MOTT MACDONALD

Quaternary geology of Birmingham and example of its impact on design

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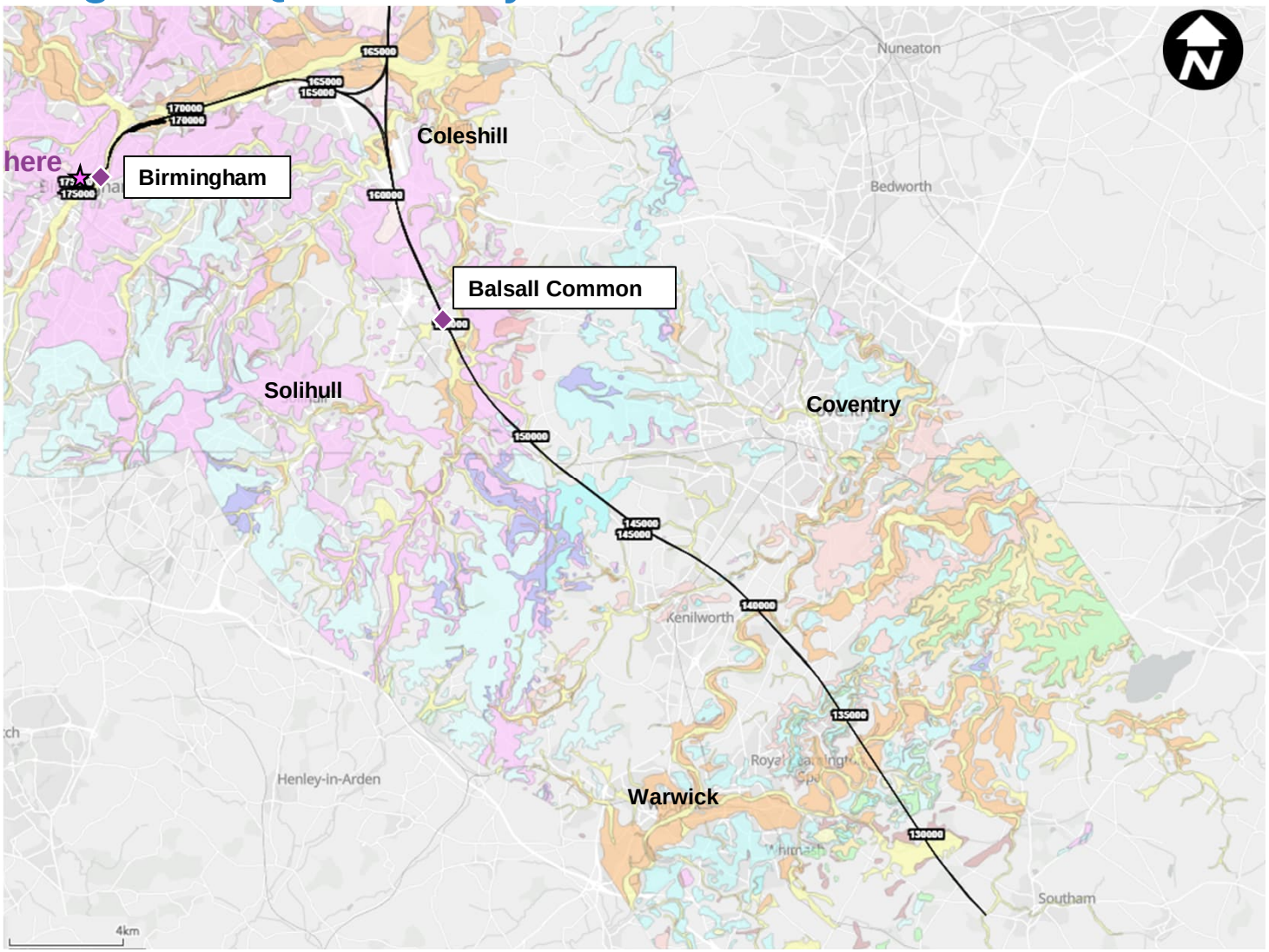
The Geological Society

