 19). The latest information on quality from these is summarised in Table 4-5 below.

Table 4-5 WFD classification for watercourses in the study area

Water body	Category	2015 Classification
River Coquet	Overall	Good
	Ecological	Good
	Chemical	Good
Longdike Burn	Overall	Moderate
	Ecological	Moderate
	Chemical	Good
River Lyne	Overall	Poor
	Ecological	Poor
	Chemical	Good

There are a number of ponds located within the study area. These are summarised in Table 4-6 below and shown in Figure 8A in Appendix B. Historical ponds are summarised in Section 4.6.2.

Table 4-6 Ponds in the Study Area

Chainage	Type	Code	Further Information
30m E of 2320	Ephemeral Pond	P15	Appears on 2012 and 2013 aerial imagery
170m W of 3910	Pond	P14	First shown on 1974 map
40m E of 9890	Pond	P16	Constructed between 1978 and 2002
180m W of 9900	Pond	P17	First shown on aerial imagery from 2012
160m NE of 10030	Pond	P18	Constructed between 1978 and 2002

The risk to the proposed scheme associated with flooding from rivers is summarised in Table 4-7 below and shown on Figure 5A in Appendix B.

Table 4-7 Risk of flooding from rivers

Classification	Classification Definition	Route Option Chainages (m)			Associated Watercourse
		Green	Blue	Orange	
High	Every year the chance of this area flooding is greater than 3.3%	4030-4050	4010-4035	4010-4035	River Lyne
		N/A	6950-6955	7000-7005	Earsdon Burn
		9945-10015	10170-10240	10145-10205	Longdike Burn
		12505-12600	12740-12835	12700-12795	River Coquet
Medium	Every year the chance of this area flooding is between 1% and 3.3%	7020-7040	6955-6980	6985-7000	Earsdon Burn
				7005-7030	
Low	Every year the chance of this area flooding is between 0.1 and 1%	4020-4030	N/A	N/A	River Lyne
		9900-9940	10160-10170	10120-10145	Longdike Burn
			10240-10250	10200-10205	
		12600-12620	12850-12865	12795-12825	River Coquet

No surface water abstractions are located within the study area.

The area to the north of Causey Park Bridge (Ch. 7350 to 13980) is in a Surface Water Safeguard Zone for metaldehyde, a pesticide.

4.5 Hydrogeology - Resource

The classification of superficial and bedrock aquifers beneath the proposed scheme are summarised in Table 4-8 and Table 4-9 below. The distribution of aquifers within the superficial deposits is shown on Figures 6A and 7A in Appendix B respectively.

Table 4-8 Aquifer classification and extent – superficial deposits

Classification	Definition	Route Option Chainages (m)			Associated Strata
		Green	Blue	Orange	
Secondary A	Permeable layers capable of supporting water at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers	9910-10010	10160-10245	10120-10205	Alluvium
		12030-12475	12270-12715	12230-12675	Glaciofluvial Deposits
		12670-13100	12910-13340	12870-13300	
		13270-13550	13500-13800	13470-13750	
Secondary Undifferentiated	Assigned when it has not been possible to attribute either category A or B to a strata	240-6930	240-6930	240-6930	Glacial till (alluvium between 1820-1870m and 4010 - 4065m)
		7065-9910	7020-10160	7045-10120	
		10010-12030	10245-12270	10205-12230	
		13250-13270	13480-13500	13450-13470	
		13560-13780	13800-14020	13750-13980	

Table 4-9 Aquifer classification and extents - bedrock

Classification	Definition	Route Option Chainages (m)			Associated Strata
		Green	Blue	Orange	
Secondary A	Permeable layers capable of supporting water at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers	240-7815	240-8010	240-7950	Stainmore Formation
		7850-7980	8050-9200	7995-9190	Pennine Lower Coal Measures Formation
		8360-8780			
		7980-8360	9200-14020	9190-13980	Stainmore Formation
		8780-13780			
		12485-12530	12720-12765	12680-12725	Corbridge Limestone
		12610-12650	12845-12890	12805-12850	

Classification	Definition	Route Option Chainages (m)			Associated Strata
		Green	Blue	Orange	
Secondary B	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering	7810-7850	8010-8050	7950-7995	Northern England Late Carboniferous Tholeiitic Dyke Swarm

There is one groundwater abstraction within the study area, detailed in Table 4-10 below and shown on Figure 8A in Appendix B.

Table 4-10 Groundwater abstractions within the study area

Chainage	280m NE of Ch. 9600m
NGR	418408 597165
Licence Number	NE/022/0003/001
Name of Licence Holder	Felmoor Park Ltd
Purpose	Industrial, Commercial And Public Services - Holiday Sites, Camp Sites & Tourist Attractions
Usage	Drinking, cooking, sanitary and washing
Maximum Daily Abstraction (m^3)	130
Maximum Annual Abstraction (m^3)	25000

The far southern extent of the scheme (Ch. 240m to 1300m) is designated as a Total Catchment (Zone 3) Source Protection Zone. This is defined as 'the area around a source within which all groundwater recharge is presumed to be discharged at the source' (Reference 20).

4.5.1 Groundwater Aspects

The details of the groundwater instrumentation and monitoring carried out during the investigation in 2006 has been summarised at the time and reported here. Independent validation is not possible as raw data and the instruments themselves have not been recovered as part of this PSSR.

"Due to the predominantly cohesive nature of the drift material groundwater strikes encountered during drilling provide an unreliable picture of ground water levels across the scheme. In order to determine the groundwater levels across the scheme more reliably groundwater monitoring installations were installed in exploratory holes at various depths along the scheme route.
Groundwater monitoring instrumentation was installed in a total of 61 exploratory holes; 50mm gas monitoring standpipes were installed in 11 exploratory holes, 19mm diameter standpipe

piezometers were installed in 46 of the exploratory holes and 8 vibrating wire piezometers were installed in 4 of the exploratory holes (two instruments per hole). Installation details are shown on the relevant exploratory hole logs within the NWHSEL Factual report presented in Appendix F and the groundwater monitoring results are summarized in Appendix A.

During the monitoring period, following a period of stabilisation, groundwater levels rarely varied by more than approximately 0.2m within each exploratory hole. However, fluctuations of between 1.28m and 4.40m were recorded in three exploratory holes (1011, 1018 and, 1034). This is thought to be due to the piezometer tip being located either within a granular horizon or at the soil-rock interface, where preferential flow paths may have established. All three instruments were installed at 4.50m bgl or shallower.

Piezometers installed at shallow depths (<3m) within Made Ground (B) recorded ground water at an average depth of 0.64m. The piezometer installed in BH1044 responding at a depth of 15m within the existing embankment fill recorded ground water at a depth of 11.36m or a level of 40.93m AOD. This corresponds to the approximate level of the water course passing beneath the embankment at this location.

Piezometers installed at shallow depths within the alluvium (C) near to the water courses of Floodgate Burn and the River Lyne typically recorded ground water levels at shallow depth (average depth of 0.56m).

Piezometers installed at an average depth of 4.45m within the Glacial Till (D) recorded ground water at an average depth of 2.15m. Piezometers installed within the bedrock at depths of greater than 10m below existing ground level typically recorded ground water levels at a lower level than instruments responding at shallower depth within drift material, suggesting perched water conditions within the drift under drained by the bedrock.

Notable exceptions to this picture are the instruments installed in BH1029 responding at 28.25m depth and BH1002R responding at 21.5m depth both within sandstone which recorded ground water at depths of 1.27m and 3.38m respectively.

Dual vibrating wire piezometers were installed in the BH1039, 1040, 1041 and 1042 to the east of the existing cutting north of the Coquet Valley. In all installations the upper piezometer was located at 5m depth within the Cohesive Glacial Till and the lower installation within bedrock at depths of 12.2m to 15m below ground level. With the exception of BH1041 the upper piezometer recorded ground water at depths of 2.67 to 3.92m. The reading from the upper piezometer in BH1041 is considered unreliable as suction was measured. The lower piezometers recorded ground water at depths of 9.04m to 12.15m below ground level. The results of the ground water monitoring indicate perched ground water in the drift deposits under drained by the bedrock as has been indicated elsewhere along the scheme.

Chemical testing was carried out on 7 samples of ground water and recorded a pH range of 5.3 to 8.2 with an average value of 7.5 and a range of soluble sulphate levels between 0.072 and 0.156 g/l with an average value of 0.115 g/l."

4.6 Land Use

4.6.1 Current Land Use

The land use within the study area is largely agricultural, with the town of Morpeth to the south of the southern end of the study area and the village of Felton to the east of the northern end of the study area. There are a number of small, scattered settlements throughout the study area.

There are a number of recreational land uses within the study area, such as Felmoor Park Holiday Park, Bockenfield Holiday Park, Burgham Park Golf and Leisure Club, and Eshott Airfield.

The current commercial / industrial land uses within the study area are summarised in Table 4-11 below, and shown on Figure 8A in Appendix B.

Table 4-11 Current commercial/industrial land uses

Type	Code	Chainage (m)	NGR
Wind Electricity Generator	C1	500m E of 2360	418942 589989
Pylon	C2	420m E of 2670	418909 590289
Telephone Mast	C3	420m E of 2670	418908 590289
Telephone Mast	C4	440m E of 2680	418933 590298
Pylon	C5	440m E of 2680	418933 590298
Vehicle Repair, Testing and Servicing	C6	90m E of 4090	418671 591691
Water Pumping Station	C7	40m E of 4790	418848 592364
Telephone Mast	C8	220m NE of 8870	418817 596453
Pipeline	C9	280m NE of 10100	418093 597454
Windsock	C10	180m NE of 10630	417743 597794
Agricultural Contractors	C11	470m W of 11560	416987 598616
Unspecified Works	C12	440m W of 11560	417009 598622

4.6.2 Historical Land Use

A summary of historical land use within the study area, based on a review of published historical OS mapping, is provided in Table 4-12 below and on Figure 8A in Appendix B. Published maps where no significant changes have been noted are not listed. Historical tanks in the study area are detailed separately in Table 4-13.

Table 4-12 Summary of historical land use and features within the study area

Map	Chainage (m)	Code	Feature	Higher Risk Feature		
				Green	Blue	Orange
1855 1:2,500	2130	P1	Small square pond			
	2130	P2	Rectangular pond			
	2470	P3	Pond to S of Hebron Hill Farm			
	2750	Q1	Old Quarry	Y	Y	Y
	4640	P4	Pond to W of Shield Green Farm			
	5260	L1	Portland Arms Inn			
	5350	P5	Pond	Y		
	5825	P6	Pond to S of Earsdon Moor Farm		Y	Y
	6100	L2	Earsdon Mill (corn mill) – Windmill			

Map	Chainage (m)	Code	Feature	Higher Risk Feature		
				Green	Blue	Orange
			shown			
	6150	P7	Pond			
	6900	Q2	Old Quarry		Y	Y
	6960	L3	Ogle Arms Inn			
	7600	P8	Pond			
	9300	Q3	Quarry, with two distinct lobes			
	12880	P9	Pond	Y	Y	Y
	12950	P10	Pond			
1866 1:10,560	920	P11	Pond to S of Warreners House			
	3650	L4	Tile Sheds - 'Gins' shown to N			
	3710	P12	Two rectangular ponds, likely associated with Tile Sheds	Y	Y	Y
	3870	P13	Three rectangular ponds, likely associated with Tile Sheds			
	7810	L5	Brick and Tile Yard		Y	
1897 1:2,500a	2130	P1	Small square pond no longer present – presumed infilled			
	3650	L4	Tile Sheds now shown as Tile Works			
	5260	L1	Portland Arms Inn no longer shown			
	6100	L2	Earsdon Mill no longer shown as corn mill			
	6900	Q2	Old quarry no longer shown – presumed infilled		Y	Y
	6960	L3	Ogle Arms Inn now shown as Oak Inn			
	6970	L6	Smithy - shown at Causey Park Bridge			
	7570	W1	Windpump			
	7600	P8	Pond no longer shown – presumed infilled			
	7790	Q4	Old Quarry	Y		
	7810	L5	Brick and Tile Yard no longer shown but buildings remain		Y	
	9300	Q3	Eastern lobe of quarry shown as 'Old Quarry'			
	10870	Q5	Disused Colliery and Shaft			
1923 1:2,500	920	P11	Pond no longer present – presumed infilled	Y	Y	Y
	3630	L7	Sheepwash	Y	Y	Y
	3650	L4	Tile Works now shown as disused			
	3870	P13	Three rectangular ponds now absent – presumed infilled			

Map	Chainage (m)	Code	Feature	Higher Risk Feature		
				Green	Blue	Orange
	4200	W2	Pump shown at Priest's Bridge House			
	4640	P4	Pond no longer present at Shield Green Farm – presumed infilled			
	4800	W3	Pump shown at Tritlington School			
	5260	L1	Former Portland Arms Inn now shown as Portland Cottage			
	5770	W4	Pump marked to S of Earsdon Moor Farm			
	5900	W5	Pump marked to N of Earsdon Moor Farm			
	6970	L6	Smithy no longer shown at Causey Park Bridge			
	8900	Q6	Quarries shown at Helm Cottage			
	9300	Q3	Quarry now shown as 'Old Quarry'			
	10870	Q5	Colliery now shown as 'Old Coal Shaft'			
1947 1:10,560	6840-7350	H1	A1 straightened and new bridge at Causey Park Bridge			
	7820	Q7	Adit shown to N of Old Quarry	Y		
	8140-8330	H2	A1 realigned			
	9100	W6	Windpump			
	10190-10650	H3	A1 straightened			
1948-50 1:10:560	500	L8	St Andrews Colony			
	4050-4550	H4	Priest's Bridge bypass			
	4960-5350	H5	A1 straightened to run to the W of Portland House			
	6150-6600	H6	A1 straightened			
	8930	A1	Eight buildings and two trackways			
	9300	A3	23 temporary buildings and five trackways		Y	Y
	9260	A2	15 temporary buildings and one trackway			
	9250	A4	Five temporary buildings and two trackways shown within quarry footprint			
	9400	A5	43 temporary buildings and one trackway			
	9800	A6	27 temporary buildings and four trackways	Y	Y	Y
	10180	A7	9 temporary buildings and three trackways	Y	Y	Y

Map	Chainage (m)	Code	Feature	Higher Risk Feature		
				Green	Blue	Orange
	12880	P9	Pond no longer present – presumed infilled	Y	Y	Y
1974 1:2,500	500	L8	St Andrews Colony now shown as Northgate Hospital and more buildings present	Y	Y	Y
	870	H7	Improved A1-A697 junction constructed			
	3500	L9	Cattle Pens building			
	3650	L4	Tile Works no longer present			
	3710	P12	Two rectangular ponds no longer present – presumed infilled	Y	Y	Y
	3910	P14	Pond			
	4180	G1	Garage		Y	Y
	5825	P6	Pond to S of Earsdon Moor Farm no longer present		Y	Y
	5900	L10	Sheep Dip		Y	Y
	6840	G2	Filling Station		Y	Y
	8900	L11	Tumulus/Pillar			
	9300	A3	Water reservoir - Camp area now shown as disused.		Y	Y
	10700-11120	A8	Airfield (disused) - three runways shown and roads / buildings to W and S of airfield boundary	Y	Y	Y

*Features are classified as 'higher risk' if an infilled pond, infilled quarry, garage, tank or potentially infilled area of land is within 100m of a proposed scheme option, or if a landfill is within 250m of a proposed scheme option.

Table 4-13 Historical tanks within the study area

Chainage (m)	Code	NGR		Dates	Higher Risk Feature		
					Green	Blue	Orange
920	T1	418280	588572	1973, 1996	Y	Y	Y
2560	T2	419012	590203	1923			
2700	T3	418866	590332	1974, 1994			
4620	T4	419231	592196	1897			
5870	T5	418848	593437	1862		Y	Y
5940	T6	418669	593508	1922			
5940	T7	418710	593508	1922			
6090	T8	418855	593655	1897		Y	Y
11640	T9	417259	598688	1924			

4.6.2.1 Airfield Site

Eshott Airfield (NGR 417684 597792, east of Ch.10700-11120) was formerly known as RAF Eshott and was used by the RAF from November 1942 to 1948. The airfield reopened for leisure use around 1990 (Reference 31). Aerial imagery (Google Earth) and photographs taken on site, in 2008 show building footprints and buildings in a semi-demolished state to the west and south of the main airfield site. Historical OS mapping shows a number of ancillary sites associated with the main airfield, which appear to contain temporary buildings. When cross-referenced with modern aerial imagery (Google Earth), some of these ancillary sites have been fully converted to another use, such as arable land or holiday parks (Felmoor Park and Bockenfield Holiday Park), while others still contain derelict buildings. On the site walkover it was noted that the camp at Helm (A3 in Table 4-12) still had either complete buildings or upright walls present.

Historical BGS exploratory hole records associated with the above ancillary sites (BGS references NZ19NE142 and NZ19NE148) encountered fragments of road stone, concrete, tiles, glass and brick, which could be associated with the construction and/or demolition of the buildings. In one trial pit (NZ19NE148) asbestos was observed, although subsequent soil testing recorded a negative result. Information on these trial pits can be found in Table 4-15.

A Pre-Desk Study Assessment was requested from Zetica which recommended a detailed desk study assessment. The detailed assessment is included in Appendix F. In summary, the report found that during World War Two, strategic targets located within 5km of the proposed scheme included RAF Eshott, anti-aircraft defences, army camps, military convoy routes and public utilities and transport infrastructure. Morpeth rural district recorded 163 bombs at 2.1 bombs per 405 ha.

Page 13 of Appendix E identifies the location of recorded UXO across the site. Between CH.4000m and 4500m may be located within the vicinity of Incendiary devices. However, this is not anticipated to be intercepted by the proposed works and ground investigation. In total, it is estimated that there is the potential for up to six unexploded bombs, six incendiary bombs and seven high explosive bombs to have been dropped within the study area between 1940 and 1941.

Records show that at least 12 high explosive bombs were recorded in close proximity to the proposed scheme, and some of these were recorded as unexploded. RAF Eshott was bombed in May 1941.

The recommendation from the specialist UXO contractor relates to the risk acceptability of the client. Should a zero tolerance to risk be adopted a clearance certificate is likely to be required. Where this is not the case, it is considered prudent to hold workshops with the staff relating to the risks and the possible indicators on site (Appendix E). In line with this advice it is advised that all staff attending site through ground investigation and construction stages are briefed on the potential presence of unexploded ordnance. It is also recommended that site procedures are to detail appropriate action on encountering indicators of unexploded ordnance.

4.7 Archaeology

The Archaeology Data Service (Reference 22) has records for two archaeological investigations within the study area. A geophysical survey took place at NGR 418300 589650 in 2006 and a desk based assessment took place at 417500 600000 in 1999. There are no records of any discoveries from either of these investigations. The only map reference to archaeological features within the study area is of a Tumulus/Pillar, shown in Table 4-12. The archaeological impacts of the proposed options will be considered as part of the Environmental Impact Assessment, further detailed study of the archaeology is therefore considered to be outside the scope of this report.

4.8 Aerial Photographs

The following is observed from an inspection of available aerial photogrammetry:

- Google earth back to 2002, shows infilled open cast workings to the east of the site at Earsdon Moor.
- A number of buildings on the outline of the Airfield north of Causey Park and South of Felton are omitted on OS maps as related to the airbase during the war. Post war evidence that they have been removed and infilled, followed by tree plantation. This has now been removed and repaired due to issues with instability.
- Footprints of buildings still identified to the east of the A1 by the Eshott Airfield, may be areas of made ground requiring excavation and replacement should the dualling of the road be to the east of the current A1.
- A Caravan Park located at the waste due for a surface coal mining works and ponds visible.

4.9 Mining and Mineral Deposits

Coal mining enquiries have been obtained for parts of the route in the past, although the actual correspondence is not available through BGS or HAGDMS at the present time. A summary was provided in an earlier report (Reference 10) as follows:

> *"The Coal Authority provided a report of historical coal mining activity in the route corridor. Their report identified two areas of coal workings, one at Causey Park Hagg (approx. Ch. 6800) and the other adjacent to the airfield at the northern end of the site (Ch. 9600 to Ch. 10700).*
>
> *The Coal Authority provided a Mine Plan NC536 for the coal workings at Causey Park Hagg. The mine plan shows the location of adits and roadways at Causey Park Hagg.*
>
> *A geophysical survey carried out in the vicinity of the mine workings and dolerite dyke at Causey Park identified a large linear dipolar anomaly and a number of smaller discrete anomalies. The results of the geophysical survey are discussed in Section 4.5 [of the origin report].*
>
> *No mine plan is available for the workings at the northern end of the route, however, the location of a disused colliery is indicated on historical plan 54NE (1899)*

and an old coal shaft is indicated at the same location on the historical O.S. plan 51SW (1947).

Due to the fact that (a) shallow mine workings are present along the route corridor, (b) that poor coals and fireclays are present within the Upper Stainmore Group and (c) the strike of the strata is parallel to the scheme alignment,

The entire route corridor has been assessed to have a moderate risk associated with the presence of shallow mine workings."

A Mining Report CON 29 M has been obtained from the Coal Authority and is presented in Appendix I. The report indicates that.

- There are nine mine entries that are within or within 200m of the route boundary. Approximate shaft locations are shown on the Geotechnical Aspects Plan in Appendix A. The condition of these is by and large unknown. Unrecorded mine entries may occur in addition to these.
- In an area of past underground workings. There are no current or planned licenced underground or opencast mines.
- No mine gas emissions that the CA are aware of.
- The route is underlain by seams of coal for which no records are known, but which may contain unrecorded workings.
- A section of mine plan presented in the earlier report and reproduced here Appendix F, is from the Causey Park area. The geophysical survey data is also reproduced and presented in Appendix F also.

Proposed Bridge structures will be treated as areas where possible unrecorded workings would pose an unacceptable risk. Future investigations to cater for this risk are presented in Annex A.

A shallow mine workings risk zone between Ch. 4500 and Ch.9000m and Ch. 12000 and Ch.13500m is shown on the Geotechnical Aspects Plan presented as Figure A4 in Appendix A.

4.10 Contaminated Land

A summary of the potential contaminants within the study area is given in Table 4-14. This list is meant to be indicative and is not exhaustive of the contaminants that may be encountered.

Table 4-14 Potential contaminants that may be encountered within the study area

Source	Potential Contaminants
Existing Road Network (A1)	Embankment fill materials (PFA, ash), oils/hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), Benzene, Toluene, Ethyl benzene and Xylenes (BTEX), Methyl Tertiary Butyl Ether (MTBE), heavy metals, antifreeze, brake fluids, road salt.
Agriculture	Slurry (nitrate, ammonium, organics), pesticides, herbicides, fertilisers, pathogens, oils, fuels, PAHs.
WW2 Airfield and associated buildings	Aviation fuel (kerosene), gasoline, diesel, antifreeze, solvents, fire-fighting agents, lubricants, hydraulic fluids, Polychlorinated Biphenyls (PCBs), asbestos, PAHs, Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs), heavy metals.
Garage and historical filling station	Oils/hydrocarbons, PAHs, BTEX, MTBE, VOCs and SVOCs, heavy metals, antifreeze, brake fluids, solvents, asbestos.
Infilled Ponds / Quarries and historical landfills	Various unknown contaminants (including heavy metals, hydrocarbons, PAHs, ash, ground gas, asbestos).
Foot and mouth burial pits	Pathogens, heavy metals, oils/hydrocarbons.
Tanks	Oils, fuels (diesel, red diesel, gasoline), pesticides, herbicides, fertilisers, slurry (nitrate, ammonium, organics),

4.10.1 Historical Contamination Records

BGS exploratory borehole records within the study area were reviewed for visual/olfactory evidence of contamination, and these are summarised in Table 4.17. The locations of these boreholes are shown on Figure 9A in Appendix B.

Table 4-15 Summary of contamination encountered within the historical BGS exploratory holes

BGS Borehole Reference	WYG/Norwest Holst Report Reference	Chainage (m)	NGR	Contamination Encountered	Depth (mbgl)
NZ19NE142	TP1278	30m NE of 10200	417852 597364	Made ground: Dark grey/black clayey sand and gravel. Gravel sized fragments are fine to coarse angular to sub-angular of sandstone, coal, pottery and asphalt/tar. Strong hydrocarbon odour noted.	2.30-3.00
NZ19NE148	TP1284	10m E of 11075	417502 598134	Made ground: Dark grey brown slightly sandy gravelly clay. Gravel sized fragments are sub-angular fine to coarse of sandstone, brick and concrete. Asbestos, door locks and glass noted.	0.20-0.30

4.10.1.1 Historical Contamination Testing

Forty soil samples were tested as part of the Norwest Holst ground investigation in 2006, and the determinands tested for are detailed in Table 4-16.

Table 4-16 Determinands tested for as part of 2006 Norwest Holst GI

Metals and semi-metals	Organics and others
Boron (water soluble)	Acidity
Arsenic	Asbestos
Cadmium	Free Cyanide
Chromium (total)	Sulphate
Copper	TPH
Lead	PAH
Mercury	EPH
Nickel	GRO
Selenium	Phenols

The results of this analysis were compared to current generic assessment criteria (GAC) by Jacobs, and screened against the LQM/CIEH S4ULs for Human Health Risk Assessment for commercial/industrial end use. Only one of the samples tested (TP1278, BGS reference NZ19NE142, Appendix H) recorded exceedances of these levels. These exceedances were for benzo(b)fluoroanthene, benzo(a)pyrene and dibenzo(ah)anthracene. It is likely that these values are related to the strong hydrocarbon odour that was encountered in the trial pit, as detailed in Table 4-15.

4.10.2 Waste

Historical landfills located within the study area are summarised in Table 4-17 below and on Figure 8A in Appendix B. There are no active landfills within the study area.

Table 4-17 Historical landfills within the study area

Name	Chainage (m)	NGR	Accepted Waste	Dates	Licence no
Eshott	90m NE of 8400	418900 596000	Industrial, Commercial, Household, Liquids/Sludge	Unknown	Unknown
The Helm, Felton	0 - 20m NE of 9090 – 9475	418500 596700	Inert	7/10/1977-31/12/1979	67279

The previous PSSR for this section of the A1 (Reference 9) recorded the presence of a foot and mouth burial pit at High Highlaws Farm, located to the north of the farm lane (70m west of 2150, NGR 418327 589732). A cleanse and disinfect pit is located to the south of the farm (160m west of 1880, NGR 418162 589526), which contains farm material and equipment. The pits are estimated to have been excavated between March and April 2001.

A subsequent Preliminary Geotechnical Report (Reference 1) found no elevated biological or chemical contamination of water from two boreholes within the vicinity of these pits. The locations of the foot and mouth pits are shown on Figure 8A in Appendix B.

There are two historical waste transfer stations within the study area, which are summarised in Table 4-18 and on Figure 8A in Appendix B.

Table 4-18 Historical Waste Transfer Stations within the study area

Name	Chainage (m)	Code	NGR	Type	License Number	Active Dates
Shield Green Farm	420m E of 4620	WT1	419200 592200	Composting facility	DIX001	29/09/1993-15/08/2000
The Helm, Felton	150m NE of 9200	WT2	418600 596700	Landfill taking other wastes	NOR018	18/07/1977-12/02/1993

There are seven active discharge consents within the study, which are summarised in Table 4-19 and on Figure 8A in Appendix B.

Table 4-19 Active Discharge Consents within the study area

Location	Chainage (m)	Code	NGR	Type	Permit Number	Receiving Water
Tritlington C of E School	260m E of 4930	D1	419080 592500	Sewage Discharges – Final/Treated Effluent	224/0996	Tributary of Earsdon Burn
Oak Inn, Causey Park	120m W of 7030	D2	418860 594600	Sewage Discharges – Final/Treated Effluent	224/0946	Earsdon Burn
Four Gables, Causey Park Bridge	50m W of 7140	D3	418946 594703	Sewage Discharges – Final/Treated Effluent	EPRCP3423GU	Tributary of Earsdon Burn
Burgham Farm	100m SW of 9960	D4	417900 597090	Sewage Discharges – Final/Treated Effluent	223/0987	Longdike Burn
The Farmhouse, Burgham Park	100m SW of 10060	D5	417830 597180	Sewage Discharges – Final/Treated Effluent	223/1003	Longdike Burn
Burgham Park Golf and Leisure Club	100m SW of 10220	D6	417740 597300	Sewage Discharges – Final/Treated Effluent	223/0961	Longdike Burn
Felmoor Park Ltd	250m NE of 10100	D7	418080 597427	Sewage Discharges – Final/Treated Effluent	NPSWQD006231	Longdike Burn

4.11 Pollution

There is one recorded pollution incident within the study area, as detailed in Table 4-20 and on Figure 8A in Appendix B.

Table 4-20 Pollution incidents within the study area

Chainage	180m W of 1130m
NGR	418040 588780
Pollutant	Commercial Waste
Impact to Air	Category 4 (No Impact)
Impact to Land	Category 3 (Minor)
Impact to Water	Category 4 (No Impact)
Date First Added	01/06/2003
Date Last Added	07/01/2004
Number of Occurrences	3

4.12 Designated Sites

The River Coquet and Coquet Valley Woodland SSSI intersect the scheme at Ch.12670 to 12770m. It is designated due to being a relatively unmodified fast flowing river that supports a wide range of flora and fauna.

Scotch Gill Wood Local Nature Reserve, designated at local level by the local authority, is 1.2miles (2km) south of all options.

All options pass close to and through areas identified by the Castle Morpeth Local Plan as having “High Landscape Value”.

There are two Noise Important Areas (IA) alongside the existing A1 between Morpeth and Felton (IA_ID 1003), at Warrener’s House, adjacent to the southbound side of the A1 just north of Morpeth; (IA_ID 1002), also adjacent to the southbound side of the A1, at Causey Park Bridge.

Table 4-21 Listed cultural heritage sites in the study area

Chainage (m)	Code	NGR	Type	Grade
10m E of 2350	CH1	418456 589979	Milepost	Grade II
15m SE of 3980	CH2	418456 589979	Milepost	Grade II
On proposed carriageway at 5625	CH3	418901 593192	Milepost	Grade II
5m E of 7280	CH4	419024 594838	Milepost	Grade II
20m NE of 10495	CH5	417674 597598	Milepost	Grade II
210m E of 11860	CH6	417639 598913	Milepost	Grade II
120m W of 13175	CH7	417344 600232	Boundary Stones	Grade II
120m W of 13280	CH8	417339 600334	Longfield Cottage	Grade II

Details of designated cultural heritage sites within the study area are summarised in Table 4-21 and on Figure 8A in Appendix B. These will be considered in the Environmental Impact Assessment.

4.13 Services

Scheme drawings are presented as Appendix A include the locations of Statutory Utilities and Services. These are not comprehensive at this stage and no reliability is placed upon their location on these plans.

Attention however is drawn to two locations where current service information indicates an existing gas main running parallel to and west of the existing A1. The main is identified on the Geotechnical Aspects drawings (within Appendix A) at existing Ch.1000 to 4000 and Ch. 9600 to 10400. All options considered will interact with this service.

5 Ground Conditions

5.1 Previous Ground Investigations

Ground investigations have been undertaken along the route previously for the purpose of road improvement works including new alignment as described herein. A summary of the scope of the investigations, their date and originator is given in Table 5-1.

A borehole and trial pit location plan for the previous boreholes is presented in Appendix A (A4).

A geological longitudinal section that is representative of the options is presented in Appendix C.

Table 5-1 List of previous ground investigations relevant to proposals.

Title	Originator and year	Scope of GI
Stage 1 Ground Investigation NWH Soil Engineering Report (Reference 12) In general this investigation had exploratory bore holes every 250m, with trial pits and window samples in-between holes.	Norwest Holst (NHSED) 2006	42No. CP boreholes 17No. with Rotary Core follow on 11No. Rotary Core boreholes 38No. dynamic window sampler probe holes 113No. Trial Pits 18No. Concrete core holes 38No. Dynamic Cone Penetrometer testing in Trial Pits Hand Vane Shear Testing 4No. Permeability testing 1No. Downhole optical imaging using a tele viewer.
Site Investigation River Coquet, Felton on behalf of Northumberland County Council (Reference 13)	Tarmac Construction Limited Central Engineering Laboratories 1974	6No. CP boreholes 6No. Rotary Core Follow on 1No. Rotary Core borehole
A1(T) Morpeth Bypass preventative maintenance, Ground Investigation Report (Reference 11)	Halcrow 2010	2No. CP boreholes 24 No. Cone penetration tests To the south of the design proposal.

Across the site the superficial deposits generally comprise cohesive glacial till overlying the Stainmore Group (formerly the Millstone Grit / Upper Limestone Series). Pockets of made ground or alluvium are present in localities associated with watercourses and in areas where the A1 has been improved. Apart from the Causey Park area there is very little made ground arising from past mining or quarrying.

The ground model for the proposed alignments has been assessed using available existing factual data from a number of ground investigations including the 2006; Stage 1 Ground Investigation along the length of a similar proposal to the current Green Offline route.

An indicative model that can be applied to all route options is presented as Table 5-2 below.

Engineering Properties	Shear Strength	MC (mean)	LL (mean)	PL (mean)	PI (mean)	m_v (m^2/MN)
Made Ground Cohesive	c_u 20 to 40 kN/m^2	22%	-	-	20%	-
Alluvium	c_u 9 kN/m^2 SPTs 2-7 N	5-31	-	-	15	0.3-1.5
Glacial Sand and Gravel	ϕ 30 °	-	-	-	-	-
Glacio-lacustrine	c_u = 70 kN/m^2 ϕ' = 28° (triaxial compression)	23	-	-	20	0.1 – 0.30

Table 5-2 Engineering Ground model-strength and compressibility for the route

Glacial Till	c_u =50 – 250 kN/m^2 ϕ' = 28°	23	-	-	15-30	0.05-0.2

The general proven thicknesses of each material is shown in Table 5-3.

Table 5-3 Ground Units average thickness proven in boreholes

Unit	Depth Encountered (mbgl)	Thickness (m) (range)
A – Made Ground	0	1.2 (0.0 – 3.7)
B – Alluvium	0	0.5 (0.0 – 1.2)
C – Glacio Fluvial deposits	2	1 (0.0 – 7.1)
D – Glaciolacustrine Deposits	4	1.5 (0.0 – 4.1)
E – Glacial Till	1.5	7 (0.0 – 24.7)
F – Bedrock (Interbedded)	8.5	N/A unproven

5.2 Unit A – Made Ground

The made ground occurs sporadically and is variably described as summarised in Table 4-15.

Classification tests indicate moisture content ranging from 13 to 40% with a standard deviation of under 5 for a mean of 22%. Fourteen from 16 plasticity tests undertaken, plot above the A line and 12 out of 16 are representative of intermediate plasticity. The Plasticity Index (PI) of the material ranges from 12 to 26 with a standard deviation of 3.8 for a mean of 19.2%. These plots are shown in Figure B10 to B11 in Appendix B.

The undrained shear strength (c_u) has been obtained from 3 triaxial tests completed on made ground samples (BH1028, BH1044 and BH1041) which represents the material to the north of Ch. 10000m. Results of 21, 20 and 21 kN/m^2 respectively were obtained indicating a clay of soft consistency. This is confirmed by SPT 'N' values of 6 to 9 within the same deposit which can be correlated to undrained shear strength of between 25 kN/m^2 and 40kN/m^2. Higher values for undrained shear strength have been recorded where SPT 'N' values are N 50.

Contamination testing has been completed on samples of Made Ground, however, these were completed ten years ago, and natural processes may make the result invalid. The results indicated that only 4 out of 14 tests exceeded screening values set by the environmental specialist at that time[6]. Of these all but one were related to Total Petroleum hydrocarbons and Polyaromatic Hydrocarbons.

5.3 Unit B – Alluvium

Alluvium is evident within the River Wansbeck, River Lyne and the River Coquet catchment and flood plains. It has been encountered in 8 boreholes along the route directly within the watercourses of Floodgate Burn, Earsdon Burn, The River Lyne, Longdike Burn and the River Coquet during the investigation for the Offline Green route. All routes cross these watercourses and are expected to encounter localised alluvium at the proposed crossings.

At Longdike Burn (Ch.10180m), BH1028 (WYG 2006) the material was described as very soft dark grey very sandy clay underlain by glacial till.

Single moisture content at 5.5m depth is 13%. Plasticity Index tests result in 18% PI and a liquid limit of 33% and a plastic limit of 15%. SPT tests are summarised below. A summary of SPT'N' values within alluvium are given in Table 5.4.

Table 5-4 - Alluvium SPT results from BH1028

Depth	SPT 'N' Value	Description
4 – 4.5m	7	Top of layer overlain by made ground
5 – 5.45m	1	Base of soft clay

One triaxial test was completed on a recovered U100 sample in BH1010 (Ch.4050m). A moisture content of 31% and undrained shear strength of 9kN/m^2 was derived.

There is limited data for alluvium along the route and a further investigation, in areas where it occurs, is required for the preferred option.

5.4 Unit C – Glacial Sands and Gravels

Extensive research (Reference 23-26) has been undertaken into the occurrence, formation and engineering properties of Northumberland glacial deposits on account of their major significance in the economic recovery of underlying coal. As a result comprehensive data is available to characterise the material in terms of its total and effective shear strength, elastic and consolidation characteristics, permeability and its remoulded properties for assessment of re-use potential as earthworks.

Glacial sand and gravel occurs directly below the alluvium or at depth interlayered with glacial till and laminated glacial clay. It occurs as beds or lenses and can vary significantly in particle size distribution, thickness and lateral extent.

Fluvio-glacial sand and gravel along the route are represented by slightly clayey slightly silty, slightly gravelly sand. From PSD tests the average sand and gravel content is 68%. From 22

tests, 3 tests from TP1277 and TP1298 indicated a clay and silt fraction greater than the combined sand and gravel.

The lenses of sands and gravel range from 0.2m to 7.1m thick and appear not to be largely represented within the glacial succession.

5.5 Unit D – Glacio-lacustrine deposits

The glacio-lacustrine deposits have been identified within the route and are located between an upper and lower glacial till (research has called these a lower ablation till and a basal glacial till[16]). The lacustrine deposits are clay and silt (often varved) having formed in lakes between periods of ice advancement and retreat. The material's absence of coarse particles such as gravels and cobbles with fine silt and fine sand partings is a noticeable feature.

Lacustrine deposits have been encountered within BH1030 and BH1031 between Ch. 10451m and 11570m for the green route, where they are described as stiff to firm thinly laminated dark grey / brown clay. Also, within BH1045 at Ch. 13390m, the material was described as thinly laminated dark grey brown sandy silt. It was encountered at 54.7mAOD, which is 4.2m bgl for a thickness of 4.1m.

A summary of laboratory derived plasticity and stiffness results are summarised in Table 5.5.

Table 5-5 - Glaciolacustrine deposits table of properties

Property	Range	Standard deviation	Characteristic Value	Most probable
Moisture Content (%)	18 – 34	4.94	29	23
Plasticity Index (%)	12 – 31	7.9	23	20
Undrained Shear Strength (Triaxial) (kN/m^2)	24 – 29	N/A	24	24
Undrained Shear Strength (SPT/ cu derived) (kN/m^2)	13.5 – 225	87.8	30	70
One dimensional volume compressibility (m^2/kN)	0.09	N/A	0.1	0.1

For this section the thickness of the material ranges from 0.5m to 4.1m. A moisture content of between 18 – 34% with a characteristic value of 29% is derived. The clay is of intermediate to high plasticity.

Effective stress parameters published for this material range from ϕ' values of 24° to 36° with a mean value of 28° (Reference 25).

5.6 Unit E – Glacial Till

A drawing showing the depth to bedrock (alternatively the total thickness of the glacial deposits) is presented as Figure 1 in the Statement of Intent and reproduced as Figure B17. The route extends from north Morpeth (Ch. 900m), where the till is moderately thin, in the order of 5m, however the first of two buried glacial channels become evident as the deposit gradually thickens, forming a flat 17m to 19m base depth for about 3km. At Tritlington the till is again of moderate thickness, in the order of 7m. Gradually as the route approaches Causey Park, it thins

to be absent where the igneous intrusion surfaces. North of Causey Park the moderately thick till (circa 7m) extends to Helm (Ch.8900m). At Helm the deposit thickens rapidly to form a narrow buried valley with a base depth 25m bgl. This depth extends over about 2.5km northwards before again rapidly thinning just south of the Felton Bypass tie in. A third buried valley is evident almost immediately north of this section. Buried valleys are centred at approximate Ch4000m, Ch7000m and CH10500m.

The glacial till varies in thickness across the site from 0m at Causey Park and the River Coquet to an proven thickness of 25.5m at BH1027 (CH 9500m), although bedrock is not encountered at this depth. A total thickness of up to 45m, is locally possible.

The Preliminary geotechnical report (Reference 10) which investigated the glacial material Unit E along its full length (albeit the data was aligned for the off line option) evaluated a large volume of data and presented the following summary.

Table 5-6- Geotechnical Properties of Glacial Till (Reference 28)

Geotechnical Property	Typical Range	Preliminary Design Values
Natural Moisture Content (%)	10-30	20
Plasticity Index (%)	15-30	22
SPT		N=2z+4 (CCE) N=2.6z+9 (CMP)
Undrained Shear Strength (kN/m^2)		N=8.6z+10 (CCE) N=12.5z+50 (CMP)
Effective Angle of Shear Resistance		28°
Bulk Density (Mg/m^3)	1.95-2.25	2.15
Effective Cohesion (kN/m^2)		0
Equilibrium CBR		3%
Optimum Moisture Content (2.5kg rammer) (%)	12-18	15
Optimum Moisture Content (4.5kg rammer) (%)	10-15	12
Lime Consumption (%)	3.45-4.6	4
One dimensional volume compressibility, m_v (m²/MN)	0.1-0.2	0.15
Compression index, c_c	0.05-0.15	0.1
Swelling index, c_s	0.01-0.05	0.03
Coefficient of consolidation, cv (m²/year)	1-9	3

(CCE = Characteristic Cautious Estimate) (CMP= Characteristic Most Probable)

The mottled clay is a recently weathered upper zone. The red material is a weathered layer thought to result from weathering within the glacial and interglacial period. The unweathered grey clay (referred to as ablation till) has undergone no oxidation following deposition. The Grey basal till exhibits an identifiable reduction in moisture content and an increase in strength/ reduction in compressibility.

Extensive research into the glacial deposits in the area has been carried out and a number of sources have been identified assessing a significantly large data for the whole glacial till

succession. At Acklington Opencast Site, to the south east of the route data has been summarised and presented in Table 5.7 below.

Table 5-7 - Classification and strength data for soils at Acklington mound (Reference 23)

Soil	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Undrained Shear Strength (kN/m2)	Effective Angle of Friction ϕ'(°)
Subsoil	19	40	17	90	(30)*
Mottled clay (unit 1)	18 (17)	39 (33)	17 (10)	124 (150)	(30)
Red brown till (Unit 2)	16 (14)	37 (34)	17 (14)	150 (180)	(28)
Grey till (Unit 3)	12 (12)	30 (32)	14 (15)	305 (200)	(31)

*The figures in brackets refer to typical values for those soils taken from an extensive database from the region.

Taken from an extract from Plate 5-1:

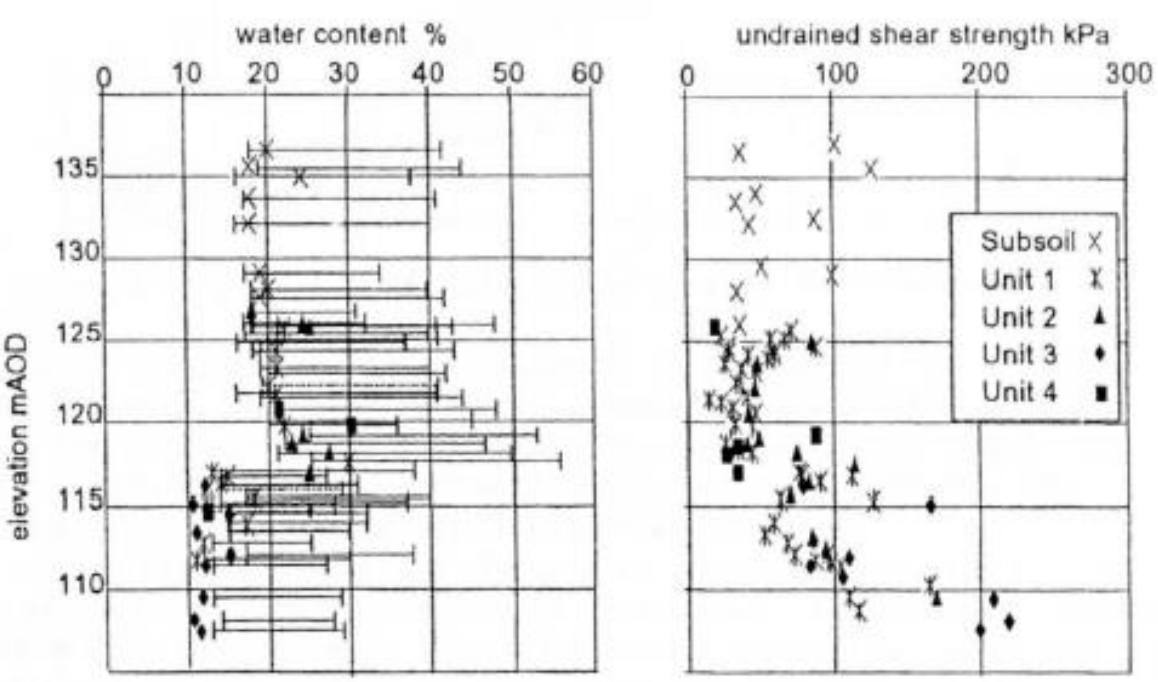

Plate 5-1 - Typical classification profile at Acklington Coal (Reference 23)

This is largely confirmatory of the values obtained from the site specific data. It does identify the undrained shear strength of the glacial till as high which has been recorded in the site specific data at shallow depth.

Compaction tests undertaken predominantly within the weathered glacial till indicate a range of values between m_{opt} = 10 % and 18 % with corresponding maximum dry density between 1.7 and 2.02Mg/m^3.

Moisture Condition Value tests have been undertaken on mottled brown clay and a range of values between 7 and 14 are derived at moistures ranging from 16 and 23%. Re-use value for all glacial till from weathered to fresh and very stiff is high.

California Bearing Ratio (CBR) determinations on the weathered till has shown that unsoaked values between 0.2% and 9% with a mean of approximately 4% are typical. Soaked tests, on samples from the weathered glacial till, return a mean value of approximately 3.5%.

5.7 Unit F – Bedrock units

The bedrock encountered across the site is the Stainmore Formation and the Upper Limestone series of the Yoredale Formation of the Carboniferous. The Causey Park Fault and discordant dykes cross the route at approximately Ch. 8000m

The Sandstone, siltstone, mudstone, shale, coal and fireclay of the Stainmore group have been intercepted between 2.3m bgl and unproven at 26m bgl across the site. The material is interbedded and from available laboratory testing on rotary cored samples, are characterised by a range of unconfined compressive strengths from 0.2 to 5.3 MN/m^2 within weakly laminated mudstone described as shale and Sandstone. A detailed geological section across the Coquet Valley dated 1978, at the existing A1 Bridge position is reproduced in Appendix C as Figure C3.

6 Preliminary Engineering Assessment

The dualling of this section of the A1 north of Newcastle requires adapting the current transport corridor. Three design options have been developed and the following sections outline the available information.

The options can be quickly summarised into the following sections where the proposed routes differ in underlying soil.

Table 6-1 - Sections of earthworks along the site

Section	Chainage from (m)	Chainage to (m)	Comments
1	0	3600	Online dualling for all options
2	3600	6238	Within glacial valley across the site, options diverge at the beginning of the chainage.
3	6238	8270	Offline option west of existing carriageway and within second glacial valley characterised by bedrock depth.
4	8270	9900	Options merge back to online options from offline and online options
5	9900	13740	Online dualling for all options and River Coquet Crossing

The following Sections outline the differences in the proposed earthworks for the proposed routes.

6.1 Earthworks Description

6.1.1 Cuttings

Along the length of the site, the cuttings required for the proposed route alignments are identified in Table 6-2. Cuttings to a depth of 10.5m bgl are required. The side slopes for the preliminary design have been based upon 1V in 3H. The effective angle of friction for the glacial till of 28° is expected to be stable at that design angle, however, the laminated clay and lenses of silt and sand within the glacial till may present areas where this design will not be suitable. Further ground investigation shall confirm the thickness and strength of these laminations throughout the material.

Cutting heights are based on preliminary values with a design slope of 1V:3H as shown on overview drawings, located in Appendix A. Ground conditions have been determined from existing ground investigation data from within close proximity of the earthworks structures.

Table 6-2 - Length of Cuttings along the proposed routes

Chainage from (m)	Chainage to (m)	Length (m)	Maximum height	North / southbound side of carriageway.	Orange Route	Blue Route	Green Route	Ground conditions
1290	1350	60	Circa 6.5m	Northbound	X	X	X	Very soft to very stiff glacial till to 19m bgl underlain by moderately strong Sandstone. Possible laminated clay at 6 to 10m bgl.
6470	6510	40	Circa3.5m	Northbound		X		Very stiff basal glacial till to 8m bgl underlain by weak to strong laminated sandstone. Proposed design of 1V in 3H.
6620	6820	200	Circa 5m	Northbound & Southbound		X		Very stiff basal glacial till to 8m bgl underlain by weak to strong laminated sandstone. Proposed design of 1V in 3H.
7580	7720	140	Circa 3m	Southbound			X	Firm laminated glacial till underlain by medium dense gravel at 3m – 4m further underlain by stiff glacial till to a depth of 16m bgl. The base within granular material may lead to seepage at the base of the cutting.
8500	8760	260	Circa 6.5m	Northbound & Southbound			X	Firm to very stiff glacial till to 6mbgl underlain by sandstone recovered as gravelly sand. Cutting expected to be based within the bedrock. Bedrock is expected to be weathered sandstone. Sandstone may require ripping.
8760	8930	170	Circa 5m	Southbound		X		Firm to very stiff glacial till to 6mbgl underlain by sandstone recovered as gravelly sand. Cutting expected to encounter weathered sandstone at the base. Weathered sandstone should not require ripping.
9470	9520	50	Circa 6m	Northbound & Southbound			X	Firm to stiff glacial till to a depth of 25m bgl. Depth of cutting within the glacial till. Preliminary batters of 1V in 3H side slope angles.
12180	12510	330	Circa 10.5m	Southbound	X	X	X	Stiff glacial till underlain by weak bedrock with shallow coal to a depth of 12m bgl. Mine workings unproven. Local dip of mudstone into excavation may lead to plane or wedge failure. Requires assessment. Additional coal band at 19m bgl.

Chainage from (m)	Chainage to (m)	Length (m)	Maximum height	North / southbound side of carriageway.	Orange Route	Blue Route	Green Route	Ground conditions
12510	12650	140	Circa 3.5m	Southbound	X	X	X	Stiff glacial till underlain by coal at 2.5m and the cutting base within sandstone. Coal bearing layer is expected. Coal and rock bedding and jointing to be clarified.
12900	13060	160	Circa 6m	Southbound	X	X	X	Firm to stiff glacial till with occasional lenses of sand to a depth of 10m bgl further underlain by very weak to weak mudstone and siltstone. Base of the cutting to be within glacial till. Boulders present and may present occasional variability in strength for the subgrade.
13060	13260	200	Circa 3.5m	Southbound	X	X	X	Made ground of reworked glacial till present across the site. The made ground has moderate strength but waste material throughout associated with the industrial history of the area. Likely to be classed as 'unsuitable' for re-use apart from 4F landscape fill.
13460	13700	240	Circa 5.5m	Southbound	X	X	X	Stiff glacial till interbedded with loose sand and laminated silt to a depth of 8.5mbgl. The cutting is expected to be based within the laminated silt which is likely to be weak and prone to sliding. Reduced side slope dimensions may be required to provide stability within the cutting.

6.1.2 Embankments

New or modified embankments are required up to 12m in height. The embankments are normally associated with the access roads approach embankments and watercourse crossing points which run generally west to east.

Table 6-3 identifies the embankments along the length of the route for the three route proposals. Embankment heights are based on preliminary values with a design slope of 1V:3H as shown on overview drawings, located in Appendix A. Ground conditions have been determined from existing ground investigation data from within close proximity of the earthworks structures.

Table 6-3 - Length of embankments along the proposed route

Chainage from (m)	Chainage to (m)	Maximum Height (m)	Length (m)	North / southbound side of carriageway.	Orange route	Blue Route	Green Route	Ground Conditions
1790	1880	Circa 3m	90	Northbound	X	X	X	Firm glacial till to a depth of 17m underlain by sandstone. There are no exceptional foundation or embankment slope issues envisaged. It is expected that site won glacial material will be used as Class 1 and 2 embankment fill. Indicative side slope angle of 1V:3H achievable subject to design confirmation.
2200	2270	Circa 7m	70	Overbridge both sides	X	X	X	Stiff glacial till to a depth of 4.4m bgl further underlain by a medium dense gravel proven to a depth of 6.2m. Conventional earthmoving equipment is envisaged within the cutting. Boulders present at formation to be removed.
3600	3670	Circa 3.5m	70	Northbound		X	X	Stiff to very stiff glacial till proven to a depth of 10m bgl. Occasional cobbles of sandstone present within boreholes.
3940	4140	Circa 8m	200	Southbound	X	X	X	Stiff to very stiff glacial till proven to a depth of 10m bgl. Occasional gravel of mixed lithology throughout. Material strength is expected to be suitable for embankment loading without undue settlement. Possible alluvium expected surrounding the watercourses to excavate and replace if found.
4860	5010	Circa 7m	150	Overbridge Northbound & Southbound	X	X	X	Soft clay underlain by stiff glacial till further underlain by sandstone at 7m bgl. Consider removal of upper soft clays prior to embankment loading.
5500	5590	Circa 3.5m	90	Southbound	X	X		Firm glacial till underlain by medium dense to dense sand to 3m bgl. Bedrock is expected to be underlying very dense sand. Borehole information is based from the offline option (i.e. over 500m away).

Chainage from (m)	Chainage to (m)	Maximum Height (m)	Length (m)	North / southbound side of carriageway.	Orange route	Blue Route	Green Route	Ground Conditions
6910	7060	Circa 6.5m	150	Southbound	X	X (8m)	X (4.5m)	Soft clay alluvium to a depth of 2m bgl further underlain by stiff glacial till to a depth of 14m bgl. Alluvium to be excavated and replaced with suitable fill for the embankment construction.
7450	7510	Circa 7m	60	Overbridge Northbound & Southbound		X		Firm to very stiff glacial till to a depth of 10m further underlain by weak to strong interbedded mudstone and sandstone. Occasional lenses of sand throughout the material, anticipate ground water entry to excavations in sand.
7600	7660	Circa 7m	60	Overbridge Northbound & Southbound	X			Firm to very stiff glacial till to a depth of 15m further underlain by weak to strong interbedded mudstone and sandstone. Occasional lenses of sand throughout the material.
7650	7690	Circa 5m	40	Overbridge Northbound & Southbound			X	Firm to very stiff glacial till to a depth of 15m further underlain by weak to strong interbedded mudstone and sandstone. Occasional lenses of sand throughout the material. Material strength is expected to be suitable for the embankment widening.
8260	8300	Circa 3m	40	Southbound		X		Firm to stiff glacial till proven to a depth of 8m bgl. Occasional cobbles throughout. Material strength is expected to be suitable for the embankment widening.
8770	8930	Circa 4.5m	160	Southbound		X		Frim to stiff glacial till interbedded with lenses of dense sand. Bedrock is expected at a depth of 5-6m bgl Adequate bearing capacity is expected for the proposed embankment.
8910	9230	Circa 5.5m	320	Northbound	X			Stiff glacial till with occasional cobbles proven to a depth of 7m bgl. Glacial till is identified as being indistinctly laminated which will require consideration of lateral movement as the embankment is built.

Chainage from (m)	Chainage to (m)	Maximum Height (m)	Length (m)	North / southbound side of carriageway.	Orange route	Blue Route	Green Route	Ground Conditions
9080	9300	Circa 5m	220	Northbound & Southbound		X		Stiff glacial till with occasional cobbles proven to a depth of 7m bgl. Glacial till is identified as being indistinctly laminated which may need further consideration during investigations.
9830	10025	Circa 3.5m	195	Northbound			X	Made ground and alluvium to a depth of 5.5m bgl further underlain by laminated stiff glacial till. Excavation and replacement of soft clay and loose sand may be required, or some form of ground treatment prior to construction. (e.g. piled embankment)
10025	10210	Circa 4m	185	Northbound	X			Made ground and alluvium to a depth of 5.5m bgl further underlain by laminated stiff glacial till. Excavation and replacement of soft clay and loose sand for the length of the proposal may be required as above.
10130	10180	Circa 4m	50	Southbound	X			Made ground and alluvium to a depth of 5.5m bgl further underlain by laminated stiff glacial till. Excavation and replacement of soft clay and loose sand for the length of the proposal cannot be ruled out. Attention should be given to bearing capacity failure in glacio-lacustrine clays during design as above..
11810	11870	Circa 7m	60	Overbridge Northbound & Southbound	X	X	X	Made ground underlain by firm to stiff laminated clay to a depth of 20m bgl where coal is encountered. Embankment height may overstress laminated clays. Consider bearing capacity failure condition during construction. Embankment side slopes (1V:3H) proposed are not considered a constraint, but should be checked at design stage.

Chainage from (m)	Chainage to (m)	Maximum Height (m)	Length (m)	North / southbound side of carriageway.	Orange route	Blue Route	Green Route	Ground Conditions
13360	13390	Circa 12m	30	Southbound	X	X	X	Stiff glacial till interbedded with loose sand and laminated silt to a depth of 8.5mbgl. The cutting is expected to be based within the laminated silt which is likely to be weak and prone to sliding from pressure of embankment. Reduced side slope dimensions may be required to provide stability within the cutting.

6.1.3 Subgrade

The sub-grade formation is expected to alternate between in situ soils, ranging from stiff glacial till, laminated glacial clay, local areas of glacial sand and very occasional alluvium, and embankment capping material (class 6F). From an estimation of soil distribution along the route, available excavated material suitable as general fill for re-use in embankments is likely to be cohesive (Class 2A, B or C).

On that basis a sub-base design CBR between 2.5 and 5% is likely achievable along the whole route length. Results of compaction and laboratory soaked and un-soaked data reviewed confirm this as a viable outcome.

However the glacial clays are occasionally high plasticity and in periods of wet conditions it is to be expected that prepared or in situ subgrade fails to meet the anticipated value. Minimum subgrade, undrained strength of 50kN/m^2 should be specified to identify 'soft' areas. Soft spots, when encountered, should be replaced with a capping layer or pavement layer aggregate.

Should alluvium be encountered at formation, it is likely to be soft and require removal and replacement.

6.2 Structure Foundations

The structures that are proposed or required to be adapted are listed in Table 6-4.

Table 6-4 - List of structures and expected ground conditions across the site

Structure	Orange	Blue	Green
Culvert (CH.1820m)	10m extension of the culvert on the northbound side. Ground conditions expected to be glacial till proven to a depth of 14.55m (BH1002 @ Ch1800m). Conventional extension methods are envisaged to suit the existing structural form.		
Highlaws Road Junction (CH.2050 – 2270m)	New 32m length overbridge and approach embankment for grade separated junction and balancing ponds. Ground conditions expected to be glacial till proven to a depth of 6m with interbedded silt and medium dense gravel (BH1004@CH.2180m) with very stiff basal lodgement till to bedrock at 18m bgl (BH1002R @ CH2120m). Spread foundations are a possible solution provided lateral forces can be accommodated. A piled foundation should cater for all structural eventualities. Significant total and differential settlement between the bridge and embankments is not envisaged.		
Floodgate Burn Culvert (CH.3650m)	12m extension to the culvert on the northbound embankment. Ground conditions expected to be stiff to very stiff till to a proven depth of 10m bgl (BH1007 @CH.3680m). Conventional shallow foundations for culvert base and wing walls are anticipated to be acceptable.		
Box culvert adjacent to Priests bridge (CH.4000m)	N/A	N/A	70m x 3.7m Box culvert structure with overpass for dual carriageway. Ground conditions are expected to be firm to stiff glacial till to a proven depth of 15m bgl (BH1009 @CH.4050m). Prepared formation to support ground bearing box is anticipated to be feasible. Bearing pressure and uplift pressures are

Structure	Orange	Blue	Green
			likely to be nominal. Total and differential settlement not envisaged to be prohibitive.
Priests Bridge (CH4000m)	Bridge widening of 5m over 10m length for dualling with raised embankment on the northbound side. Ground conditions are expected to be firm to stiff glacial till to a proven depth of 15m bgl (BH1009 @CH.4050m). Spread foundations are feasible depending upon lateral forces resulting from approach embankment loads. Piled foundations are an alternative.		N/A
Fenrother Junction (CH.4900 - 5000m)	New 32m (36m Green route) length overbridge and approach embankments for grade separated junction and balancing ponds. Ground conditions expected to be firm to very stiff lodgement till to a depth of 7.7m bgl underlain by weak to strong mudstones and sandstones to depth. Ground conditions based on Green route boreholes (BH1012R@ CH.4950m). Online routes not covered by historical ground investigation. Spread or shallow piled group foundations are both feasible depending on depth to very stiff glacial till. Bedrock at an elevation that requires the investigation of possible mine voids. Mine searches may eliminate this risk.		
Earsdon Burn Culvert (CH.6980m)	15m culvert extension on the northbound side for extension of dual carriageway. Ground conditions are soft to very stiff glacial till (possibly alluvium) to a depth of 14m bgl (BH1015 @CH.7030m). Outside of the investigated area during initial GI. With shallow soft clay feasible to remove and adopt spread foundations. Piles an alternative should the soft soils extend to moderate depth.	70m box culvert and approach embankments. Ground conditions are soft to very stiff glacial till to a depth of 14m bgl (BH1015 @CH.7030m). Outside of the investigated area during initial GI. Foundation solution and embankment construction sequence will depend upon thickness of soft layer.	40m box culvert required for dual carriageway overpass. Ground conditions are soft to very stiff glacial till to a depth of 14m bgl. (BH1015 @CH.7030m).
Overpass (CH.7000m)	Pedestrian overbridge 50m length by 5m wide Ground conditions are soft to very stiff ablation till to a depth of 14m bgl (BH1015 @CH.7030m). Spread foundations will depend upon depth to very stiff	N/A	N/A

Structure	Orange	Blue	Green
	glacial clay. Piled group a feasible alternative.		
Causey Park Overbridge (CH.7600m)	N/A	N/A	34m bridge and approach embankments for side road crossing. Ground conditions are firm to stiff glacial till to 16m depth underlain by weak to strong interbedded mudstone and sandstone. (BH1017 @CH7655m). Piled foundations are feasible terminating in the very stiff glacial soil. Firm clay unlikely as a suitable bearing horizon for the bridge foundations. Embankment constructed in advance possibly in stages if firm layer is thick. Shallow underground mine voids a risk at this locality.
Earsden Junction (CH.7600m)	32 m length overbridge for compact grade separated junction and approach embankment. Ground conditions are firm to stiff glacial till to 16m depth underlain by weak to strong interbedded mudstone and sandstone (BH1017 @CH7655m). No ground investigation on location for structures on online options. Spread foundations for bridges a possible alternative to piled groups.		N/A
Burgham Underbridge (CH.9450m)	N/A	N/A	10m length 25m wide underbridge for dual carriageway and cuttings for access road. Ground conditions are firm to stiff glacial till underlain by basal lodgement till from 10m to 25m bgl (BH1027 @ CH9510m). Spread foundations are a possible solution against a feasible piled group.
Longdike Burn Culvert (CH10200m Orange Route)	20m culvert extension both north and southbound side. Ground conditions are soft sandy clay alluvium to 5.6m underlain by stiff ablation till to a depth of 20m bgl (BH1028 @ Ch.10000m). Possible spread foundation (raft) depending upon bearing and uplift pressures. Piled group through soft alluvium into stiff glacial clay a feasible alternative.		30m extension on the northbound side for carriageway loading. The ground conditions are soft sandy clay alluvium to 5.6m underlain by stiff ablation till to a depth of 20m bgl (BH1028 @ Ch.10000m).
Westmoor Junction (CH.11500 – 11600m)	37m overbridge with approach embankments for grade separated junction. Ground conditions are firm to stiff glacial till with occasional laminations throughout. (BH1031 @CH11570m). Confirmation of the extent of		30m overbridge with approach embankments for grade separated junction. Ground conditions are firm to stiff glacial till with occasional laminations throughout.

Structure	Orange	Blue	Green
	the laminations and the effect on embankment stability are to be investigated.		(BH1031 @CH11570m). Confirmation of the extent of the laminations and the effect on embankment stability are to be investigated.
Culvert (CH.12050m)	Culvert Extension of 15m on the southbound side. Ground conditions are firm to stiff glacial till with occasional laminations throughout. (BH1031 @CH11570m). Confirmation of the extent of the laminations and the effect on embankment stability are to be investigated, but not directly on top of likely structural foundation locations. Spread foundations (raft) are likely to be feasible.		
River Coquet Bridge (CH.12700m)	200m length 13.5m wide overbridge deck to be constructed adjacent to current structure. Ground conditions are glacial till overlying weak mudstone and coal at 5.7m bgl, further underlain by moderately strong sandstone to 15m bgl on the southbound side (BH1036 @12490m) and soft to firm glacial till underlain by very weak laminated mudstone and moderately strong limestone (BH1038 @CH.12685m) on the northbound side. Complex foundation issues involving the sloping valley that may be unstable, shallow coal and weak rock at surface, bridge foundation interaction with existing structure are present. Likely foundation solution will be similar to that currently employed in the existing bridge.		
Parkwood Subway (CH.13300m)	Extension of existing structure to 8m length by 14m wide. Ground conditions are Made Ground of reworked basal lodgement till to 16m bgl (BH1044 @CH.13135m and stiff clay and loose sand underlain by laminated silt at 4.3m bgl which is underlain by stiff basal glacial till at a depth of 8.4mbgl (BH1045 @ CH.13390m). In view of made ground thickness should attempt to found in the re-worked glacial till. Total and differential settlement will govern feasibility of shallow foundations.		
Culvert (CH.13380m)	A 20m culvert extension on the southbound side Ground of reworked basal lodgement till to 16m bgl (BH1044 @CH.13135m and stiff clay and loose sand underlain by laminated silt at 4.3m bgl which is underlain by stiff basal glacial till at a depth of 8.4mbgl (BH1045 @ CH.13390m). Foundations comments as for Parkwood Subway.		

6.3 Drainage

Earthworks drainage will take the form of longitudinal toe drains in cuttings and open drains at the crest of cuttings and toe of embankments. These will be incorporated into a drainage system involving the creation of swales and shallow balancing ponds and outlet structures. Online options require a greater number of balancing ponds than are expected for the offline options. Table 6-5 summarises the number of balancing ponds considered necessary.

Table 6-5 - SUDS ponds indicative location along the site for the 3 route options

Orange Route		Blue Route		Green Route	
Chainage	No.	Chainage	No.	Chainage	No.
1090 – 1140m	1	1090 – 1140m	1	2120 – 2230m	3
2120 – 2230m	3	2120 – 2230m	3	3920 – 4000m	3
3860 – 3920m	1	3860 – 3920m	1	6950 – 7050m	2
4040 – 4100m	1	4040 – 4100m	1	9300 – 9400m	2
4720 – 4760m	1	4720 – 4760m	1		
4830 – 4865m	1	4830 – 4865m	1		
4940 – 4970m	1	4940 – 4970m	1		
6540 – 6600m	1	7520 – 7570m	2		
6700 – 6770m	1	8050 – 8090m	1		
8260 – 8290m	2	9620 – 9700m	2		
10210 – 10340m	2	10240 – 10320m	1		
11700 – 11760m	2	10330 – 10400m	1		
		11740 – 11800m	2		

6.4 Contaminated Land Assessment

There are a number of potential sources of contamination within the study area. Table 6-6 below summarises the contaminant sources and the potential pathways, receptors and management options. The possible contaminants associated with these sources are detailed in Table 4-14. The main factors related to contaminated land that will influence the option selection for the scheme are summarised in Table 6-6.

Table 6-6 Contaminated land assessment

Potential Source	Potential Migration Pathways	Potential Receptors	Management Options
Existing Road Network (A1)	• Underground service conduits and trenches • Groundwater flow beneath the site • Surface water flow • Made ground acting as a preferential pathway for contaminant migration • Direct contact with soil / groundwater and inhalation of soil dust	• Site workers • Construction materials • Surface waters • SSSI • Groundwater	• Utility pit vapour monitoring • Soil, gas and groundwater sampling on site • Appropriate OHS techniques to minimise potential exposure

Potential Source	Potential Migration Pathways	Potential Receptors	Management Options
Agriculture	• Underground service conduits and trenches • Groundwater flow beneath the site • Surface water flow • Made ground acting as a preferential pathway for contaminant migration • Direct contact with soil / groundwater and inhalation of soil dust	• Site workers • Construction materials • Surface waters • SSSI • Groundwater	• Utility pit vapour monitoring • Soil, gas and groundwater sampling on site • Appropriate OHS techniques to minimise potential exposure
WW2 Airfield and associated buildings	• Underground service conduits and trenches • Groundwater flow beneath the site • Surface water flow • Made ground acting as a preferential pathway for contaminant migration • Direct contact with soil / groundwater and inhalation of soil dust	• Site workers • Construction materials • Surface waters • Groundwater	• Utility pit vapour monitoring • Soil, gas and groundwater sampling on site • Appropriate OHS techniques to minimise potential exposure
Garage and historical filling station	• Underground service conduits and trenches • Groundwater flow beneath the site • Surface water flow • Made ground acting as a preferential pathway for contaminant migration • Direct contact with soil / groundwater and inhalation of soil dust	• Site workers • Construction materials • Surface waters • Groundwater	• Utility pit vapour monitoring • Soil, gas and groundwater sampling on site • Appropriate OHS techniques to minimise potential exposure
Infilled ponds/ quarries and historical landfills	• Underground service conduits and trenches • Groundwater flow beneath the site • Surface water flow • Made ground acting as a preferential pathway for contaminant migration • Direct contact with soil / groundwater and inhalation of soil dust • Migration and accumulation of ground gases in excavations / confined spaces	• Site workers • Construction materials • Surface waters • SSSI • Groundwater	• Utility pit gas/vapour monitoring • Soil, gas and groundwater sampling on site • Appropriate OHS techniques to minimise potential exposure

Potential Source	Potential Migration Pathways	Potential Receptors	Management Options
Foot and mouth burial pits	• Underground service conduits and trenches • Groundwater flow beneath the site • Surface water flow • Made ground acting as a preferential pathway for contaminant migration • Direct contact with soil / groundwater and inhalation of soil dust • Migration and accumulation of gases in excavations / confined spaces	• Site workers • Construction materials • Surface waters • Groundwater	• Utility pit vapour monitoring • Soil, gas and groundwater sampling on site • Appropriate OHS techniques to minimise potential exposure

Table 6-7 Evaluation of contamination-related impacts

Potential Receptors	Assessment of Impact			Comments
	Green Route	Orange Route	Blue Route	
Site Workers	Low	Medium	Medium	• Green route traverses more greenfield land so is less likely to encounter contamination associated with the A1. • Green route is not located within 250m of historical landfills. • Green route is not located within 100m of current and historical garage / filling station and only one historical tank is located within 100m of the route. • All route options located adjacent to WW2 airfield. • All route options are within 70m of foot and mouth Carcass Pit.
Surface Waters	Medium	Low	Medium	• Green route includes six new watercourse crossings. • Blue route includes one new crossing over Earsdon Burn, near Causey Park Bridge, which is in the vicinity of an old quarry and an old filling station. • Orange Route includes modification of existing crossings. •
Sites of Special Scientific Interest	Medium	Medium	Medium	• All route options share the same bridge over the River Coquet. • Modifications to the existing bridge, including earthworks and foundation construction may create new pollution pathways.
Groundwater	Medium	Medium	Medium	• All route options include new bridges at existing junctions. The use of deep / piled foundations may create pollution pathways into the underlying aquifers.

6.5 Existing Geotechnical Problems

The northbound abutment for the River Coquet Bridge has been the subject of an assessment during recent maintenance periods. The geomorphological map included in Appendix D outlines the area where rotational slips have occurred within the bedrock and superficial soils. Potential slope failures in this area will be a key risk for the development of the design for this proposal. Parkwood is a valley crossing the A1 centred approximately around chainage 13000m to north of the River Coquet. The northern and southern slopes are identified as unstable. BGS mapping identifies the valley as a landslide area. Further study of this area is recommended at detailed investigation stage.

7 Geotechnical Risk Register

The geotechnical risk register relevant to the A 1 North of Northumberland scheme is included below, as well as the Risk Rating methodology that has been applied.

The likely design risks of the project and their potential impact on the scheme are identified in the geotechnical risk register. The risk register is a semi-quantitative assessment based on engineering judgement. The assessment deals with the potential for a design hazard to occur (Likelihood) and its impact (Severity) with respect to the proposed works and scheme, where the product of Likelihood x Severity provides a measure of the assessed Risk. Recommended mitigation measures to reduce the associated risks are considered.

The mitigation measures considered are those that may be applied during design or construction, as appropriate, to mitigate against the hazard identified and, in most cases, to reduce the Risk to "As Low as Reasonably Practicable" (ALARP). For some situations the risks may have been reduced, but significant residual risk remains, which will need to be carefully controlled during construction.

When the risk assessment identifies that the risk falls into the medium to high category, control measures are required to reduce the risk to 'As Low as Reasonably Practicable' (ALARP).

Rating	LIKELIHOOD		SEVERITY
1	Very unlikely	Once in over 100 years	Incident, Minor injury, damage, sickness or other loss (with no time off). Minor impact to programme. Minor impact on scheme cost. Minor, easily rectified environmental impact.
2	Unlikely	Once in 10 to 100 years	Minor damage or loss, First Aid injury or illness, (and/or up to 3 days off) Lost time injury. Impact to programme. Small effect on scheme costs. Any environmental impact regarded as significant.
3	Likely	Once in one to 10 years	Serious / substantial damage or loss Reportable injury or illness, (or over 3 days off). Impact to construction and maintenance/operational costs/programme. Third party environmental impact requiring management response to recover.
4	Very Likely	Once in two to 10 per year	Major loss, or injury, long term absence. Significantly increased construction costs &operational difficulty. Environmental incident triggers damage &/or nuisance prosecution and / or compensation.
5	Certain	More than 10 per year	Catastrophic damage, or Fatality Construction/maintenance/operation unsustainable. Major environmental incident, threat to public health and safety.