West Midlands Regional Group
13/02/2024

Simplified Regional Quaternary



Simplified Regional Quaternary

Holocene
Warmer Holocene drainage network
12,000 years ago to present day

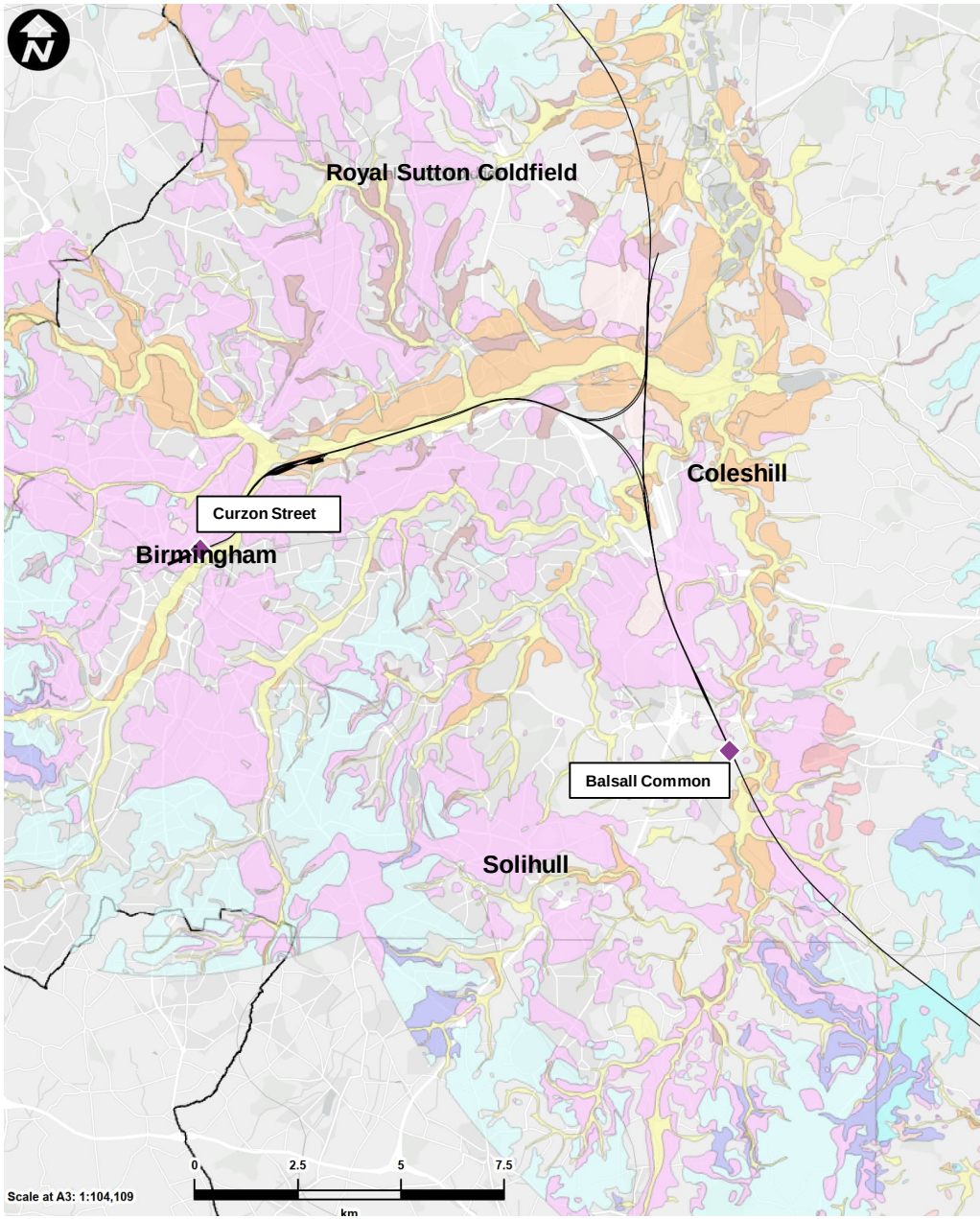
Devensian glaciation
Glacial cover extending to the Birmingham area
33,000 years ago

Relatively warmer period
Warmer period – large scale retreat of ice released significant volumes of water

Wolstonian glaciation
~200,000 to ~150,000 years ago
Glaciation extending south of Birmingham into Gloucestershire.

Relatively warmer period (Hoxnian)
Warmer period – retreating ice releasing water

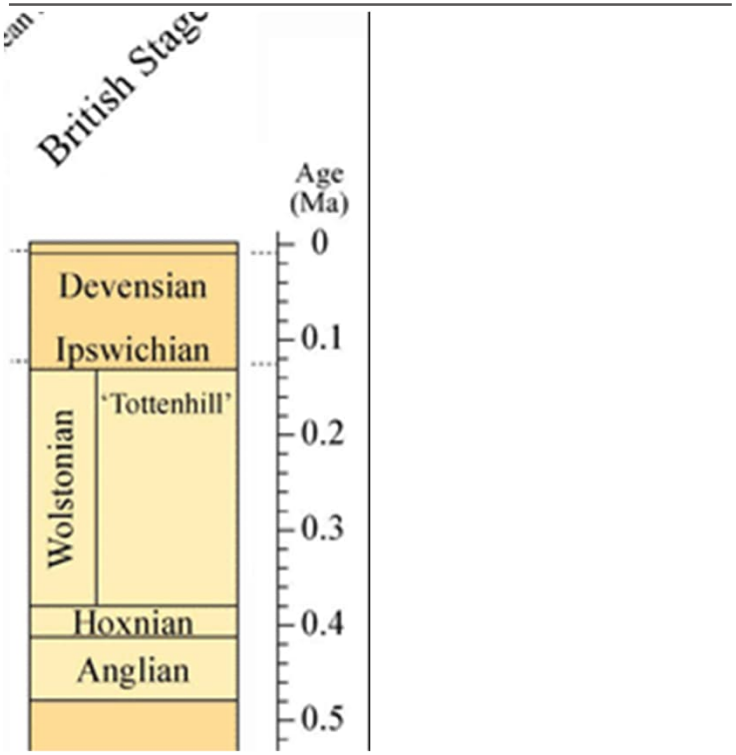
Anglian glaciation
Widespread glacial cover extending further south from Birmingham
>423,000 years ago