Key	RISK		ALARP Criteria
High (H)	12 - 25	Hazard must be avoided (or the level of risk reduced significantly and reliably by controls)	Intolerable risk
Medium (M)	5 - 10	Hazard should be avoided (or the level of risk reduced significantly and reliably by controls)	Within the ALARP region, **but** the higher the number the more critical it is to reduce the risk.
Low (L)	1 - 4	Risks to be controlled	Tolerable

(1) Hazard Reference	(2) Activity/Process/ Material/Element	(3) Hazard (also indicate who is at risk and how)	(4) Stage of Work	(5) Initial Risk Level			(6) Risk Control Measures: Design action taken, record of decision process including option considered, design constraints and justification for options/actions not having been taken	(7) Residual Risk Level			(8) Is there a 'significant' residual risk to be passed on? (Y/N)	(9) Status (Active / Closed)
				Likelihood	Severity	Risk Level		Likelihood	Severity	Risk Level		
Geotechnical Risks												
1	Shallow unconsolidated mine workings	Instability of ground leading to subsidence or collapse of the infrastructure.	During Design, During Construction, Maintenance period	3	4	12	Carry out ground investigation at key structures and undeveloped land to reduce the risk of encountering unknown workings. Detailed study for the preferred option.	2	3	6	Y(Detailed study for chosen option)	Active
2	Deep underground mine working (ancient and recent)	Instability of the ground leading to subsidence or collapse of the infrastructure.	During Design, During construction, During Maintenance period.	4	3	12	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	2	3	6	Y (Passed on to drilling teams)	Active
3	Possible future mining of coal (underground and opencast)	Instability of the ground leading to subsidence or collapse of the infrastructure.	During Design, During construction, During Maintenance period.	3	3	9	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	1	3	3	Y (Passed on to drilling teams)	Active
4	Area of uncompacted opencast mining backfill	Instability of the ground leading to subsidence or collapse of the infrastructure.	During Design, During construction, During Maintenance period.	4	3	12	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	2	3	6	Y (Passed on to drilling teams)	Active
5	Mine shaft (and adits) recorded and unrecorded	Instability of the ground leading to subsidence or collapse of the infrastructure.	During Design, During construction, During Maintenance period.	4	3	12	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	3	3	9	Y (Passed on to drilling teams)	Active
6	Mine Gas	Illness or death to site workers, local residents or workforce.	During Design, During construction, During Maintenance period.	4	3	12	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	2	3	6	Y (Passed on to drilling teams)	Active
7	Acidic mine water	Emissions at surface have potential to cause widespread pollution	During construction, During Maintenance period.	4	3	12	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	2	3	6	Y (Passed on to drilling teams)	Active

8	Areas with alluvium and peat	Differential settlement and subsidence of structures founded on soft ground.	During Design, During construction, During Maintenance period.	3	3	9	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	3	3	9	Y (Passed on to drilling teams)	Active
9	Unknown groundwater depth	Potentially impact on temporary works if shallow ground water.	During Design, During construction, During Maintenance period.	3	2	6	Carry out a detailed ground investigation for the proposed site extents and structures where relevant.	2	2	4	Y (Passed on to drilling teams)	Active
10	Intermittent Laminated Glaciolacustrine deposits.	Long term failure of earthworks following construction via bearing failure and slope instability. Preferential pathway for failure within shallow slopes. Anisotropic shear strength throughout the material.	During Design, During Construction, Maintenance period.	3	4	12	Ground investigation specification to consider requirement f or sufficient samples of laminated glaciolacustrine deposits to be obtained and tested as to provide accurate representation of shear strength parameters. Detailed design to take cognisance of locations of lenses and use suitable parameters in the designs of earthworks in the area.	2	3	6	Y (Designer to speculate failure mode relating to this risk)	Active
11	Unexploded Ordnance (UXO)	Borehole drilling rigs encountering buried ordnance and force and vibration causing explosion which will be life threatening for drilling crews and excavation crews and supervisors during the ground investigation.	Ground Investigation, Piling requirements	1	5	5	Detailed Desk Study requested owing to historical land use as training location for WWII warplane training. Detailed desk study confirmed the locations of recorded ordnance and a site risk of low probability. Clearance certificate only required where risk of explosion is not accepted by the client.	1	5	5	Y (Staff to briefed on key indicators)	Active
12	Cobbles and boulders within cohesive glacial till	Damage to Ground Investigation equipment and lack of supplementary evidence of in situ strength due to lack of Class 1 Sampling	Detailed design, Ground Investigation, Structure / Earthwork construction	4	3	12	Design to take account of the possible increased in situ strength and difficulty in driving. Design parameters to include both reduced strength for earthwork stability and high strength for drivability of piles where required. Suitable section sizes to reduce diversion whilst driving where required.	2	3	6	Y (Inform variability and stratificatio n of Northumber land Till to Designer)	Active
13	Differential settlement between new and existing pavement	Failure of the carriageway due to significant level changes and increased erosion	Maintenance Period	2	4	8	Assessment of the ground conditions for long term settlement from embankment loading on undeveloped land.	1	4	4	N	Active

14	Existing road network (A1), agricultural land use, WW2 airfield, garage and historical filling station, infilled ponds/quarries, historical landfills, tanks and foot and mouth pits. Potential contamination could include: Oils/hydrocarbons, PAHs, BTEX, MTBE, VOCs, SVOCs, PCBs, heavy metals, antifreeze, brake fluids, road salt, slurry, pesticides, herbicides, fertilisers, pathogens, solvents, lubricants, fire-fighting agents and, asbestos.	Contamination could cause sickness, injury or fatality to personnel site workers through dermal contact/ingestion of soils, and inhalation of soil dust. Contaminated soils or material may require waste disposal or treatment, resulting in increased costs, programme delays and potential redesign.	Ground investigation, Construction phases	2	3	6	Undertake targeted and non-targeted contamination sampling and laboratory testing to determine the presence and extent of any contamination. This could include VOC vapour monitoring depending on the contaminant source. Undertake supplementary ground investigation to better delineate areas of significant contamination. If required, remediate the land by treatment or materials removal. Appropriate OHS techniques to be employed to minimise exposure.	1	3	3	N	Active
15	Existing road network (A1), agricultural land use, WW2 airfield, garage and historical filling station, infilled ponds/quarries, historical landfills, tanks and foot and mouth pits. Potential contamination could include: Oils/hydrocarbons, PAHs, BTEX, MTBE,	Creation of pollutant pathways during development works could cause pollution of controlled waters, including groundwater and surface waters. This could result in possible programme delays, redesign and litigation.	Ground Investigation	2	3	6	Undertake targeted and non-targeted contamination sampling and laboratory testing to determine the presence and extent of any contamination. This could include VOC vapour monitoring depending on the contaminant source. Undertake supplementary ground investigation to better delineate areas of significant contamination. If required, remediate the land by treatment or material removal. Appropriate environmental control measures to be employed during development works to prevent cross-	1	3	3	N	Active

	VOCs, SVOCs, PCBs, heavy metals, antifreeze, brake fluids, road salt, slurry, pesticides, herbicides, fertilisers, pathogens, solvents, lubricants, fire-fighting agents and asbestos.						contamination and the creation of pollution pathways.					
16	Infilled ponds / quarries and historical landfills – potential source of ground gas.	Migration and accumulation of ground gases within excavations and confined spaces into below ground structures and excavations could create a risk of explosion and/or asphyxiation.	Ground investigation, maintenance	2	5	10	Undertake targeted and non-targeted ground investigation to establish presence of ground gas, including VOC and gas monitoring. Undertake supplementary ground investigation to better delineate areas of significant ground gas. Appropriate OHS techniques to be employed to minimise exposure, i.e. passive gas monitoring within excavations and confined spaces, plus use of personal gas alarms by site workers.	1	5	5	N	Active

Design and Construction Risks

(1)	(2)	(3)	(4)	(5)			(6)	(7)			(8)	(9)
				Initial Risk Level				Residual Risk Level				
Hazard Reference	**Activity/Process/ Material/Element**	**Hazard (also indicate who is at risk and how)**	**Stage of Work**	**Likelihood**	**Severity**	**Risk Level**	**Risk Control Measures: Design action taken, record of decision process including option considered, design constraints and justification for options/actions not having been taken**	**Likelihood**	**Severity**	**Risk Level**	**Is there a 'significant' residual risk to be passed on? (Y/N)**	**Status (Active / Closed)**
17	Access to site	Single carriageway access road and side road access via main road. Driving to and from site and site and parking to access. Construction segregation required for surveys and construction for laybys.	Design, Survey Phases, Construction and Maintenance.	3	5	15	Reduce requirements to cross lanes. Protective barriers and traffic calming measures introduced where sites are not transient. Complete works from outside of the corridor where possible.	2	5	10	Y (Traffic rules on site for staff protection)	Active
18	Working on sloping ground	Ground investigation required on existing earthworks slopes. Danger to workers and to road users from falling equipment and slips trips and falls when working on a slope.	Ground Investigation, Site Inspections, Spot surveying.	2	4	8	Reduce investigation within slopes where access is difficult, in particular in the area to the north of the River Coquet overbridge. Investigation to be completed at the top of the earthworks and at the toe. Anchored slope climbing rigs only to be used within the slopes.	1	4	4	N	Active

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GEOTECHNICAL CERTIFICATE

Scheme Title: A1 in Northumberland

Geotechnical Certificate
(*- Delete as appropriate)

Seq. No. 02

HAGDMS No. 29386

GEOTECHNICAL CERTIFICATE

Form of Certificate to be used by the Designer for certifying the design of geotechnical works

1. We certify that the Reports*, for the Geotechnical Activities listed below have been prepared by us with reasonable professional skill, care and diligence, and that in our opinion:

   i. constitute an adequate and economic design for the project

   ii. solutions to all the reasonably foreseeable geotechnical risks have been incorporated

   iii. the work intended is accurately represented and conforms to the Employer's*/Client's* requirements

   iv. with the exception of any item listed below or appended overleaf, the documentation has been prepared in accordance with the relevant standards from the Design Manual for Roads and Bridges and the Manual of Contract Documents for Highway Works.

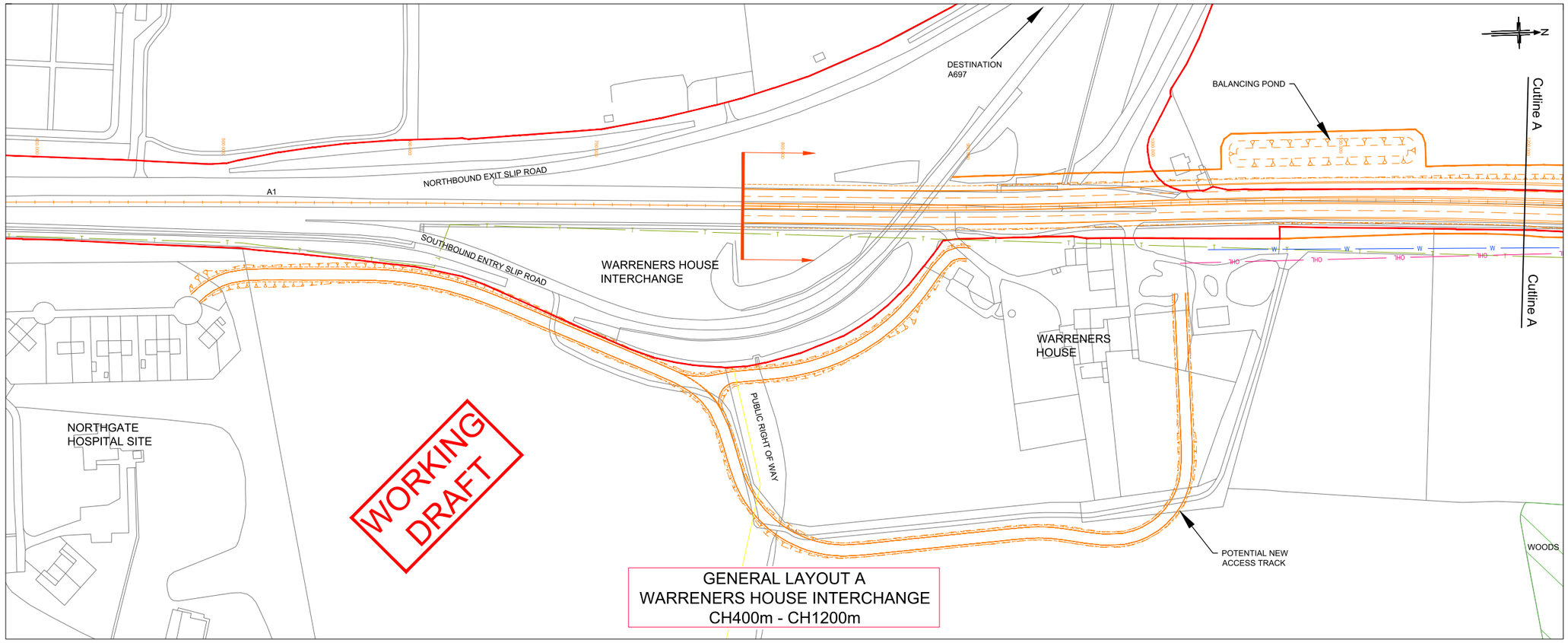
2. LIST OF REPORTS, DESIGN DATA, DRAWINGS OR DOCUMENTS

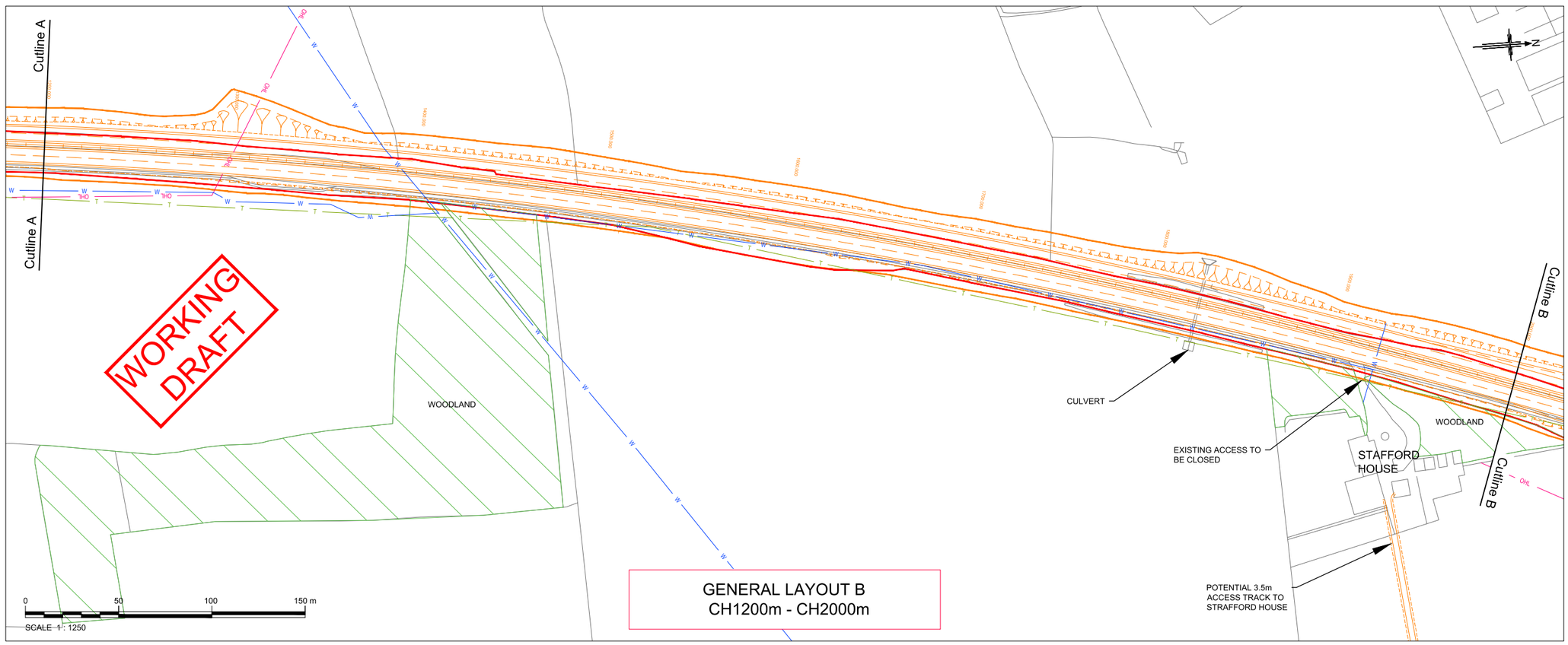
Preliminary Sources Study Report

3. DE PARTURES FROM STANDARDS

None

Appendix A – Site Overview Drawings



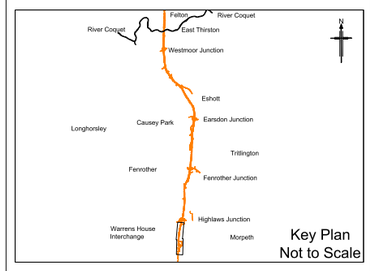


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Orange Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-002 to 011
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Orange Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CS	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

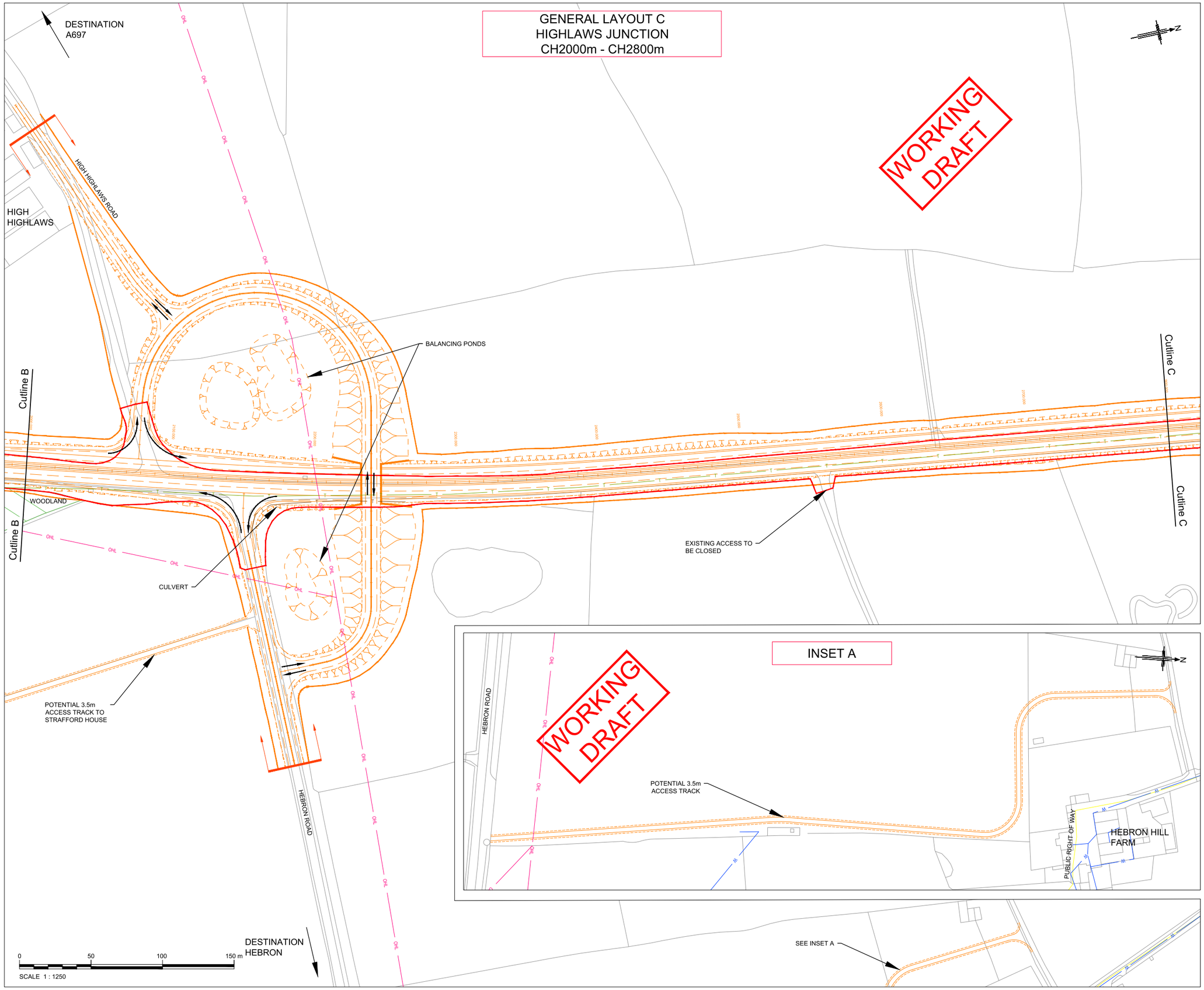
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:
ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 1 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-02	Rev B

GENERAL LAYOUT C
HIGHLAWS JUNCTION
CH2000m - CH2800m



NOTES

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   - HA551459-JAC-GEN-Section A-WD-C-002 to 011
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KEY

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- FWDR — Northumbrian Water Abandoned Pipes
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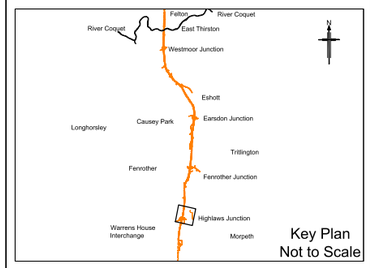
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CR	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 2 OF 10

Drawing status: WORKING PROGRESS

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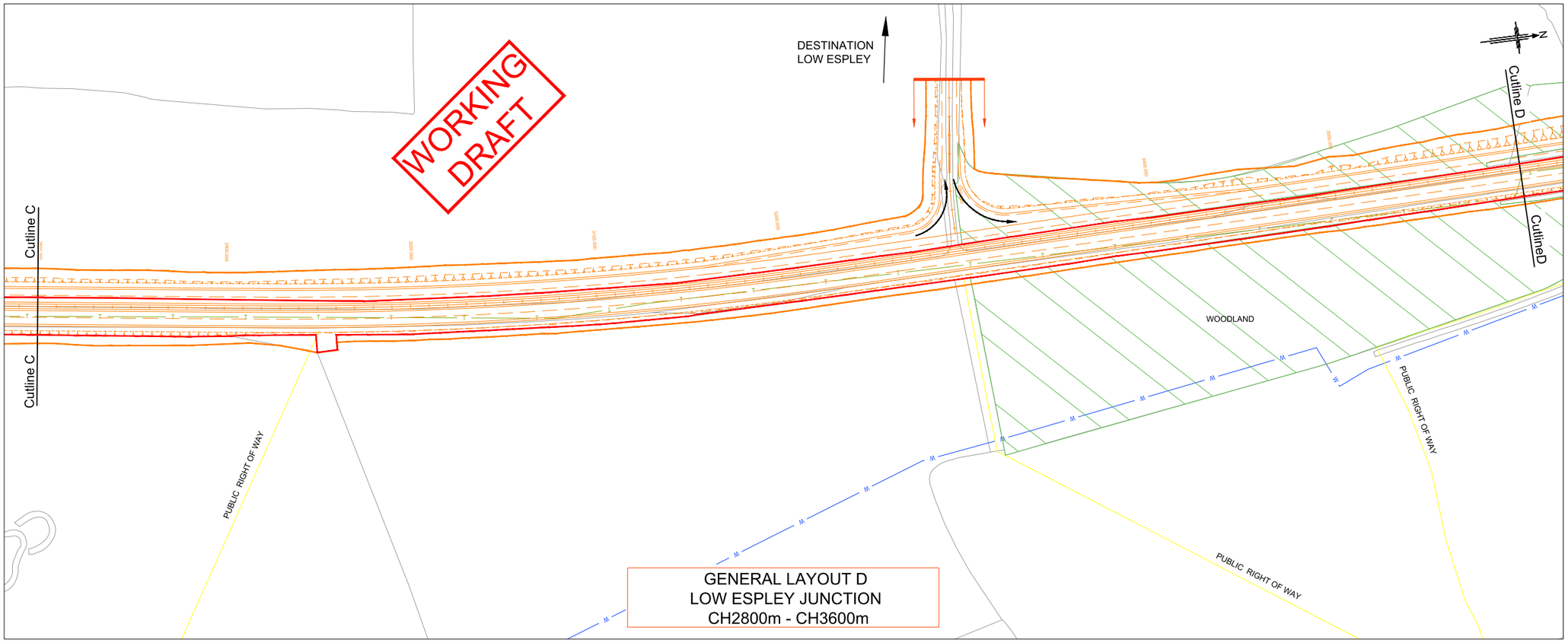
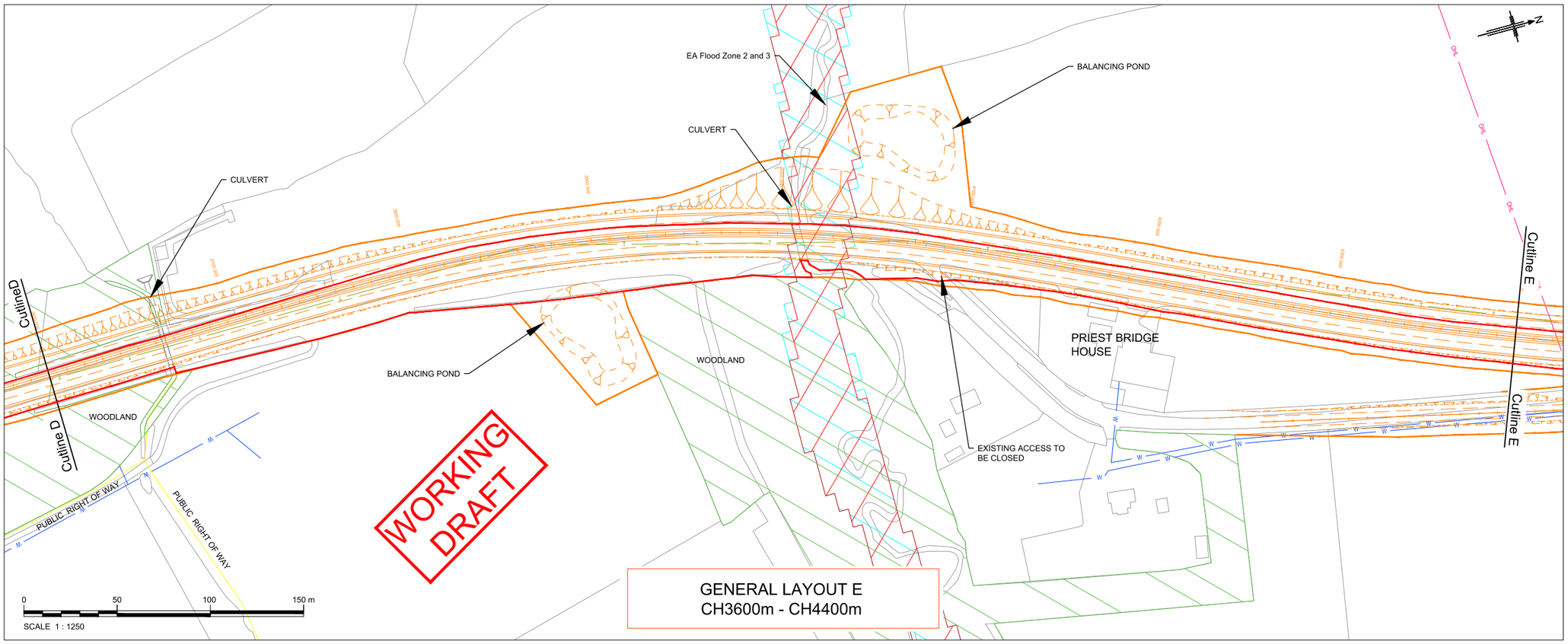
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-03 — Rev: B





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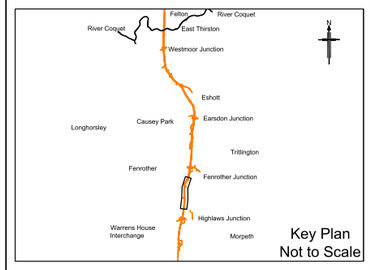
KEY

- Existing Highway Boundary
- Orange Option Highway Footprint
- Extents of Scheme
- Gamma
- National Grid
- Northern Powergrid
- Northumbrian Water Mains
- Northumbrian Water Abandoned Pipes
- Scottish Power 11kV Overhead
- Scottish Power 11kV Underground
- Scottish Power LV
- Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CS	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 3 OF 10

Drawing status: WORKING PROGRESS

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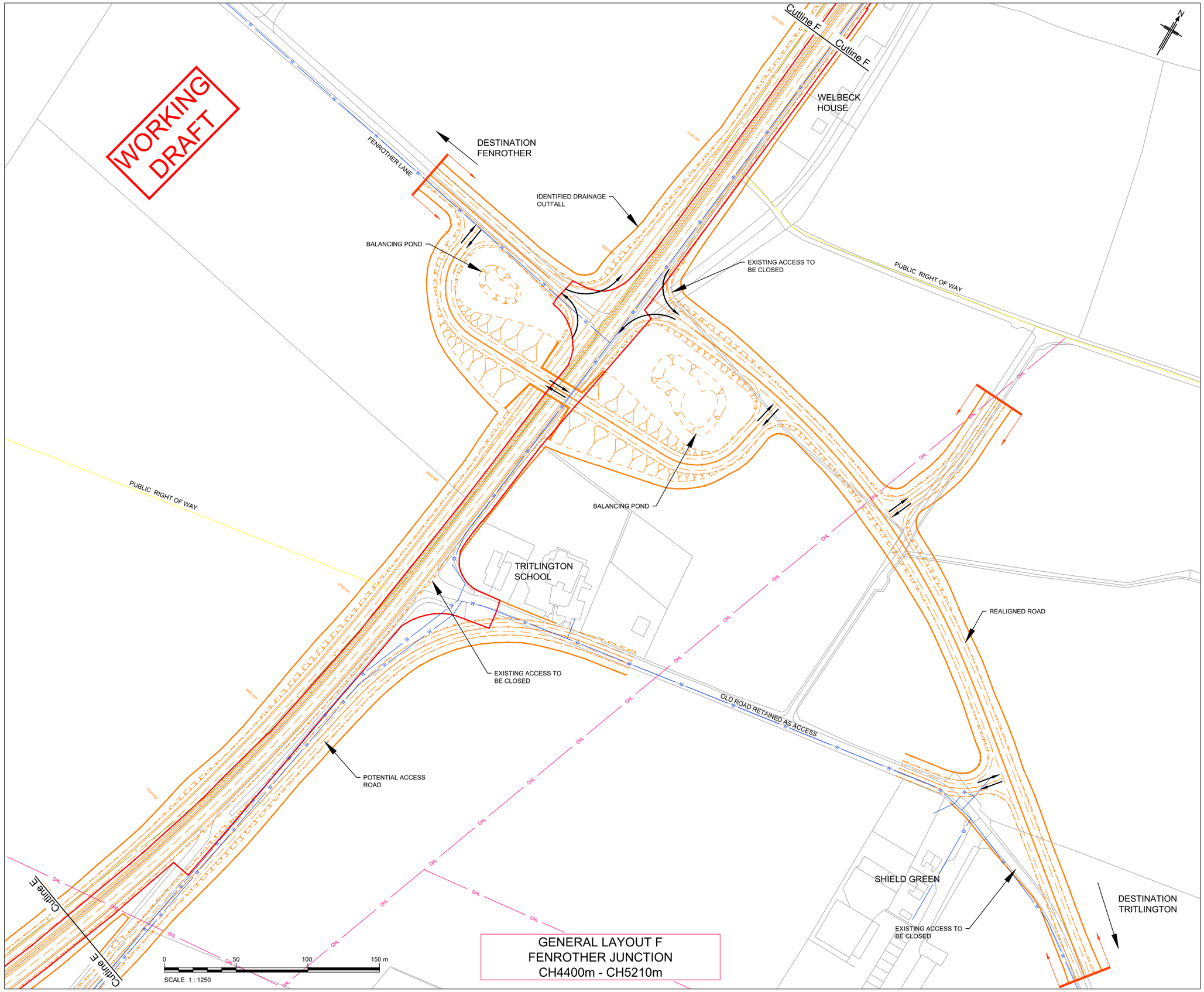
Jacobs No.	B2104700
Client no.	551459
Drawing number	HA551459-JAC-GEN-Section A-WD-C-04
Rev	B



GENERAL LAYOUT F
FENROTHER JUNCTION
CH4400m - CH5210m

NOTES

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4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-002 to 011
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KEY

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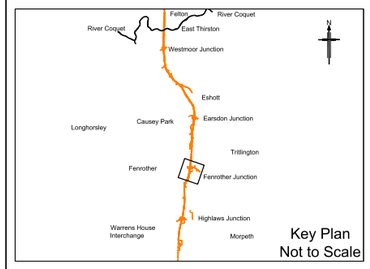
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CS	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 4 OF 10

Drawing status: WORKING PROGRESS

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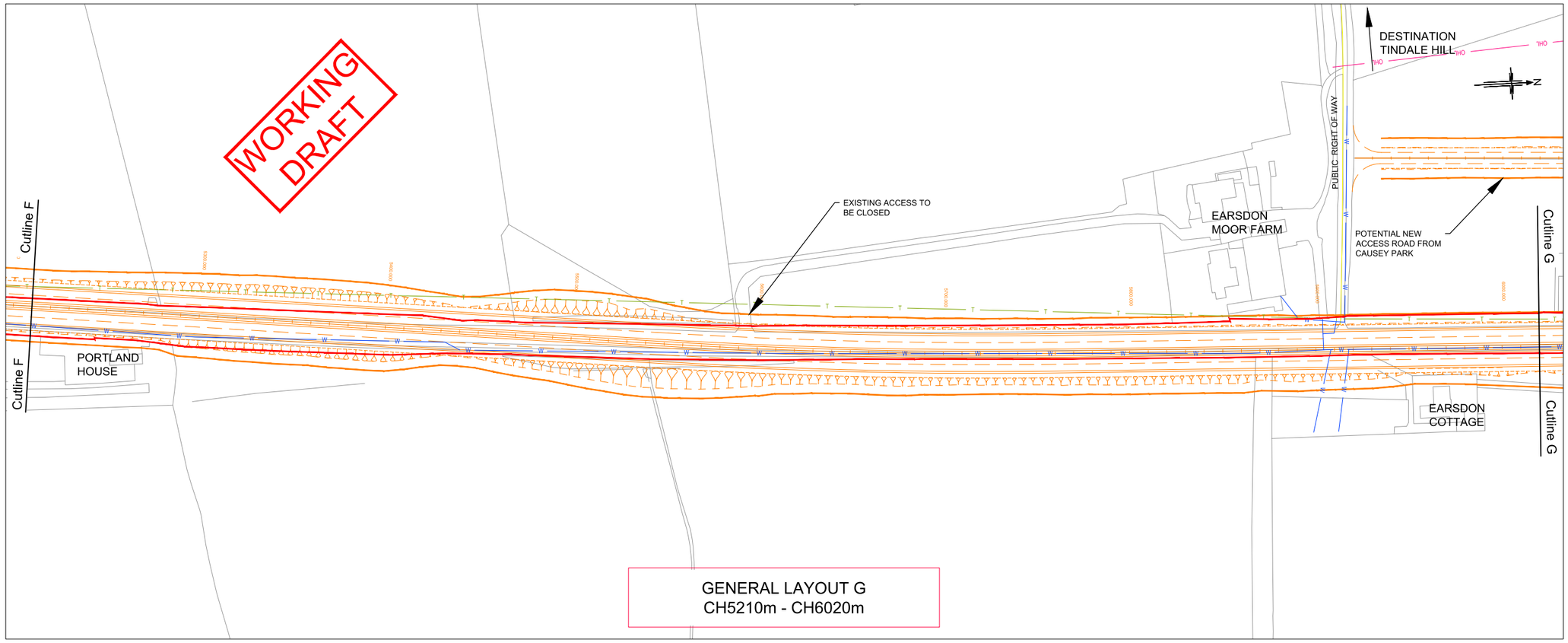
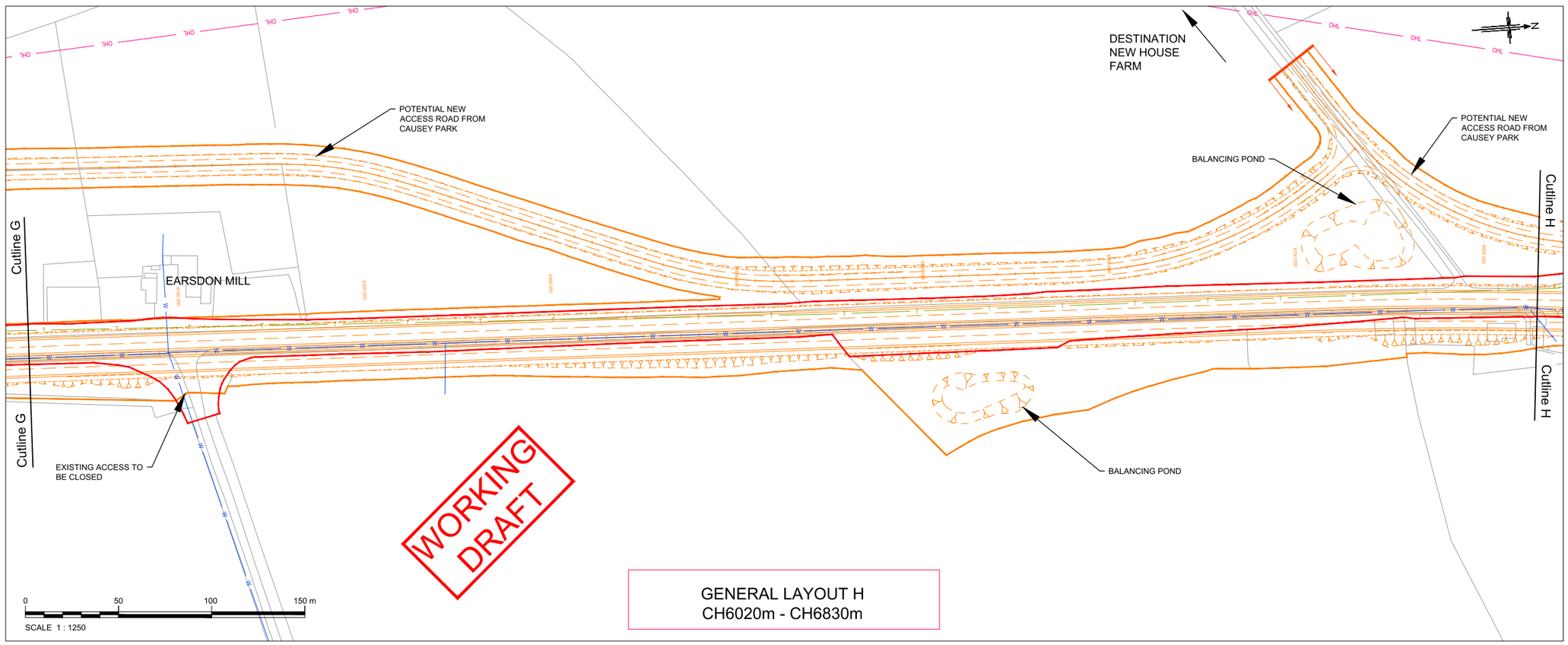
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-05	Rev B



GENERAL LAYOUT G
CH5210m - CH6020m



GENERAL LAYOUT H
CH6020m - CH6830m

NOTES

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3. This drawing shows Orange Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-002 to 011
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KEY

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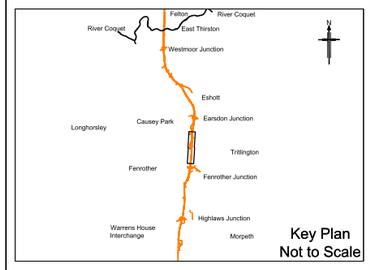
- LV — Scottish Power LV
- T — Vodafone



Key Plan
Not to Scale

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B	15/09/16	Post Public Awareness Design	KS	CR	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:
ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 5 OF 10

Drawing status: WORKING PROGRESS

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Jacobs No.	B2104700	
Client no.	551459	
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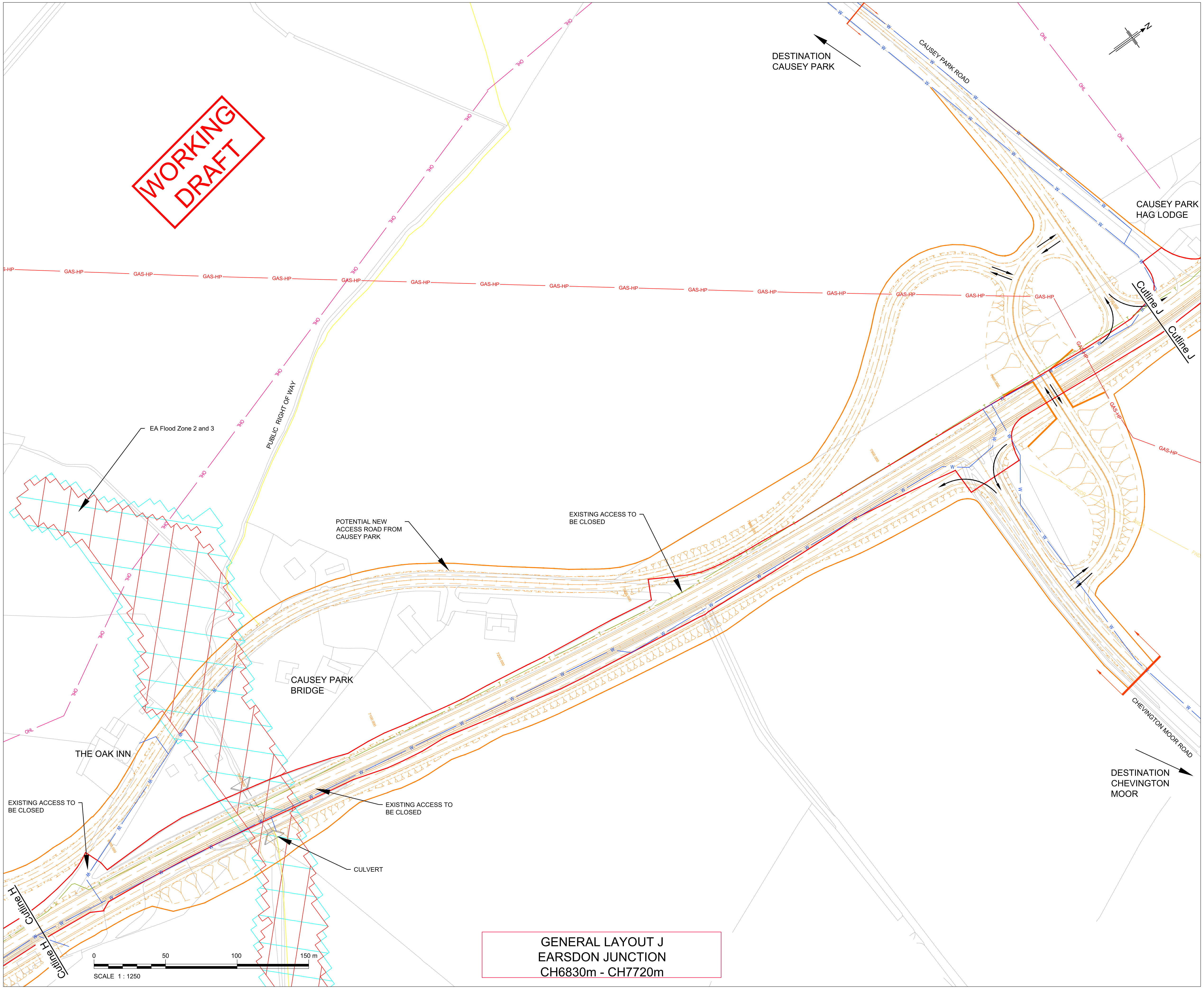

GENERAL LAYOUT J
EARSDON JUNCTION
CH6830m - CH7720m

NOTES

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4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-002 to 011
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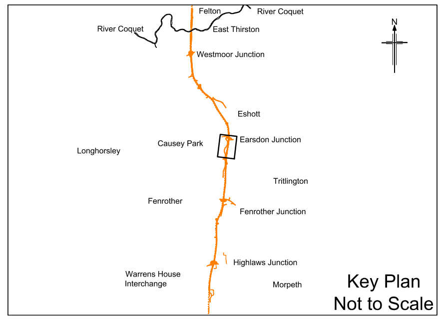
KEY

- Existing Highway Boundary
- Orange Option Highway Footprint
- Extents of Scheme
- Gamma
- National Grid
- Northern Powergrid
- Northumbrian Water Mains
- Northumbrian Water Abandoned Pipes
- Scottish Power 11kV Overhead
- Scottish Power 11kV Underground
- Scottish Power LV
- Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CS	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client
highways england driving forward

Project
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 6 OF 10

Drawing status
WORKING PROGRESS

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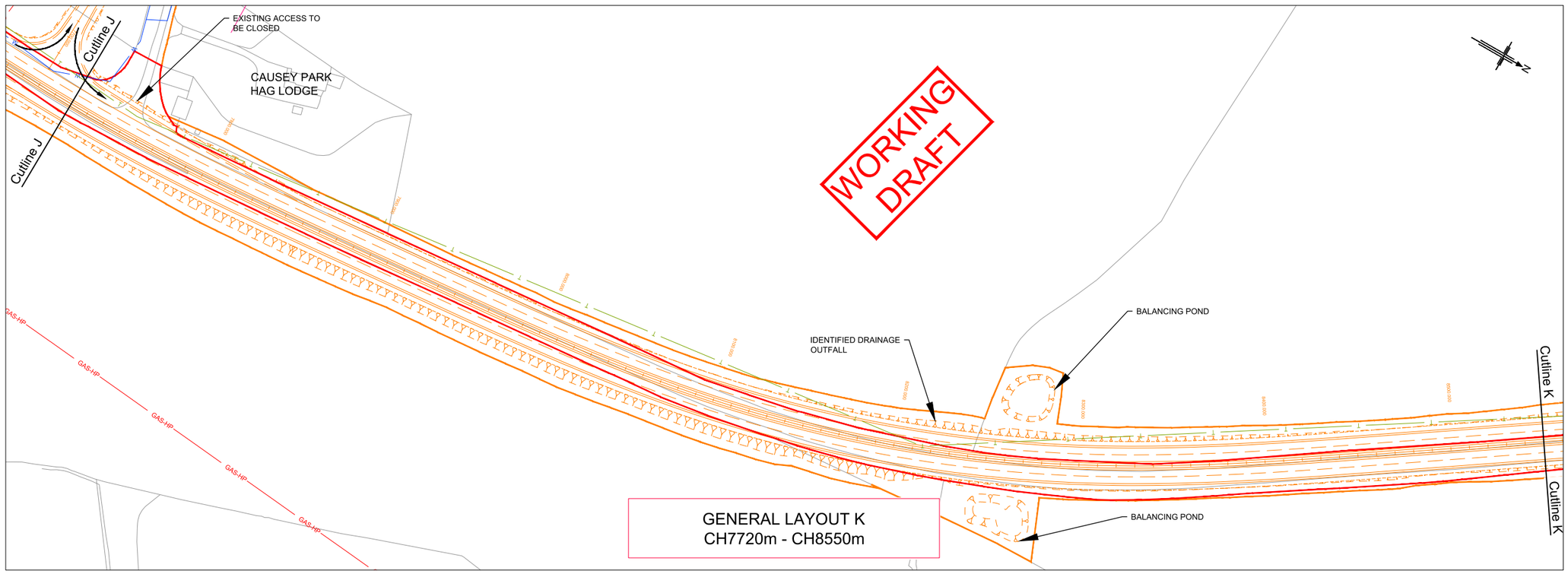
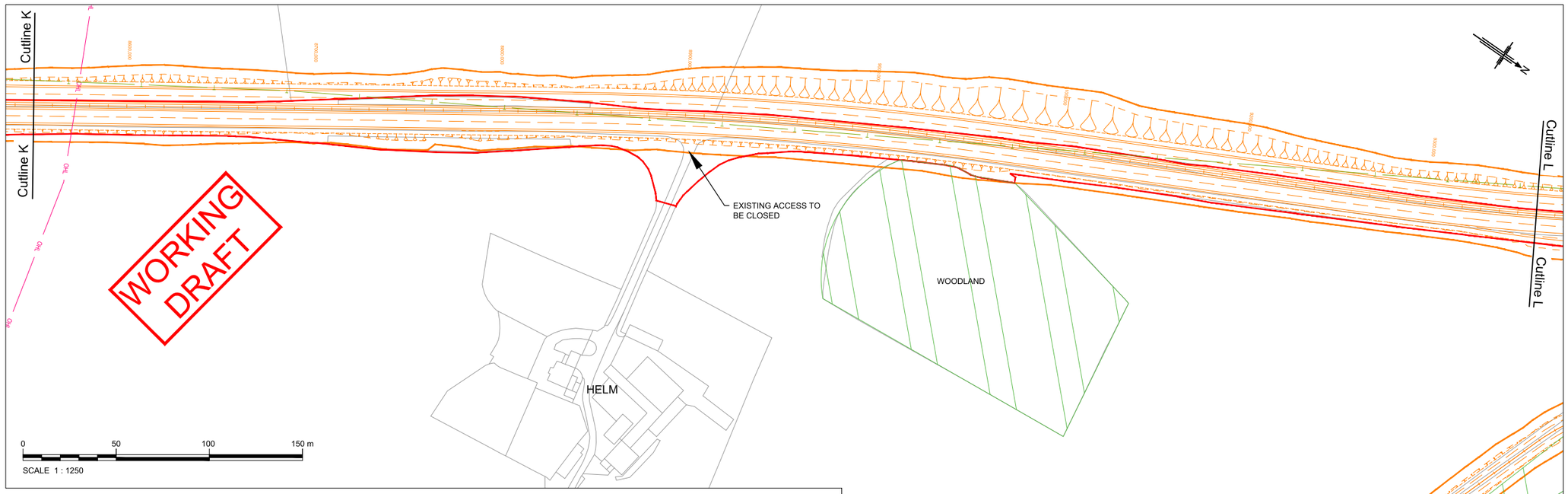
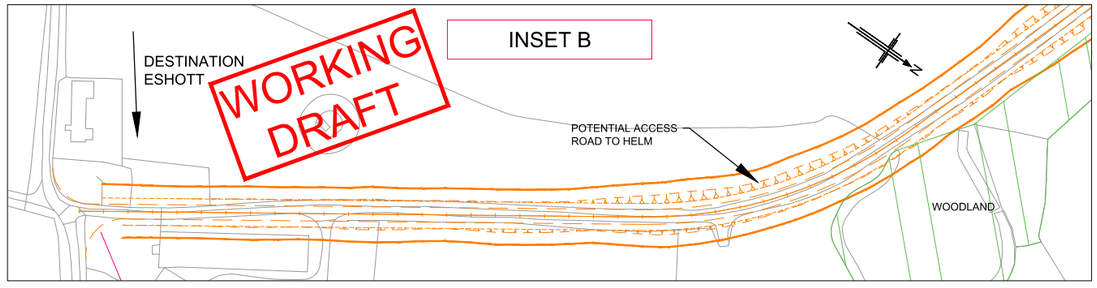
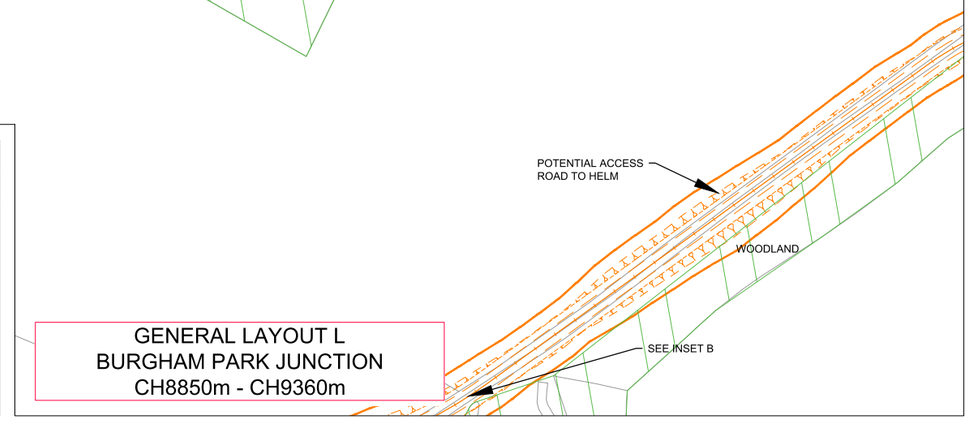
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-07
Rev: B









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4. This drawing shall be read in conjunction with drawing number:
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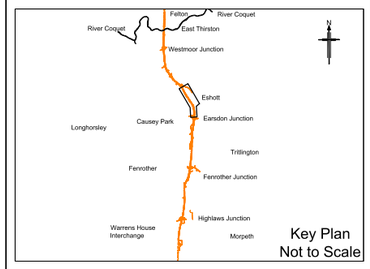

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CR	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: ORANGE OPTION ONLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 7 OF 10

Drawing status: WORKING PROGRESS

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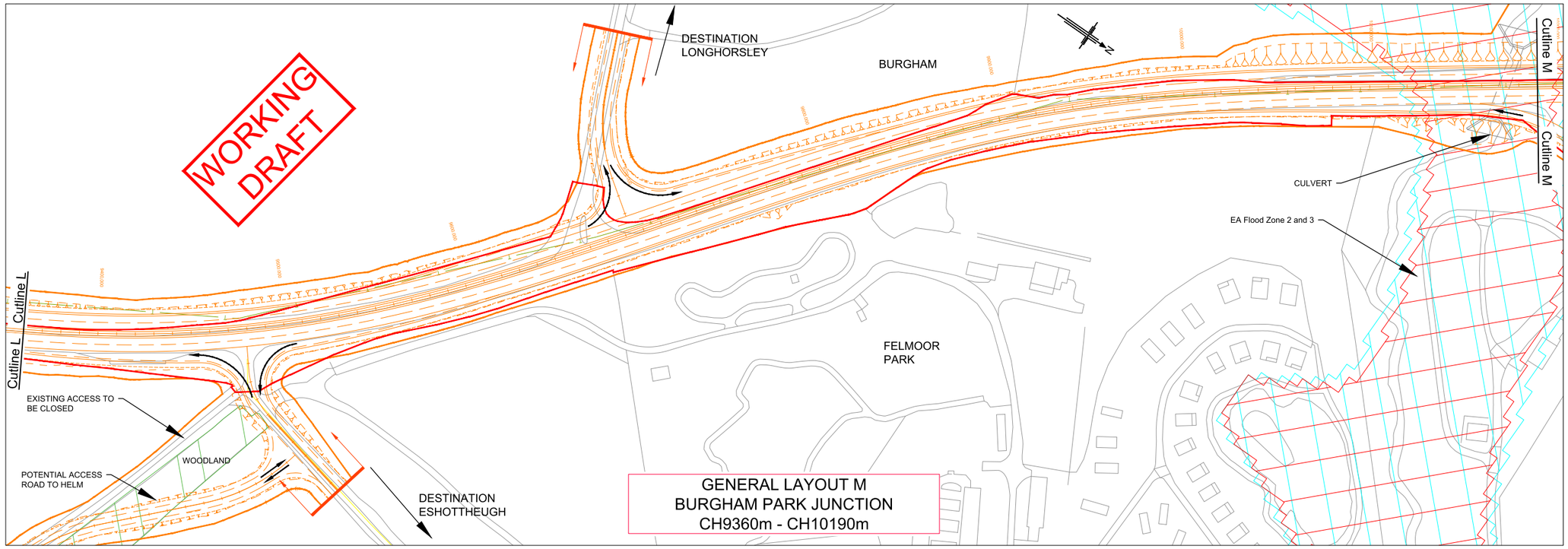
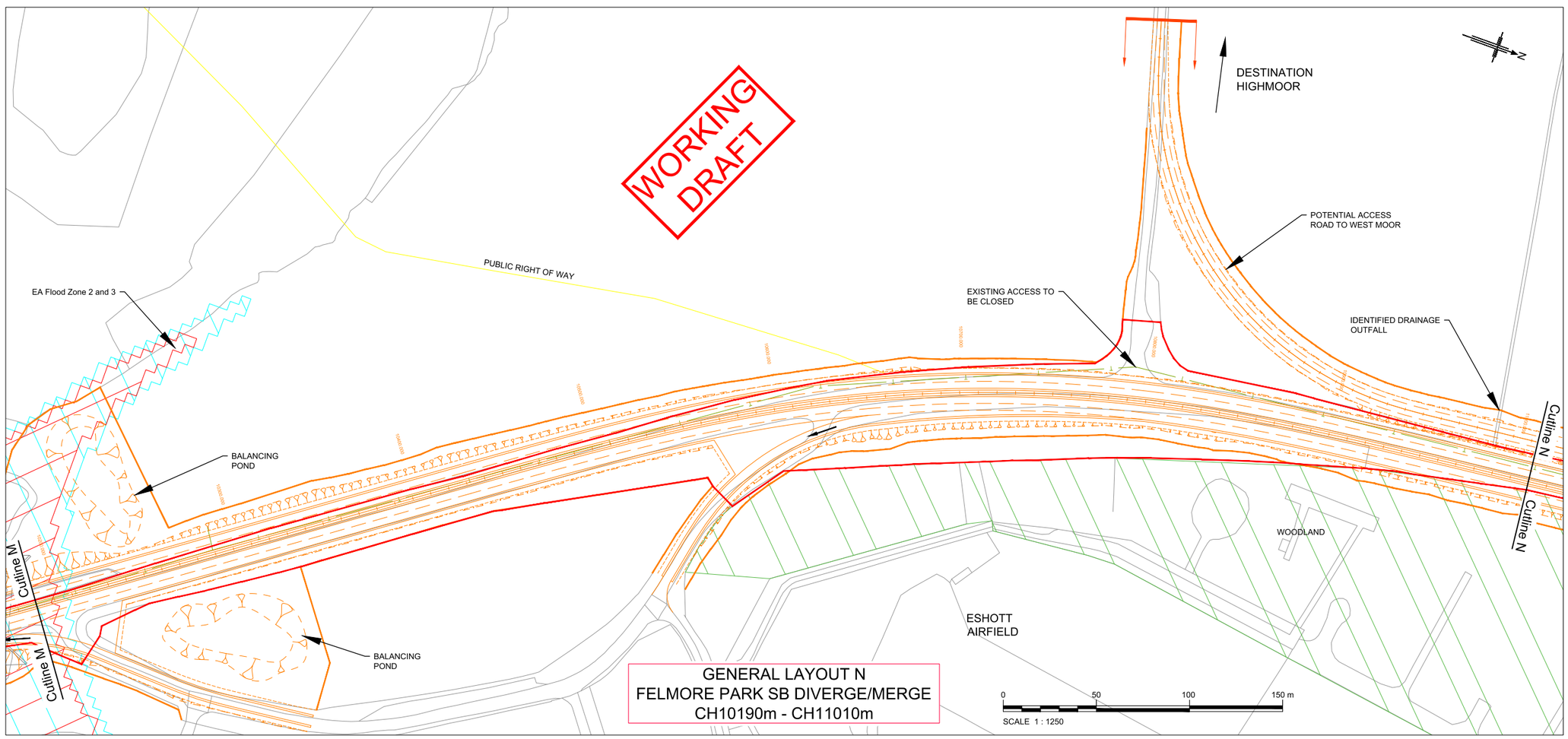
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-08	Rev B





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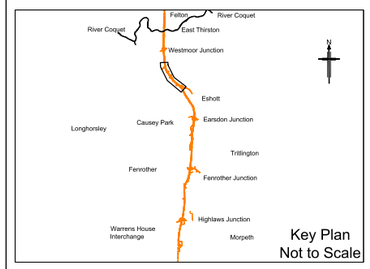

Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CR	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:
ORANGE OPTION
ONLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 8 OF 10

Drawing status	WORKING PROGRESS
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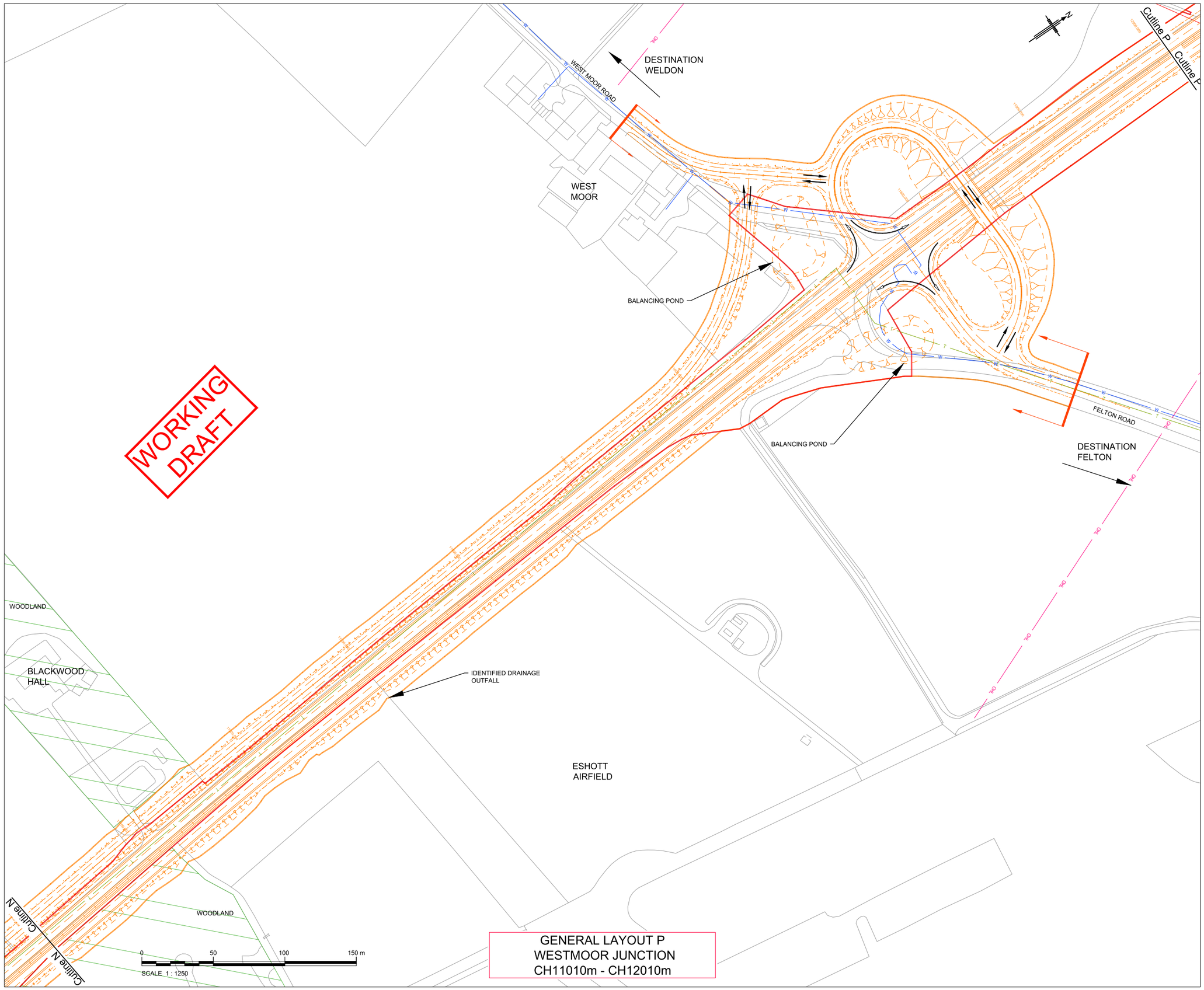
Client no.	551459
Drawing number	HA551459-JAC-GEN-Section A-WD-C-09 — Rev B



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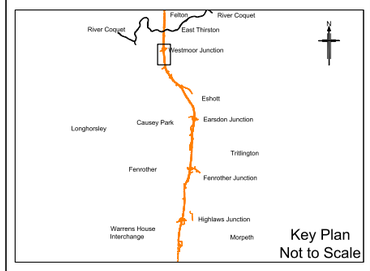
- LV — Scottish Power LV
- T — Vodafone



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Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CS	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

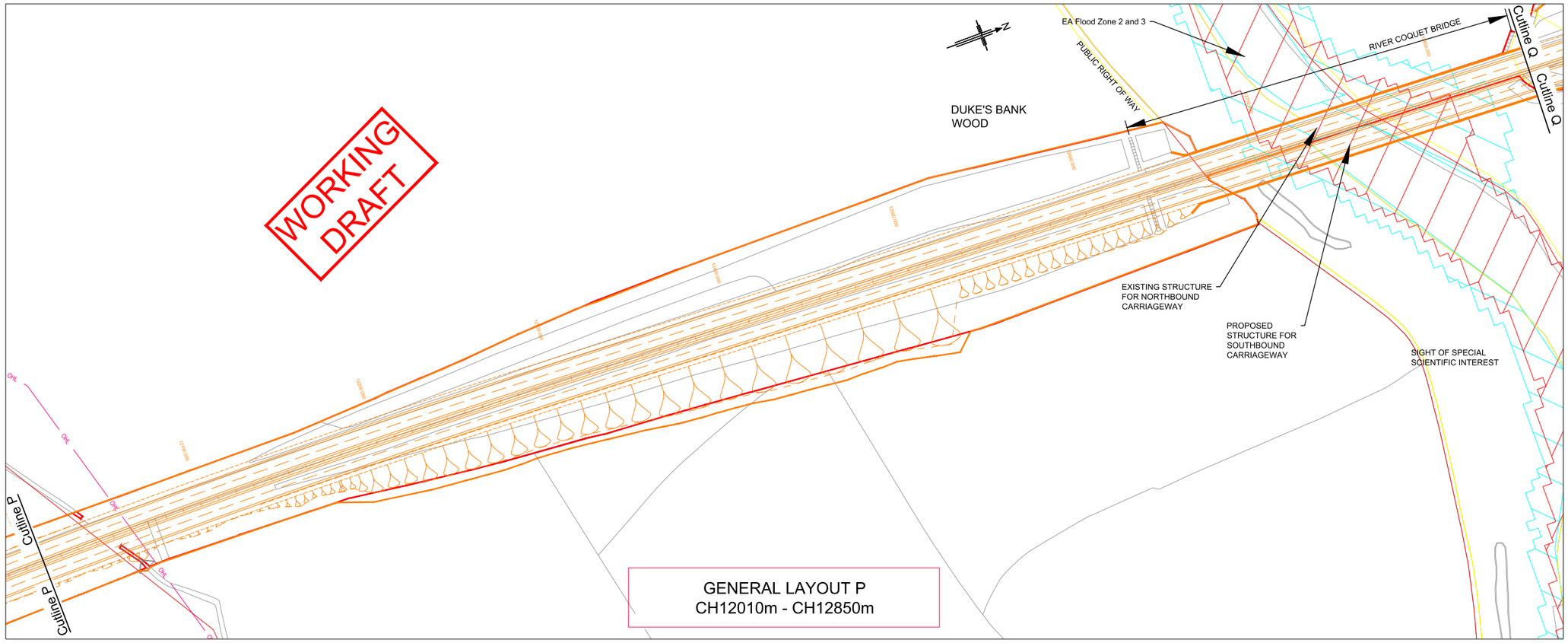
Client: highways england — driving forward

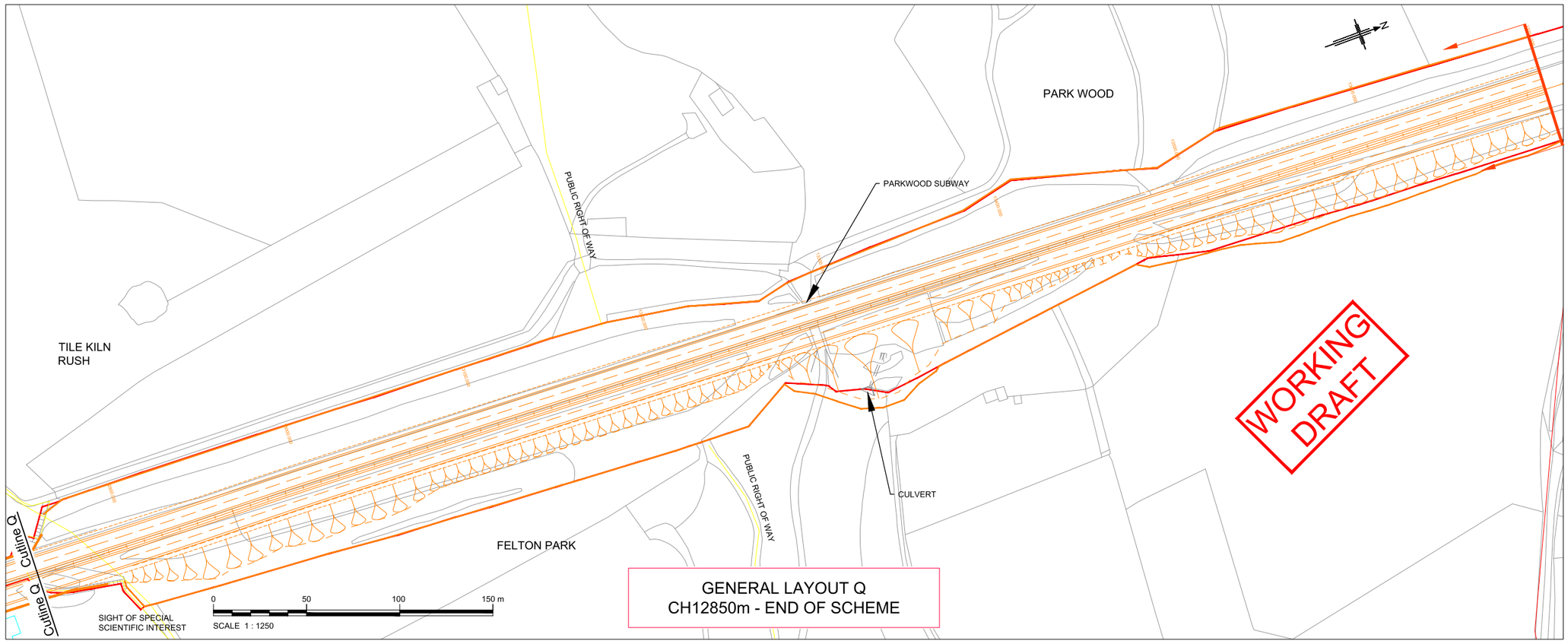
Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: ORANGE OPTION ONLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 9 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-010	Rev B



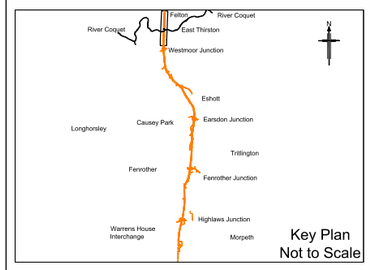


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Orange Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-002 to 011
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Orange Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	15/09/16	Post Public Awareness Design	KS	CS	PF	MC
A	25/04/16	Revised Alignment	CS	CS	PF	MC

JACOBS

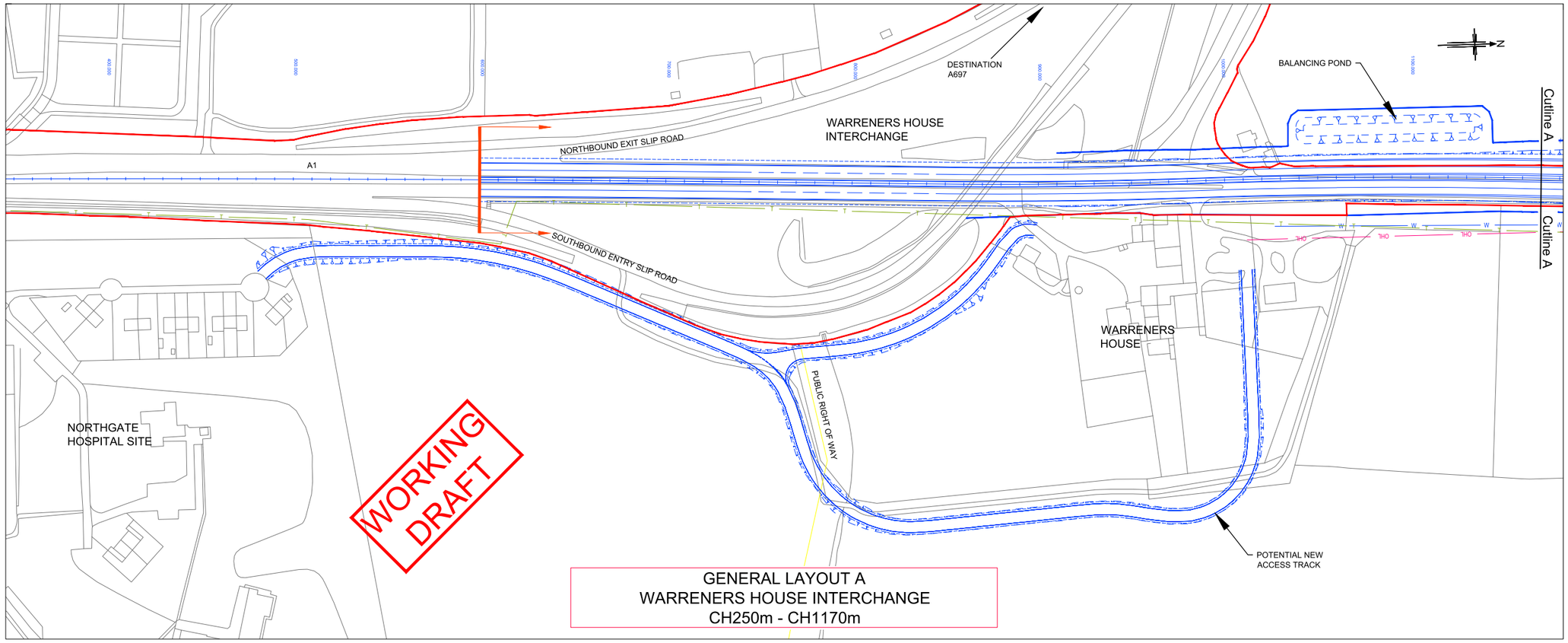
Client: highways england driving forward