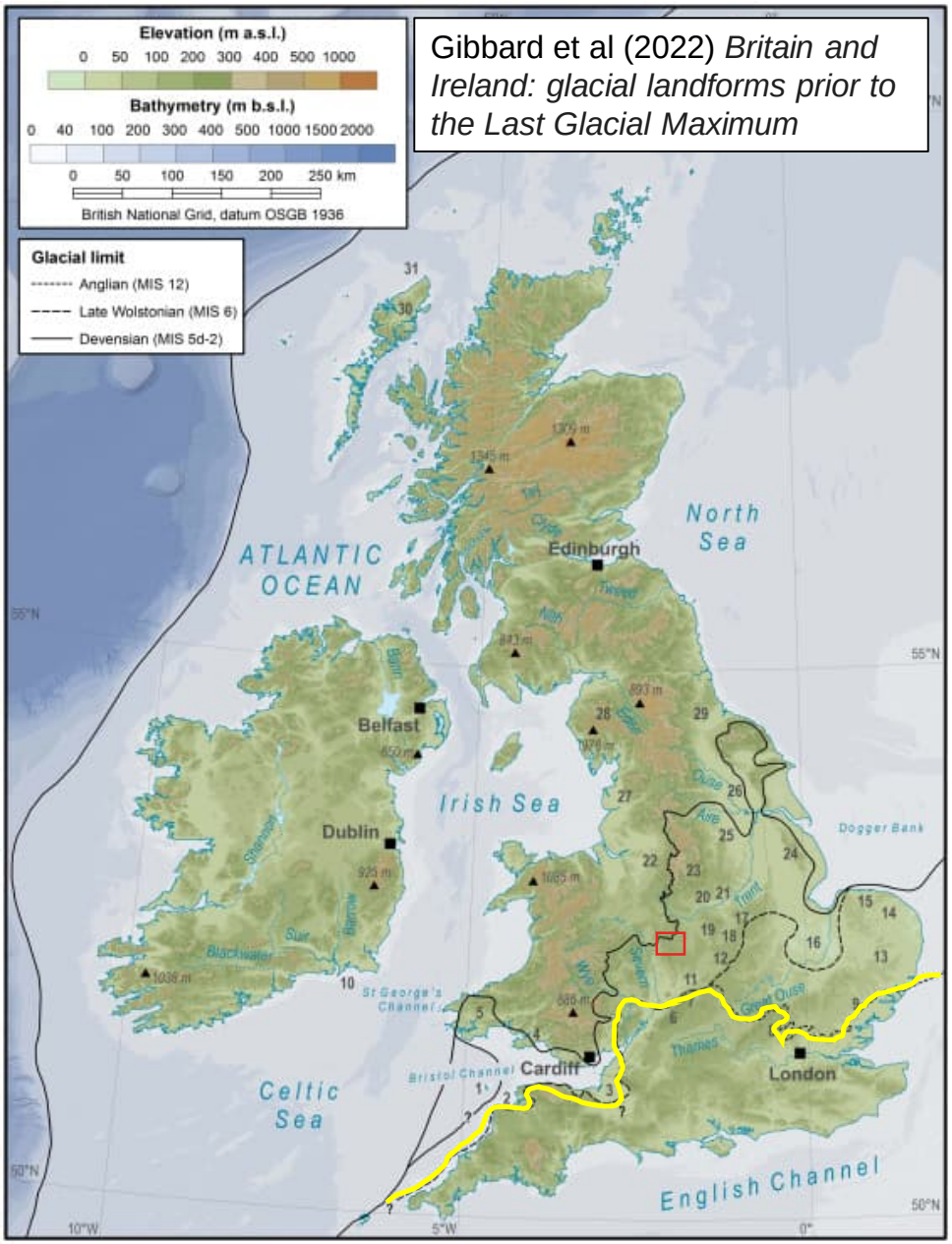
Glacial deposits

ERA	PERIOD	SERIES/ EPOCH		AGE	BRITISH QUATERNARY STAGE (ONSHORE) After Gordon and Sutherland (1993a), Mitchell et al. (1973a), West (1961, 1980), Zalasiewicz et al. (1991). Equivalent Greenland Ice Core Chronology 2005 events (GS/GI) shown for the Late Devensian (after Lowe et al., 2008)		NORTH–WEST EUROPEAN QUATERNARY STAGE After Gibbard et al. (1991a), Funnell (1996), Lister (1998, 2000), Zagwijn (1992)	Marine Oxygen Isotope stage (MIS) – approx. correl-ation	SUPERGROUP	LITHO-STRATIGRAPHICAL GROUPS		
		HOLOCENE 0.012Ma						1				
	QUATERNARY	PLEISTOCENE	LATE	'TARANTIAN'	DEVENSIAN	Loch Lomond Stadial (LLS) (Younger Dryas) GS-1	WEICHSELIAN	2-1		CALEDONIA GLACIGENIC GROUP		BRITANNIA CATCHMENTS GROUP
						Windermere (Late Glacial) Interstadial (WI) equivalent to Bølling/Allerød. GI-1e –GI-1a		2				
						Dimlington Stadial GS-5–GS-2a						
								3				
								4				
								5d-a				
				0.126Ma	IPSWICHIAN		EEMIAN	5e				
			MIDDLE	'IONIAN'	'WOLSTONIAN'		SAALIAN	10-6		ALBION GLACIGENIC GROUP		
					HOXNIAN		HOLSTEINIAN	11				
					ANGLIAN		ELSTERIAN	12				
					'CROMERIAN COMPLEX'		'CROMERIAN COMPLEX'	21-13				
				0.781 Ma								

BGS research report RR/10/03



Cohen & Gibbard (2010)