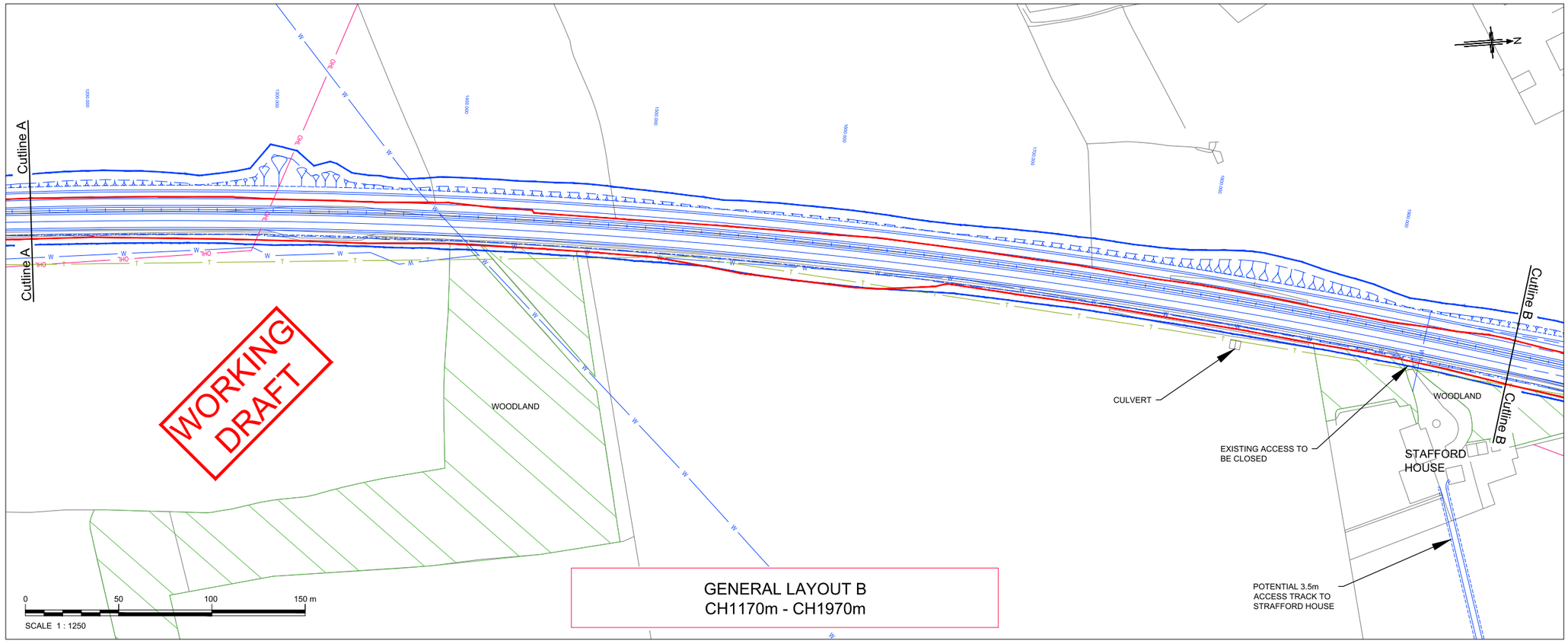
Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: ORANGE OPTION ONLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 10 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250 DO NOT SCALE
Jacobs No.	B2104700
Client no.	551459
Drawing number	HA551459-JAC-GEN-Section A-WD-C-011
Rev	B



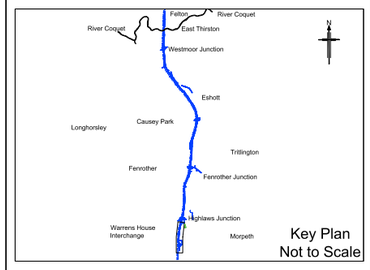


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:

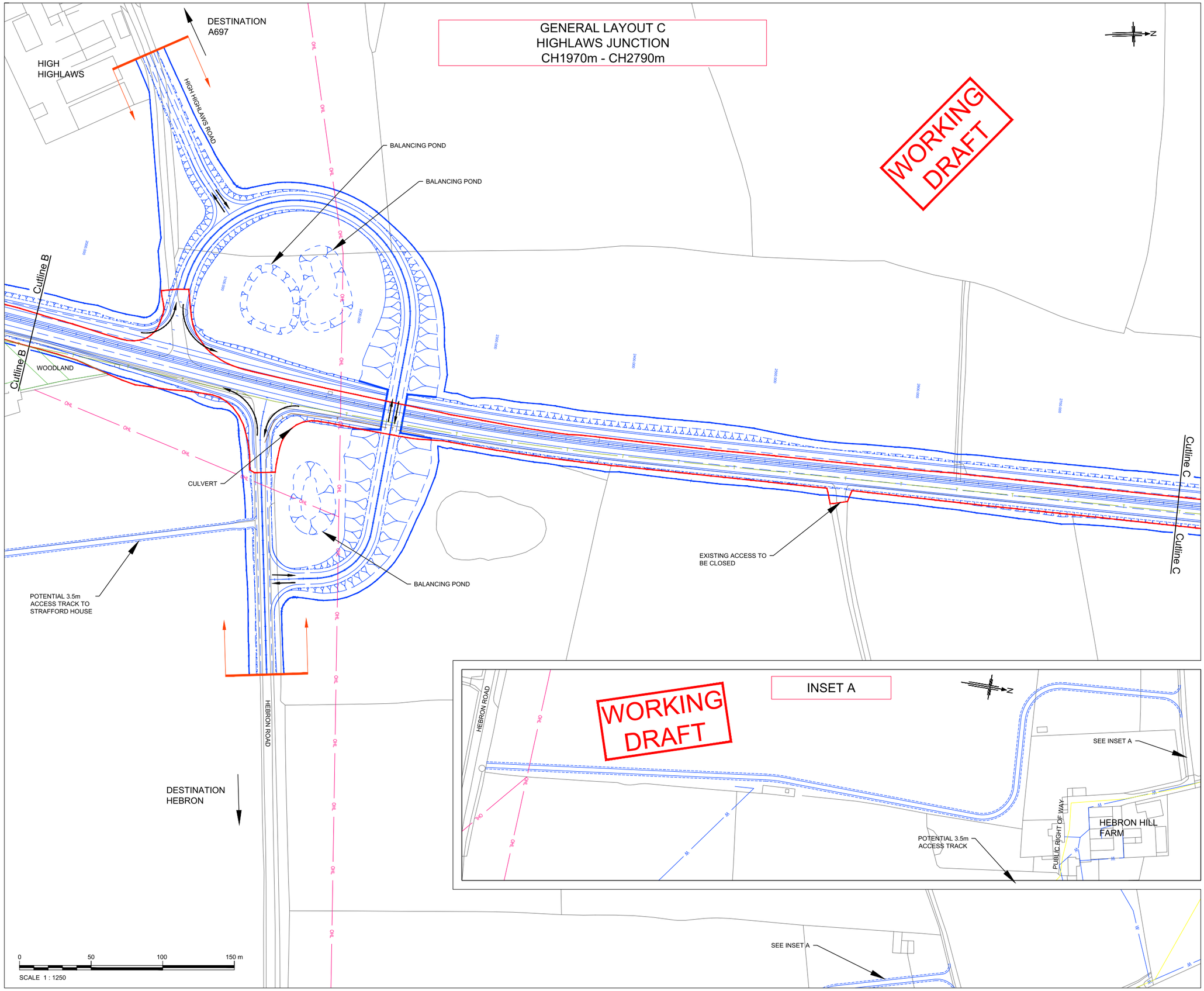
BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 1 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-070 — Rev: B

GENERAL LAYOUT C
HIGHLAWS JUNCTION
CH1970m - CH2790m



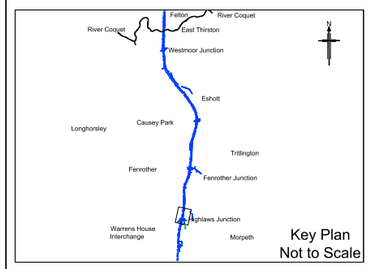
WORKING DRAFT

NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

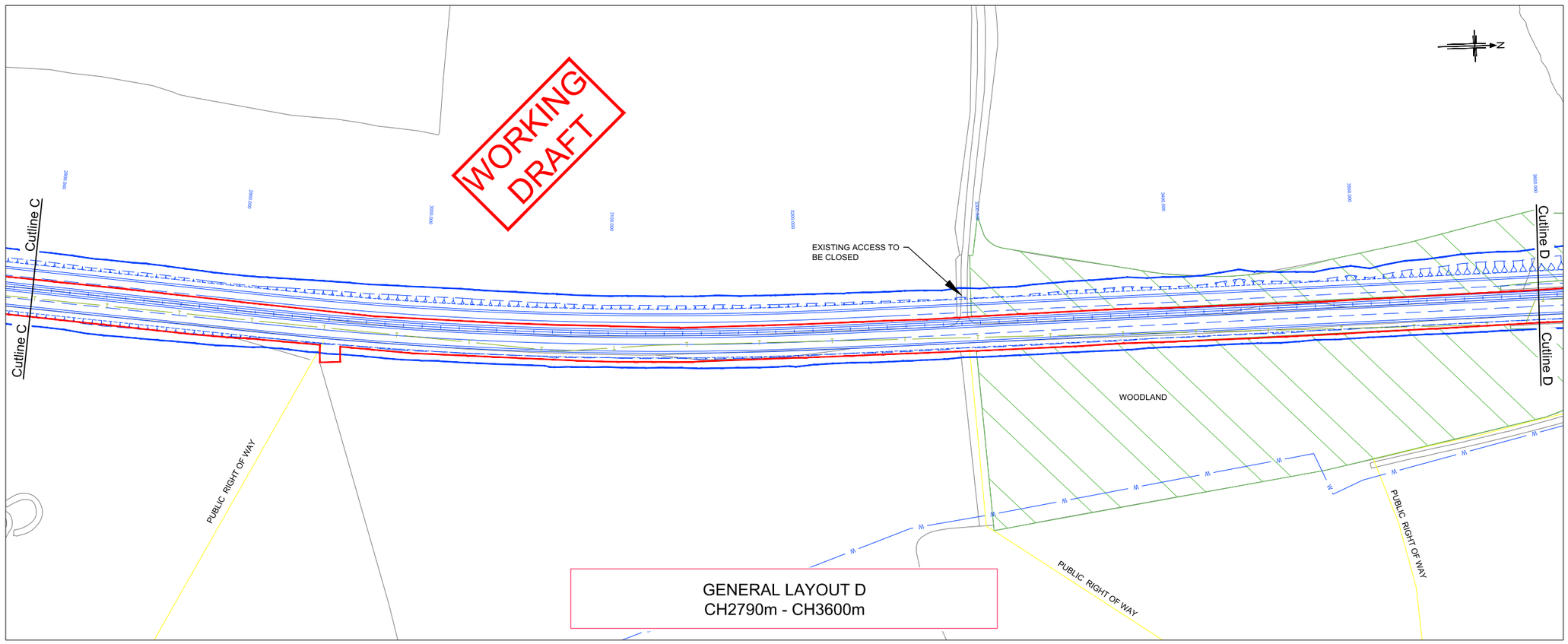
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

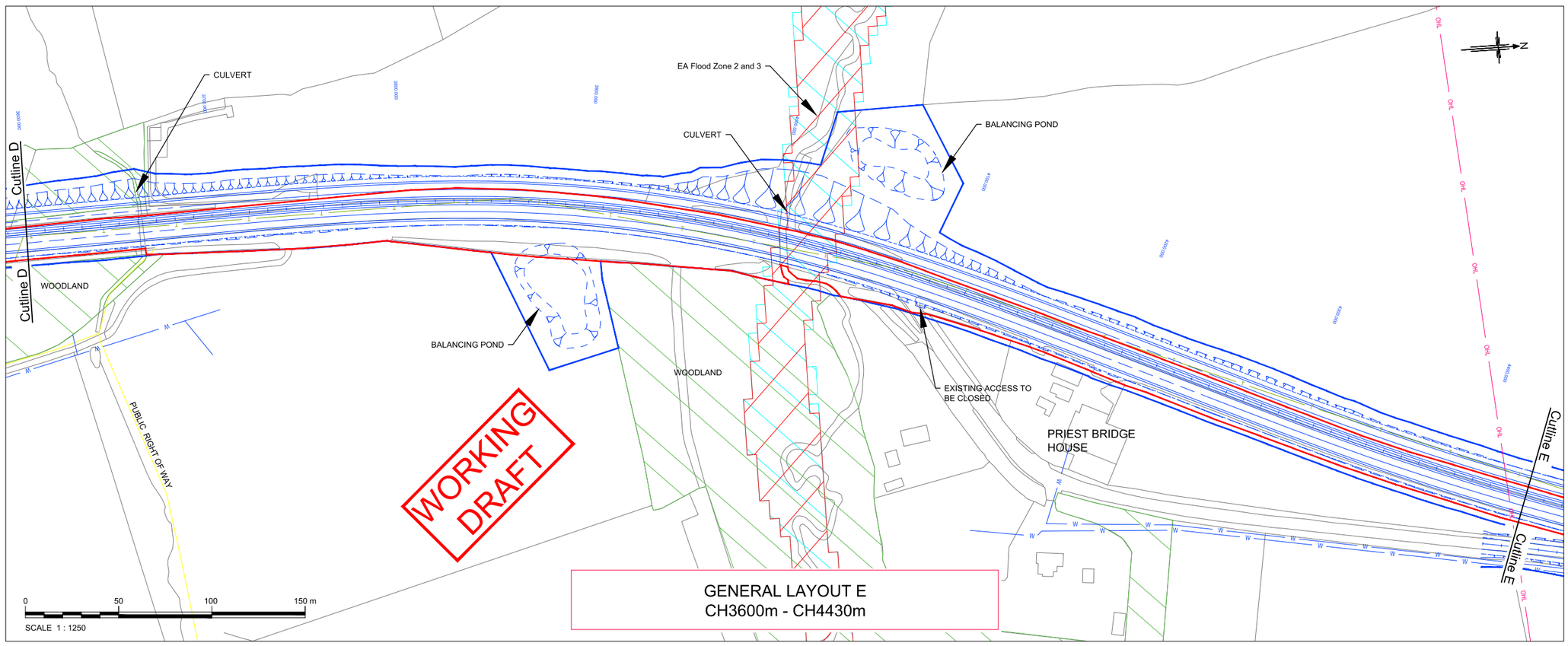
Drawing title: BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 2 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-071 — Rev: B



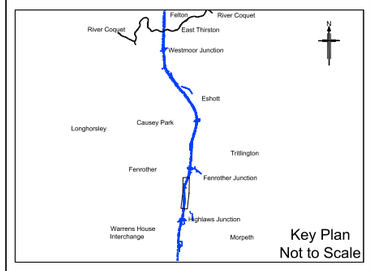


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

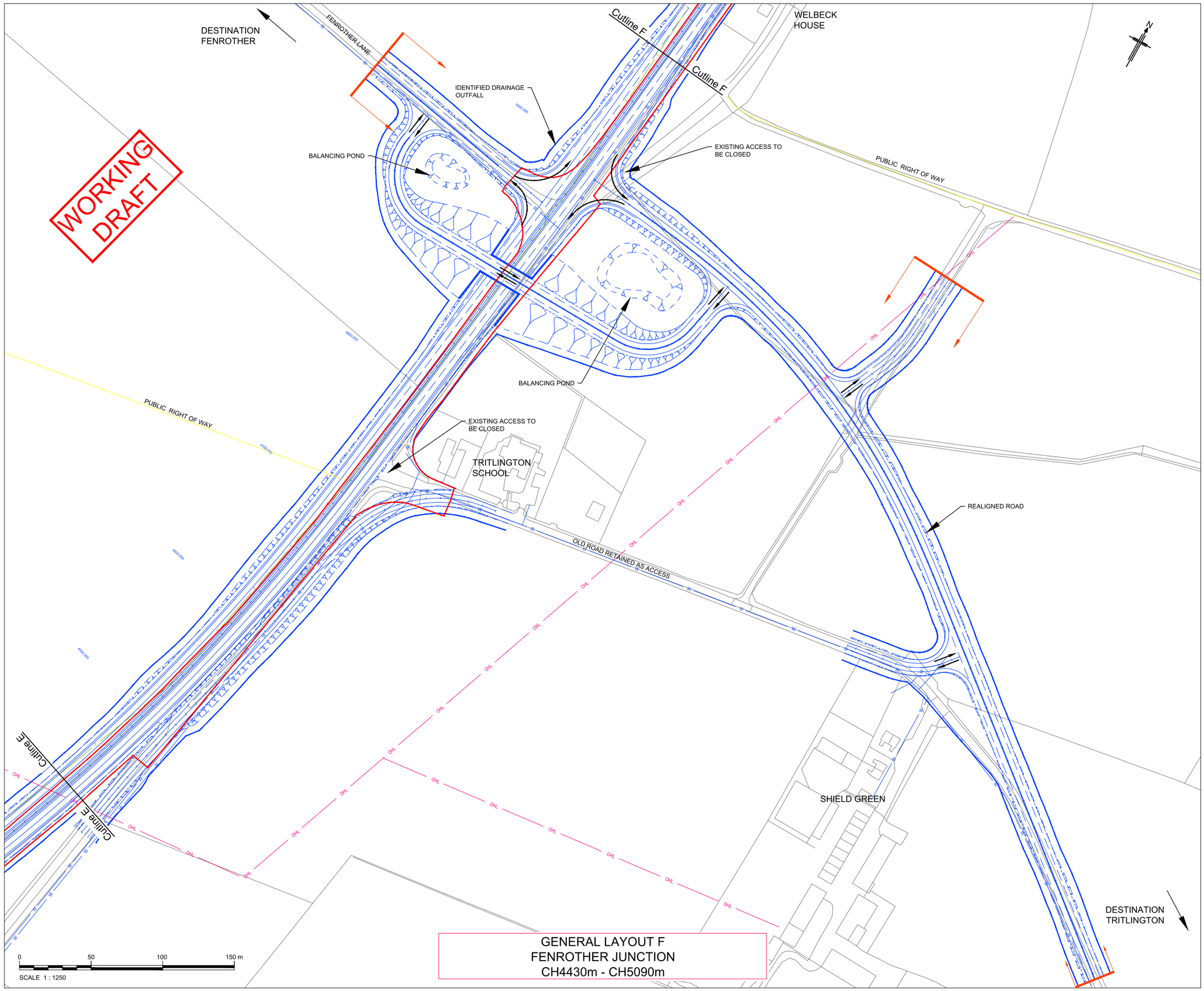
Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: BLUE OPTION HYBRID DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 3 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-072 Rev: B



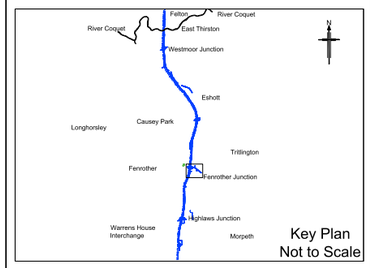
GENERAL LAYOUT F
FENROTHER JUNCTION
CH4430m - CH5090m

NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:

BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 4 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-073 Rev B

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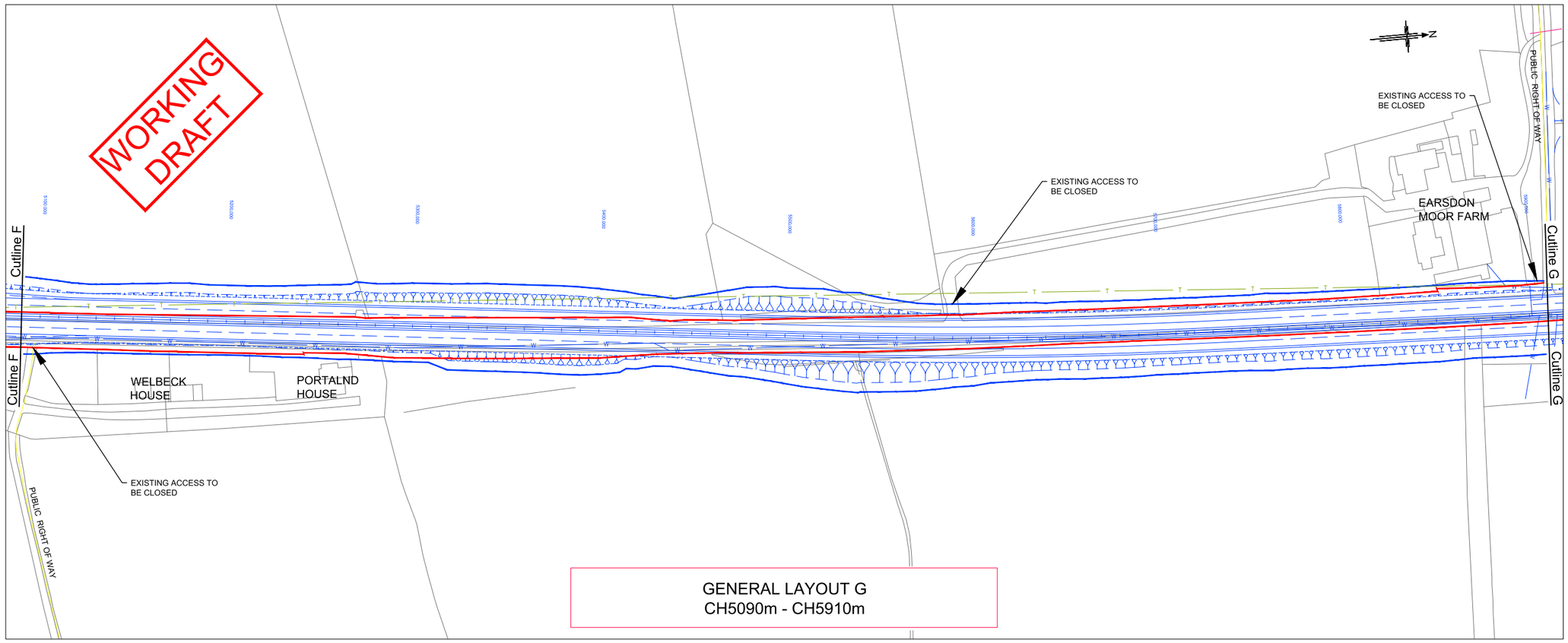
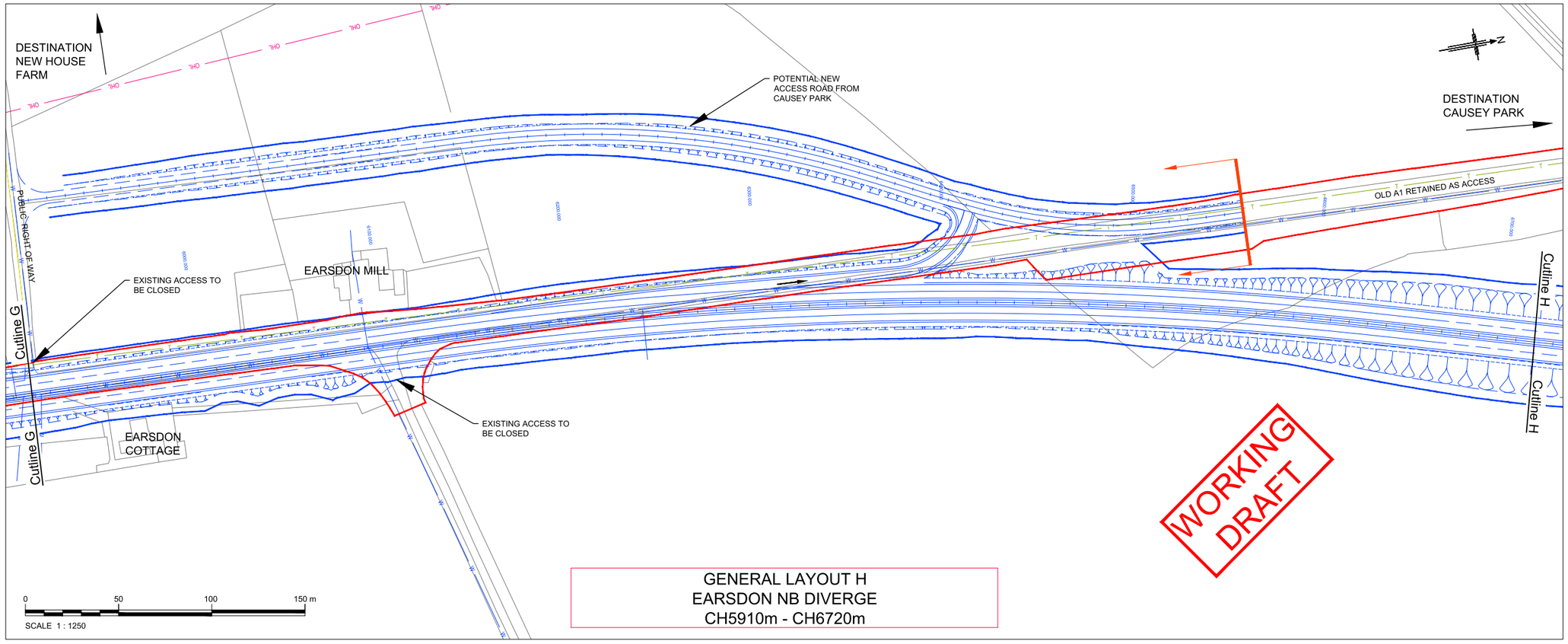


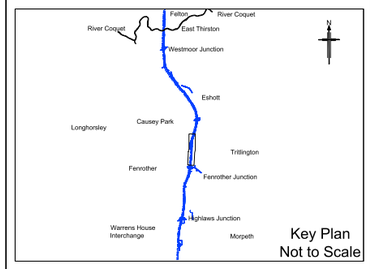


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: BLUE OPTION HYBRID DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 5 OF 11

Drawing status	WORKING PROGRESS
Scale	1:1250 DO NOT SCALE
Jacobs No.	B2104700
Client no.	551459
Drawing number	HA551459-JAC-GEN-Section A-WD-C-074
Rev	B

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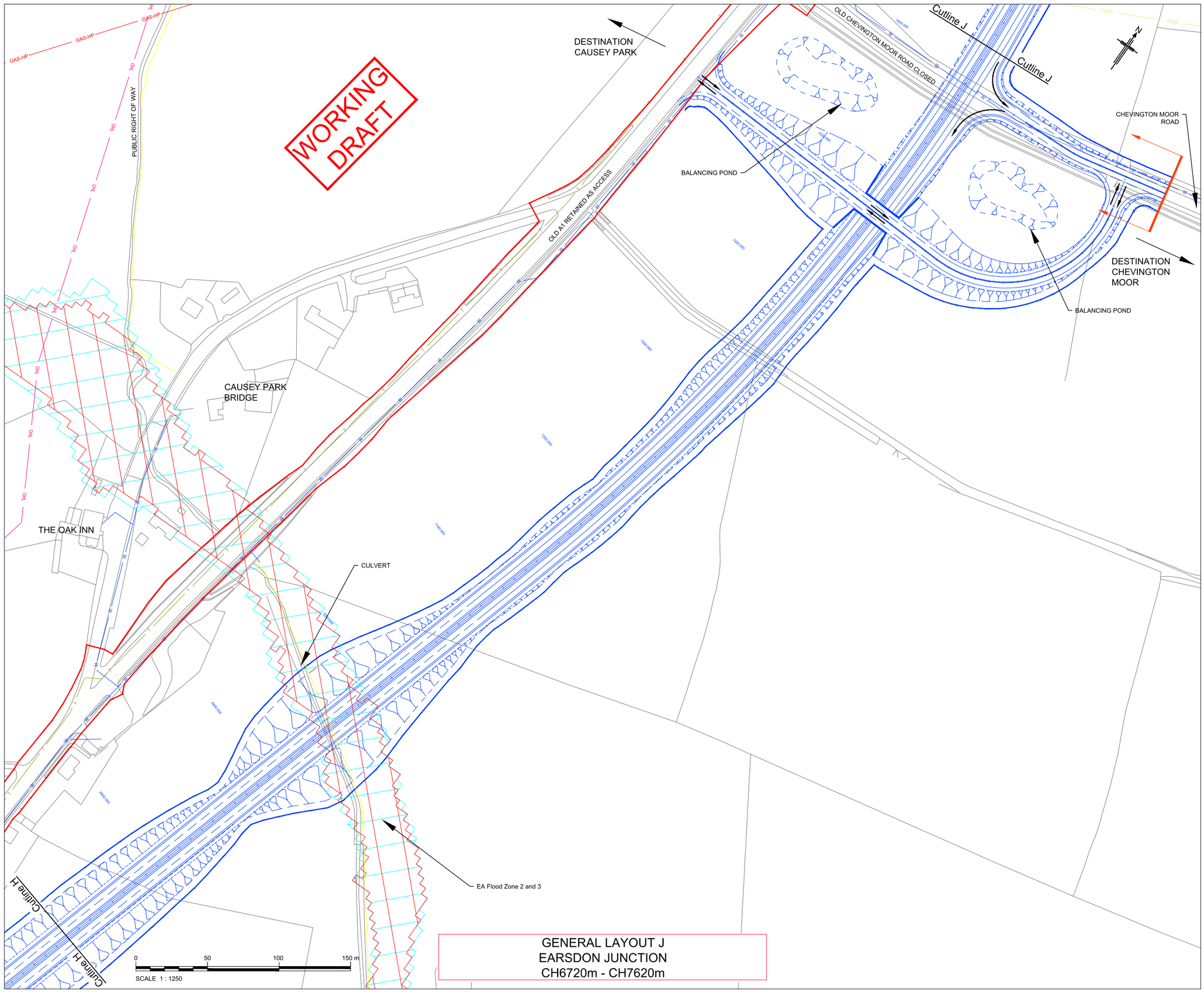


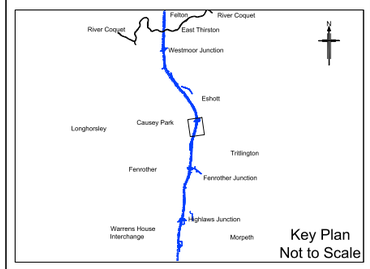
GENERAL LAYOUT J
EARSDON JUNCTION
CH6720m - CH7620m

NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWOR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

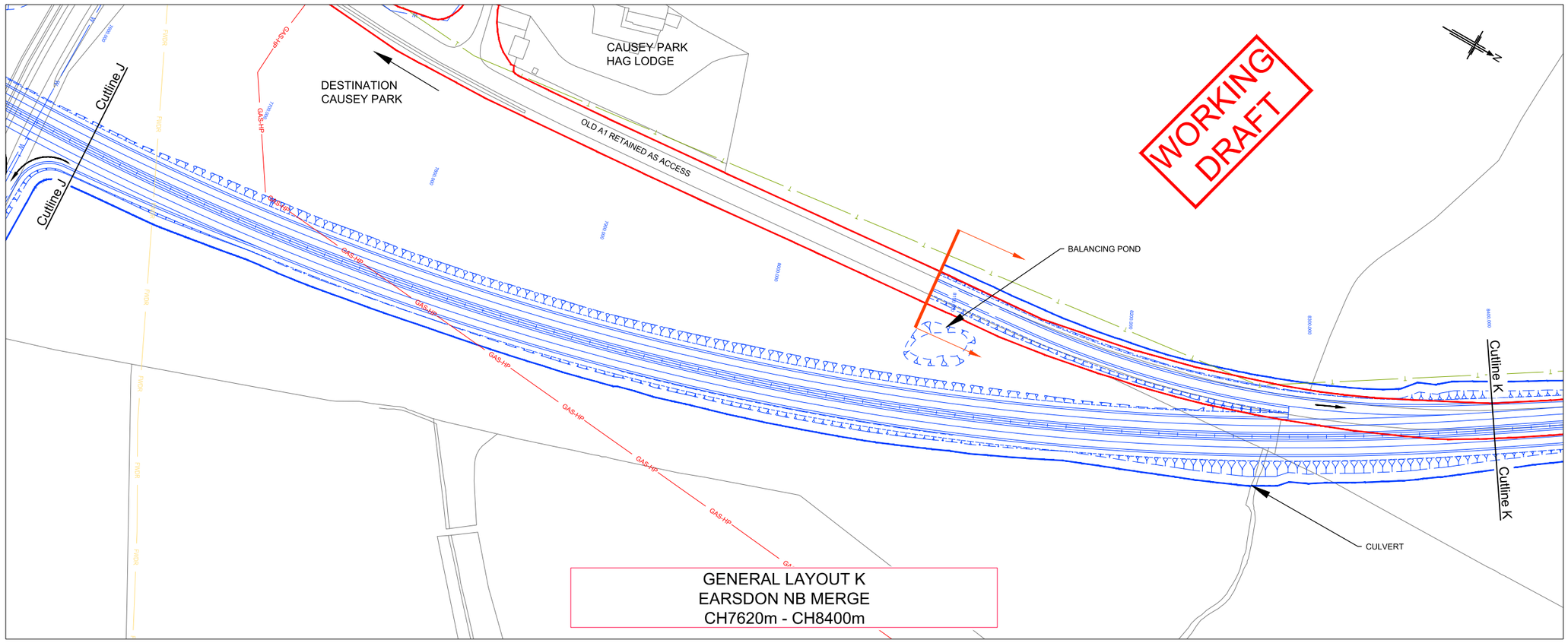
Client: highways england driving forward

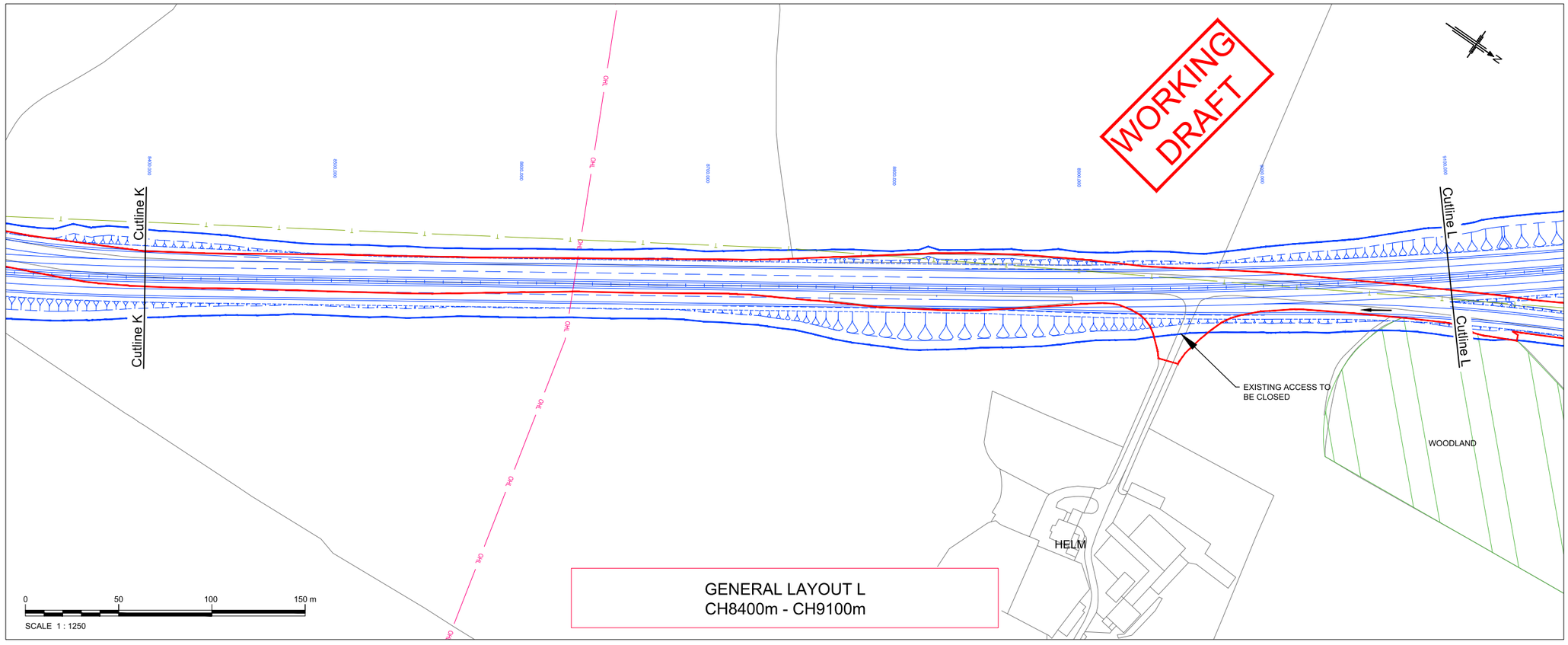
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 6 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-075	Rev B



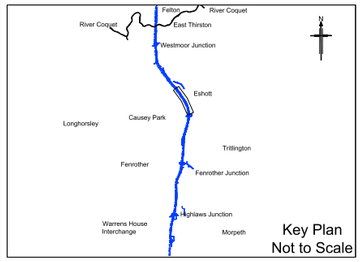


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

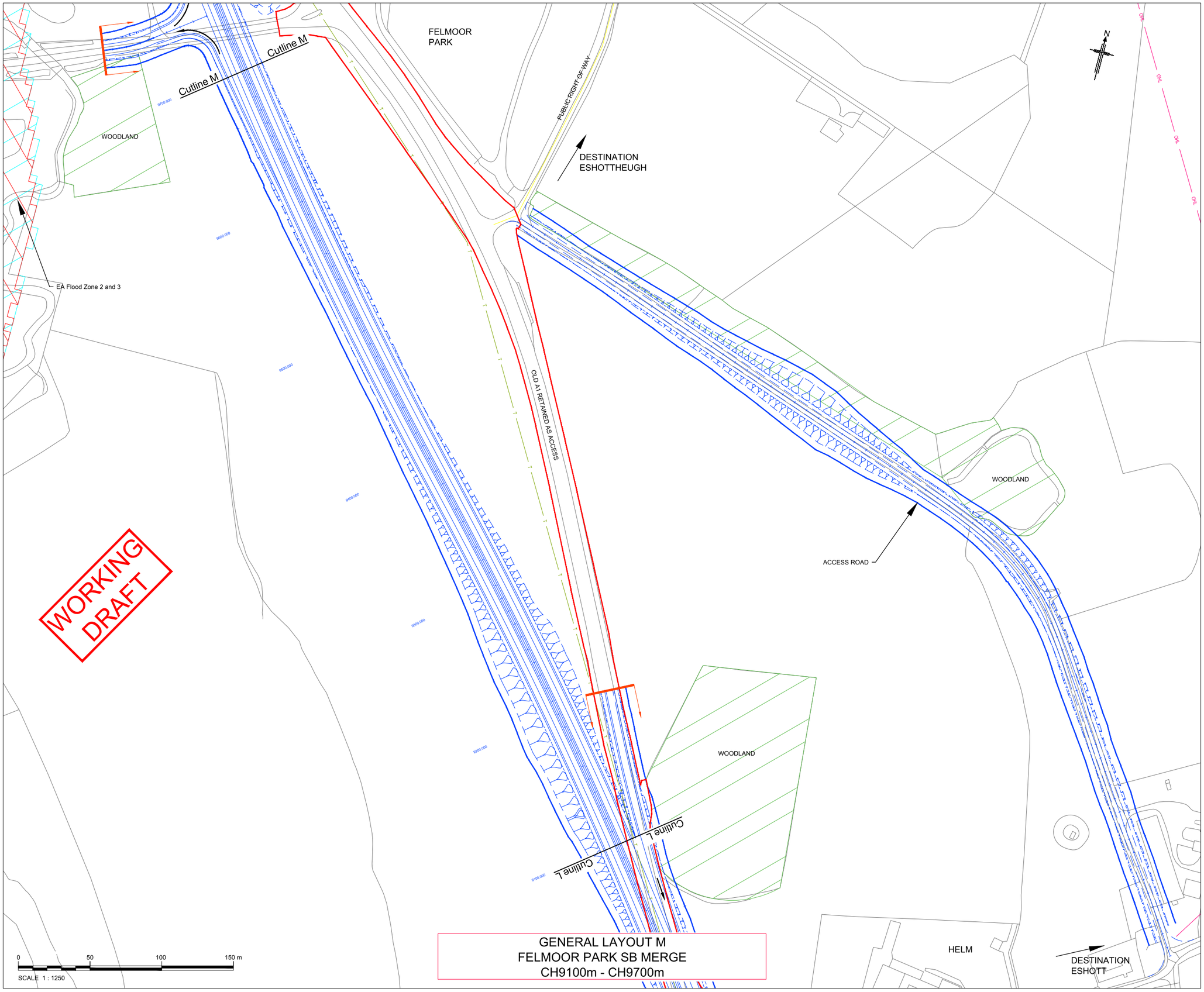
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:

BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 7 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-076	Rev B



WORKING DRAFT

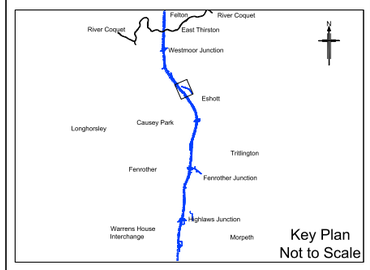
GENERAL LAYOUT M
FELMOOR PARK SB MERGE
CH9100m - CH9700m

NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england — driving forward

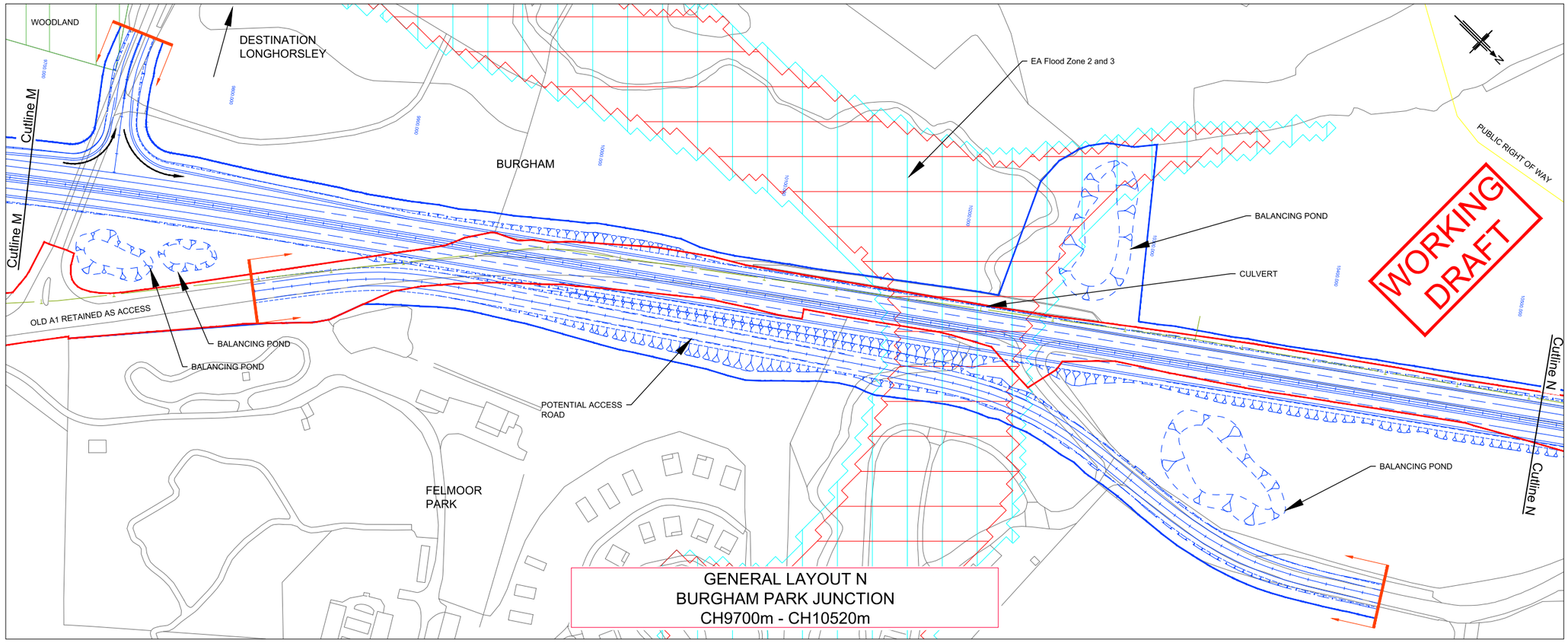
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 8 OF 11

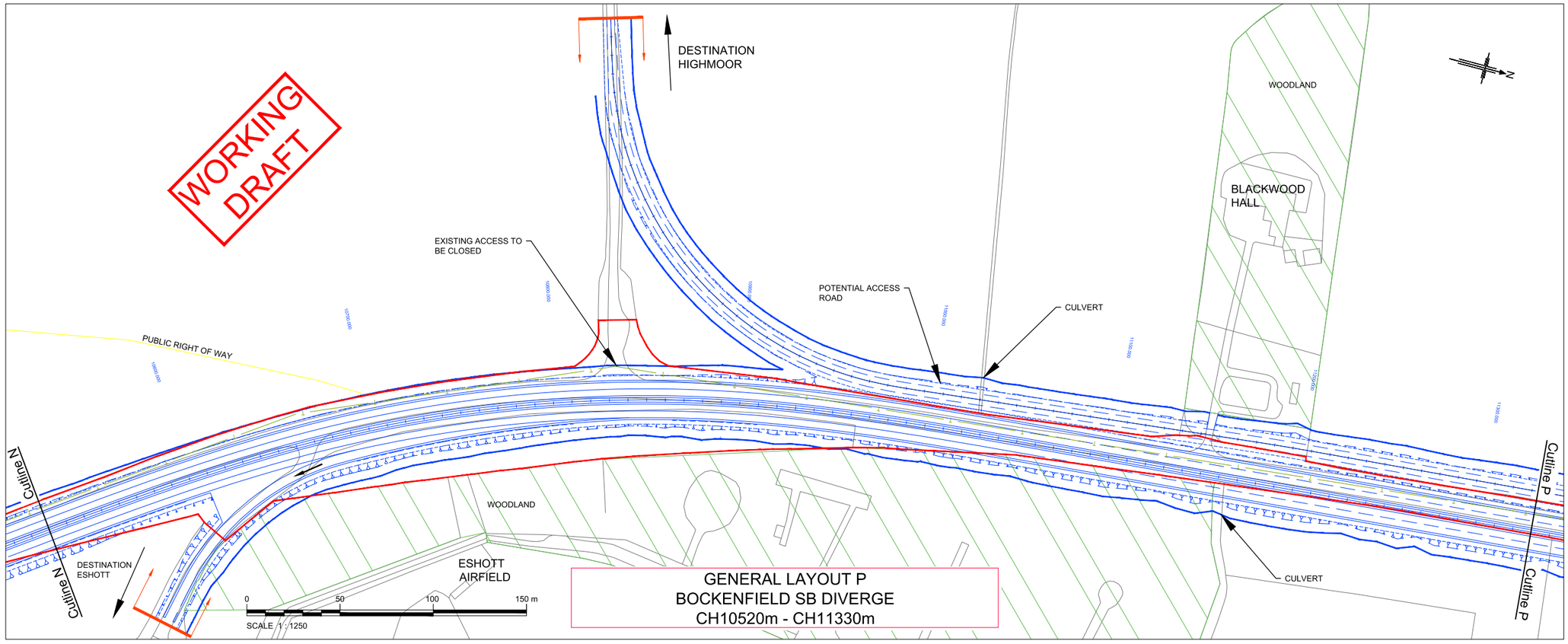
Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-077 — Rev: B



GENERAL LAYOUT N
BURGHAM PARK JUNCTION
CH9700m - CH10520m



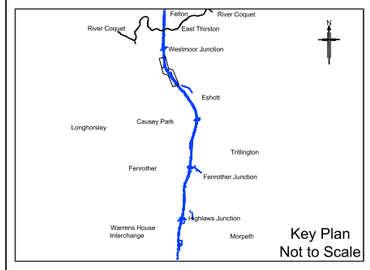
GENERAL LAYOUT P
BOCKENFIELD SB DIVERGE
CH10520m - CH11330m

NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Blue Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

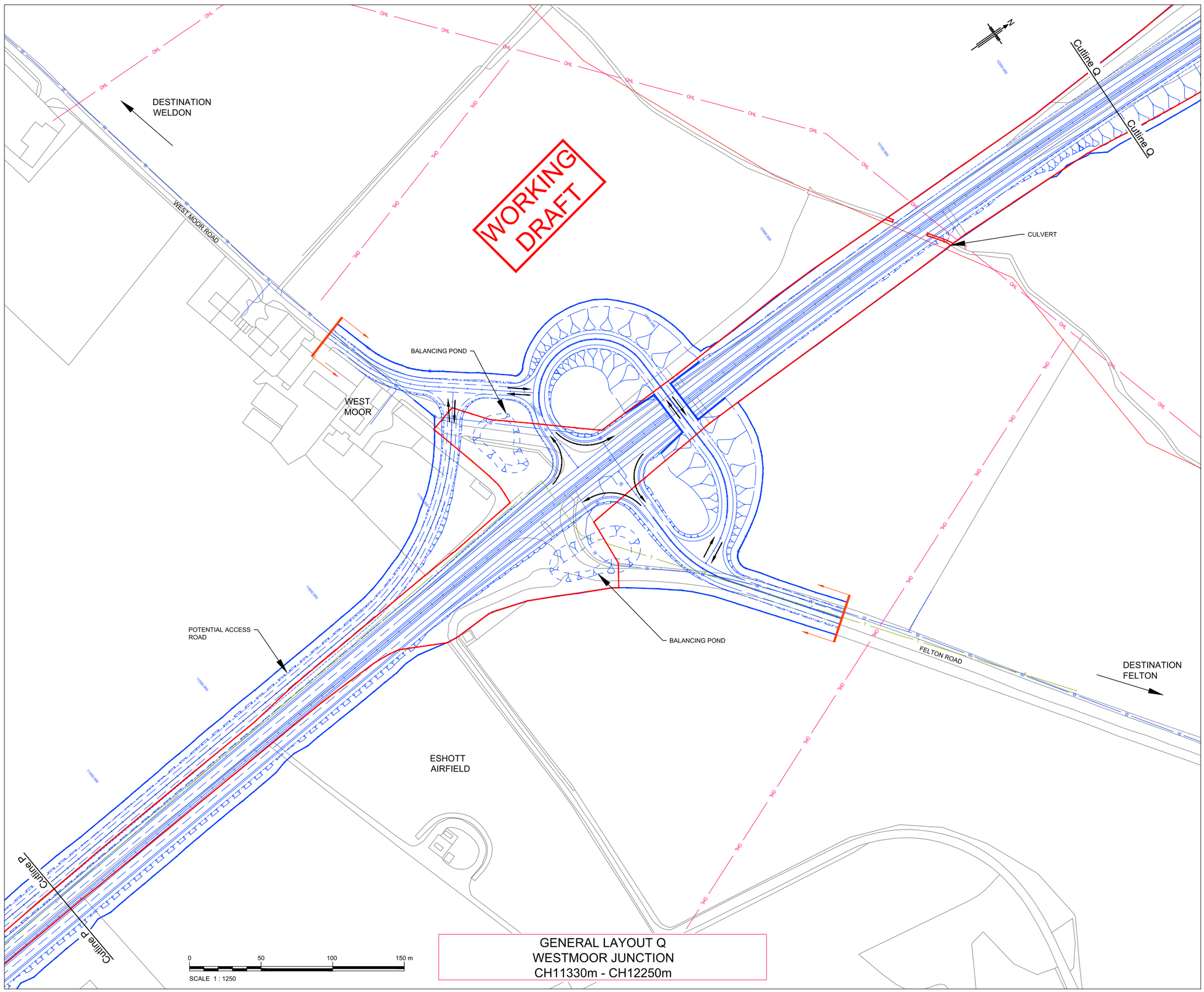
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 9 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-078 — Rev: B



GENERAL LAYOUT Q
WESTMOOR JUNCTION
CH11330m - CH12250m

NOTES

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2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
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KEY

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- Hybrid Option Highway Footprint
- Extents of Scheme
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- FWDR — Northumbrian Water Abandoned Pipes
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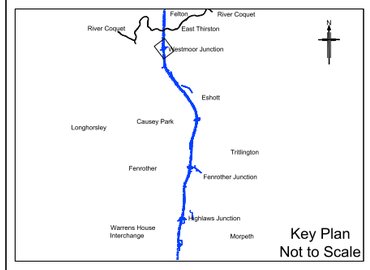
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title:

BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 10 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-079	Rev B

DUKE'S BANK WOOD

PUBLIC RIGHT OF WAY

SIGHT OF SPECIAL SCIENTIFIC INTEREST

EA Flood Zone 2 and 3

TILE KILN RUSH

PUBLIC RIGHT OF WAY

RIVER COQUET BRIDGE

EXISTING STRUCTURE FOR NORTHBOUND CARRIAGEWAY

PROPOSED STRUCTURE FOR SOUTHBOUND CARRIAGEWAY

Cutline Q

Cutline Q

Cutline R

Cutline R

SIGHT OF SPECIAL SCIENTIFIC INTEREST

GENERAL LAYOUT R
CH12250m - CH13050m

PARK WOOD

PUBLIC RIGHT OF WAY

PARKWOOD SUBWAY

Cutline R

Cutline R

CULVERT

PUBLIC RIGHT OF WAY

FELTON PARK

0 50 100 150 m

SCALE 1 : 1250

GENERAL LAYOUT S
CH13050m - END OF SCHEME

NOTES

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4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-070 to 079A
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KEY

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- Hybrid Option Highway Footprint
- Extents of Scheme
- T — Gamma
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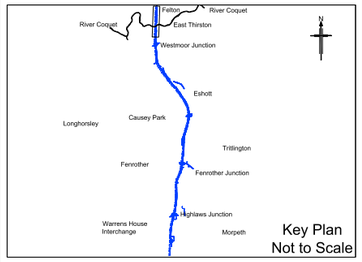


Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	JH	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

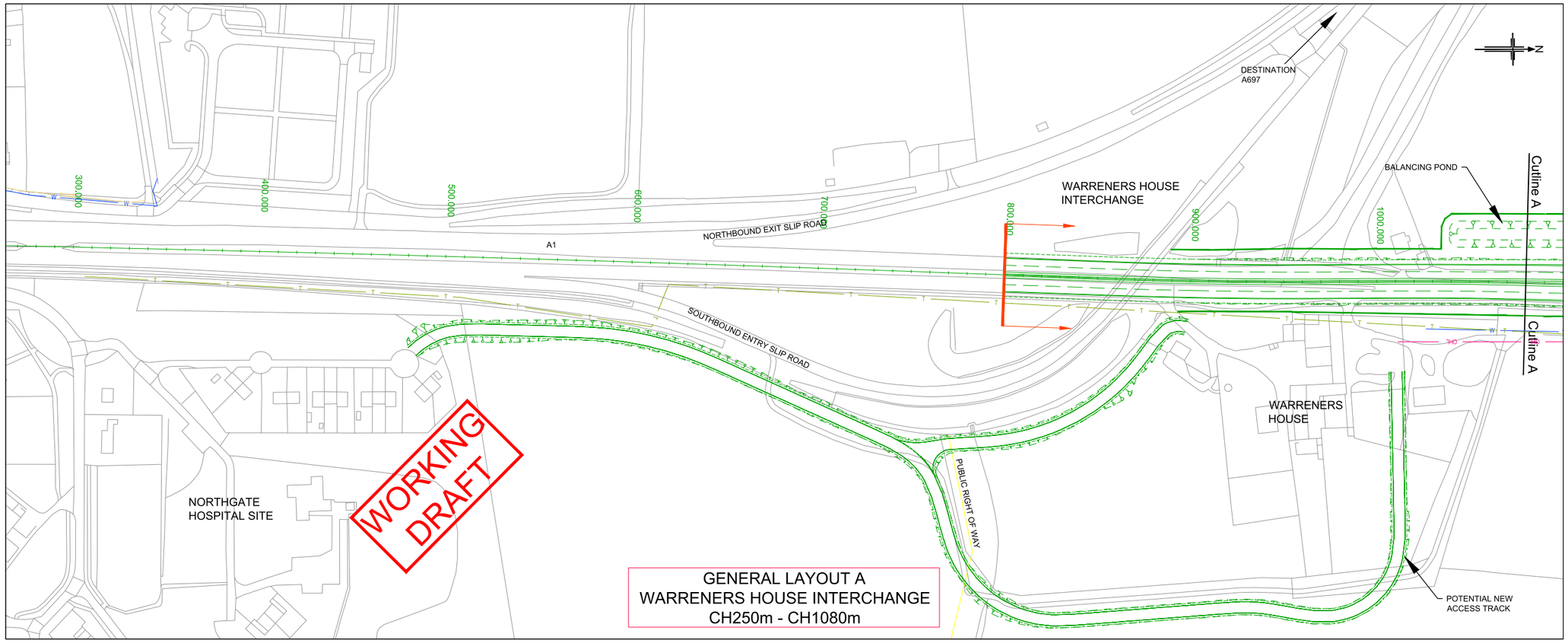
Drawing title:

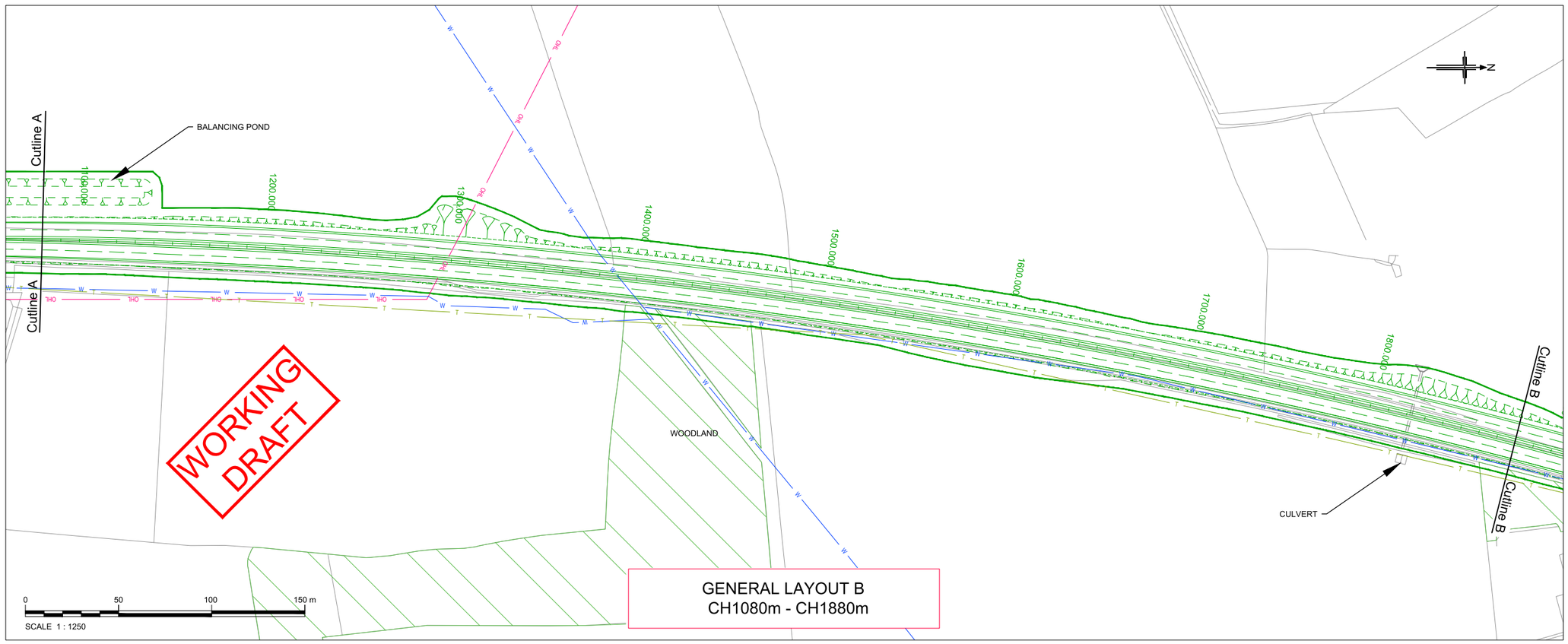
BLUE OPTION
HYBRID DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 11 OF 11

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-079A — Rev: B





NOTES

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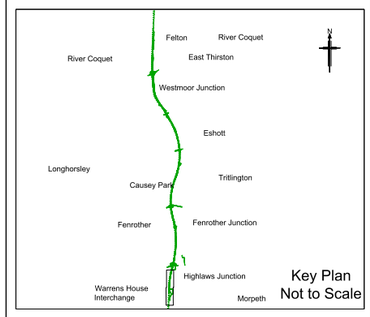
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Option A Highway Footprint
- Extents of Scheme
- Gamma
- National Grid
- Northern Powergrid
- Northumbrian Water Mains
- Northumbrian Water Abandoned Pipes
- Scottish Power 11kV Overhead
- Scottish Power 11kV Underground
- Scottish Power LV
- Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
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-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

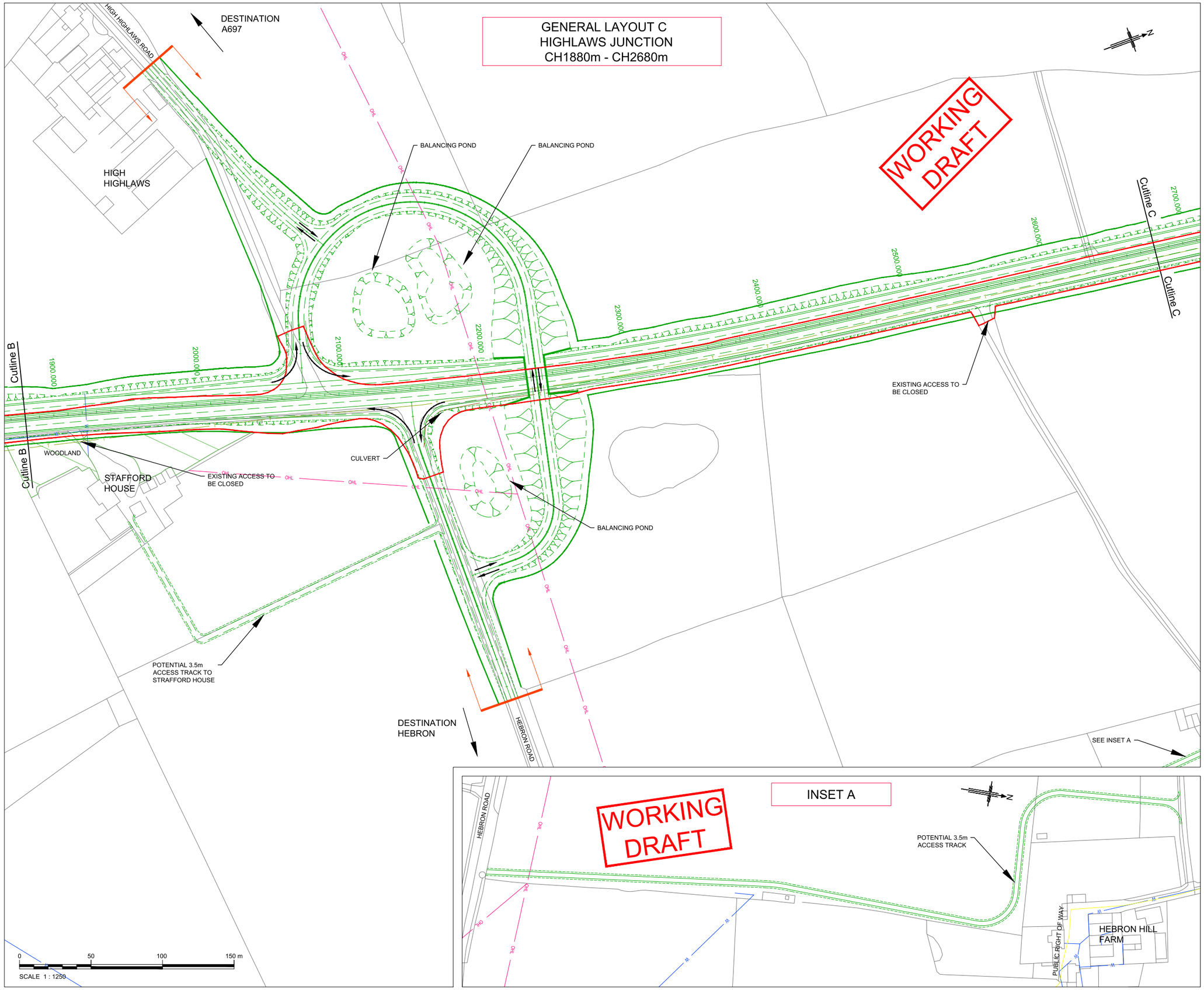
Drawing title: GREEN OPTION
OFFLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 1 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-030 — Rev: B

GENERAL LAYOUT C
HIGHLAWS JUNCTION
CH1880m - CH2680m



NOTES

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4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

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- Option A Highway Footprint
- Extents of Scheme
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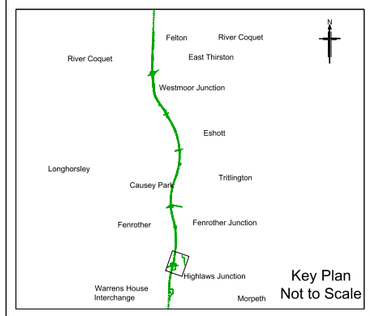
- T — Vodafone



Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

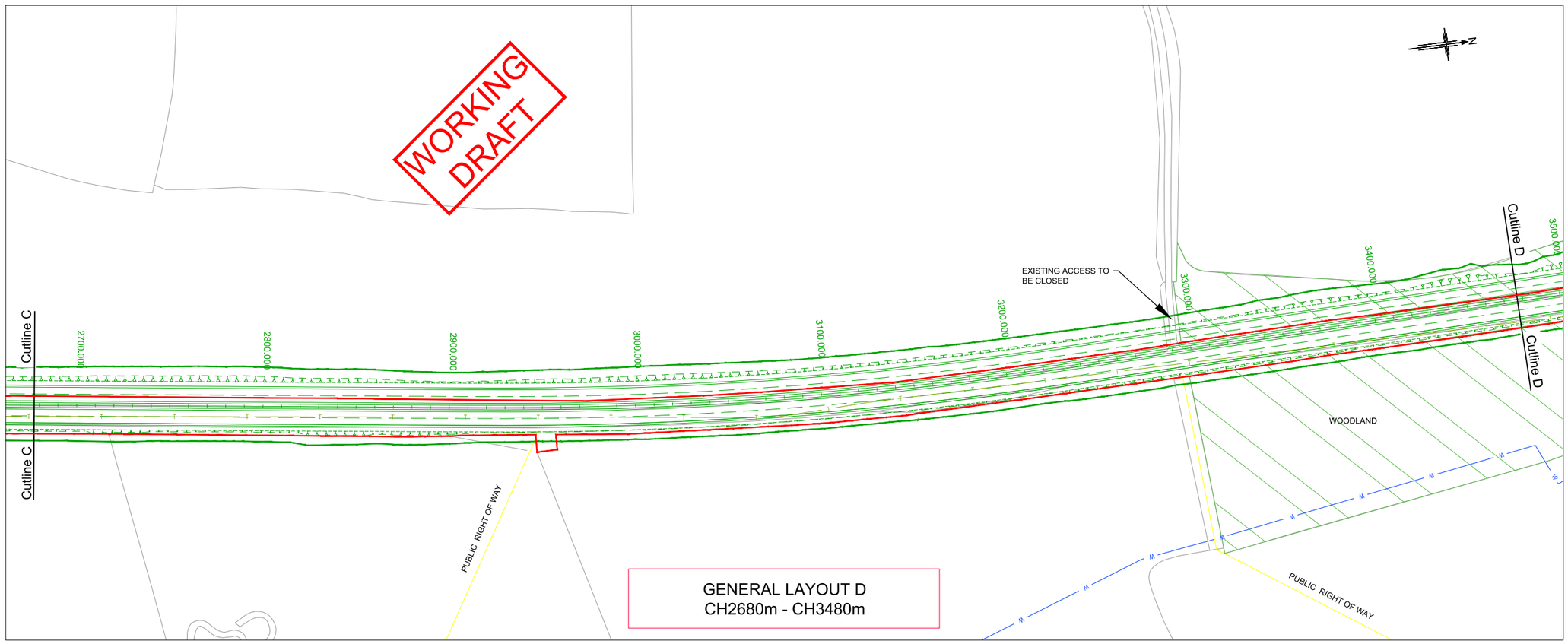
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

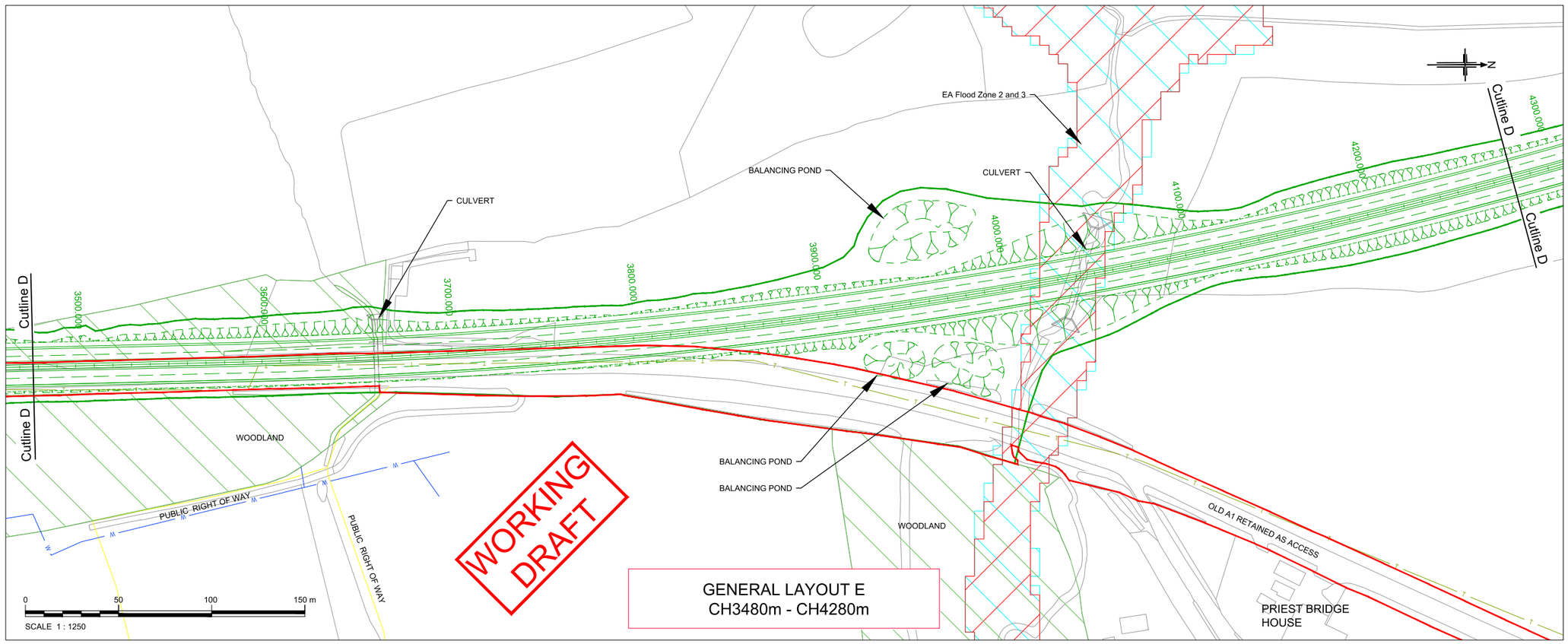
Drawing title: GREEN OPTION
OFFLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 2 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250 DO NOT SCALE
Jacobs No.	B2104700
Client no.	551459

Drawing number: HA551459-JAC-GEN-Section A-WD-C-031 Rev B





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   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
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KEY

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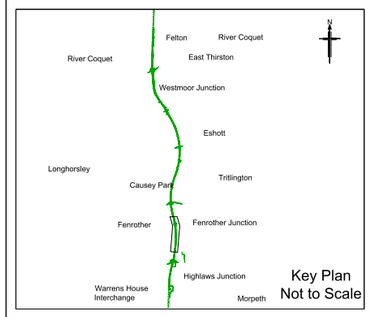

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: GREEN OPTION OFFLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 3 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-032	Rev B

DESTINATION
FENROTHER

FENROTHER LANE

WORKING DRAFT

Cutline F

IDENTIFIED DRAINAGE OUTFALL

WOODLAND

PUBLIC RIGHT OF WAY

OHL

FENROTHER LANE

DESTINATION
TRITLINGTON

OLD A1 RETAINED AS ACCESS

PUBLIC RIGHT OF WAY

TRITLINGTON SCHOOL

Cutline E

0 50 100 150 m

SCALE 1 : 1250

GENERAL LAYOUT F
FENROTHER JUNCTION
CH4280m - CH5060m

NOTES

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4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
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KEY

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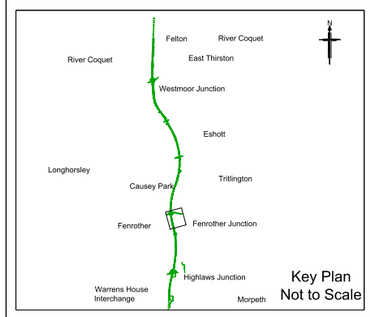


Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

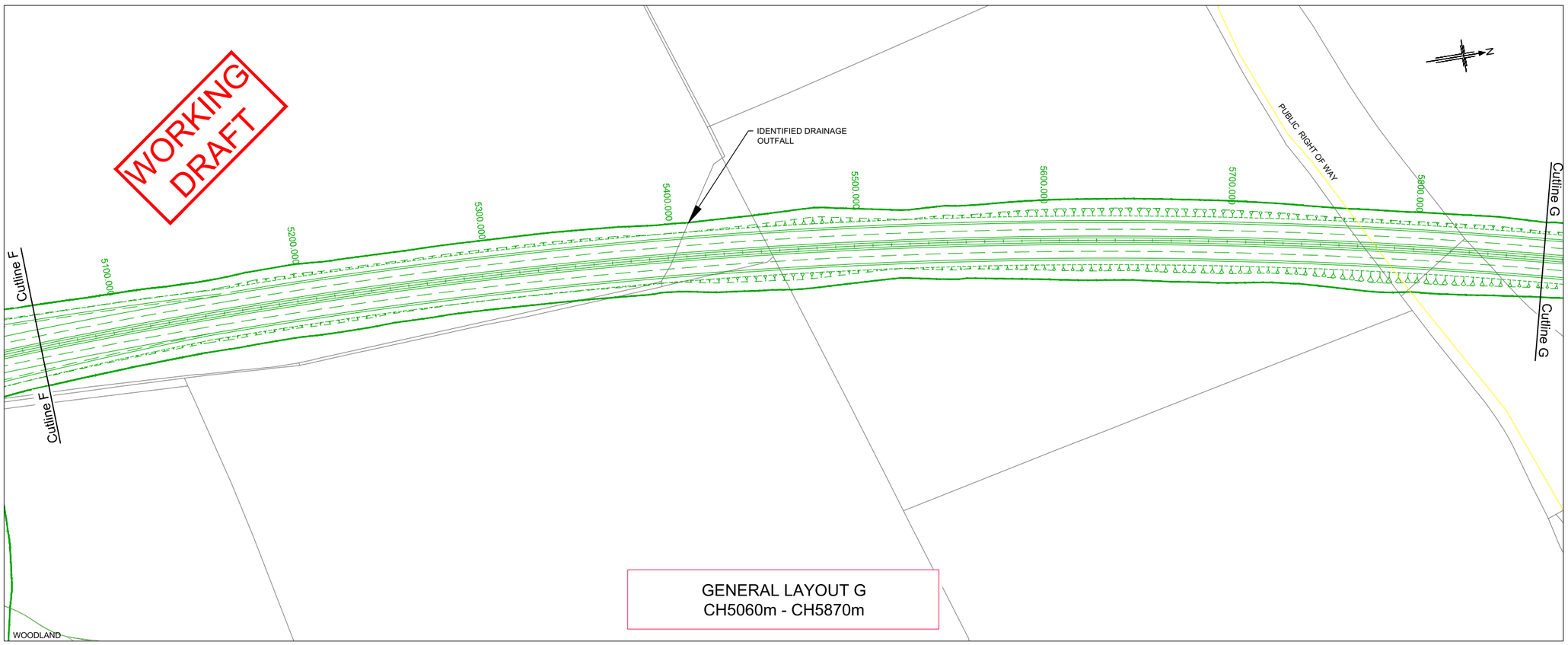
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

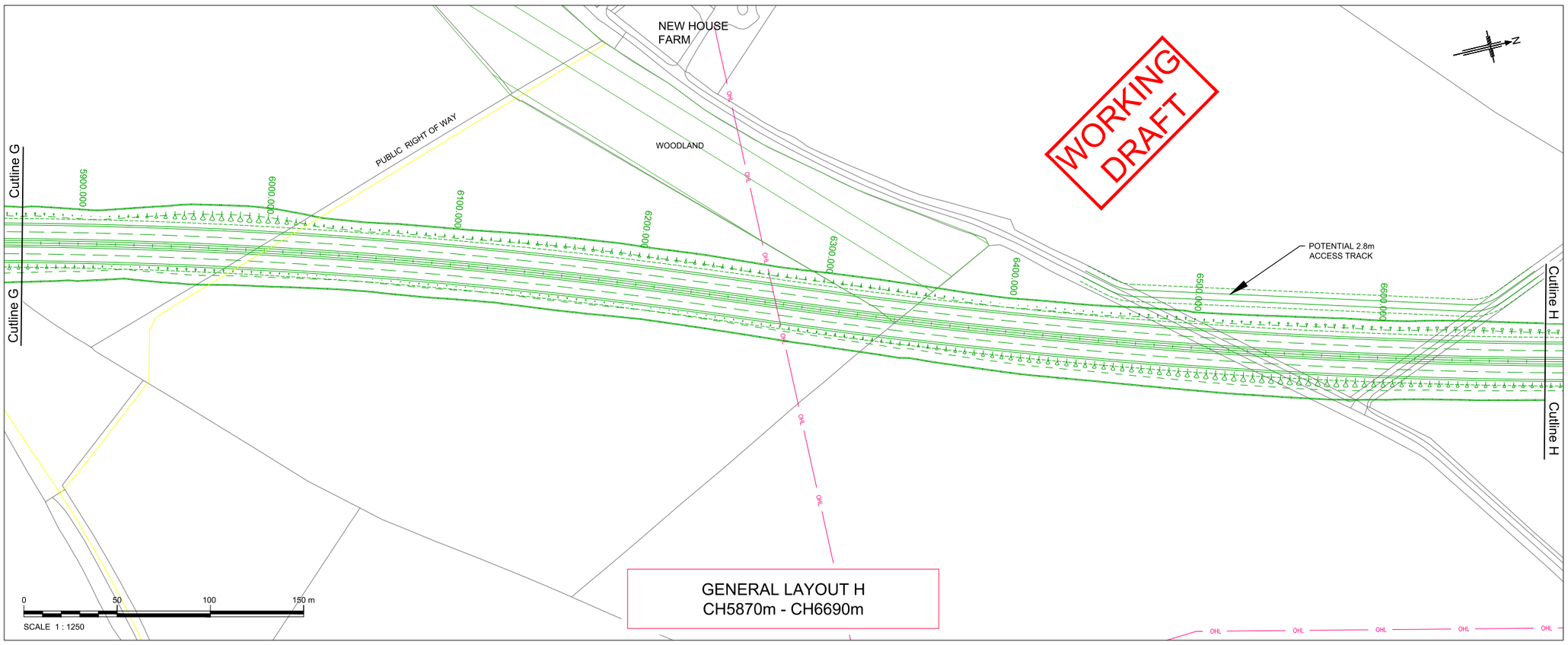
Drawing title: GREEN OPTION
OFFLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 4 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-033 Rev: B





NOTES

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KEY

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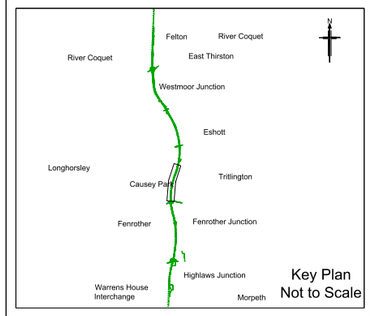


Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

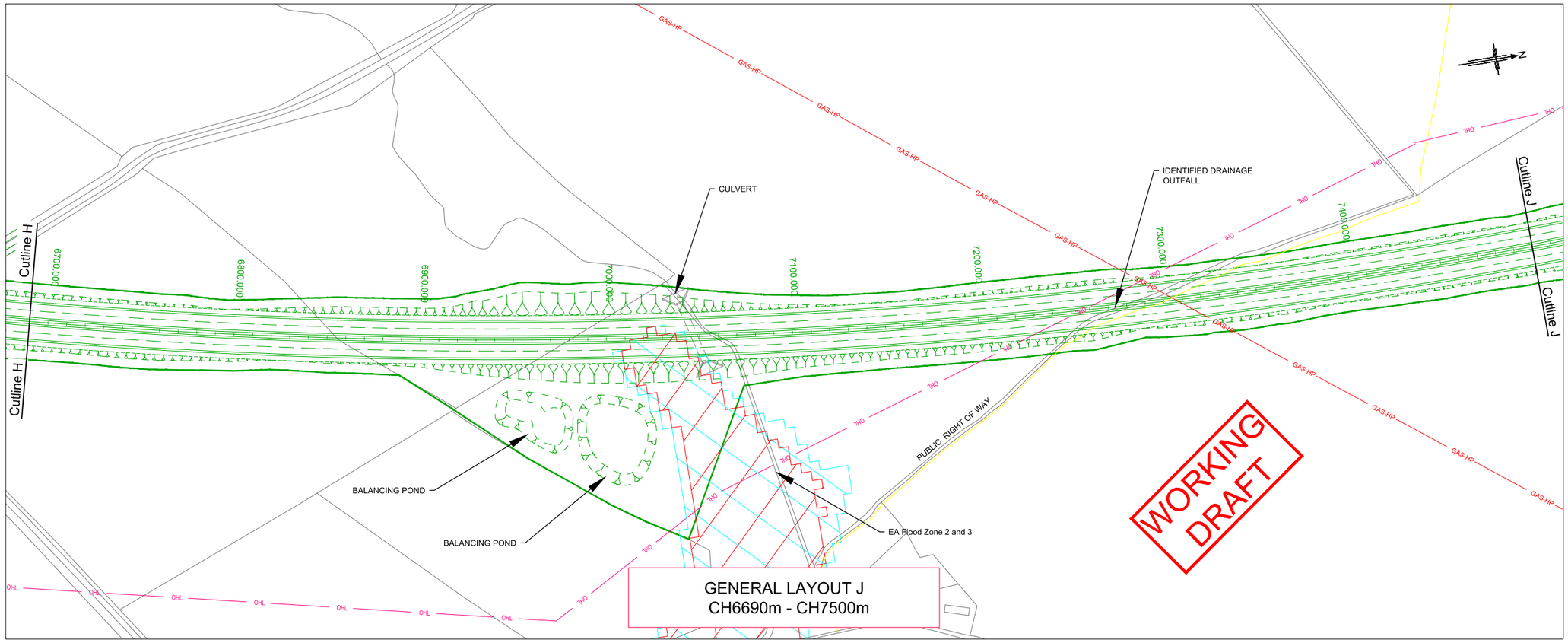
Client: highways england driving forward

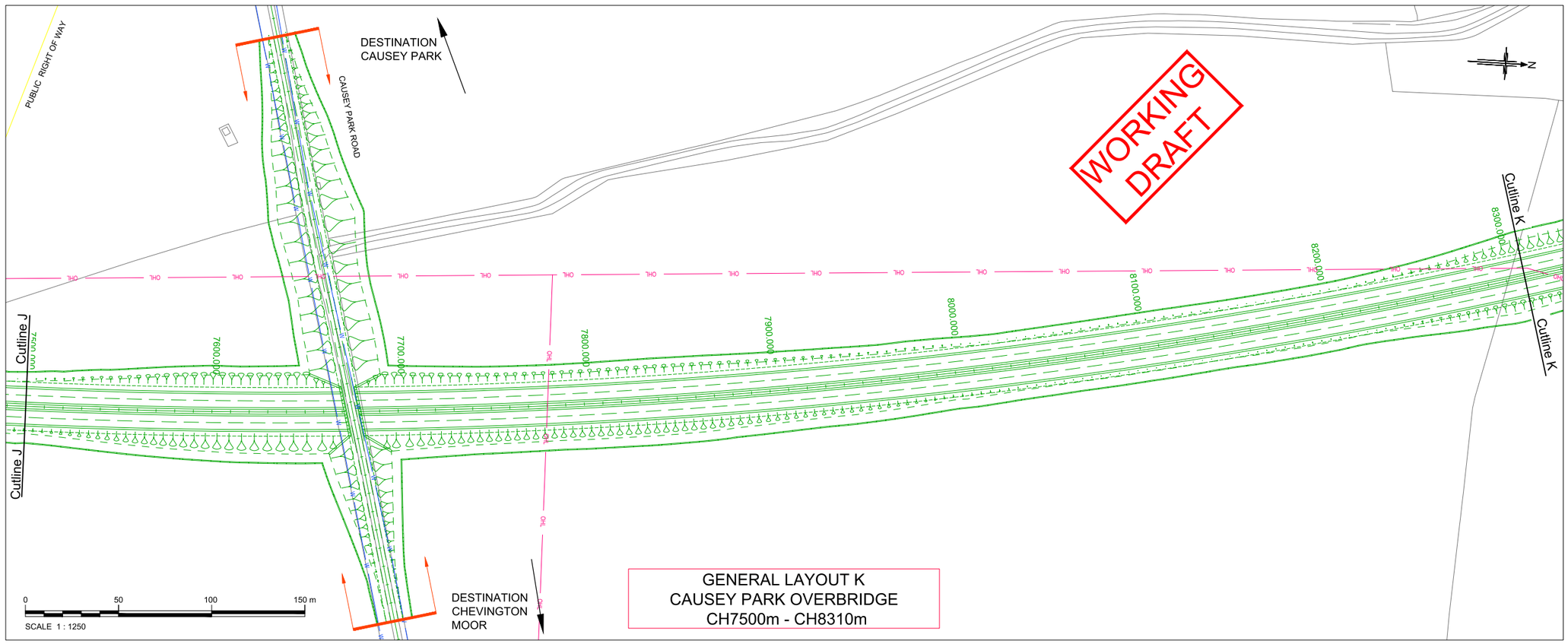
Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: GREEN OPTION OFFLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 5 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-034	Rev B





NOTES

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KEY

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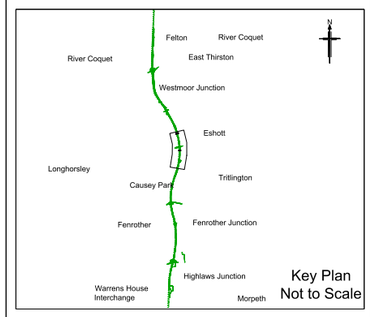


Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

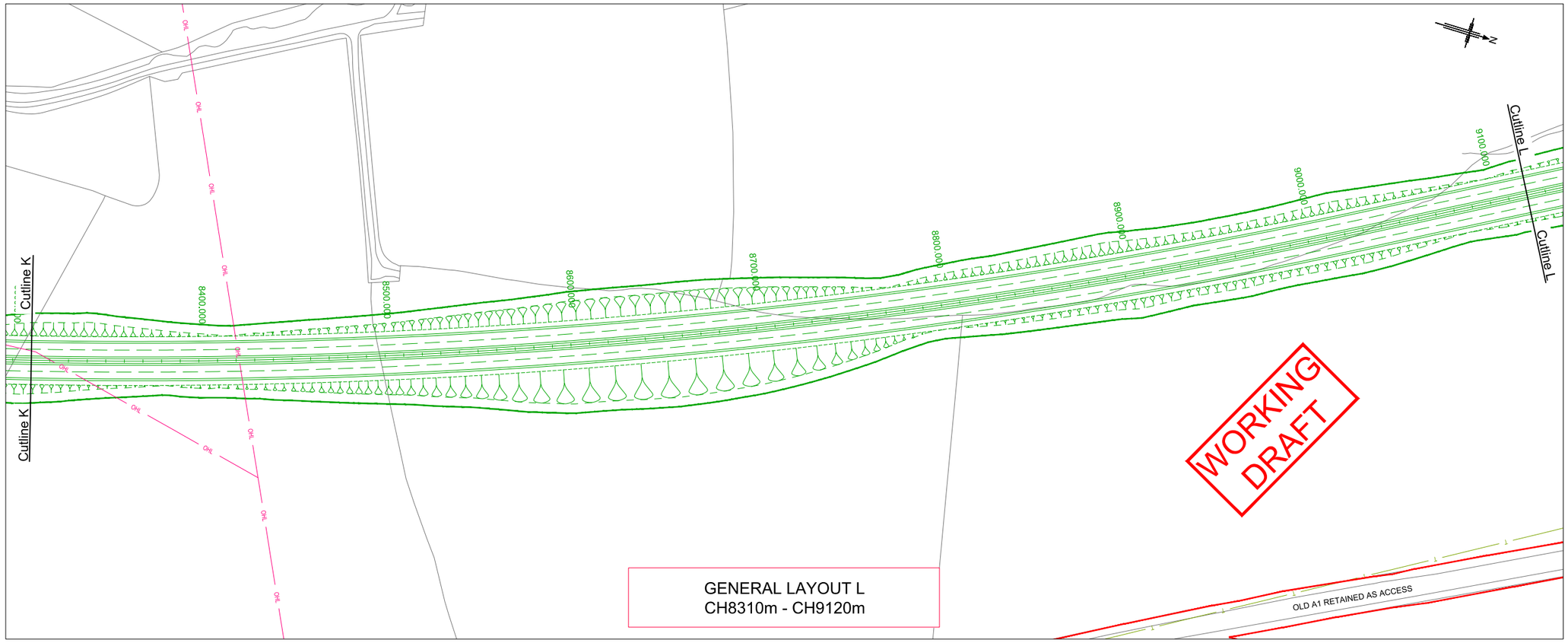
Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: GREEN OPTION
OFFLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 6 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-035	Rev B



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- 11kV — Scottish Power 11kV Underground
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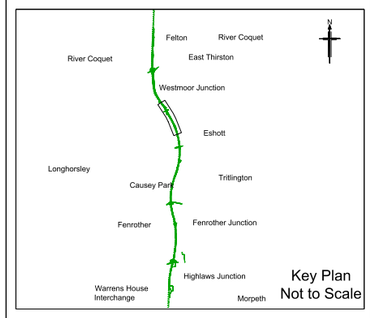
- T — Vodafone



Key Plan
Not to Scale

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

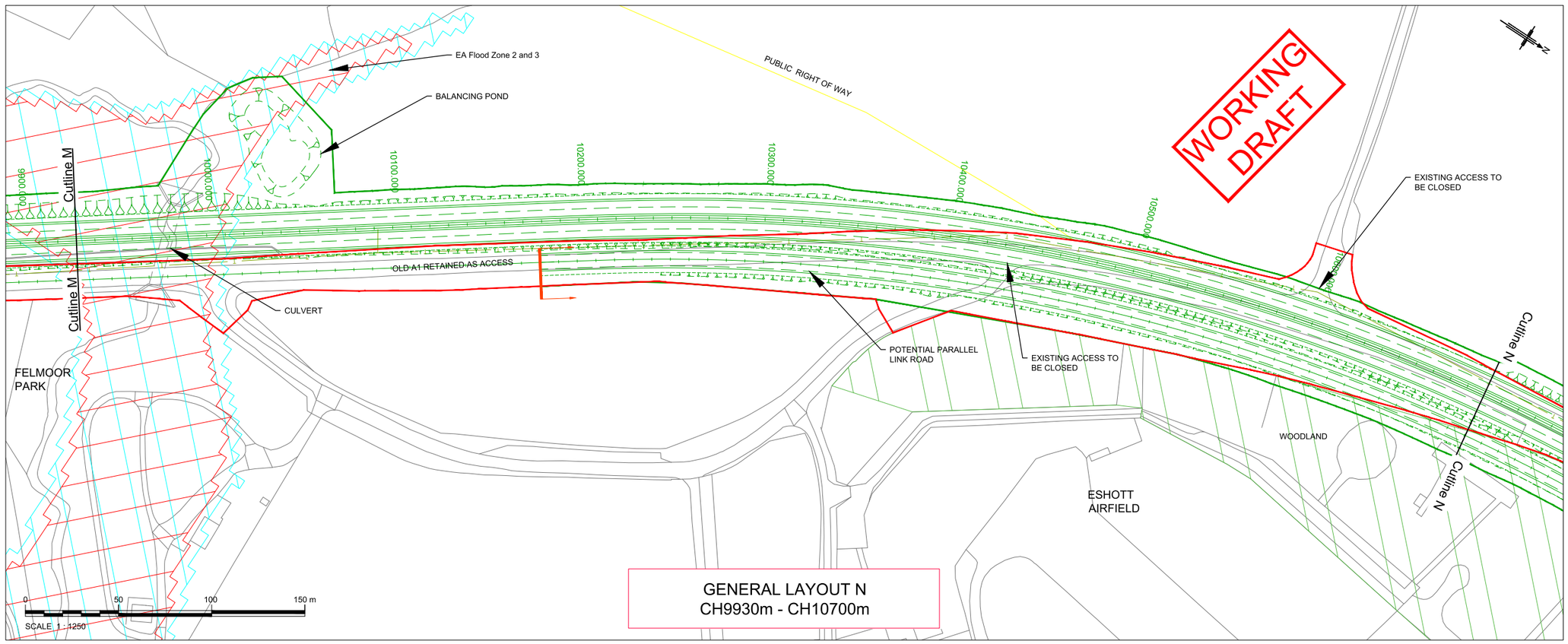
Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

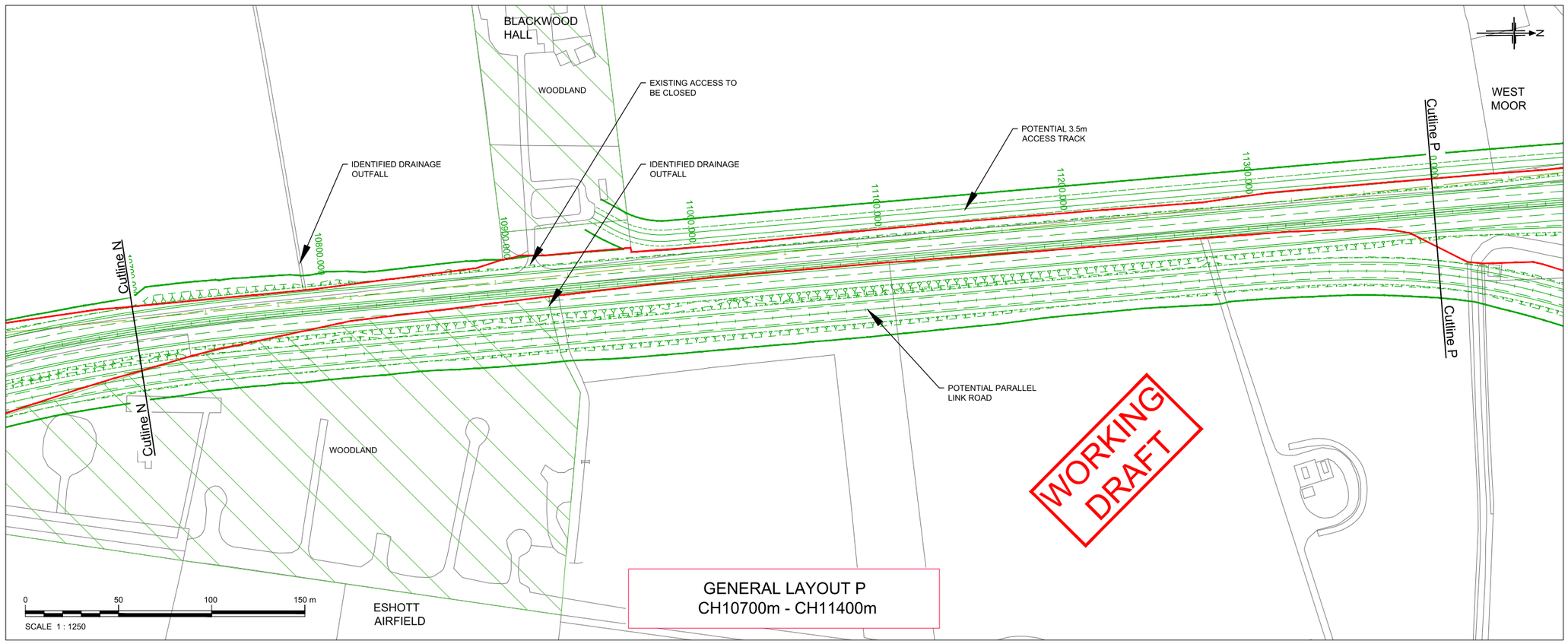
Drawing title: GREEN OPTION
OFFLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 7 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
Jacobs No.	B2104700	
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-036 — Rev: B



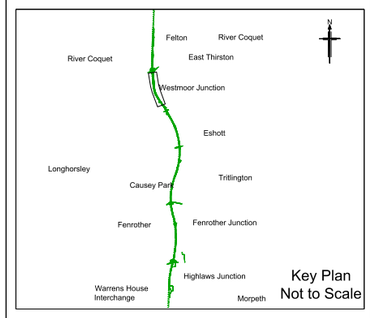


NOTES

1. All dimensions in metres unless stated otherwise
2. This drawing shows the preliminary layout for online carriageway upgrade for the A1 from a Single Carriageway (S2) to a Dual Carriageway (D2AP) from Morpeth to Felton
3. This drawing shows Green Option as the primary alignment.
4. This drawing shall be read in conjunction with drawing number:
   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Option A Highway Footprint
- Extents of Scheme
- Gamma
- National Grid
- Northern Powergrid
- Northumbrian Water Mains
- Northumbrian Water Abandoned Pipes
- Scottish Power 11kV Overhead
- Scottish Power 11kV Underground
- Scottish Power LV
- Vodafone



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-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: GREEN OPTION OFFLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 8 OF 10

Drawing status: WORKING PROGRESS

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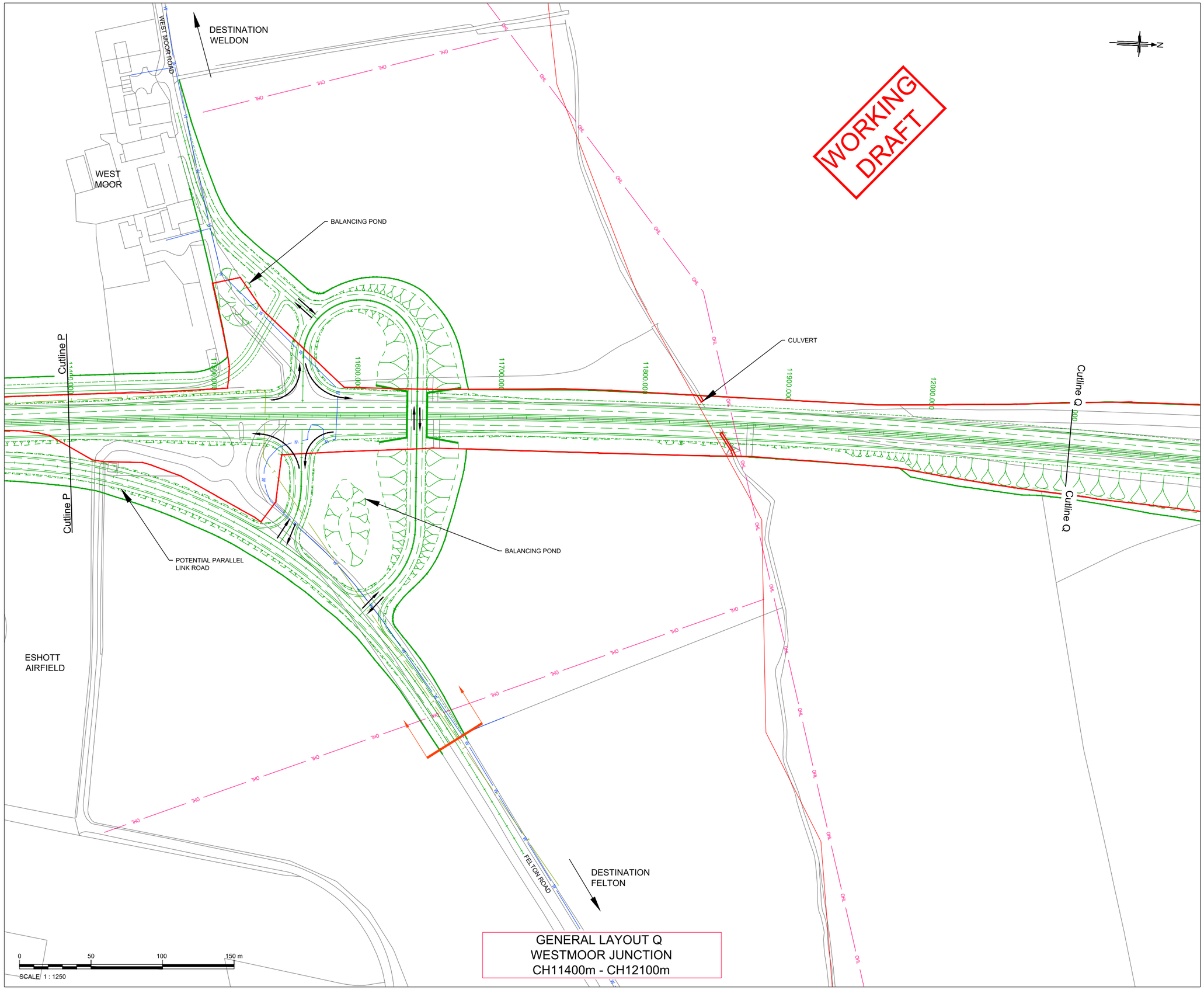
Jacobs No.	B2104700	
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-037	Rev B



WORKING DRAFT

GENERAL LAYOUT Q
WESTMOOR JUNCTION
CH11400m - CH12100m

NOTES

1. All dimensions in metres unless stated otherwise
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   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
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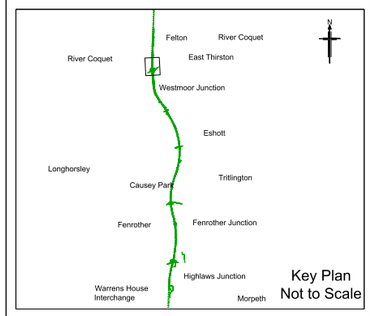
KEY

- Existing Highway Boundary
- Option A Highway Footprint
- Extents of Scheme
- T — Gamma
- GAS-HP — National Grid
- OHL — Northern Powergrid
- W — Northumbrian Water Mains
- FWDR — Northumbrian Water Abandoned Pipes
- OHL — Scottish Power 11kV Overhead
- 11kV — Scottish Power 11kV Underground
- LV — Scottish Power LV
- T — Vodafone



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-	-	-	-	-	-	-
B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england driving forward

Project: A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title: GREEN OPTION
OFFLINE DUAL CARRIAGEWAY
GENERAL LAYOUT
SHEET 9 OF 10

Drawing status: WORKING PROGRESS

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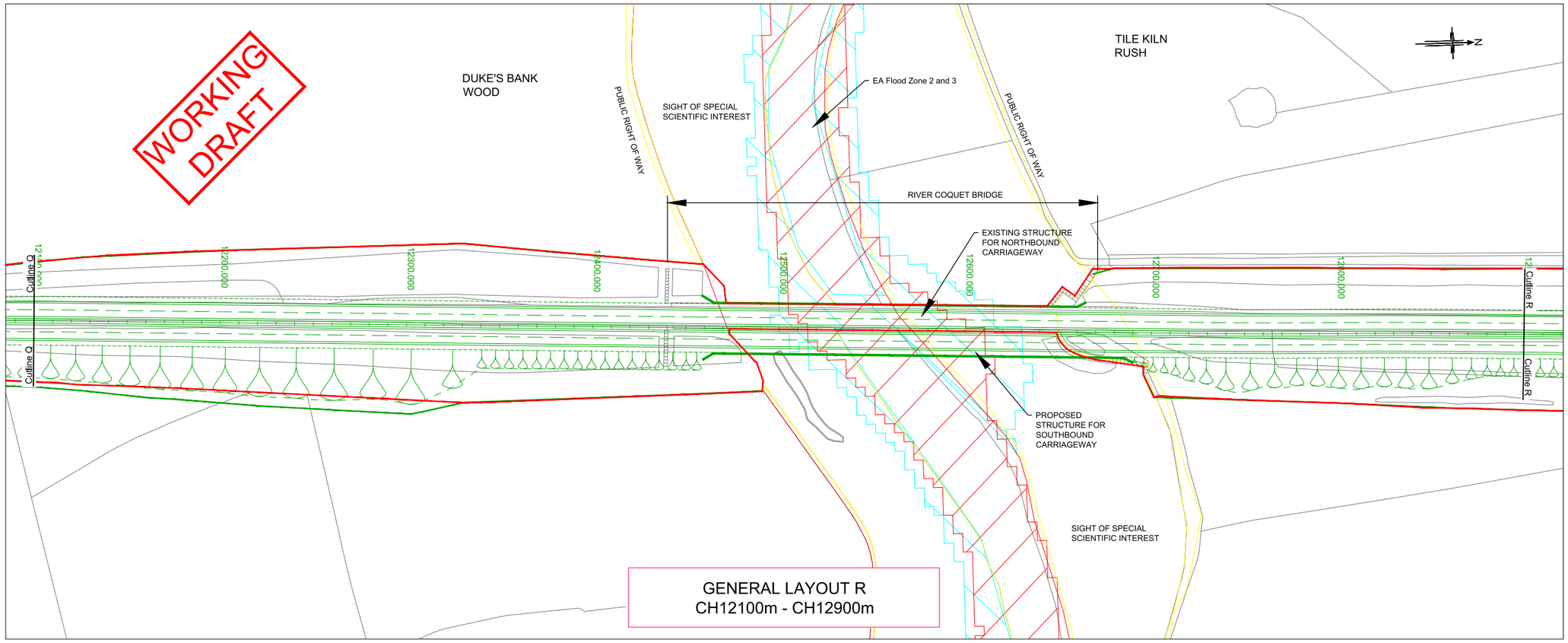
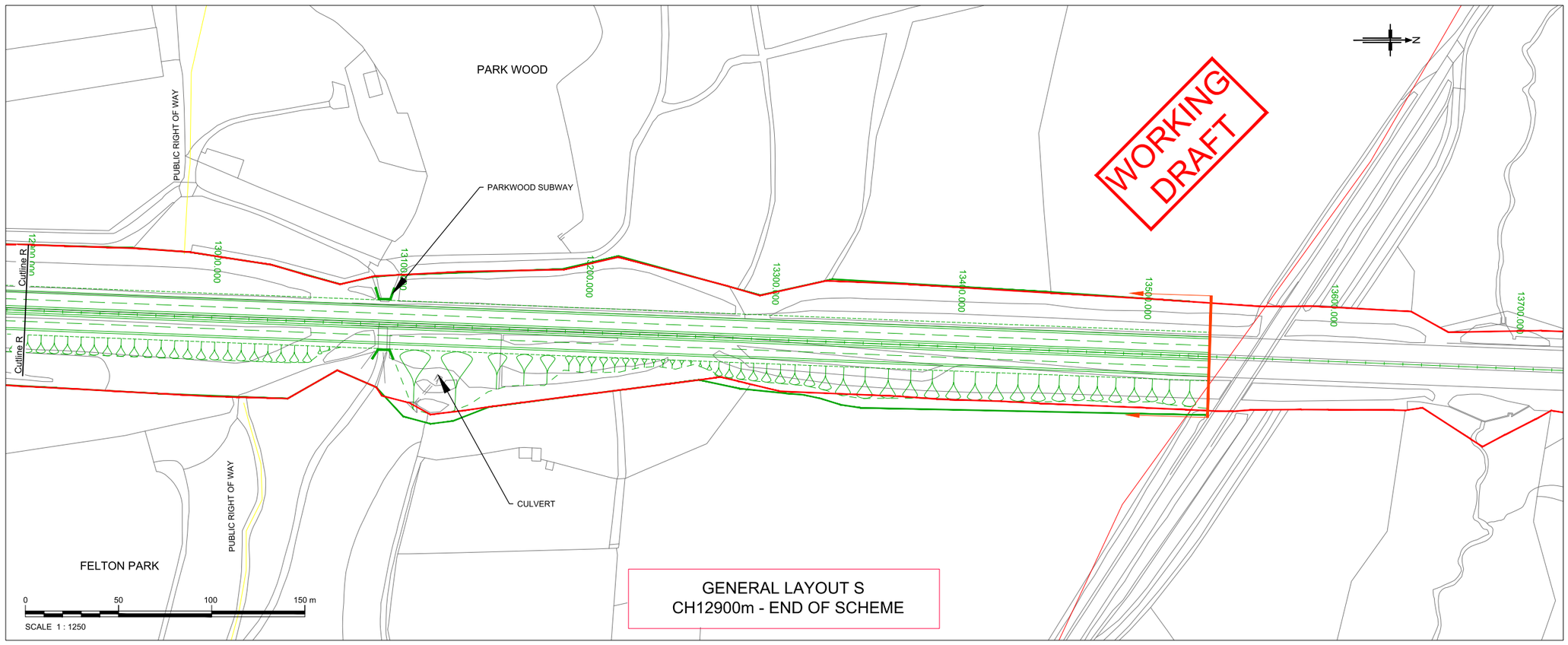
Client no.	551459	
Drawing number	HA551459-JAC-GEN-Section A-WD-C-038	Rev B





NOTES

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3. This drawing shows Green Option as the primary alignment.
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   - HA551459-JAC-GEN-Section A-WD-C-040 to 043 Long Sections.
5. The Design is based upon Ordnance Survey Mastermap data and Ordnance Survey Digital Terrain Model data 5m grid. No warranty for its accuracy can be given or implied.

KEY

- Existing Highway Boundary
- Option A Highway Footprint
- Extents of Scheme
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- GAS-HP — National Grid
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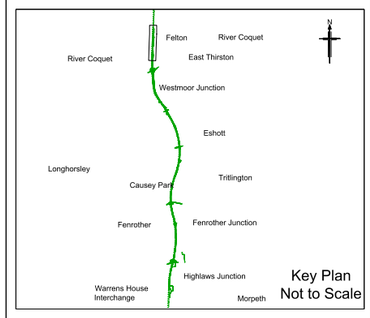

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B	OCT 16	Post Public Awareness Design	KS	CS	PF	MC
A	MAY 16	Revised Alignment	CS	CS	PF	MC

JACOBS

Client: highways england — driving forward

Project: A1 IN NORTHUMBERLAND MORPETH TO FELTON

Drawing title: GREEN OPTION OFFLINE DUAL CARRIAGEWAY GENERAL LAYOUT SHEET 10 OF 10

Drawing status: WORKING PROGRESS

Scale	1:1250	DO NOT SCALE
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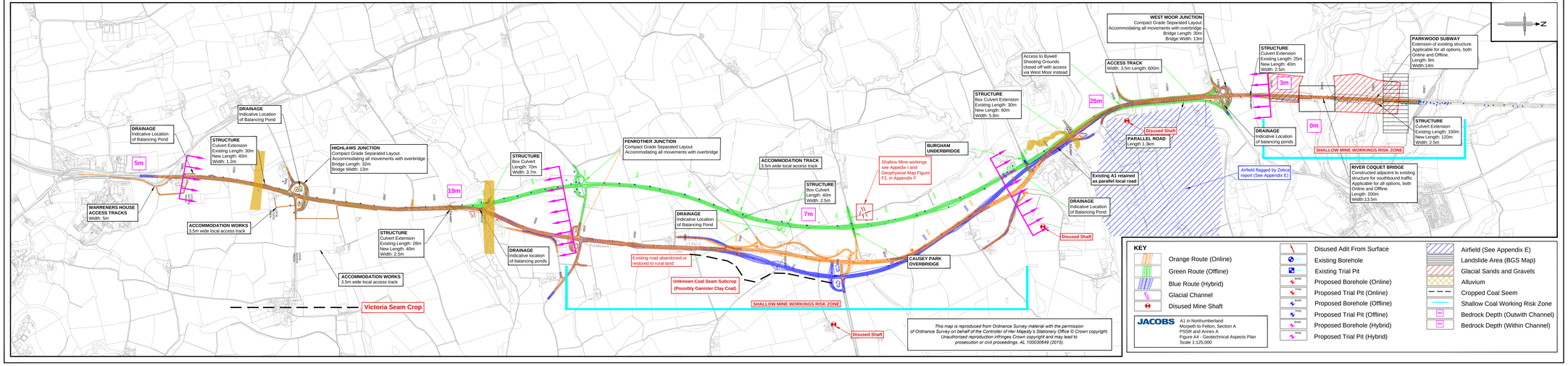
Client no.	551459	

Drawing number: HA551459-JAC-GEN-Section A-WD-C-039 — Rev: B



A1 in Northumberland
Section A Morpeth to Felton
PSSR and Annex A
Figure A4
Geotechnical Aspects Plan
Scale 125,000

Appendix B – Figures B1 to B17

FIGURE 1A

Legend

250m Buffer (all combined options)

Linear Features

Coal seam, inferred

Fault, inferred, displacement unknown

Marine band

Solid Geology

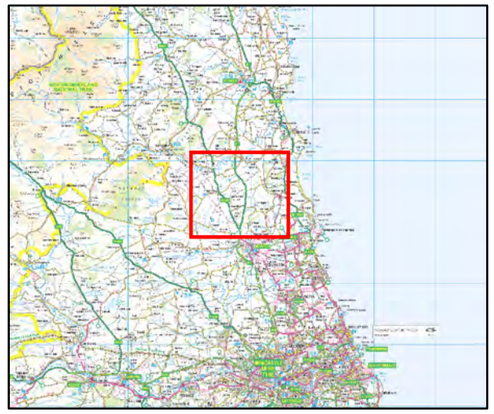
Pennine Lower Coal Measures Formation

Corbridge Limestone

Stanmore Formation

Stanmore Formation

Northern England Late Carboniferous Dyke



0 2 Km

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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Drawing Title: SECTION A - MORPETH TO FELTON
SOLID GEOLOGY

Drawing Status

Scale @ A3	1:50,000	DO NOT SCALE
Jacobs No.	B2104700	
Client No.	551459	

Drawing No. B2104700_PSSR_01a

FIGURE 2A

Legend

250m Buffer (all combined options)

Linear Features

Coal seam, inferred

Fault, inferred, displacement unknown

Marine band

Drift Geology

Alluvium

Alluvium

Glacial Till

Glaciofluvial Deposits

Glaciofluvial Deposits

Superficial theme not mapped

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Client

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Project

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Drawing Title

SECTION A - MORPETH TO FELTON
DRIFT GEOLOGY

Drawing Status

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Jacobs No.	B2104700	
Client No.	551459	

Drawing No.

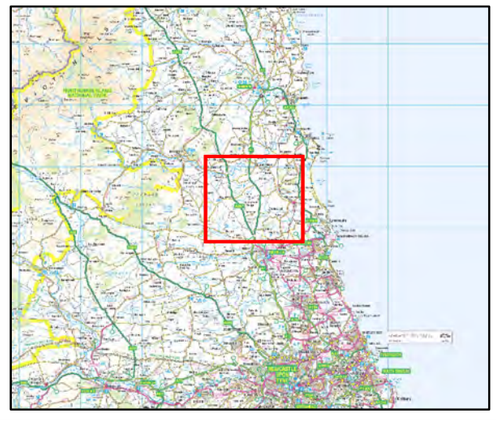
B2104700_PSSR_02a

0 2 Km

FIGURE 3A

Legend

- Existing Borehole
- 250m Buffer (all combined options)



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EXISTING BOREHOLE LOCATION PLAN

Drawing Status:

Scale @ A3	1:50,000	DO NOT SCALE
Jacobs No.	B2104700	
Client No.	551459	
Drawing No.	B2104700_PSSR_03a	

0 2 Km

FIGURE 4A

Legend

- 1 Walkover Stopping Points
- 250m Buffer (all combined options)

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Drawing Title: SECTION A - MORPETH TO FELTON
WALKOVER STOPPING POINTS

Drawing Status:

Scale @ A3	1:50,000	DO NOT SCALE
Jacobs No.	B2104700	
Client No.	551459	

Drawing No.: B2104700_PSSR_04a

0 2 Km

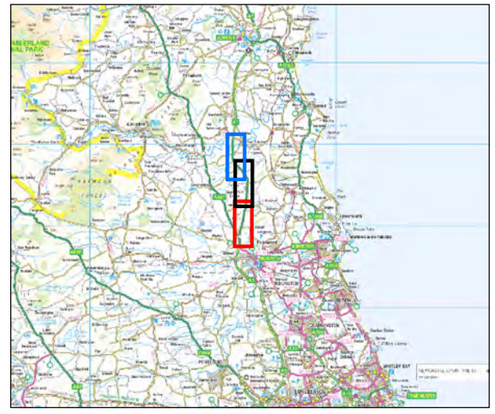
FIGURE 5A

Legend

- 250m Buffer (all combined options)
- Primary River
- Secondary River
- Tertiary River
- Lake/Reservoir
- Underground River (inferred)
- Canal
- Canal Tunnel
- Culvert
- Multiple Channel Culvert
- Underground River (Potential Sewer)
- Underground River (local knowledge)

Flood Risk

- Very Low
- Low
- Medium
- High



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Client: highways england

Project: A1 NORTHUMBERLAND

Drawing Title: SECTION A - MORPETH TO FELTON FLOOD RISK

Drawing Status:

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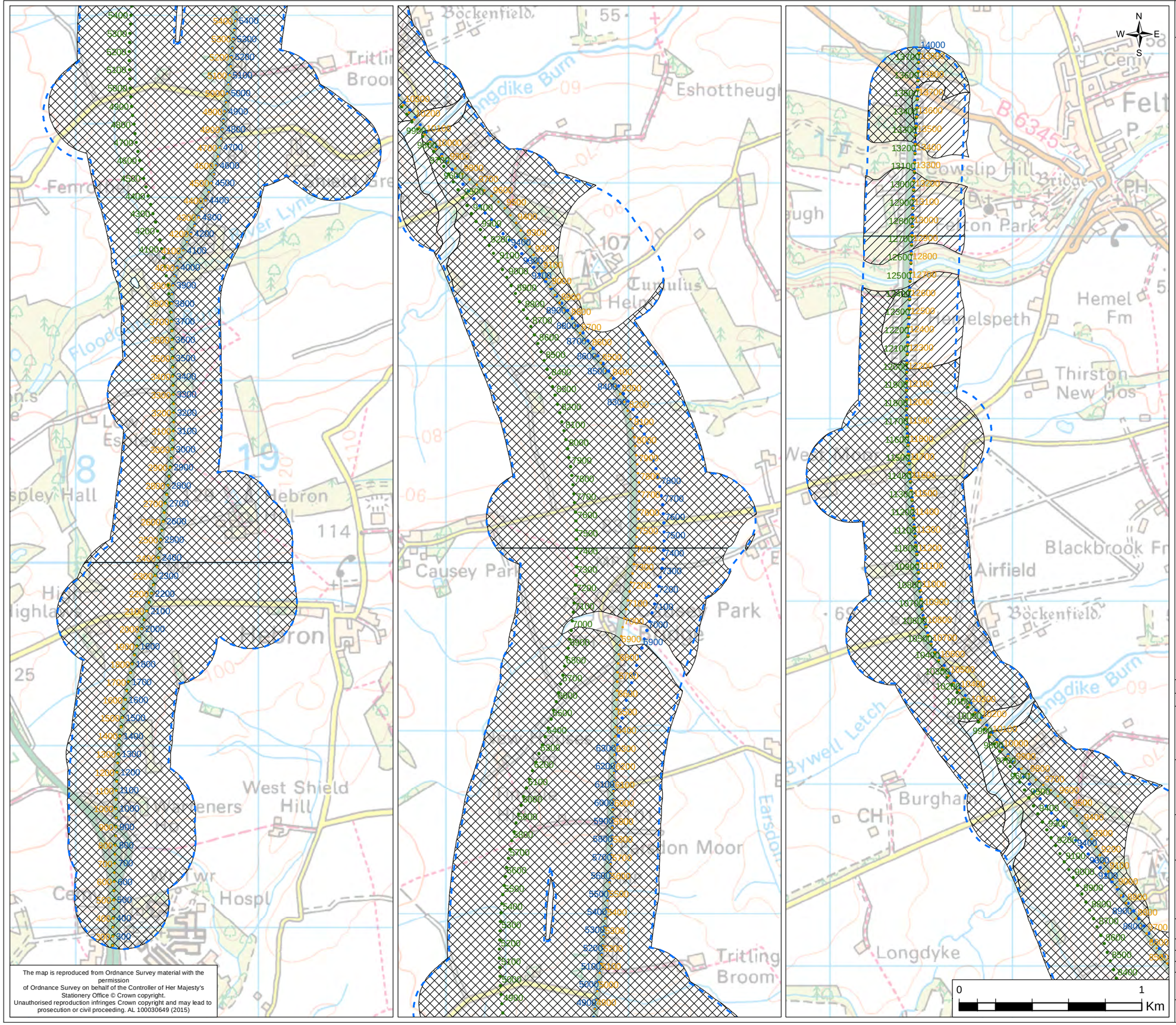
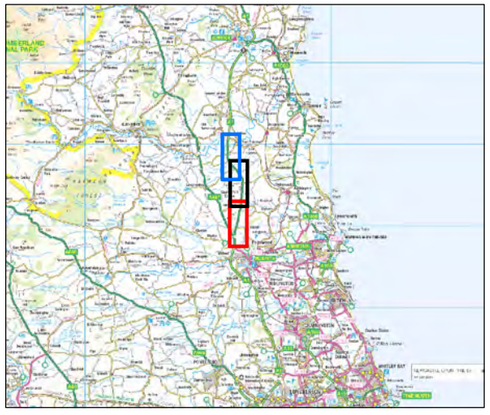
Jacobs No.	B2104700	
Client No.	551459	

Drawing No.: B2104700_PSSR_05a

FIGURE 6A





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Project: A1 NORTHUMBERLAND

Drawing Title: SECTION A - MORPETH TO FELTON SUPERFICIAL HYDROGEOLOGY

Drawing Status

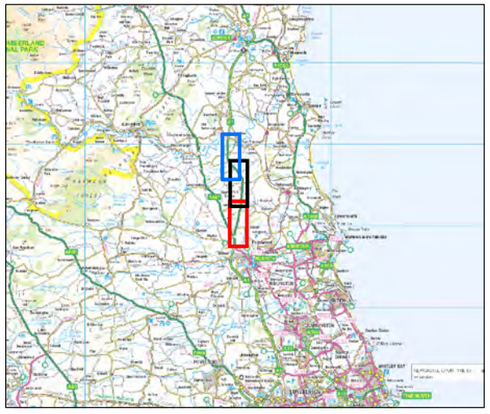
Scale @ A3	1:20,000	DO NOT SCALE
Jacobs No.	B2104700	
Client No.	551459	

Drawing No.: B2104700_PSSR_06a

FIGURE 7A

Legend

- 250m Buffer (all combined options)
- Secondary A Bedrock Aquifer
- Secondary B Bedrock Aquifer



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	NOV 16	Initial Issue	IM	HW	RS	MC

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Client: highways england

Project: A1 NORTHUMBERLAND

Drawing Title: SECTION A - MORPETH TO FELTON
BEDROCK HYDROGEOLOGY

Drawing Status

Scale @ A3	1:20,000	DO NOT SCALE
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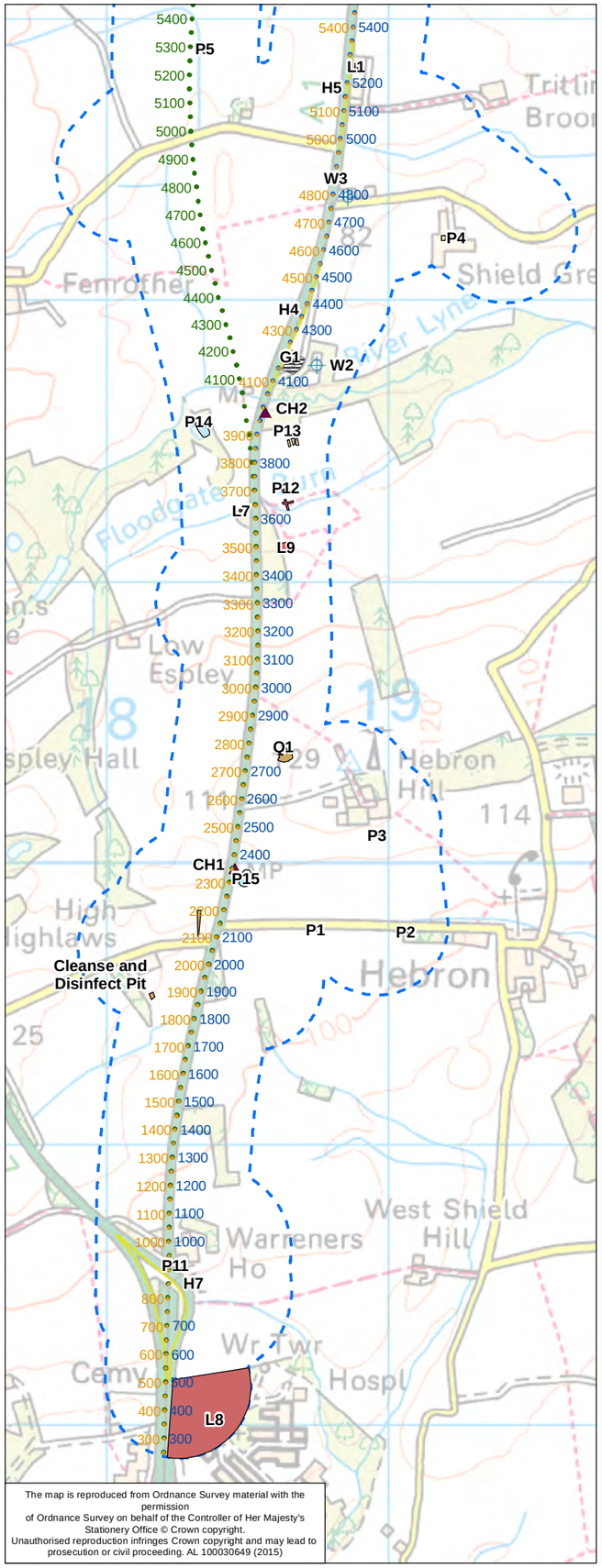
Client No.	551459	

Drawing No.: B2104700_PSSR_07a

0 1 Km

FIGURE 8A



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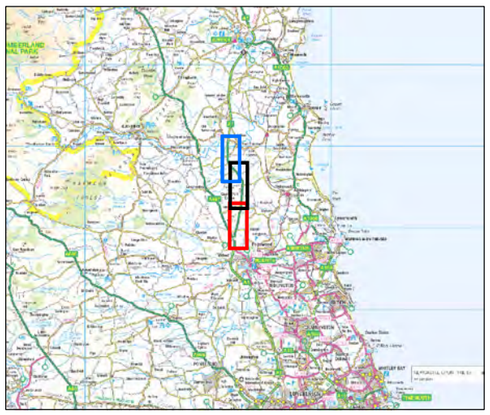
Legend

- 250m Buffer (all combined options)
- BGS Boreholes - See Table 4.15 in Report
- Designated Sites - See Table 4.21 in Report
- Water Pump - See Table 4.12 in Report
- Highways - See table 4.12 in Report
- Carcass Pit - See Section 4.10.2 in Report
- Cleanse and Disinfect Pit - See section 4.10.2 in Report
- Garages See Table 4.12 in Report
- Land Use See Table 4.12 in Report
- Infilled Pond - See table 4.12 in Report
- Present Pond - See Table 4.6 in Report
- RAF - See Table 4.12 in Report
- Quarries - See Table 4.12 in Report



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Project: A1 NORTHUMBERLAND

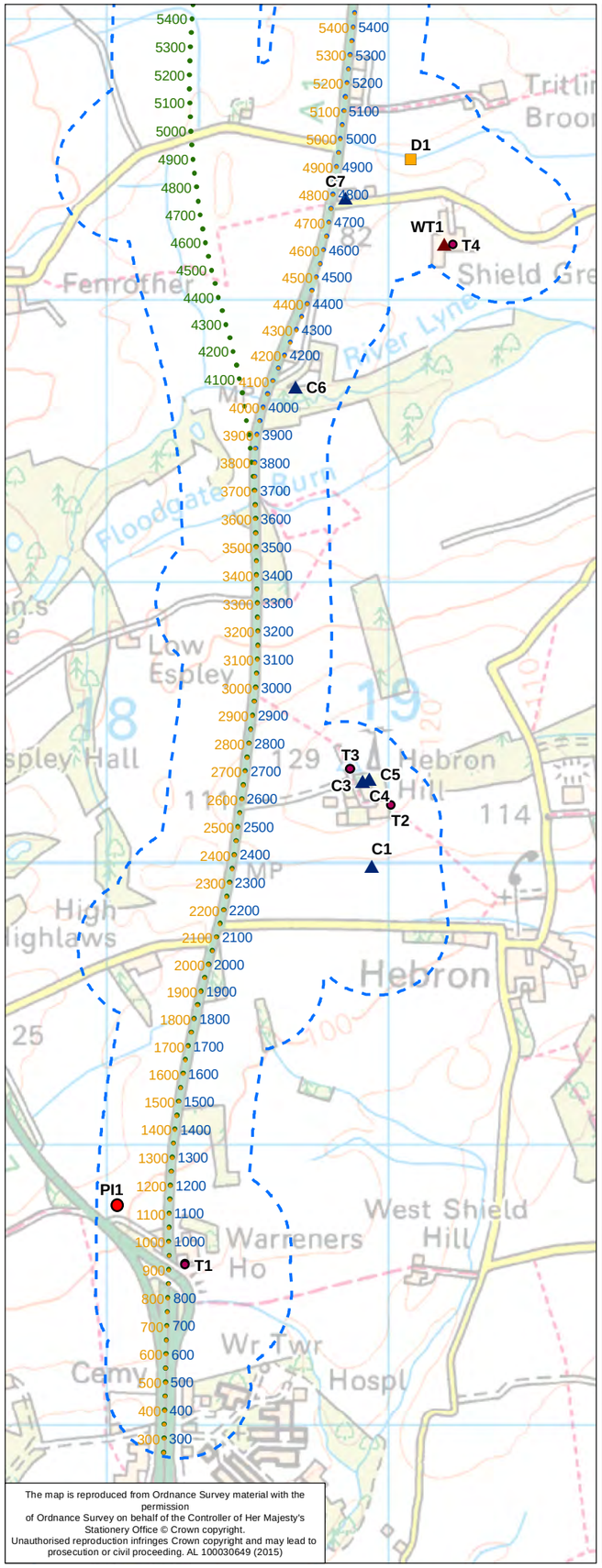
Drawing Title: SECTION A - MORPETH TO FELTON HISTORICAL LAND USE

Drawing Status

Scale @ A3	1:20,000	DO NOT SCALE
Jacobs No.	B2104700	
Client No.	551459	

Drawing No. B2104700_PSSR_08a

FIGURE 9A



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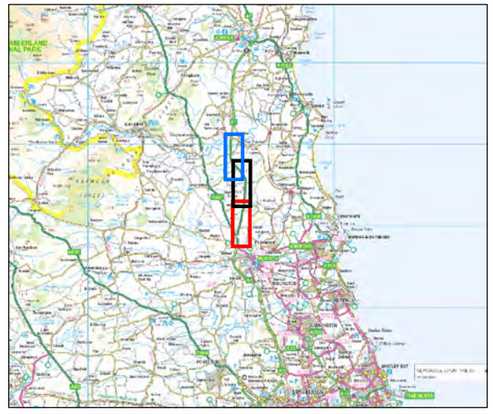
Legend

- 250m Buffer (all combined options)
- Tanks - See Table 4.13 in report
- Current Land Use - See Table 4.11 in report
- Discharge Consents - See Table 4.19 in report
- Groundwater Abstractions - See Table 4.10 in report
- Pollution Incidents - See Table 4.20
- Waste Transfer Stations - See Table 4.18 in report
- Historic Landfills - See Table 4.17 in report
- Site of Special Scientific Interest



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Client: highways england

Project: A1 NORTHUMBERLAND

Drawing Title: SECTION A - MORPETH TO FELTON WASTE

Drawing Status:

Scale @ A3	1:20,000	DO NOT SCALE
Jacobs No.	B2104700	
Client No.	551459	

Drawing No.: B2104700_PSSR_09a

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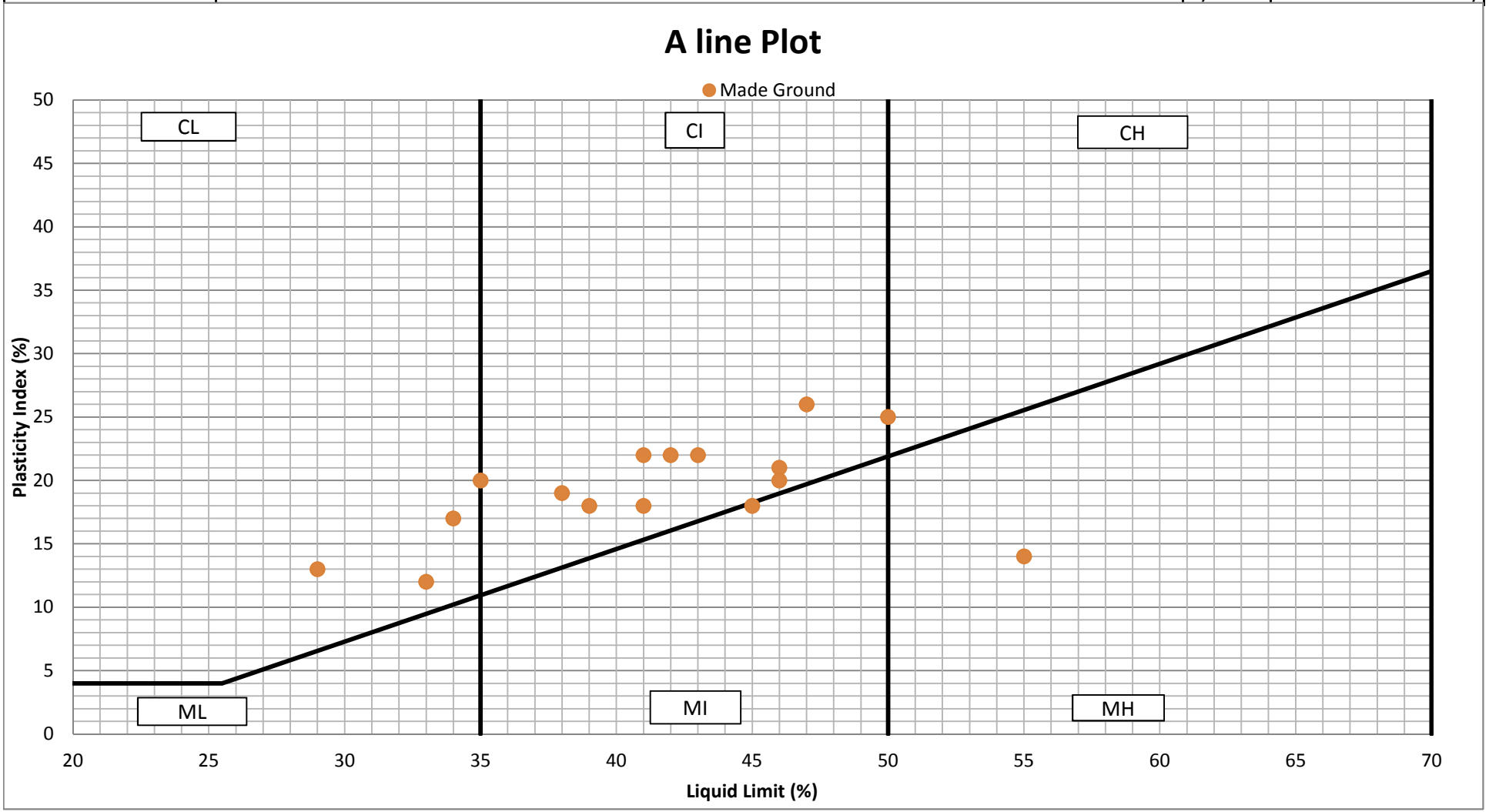
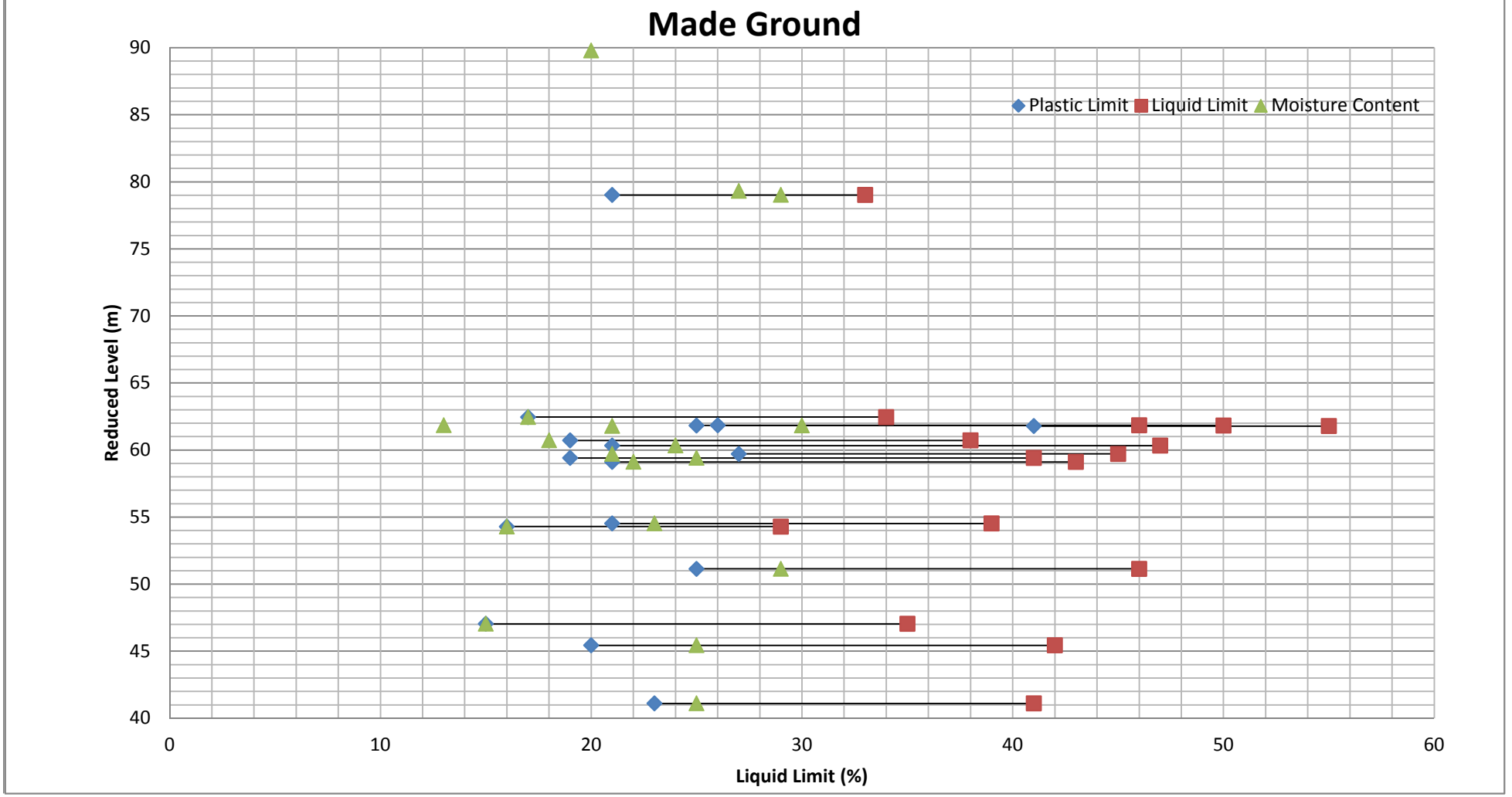
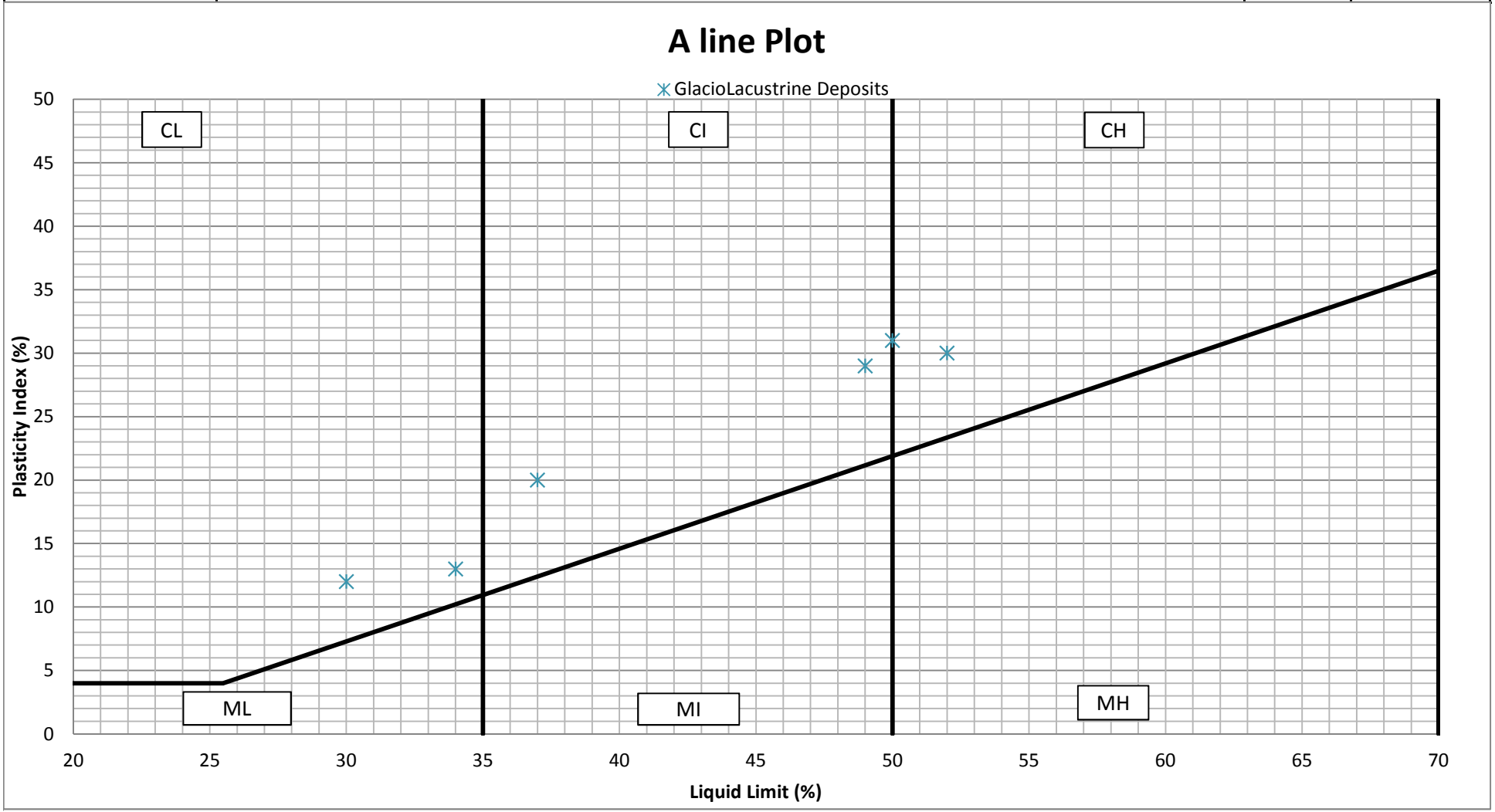
		By	Simon Berry



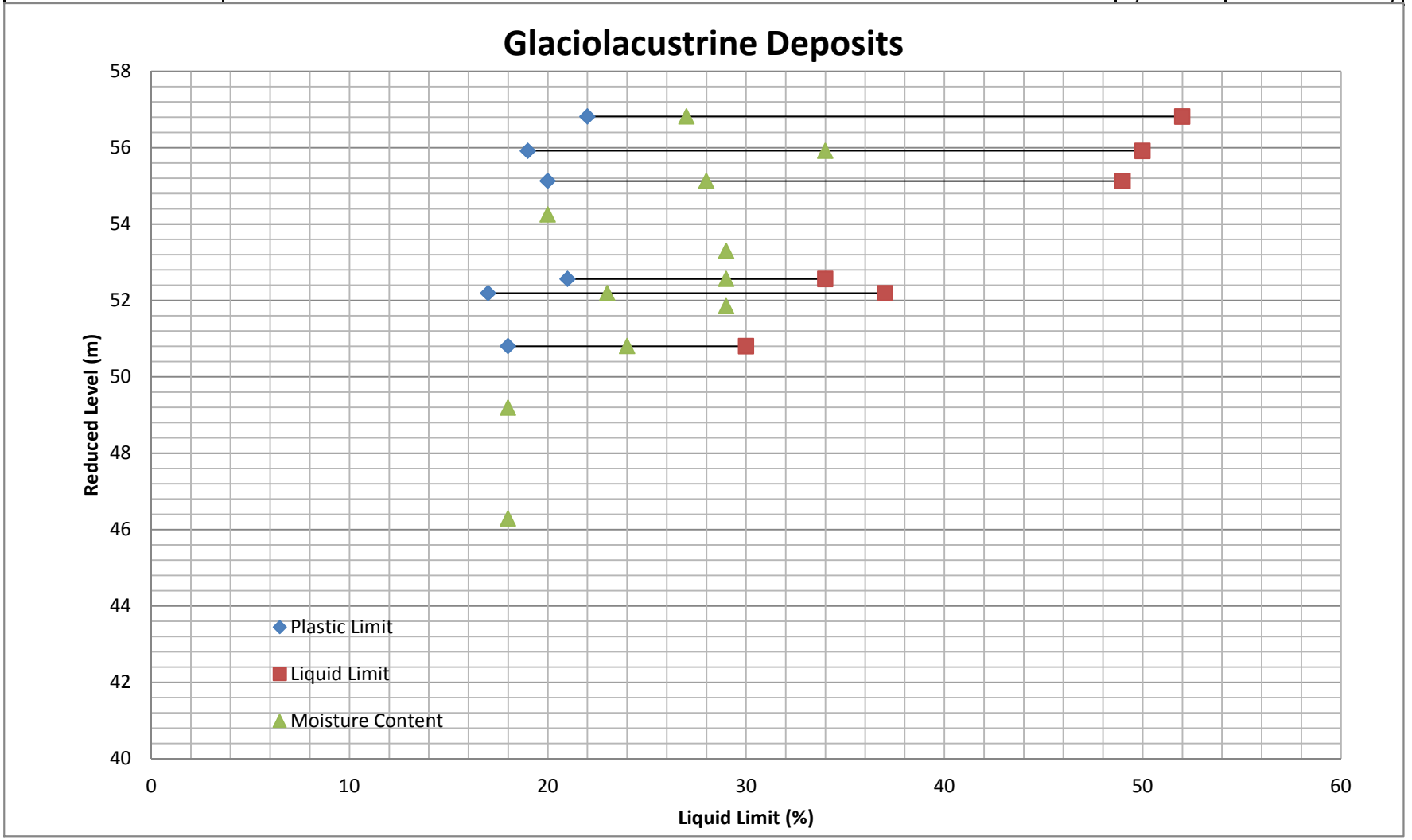
JACOBS	A1 Morpeth to Felton - Figure B11 Made Ground	Date	25/11/2016
		By	Simon Berry



JACOBS	A1 Morpeth to Felton - Figure B12 Glacio Lacustrine	Date	25/11/2016
		By	Simon Berry



JACOBS	A1 Morpeth to Felton - Figure B13 Glaciolacustrine Deposits	Date	25/11/2016
		By	Simon Berry