Glacial deposits

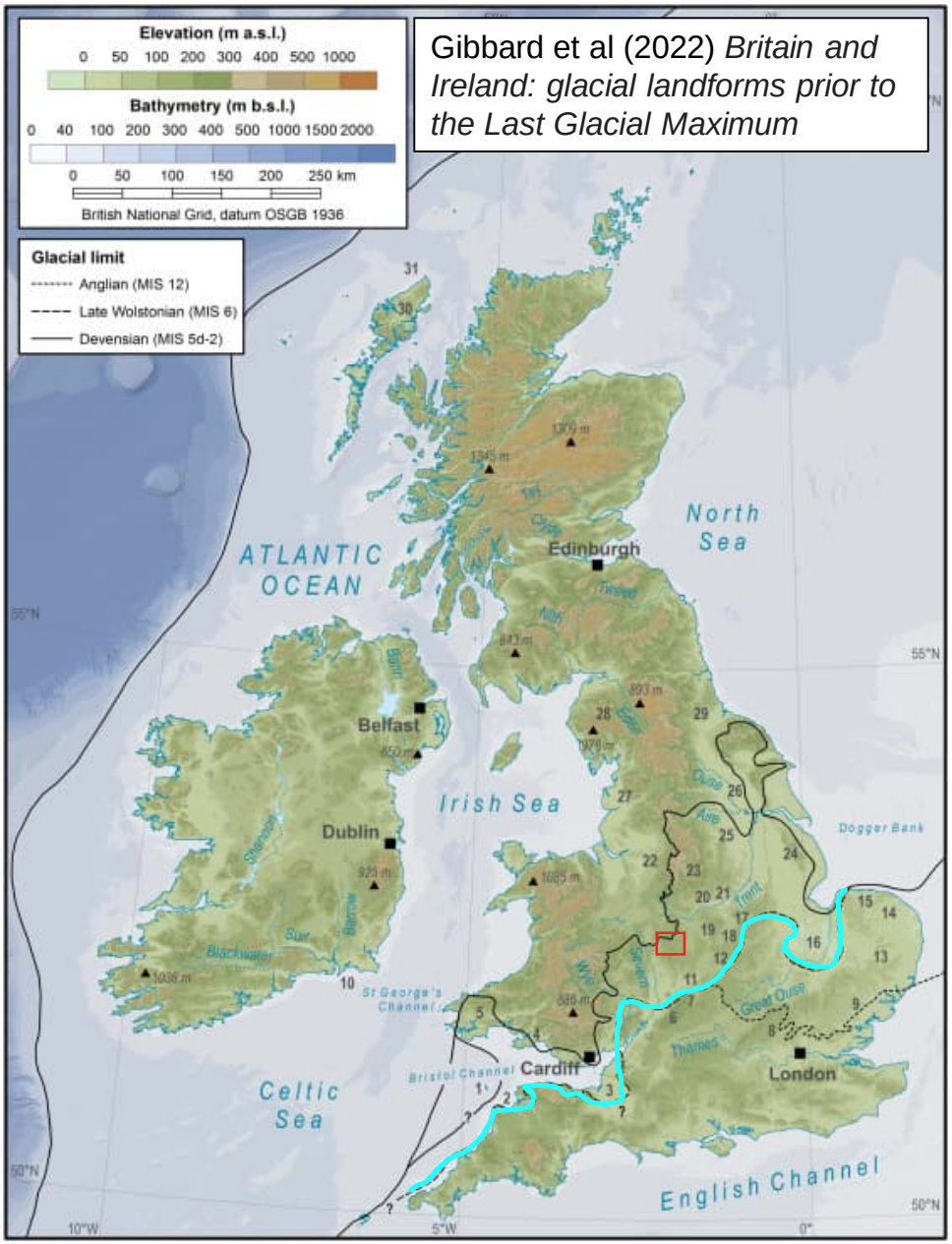
Anglian glacial extents

Middle Pleistocene approximately 450,000 years ago.

Most extensive glacier in the Quaternary.

Dramatic impact on drainage and landforms.