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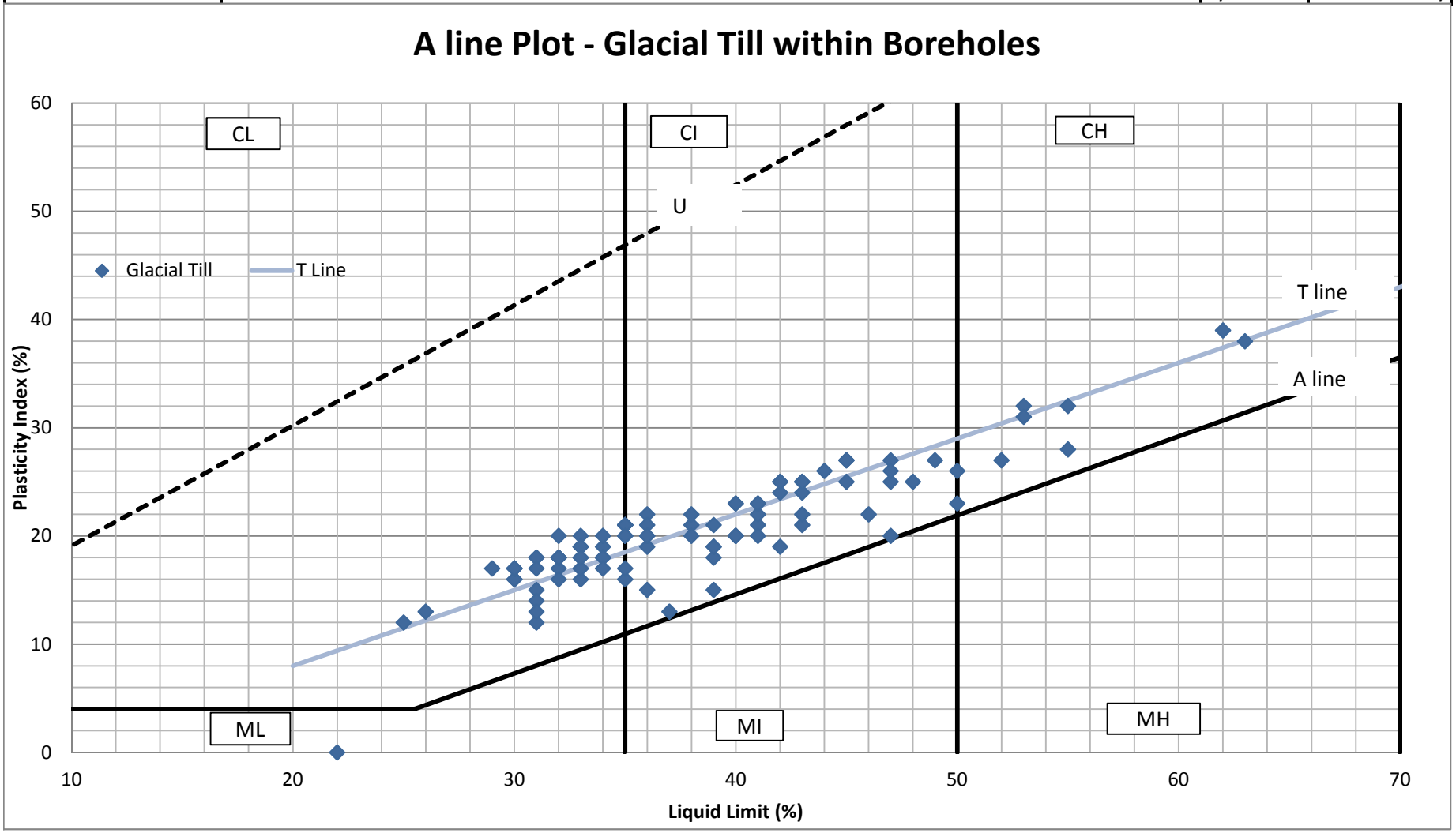
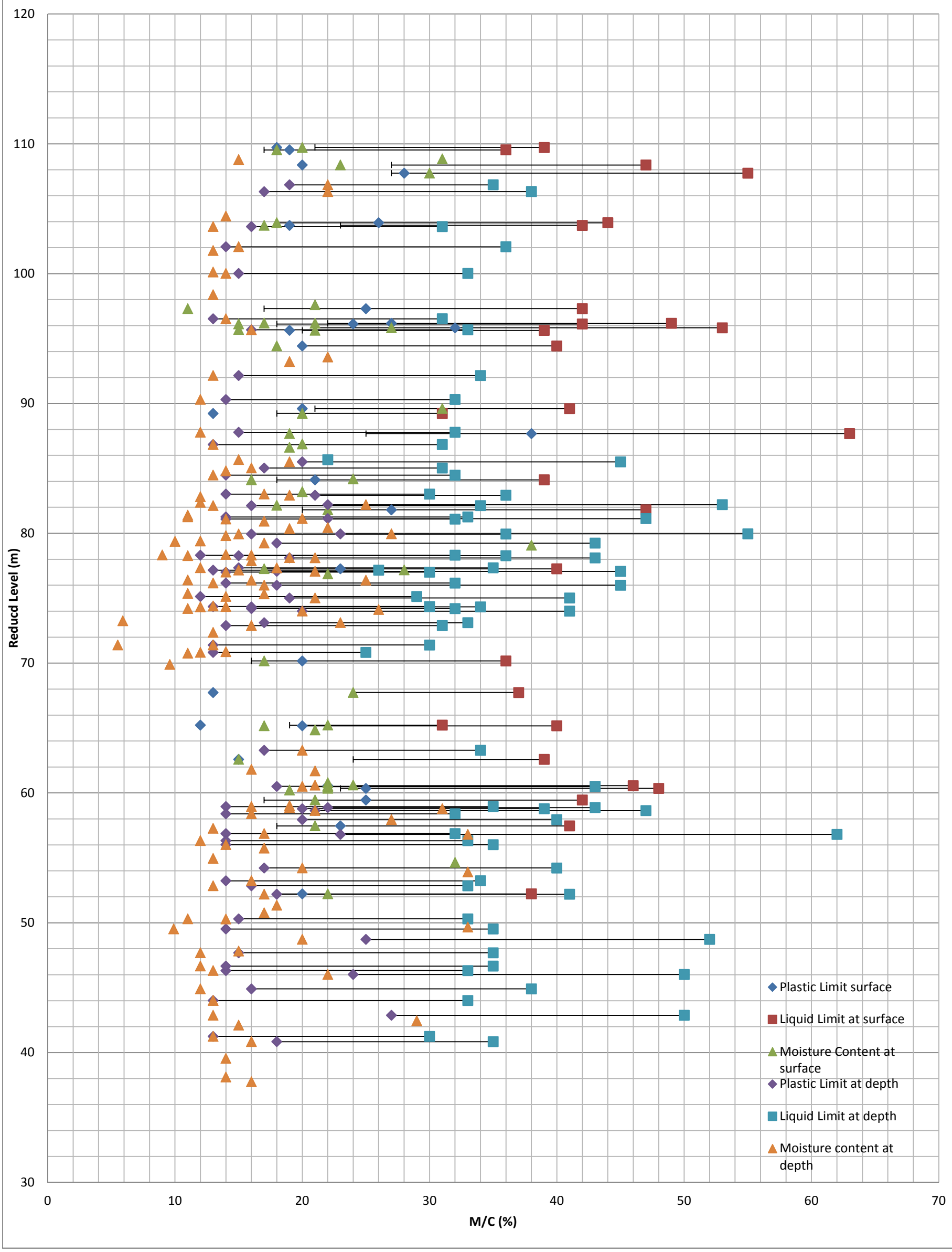
		By	Simon Berry



JACOBS	A1 Morpeth to Felton - Figure B16 Glacial Till within boreholes	Date	25/11/2016
		By	Simon Berry



N

History of rotational slips in glacial deposits

20m
20m
11.5m
3.3m
5.7m
1.75m
19.25m
21.55m
25.53m
25m
1.45m
5m
8.3m
7.8m
9.3m
3m
14m
7.7m
19.35m
17.3m
17.3m
17.4m
17m
5.4m

KEY

On-line Route Option A

On-line Route Option B

On-line Route Option C

Off-line Route Option

1.0m Depth to rockhead 0 - 5m

1.0m Depth to rockhead 5 - 10m

1.0m Depth to Rockhead 10 - 15m

1.0m Depth to Rockhead 15 + m

JACOBS

Highways England

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

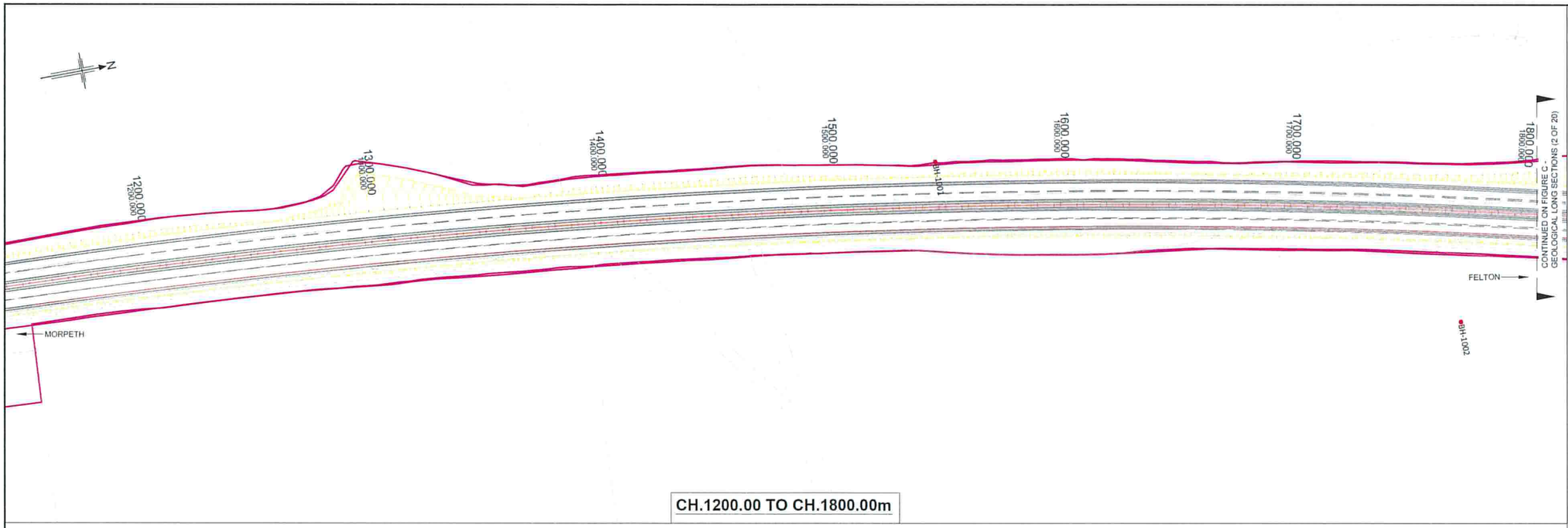
GLACIAL TILL THICKNESS
MORPETH TO FELTON

WORKING DRAWING

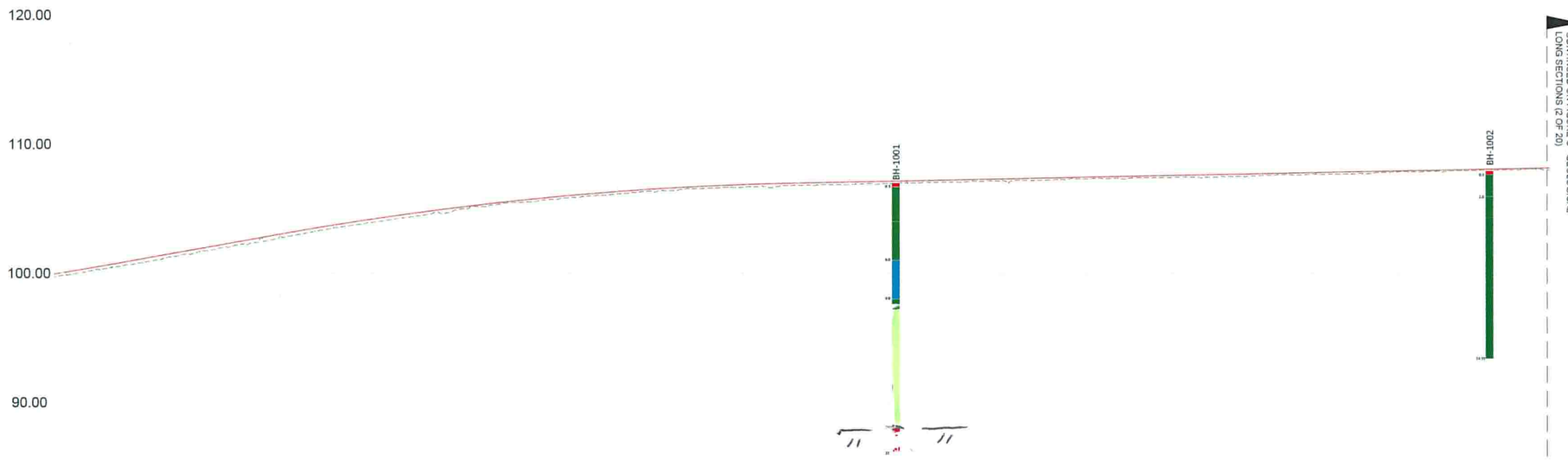
FIGURE 1

Rev 0

Appendix C - Geological Long Sections



CH.1200.00 TO CH.1800.00m



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EXISTING GROUND LEVEL	99.587	99.927	100.220	100.551	100.905	101.316	101.650	102.019	102.297	102.698	103.071	103.453	103.709	104.015	104.297	104.652	104.936	105.200	105.400	105.593	105.756	105.921	106.097	106.255	106.333	106.494	106.574	106.640	106.601	106.749	106.793	106.803	106.829	106.949	106.993	107.000	107.062	107.109	107.139	107.219	107.263	107.272	107.336	107.328	107.399	107.394	107.450	107.529	107.612	107.647	107.629	107.669	107.761	107.813	107.831	107.901	107.926	107.979	107.978

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- UNIT E - Glacial Till
- UNIT F - Bedrock
- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

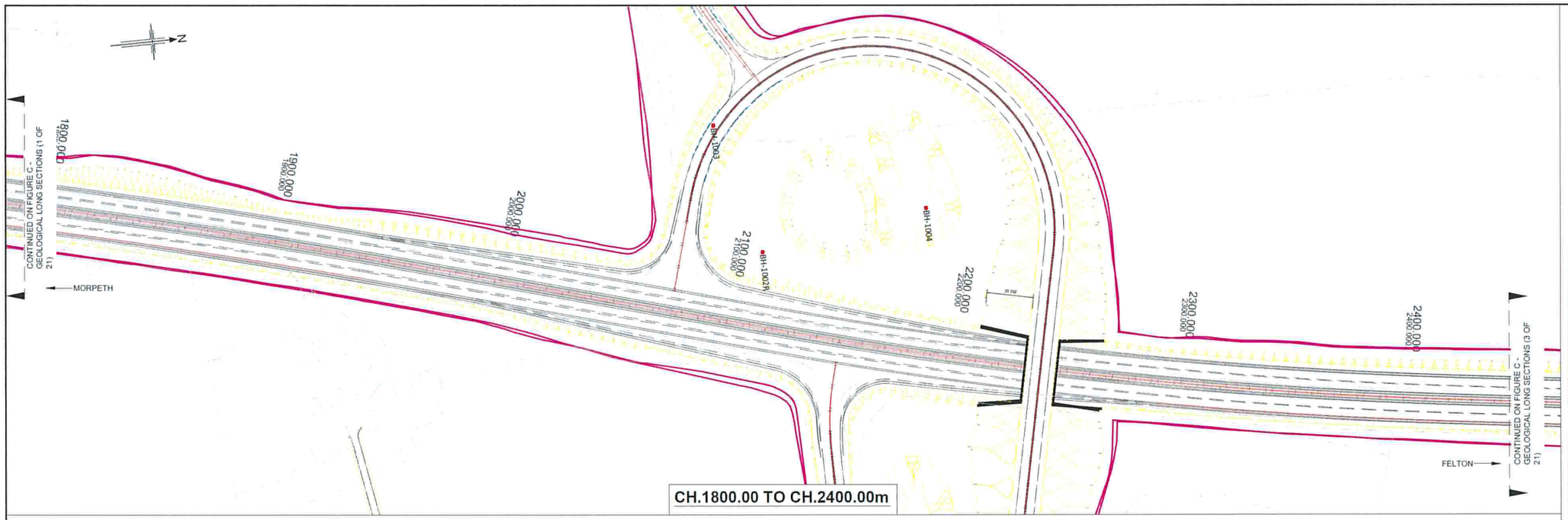
Drawing title

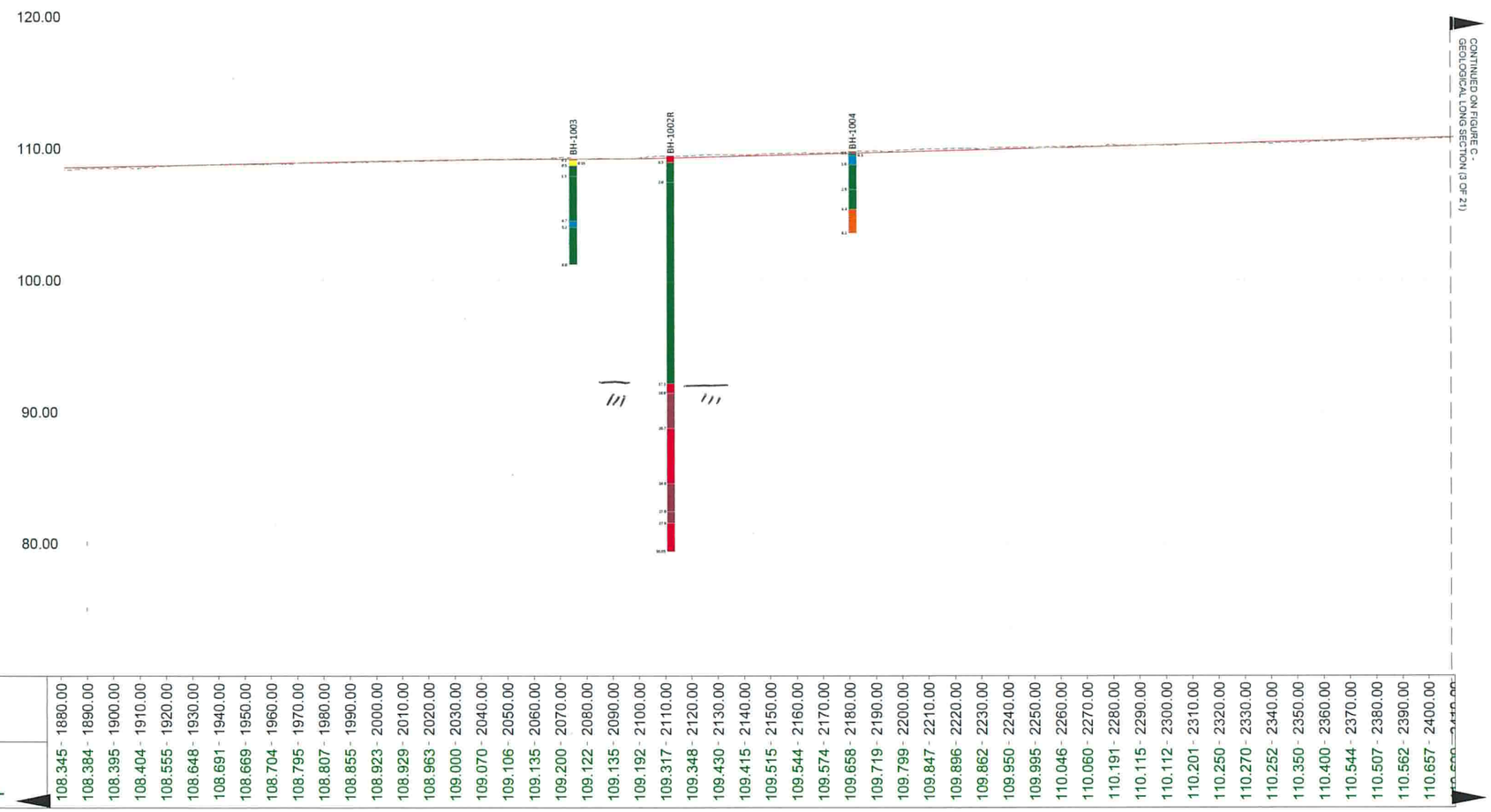
FIGURE C
GEOLOGICAL LONG SECTIONS
(1 OF 20)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0

P:\B2000000\B2104700 - A1 Northumberland\Calculations\Geotechnical\Working Drawings\Drawings and sketches\Geological Long Sections\FIGURE C - GEOLOGICAL LONG SECTIONS 13 SHEETS.dwg - 15/12/2016 14:53:35 - 1 - kelsalw





M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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WORKING DRAFT

Rev.	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
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-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

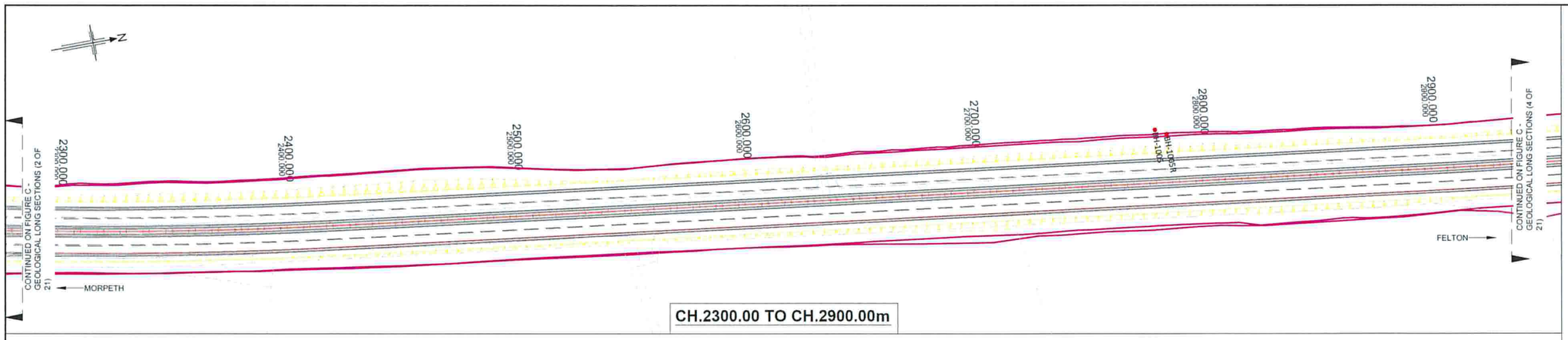
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title

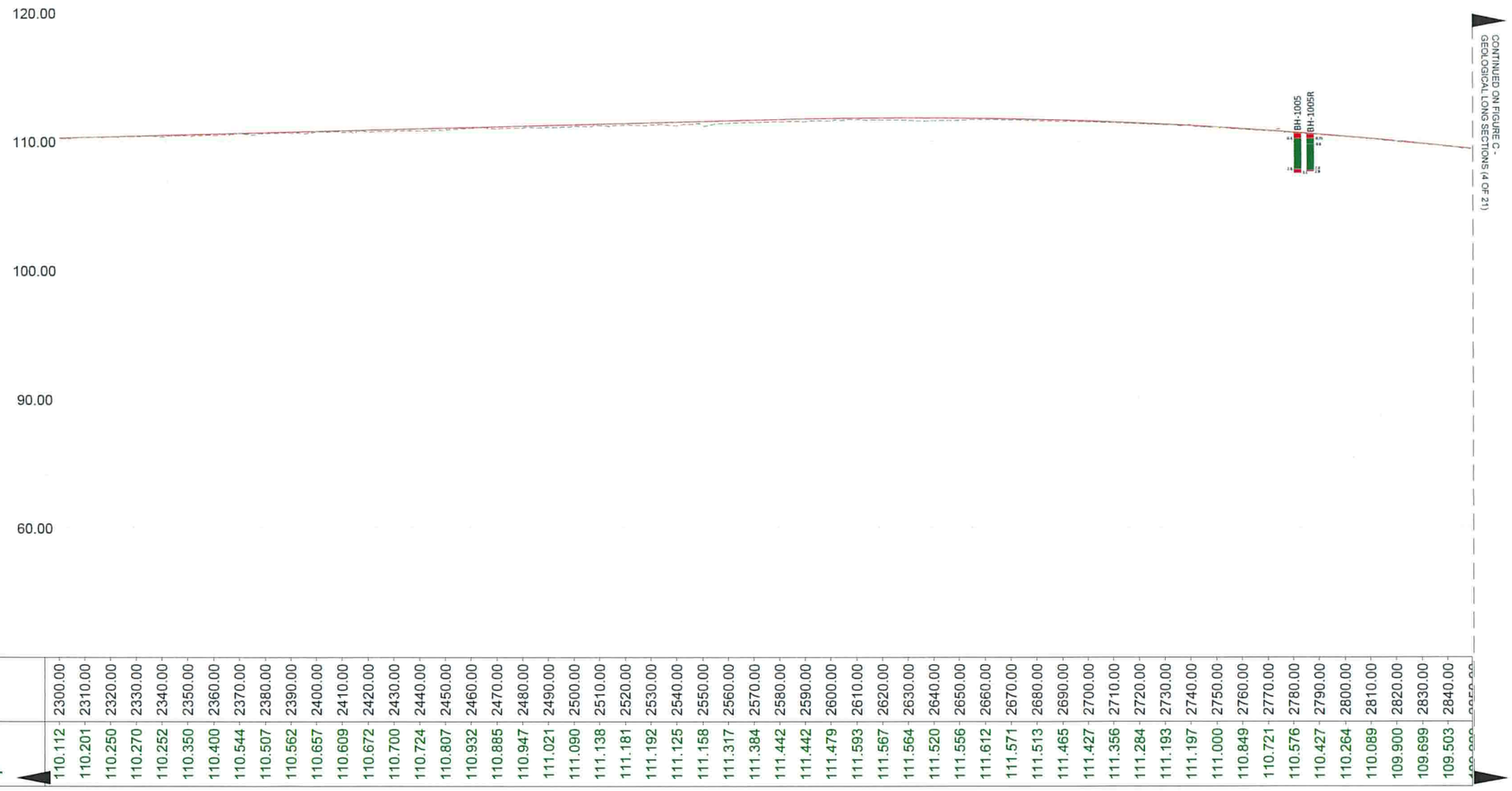
FIGURE C
GEOLOGICAL LONG SECTIONS
(2 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0



CH.2300.00 TO CH.2900.00m



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EXISTING GROUND LEVEL	110.112	110.201	110.250	110.270	110.252	110.350	110.400	110.544	110.507	110.562	110.657	110.609	110.672	110.700	110.724	110.807	110.932	110.885	110.947	111.021	111.090	111.138	111.181	111.192	111.125	111.158	111.317	111.384	111.442	111.442	111.479	111.593	111.567	111.564	111.520	111.556	111.612	111.571	111.513	111.465	111.427	111.356	111.284	111.193	111.197	111.000	110.849	110.721	110.576	110.427	110.264	110.089	109.900	109.699	109.503

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
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-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(3 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No.	B2104701	
Client no.	551459	
Drawing number		Rev 0

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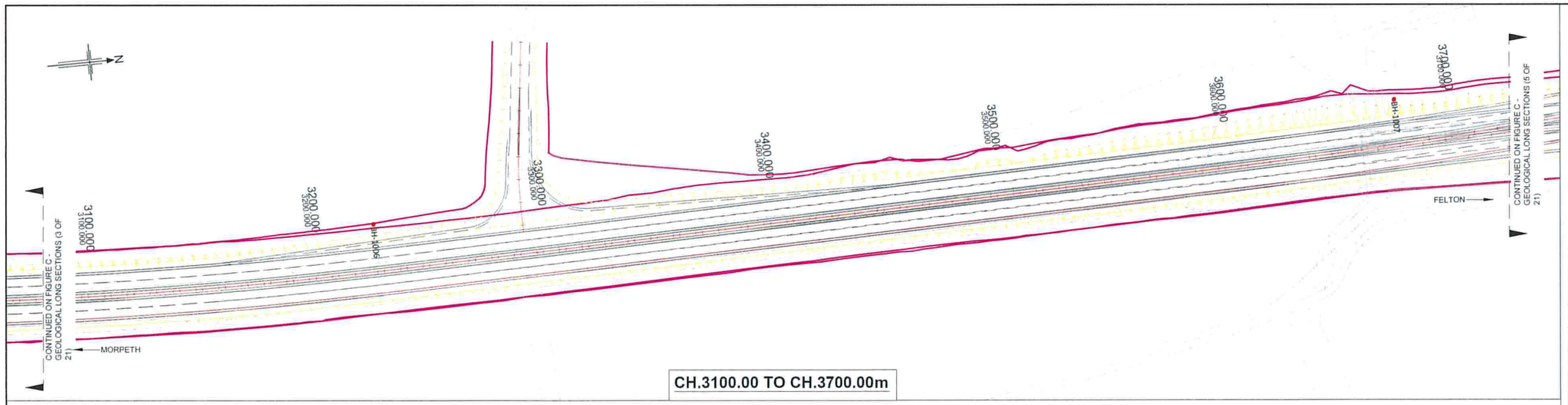
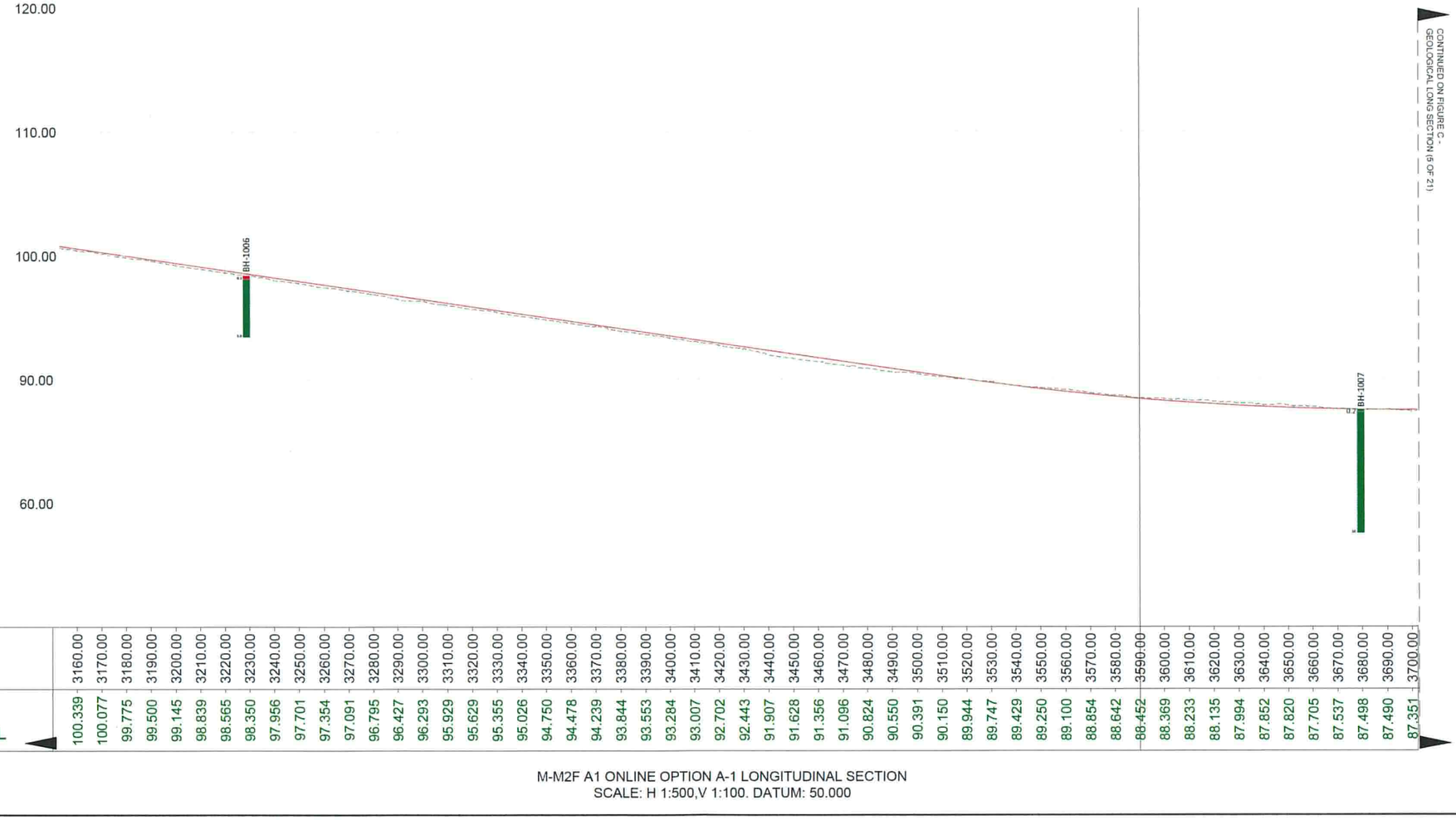


CH.3100.00 TO CH.3700.00m



mAOD 50m

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EXISTING GROUND LEVEL	100.339	100.077	99.775	99.500	99.145	98.839	98.565	98.350	97.956	97.701	97.354	97.091	96.795	96.427	96.293	95.929	95.629	95.355	95.026	94.750	94.478	94.239	93.844	93.553	93.284	93.007	92.702	92.443	91.907	91.628	91.356	91.096	90.824	90.550	90.391	90.150	89.944	89.747	89.429	89.250	89.100	88.854	88.642	88.452	88.369	88.233	88.135	87.994	87.852	87.820	87.705	87.537	87.498	87.490	87.351

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- Coal
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WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Revid	Apprv'd
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-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

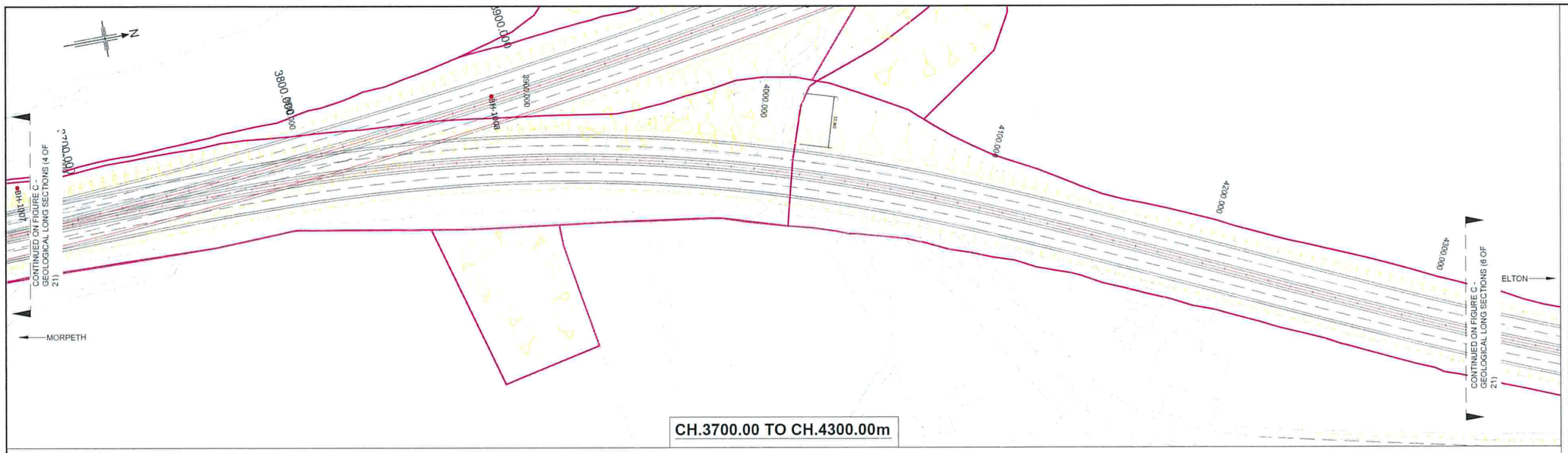
highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

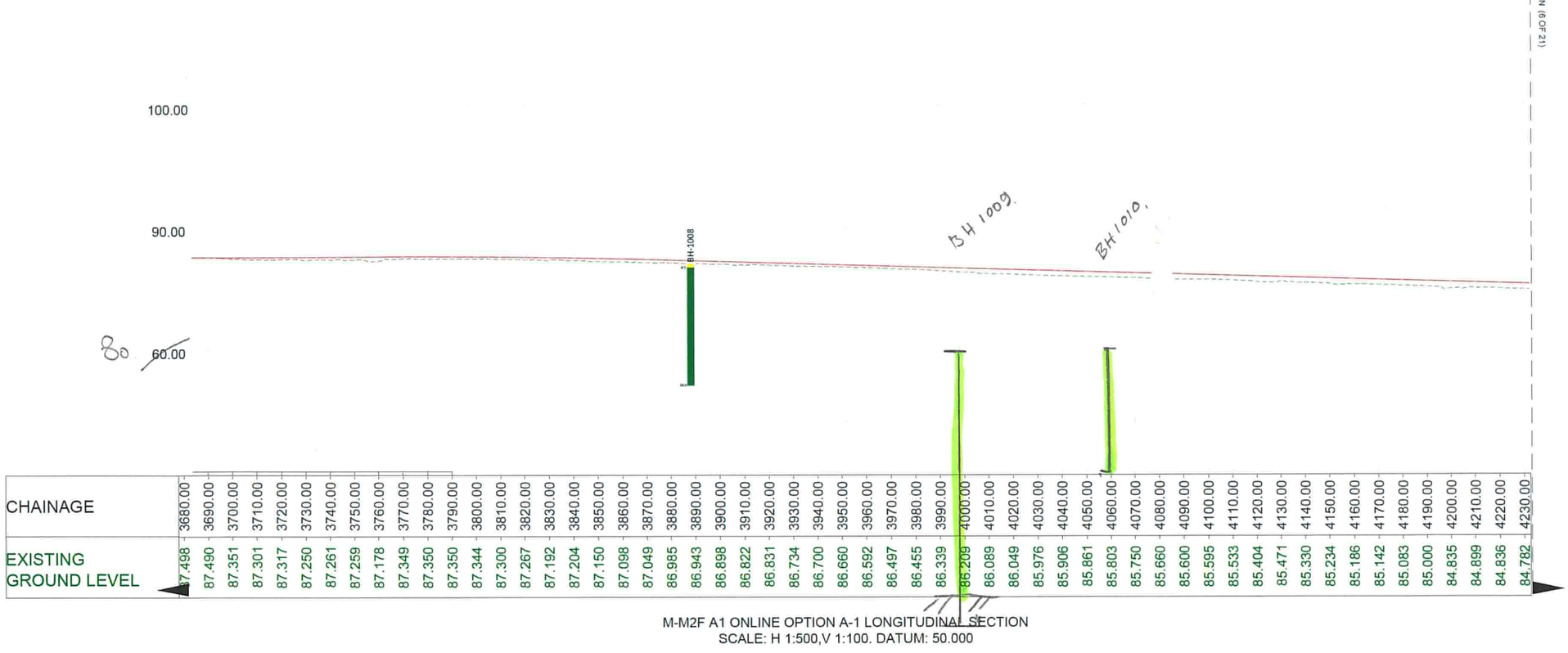
Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(4 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0



CH.3700.00 TO CH.4300.00m



M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
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Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

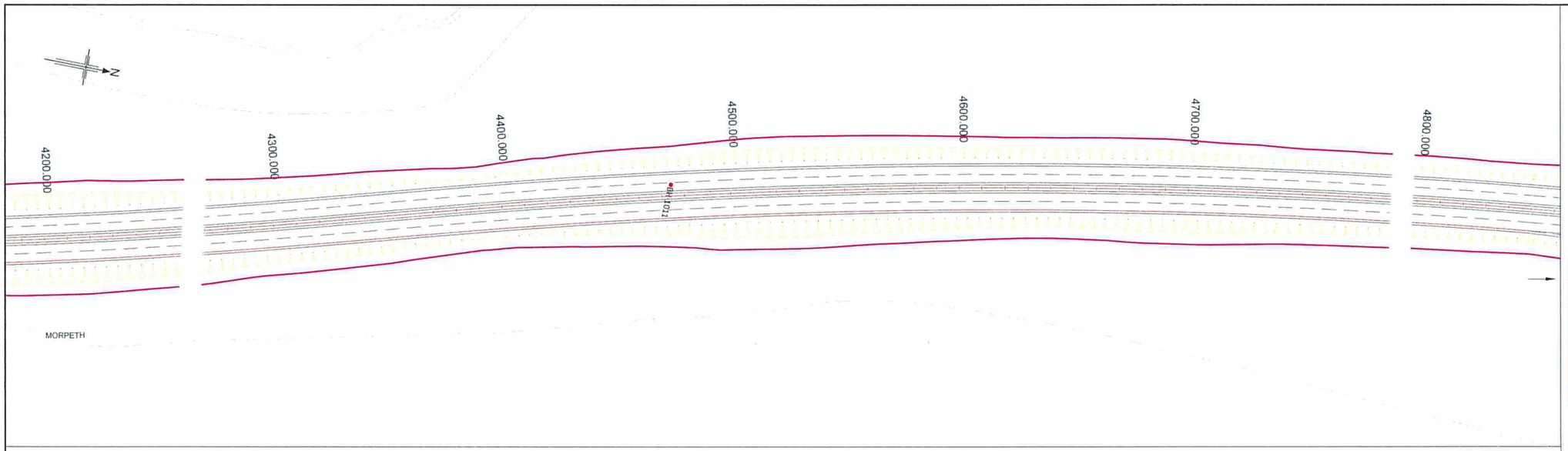
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

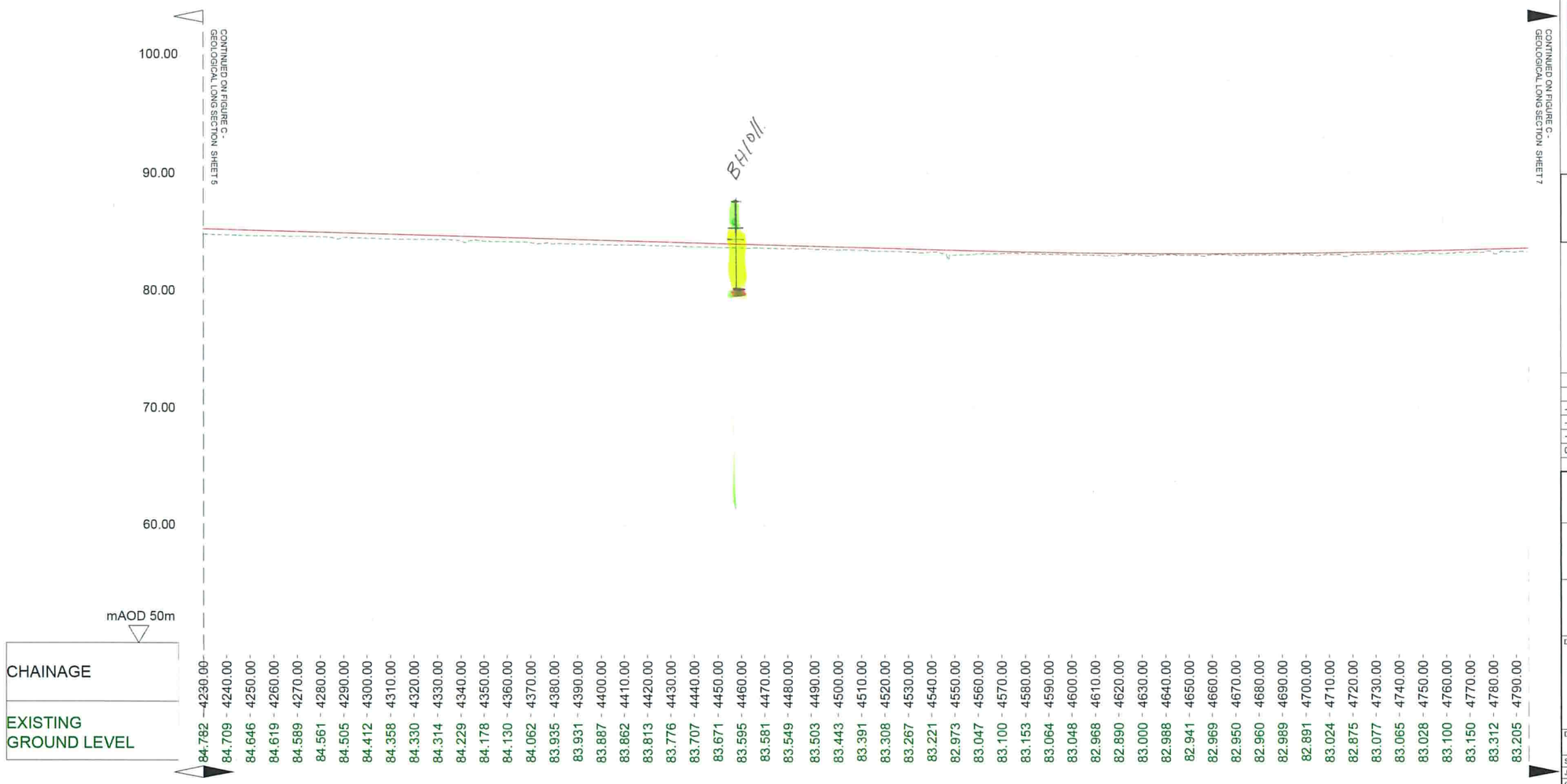
Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(5 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0

P:\B2000000\B2104700 - A1 Northumberland\Calculations\Geotechnical\Working Drawings\Drawings and sketches\Geological Long Sections\FIGURE C - GEOLOGICAL LONG SECTIONS 13 SHEETS.dwg - 15/12/2016 14:56:10 - 5 - kelsalw





M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

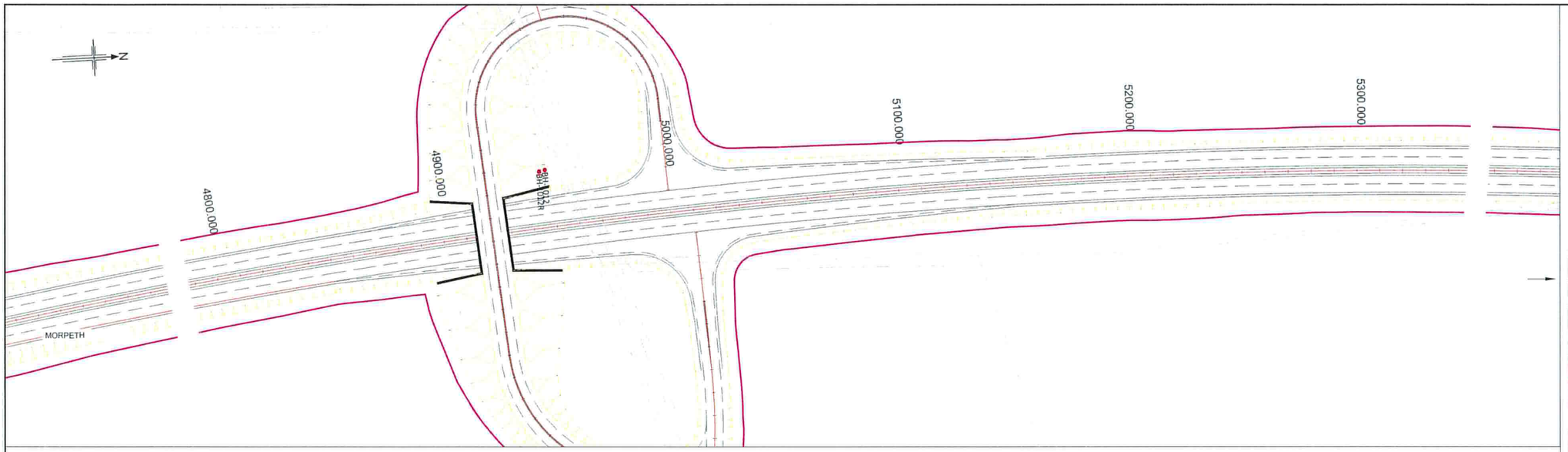
highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(6 OF 21)

Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no.	551459	
Drawing number		Rev 0



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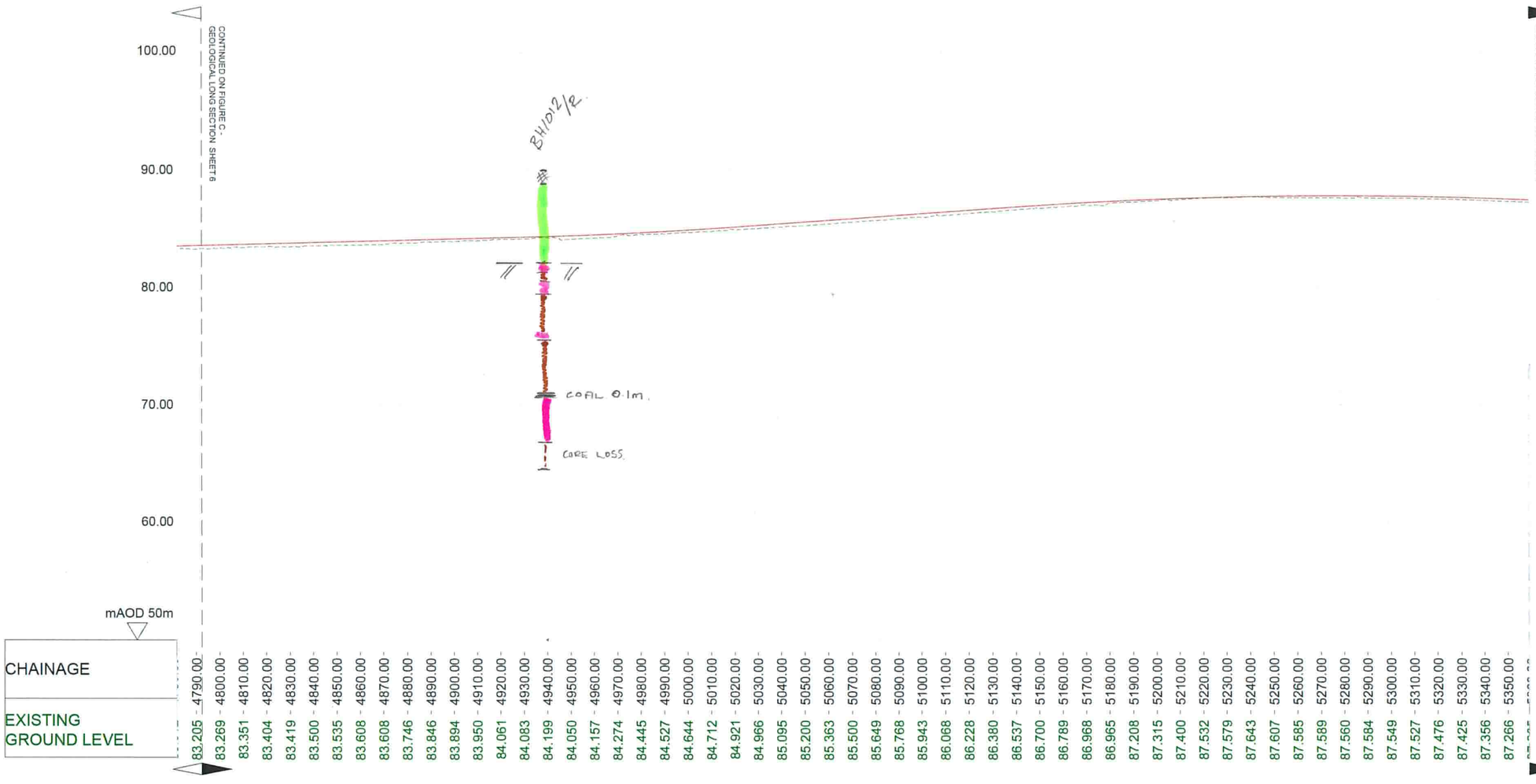
WORKING DRAFT



M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

Rev.	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

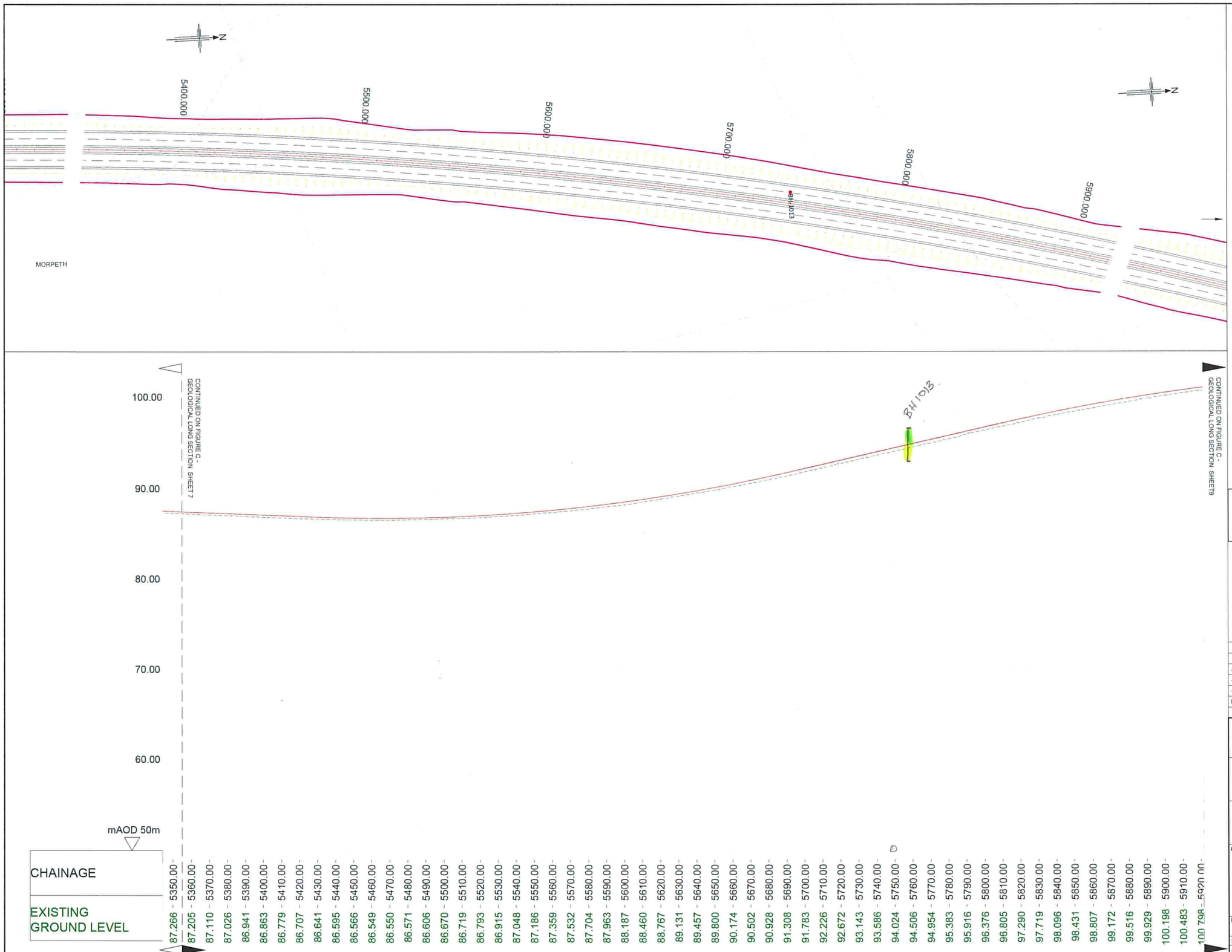
Drawing title

FIGURE C
GEOLOGICAL LONG SECTIONS
(7 OF 21)

Drawing status

WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0



M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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WORKING DRAFT

Rev.	Date	Purpose of revision	Drawn	Checkd	Revid	Apprvd
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-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

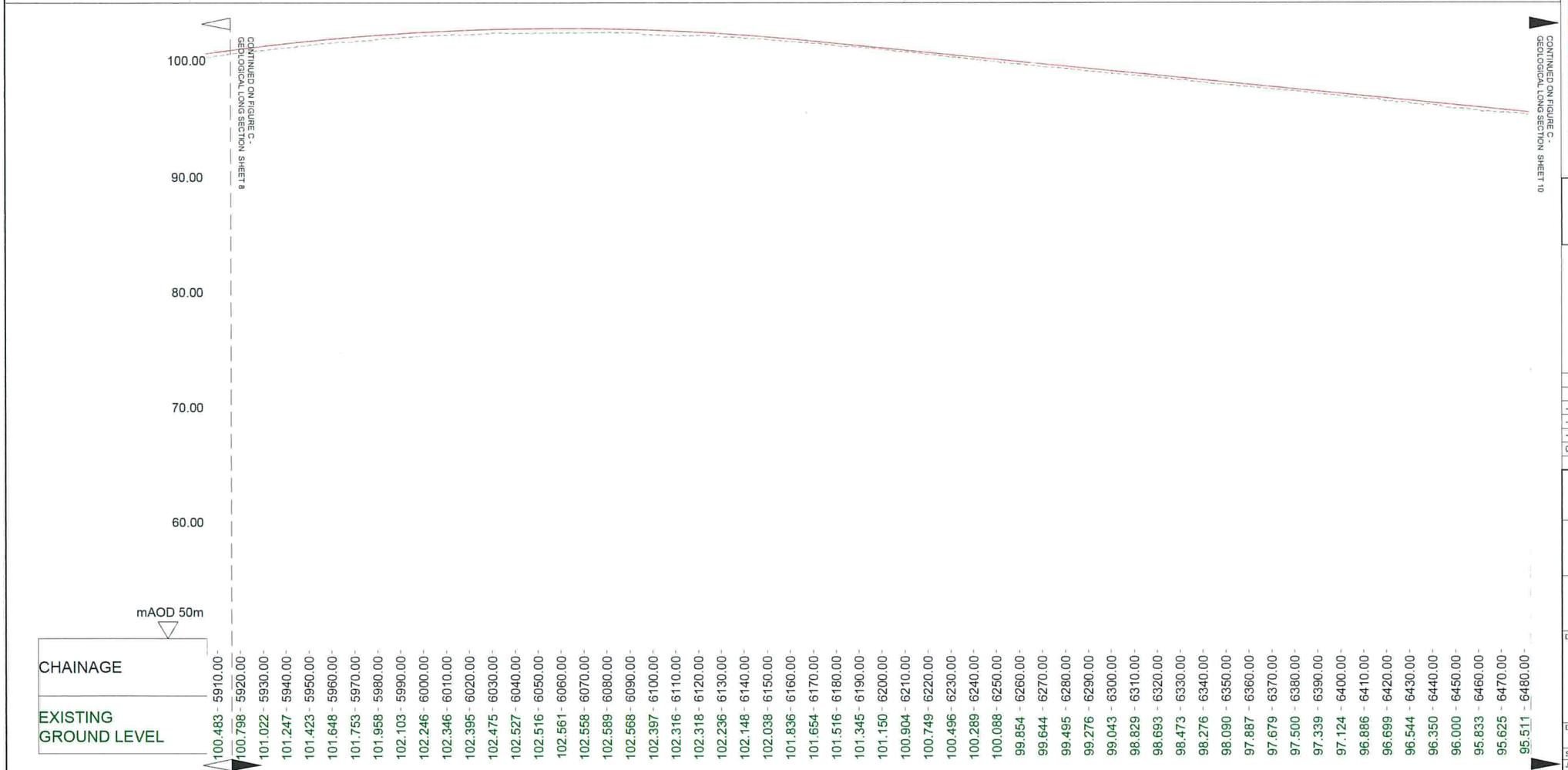
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(8 OF 21)

Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no.	551459	
Drawing number		Rev 0

P:\B2000000\B2104700 - A1 Northumberland\Calculations\Geotechnical\Working Drawings\Drawings and sketches\Geological Long Sections\FIGURE C - GEOLOGICAL LONG SECTIONS 13 SHEETS.dwg - 15/12/2016 14:56:51 - 8 - kelsallw



M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

NOTES:

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- UNIT D - Glaciolacustrine deposits
- UNIT E - Glacial Till
- UNIT F - Bedrock
- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT

Rev.	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(9 OF 21)

Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No.	B2104701	
Client no.	551459	
Drawing number		Rev 0

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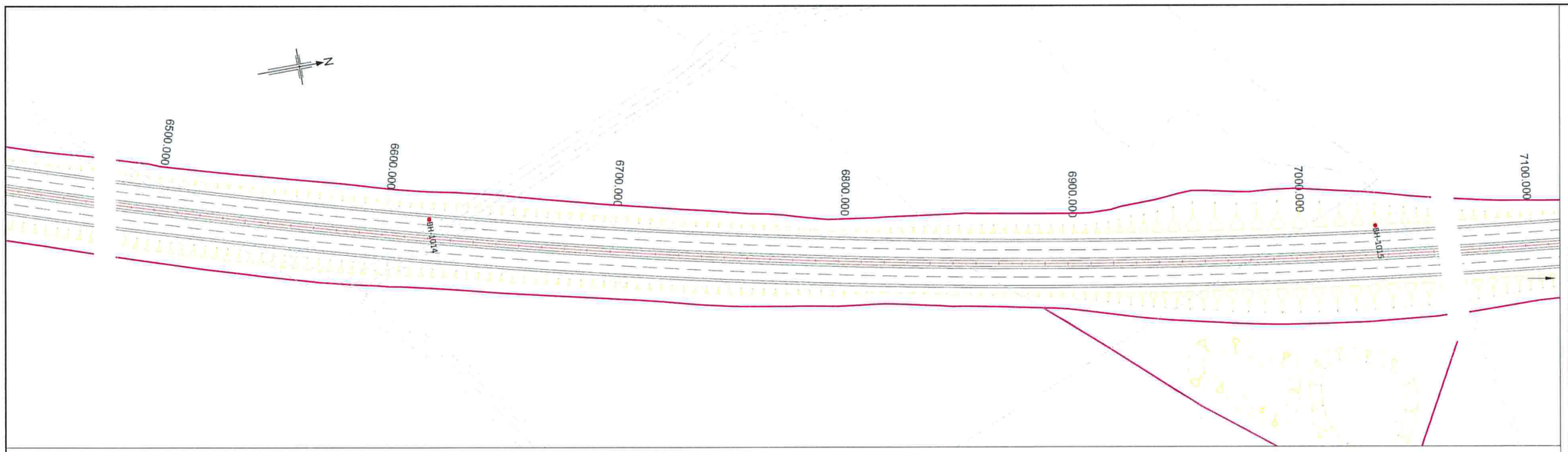

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- UNIT D - Glaciolacustrine deposits
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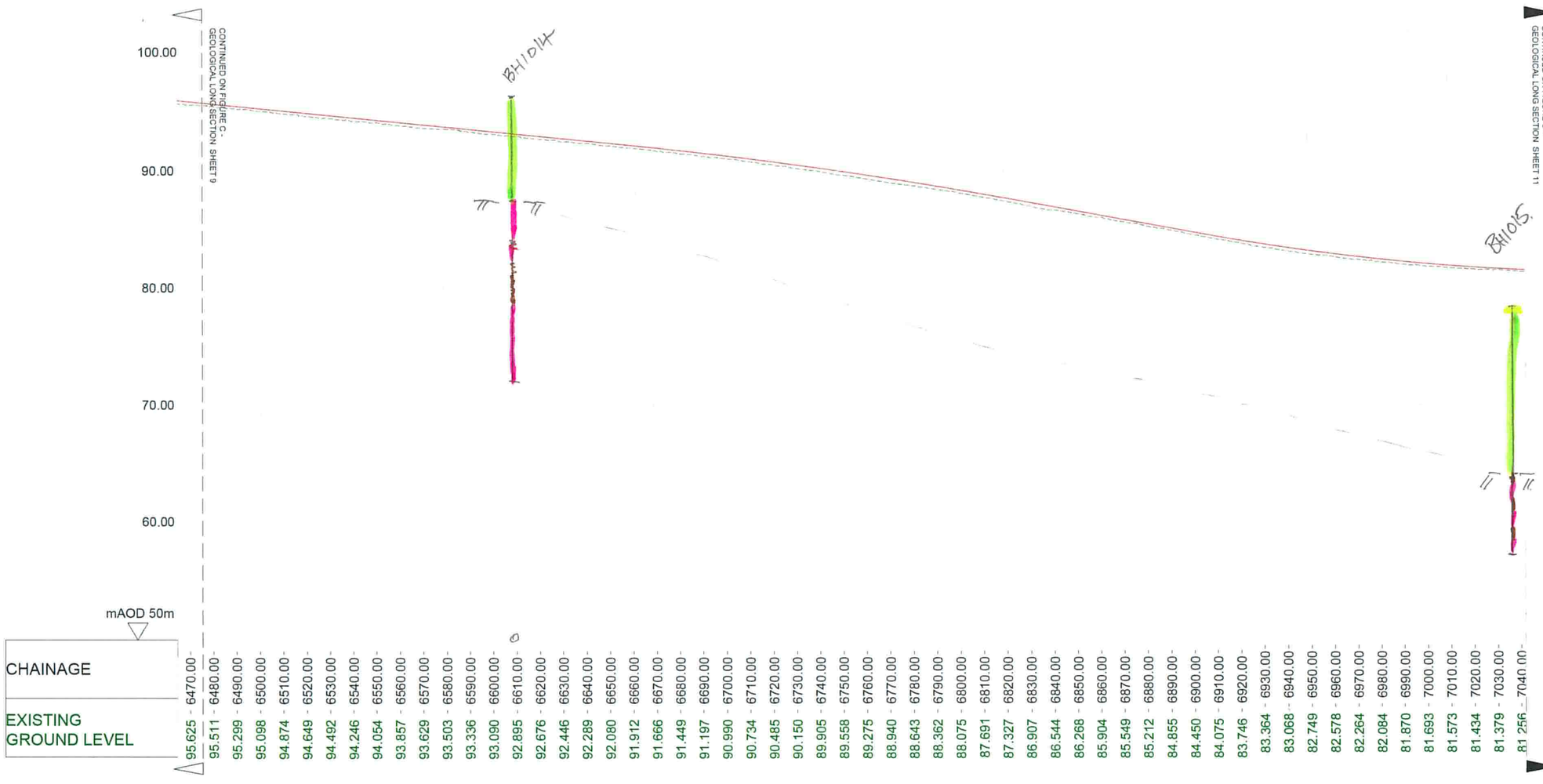
- UNIT F - Bedrock
- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT



M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

Rev.	Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title

FIGURE C
GEOLOGICAL LONG SECTIONS
(10 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0

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- UNIT E - Glacial Till
- UNIT F - Bedrock — interface.
- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

CONTINUED ON FIGURE C - GEOLOGICAL LONG SECTION SHEET 10

CONTINUED ON FIGURE C - GEOLOGICAL LONG SECTION SHEET 12

100.00
90.00
80.00
70.00
60.00

BH1016

mAOD 50m

CHAINAGE	81.256 - 7040.00	81.156 - 7050.00	81.100 - 7060.00	81.050 - 7070.00	81.050 - 7080.00	81.050 - 7090.00	81.085 - 7100.00	81.100 - 7110.00	81.108 - 7120.00	81.150 - 7130.00	81.167 - 7140.00	81.221 - 7150.00	81.263 - 7160.00	81.355 - 7170.00	81.403 - 7180.00	81.477 - 7190.00	81.567 - 7200.00	81.616 - 7210.00	81.700 - 7220.00	81.726 - 7230.00	81.826 - 7240.00	81.812 - 7250.00	81.851 - 7260.00	81.903 - 7270.00	81.908 - 7280.00	81.909 - 7290.00	81.949 - 7300.00	82.020 - 7310.00	82.049 - 7320.00	82.049 - 7330.00	82.106 - 7340.00	82.142 - 7350.00	82.157 - 7360.00	82.201 - 7370.00	82.267 - 7380.00	82.296 - 7390.00	82.318 - 7400.00	82.351 - 7410.00	82.375 - 7420.00	82.325 - 7430.00	82.349 - 7440.00	82.323 - 7450.00	82.327 - 7460.00	82.251 - 7470.00	82.323 - 7480.00	82.365 - 7490.00	82.384 - 7500.00	82.385 - 7510.00	82.485 - 7520.00	82.550 - 7530.00	82.417 - 7540.00	82.327 - 7550.00	82.355 - 7560.00	82.400 - 7570.00	82.517 - 7580.00	82.629 - 7590.00	82.681 - 7600.00
EXISTING GROUND LEVEL																																																			

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Appr'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

WORKING DRAFT

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title

FIGURE C
GEOLOGICAL LONG SECTIONS
(11 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0

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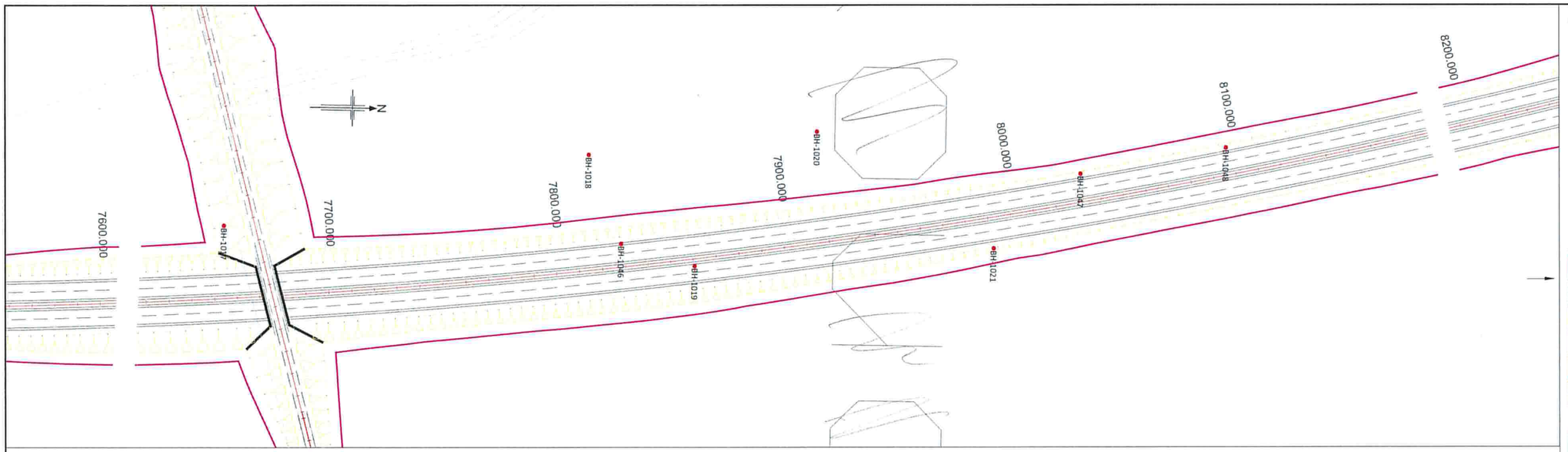

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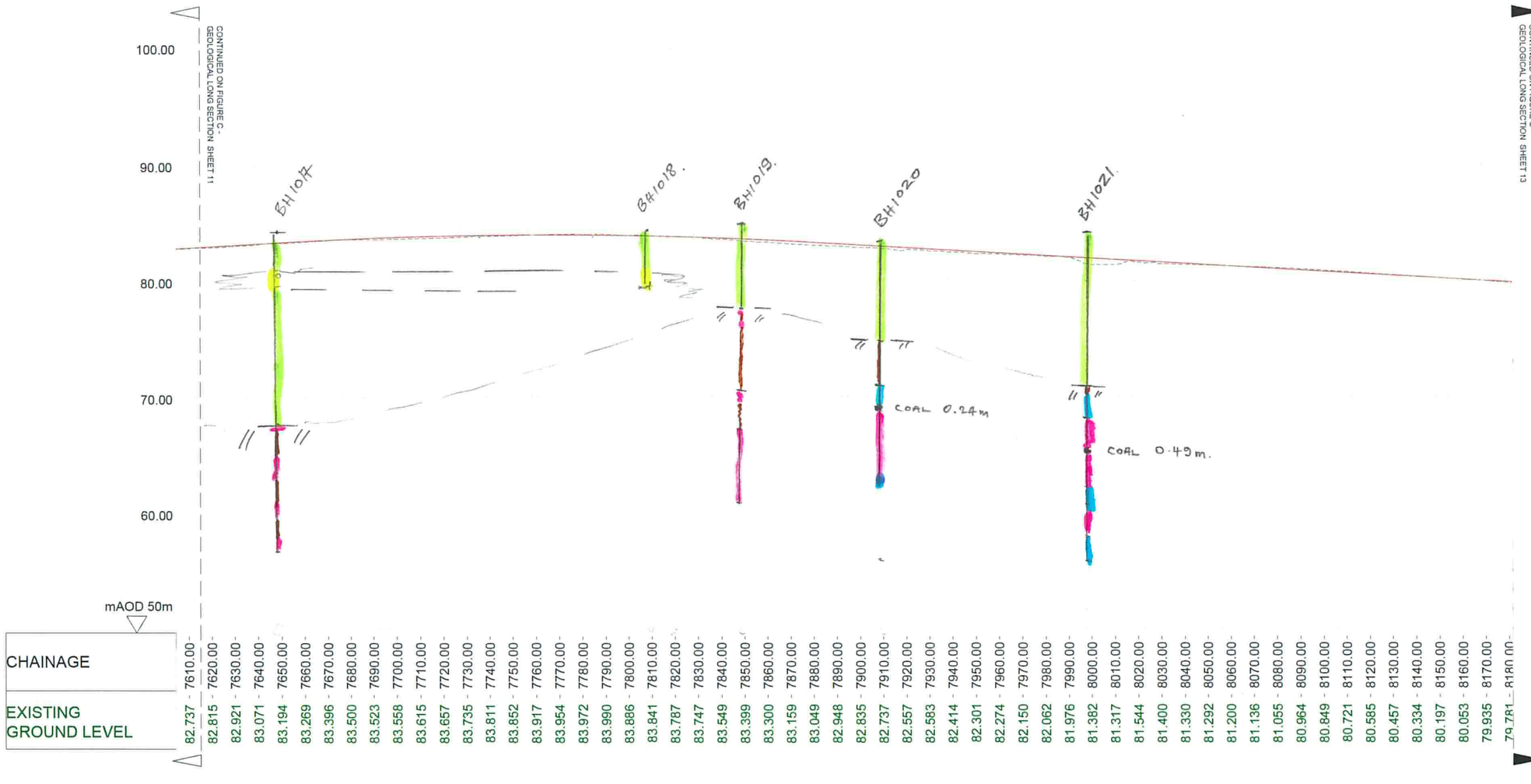
- UNIT F - Bedrock
- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT



M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-
Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(12 OF 21)

Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No.	B2104701	
Client no.	551459	
Drawing number		Rev 0