Initiated the separation of UK from Europe



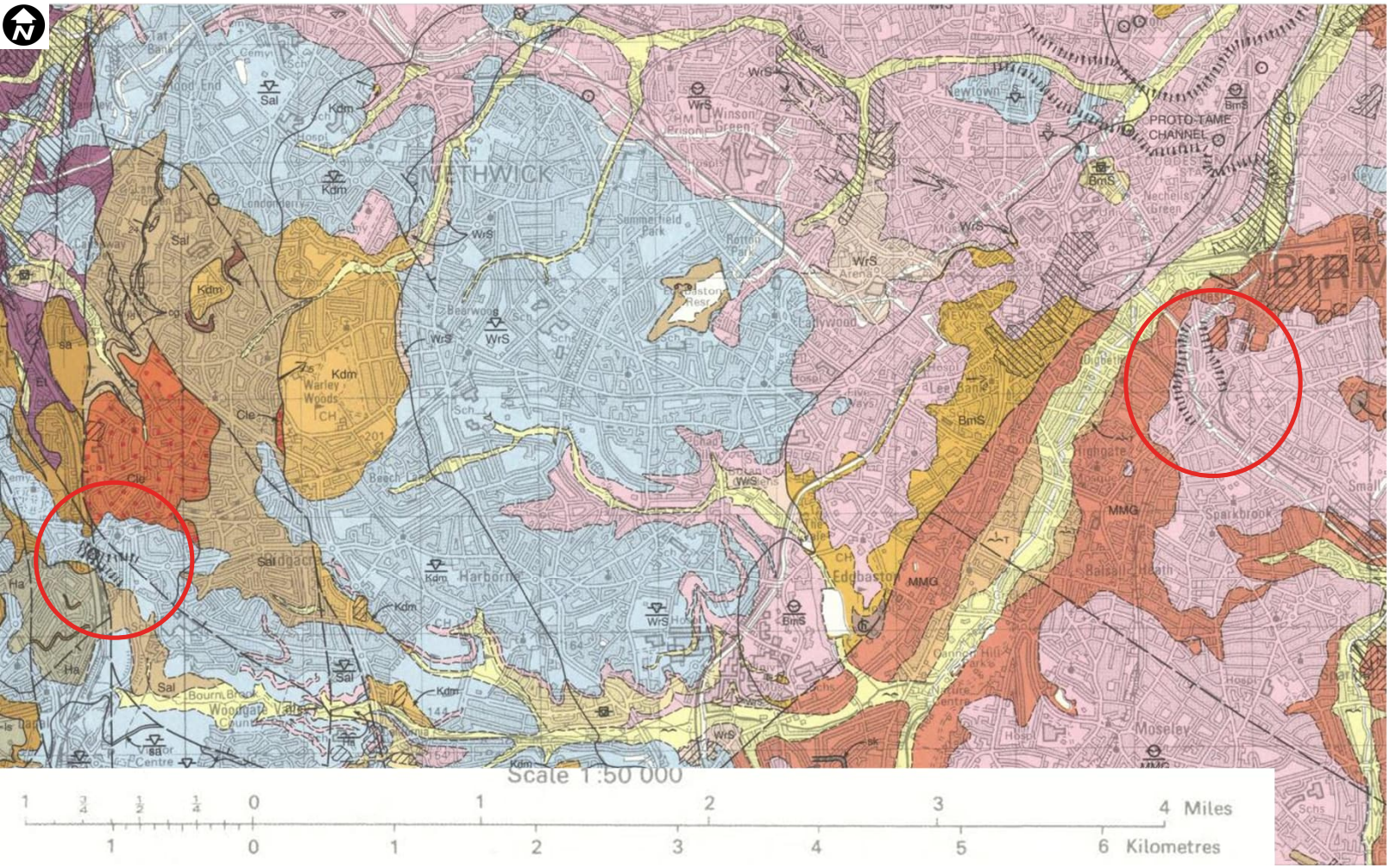
Glacial deposits

Wolstonian glacial extents

Middle Pleistocene approximately 150,000 to years ago

Hoxnian interglacial stage

Nechells & Quinton channels



- Interglacial stage between Angian and Wolstonian
- Approximately 360,000 years ago
- Warmer period
- Lacustrine environments
- Restricted deposition
- Deposition of organic matter