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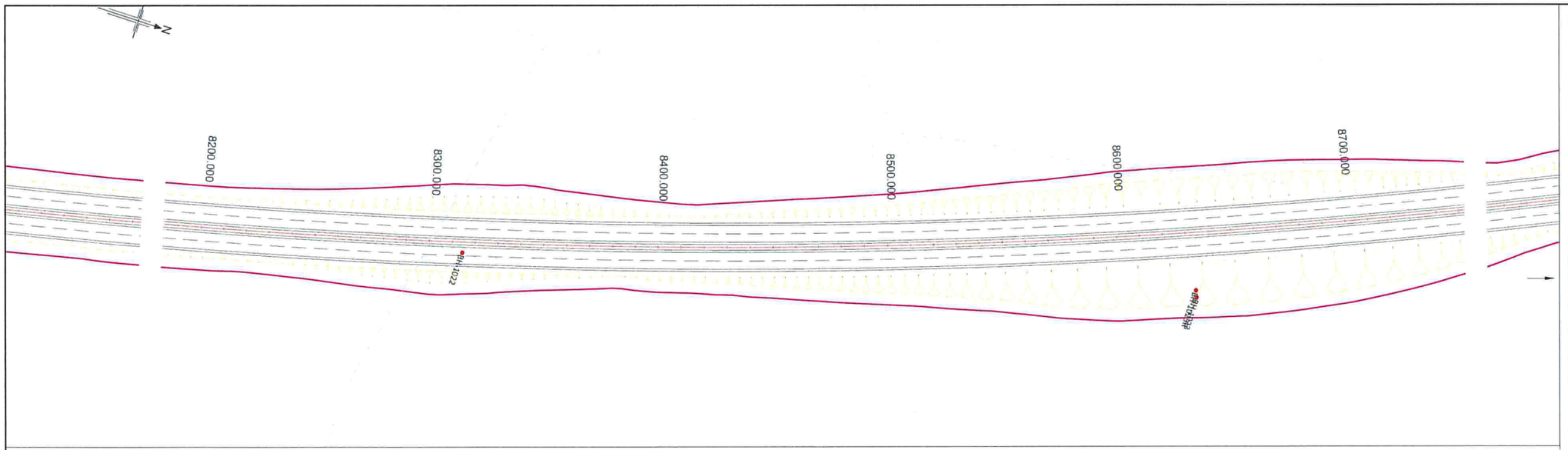

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- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

CONTINUED ON FIGURE C - GEOLOGICAL LONG SECTION SHEET 12

CONTINUED ON FIGURE C - GEOLOGICAL LONG SECTION SHEET 14

100.00
90.00
80.00
70.00
60.00

BH1022
BH1023

mAOD 50m

CHAINAGE	8180.00	8190.00	8200.00	8210.00	8220.00	8230.00	8240.00	8250.00	8260.00	8270.00	8280.00	8290.00	8300.00	8310.00	8320.00	8330.00	8340.00	8350.00	8360.00	8370.00	8380.00	8390.00	8400.00	8410.00	8420.00	8430.00	8440.00	8450.00	8460.00	8470.00	8480.00	8490.00	8500.00	8510.00	8520.00	8530.00	8540.00	8550.00	8560.00	8570.00	8580.00	8590.00	8600.00	8610.00	8620.00	8630.00	8640.00	8650.00	8660.00	8670.00	8680.00	8690.00	8700.00	8710.00	8720.00	8730.00	8740.00
EXISTING GROUND LEVEL	79.781	79.661	79.553	79.460	79.553	79.599	79.474	79.527	79.509	79.550	79.609	79.672	79.792	79.876	80.039	80.160	80.327	80.545	80.762	80.904	81.084	81.204	81.417	81.650	81.764	82.002	82.202	82.339	82.529	82.672	82.857	82.757	82.997	83.126	83.260	83.362	83.464	83.582	83.752	83.941	84.114	84.233	84.304	84.273	84.315	84.616	85.005	85.369	85.657	85.918	86.037	86.242	86.450	86.761	86.839	86.796	86.753

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checked	Rev'd	Appr'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

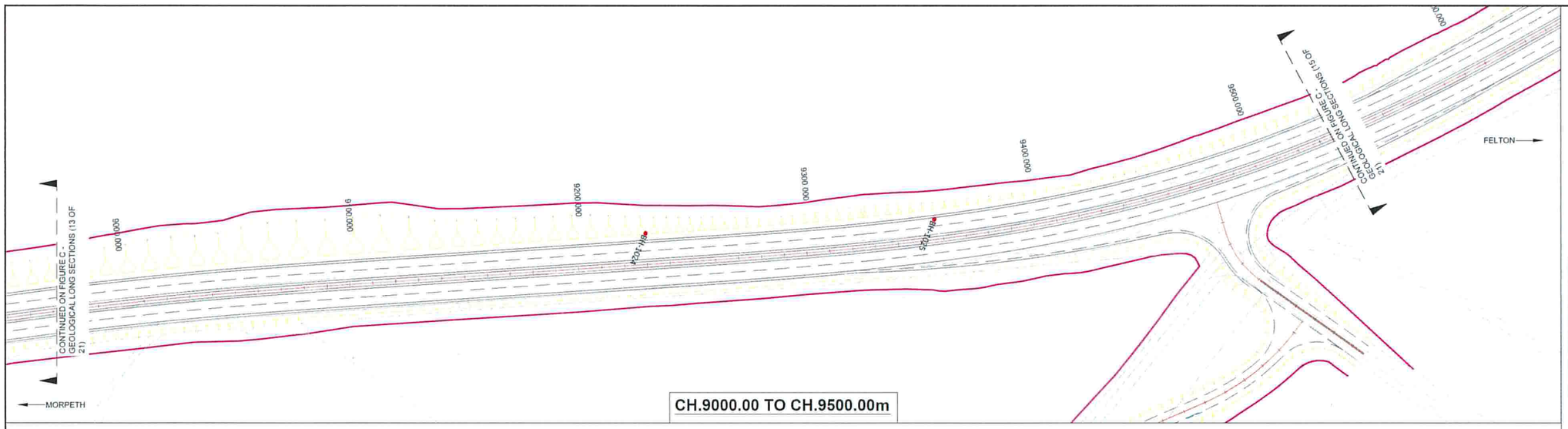
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

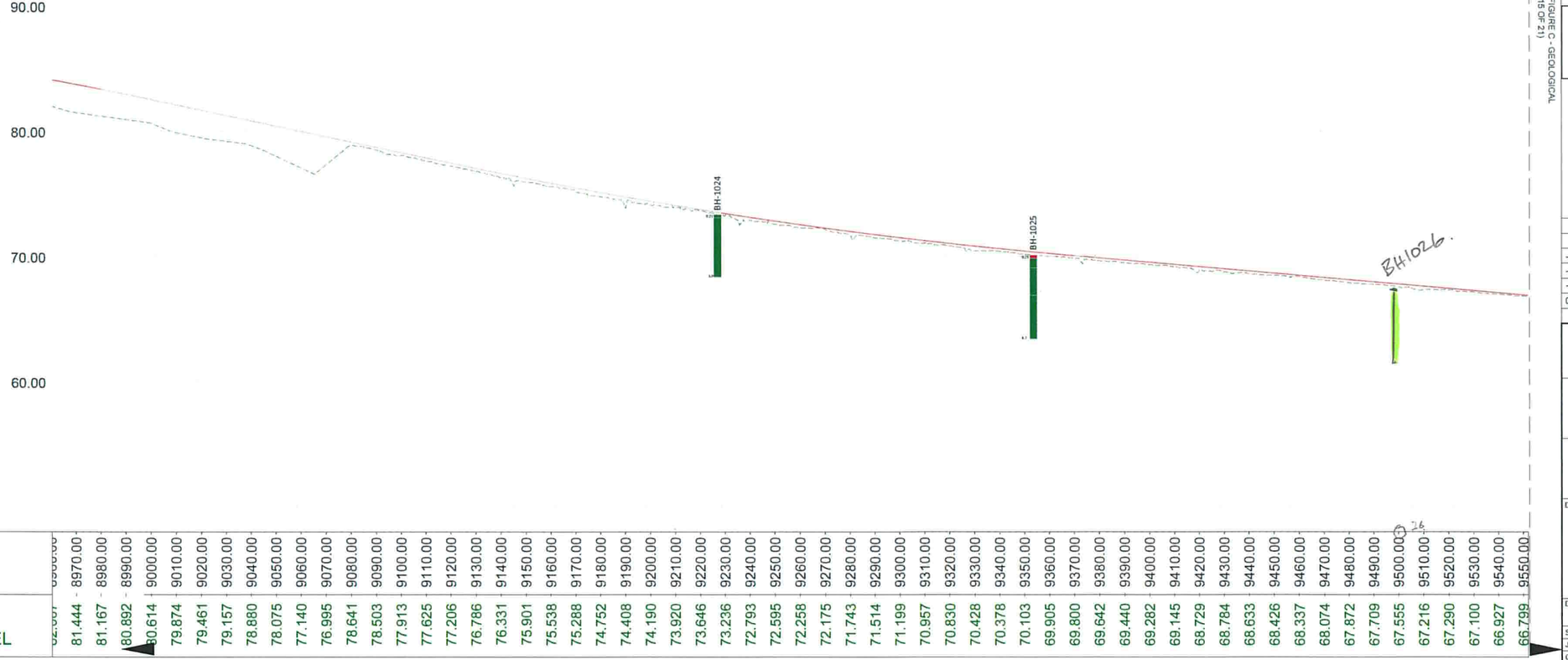
Drawing title

FIGURE C
GEOLOGICAL LONG SECTIONS
(13 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0





CHAINAGE	8960.00	8970.00	8980.00	8990.00	9000.00	9010.00	9020.00	9030.00	9040.00	9050.00	9060.00	9070.00	9080.00	9090.00	9100.00	9110.00	9120.00	9130.00	9140.00	9150.00	9160.00	9170.00	9180.00	9190.00	9200.00	9210.00	9220.00	9230.00	9240.00	9250.00	9260.00	9270.00	9280.00	9290.00	9300.00	9310.00	9320.00	9330.00	9340.00	9350.00	9360.00	9370.00	9380.00	9390.00	9400.00	9410.00	9420.00	9430.00	9440.00	9450.00	9460.00	9470.00	9480.00	9490.00	9500.00	9510.00	9520.00	9530.00	9540.00	9550.00
EXISTING GROUND LEVEL	82.007	81.444	81.167	80.892	80.614	79.874	79.461	79.157	78.880	78.075	77.140	76.995	78.641	78.503	77.913	77.625	77.206	76.786	76.331	75.901	75.538	75.288	74.752	74.408	74.190	73.920	73.646	73.236	72.793	72.595	72.258	72.175	71.743	71.514	71.199	70.957	70.830	70.428	70.378	70.103	69.905	69.800	69.642	69.440	69.282	69.145	68.729	68.784	68.633	68.426	68.337	68.074	67.872	67.709	67.555	67.216	67.290	67.100	66.927	66.799

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- Coal
- Limestone
- No Recovery

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

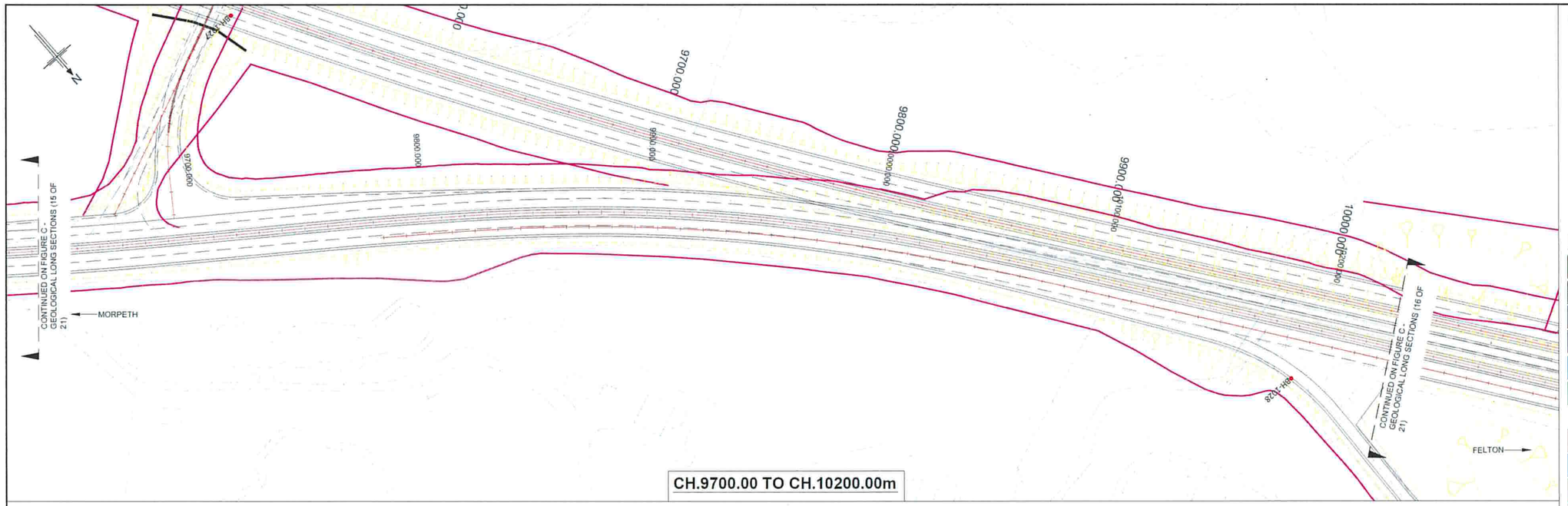
highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

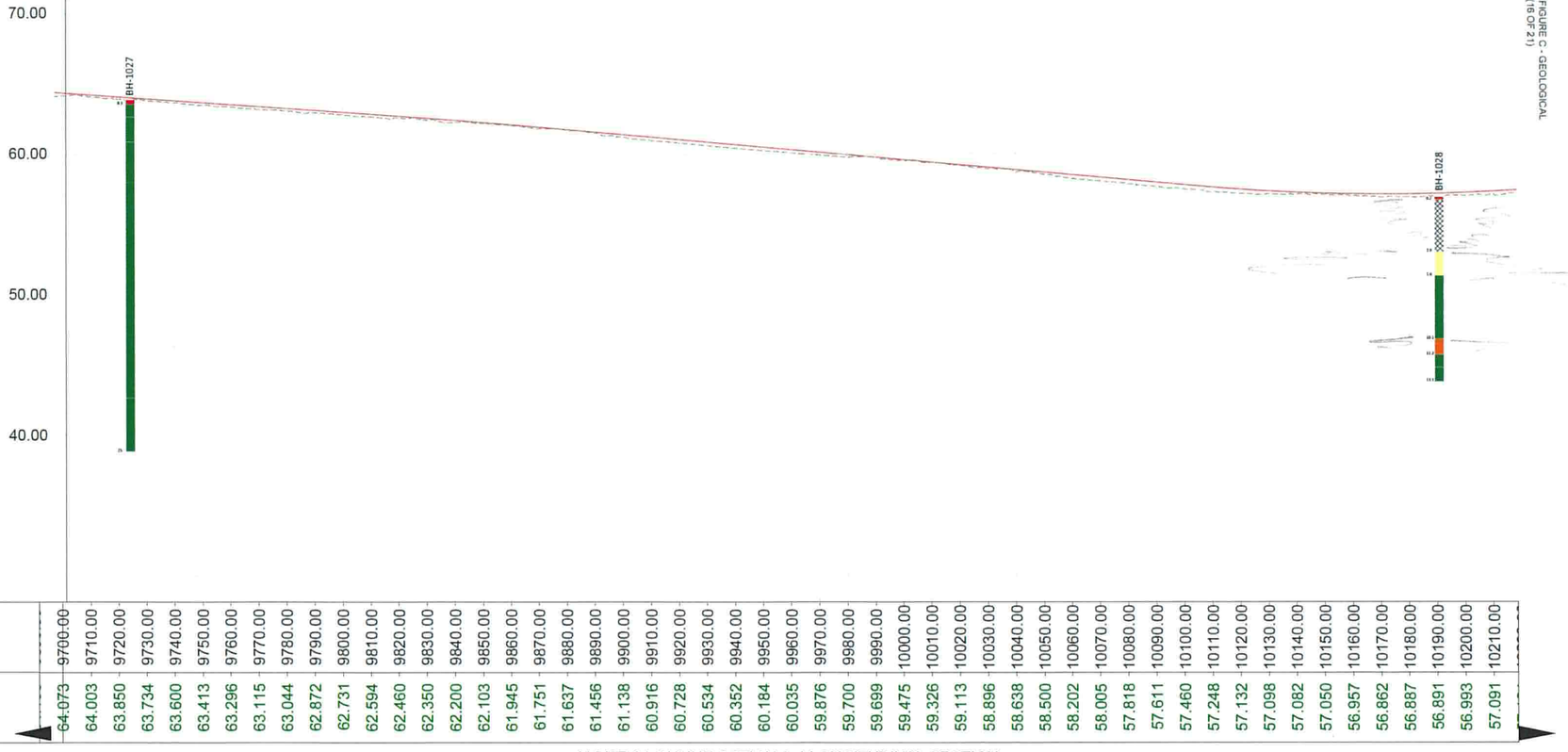
Drawing title:
FIGURE C
GEOLOGICAL LONG SECTIONS
(14 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no.	551459	
Drawing number		Rev 0



CH.9700.00 TO CH.10200.00m



CHAINAGE	9700.00	9710.00	9720.00	9730.00	9740.00	9750.00	9760.00	9770.00	9780.00	9790.00	9800.00	9810.00	9820.00	9830.00	9840.00	9850.00	9860.00	9870.00	9880.00	9890.00	9900.00	9910.00	9920.00	9930.00	9940.00	9950.00	9960.00	9970.00	9980.00	9990.00	10000.00	10010.00	10020.00	10030.00	10040.00	10050.00	10060.00	10070.00	10080.00	10090.00	10100.00	10110.00	10120.00	10130.00	10140.00	10150.00	10160.00	10170.00	10180.00	10190.00	10200.00	10210.00
EXISTING GROUND LEVEL	64.973	64.003	63.850	63.734	63.600	63.413	63.296	63.115	63.044	62.872	62.731	62.594	62.460	62.350	62.200	62.103	61.945	61.751	61.637	61.456	61.138	60.916	60.728	60.534	60.352	60.184	60.035	59.876	59.700	59.699	59.475	59.326	59.113	58.896	58.638	58.500	58.202	58.005	57.818	57.611	57.460	57.248	57.132	57.098	57.082	57.050	56.957	56.862	56.887	56.891	56.993	57.091

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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WORKING DRAFT

Rev.	Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

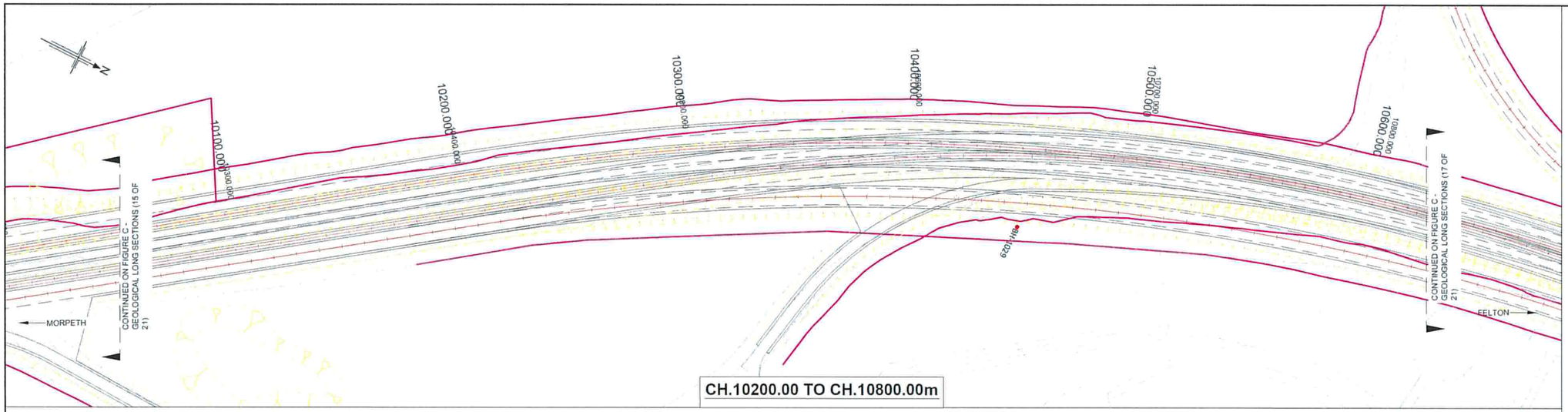
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

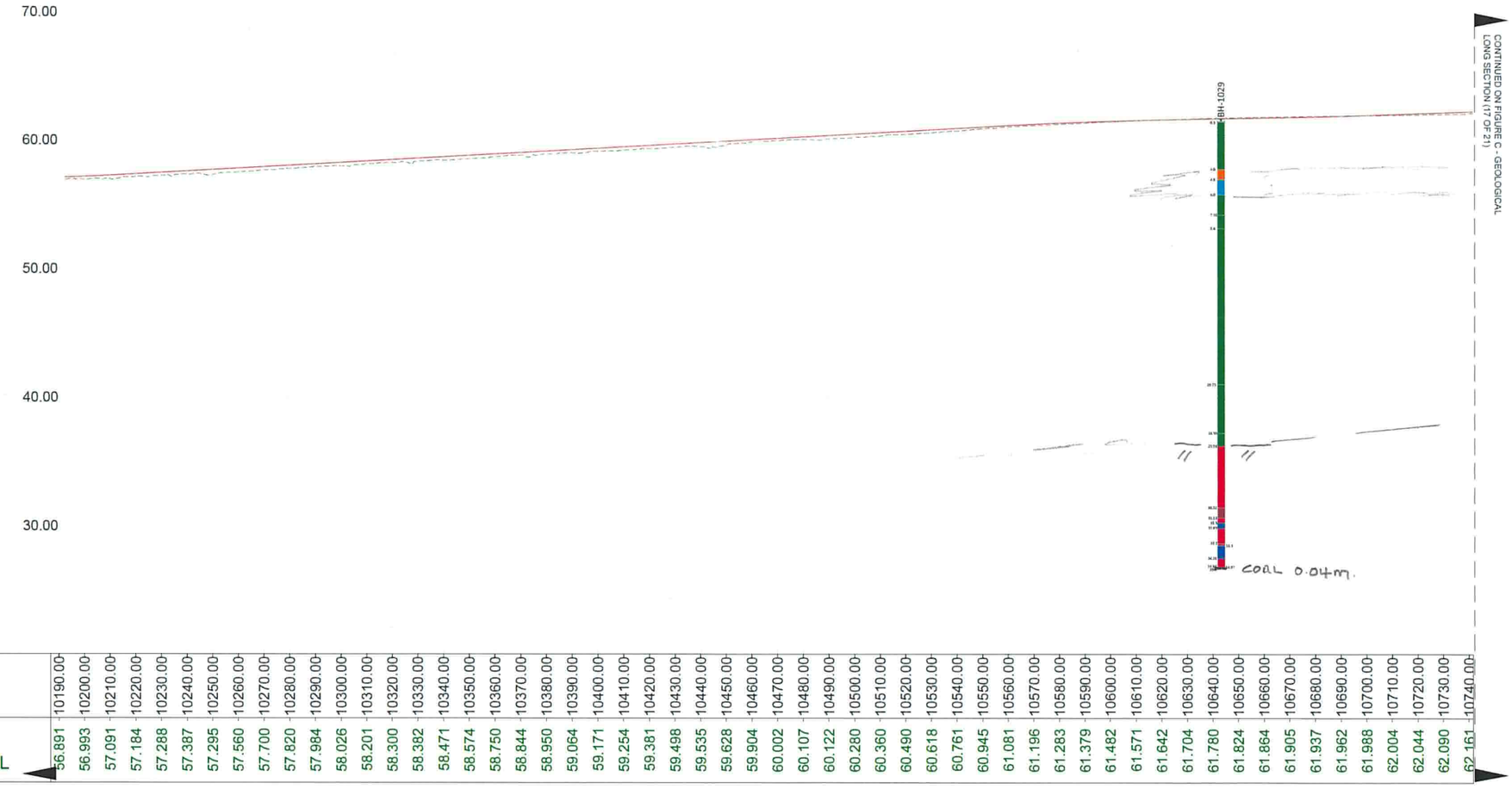
Drawing title

FIGURE C
GEOLOGICAL LONG SECTIONS
(15OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0





CHAINAGE	10190.00	10200.00	10210.00	10220.00	10230.00	10240.00	10250.00	10260.00	10270.00	10280.00	10290.00	10300.00	10310.00	10320.00	10330.00	10340.00	10350.00	10360.00	10370.00	10380.00	10390.00	10400.00	10410.00	10420.00	10430.00	10440.00	10450.00	10460.00	10470.00	10480.00	10490.00	10500.00	10510.00	10520.00	10530.00	10540.00	10550.00	10560.00	10570.00	10580.00	10590.00	10600.00	10610.00	10620.00	10630.00	10640.00	10650.00	10660.00	10670.00	10680.00	10690.00	10700.00	10710.00	10720.00	10730.00	10740.00
EXISTING GROUND LEVEL	56.891	56.993	57.091	57.184	57.288	57.387	57.295	57.560	57.700	57.820	57.984	58.026	58.201	58.300	58.382	58.471	58.574	58.750	58.844	58.950	59.064	59.171	59.254	59.381	59.498	59.535	59.628	59.904	60.002	60.107	60.122	60.280	60.360	60.490	60.618	60.761	60.945	61.081	61.196	61.283	61.379	61.482	61.571	61.642	61.704	61.780	61.824	61.864	61.905	61.937	61.962	61.988	62.004	62.044	62.090	62.161

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

NOTES:

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- UNIT D - Glaciolacustrine deposits
- UNIT E - Glacial Till
- UNIT F - Bedrock
- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

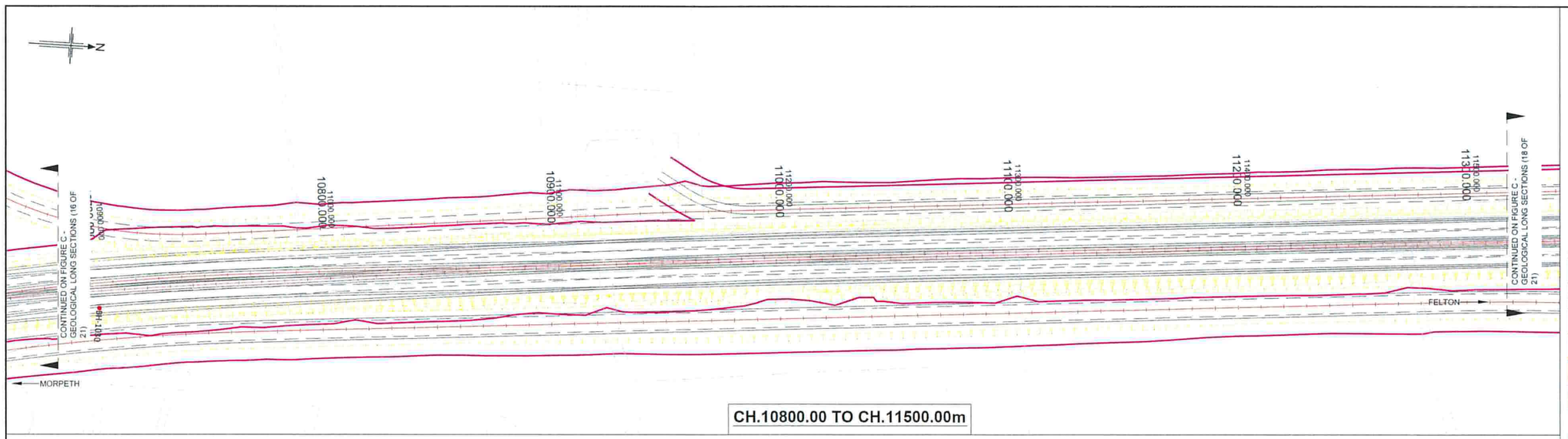
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(16 OF 21)

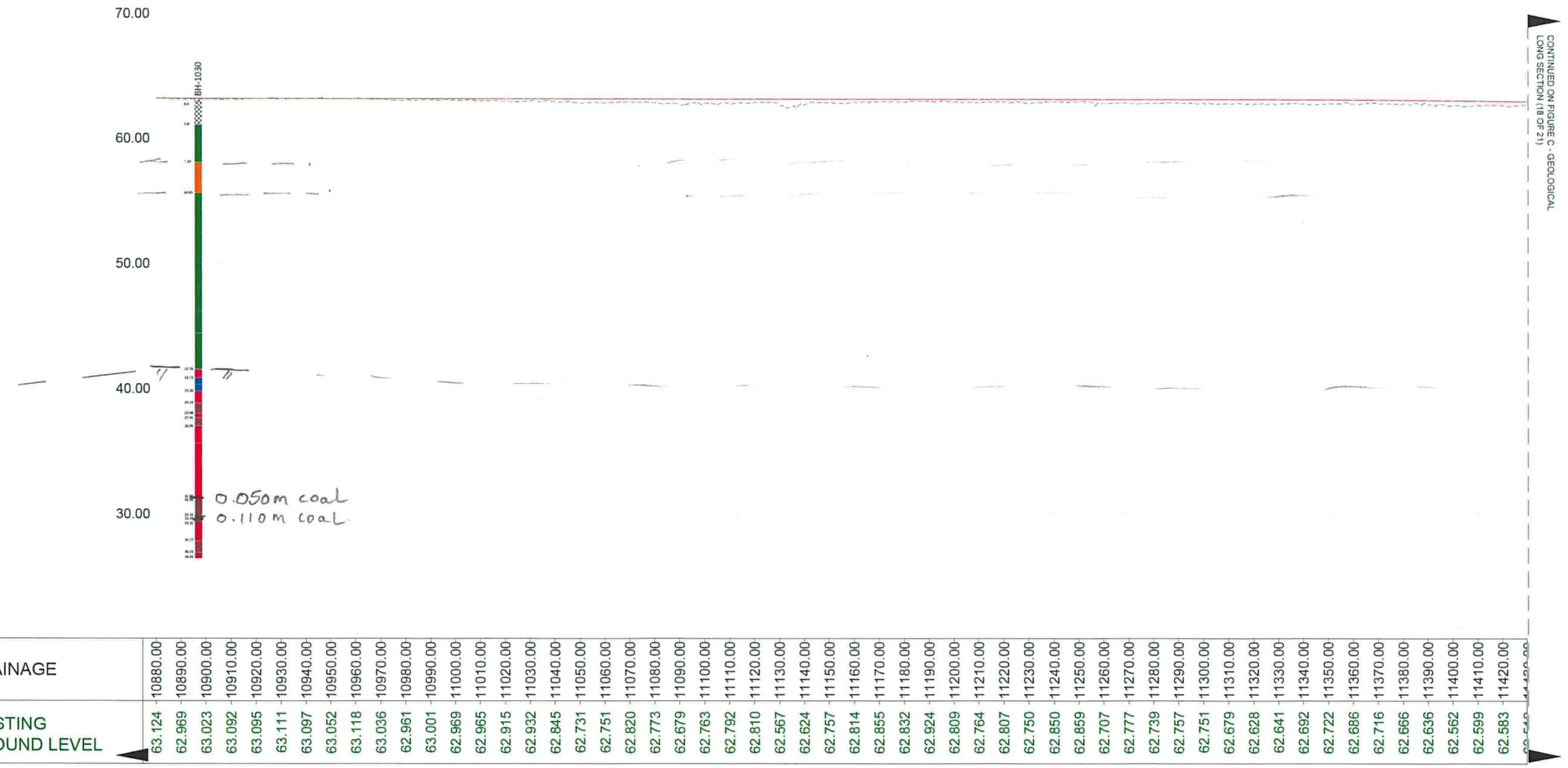
Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no.	551459	
Drawing number		Rev 0

P:\B2000000\B2104700 - A1 Northumberland\Calculations\Geotechnical\Working Drawings\Drawings and sketches\Geological Long Sections\FIGURE C - GEOLOGICAL LONG SECTIONS 13 SHEETS.dwg - 15/12/2016 14:59:27 - 16 - kelsallw



CH.10800.00 TO CH.11500.00m



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EXISTING GROUND LEVEL	63.124	62.969	63.023	63.092	63.095	63.111	63.097	63.052	63.118	63.036	62.961	63.001	62.969	62.965	62.915	62.932	62.845	62.731	62.751	62.820	62.773	62.679	62.763	62.792	62.810	62.567	62.624	62.757	62.814	62.855	62.832	62.924	62.809	62.764	62.807	62.750	62.850	62.859	62.707	62.777	62.739	62.757	62.751	62.679	62.628	62.641	62.692	62.722	62.686	62.716	62.666	62.636	62.562	62.599	62.583

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- Mudstone
- Siltstone
- Sandstone
- Fireclay
- Coal
- Limestone
- No Recovery

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

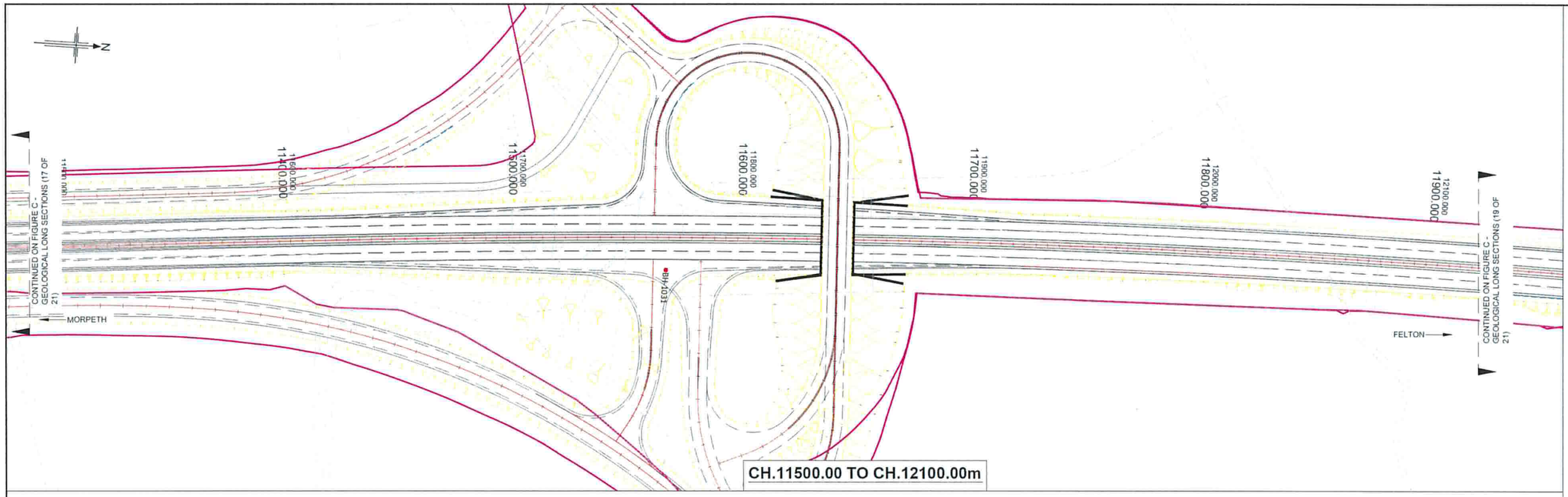
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

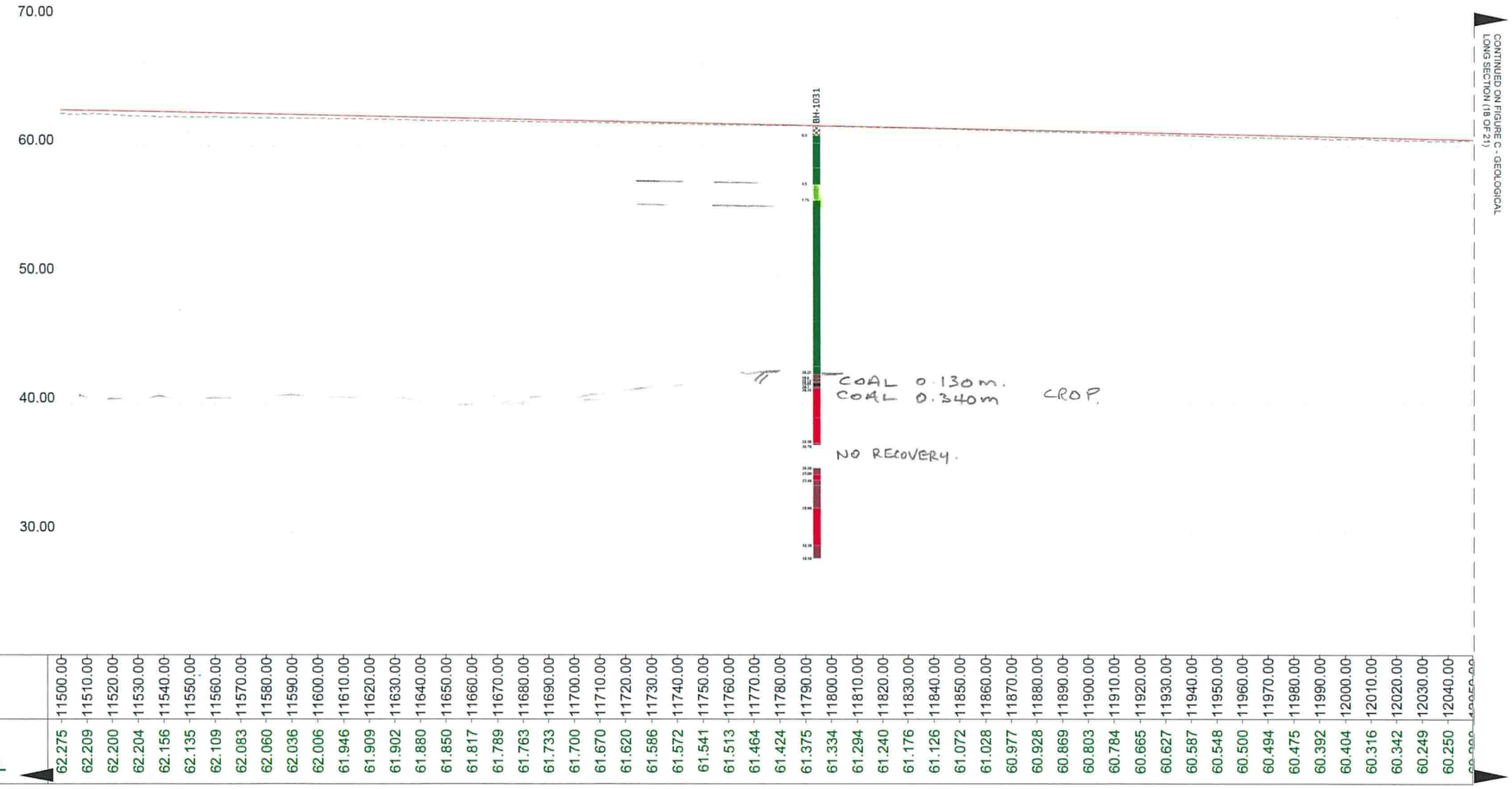
Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(17 OF 21)

Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No.	B2104701	
Client no.	551459	
Drawing number		Rev 0

P:\B2000000\B2104700 - A1 Northumberland\Calculations\Geotechnical\Working Drawings\Drawings and sketches\Geological Long Sections\FIGURE C - GEOLOGICAL LONG SECTIONS 13 SHEETS.dwg - 15/12/2016 14:59:53 - 17 - kelsaltw





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EXISTING GROUND LEVEL	62.275	62.209	62.200	62.204	62.156	62.135	62.109	62.083	62.060	62.036	62.006	61.946	61.909	61.902	61.880	61.850	61.817	61.789	61.763	61.733	61.700	61.670	61.620	61.586	61.572	61.541	61.513	61.464	61.424	61.375	61.334	61.294	61.240	61.176	61.126	61.072	61.028	60.977	60.928	60.869	60.803	60.784	60.665	60.627	60.587	60.548	60.500	60.494	60.475	60.392	60.404	60.316	60.342	60.249	60.250	60.200

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- Sandstone
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- Coal
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- No Recovery

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

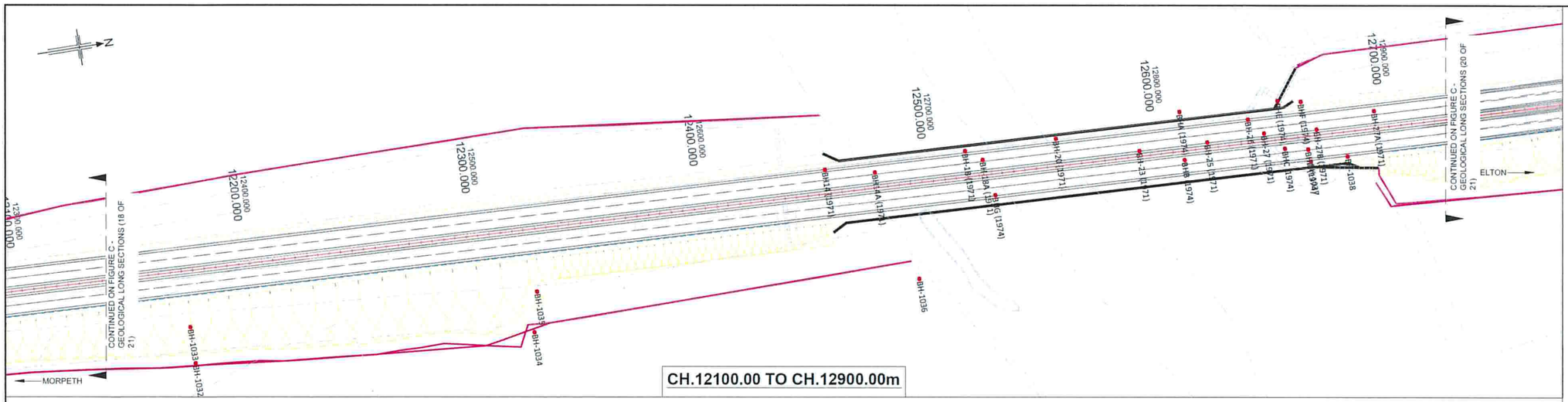
highways england

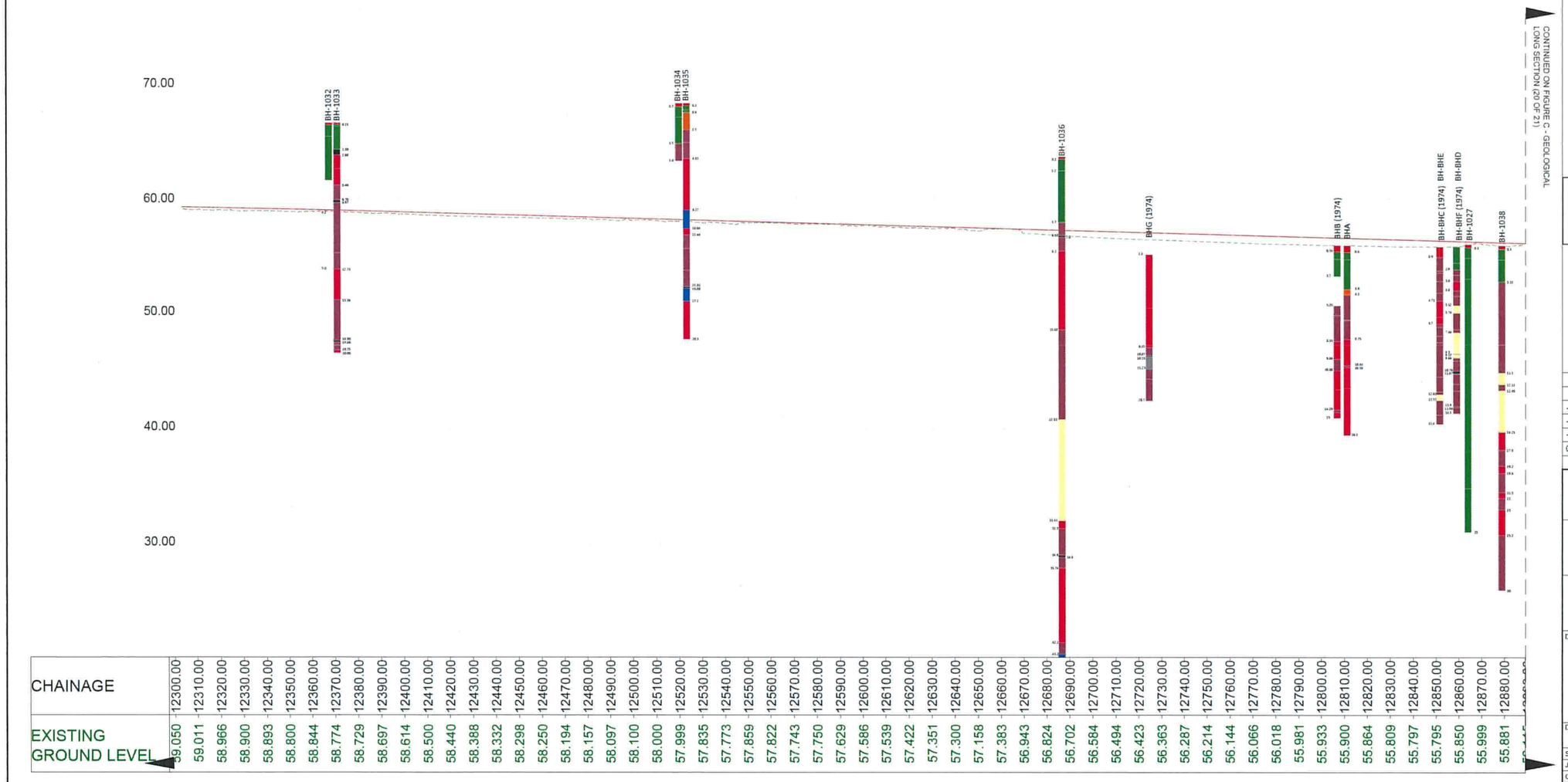
A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(18 OF 21)

Drawing status
WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No.	B2104701	
Client no.	551459	
Drawing number		Rev 0





M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(19 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No.	B2104701	
Client no.	551459	
Drawing number		Rev 0

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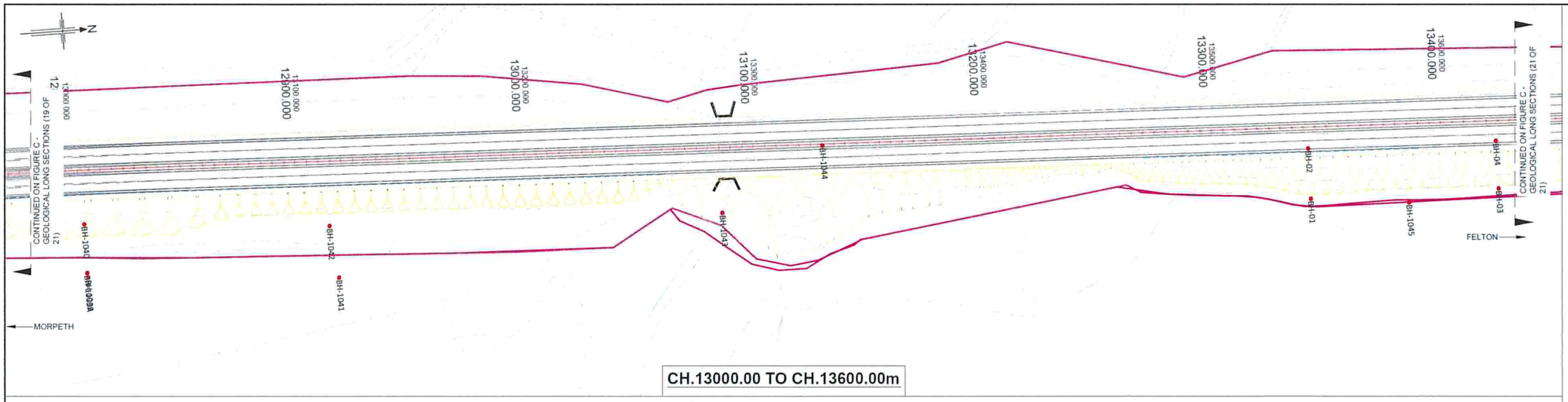
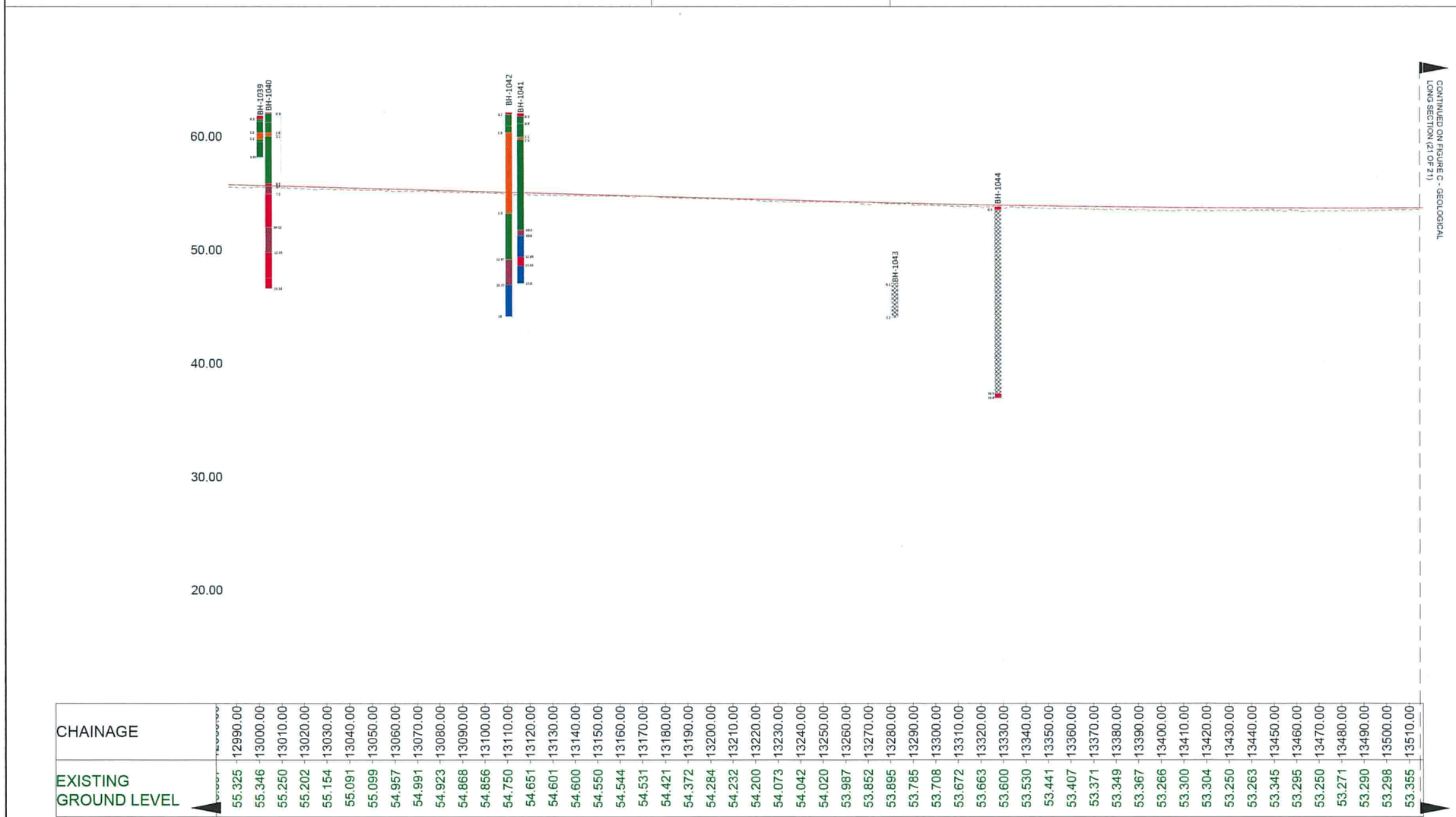


CH.13000.00 TO CH.13600.00m



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EXISTING GROUND LEVEL	55.325	55.346	55.250	55.202	55.154	55.091	55.099	54.957	54.991	54.923	54.868	54.856	54.750	54.651	54.601	54.600	54.550	54.544	54.531	54.421	54.372	54.284	54.232	54.200	54.073	54.042	54.020	53.987	53.852	53.895	53.785	53.708	53.672	53.663	53.600	53.530	53.441	53.407	53.371	53.349	53.367	53.266	53.300	53.304	53.250	53.263	53.345	53.295	53.250	53.271	53.290	53.298	53.355

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
SCALE: H 1:500,V 1:100. DATUM: 50.000

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- Limestone
- No Recovery

WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(20 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0

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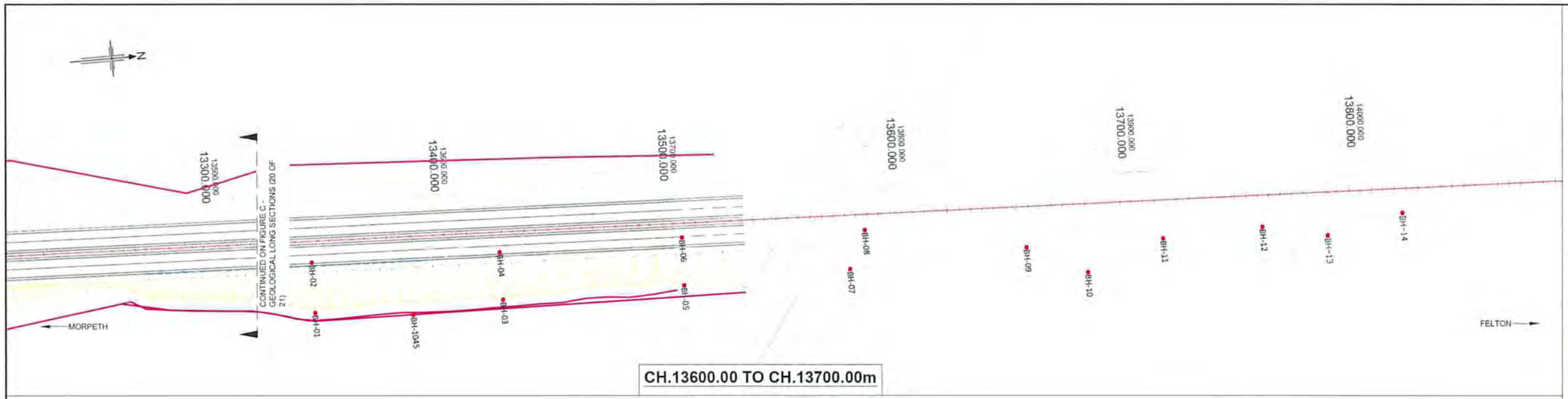
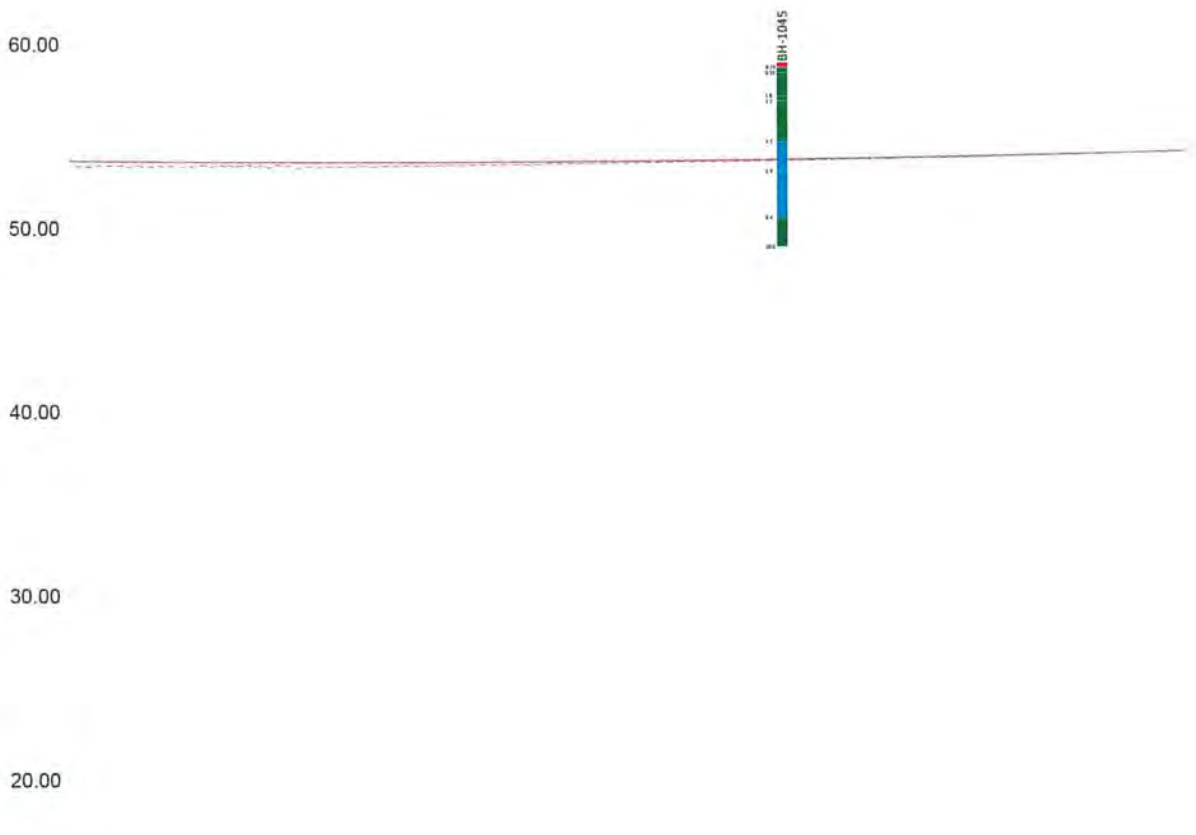


CH.13600.00 TO CH.13700.00m



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EXISTING GROUND LEVEL	53.266	53.300	53.304	53.250	53.263	53.345	53.295	53.250	53.271	53.290	53.298	53.355	53.368	53.376	53.427	53.463	53.500	53.529	53.550	53.590	53.622	53.661	53.706	53.737	53.780	53.822	53.899	53.950	53.998	54.050	54.100	

M-M2F A1 ONLINE OPTION A-1 LONGITUDINAL SECTION
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WORKING DRAFT

Rev	Date	Purpose of revision	Drawn	Checked	Revid	Apprv'd
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
0	22/11/16	BOREHOLE LOCATIONS	LT	-	-	-

JACOBS

highways england

A1 IN NORTHUMBERLAND
MORPETH TO FELTON

Drawing title
FIGURE C
GEOLOGICAL LONG SECTIONS
(21 OF 21)

Drawing status: WORKING DRAWING

Scale	1:1000 @ A1	DO NOT SCALE
Jacobs No	B2104701	
Client no	551459	
Drawing number		Rev 0

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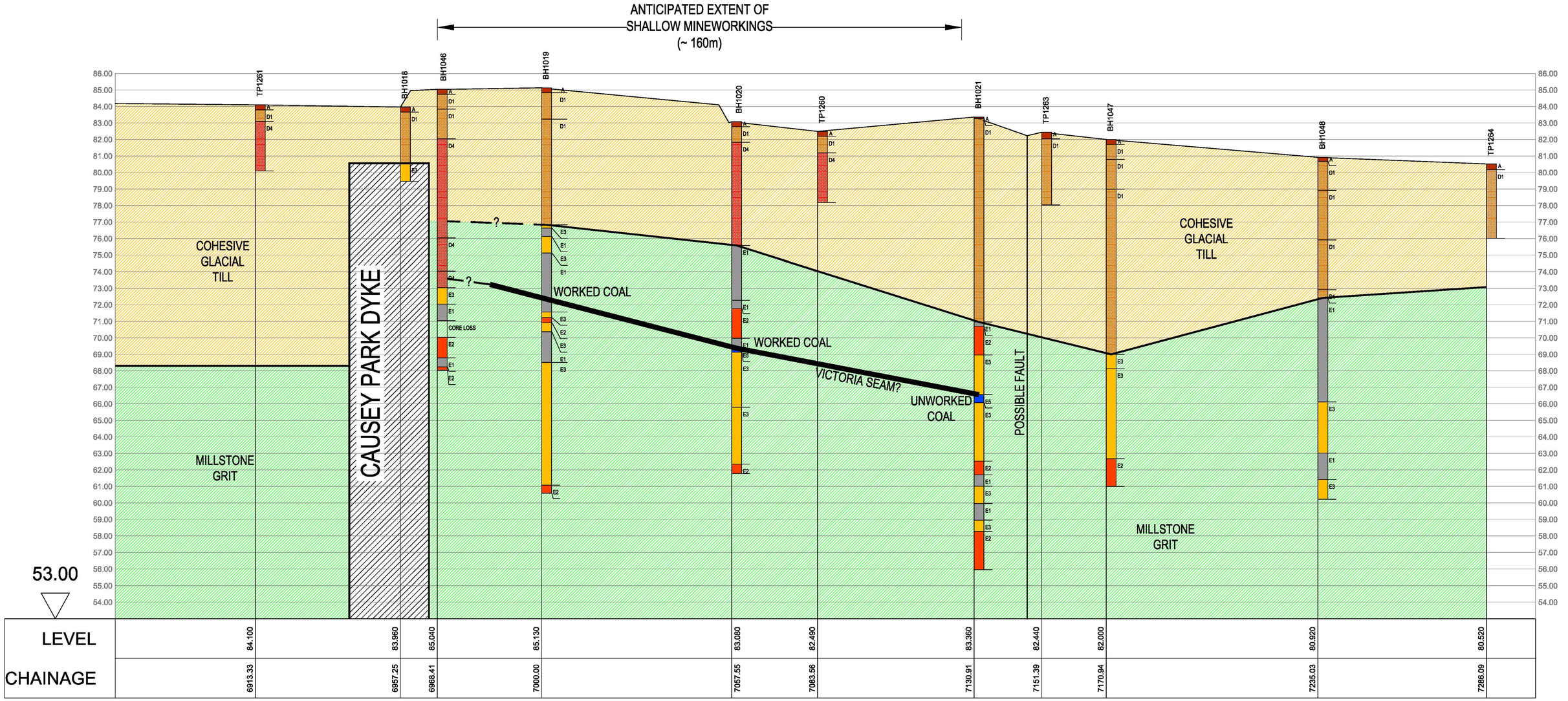
DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



LEVEL	84.100	83.960	85.040	85.130		83.080	82.490	83.360	82.440	82.000	80.920	80.520
CHAINAGE	6913.33	6957.25	6968.41	7000.00		7057.55	7083.56	7130.91	7151.39	7170.94	7235.03	7286.09

Rev	Description	By	Chk	App	Date
P1	FIRST ISSUE	PMC	JRJ	MC	03.08.06

CLIENT

HIGHWAYS AGENCY

LAING O'ROURKE

Arndale Court
Headingley
Leeds
LS6 2UJ

Tel: 0113 278 7111
Fax: 0113 278 3487
e-mail: leeds@wyg.com

White Young Green Consulting

Civil Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Project: A022282

A1 MORPETH TO FELTON DUALLING

Drawing Title:

CAUSEY PARK MINEWORKINGS
GEOLOGICAL CROSS SECTION

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
AS SHOWN	PMC	03.08.06	JRJ	03.08.06	SM	03.08.06

Project No.	Office	Type	Drawing No.	Revision
A022282	21	E	G.09	P1

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

MATERIAL	ABBREVIATION	SYMBOL	MATERIAL	ABBREVIATION	SYMBOL	MATERIAL	ABBREVIATION	SYMBOL
Topsoil	T		Mudstone	Ms		Limestone	Ls	
Sand	S		Sandstone	Ss		Ironstone	Is	
Coal	C		Siltstone	St				
Clay	Cl		Shale	Sh				

NOTE 1. The foundation investigation was carried out by the Geotechnical Division of Tarmac Construction Limited. Proof boreholes 1-17 carried out during the Contract period (See Note 4)

Boreholes sunk October – November 1971 are shown thus ◔
and the sections shown on this drawing are based on the borehole log records given in Tarmac's Report No. 90759 dated March 1972.

Boreholes sunk March – May 1974 are shown thus ◑
and the sections shown on this drawing are based on the borehole log records given in Tarmac's Report No. 940109/199 dated June 1974.

2. For details descriptions of strata shown see Bore Hole Record Logs.

3. Surface levels given are at time of boring.

4. Proof boreholes sunk during the period of the Contract between August 1979 and December 1979 shown thus ◕
Proof boreholes 6,7,8 & 9 sunk by C.H. Stevenson Ltd. Borehole logs produced by N.C.C.
Proof boreholes SM10, SM11 & SM12 sunk and logged by Soil Mechanics Ltd.
Proof boreholes 1, 2, 3, 4 & 5 sunk by B.B. Drilling Ltd. and logged by N.C.C. Proof borehole 15 sunk by B.B. Drilling Ltd. for Balfour Beatty (Log shown produced by R.E. staff)

This drawing to be read in conjunction with Drawing No. 534/CS/201.

SECTION 11m EAST OF CENTRE LINE OF CARRIAGEWAY

SECTION ON CENTRE LINE OF CARRIAGEWAY

Note: For clarity Contract Proof boreholes 1, 2, 3, 4, 5, SM10, SM11, SM12 at the South Pier have been omitted. For details see Drawing No. 534/CS/201.

Ground Level as at 1971

Ground Level as at 1979 (After Stage I earthworks)

Foundation Level

PLAN LOCATION OF BOREHOLES

AS CONSTRUCTED

Harris & Sutherland
Consulting Civil and Structural Engineers

DEPARTMENT OF TRANSPORT
NORTHERN REGIONAL OFFICE
NEWCASTLE UPON TYNE

REV.	DATE	AMENDMENT	CHK'D
Z	14th Sept. 81	As constructed.	

LONDON – EDINBURGH – THURSO TRUNK ROAD A1 FELTON BY-PASS STAGE IIA

RIVER COQUET BRIDGE

SITE INVESTIGATION

ORIGINAL DRG. SIZE (B1)

DRAWN		DATE	Jan.'78
TRACED			
CHECKED M.P.B.			Sept.'78
APPROVED B.M.F.			Oct.'78

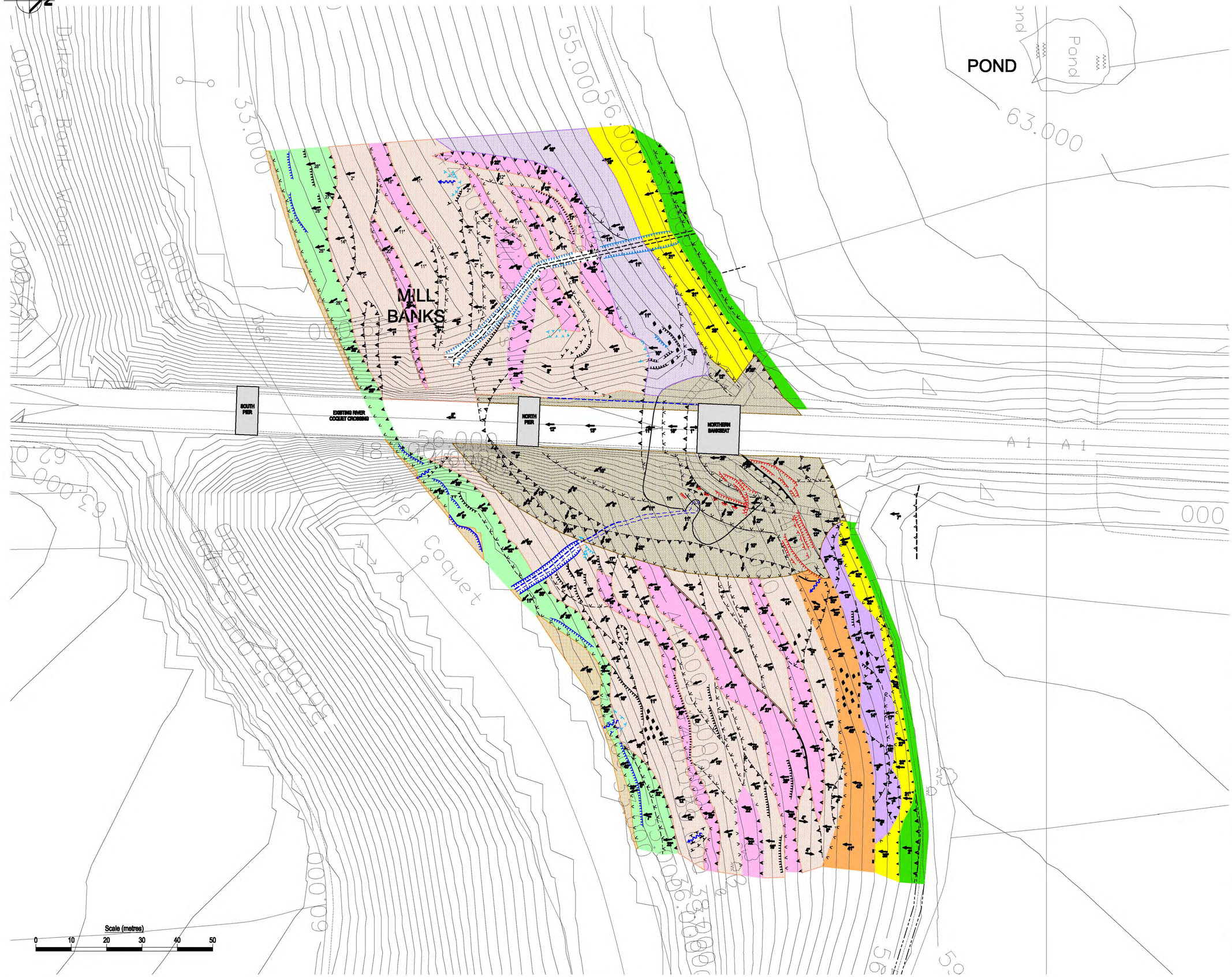
SCALE 1:25

DRAWING No. 534/C/05 Z

REDUCED DRAWING — 0 10 20 30 40 50 — 50mm ON ORIGINAL

Appendix D – Geomorphological Mapping

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



KEY

- PROMINANT SECONDARY SANDSTONE LANDSLIP BACK SCARP
- ANGULAR BOULDERS (ROCK FALL)
- CREST
- SURFACE WATERCOURSE
- SHALLOW DRAINAGE CHANNEL
- PROMINANT DRAINAGE CHANNEL
- STEEP RIVER CHANNEL BANKS
- ACTIVE TENSION CRACK
- MAIN LANDSLIP BACK SCAR
- SURFACE OF SERIES OF ROTATED BLOCKS (SOME BACK-TILTED) BETWEEN THE MAIN LANDSLIP BACK SCAR & SECONDARY SANDSTONE LANDSLIP BACK SCARP
- MINOR LANDSLIP SCARPS WITHIN LANDSLIP DEGREDATION ZONE
- LANDSLIP TOE
- RIVER SEDIMENTS
- SERIES OF BENCHES WITHIN LANDSLIP DEGREDATION ZONE
- SURFACE OF BENCH BELOW THE MAIN LANDSLIP BACK SCAR
- MADE GROUND FILL USED TO CONSTRUCT AREA FOR HAUL ROAD ROUTE
- CLIFFS (EXPOSED ROCKFACE, SLOPE >40°)
- ABRUBPT ANGULAR CONVEX BREAK OF SLOPE (WITH AREAS OF EXPOSED SOIL/ROCK)
- **ANGULAR CONVEX BREAK OF SLOPE**
- SMOOTHLY CONVEX CHANGE OF SLOPE
- ANGULAR CONCAVE BREAK OF SLOPE
- SMOOTHLY CONCAVE CHANGE OF SLOPE
- **BREAKS OF SLOPE**
- **CHANGES OF SLOPE**
- **DIRECTION OF SLOPE (ANGLE IN DEGREES)**

Rev	Description	By	Chk	App	Date
P1	FIRST ISSUE	PMC	JRJ	SM	30.06.06

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Consulting

Civil Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Project: A022282

A1 MORPETH TO FELTON DUALLING

Drawing Title:

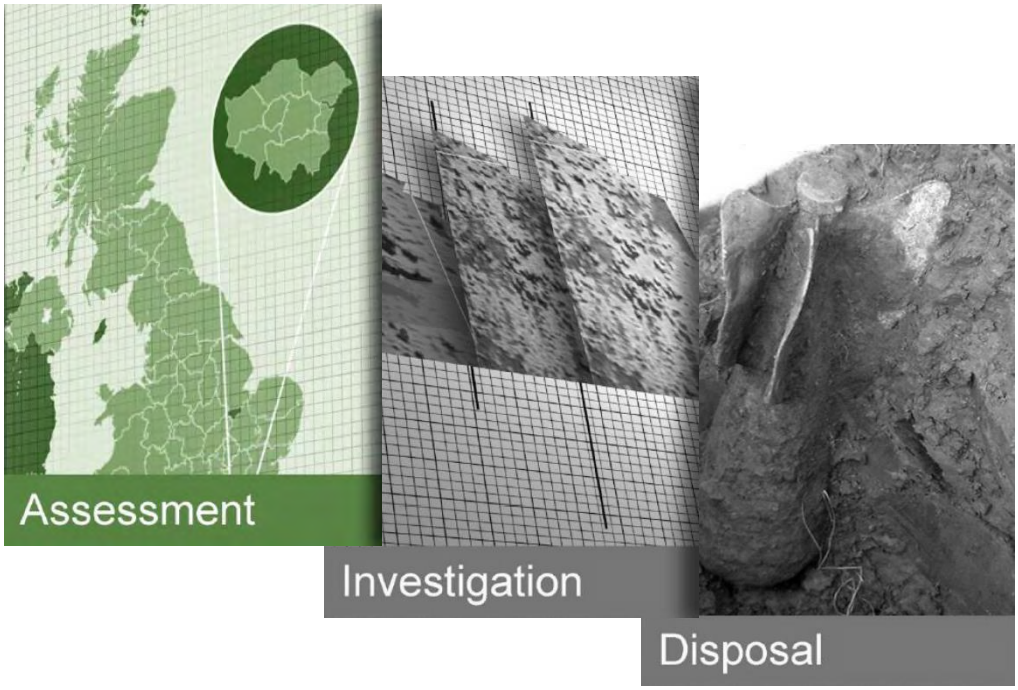
GEOMORPHOLOGICAL MAPPING
NORTHERN VALLEY SIDE OF RIVER COQUET

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
1:500	CM	28.06.06	JRJ	30.06.06	SM	30.06.06

Project No.	Office	Type	Drawing No.	Revision
A022282	21	E	G.04	P1

APPROVAL ☐ INFORMATION ☐ TENDER ☒ CONTRACT ☐ CONSTRUCTION ☐

Appendix E – Zetica Detailed Desk Study



A1 Morpeth to Felton - UXO Desk Study & Risk Assessment

Drafted by Will Hazell
Checked by Stefan Lang
Authorised by Mike Sainsbury

Document Title	**UXO Desk Study & Risk Assessment**
Document Ref.	**P6478-16-R1**
Revision	**A**
Project Location	**A1 Morpeth to Felton, Northumberland**
Client	**Jacobs**
Date	**8th November 2016**

UXO DESK STUDY & RISK ASSESSMENT

A1 Morpeth to Felton, Northumberland

EXECUTIVE SUMMARY

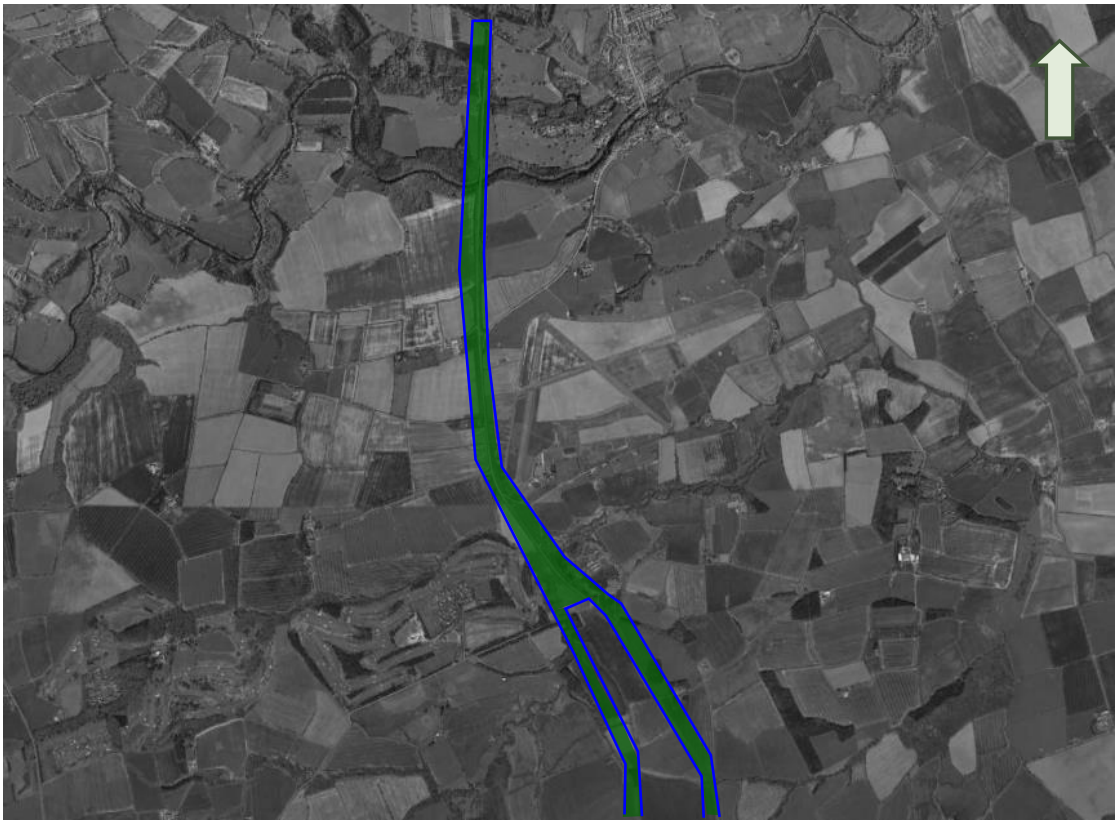
Zetica Ltd was commissioned by Jacobs to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an approximately 13 kilometre (km) section of the A1 between Morpeth and Felton, with an additional 6km proposed route ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

It is considered that the Site has a low UXO hazard level, as shown in the Figures below, reproduced as Figures 6 and 7 in the main report.

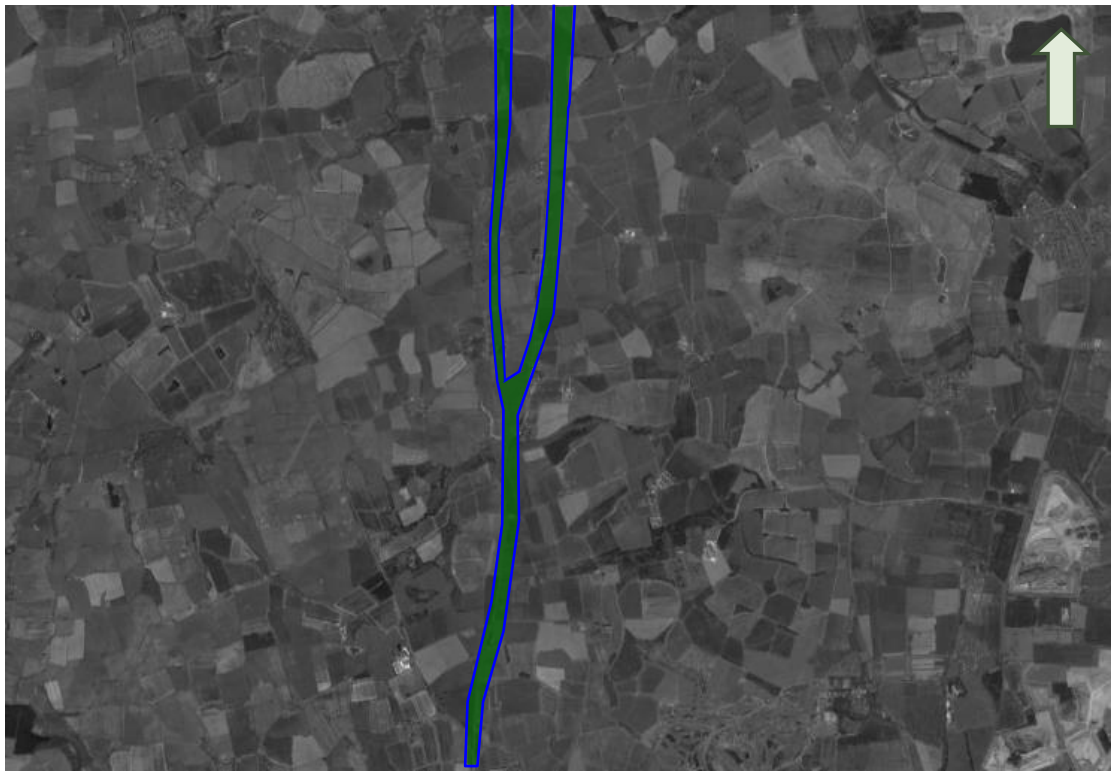
Figure	UXO hazard zone plan of the Site (northern part of the Site)



Source: Google Earth *Not to Scale*

Legend	Very Low	Low	Moderate
	High	Very High	Site boundary

Figure	UXO hazard zone plan of the Site (southern part of the Site)



Source: Google Earth *Not to Scale*

Legend	Very Low	Low	Moderate
	High	Very High	Site boundary

The main findings of the report are summarised below.

- No records of bombing or military activity on the Site during World War One (WWI) have been found.
- During World War Two (WWII), the Site was located on the boundary between the Rural Districts (RD) of Morpeth and Alnwick, which both recorded low regional bombing densities.
- During WWII, the main strategic targets in the area surrounding the Site included military airfields, anti-invasion defences and army camps.
- Royal Air Force (RAF) Eshott was established adjacent to the Site in 1942. This was used as a training airfield for Fighter Command.
- No records have been found indicating that the Site was bombed during WWII. 8No. High Explosive (HE) bombs were recorded falling in the immediate vicinity of the Site. These were all recorded as Unexploded Bombs (UXB) and removed.
- No significant post-WWII military activity is recorded on the Site.

The Table below, reproduced as Table 5 in the main report, provides a UXO risk assessment for potential work on the Site.

Further details on the methodology of the risk assessment are provided in Section 11.1 of the main report.

Table UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Shallow Excavations	1	1	1	1	5	5	**Low**
	Deep Excavations	1	1	1	1	5	5	**Low**
	Piling/boreholes	1	1	1	1	4	4	**Low**
Other UXO	Shallow Excavations	1	1	1	1	4	4	**Low**
	Deep Excavations	1	1	1	1	4	4	**Low**
	Piling/boreholes	1	1	1	1	3	3	**Low**

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

Shallow excavations defined as <1.0m below ground level (bgl).

Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff.

Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.

Table 6 in the main report gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.

Further advice on the mitigation methods can be provided by Zetica on request.

CONTENTS

Figures, Plates, Tables & Drawings

Appendices

UXO DESK STUDY & RISK ASSESSMENT

A1 Morpeth to Felton, Northumberland

Note: To aid the reader of this report, Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Paragraphs in a dark green text with a green background are paragraphs containing background information or explanations which may appear as standard text in all similar reports.

1 INTRODUCTION

1.1 Project Outline

Zetica Ltd was commissioned by Jacobs to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an approximately 13 kilometre (km) section of the A1 between Morpeth and Felton, with an additional 6km proposed route ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and it's immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

This hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance (UXO).
- Probable location.
- Ordnance condition.

It is essential to note that the effects of military activity will often extend beyond the source of the activity. For example, a base for armed forces may use surrounding areas of open land outside the official or recorded military boundaries for practice and military related activities.

In addition, World War One (WWI) and World War Two (WWII) aerial bombardment was not discrete. 'Pinpoint' targeting did not exist in WWI or WWII. The effects of bombardment would be apparent in areas around the intended target.

It is for these reasons that it is important to address military activity both on the Site and in the relevant surrounding areas.

It should be noted that some military activity providing a source of UXO hazard may not be readily identifiable and therefore there cannot be any guarantee that all UXO hazards on the Site have been identified in this report.

1.2 The Site

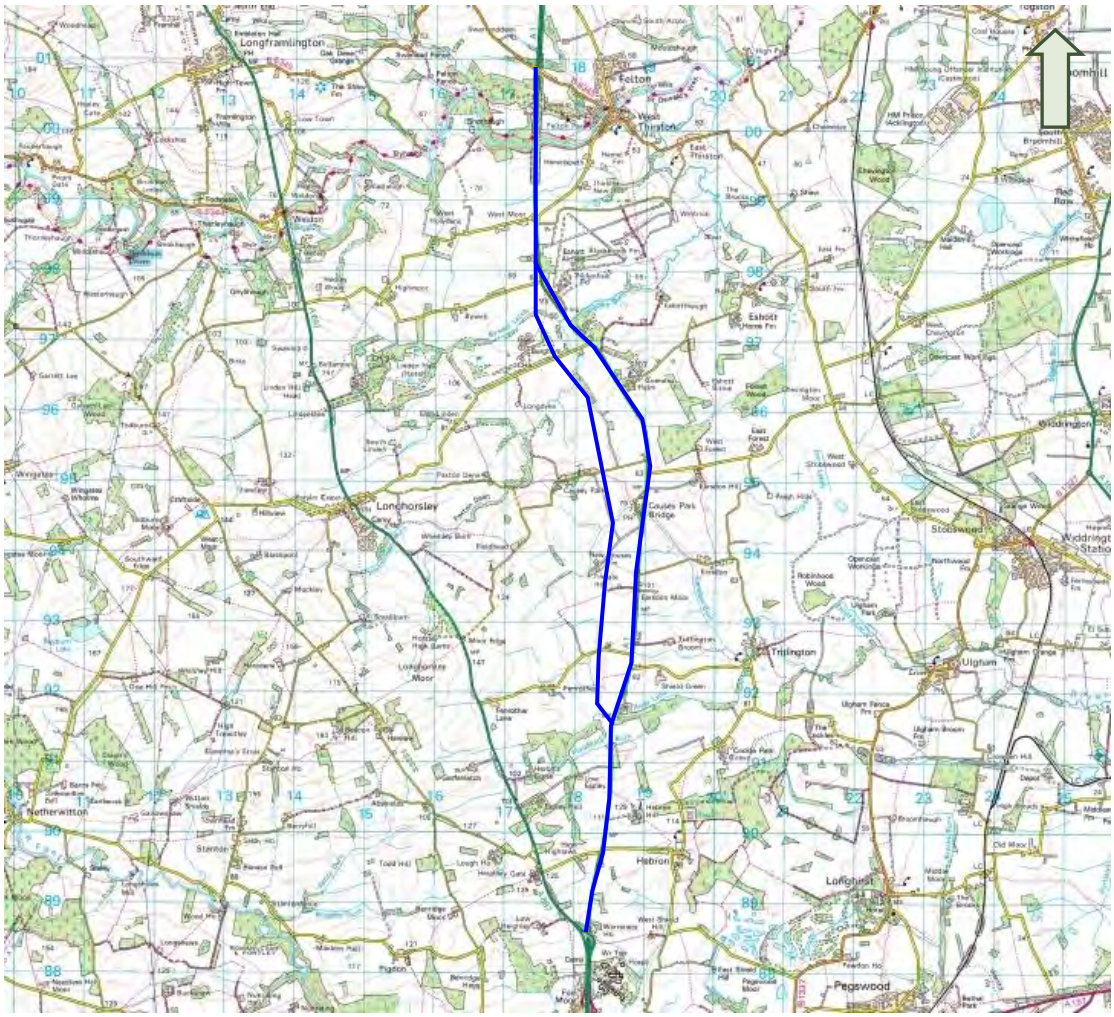
The main Site route, comprising the A1 road, runs from the A697 junction north of Morpeth at Ordnance Survey National Grid Reference (OSNGR) NZ 182885 to the B6345 bridge at Felton (NU 174008). It bounded along its route by farmland, with several areas of woodland.

The Site also includes an additional 6km route, comprising open fields, which runs parallel to the main part of the Site.

It is understood that planned works on the Site may include intrusive ground investigations and excavations associated with the widening of a carriageway and the construction of a new road.

Figure 1 is a Site location map and Plate 1 is a recent satellite photograph of the Site.

Figure 1 Site location map



Source: © Crown Copyright 2016. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend Site

Plate 1	Recent satellite photograph of the Site

Source: Google Earth *Not to Scale*

Legend	Site

2 SOURCES OF INFORMATION

2.1 Historical Information

With most locations, the potential presence of UXO as a result of enemy action, unauthorised disposal or unrecorded military activity can never be totally discounted.

Detailed records of military activity are rarely released into the public domain. Even when military information is made public there may be gaps in the records because files have been lost or destroyed.

Records for periods such as WWII are only as detailed and accurate as the resources and working conditions would allow at the time. Densely populated areas tend to have a greater number of records than rural areas. Such records may be inaccurate due to the confusion surrounding continuous air raids.

Press records can supplement local information, although this source of information must be treated with caution, as inaccuracies do exist, either inadvertently or intentionally in order to confuse enemy intelligence. Classified official records can sometimes be considered inaccurate for the same reason.

Recent research indicates that England alone had 17,434No. recorded defence sites, of which 12,464No. were classified as defensive anti-invasion sites. The precise locations of many of these sites are still to be identified, illustrating the scale of the problem when establishing potential risks from limited historical data.

Zetica Ltd researched the military history of the Site and its surrounding area utilising a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

2.2 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

2.3 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on ZeticaUXO's website (http://zeticauxo.com/guidance/uxb-risk-maps/).

2.4 Ministry of Defence and Government Records

Various government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Home Office records of abandoned bombs.

2.5 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, Historic England and the Defence of Britain Project.

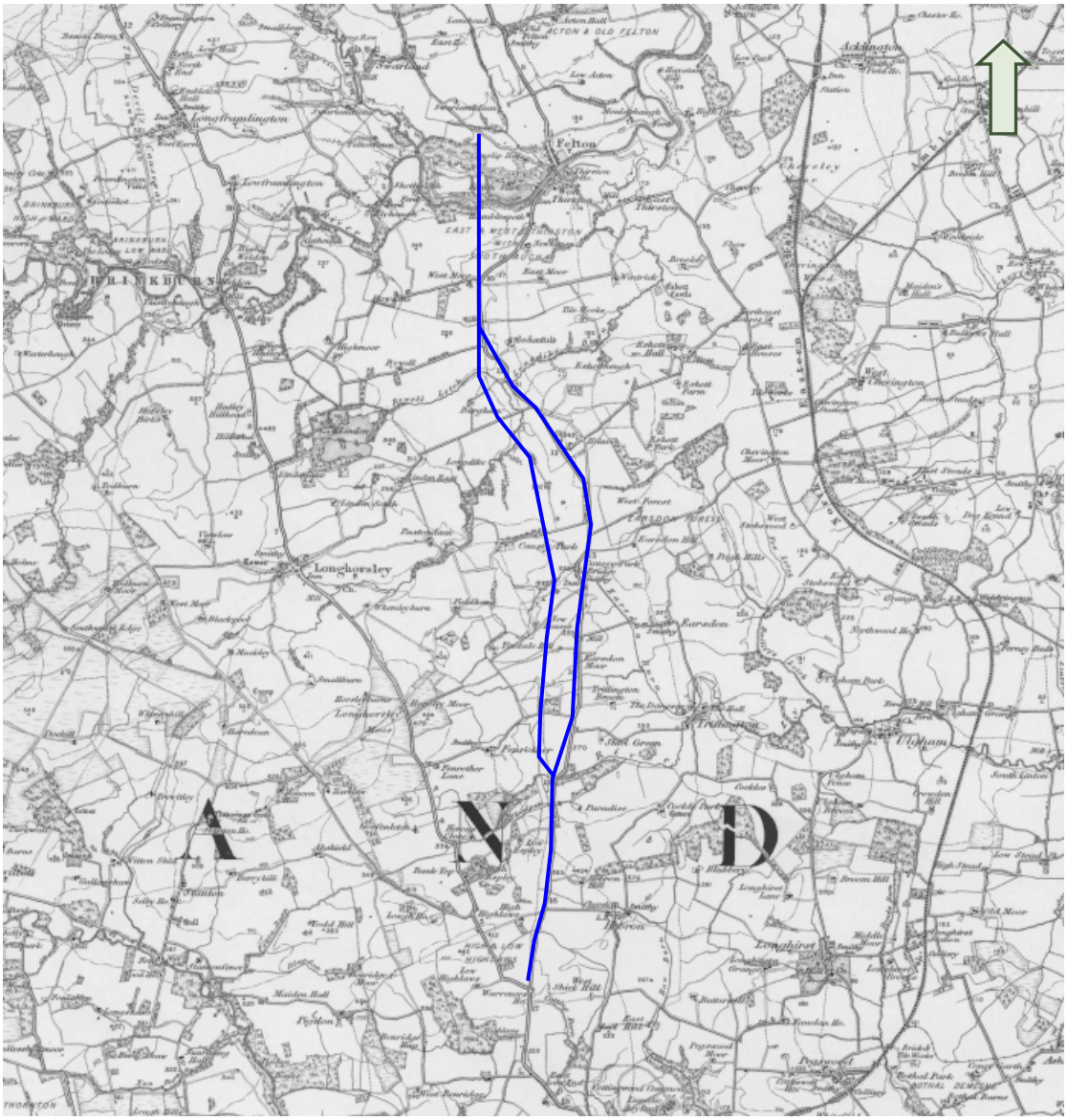
The British Geological Survey (BGS) was consulted for borehole information.
2.6 Local Authority Records
Information was obtained from Northumberland County Council.
2.7 Local Record Offices and Libraries
The Woodhorn Museum and Northumberland Archives were consulted for information.
2.8 Local Historical and Other Groups
Local history groups and archaeological bodies, including Keys to the Past, were consulted.
2.9 Data Confidence Level
In general, there is a high level of confidence in the researched information sources used for this report. Any exceptions to this are specifically detailed in the text of this report.

3 SITE HISTORY

3.1 General History

The historical map of 1897 (Figure 2) shows that in the late 19th century the Site comprised part of the Great North Road and areas of adjacent farmland in a largely rural area.

Figure 2	Historical map, 1897



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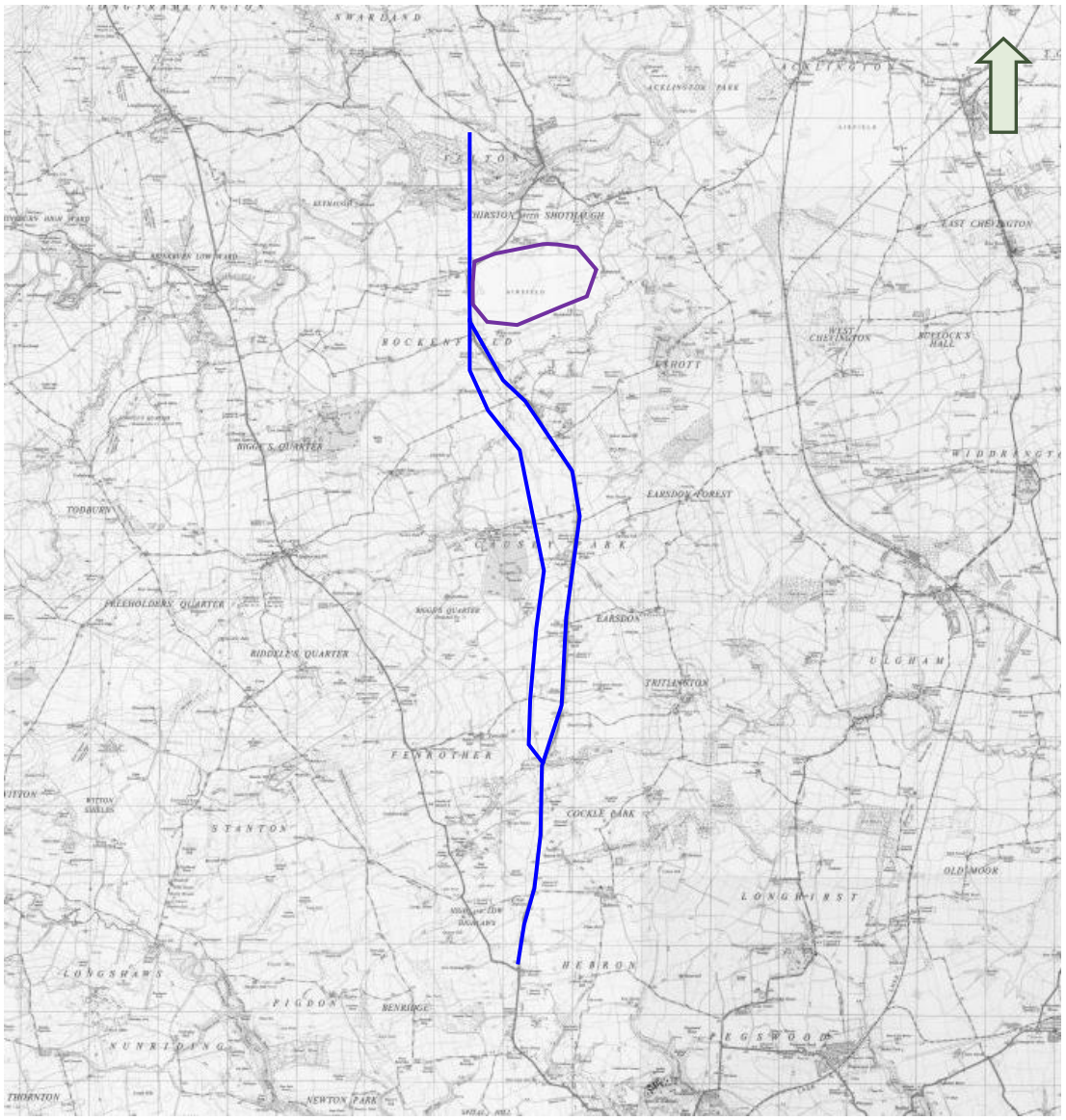
Legend	Site

During 1942 Royal Air Force (RAF) Eshott (NZ 181985), a training airfield for Fighter Command, was established on land adjacent to the Site. In the late 1940s it was relinquished by the RAF and returned to agricultural use.

No significant development had occurred on the Site during the first half of the 20th century, which remained comprised of a roadway and adjacent farmland. This is shown on the historical map of 1950 (Figure 3).

Figure 3	Historical map, 1950



Source: © Crown Copyright 2016. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site	Airfield boundary

In the 1980s the Felton Bypass was constructed on the Site between NZ 174987 and NU 174008, on land previously comprised of fields and woodland. The majority of the Site remained comprised of the A1.

In the 1990s Eshott Airfield was reopened for use as a civilian aerodrome, as is shown in Plate 2, a satellite photograph of the Site dating from 2002.

Plate 2	Satellite photograph of the Site, 2002

Source: Google Earth *Not to scale*

Legend	Site	Airfield boundary

No significant development has occurred on the Site since 2002 (see Plate 1).

3.2 Pre-WWI Military Activity

No records of any significant pre-WWI military activity on the Site have been found.

3.3 WWI Military Activity

No records of any significant WWI military activity on the Site have been found.

Records have been found indicating the troops recruited from nearby villages undertook training exercises in Felton Park (NU 179000), within approximately 0.6km of the Site. This training consisted of basic drills and did not include the use of ordnance.

During WWI an estimated 9,000No. German bombs were dropped over Britain. It was the first time that strategic aerial bombing had been used.

During WWI the Site was located in a rural area, with no significant strategic targets nearby.

No records have been found indicating that the Site was bombed during WWI.

In response to the air raids, Anti-Aircraft (AA) guns were established. These were potential sources of Unexploded AA (UXAA) shells which could land up to 13km from the firing point, although more typically fell within 10km during WWI.

No records have been found indicating that there were any static AA guns within 10km of the Site during WWI.

WWI military activity is not considered to provide a source of UXO hazard to the Site.

3.4 WWII Military Activity

The area was of little strategic importance during WWII and regional bombing densities were low. Details of air raid incidents in the vicinity of the Site are provided in Section 4 and Appendix 1.

Defensive and offensive military establishments were built during WWII. These included lines of defences (Stop Lines), pillboxes, AA guns and bombing decoys. Details for those nearest to the Site are provided in Section 5.

Other military establishments in the vicinity of the Site, including RAF Eshott, are described in Sections 6 to 8.

3.5 Post-WWII Military Activity

No records of any significant post-WWII military activity on or in close proximity to the Site have been found.

4 WWII BOMBING

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, industrial premises, power stations and airfields.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact, within 25m of this, death or fatal injury could occur.

PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration. Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any UXO. In more rural areas, fewer bombing raids occurred. It is known that Air Raid Precaution (ARP) records under-represent the number and frequency of bombs falling in rural and coastal areas.

Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid Anti-Aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural, river, marsh or coastal areas were often unrecorded or entered as 'fell in open country', 'fell in the sea' or 'fell in the river' and left little evidence of the fall.

4.1 Bombing in Northumberland

From prior to the declaration of war in 1939, Britain was subjected to reconnaissance flights by the Luftwaffe which was building up a photographic record of potential targets.

The Northumberland coast was subjected to several heavy air raids during WWII, mainly aimed at destroying the shipyards and naval bases in the region. The most significant air raids were directed at Tynemouth and South Shields, approximately 20km south of the Site.

Sporadic attacks by single aircraft were made on collieries and other industrial targets in Northumberland. The region was on the Luftwaffe flight path to several larger target cities, including Glasgow, and as such was subject to 'tip and run' bombing and jettisoned bombs.

4.2 Strategic Targets

The presence of strategic targets significantly increased the likelihood of bombing within the local area. Airfields, docks, industrial facilities, transport infrastructure and anti-invasion defences were all targeted by Luftwaffe bombers. The inherent bombing inaccuracies at the time meant that areas surrounding the targets were often subjected to bombing.

During WWII the Site was located in a rural area with few significant strategic targets. Potential targets in the vicinity of the Site are described below.

4.2.1 Military Airfields

RAF Eshott (NZ 181985), adjacent to the Site, was opened in 1942 for use as a training airfield (see Section 6.1).

RAF Acklington (NU 229008), approximately 5.4km east of the Site, operated as a station for No. 13 Group Fighter Command. Squadrons based at the airfield were tasked with defending the Northeast during the Battle of Britain.

RAF Morpeth (NZ 173818), approximately 6.6km south of the Site, was used to accommodate No. 4 Air Gunnery School (AGS) and No. 80 (French) Operational Training Unit (OTU).

4.2.2 Army Camps

Several army camps were located in the surrounding area. These included camps at Acton, Felton (NU 188026), approximately 2.2km northeast of the Site, and at Longhorsley (NZ 154946), approximately 3.6km west of the Site.

4.2.3 Transport Infrastructure

The Site comprised one of the main roadways in the region, which was used by military convoys moving supplies to and from the major industrial centres on the River Tyne.

A London & North Eastern Railway (LNER) mainline ran past Morpeth, approximately 3.9km southeast of the Site

4.3 Bombing Density and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal Boroughs (MB) and Country Boroughs (CB). The majority of the Site was located in Morpeth RD, with its northern end crossing into Alnwick RD.

The figures for West Ham CB, generally considered to represent a high regional bombing density, are included for comparison.

Table 1	Bombing Statistics				
Area	**Bombs Recorded**				
	High Explosive	**Parachute Mines**	**Other**	**Total**	**Bombs per 405ha (1,000 acres)**
Morpeth RD	**161**	**2**	**0**	**163**	**2.1**
Alnwick RD	**110**	**3**	**0**	**113**	**1.2**
Amble UD	18	0	0	18	14.3
Morpeth MB	0	0	0	0	0
West Ham CB	1,498	45	47	1,590	334.0

Note that Table 1 excludes the figures for AA shells and IBs. Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

The nearest recorded incidents to the Site are described below. Appendix 1 provides details of further air raid incidents in the vicinity of the Site.

29th August 1940

Approximately 4No. HE bombs and 400No. IBs fell on fields south of Tritlington School (NZ 188922), in the immediate vicinity of the Site. The HE bombs were recorded as UXBs.

1No. HE bomb fell on a field near Earsdon Moor (NZ 190934), in the immediate vicinity of the Site. This was recorded as a UXB.

Several HE bombs fell on fields near New House Farm (NZ 175943), within approximately 0.4km of the Site. These were all recorded as UXBs.

1st September 1940

17No. HE bombs fell between Tritlington Broom Farm (NZ 193927), approximately 0.4km east of the Site, and Tritlington Farm (NZ 204927), approximately 1.3km east of the Site.

31st March 1941

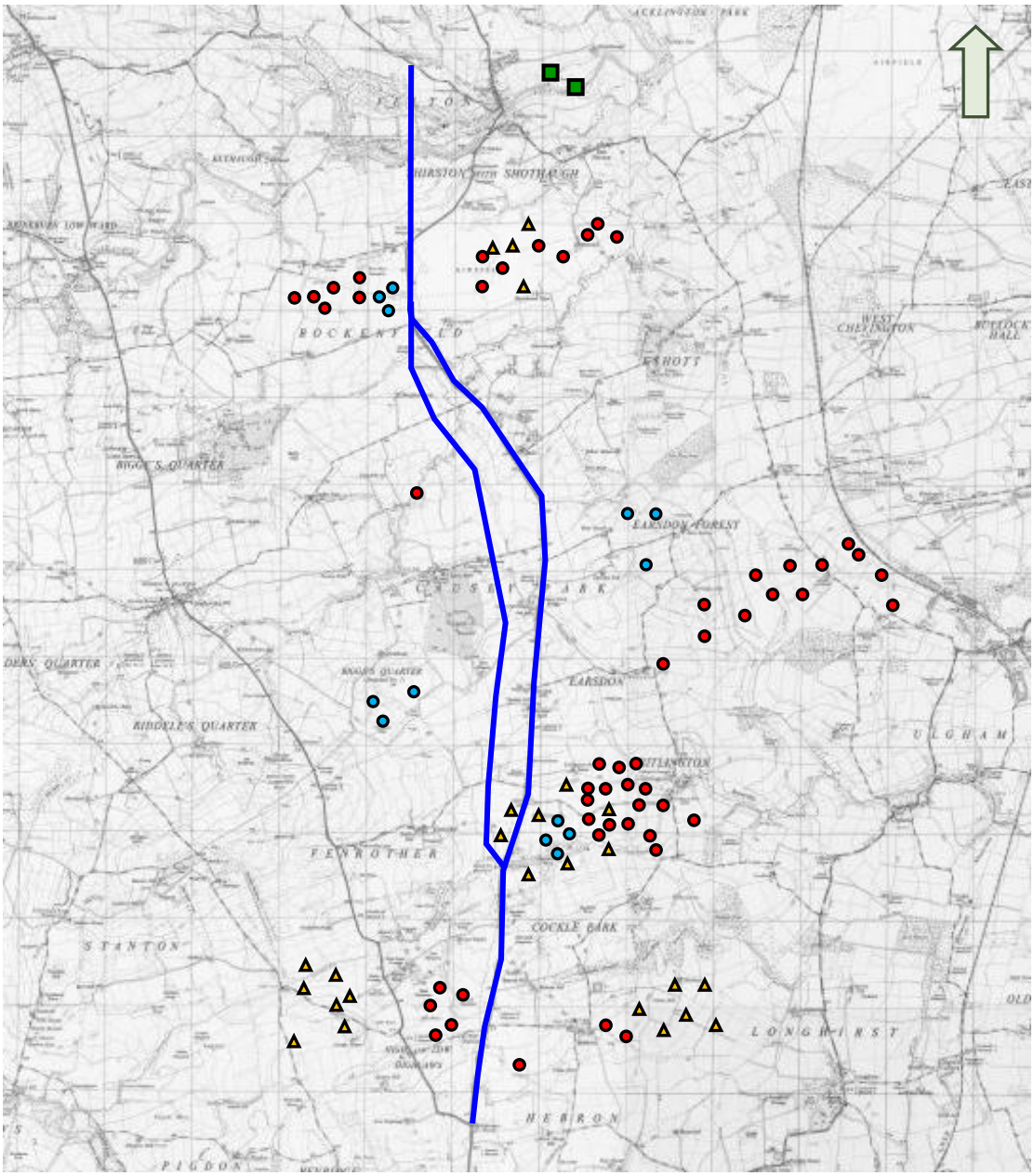
9No. HE bombs fell on fields north of Bywell Farm (NZ 169982), within approximately 1km west of the Site. 3No. of these were recorded as UXBs.

It should be noted that during WWII, many UXB were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXB were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Figure 4 is a map showing the approximate locations of bomb impacts in the vicinity of the Site. IBs shown are indicative of larger numbers of similar devices that fell within the given area. The map has been compiled from a number of different sources, including air raid incident reports, bomb census maps and historical aerial photographs.

Note that air raid incident reports did not always record precise locations, often only indicating on which street, area or farm a bomb fell.

Figure 4	Compiled bomb impact map for the vicinity of the Site



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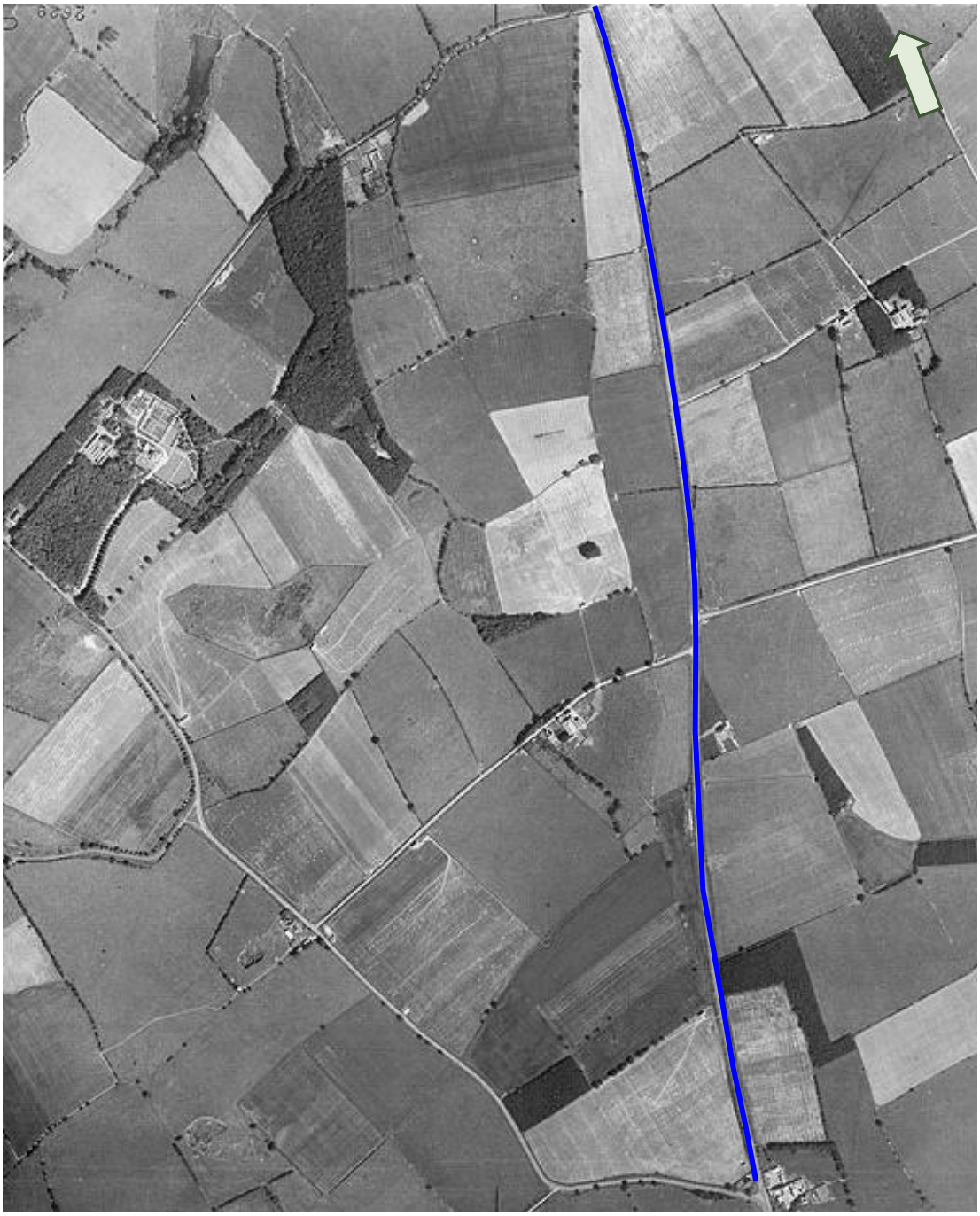
Legend	Site	HE bomb	UXB	PM	IBs

Plates 3 to 8 are aerial photographs of the Site dating from the end of WWII.

No significant bomb damage or cratering has been identified on or in close proximity to the Site.

Plate 3	Aerial photograph, 2nd August 1945 (NZ 182886 to NZ 185909)



Source: Historic England *Not to scale*

Legend	Site

Plate 4	Aerial photograph, 2nd August 1945 (NZ 185905 to NZ 187921)

Source: Historic England *Not to scale*

Legend	Site

Plate 5	Aerial photograph, 30th July 1948 (NZ 185915 to NZ 188928)

Source: Historic England *Not to scale*

Legend	Site

Plate 6	Aerial photograph, 2nd August 1945 (NZ 188928 to NZ189946)

Source: Historic England *Not to scale*

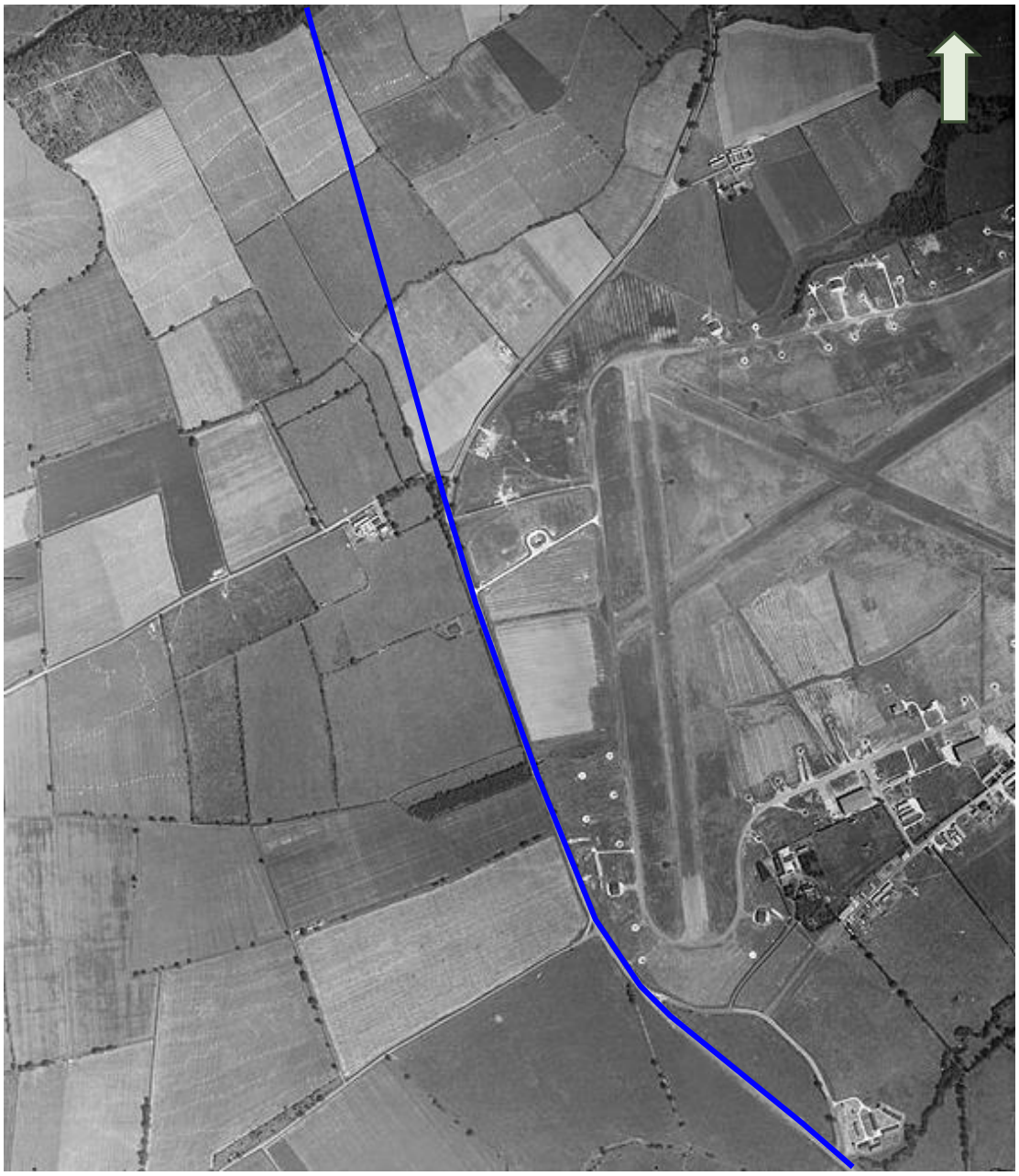
Legend	Site

Plate 7	Aerial photograph, 2nd August 1945 (NZ 189958 to NZ 178973)

Source: Historic England *Not to scale*

Legend	Site

Plate 8	Aerial photograph, 2nd August 1945 (NZ 178972 to NZ 174997)



Source: Historic England *Not to scale*

Legend	Site

No records have been found indicating that the Site was bombed and no significant bomb damage has been identified on the Site on WWII aerial photographs.

WWII bombing is not considered to provide a source of UXO hazard to the Site.

4.4 Geology and Bomb Penetration Depths

It is important to consider the geological materials present on the Site at the time that a bomb was dropped in order to establish its maximum penetration depth. The BGS 1:50,000 Sheet 9 (Solid and Drift) Rothbury and BGS borehole records were consulted.

The geology for the majority of the Site during WWII comprised Made Ground over Devensian Till, overlying the Stainmore Formation.

The additional route part of the Site comprised a thin layer of topsoil over Devensian Till, overlying the Stainmore Formation.

The northern part of the Site during WWII comprised a thin layer of topsoil over Glaciofluvial Deposits, overlying the Stainmore Formation.

Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 2m of Made Ground over 7m of stiff clay, overlying more than 30m of weak rock.

Table 2	Estimated average maximum bomb penetration depths (Made Ground)	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	3.0m
	500kg	10.0m
	1,000kg	11.0m

Table 3 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 1m of stiff clay over 3m of sand and 5m of stiff clay, overlying more than 30m of weak rock.

Table 3	Estimated average maximum bomb penetration depths (Glaciofluvial deposits)	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	3.0m
	500kg	8.5m
	1,000kg	10.5m

Table 4 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 8m of stiff clay overlying more than 30m of weak rock.

Table 4	Estimated average maximum bomb penetration depths (No Made Ground)	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	5.5m
	500kg	10.5m
	1,000kg	11.5m

The estimated bomb penetration depths given in Tables 2, 3 and 4 are from the WWII ground level and are based on the following assumptions:

a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).

b) A strike angle of 10 to 15 degrees to the vertical.

c) That the bomb is stable, both in flight and on penetration.

d) That no retarding units are fitted to the bomb.

e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10^{o} and 15^{o} to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

The average offset is one third of the penetration depth, i.e. an offset of 2m may be expected for a 50kg bomb in dry silts and clays. If hard standings or Made Ground were present during WWII, bomb penetration depths would have been significantly reduced but offset distances may have been up to four times greater.

In low level attacks over deep water bodies, the offset distances from the point of entry at the water surface may be considerably enhanced due to hydrodynamic effects before the bomb penetrates or settles on the sea bed. Shallow water has little effect on bomb penetration depths during high level attacks.

5 WWII DEFENCES

5.1 Bombing Decoys

In order to draw enemy aircraft away from towns and other strategically important targets, a series of decoys were developed between 1940 and 1941.

They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. Approximately 792No. static decoy sites were built at 593No. locations in England. In addition, numerous temporary and mobile decoys were deployed.

Several different types of decoy were devised:

- Night time dummy airfields (Q sites).
- Daytime dummy airfields (K sites).
- Diversionary fires to simulate successful bombing raids on airfields (QF sites), petroleum depots (P sites) and major towns and cities (Starfish or SF sites).
- Simulated urban lighting (QL sites).
- Dummy Heavy Anti-Aircraft (HAA) batteries, factories and buildings (C series).
- Mobile decoys representing 'hards' for troop embarkation (MQLs), tanks and other vehicles.

Machine gun emplacements and Light Anti-Aircraft (LAA) guns were used to prevent possible enemy landings at decoy airfields.

By their nature, decoy sites provide a potential risk from Unexploded Bombs (UXB), both within the decoy site boundary and in the surrounding areas.

The nearest recorded bombing decoy was located near Widdrington (NZ 268942), approximately 7.4km east of the Site.

This decoy is not considered to provide a source of UXO hazard to the Site.

5.2 Anti-Aircraft Defences

Anti-Aircraft (AA) gun batteries were targeted by the Luftwaffe. They were also a source of Unexploded AA (UXAA) shells which could land up to 27km from the firing point during WWII, although more typically fell within 15km. These could be distributed over a wide area.

AA batteries present a potential source of UXO hazard as a result of the storage, use and disposal of ordnance associated with the armaments used. They may have a risk from small caches of ammunition buried locally to them. 3No. types of AA batteries existed:

- Heavy Anti-Aircraft (HAA) batteries of large guns designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- Light Anti-Aircraft (LAA) weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields.
- Rocket batteries (ZAA) firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were also relatively permanent emplacements.

Many AA batteries were associated with searchlights and consequently 'visible' at night, providing clear targets to the Luftwaffe bombers and a potential for UXB.

No records have been found indicating that any HAA gun batteries were located within 10km of the Site.

It should be noted that the lack of official records of HAA batteries or armaments cannot be taken to imply their absence because many units were mobile and were moved around as operational requirements dictated.

It is likely that RAF Eshott was defended by LAA guns, although no records have been found specifying their location.

Records have been found indicating that a searchlight battery was located on Peigh Hill (NZ 208952), approximately 2km east of the Site.

AA defences are not considered to provide a source of UXO hazard to the Site.

5.3 Barrage Balloons and Anti-Landing Obstacles

Balloon barrages were flown in many British towns and cities to protect against air raids. Their presence deterred low flying aircraft, making it more difficult for bombs to reach their intended targets. Barrage balloon sites can be a source of UXO as they were targeted by the Luftwaffe. They also often had a small explosive charge fitted with tilt fuzes attached approximately 50m from each end of the balloon cables and designed to detonate if the cables were hit by an aircraft.

Measures were also taken to prevent enemy aircraft landing in the event of invasion. Obstructions were constructed around airfields and on other open sites deemed fit for use as landing grounds. Solid obstructions (such as concrete blocks), posts or stakes, felled trees, haystacks, scaffolding with wire and trenching were the main measures used.

No records of any barrage balloons or anti-landing obstacles on or in close proximity to the Site have been found.

5.4 Anti-Invasion Defences

Defence structures are a potential source of UXB as they were especially targeted by low flying enemy aircraft, particularly during 'tip and run' raids which were common in industrialised regions. These defences may also be associated with small caches of UXO in the form of small arms, used by the troops manning the emplacement.

The rapid advance of German Troops into France, Holland and Belgium after the start of WWII prompted the War Office to review the vulnerability of the UK to invasion and a decision was taken to begin work on a national plan of anti-invasion defences. Static defences were built to interrupt and delay the progress of any invading force.

Coastal defences were strengthened (the 'Coastal Crust'). These defences included barbed wire entanglements and minefields, which were often combined to give defence in depth.

Inland, lines of defence structures were constructed along 'Stop Lines' in order to impede enemy progress for long enough to allow mobile defending forces to counter-attack.

Stop Lines included the fortification of key 'centres of resistance', such as river crossings and important road or rail junctions that could seriously hamper the enemy's advance across country. Bridges were mined for demolition and tank traps installed.

Stop Lines were further integrated into a network of fortified nodal points and 'Anti-Tank (AT) Islands'.

During WWII 2No. Stop Lines were established along rivers in the vicinity of the Site. These were the Northern Command Coquet Stop Line, near the northern end of the Site, and the Northern Command River Wansbeck Stop Line, near the southern end of the Site.

Further details of these anti-invasion defences are given in the Sections below.

5.5 Pillboxes, Mortar and Gun Emplacements

Defences also included spigot mortar positions and gun emplacements.

Spigot mortars, also known as Blacker Bombards, were used primarily in an anti-tank role at road blocks or to defend airfields. Typically they fired a 20 pound (lb) HE mortar bomb. The fixed positions, in weapons pits with ammunition lockers, were frequently positioned near pillboxes.

Spigot mortar positions could be either fixed or mobile.

No records of any spigot mortar or gun emplacements on or in close proximity to the Site have been found.

Pillboxes provide a potential UXO hazard both from the storage, use and disposal of ordnance associated with them and from UXB because they were targeted by enemy aircraft.

Pillboxes were common along Stop Lines, perimeters of airfields, potential land invasion sites and around important civil sites. Several different designs existed including Seagull Trenches (semi-buried structures), Alan Williams and Tett Turrets (small prefabricated pillboxes). Fortified sites, buildings or loop-holed walls also functioned as pillboxes.

Records have been found indicating that least 29No. pillboxes were located within 5km of the Site. The nearest recorded pillbox to the Site was located approximately 1km west of the Site at West Moor, Felton (NZ 165991).

Pillboxes and gun emplacements are not considered to provide a source of UXO hazard to the Site.

5.6 Home Guard and Auxiliary Units

Local Defence Volunteers (LDV) units, later known as the Home Guard, were located in all cities, towns and large villages.

Anti-invasion defences were to be defended by the Home Guard and regular Army troops for as long as possible in the event of an invasion. The troops were issued with 'No Withdrawal' orders.

Important elements of the ordnance supply for the use of the Home Guard included substantial supplies of Mills bombs (fragmentation grenades) and Self Igniting Phosphorus (SIP) grenades as well as machine gun and small arms ammunition.

In October 2006 a cache of 76No. SIP grenades was found in a garden at Seend, Wiltshire. In October 2008, a further 26No. SIP grenades were discovered in a garden in Wimborne, Dorset.

Similar caches were discovered in October 2009 in Hove, Sussex and during May 2010 in Halesowen in the West Midlands, and a further cache of 20No. was uncovered on a construction site at Birdlip, Gloucestershire, in July 2010. Also in July 2010, a box of 24No. SIP grenades was found on Cogden Beach, Dorset. In April 2012, more than 8No. SIP grenades were found on a construction site in Banbury and destroyed by members of the Army Royal Logistic Corps (RLC).

In March 2015, 80No. SIP grenades were found at a building site in Eastbourne, some of which exploded before they could be made safe by a Bomb Disposal unit. In all 8No. cases, the bottles were in good condition and exploded in flames when broken.

Most recently, in May 2016, 1No. No. 76 SIP grenade was found during excavation at Chapel Point, Lincolnshire forcing works to be delayed. During WWII, the site was occupied by a pillbox and gun emplacement associated with the heavily-defended 'Coastal Crust', manned by Home Guard units. The device was removed safely.

Records of Home Guard activities and related sites are rarely preserved. Storage and disposal of munitions by the Home Guard was poorly documented and surplus supplies were either buried or dumped in lakes and ponds. Given the irregular nature of this activity, the possibility of items of UXO being discovered at any locations occupied or used for training by the Home Guard can never be totally discounted.

In addition to the regular Home Guard, Auxiliary Units existed which were made up of guerrilla troops trained in sabotage and assassination in case of invasion. Sites used by these Units were Top Secret and many locations are still unknown.

No Home Guard or Auxiliary Unit activity has been identified on or in close proximity to the Site.

The 3rd (Morpeth) and 2nd (Alnwick) Northumberland Home Guard Battalions operated in the vicinity of the Site, tasked with undertaking patrols and manning anti-invasion defences.

Home Guard units were also engaged in defending RAF Eshott, adjacent to the Site. Home Guard troops often participated in mock attacks on airfields to test their defences. It is unlikely that live ammunition would have been used in these exercises, but it cannot be totally discounted.

Records indicate that several Auxiliary Units were operational within 2km of the Site. Operational Bases (OBs) are recorded near Espley (NZ 195900), Causey Park (NZ 167950) and Felton (NU 185007).

In the event of an enemy invasion, these units were tasked with destroying nearby bridges, and the facilities at RAF Eshott.

Home Guard and Auxiliary Unit activity is not considered to provide a source of UXO hazard to the Site.

5.7 Minefields and Mined Locations

Minefields were laid along the coast, in estuaries and along the banks of major rivers to deter infantry invasion. Strategic points such as bridges and gaps in cliffs were mined to impede enemy advance. Most of the mined locations in the UK have been cleared and the risk of finding UXO in these areas is considered to be low.

No minefields have been identified on or in close proximity to the Site.

6 MILITARY AIRFIELDS

Military airfields offer the potential for significant UXO hazards due to the use, storage and disposal of ordnance and as a result of enemy bombing during WWI and WWII.

Airfields active during WWII were targeted by the Luftwaffe, providing a potential source of UXB on the airfield.

As bombing accuracy was so poor during WWII, it is likely to find UXB in the surrounding areas. Aircraft crashes are also associated with operational airfields.

During WWI there were 2No. Royal Flying Corps (RFC) landing grounds in the vicinity of the Site. Longhorsley Airfield (NZ 159926), located approximately 2.4km west of the Site, was used between February 1917 and 1918. Beacon Hill Airfield (NZ 145917), approximately 4.2km west of the Site, was used for a short period between the end of 1916 and early 1917.

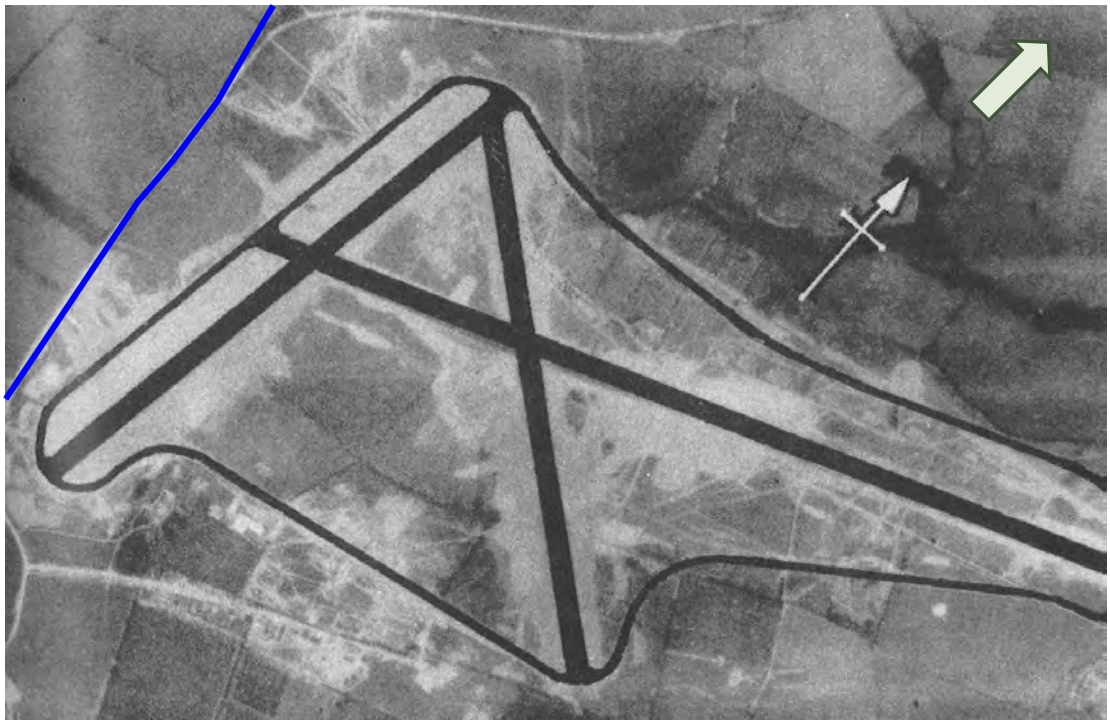
During WWII RAF Eshott (NZ 180985) was established adjacent to the Site. The operational history of the airfield is described below.

6.1 RAF Eshott

In 1941 construction of an airfield began on agricultural land near the village of Eshott, adjacent to the Site. It was originally intended to operate as a fighter station, and was consequently built with 3No. concrete runways. It eventually opened as a training airfield in late 1942.

Plate 9 is a WWII-era aerial photograph of the airfield.

Plate 9	Aerial photograph of RAF Eshott, WWII

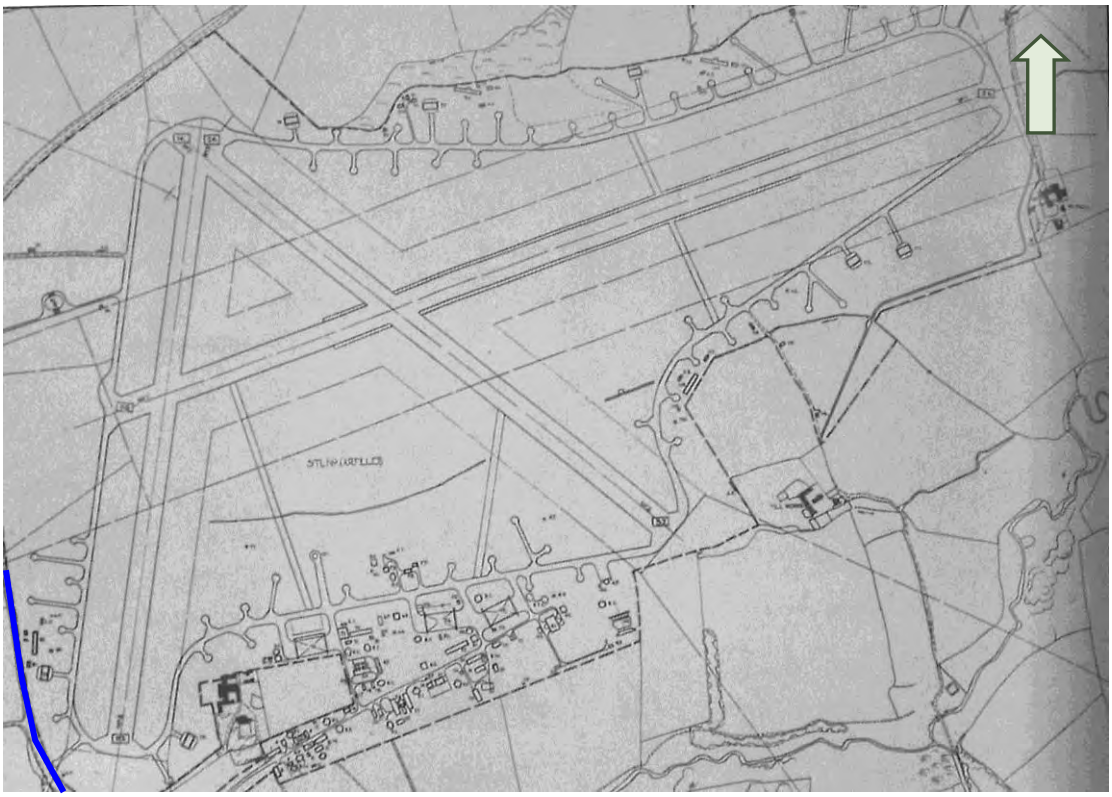


Source: Delve *Not to scale*

Legend	Site

Figure 5 is an extract of the airfield site plan. It shows that the Site ran in close proximity to aircraft dispersals, and was located approximately 0.3km from the Technical Area, which included 1No. T1 hangar and 8No. Blister hangars.

Figure 5	Extract of WWII site plan of RAF Eshott



Source: Delve *Not to scale*

Legend	Site

Domestic facilities associated with the airfield were constructed adjacent to the Site, as shown in Plate 10.

Plate 10	Aerial photograph of RAF Eshott accomodation camps, 2nd August 1945

Source: Historic England *Not to scale*

Legend	Site	Accomodation camps

In November 1942 No. 57 Operational Training Unit (OTU) was transferred to RAF Eshott. Training at the airfield typically took place over 3No. months, and involved a combination of ground instruction and flight practice.

The majority of the flight practice took place in Miles Master training aircraft and Mk 1 and Mk 2 Supermarine Spitfire fighter aircraft. It included rehearsing dog-fighting and aerial gunnery, which used targets towed by Fairey Battle and Westland Lysander aircraft.

In 1945 RAF Eshott was used to accommodate No. 289 Squadron, primarily armed with Vultee Vengeance dive-bomber aircraft. In early June 1945 both No. 289 Squadron and No. 57 OTU were disbanded, leaving the airfield unoccupied.

In October 1945 No. 261 Maintenance Unit (MU), primarily based at RAF Morpeth, began using RAF Eshott as a sub-site.

In January 1948 the RAF relinquished control of RAF Eshott, and it was returned to agricultural use. In the early 1990s it was reopened as the home of Eshott Airfield Flying Club.

Personnel stationed at the airfield would have been issued with Small Arms Ammunition (SAA). The possibility that SAA was discarded in the vicinity of the airfield and domestic sites, whilst unlikely, cannot be fully discounted. SAA is not considered to provide a significant UXO hazard (see Appendix A2.1).

Airfield activity at RAF Eshott is not considered to provide a significant source of UXO hazard to the Site.

6.2 Aircraft Crashes

Aircraft crash sites are a known UXO hazard. The MoD advises that if crashed aircraft are found, the safest policy is to leave them alone where possible. Unless disturbed there is no statutory requirement for the MoD to clear such sites.

No records of military aircraft crashes on or in close proximity to the Site have been found.

Given the role of RAF Eshott as a training airfield, large numbers of aircraft crashes were recorded in the surrounding area. The most significant are described below.

27th March 1942

1No. Hawker Hurricane I fighter aircraft (P3030) crashed south of Felton during a forced landing, approximately 1.2km east of the Site.

6th July 1942

1No. Bristol Beaufighter VI fighter-bomber aircraft (X7940) crashed at Causey Park Hall, approximately 0.5km west of the Site.

28th August 1942

1No. Bristol Beaufighter I fighter-bomber aircraft (X7612) crash-landed at East Linden Farm, approximately 1.3km west-southwest of the Site.

15th January 1943

1No. Miles Master I training aircraft (N7575) crashed on approach to RAF Eshott, within approximately 1km of the Site.

27th February 1943

2No. Supermarine Spitfire fighter aircraft (P8360 and P8362) collided and crashed near Eshott, approximately 1.5km east of the Site.

26th March 1943

1No. Miles Master I training aircraft (T8391) crashed on landing at RAF Eshott, approximately 0.5km northeast of the Site.

27th March 1943

1No. Miles Master I training aircraft (N7873) crashed on approach to RAF Morpeth, within approximately 1.5km of the Site.

19th May 1943

1No. Supermarine Spitfire fighter aircraft (R7121) crashed during a forced landing at RAF Eshott, approximately 0.5km northeast of the Site.

20th May 1943

1No. Hawker Hurricane fighter aircraft (BD594) crashed near Eshott, approximately 1.5km east of the Site.

8th July 1943

1No. Supermarine Spitfire fighter aircraft (X4482) crashed at RAF Eshott, approximately 0.5km east of the Site.

4th August 1943

1No. Bristol Beaufighter VI fighter-bomber aircraft crashed at Bywell Farm, approximately 0.8km west of the Site.

12th April 1944

1No. United States Army Air Force (USAAF) Republic P47 Thunderbolt fighter aircraft collided with an RAF Supermarine Spitfire fighter aircraft. The Republic P47 Thunderbolt aircraft crashed in Felmoor Park, approximately 0.4km east of the Site.

These crashes may have scattered SAA over a wide area, potentially including the Site. SAA is not considered to provide a significant source of UXO hazard (see Appendix A2.1).

7 EXPLOSIVES AND MUNITIONS ESTABLISHMENTS AND DEPOTS

Explosives and munitions manufacturing or storage sites offer a particularly high risk from both explosive substances and UXO. Standard procedures of explosive/ordnance disposal through burial or burning means that explosive and UXO hazards will be present in some areas of such establishments.

In addition, UXB hazards may be present as a result of enemy bombing during WWI and WWII.

7.1 Explosives and Ordnance Factories

No records of any explosives or ordnance factories on or in close proximity to the Site have been found.

7.2 Munitions Stores

Local ammunition caches would have been present near to defended road blocks, pillboxes, HAA and LAA sites. Most of those associated with the anti-invasion sites are understood to have been cleared.

No records of any official munitions depots on or in close proximity to the Site have been found.

RAF Eshott had munitions stores and armouries in the airfield Technical Area, approximately 0.4km east of the Site.

These munitions stores are not considered to provide a source of UXO hazard to the Site.

7.3 Informal Munitions Depots

Informal munitions depots, often made by requisitioning roadside lay-bys or parks. Other informal munitions depots were commonly located in areas of woodland or on train wagons along sidings in marshalling yards.

No records of any informal munitions depots on or in close proximity to the Site have been found.

7.4 Munitions Disposal Areas and Bomb Cemeteries

Munitions disposal areas were often made by requisitioning open areas of land, usually away from habitation. Marshland, beaches or sand dunes were frequently used for this purpose. Disposal of munitions was carried out in many different ways, ranging from destruction to burial. Full records were not necessarily maintained for these locations, and so they can potentially be a source of UXO.

No records of any munitions disposal areas on or in close proximity to the Site have been found.

Whilst no official munitions disposal areas were recorded at RAF Eshott, it is possible that munitions were disposed of in remote locations, such as nearby patches of woodland. It is unlikely that this would have occurred in the vicinity of the Site, which was outside the airfield boundary and comprised a roadway.

Munitions disposal areas are not considered to provide a source of UXO hazard to the Site.

8 FIRING RANGES AND MILITARY TRAINING AREAS

By their nature, firing ranges and military training areas represent a potential source of UXO due to associated training activities. The training will involve both practice and live munitions and will offer a significant risk from a very wide range of potential UXO.

8.1 Small Arms Ranges

Small arms ranges (such as rifle ranges) and close combat ranges (such as mortar and grenade ranges) are likely to provide a significant source of UXO. It should be noted that even on small arms ranges, larger munitions such as mortars or grenades cannot be discounted.

No records of any small arms ranges on or in close proximity to the Site have been found.

There were test butts at RAF Eshott, approximately 0.9km east of the Site, for harmonising aircraft machine guns.

A 25 yard (yd) small arms range was also located at RAF Eshott, approximately 1km east of the Site.

These ranges are not considered to provide a source of UXO hazard to the Site.

8.2 Artillery Ranges

Artillery ranges will have utilised a wide range of munitions, predominantly shells, although close combat munitions such as mortars, or larger munitions such as bombs, cannot be discounted.

No records of any artillery ranges on or in close proximity to the Site have been found.

8.3 Bombing Ranges

Bombing ranges will have primarily used bombs, although other munitions such as shells and close combat munitions such as mortars cannot be totally discounted.

No records of any bombing ranges on or in close proximity to the Site have been found.

8.4 Training Areas

Training areas will have primarily used blank ammunition or practice shells in 'dry' areas, although live munitions such as shells and close combat munitions such as mortars cannot be discounted in any training area.

No records of any military training areas on the Site have been found.

Home Guard units were engaged in defending RAF Eshott, adjacent to the Site. Home Guard troops often participated in mock attacks on airfields to test their defences. It is unlikely that live ammunition would have been used in these exercises, but it cannot be totally discounted.

Records have been found indicating that trainee pilots at RAF Eshott, in preparation for the possibility of crashing behind enemy lines, were trained in survival techniques in nearby countryside. This included practicing river crossing over Longdike Burn approximately 0.4km east of the Site.

Home Guard units were engaged in defending RAF Eshott. Home Guard troops often participated in mock attacks on airfields to test their defences. It is unlikely that live ammunition would have been used in these exercises, but it cannot be totally discounted.

Anecdotal evidence has been found indicating that Longhorsley Moor, approximately 3km west of the Site, was used as a tank training ground during WWII.

Military training areas are not considered to provide a significant source of UXO hazard to the Site.

9 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27th February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear.

Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

9.1 Abandoned Bombs

No records of any officially abandoned bombs on the Site have been found.

9.2 EOC Tasks

Zetica Ltd holds no records of post-WWII EOC tasks being undertaken in the vicinity of the Site.

10 UXO HAZARD ASSESSMENT

10.1 UXO Hazard Level

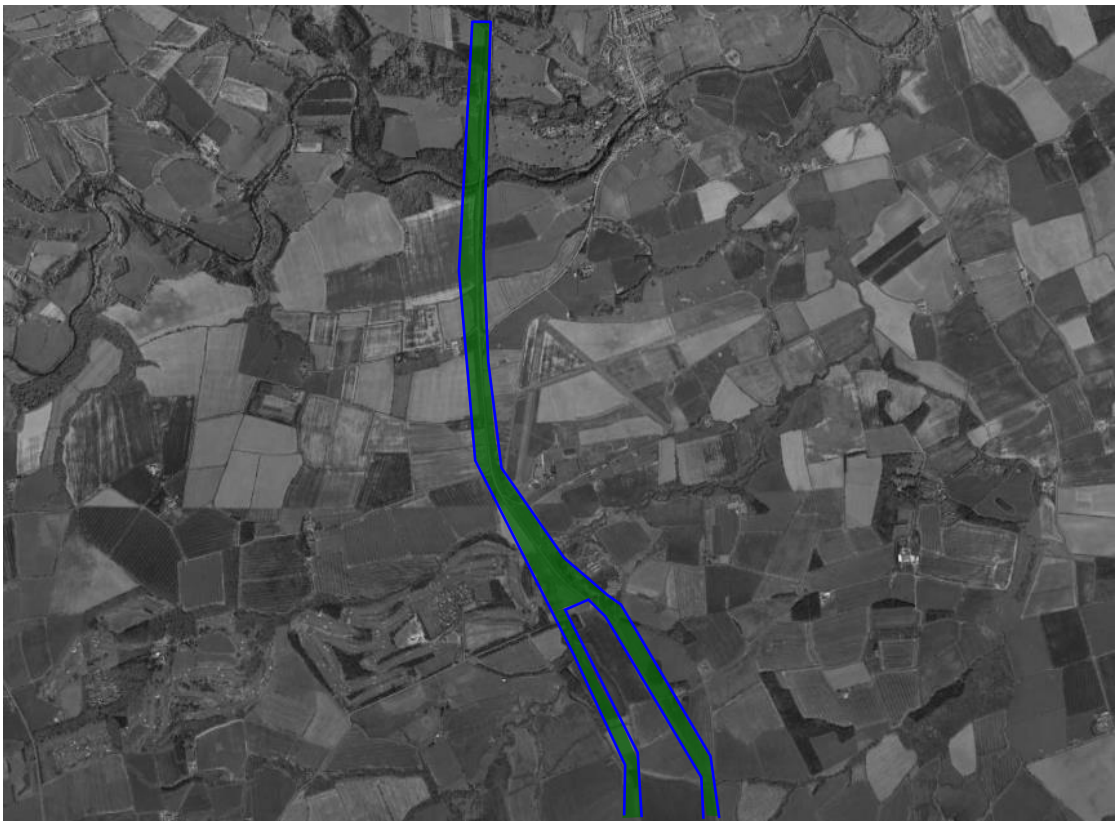
The definitions for the levels of UXO hazard are provided below.

Definitions of UXO Hazard Level for a Site	
Hazard Level	**Definition**
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present and that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

It is considered that the Site has a low UXO hazard level, as shown in Figures 6 and 7.

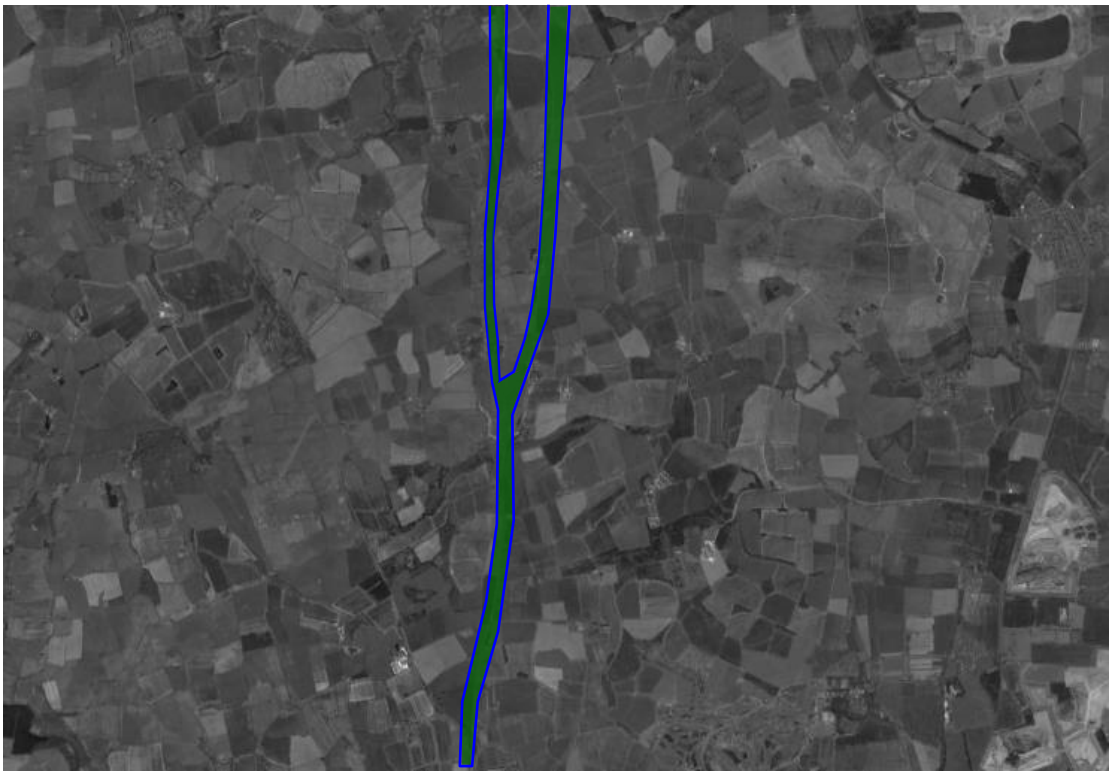
Figure 6	UXO hazard zone plan of the Site (northern part of the Site)



Source: Google Earth *Not to Scale*

Legend	Very Low	Low	Moderate
	High	Very High	Site boundary

Figure 7 UXO hazard zone plan of the Site (southern part of the Site)



Source: Google Earth *Not to Scale*

Legend					
	Very Low		Low		Moderate
	High		Very High		Site boundary

11 UXO RISK ASSESSMENT

11.1 UXO Risk Level

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	LIKELIHOOD of Encounter and Detonation	Rating
20 to 25	Frequent, highly likely, almost certain.	5
13 to 19	Probable, more likely to happen than not.	4
6 to 12	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0

P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.

The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix

		SEVERITY (S)					
		5	4	3	2	1	0
LIKELIHOOD (P)	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

The final risk assessment for the Site is given in Table 5.

Table 5 UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Shallow Excavations	1	1	1	1	5	5	Low
	Deep Excavations	1	1	1	1	5	5	Low
	Piling/boreholes	1	1	1	1	4	4	Low
Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
	Deep Excavations	1	1	1	1	4	4	Low
	Piling/boreholes	1	1	1	1	3	3	Low

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

Shallow excavations defined as <1.0m below ground level (bgl).

UXO Risk	Matrix Rating	Definition
Very Low	0-1	Little action is required by the client provided that suitable records and procedures are in place to ensure appropriate action is undertaken should the UXO risk level change.
Low	2-5	Tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to.
Moderate	6-15	May be tolerable for the client, but it is prudent to reduce the risk where cost effective and reasonably practicable.
High	16-20	Tolerable to the client only where further risk reduction is impracticable or disproportionate to the risk involved. Essential that all practicable measures are taken to reduce the level of risk.
Very High	21-25	Unacceptable to the client except in extraordinary circumstances. Imperative that all control measures are taken.

11.2 Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff.

Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.

Table 6 below gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.

Further advice on the mitigation methods can be provided by Zetica on request.

Table 6	Risk mitigation for assumed Site activities			
Risk Level	**Typical Future Activity on the Site**			
	None	**Shallow Excavations (<1.0m)**	**Deep Excavations (>1.0m)**	**Boreholes or Pile Construction**
Very low	Ensure suitable records and procedures are in place to highlight the risk should future development be planned.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.
Low	**As very low.**	**As very low.** **+ It is considered prudent to include some UXO awareness training in site inductions.**	**As very low.** **+ It is considered prudent to include some UXO awareness training in site inductions.**	**As very low.** **+Clearance certification for borehole or pile locations would be considered prudent only if a zero tolerance to risk is adopted.** **Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.**
Moderate	**As very low.**	**As low.** **+Non-intrusive investigation methods considered prudent where practical.** **+Alternatively, EOC Engineer supervision is considered prudent.**	**As low.** **+Non-intrusive investigation methods considered prudent where practical.** **+Alternatively, EOC Engineer supervision is considered prudent.**	**As low.** **+Clearance certification for borehole or pile locations is considered essential.**
High	As very low.	As moderate. +Non-intrusive investigation methods considered essential where practical. + Alternatively, EOC Engineer supervision is considered essential.	As moderate. +Non-intrusive investigation methods considered essential where practical. + Alternatively, EOC Engineer supervision is considered essential.	As moderate.
Very High	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.
The above table is for guidance only.				

Appendices

Appendix 1 WWII Bombing Incident List

11th August 1940

3No. HE bombs near Wintrick Farm (NZ 194988), approximately 1.9km east of the Site.

29th August 1940

Approximately 4No. HE bombs and 400No. IBs fell on fields south of Tritlington School (NZ 188922), in the immediate vicinity of the Site. The HE bombs were recorded as UXBs.

1No. HE bomb fell on a field near Earsdon Moor (NZ 190934), in the immediate vicinity of the Site. This was recorded as a UXB.

Several HE bombs fell on fields near New House Farm (NZ 175943), within approximately 0.4km of the Site. These were all recorded as UXBs.

3No. HE bombs fell in fields northwest of Earsdon Hill Farm (NZ 197949), approximately 1.3km east of the Site.

200No. IBs fell on fields near Lough House, Espley (NZ 168895), approximately 1.5km west of the Site.

1st September 1940

17No. HE bombs fell between Tritlington Broom Farm (NZ 193927), approximately 0.4km east of the Site, and Tritlington Farm (NZ 204927), approximately 1.3km east of the Site.

3rd September 1940

13No. HE bombs fell on fields between Earsdon West Farm (NZ 200939), approximately 0.9km east of the Site, and West Stobswood Farm (NZ 219952), approximately 3.2km east of the Site.

5th September 1940

5No. HE bombs fell on fields at High Highlaws Farm (NZ 181902), within approximately 0.5km west of the Site.

6No. HE bombs fell on fields at Hebron East Farm (NZ 197897), approximately 1.3km east of the Site.

3rd March 1941

1No. HE bomb fell on a field 400yds northeast of Causey Park Farm (NZ 181956), approximately 0.5km west of the Site.

2No. HE bombs fell near Fairmoor, Morpeth (NZ 181876), approximately 0.8km south of the Site.

200No. IBs fell east of Hebron (NZ 199898), approximately 1.4km east of the Site.

26th March 1941

2No. PMs fell east of Felton NU 190011), approximately 1.6km east of the Site.

31st March 1941

9No. HE bombs fell on fields north of Bywell Farm (NZ 169982), within approximately 1km west of the Site. 3No. of these were recorded as UXBs.

17th April 1941

IBs fell over East Shield Hill Farm (NZ 163900), approximately 1.8km east of the Site.

11th May 1941

HE bombs and IBs (numbers unspecified) fell on the partly constructed RAF Eshott (NZ 181985), within approximately 1.1km east of the Site.

Appendix 2 UXO Hazard and Ordnance Types

When assessing the risk from UXO including UXB, it is important to be aware of ordnance type and function. The following Section briefly describes the more common types of UXO. More data on these can be found at http://zeticauxo.com/guidance/ordnance-data-sheets/.

A2.1 Small Arms Ammunition

Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

Larger calibre small arms munitions can contain fuze mechanisms and high explosives or pyrotechnic fillings and may have been used for anti-aircraft or anti-vehicle purposes.

Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance. SAA is often associated with discarded ammunition boxes around firing practice ranges. The Plate below illustrates some common SAA.

Plate	Photograph of typical WWII small arms ammunition

Source: Google Images

A2.2 Hand Grenades

Hand grenades can be filled with explosives or chemicals and have 3No. main parts, a body, a fuze with a pull ring and a safety-clip assembly. Fragmentation grenades are the most common and have a metal or plastic body filled with an explosive. Most use a burning delay fuze that functions for 3 to 5 seconds after the safety lever is released.

Some, such as smoke grenades, are activated instantly when the lever is released. The Plate below illustrates the typical character and condition of No. 36 hand grenades (Mills Bombs) that have been excavated from a site.

Plate	Photographs of a typical and an excavated WWII No. 36 hand grenades

Source: Google Images

Source: Zetica Ltd

A2.3 Projected Grenades

Projected grenades are among the most commonly found UXO items, particularly the 40mm type. These contain high explosives and use a variety of fuzes, including some of the most sensitive internal impact-fuzing systems. They are extremely dangerous and can explode if moved or handled.

A2.4 Mortars

A mortar is a short tube designed to fire a projectile at a steep angle. Mortars can range from approximately 50mm to 280mm in diameter and can be filled with explosives, toxic chemicals, white phosphorous or illumination flares. They generally have a thinner metal casing than projectiles, but use the same types of fuzing and stabilisation.

During WWII there are records that the target areas of RAF practice bombing ranges were occasionally used for mortar training.

The Plate below shows a typical 2-inch mortar bomb found (left) and a demonstration 3-inch mortar bomb (right).

Plate	Photographs of WWII 2-inch and 3-inch mortars

Source: Daily Mail

Source: Zetica Ltd

A2.5 Shells

Shells are a projectile containing an explosive charge designed to burst the casing that can contain High Explosives, pyrotechnic compounds or other chemicals.

Shells can be found in a range of sizes, from <20mm to several times this size. The most likely shells to be found on the Site are Small Arms Ammunition (SAA) or UXAA shells that have fallen back to the ground unexploded.

Most commonly used anti-aircraft shells were 2" and 3.7" HE shells.

If fired and found as UXO, shells can offer a particular hazard from accidental detonation as they can have sensitive fuze mechanisms. A fuze is a device which incorporates mechanical, electrical, chemical or hydrostatic components to initiate a train of fire or detonation.

The Plate below is a photograph of a 3.7" UXAA shell found in Camberwell, London.

Plate	Photograph of a recently excavated 3.7" AA shell

Source: Zetica Ltd

A2.6 Incendiary Bombs

Incendiary Bombs (IBs) ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. By far the most common air dropped devices across the UK during WWII were small 1kg to 2kg IBs.

In some cases the IBs were fitted with a very small High Explosive (HE) bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs.

The small amount of HE, if any, and the almost negligible potential for IBs to remain active after more than 65 years in the ground means that these items have very little prospect of causing damage. In the majority of cases if IBs are found in the ground, the incendiary materials have deteriorated to such an extent that they are considered to provide a low UXO hazard level.

However, since magnesium and phosphorus were common components in IBs, some localised chemical contamination may occur where the contents have leached out of the IB into the surrounding soil.

The Plate below shows a typical variety of fragmentary remains of IBs and 2No. IBs recovered by the Civil Defence during WWII.

Plate	Photographs of typical fragmentary remains of IBs and a UXIB

Source: Swansea Museum

Source: Museum of London

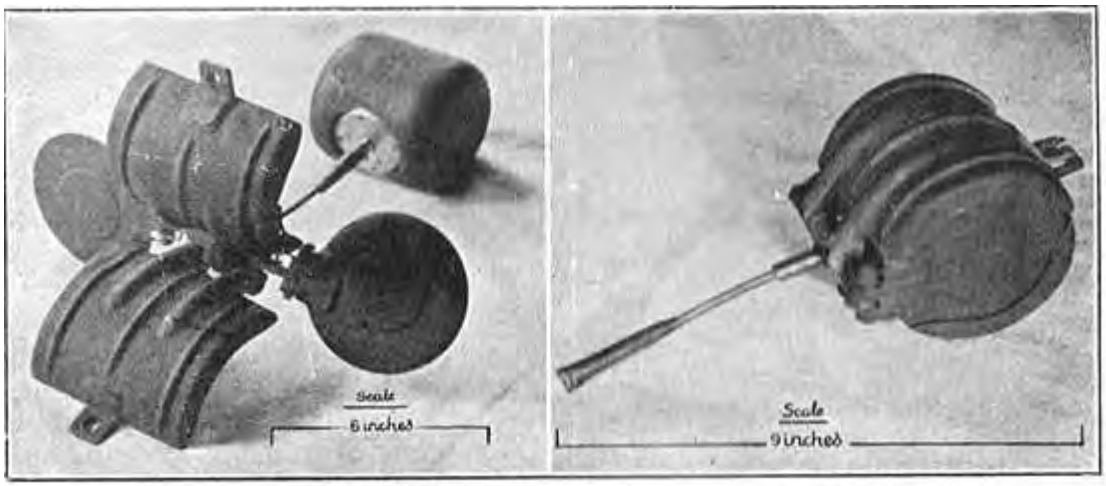
A2.7 Anti-Personnel Bombs

2No. types of Anti-Personnel (AP) bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact, within 25m of this, death or fatal injury could occur.

In the majority of cases WWII AP bombs were so sensitive to disturbance that none have been found since WWII as UXAPB and it is considered very unlikely that such an item would be found buried as an UXAPB

The Plate below shows typical AP ('Butterfly') bombs recovered by the Civil Defence during WWII.

Plate	Photographs of typical AP ('Butterfly') bombs



BOMB WITH CASING OPEN BOMB WITH CASING CLOSED

Source: Smith

A2.8 German High Explosive Bombs

Probably the most common and certainly most publicised UXOs to be found in the UK are bombs. Air dropped bombs, as a result of WWII enemy action, are found on a relatively frequent basis as UXO. They tend to be highly publicised (at least on a local basis) due to the common disruption where an evacuation of the potentially affected area is put in place.

The amount of High Explosive and the potential for a fuze to still be activated means that these devices have the prospect of causing some of the most widespread damage. WWII bombs were particularly sophisticated for their time, with anti-tamper fuzes.

Many German bombs were designed to not explode on impact and instead to cause disruption as a UXB. Some fuzes were set with a delay time of over 70 hours. During this time, an anti-tamper fuze could also be activated to detonate should it be disturbed.

The most commonly used bombs during WWII were the 50kg and 250kg sized general purpose bombs. Less frequently, the 500kg bomb was also used. Larger bombs were used, but so infrequently that any assessment of hazard is more typically based on bombs ranging up to 500kg only.

It should be noted that the June 2008 find of a 1000kg bomb in London, does demonstrate that larger bombs can be found and any risk mitigation measures should consider this.

The Plate below shows the variety of UXB recovered by the Civil Defence during WWII.

Plate	Photograph of a variety of UXB recovered by the Civil Defence during WWII

Source: Imperial War Museum

A2.9 Detonators, Gaines and Fuzes

Bomb components such as detonators, gaines and fuzes were stored at operational airfields during WWII and typically contained some type of explosive charge to initiate the detonation of a munition.

A wide variety of these components were used and examples of some common fuzes are shown in the Plate below.

Plate	Photographs showing examples of WWII fuzes

Source: Zetica Ltd

A2.10 Land Mines

Wartime activities provide numerous sources of UXO within the land environment. Whilst efforts have been made to clear the known British minefields, it was common for mines to become lost for a variety of reasons and so not recovered. Additionally, such munitions might have been disposed of on an unofficial basis and so no records were kept.

Most of the mined beaches and other land areas in the UK have been cleared by the MoD. Occasionally, wave action or activities such as bombing caused mines to become displaced and these were missed as part of any past clearance activities.

The Plate below is a photograph of a typical WWII land mine used on the land area, beaches and cliffs around Britain. This example was found at Gatwick Airport formerly RAF Gatwick.

Plate	Photographs of original and recently excavated WWII land mines

Source: Google Images

Source: Zetica Ltd

A2.11 Home Guard Weapons

Initially, the Home Guard's armoury was largely second-hand and much of it was of WWI vintage. Personal weapons (such as shotguns) and home-made devices were also employed.

By the end of WWII, some units were well equipped with a wide variety of small arms and munitions.

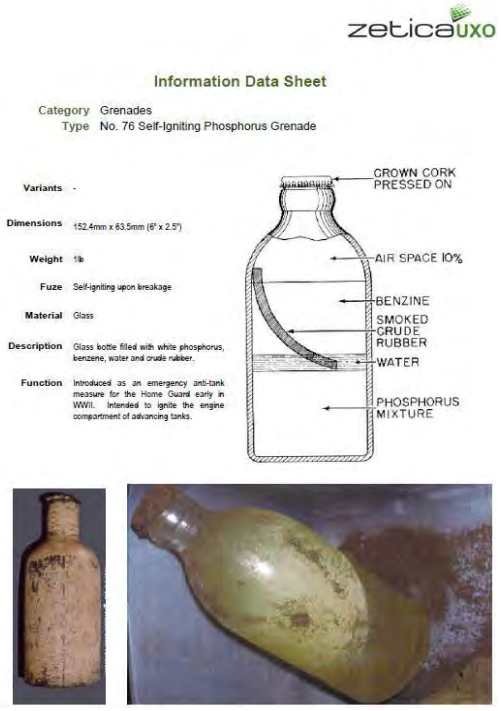
These included .32, .38 and .455 revolvers, .303 P14, .300 P17 and .303 Canadian Ross rifles, anti-tank rifles and a variety of Sub- Machine Guns (SMG) such as the .45 Thompson and 9mm Sten Guns.

Other heavier Machine Guns (MG) at their disposal included Browning, Hotchkiss, Lewis, Vickers and Marlin MG. Sub-artillery weapons were developed for them, including grenade throwers (the Northover Projector) and spigot mortars (the Blacker Bombard). 2-pdr anti-tank guns and Projector, Infantry Anti Tank (PIAT) weapons were in circulation amongst some units, and the Home Guard also manned AA guns later in WWII.

Explosives were available to some Home Guard units and were used and stored by all Auxiliary Unit patrols. As well as the flame fougasse and hand grenades detailed in this Appendix, the Home Guard had stocks of Molotov Cocktails, Sticky Bombs and SIP grenades.

The Plate below is a photograph of a No. 76 SIP grenade (LHS) with an explanatory leaflet produced by ZeticaUXO for site staff (RHS).

Plate	Photograph of the No. 76 SIP grenade



Source: Zetica Ltd

Given the irregular nature of Home Guard activity, the possibility of items of UXO or weapons being discovered at any locations occupied or used for training by them can never be totally discounted.

A2.12 UXO Migration

It is possible for explosive material, UXO or ordnance scrap to migrate to a site during landfill or dredging operations or other ground works which import Made Ground or natural materials already containing UXO. It is important to understand the nature and age of such landfill or dredging operations when assessing the potential UXO hazard level on the site.

A2.13 Effects and Consequences

There have been a limited number of recorded incidents in the UK since WWII where bombs have detonated during engineering works, though a significant number of bombs have been discovered. Incidents involving smaller ordnance are, however, relatively common in the UK.

In the UK, there are no recorded incidents since the decade after WWII, of a UXB accidentally detonating. In recent years, bombs have been found that have fuze mechanisms that have started to operate indicating that given the right conditions a UXB may still function.

In June 2008 the UXB uncovered in the Lea Valley caused difficulty to No. 33 Regiment (Explosive Ordnance Disposal) Royal Engineers because the fuze mechanism started to operate.

The 1,000kg 'Hermann' bomb, the first of this size to be found in over 30 years, took 5 days to deactivate. This demonstrates that larger bombs can be found and any risk mitigation measures should provide the option to deal with this size of device. Since WWII, UXBs have been found on a regular basis in London.

Since WWII, UXBs have been found on a regular basis throughout Britain. Some of the most recent cases are described below.

In May 2009 1No. 50kg WWII bomb was found on a building site in Bexhill-on-Sea, Sussex, and on the 16th August 2009, 1No. 250kg WWII bomb was found near Ebberston, North Yorkshire. Both of these were destroyed in controlled explosions by Bomb Disposal Units.

On the 8th March 2010 1No. 500kg WWII bomb was found at Bowers Marsh in Essex by Zetica EOC operatives following a Zetica desk study concluding a high risk of UXB on the site. The bomb was demolished in situ by members of the Army Royal Logistics Corps (RLC).

The Plate below is a photograph of the bomb in situ.

Plate	Photograph of the 500kg WWII UXB at Bowers Marsh, 8th March 2010

Source: Zetica Ltd

On the 23rd February 2011, 1No. WWII UXB was found on a building site in Notte Street in Plymouth City centre. The bomb was removed by EOD personnel and demolished at sea.

On the 22nd July 2012, a landslip in the cliffs at Mappleton in the East Riding of Yorkshire exposed over 1,000No. UXO items, including practice bombs, mortars, rockets, shells and grenades. The cliff was part of a former bombing and artillery range, used during WWII and until the 1970s.

UXO items were removed by Explosive Ordnance Disposal (EOD) officers from Catterick and MoD staff from Leconfield. 15No. controlled explosions were undertaken by the Royal Engineers (RE) to detonate the more volatile items in situ, while other less hazardous UXO devices were left in place to be dealt with at a later date.

1No. WWI bomb (shown in the Plate below) was found on the Isle of Sheppey on the 2nd August 2012 during a geophysical survey following desk study research by Zetica Ltd which had established that a previously unknown WWI bombing range existed on the site. A further WWI bomb was found in the same location in August 2015.

Plate	Photograph of WWI bomb, Isle of Sheppey, 2nd August 2012

Source: Zetica Ltd

On the 23rd March 2015, 1No. WWII 500kg UXB was found on a building site in The Grange, Bermondsey. The bomb was made safe by EOD personnel and removed for demolition.

On the 21st May 2015, 1No. 50kg UXB was found on a building site near Wembley Stadium, London Borough of Brent. The bomb was made safe by EOD personnel and removed for demolition.

On the 10th August 2015, 1No. 250kg UXB was found under the basement of a building site at Bethnal Green, London Borough of Tower Hamlets. It was made safe and removed by an EOD team from the RLC.

On the 21st September 2015, 1No. UXB was uncovered on a construction site in Cheylesmore, Coventry, by the operator of a mechanical digger. It was destroyed in situ by an EOD team from the RLC.

In January 2016, Zetica discovered 3No. 500lb British UXB at a former airfield in Cambridgeshire. These were destroyed in controlled explosions. The Plate below is a photograph of one of the bombs.

Plate	Photograph of a recently excavated WWII British 500lb GP bomb

Source: Zetica Ltd

On the 12th May 2016, 1No. 250kg UXB was found on a building site in Bath. It was made safe and then taken to a local quarry for demolition.

There is a long list of incidents during construction work in Germany that in some cases have led to the deaths of workers.

In June 2010, 3No. members of a bomb disposal team were killed, and 6No. others injured, whilst attempting to defuze an unexploded WWII bomb in Goettingen, Central Germany.

The bomb, the second found in Goettingen in the space of a few days, was unearthed at a depth of 7.5m during excavations for a sports stadium.

In September 2008, 17No. people were injured and considerable damage occurred to adjacent buildings when a bomb exploded on a construction site in Hattingen, Germany.

In October 2006 during road works on a motorway near Aschaffenburg in Bavaria, southern Germany, a bomb was struck by a machine and detonated. The plant driver was killed and 5No. others injured, including passing motorists.

In a similar incident in October 2004 in Linz, Austria a bomb exploded injuring 3No. workers and causing considerable damage to plant. In the same month, a WWII bomb under a back garden in Vienna, Austria, was detonated without warning by a minor earth tremor, after remaining undiscovered for over 60 years.

Incidents involving UXO are also reported from the marine areas around the North Sea. For example, on 6th April 2005, 3No. Dutch fishermen were killed when they accidentally trawled up a WWII UX bomb which exploded when it hit the deck.

More recently, an unexploded HE bomb was trawled from the sea floor off South Shields on the 25th February 2015 but caused no damage.

Further details of similar finds can be found at http://zeticauxo.com/news/.

The effects of a partial or full detonation of ordnance are usually shock, blast, heat and shrapnel damage. A 50kg buried bomb can damage brick / concrete structures up to a distance of approximately 16m away. Unprotected personnel on the surface up to 70m away from the blast could also be seriously injured. Larger ordnance would obviously be more destructive.

Explosives rarely lose effectiveness with age, although over time mechanisms such as fuzes and gaines can become more sensitive and therefore more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of a detonation of explosive ordnance are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved.

Appendix 3 Abbreviations	
AA	Anti-Aircraft
ACPO	Association of Chief Police Officers
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
ASACS	Air Surveillance and Control System
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BDU	Bomb Disposal Unit
CBRN	Chemical, Biological, Radiological and Nuclear
CMD	Conventional Munitions Disposal
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FFE	Free From Explosives
HAA	Heavy Anti-Aircraft
HE	High Explosive
HSE	Health and Safety Executive
JSEODOC	Joint Services EOD Operations Centre
IB	Incendiary Bomb
IED	Improvised Explosive Device

IEDD	Improvised Explosive Device Disposal
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
PUCA	Pick Up and Carry Away
RAF	Royal Air Force
SIP	Self-Igniting Phosphorous
TEP	Time Expired Pyrotechnics
USAAF	United States Army Air Forces
UXB	Unexploded Bomb
UXO	Unexploded Ordnance

Appendix 4 Glossary & Definitions	
Abandoned Explosive Ordnance (AXO)	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Camouflet	The type of cavity produced when a charge explodes underground without breaking the surface of the earth to form a crater.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
Explosive	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.

Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.
Explosive Substances and Articles (ESA)	Explosive substance are solid or liquid substance (or a mixture of substances), which is either: • capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. • designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction. Explosive article is an article containing one or more explosive substances.
Fuze	A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
High Explosive	Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).
Munition	Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:- • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.
Primary Explosive	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.

Propellants	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
Pyrotechnic	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Unexploded Ordnance (UXO)	UXO is explosive ordnance that has been either primed, fuzed, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.

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Appendix F – Mine Abandonment Plan

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors

STAGE 1 GROUND INVESTIGATION

- CABLE PERCUSSION BOREHOLE
- CABLE PERCUSSION/ROTARY CORE BOREHOLE
- ROTARY CORE BOREHOLE
- ROTARY OPENHOLE BOREHOLE
- TRIAL PIT
- WINDOW SAMPLE

Rev	Description	By	Chk	App	Date
P1	FIRST ISSUE	PMC	JRJ	MC	03.08.06

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Civil Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Project: A022282

A1 MORPETH TO FELTON DUALLING

Drawing Title:

CAUSEY PARK MINEWORKINGS MINE ABANDONMENT PLAN

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	PMC	03.08.06	JRJ	03.08.06	MC	03.08.06

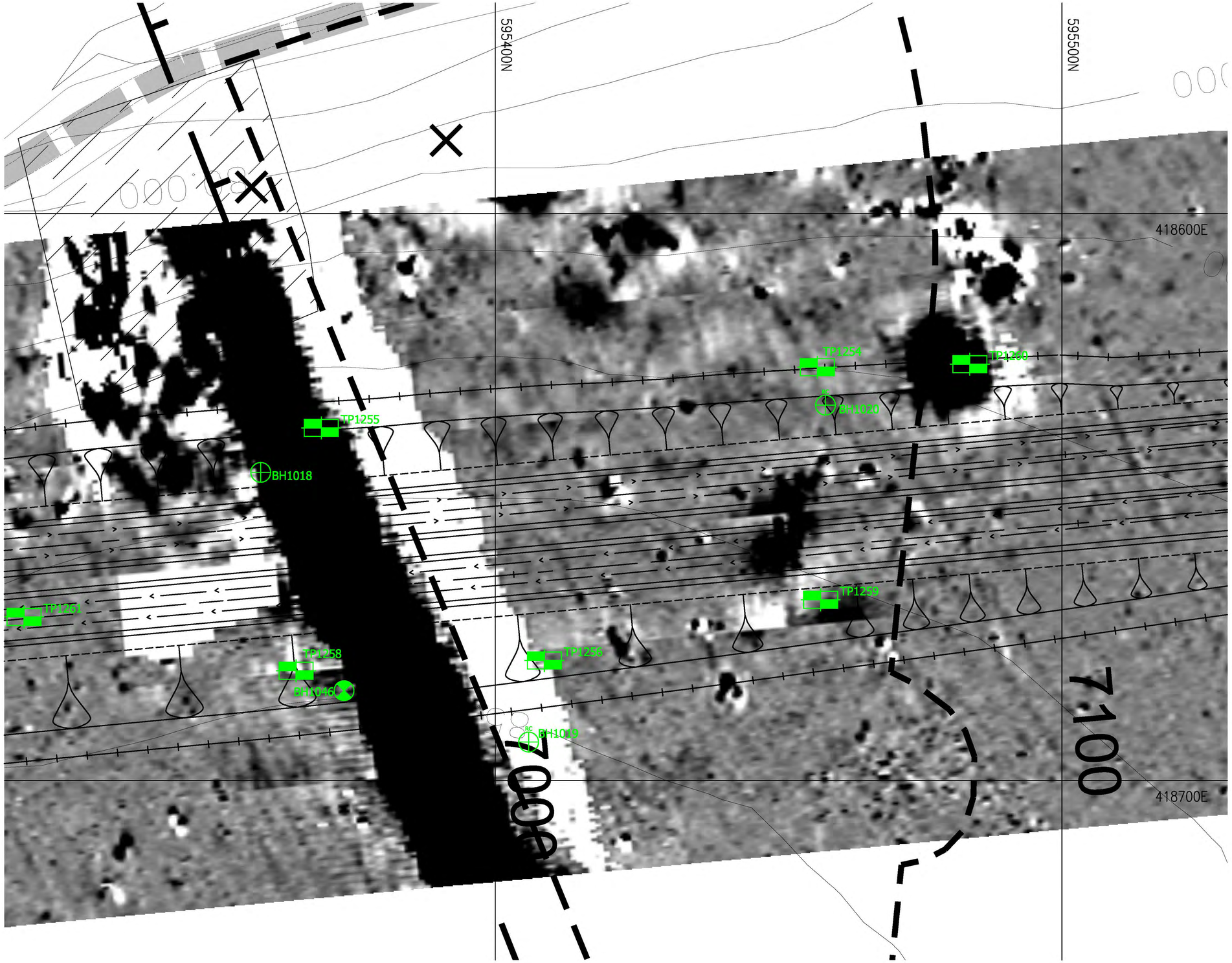
Project No.	Office	Type	Drawing No.	Revision
A022282	21	E	G.07	P1

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors

STAGE 1 GROUND INVESTIGATION

- CABLE PERCUSSION BOREHOLE
- CABLE PERCUSSION/ROTARY CORE BOREHOLE
- ROTARY CORE BOREHOLE
- ROTARY OPENHOLE BOREHOLE
- TRIAL PIT
- WINDOW SAMPLE



Rev	Description	By	Chk	App	Date
P1	FIRST ISSUE	PMC	JRJ	MC	30.06.06

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Project: A022282

A1 MORPETH TO FELTON DUALLING

Drawing Title:

CAUSEY PARK MINEWORKINGS
GEOPHYSICAL SURVEY

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	PMC	03.08.06	JRJ	03.08.06	MC	03.08.06

Project No.	Office	Type	Drawing No.	Revision
A022282	21	E	G.08	P1

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

Appendix G – Site Walkover

The site walkover was completed on a bright day in October 2016. The wind was low and the visibility was clear. All Chainages referenced refer to the Orange Route which represents the online option in the Preliminary Sources Study Report. All locations refer to Figure 3.1 in the PSSR.

Stop 1

Stop 1 is a lay-by on the northbound carriageway at the southern end of the Morpeth to Felton dualling route. Photo A- 1 and Photo A- 2 show the road is at-grade with the surrounding agricultural land. The topography gently falls to the east (Photo A- 2).

Photo A- 1 Stop 1 looking south down the A1 from a lay-by on the west of the road.

Photo A- 2 Stop 1 looking north over the fields adjacent to the lay-by on the west side of the A1. Gate is accessed from the lay-by.

Stop 2

Stop 2 was at the junction of the northbound A1 and High Highlaws. The roads are at grade with the surrounding fields that are generally level (Photo A- 3 and Photo A- 4).

Photo A- 3 Stop 2 Looking north up the A1 at the junction with High Highlaws lane.

Photo A- 4 Stop 2 looking north towards the A1 from High Highlaws lane. Fields are at-grade with the A1.

Stop 3

The lay-by on the northbound side of the A1 near Floodgate Burn was the location of Stop 3. The route passes at-grade through a small woodland (Photo A- 5and Photo A- 6).

Photo A- 5 Stop 3 looking south on the A1 from the lay-by on the west on the carriageway.

Photo A- 6 Stop 3 Looking north on the A1 from the lay-by on the west side of the carriageway.

Stop 4

Stop 4 was at the junction of the northbound A1 and Fenrother Lane. The route is at-grade and vegetation is limited to hedgerows surrounding the adjacent agricultural land (Photo A- 7, Photo A- 8 and Photo A- 9).

Photo A- 7 Stop 4 looking north on the west side of A1 from Fenrother Lane.

Photo A- 8 Stop 4 looking north-east from Fenrother Lane towards the A1. A1 is at-grade with surrounding fields.

Photo A- 9 Stop 4 looking west along Fenrother Lane. Gently undulating agricultural land.

Stop 5

Stop 5 was located on Fenrother Lane at the proposed location of the offline option, approximately 0.5km west of the A1. Photo A- 10 shows that fields south of the lane are approximately at-grade with the existing lane. The topography is undulating and falls to the south (Photo A- 11).

Photo A- 10 Stop 5 on Fenrother Lane looking south towards proposed location of offline route.

Photo A- 11 Stop 5 looking east towards undulating topography on Fenrother Lane that falls to the south.

Stop 6

Stop 6 on the lane at Causey Park Bridge was situated west of the A1 alignment. Photo A- 12 shows disused land between the Causey Park Bridge and the A1. The A1 is on an embankment (estimated <2m) behind the tree line. West of the lane is open agricultural land. Causey Park is highlighted in Photo A- 13 and the topography falls to the south-east.

Photo A- 12 Stop 6 looking east from the Oak Inn over disused land.

Photo A- 13 Stop 6 Looking west from the lane towards the proposed offline option location. Ground level increases to the north-west.

Stop 7

Stop 7 was at Causey Park. Photo A- 14 is a view towards the south-east over the land through which the offline option is proposed. Land falls to the south east and is gently undulating,

Photo A- 14 Stop 7 at Causey Park. Looking south east towards the proposed offline option.

Stop 8

Stop 8 was located on East Road. Burgham Underbridge is proposed for the offline option to take East Road underneath the re-aligned A1. Photo A- 15 looks eastwards towards the proposed offline alignment. Material will need to be excavated to create the underbridge. Thick deposits of glacial till (>25m in BGS Borehole NZ19NE82) are expected above the bedrock unit of the Stainmore Formation.

Photo A- 15 Stop 8 looking east (uphill) from the stream on East Road.

Stop 9

Stop 9 was located at the lay-by at Felmore Park (approximate chainage 9700m). Photo A- 16 shows the road is at-grade and falling to the north (Photo A- 16).

Photo A- 16 Stop 9 in looking north from A1 lay-by.

Stop 10

Stop 10 was on the northbound side of the A1 at chainage 10800m. At this location the corridor is at grade with the adjacent agricultural land.

Photo A- 17 Stop 10 looking north to the A1 from the side road.

Photo A- 18 Stop 10 looking south over the side road towards agricultural land with the A1 on the east (left hand side of the picture).

Stop 11

Stop 11 includes multiple points from Felton to the River Coquet Bridge at Chainage 12750m.

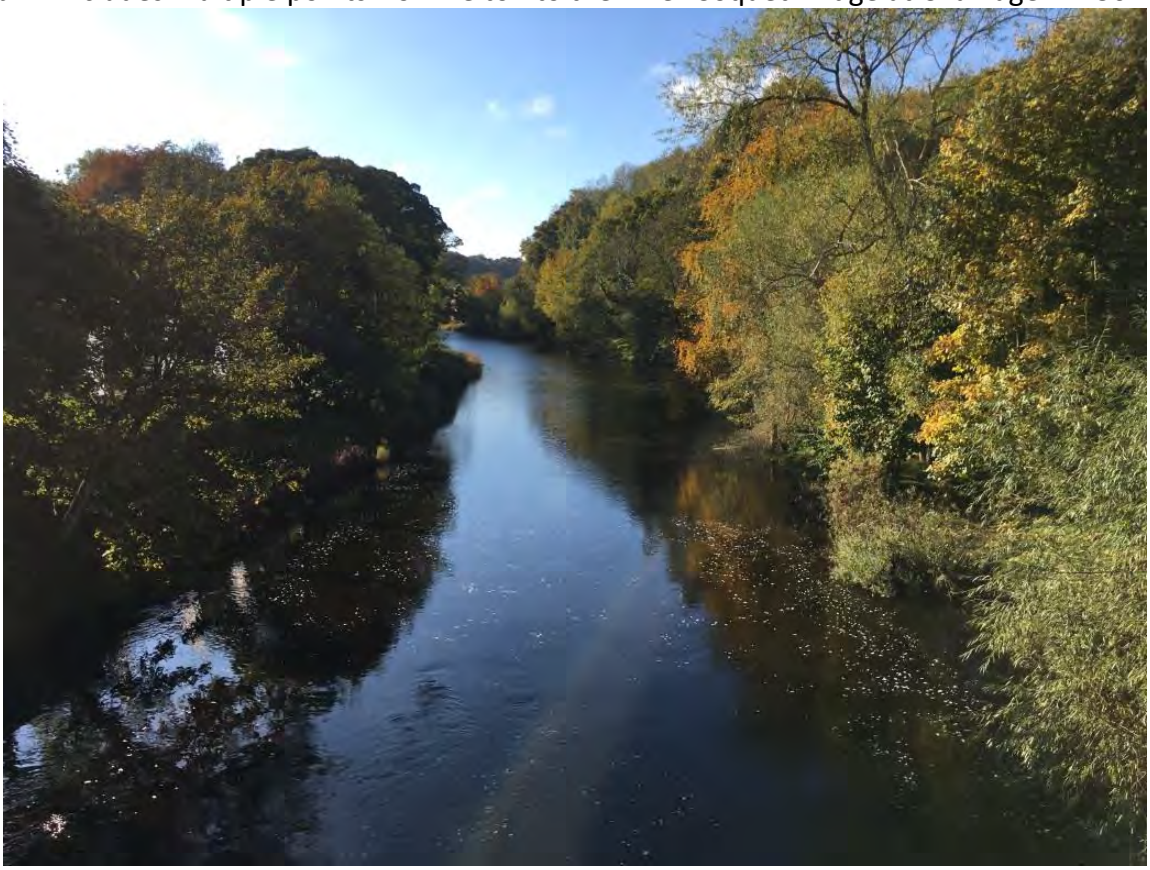


Photo A- 19 Stop 11 View from Felton Bridge looking west down the River Coquet.

Photo A- 20 Stop 11 from the footpath on the north side of the River Coquet looking south-east down the valley.

Photo A- 21 Stop 11 View from the footpath on the north side of the River Coquet looking west to the River Coquet bridge.

Photo A- 22 Stop 11 view from the footpath north of the River Coquet looking south underneath the River Coquet bridge.

Stop 12

Stop 12 was at chainage 11800m on the east of the carriageway at West Moor Junction. The topography is at-grade. All options propose an overbridge structure to link the side roads at this junction.

Photo A- 23 Stop 12 view south from the east side of the A1 at West Moor

Photo A- 24 Stop 12 view north from the east side of the A1 at West Moor.

Stop 13

Stop 13 was located at the lay-by on the east of the A1 at chainage 10250m shows the route is at grade with adjacent land. Photo A- 25 and Photo A- 26 show a wide grass verge at the side of the highway.

Photo A- 25 Stop 13 view south over the A1 from the bank of the lay by to the east of the A1.

Photo A- 26 Stop 13 looking north from east of the A1.

Stop 14

Stop 14 was in Helm is east of the A1. Photo A- 27 identifies the area where the online options propose maintaining a local access from Helm to the A1.

Photo A- 27 Stop 14 looking south-west towards to A1.

Photo A- 28 Stop 14 disused buildings on top of the hill east of the A1.

Photo A- 29 Stop 14 looking west from the hill top, east of the A1.

Photo A- 30 Stop 14 disused quarry east of the A1.

Stop 15

Stop 15 was located opposite Tritlington School on the southbound side of the A1.

Photo A- 31 looking north. Adjacent land is at-grade with the existing carriageway.

Stop 16

Stop 16 was located at Priests Bridge to the west of the current A1 alignment.

Photo A- 32 Stop 16 at Priest's Bridge House looking north.

Photo A- 33 Stop 16 looking south from Priest's Bridge House towards the A1.

Photo A- 1 Stop 1 looking south down the A1 from a lay-by on the west of the road.
Photo A- 2 Stop 1 looking north over the fields adjacent to the lay-by on the west side of the A1. Gate is accessed from the lay-by.
Photo A- 3 Stop 2 Looking north up the A1 at the junction with High Highlaws lane.
Photo A- 4 Stop 2 looking north towards the A1 from High Highlaws lane. Fields are at-grade with the A1.
Photo A- 5 Stop 3 looking south on the A1 from the lay-by on the west on the carriageway.
Photo A- 6 Stop 3 Looking north on the A1 from the lay-by on the west side of the carriageway.
Photo A- 7 Stop 4 looking north on the west side of A1 from Fenrother Lane.

Photo A- 8 Stop 4 looking north-east from Fenrother Lane towards the A1. A1 is at-grade with surrounding fields.

Photo A- 9 Stop 4 looking west along Fenrother Lane. Gently undulating agricultural land.

Photo A- 10 Stop 5 on Fenrother Lane looking south towards proposed location of offline route.

Photo A- 11 Stop 5 looking east towards undulating topography on Fenrother Lane that falls to the south.

Photo A- 12 Stop 6 looking east from the Oak Inn over disused land.

Photo A- 13 Stop 6 Looking west from the lane towards the proposed offline option location. Ground level increases to the north-west.

Photo A- 14 Stop 7 at Causey Park. Looking south east towards the proposed offline option.

Photo A- 15 Stop 8 looking east (uphill) from the stream on East Road.

Photo A- 16 Stop 9 in looking north from A1 lay-by.

Photo A- 17 Stop 10 looking north to the A1 from the side road.

Photo A- 18 Stop 10 looking south over the side road towards agricultural land with the A1 on the east (left hand side of the picture).

Photo A- 19 Stop 11 View from Felton Bridge looking west down the River Coquet.

Photo A- 20 Stop 11 from the footpath on the north side of the River Coquet looking south-east down the valley.

Photo A- 21 Stop 11 View from the footpath on the north side of the River Coquet looking west to the River Coquet bridge.

Photo A- 22 Stop 11 view from the footpath north of the River Coquet looking south underneath the River Coquet bridge.

Photo A- 23 Stop 12 view south from the east side of the A1 at West Moor

Photo A- 24 Stop 12 view north from the east side of the A1 at West Moor.

Photo A- 25 Stop 13 view south over the A1 from the bank of the lay by to the east of the A1.

Photo A- 26 Stop 13 looking north from east of the A1.

Photo A- 27 Stop 14 looking south-west towards to A1.

Photo A- 28 Stop 14 disused buildings on top of the hill east of the A1.

Photo A- 29 Stop 14 looking west from the hill top, east of the A1.

Photo A- 30 Stop 14 disused quarry east of the A1.

Photo A- 31 looking north. Adjacent land is at-grade with the existing carriageway.

Photo A- 32 Stop 16 at Priest's Bridge House looking north.

Photo A- 33 Stop 16 looking south from Priest's Bridge House towards the A1.

Appendix H – Historic Borehole Records

BOREHOLE LOG

Client Northumberland County Council.
Location Coquet Bridge, Felton.
B.H. No A
Type of boring Hand Auger.
Date(s) 19.3.74.
Dia. of boring 125 mm
Ground Level 40.40 m
Water Level Not encountered
Scale 1:50 metres.

Description of Strata	Reduced Level	Legend	Thickness	Depth	SAMPLES Type	SAMPLES Depth	NOTES
Topsoil.			0.60				
	39.80			0.60	U	0.75-1.20	
Firm yellow brown grey mottled silty CLAY with traces of shale fragments.			0.60				
	39.20			1.20			
Firm grey brown silty CLAY with a little siltstone gravel and weathered shale fragments increasing in content with depth.			2.60		B U B	2.00 2.20-2.65 3.40	
	36.60			3.80	U	3.80-4.25	
Firm brown grey mottled silty CLAY with traces of poorly cemented sandstone gravel.	36.10		0.50	4.30			
Medium dense poorly graded clayey SAND with a little gravel			2.15		S(14) B	5.65-5.95 6.00	
	33.95			6.45			
Moderately weak grey SHALE	33.80		0.15	6.60	D	6.60	
Borehole continued by rotary drilling.							

PROJECT:- Coquet Bridge North Pier and Abutment.

S( ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

BOREHOLE LOG

Client: Northumberland County Council.
Location: Coquet Bridge; Felton.
B.H. No: A. (Sheet 1 of 2)
Type of boring: Edico Rotary Water Flush.
Date(s): 17 & 18/4/74.
Dia. of boring: 76mm Core 412 Bit.
Ground Level: 40.40m.
Casing: 150mm dia 5.60 m depth.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( ) RQD	Fract. Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling No Samples Taken.										
(Drillers description) Very weak weathered SHALE.	34.80		100% water return	5.60	0% (0)	0.90				
Slightly weathered laminated broken black moderately well cemented moderately weak SHALE.	33.90			6.50	69% (0)	1.65			10	
Faintly weathered medium bedded light grey iron stained carbonaceous well cemented strong SANDSTONE	32.25			8.15	61% (95)	Highly weathered very weak SHALE 8.15m - 9.10m			10	

PROJECT:- Coquet Bridge North Pier and Abutment.

Instrumentation: NONE

Logged by: A.R. WARD.

BOREHOLE LOG

Client: Northumberland County Council.
Location: Coquet Bridge; Felton.
B.H. No: A (Sheet 2 of 2)
Type of boring: Edico Rotary Water Flush.
Date(s): 17 & 18/4/74
Dia. of boring: 76mm Core 412 Bit.
Ground Level: 40.40m.
Casing: 150mm dia 5.60m depth.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
As Above.						2.29				
Highly weathered very weak SHALE.	29.96			10.44						
	29.82			10.58	100%	0.14				
Faintly weathered thinly bedded fractured grey well cemented strong fine SANDSTONE.	28.91			11.49	93% (10)	0.91		70	10	
			11.60 Lost water		95%					
Faintly weathered medium bedded grey ironstained well cemented strong fine SANDSTONE.	27.99			12.41	(50)	0.92			10	
Faintly weathered medium bedded light grey well cemented strong fine SANDSTONE with thin bands of dark grey well cemented moderately strong SHALE.	23.90			16.50	98% (45)	4.09			10	
Borehole Complete. Backfilled with sand/ cement grout.						Standing level of water on 18/4/74 am: 12.00m.				

PROJECT:- Coquet Bridge North Pier and Abutment.

Instrumentation: NONE

Logged by: A.R. WARD.

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge, Eelton.
B.H. No: B
Type of boring: Hand Auger.
Date(s): 19.3.74.
Dia. of boring: 125 mm
Ground Level: 38.93m.
Water Level: Not encountered.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Thickness	Depth	SAMPLES Type	SAMPLES Depth	NOTES
Topsoil.	38.38		0.55	0.55	U	0.75-1.20	
Soft brown grey silty CLAY with pockets of brown calcareous silty CLAY	37.73		0.65	1.20	B	2.00	
Firm brown and grey silty CLAY with traces of coarse fragments of sandstone.	36.23		1.50	2.70	U	2.25-2.70	
Soft light brown grey silty CLAY.	33.68		2.55	5.25	B	3.50	
					U	3.80-4.25	
					B	4.50	
					D	5.25	
Borehole Continued by rotary drilling.							

PROJECT:- Coquet Bridge North Pier and Abutment.

S ( ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

BOREHOLE LOG

Client: Northumberland County Council.
Location: Coquet Bridge; Felton.
B.H. No: B (Sheet 1 of 2)
Type of boring: Pendant Rotary Water Flush.
Date(s): 12 & 16/4/74.
Dia. of boring: 76mm Core 412 Bit.
Ground Level: 38.93m
Casing: 150mm dia. 8.35m depth.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run %rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling. No Samples Taken.			100% water return							
Moderately weathered fractured thinly bedded dark grey carbonaceous poorly cemented weak SHALE.	33.36			5.57	27% (0)	0.50			4	
Moderately weathered fractured thinly bedded dark grey poorly cemented moderately weak SHALE.	32.86			6.07	43% (0)	1.28			4	
Moderately weathered fractured thinly bedded dark grey poorly cemented moderately weak SHALE with bands of light grey strong fine SANDSTONE	30.58			8.35	66% (20)	1.53				
See Over.	29.05			9.88						

PROJECT:- Coquet Bridge North Pier and Abutment.

Instrumentation: NONE

Logged by: A.R. WARD.

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge; Felton.
B.H. No: B (Sheet 2 of 2)
Type of boring: Pendant Rotary Water Flush.
Date(s): 12 & 16/4/74.
Dia. of boring: 76mm Core 412 Bit.
Ground Level: 38.93m.
Casing: 150mm dia 8.35 depth.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Highly weathered thinly bedded grey poorly cemented very weak SHALE.	28.05		100%	10.88	17% (0)	1.00			4	
Faintly weathered medium bedded light grey ironstained brown moderately well cemented strong fine SANDSTONE.	26.40			12.53	76% (100)	1.65			4	
Faintly weathered medium bedded light grey moderately well cemented strong fine SANDSTONE.	24.64			14.29	94% (90)	1.76			4	
Faintly weathered thin bands strong SHALE and SANDSTONE.	24.40			14.53	100% (0)	0.24			4	
Faintly weathered grey well cemented strong fine SANDSTONE.	23.93			15.00	49% (60)	0.47			4	
Borehole Complete. Backfilled with sand/ cement grout.										

PROJECT:- Coquet Bridge North Pier and Abutment.

Instrumentation: NONE.

Logged by: A.R.WARD.

BOREHOLE LOG

Client: Northumberland County Council.
Location: Coquet Bridge, Felton.
B.H. No: C.
Type of boring: Hand Auger.
Date(s): 20.3.74.
Dia. of boring: 125 mm
Ground Level: 51.66 m
Water Level: Not encountered.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Thickness	Depth	SAMPLES Type	SAMPLES Depth	NOTES
Topsoil - sandy with vegetation.	50.76		0.90	0.90	B	0.90	
Weak poorly cemented grey SHALE.	49.56		1.20	2.10	S(16)	1.35-1.65	
Moderately weak poorly cemented grey SHALE	49.41		0.15	2.25	D	2.25	
Borehole Continued by Rotary drilling.							

PROJECT: Coquet Bridge North Pier and Abutment.

S ( ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge: Felton
B.H. No: C
Type of boring: Pendant Rotary Water Flush
Date(s): 19, 20, 22 & 23/4/74
Dia. of boring: 76mm Core 412 Bit.
Ground Level: 51.72 m
Casing: 150mm dia. 3.00m depth
Scale: 1:50 metres

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling No samples taken			100% water return to 11.30							
Moderately weathered thinly bedded broken dark grey poorly cemented weak shale	48.72			3.00	26% (0)	1.00			5	
Moderately weathered thinly bedded broken ironstained brown poorly cemented weak calcareous shale	47.72 47.01			4.00 4.71	87% (0)	0.71			5	
Slightly weathered thinly bedded grey calcareous sandstone and shale bands	45.62			6.10	86% (0)	1.39			5	
Moderately weathered very broken grey moderately strong limestone	45.02			6.70	83% (0)	0.60			5	
Slightly weathered thinly bedded broken grey moderately well cemented moderately strong calcareous shale	44.74 44.00			6.98 7.72	82% (0) 100% (10)	0.28 0.74			5 5	
Moderately weathered thinly bedded grey poorly cemented weak calcareous shale	43.42			8.30	26% (10)	0.58			5	
Slightly weathered thinly bedded jointed dark grey moderately well cemented moderately strong shale					95% (60)			50	5	

Instrumentation: None

PROJECT:-
Coquet Bridge North Pier and Abutment

Logged by: A.R. WARD

BOREHOLE LOG

Client Northumberland County Council
B.H. No C
Date(s) 19, 20, 22 & 23.4.74
Ground Level 51.72 m
Scale 1:50 metres

Location Coquet Bridge ; Felton
Type of boring Pendant Rotary Water Flush
Dia. of boring 76mm Core 412 Bit
Casing 150 mm dia. 3.00 depth.
Sheet 2 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Slightly weathered thinly bedded jointed dark grey moderately well cemented strong shale			100% Water Return		95% (60)	3.00		50	5	
	40.42			11.30						
Faintly weathered thinly bedded broken dark grey well cemented strong shale			Lost Water Return Final		98% (30)	1.27		80	5	
	39.15			12.57						
Faintly weathered thinly bedded grey well cemented strong limestone			Final Water Level on Completion 12.20	12.83	100% (0)	0.26			5	
				13.33	100% (0)	0.50			5	
Faintly weathered thinly bedded dark grey well cemented strong shale	38.39				96% (20)	1.27			5	
	37.12			14.60						
Moderately weathered thinly bedded dark grey poorly cemented weak shale					25% (40)	0.80			5	
	36.32			15.40						
Borehole complete Backfilled with sand/cement grout.										

PROJECT:- Coquet Bridge North Pier and Abutment

Instrumentation : None

Logged by : A.R. WARD

Tarmac Construction Ltd., Geotechnical Division.

4A.G/72/012

BOREHOLE LOG

Client Northumberland County Council.
Location Coquet Bridge,Felton.
B.H. No D
Type of boring Hand Auger.
Date(s) 19.3.74.
Dia. of boring 125 mm.
Ground Level 47.41m.
Water Level Not Encountered.
Scale 1:50 metres.

Description of Strata	Reduced Level	Legend	Thickness	Depth	SAMPLES Type	SAMPLES Depth	NOTES
Brown sandy silty CLAY with a little gravel and organic material.	46.01		1.40	1.40	B	1.00	
Brown sandy silty CLAY with fragments of shale.	45.41		0.60	2.00	S(13)	1.65-1.95	
Weak becoming stronger dark grey SHALE.	44.96		0.45	2.45	B	1.80	
Borehole Continued by rotary drilling.					B	2.30	

PROJECT:- Coquet Bridge North Pier and Abutment.

S ( ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

Tarmac Construction Ltd., Geotechnical Division.

4/LG/72/012

BOREHOLE LOG

Client Northumberland County Council
B.H. No D
Date(s) 24 & 25.4.74
Ground Level 47.70m
Scale 1:50 metres

Location Coquet Bridge: Felton
Type of boring Pendant Rotary Water Flush
Dia. of boring 76mm Core 412 Bit.
Casing 125mm dia 3.00 m depth

Sheet 1 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( ) RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling No samples taken			100% water return to 8.00							
Slightly weathered broken light brown ironstained well cemented moderately strong fine sandstone										
Highly weathered fragmented grey poorly cemented very weak shale										
	44.70			3.00						
Slightly weathered fragmented grey moderately well cemented moderately strong calcareous shale.					38% (0)	0.80			5	
	43.90			3.80						
Slightly weathered thinly bedded fractured grey moderately well cemented moderately strong limestone					30% (0)	0.50			5	
	43.40			4.30						
					70% (0)	0.82			5	
	42.58			5.12						
Slightly weathered thinly bedded fractured grey moderately well cemented moderately strong calcareous shale					97% (0)	0.64		50	5	
	41.94			5.76						
Highly weathered grey brown poorly cemented very weak calcareous shale					90% (20)	1.44		50	5	
	40.50			7.20						
Slightly weathered medium bedded fractured light grey ironstained well cemented moderately strong limestone	40.24		Lost Water Return	7.46	21% (0)	0.26			5	
					75 (35)	1.46		60	5	
Highly weathered very weak shale				8.92						
Moderately weathered jointed moderately strong limestone	38.40				95% (60)	0.38			5	
	38.33			9.30	00% (0)	0.07			5	
Faintly weathered dark grey strong shale	38.04			9.37	00% (0)	0.29			5	
	37.78			9.66	100% (80)	0.26			5	
				9.92						

PROJECT:- Coquet Bridge North Pier and Abutment

Instrumentation: None

Logged by: A R WARD

Tarmac Construction Ltd., Geotechnical Division.

4/LG/72/012

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge: Felton
B.H. No: D
Type of boring: Pendant Rotary Water Flush
Date(s): 24 & 25.4.74
Dia. of boring: 76mm Core 412 Bit
Ground Level: 47.70 m
Casing: 125mm dia 3.00m depth
Scale: 1:50 metres
Sheet 2 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Faintly weathered thinly bedded fractured dark grey well cemented moderately strong shale	36.92		Lost Water Return	10.78	98% (0)	0.86			5	
	36.68			11.02	100% (45)	0.24			5	
Slightly weathered fissile moderately weak coal	36.63			11.07	100%	0.63			5	
					12% (0)	0.86			5	
Moderately strong ironstone	35.77			11.93						
			Final Level on Completion 9.00m		90% (0)	0.60			5	
Moderately weathered thinly bedded light grey poorly cemented moderately weak shale	35.17			12.53	81% (70)	1.97		6mm Coal Band at 13.90 m	5	
Moderately weathered fractured thinly bedded light grey poorly cemented medium strong shale	33.20			14.50						
Faintly weathered medium bedded light grey fine sandstone and dark grey shale bands moderately well cemented moderately strong										
Borehole complete Back filled with sand/cement grout										

PROJECT:- Coquet Bridge North Pier and Abutment

Instrumentation: None

Logged by: A. R. WARD

BOREHOLE LOG

Client Northumberland County Council.
Location Coquet Bridge, Felton.
B.H. No E
Type of boring Hand Auger.
Date(s) 20.3.74.
Dia. of boring 125 mm
Ground Level 56.40m.
Water Level Not encountered.
Scale 1:50 metres.

Description of Strata	Reduced Level	Legend	Thickness	Depth	SAMPLES Type	SAMPLES Depth	NOTES
Topsoil - sandy with vegetation.	54.80		0.60	0.60			
Stiff mottled brown grey silty sandy CLAY with a little sandstone gravel and shale fragments.	54.50		1.30	1.90	B U B	1.00 1.20-1.65 1.50	
Weak becoming stronger dark grey SHALE.	53.55		0.95	2.85	S(14) D	2.15-2.45 2.85	
Borehole continued by rotary drilling.							

PROJECT:- Coquet Bridge North Pier and Abutment.

S ( ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

Tarmac Construction Ltd., Geotechnical Division.

4/LG/72/012

BOREHOLE LOG

Client: Northumberland County Council
B.H. No: E
Date(s): 2, 10, 11/4/74 & 3,4,5/5/74
Ground Level: 56.40m
Scale: 1:50 metres

Location: Coquet Bridge: Felton
Type of boring: Edico Rotary Water Flush
Dia. of boring: 76mm Core 412 Bit
Casing: 125mm dia 3.00 m depth

Sheet 1 of 3

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq./m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling No samples taken			100% water return							
Moderately weathered very thinly bedded and jointed dark grey iron-stained poorly cemented weak shale	53.55			2.85	22% (20)	2.65		30	5	
				5.50	100% (0)	0.85				
Slightly weathered very thinly bedded fractured light grey moderately cemented moderately strong shale	49.27			6.35	100% (0)	0.78				
				7.13	74% (0)	0.46				
				7.59	100% (0)	0.30			5	
Moderately weathered thinly bedded highly fractured light grey poorly cemented weak shale	47.94			7.89	98% (20)	0.57				
				8.46	100% (0)	0.90			5	
Slightly weathered thinly bedded fractured light grey poorly cemented weak shale	46.04			9.36					5	

PROJECT:- Coquet Bridge North Pier and Abutment

Instrumentation: None

Logged by: A.R. WARD

BOREHOLE LOG

Client: Northumberland County Council
B.H. No: E
Date(s): 2,10,11/4/74 & 3,4/5/74
Ground Level: 56.40 m
Scale: 1:50 metres

Location: Coquet Bridge: Felton
Type of boring: Edico Rotary Water Flush
Dia. of boring: 76mm Core 412 Bit
Casing: 125 mm dia 3.00 m depth

Sheet 2 of 3

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
As above			100% water return		92% (0)	1.30			5	
Slightly weathered thinly bedded and fractured grey moderately well cemented moderately strong shale	45.74		No Water return	10.66	100% (12)	0.61				
				11.27	100% (12)	0.39			5	
Slightly weathered thinly bedded and fractured dark grey moderately well cemented moderately strong shale	44.74			11.66	93% (30)	2.00			5	
Faintly weathered medium bedded dark grey well cemented moderately strong shale	42.74			13.66	95% (45)	2.22			5	
Soft brown shale (drillers description)										
Slightly weathered medium bedded jointed ironstained grey well cemented strong limestone	40.52			15.88	0% (0)	1.12				
Slightly weathered thinly bedded jointed ironstained grey well cemented strong limestone	39.40			17.00	100% (50)	0.72		80	5	
	38.68			17.72	100%	0.11		50	5	
	38.57			17.83	80% (95)	0.30			5	
Faintly weathered thinly bedded dark grey well cemented strong calcareous shale.	38.23			18.17	78% (50)	0.60		80	5	
	37.63			18.77	53% (0)	0.30			5	
Faintly weathered thinly bedded jointed dark grey moderately cemented weak calcareous shale	37.33			19.07	52% (0)	0.93		80	5	
				19.90						

Instrumentation: None

PROJECT:- Coquet Bridge North Pier and Abutment

Logged by: A.R. WARD

BOREHOLE LOG

Client Northumberland County Council
B.H. No. E
Date(s) 2, 10, 11/4/74 & 3, 4, 5/5/74
Ground Level 56.40 m
Scale 1:50 metres

Location Coquet Bridge ; Felton
Type of boring Edico Rotary Water Flush
Dia. of boring 76mm Core 412 Bit
Casing 125 mm dia. 3.00 m depth

Sheet 3 of 3

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Fresh fissile black moderately strong coal			No Water Return		100% (25)	1.25			5	
Faintly weathered thinly bedded jointed dark grey moderately cemented moderately strong shale (Fireclay)	35.25			21.15	55% (65)	0.55			5	
Fresh thinly bedded light grey well cemented moderately strong fine sandstone with carbonaceous stringers	34.70			21.70	70% (98)	2.30			5	
Fresh thickly bedded dark grey well cemented strong fine sandstone	32.40			24.00						
Fresh thickly bedded banded light and medium grey well cemented strong fine sandstone										
Borehole complete Back filled with sand/cement grout										

PROJECT:- Coquet Bridge North Pier and Abutment

Instrumentation : None

Logged by : A.R. WARD

BOREHOLE LOG

Client: Northumberland County Council.
Location: Coquet Bridge, Felton.
B.H. No: F
Type of boring: Hand Auger.
Date(s): 20.3.74.
Dia. of boring: 125 mm.
Ground Level: 50.72m.
Water Level: Not encountered.
Scale: 1:50 metres.

Description of Strata	Reduced Level	Legend	Thickness	Depth	SAMPLES Type	SAMPLES Depth	NOTES
Topsoil - sandy with vegetation.	49.82		0.90	0.90	B	1.00	
Brown poorly graded sandy silty CLAY with boulders.	48.22		0.60	1.50	S(16)	1.65-1.95	
Weak becoming stronger dark grey SHALE.	47.47		0.75	2.25	D	2.25	
Borehole continued by rotary drilling.							

PROJECT:- Coquet Bridge North Pier and Abutment.

S ( ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

Tarmac Construction Ltd., Geotechnical Division.

4/LG/72/012

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge : Felton
B.H. No.: F
Type of boring: Pendant Rotary Water Flush
Date(s): 26 & 30/4/74 and 1 & 2/5/74
Dia. of boring: 76 mm dia Core 412 Bit
Ground Level: 50.72 m
Casing: 150 mm dia 2.00 m depth
Scale: 1:50 metres
Sheet 1 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling No Sample Taken			100% water return							
Soft brown decomposed shale (Drillers desription)	48.72			2.00	0% (0)	2.20				
Moderately weathered thinly bedded very fractured grey iron-stained poorly cemented moderately weak calcareous shale	46.52			4.20	100% (0)	1.55			3	
Slightly weathered thinly bedded fractured dark grey poorly cemented weak calcareous shale	44.97			5.75	31% (0)	0.65				
				6.40	57% (0)	0.70				
				7.10	100% (0)	1.42		45	3	
Slightly weathered thinly bedded dark grey well cemented moderately strong calcareous shale	42.20			8.52	71% (60)	0.78			3	
Slightly weathered thinly bedded jointed dark grey ironstained well cemented moderately strong calcareous shale	41.42			9.30				90	3	

Instrumentation: None

PROJECT:- Coquet Bridge North Pier and Abutment

Logged by: A.R. WARD

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge : Felton
B.H. No: F
Type of boring: Pendant Rotary Water Flush
Date(s): 26 & 30/4/74 and 1 & 2/5/74
Dia. of boring: 76mm dia Core 412 Bit
Ground Level: 50.72 m
Casing: 150 mm dia 2.00 m depth
Scale: 1:50 metres
Sheet 2 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq./m	Inclination Joint	Inclination Bedding	Weath. Grade
Slightly weathered thinly bedded jointed dark grey ironstained well cemented moderately strong calcareous shale			100% water return		100% (5)	1.90		90	3	
Faintly weathered along joints medium bedded jointed grey well cemented strong limestone	39.52		Lost water return	11.20	73% (70)	0.96		90	3	
Slightly weathered thinly bedded jointed dark and light grey ironstained well cemented moderately strong calcareous shale	38.56			12.16	100% (45)	0.55		90	3	
Moderately weathered thinly bedded very fractured poorly cemented dark grey weak calcareous shale	38.01			12.71	75% (0)	1.14			3	
Fresh fissile weak coal	36.87			13.85	77% (0)	0.30			3	
Moderately weathered very fractured grey poorly cemented very weak shale (Fireclay)	36.57			14.15	57% (0)	1.41			3	
Fresh medium bedded light and dark grey banded well cemented strong fine sandstone	35.16			15.56	100% (65)	0.53			3	
Slightly weathered very fractured dark grey poorly cemented weak shale	34.73			16.09	88% (0)	0.34			3	
Slightly weathered thinly bedded jointed dark grey ironstained shale and light grey fine sandstone bands well cemented moderately strong	34.29			16.43	90% (20)	1.74		70	3	
Slightly weathered laminated bands of shale and sandstone moderately strong	32.55			18.17	90% (70)	0.33		70	3	
Borehole complete backfilled with sand/cement grout	32.22			18.50						

PROJECT:- Coquet Bridge North Pier and Abutment

Instrumentation: None

Logged by: A. R. WARD

BOREHOLE LOG

Client: Northumberland County Council
C

Location: Coquet Bridge : Felton

B.H. No.:

Type of boring: X-Ray Rotary Water Flush

Date(s): 7, 8 & 9/5/74

Dia. of boring: 55 mm Core TNX Bit

Ground Level: 32.81m

Casing: 92mm dia 0.70m depth

Scale: 1:50 metres

Sheet 1 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq./m	Inclination Joint	Inclination Bedding	Weath. Grade
Open Hole Drilling No samples taken			100% Water return							
	31.51			1.30						
Fresh medium bedded jointed light brown with carbonaceous stringers well cemented moderately strong fine micaceous sandstone					97% (90)	1.50				
				2.80	98% (90)	1.59		30	20	
				4.39	99% (90)	1.55				
	26.86			5.95						
Fresh medium bedded jointed light brown with numerous carbonaceous stringers well cemented moderately strong fine micaceous sandstone					71% (90)	3.40		30 and 80	20	
	23.46			9.35						
Slightly weathered thinly bedded dark grey well cemented moderately strong shale					95% (10)	0.72			20	

Instrumentation: None

PROJECT:- Coquet Bridge Foundations

Logged by: A.R. WARD

Tarmac Construction Ltd., Geotechnical Division.

4/LG/72/012

BOREHOLE LOG

Client: Northumberland County Council
Location: Coquet Bridge : Felton
B.H. No: G
Type of boring: X-Ray Rotary Water Flush
Date(s): 7, 8 & 9/5/74
Dia. of boring: 55mm Core TNX Bit
Ground Level: 32.81m
Casing: 92mm dia 0.70m depth
Scale: 1:50 metres
Sheet 2 of 2

Description of Strata	Reduced Level	Legend	Water Level	Depth	Run % rec. ( )RQD	Depth	Fract. Freq. /m	Inclination Joint	Inclination Bedding	Weath. Grade
As above	22.74		100% water return	10.07	100%	0.72 0.08				
Fresh fissile iron-stained moderately strong coal	22.66			10.15	100% (40)	1.08			20	
Faintly weathered medium bedded light grey well cemented moderately strong shale (Fireclay)	21.58			11.23	74% (30)	0.88		60	20	
Fresh medium bedded jointed dark grey well cemented moderately strong shale with stringers of fine sandstone	20.70			12.11	95% (93)	1.89		60	20	
Fresh medium bedded jointed dark grey well cemented moderately strong shale	18.81			14.00						
Borehole complete Back-filled with sand/cement grout										

PROJECT:- Coquet Bridge Foundations

Instrumentation: None

Logged by: A.R. WARD

Tarmac Construction Ltd., Geotechnical Division.

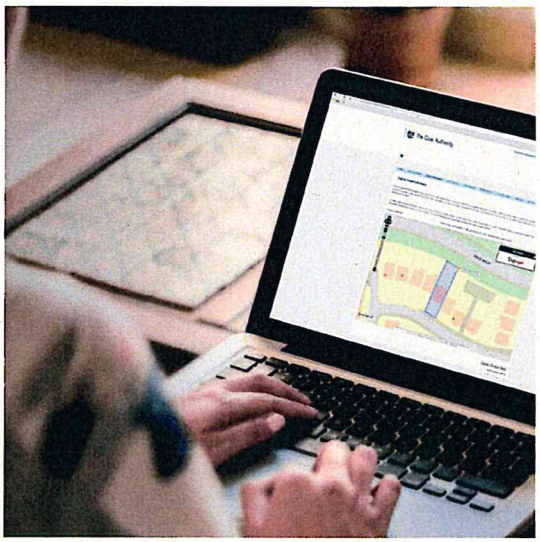
4/LG/72/012

Appendix I – CON29M Coal Authority Report

The Coal Authority

Resolving the **impacts** of mining

CON29M Non-Residential Mining Report



NORTHUMBERLAND REFINED
NORTHUMBERLAND

Date of enquiry:	25 November 2016
Date enquiry received:	25 November 2016
Issue date:	02 December 2016
Our reference:	51001302436001
Your reference:	NORTHUMBERLAND REFINED

CON29M Non-Residential Mining Report

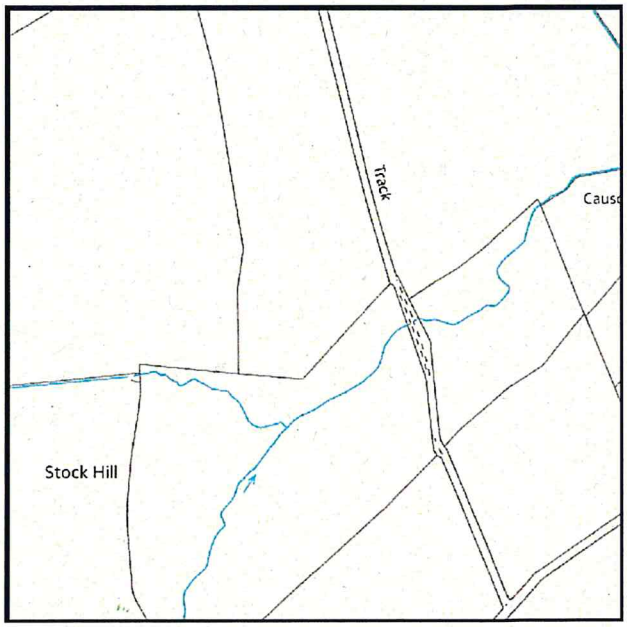
This report is based on, and limited to, the records held by the Coal Authority and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Client name

LANDMARK INFORMATION GROUP LIMITED

Enquiry address

NORTHUMBERLAND REFINED ,
NORTHUMBERLAND



Approximate position of property

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

/company/the-coal-authority
/thecoalauthority
/coalauthority

Summary

Has the search report highlighted evidence or potential of		
1	Past underground coal mining	Yes
2	Present underground coal mining	No
3	Future underground coal mining	Yes
4	Mine entries	Yes
5	Coal mining geology	No
6	Past opencast coal mining	No
7	Present opencast coal mining	No
8	Future opencast coal mining	No
9	Coal mining subsidence	No
10	Mine gas	No
11	Hazards related to coal mining	No
12	Withdrawal of support	Yes
13	Working facilities order	No
14	Payments to owners of former copyhold land	No
15	Information from the Cheshire Brine Subsidence Compensation Board	No

Further recommended reports
Mine entry interpretive report
Mine entry plan and data sheets

For detailed findings, please go to page 4.

Detailed findings

1. Past underground coal mining

The property is in a surface area that could be affected by underground mining in 1 seam of coal at shallow depth, and last worked in 1965.

2. Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3. Future underground coal mining

The property is not in an area where the Coal Authority has plans to grant a licence to remove coal using underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4. Mine entries

Within, or within 20 metres of, the boundary of the property there are 9 mine entries, the approximate positions of which are shown on the enquiry boundary plot.

Our records disclose the following information:

418595-001. it is suggested that this entry has been filled to an unknown specification at some time in the past.

418597-001. No treatment details.

417597-001. it is reported that this entry may have been filled by the RAF at some time in the past.

419594-001. No treatment details.

418595-006. No treatment details.

418595-002. it is suggested that this entry has been filled to an unknown specification at some time in the past.

418595-003. No treatment details.

418595-005. No treatment details.

418595-004. No treatment details.

There may however be mine entries/additional mine entries in the local area which the Coal Authority has no knowledge of.

For an additional fee, the Coal Authority can provide a Mine Entry Interpretive Report. The report will provide a separate assessment for the mine entry/entries referred to in this report. It gives an opinion on the likelihood of mining subsidence damage caused from ground movement as a consequence of the mine entry/entries. It also gives details of the remedies available for subsidence damage where the mine entry was sunk in connection with coal mining.

Please note that it may not be possible to produce a report if the main building to the property cannot be identified from Coal Authority plans (ie for development sites and new build).

For further advice on how to order this additional information please visit www.groundstability.com.

5. Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6. Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7. Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8. Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9. Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

10. Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11. Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

12. Withdrawal of support

The property is in an area where notices to withdraw support were given in 1943, 1972.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

13. Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14. Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

15. Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

This document is also available on our website at **www.gov.uk /highways**

If you have any enquiries about this document
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or call **0300 470 4580***.