Hoxnian interglacial stage

Nechells & Quinton channels

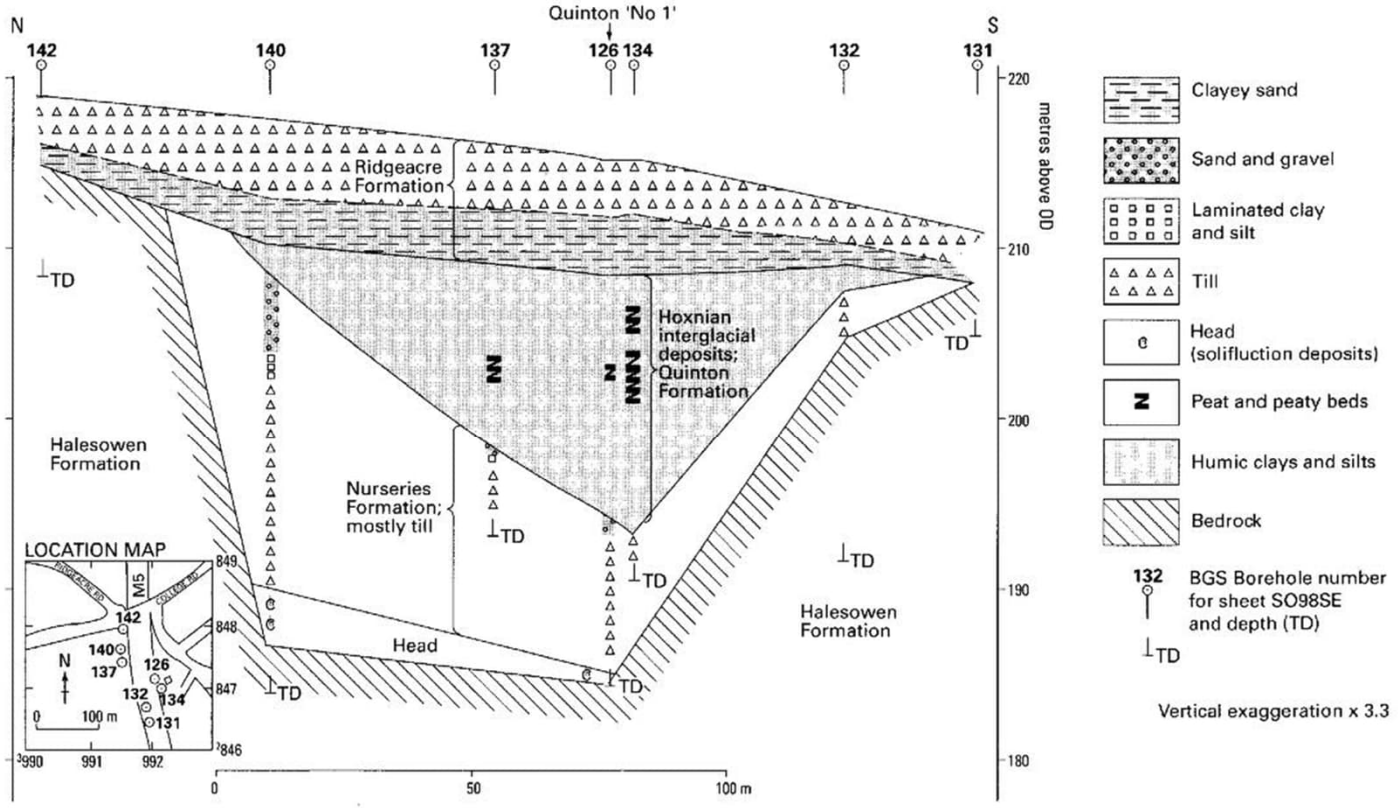
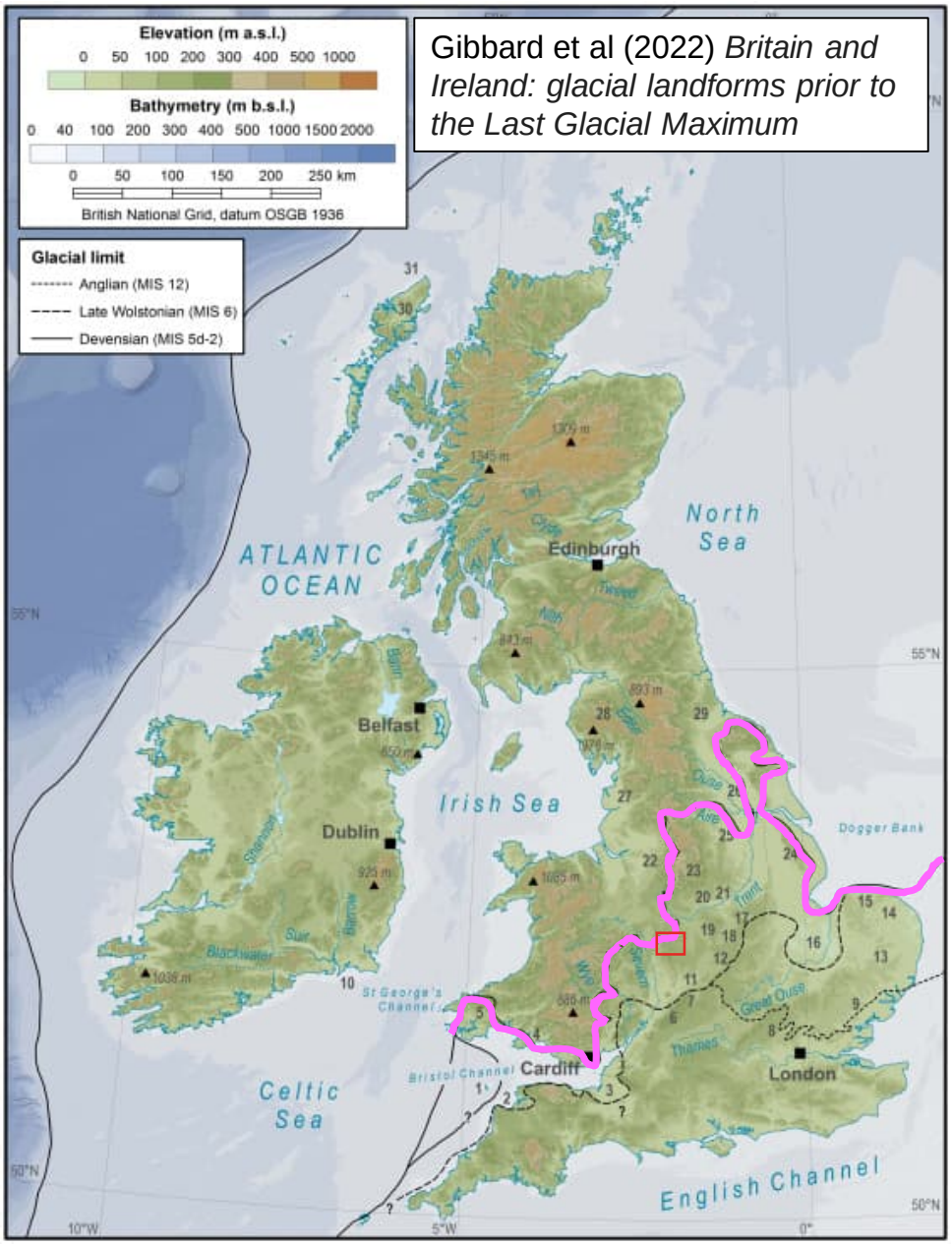


Figure 25 Cross-section through the Quinton palaeovalley; formation names and information after Horton (1989).

Glacial deposits

Quinton

- Upper Till – possibly Wolstonian or Devensian
- Sand silt and clay with organic matter – Hoxnian
- Lower Till - Anglian

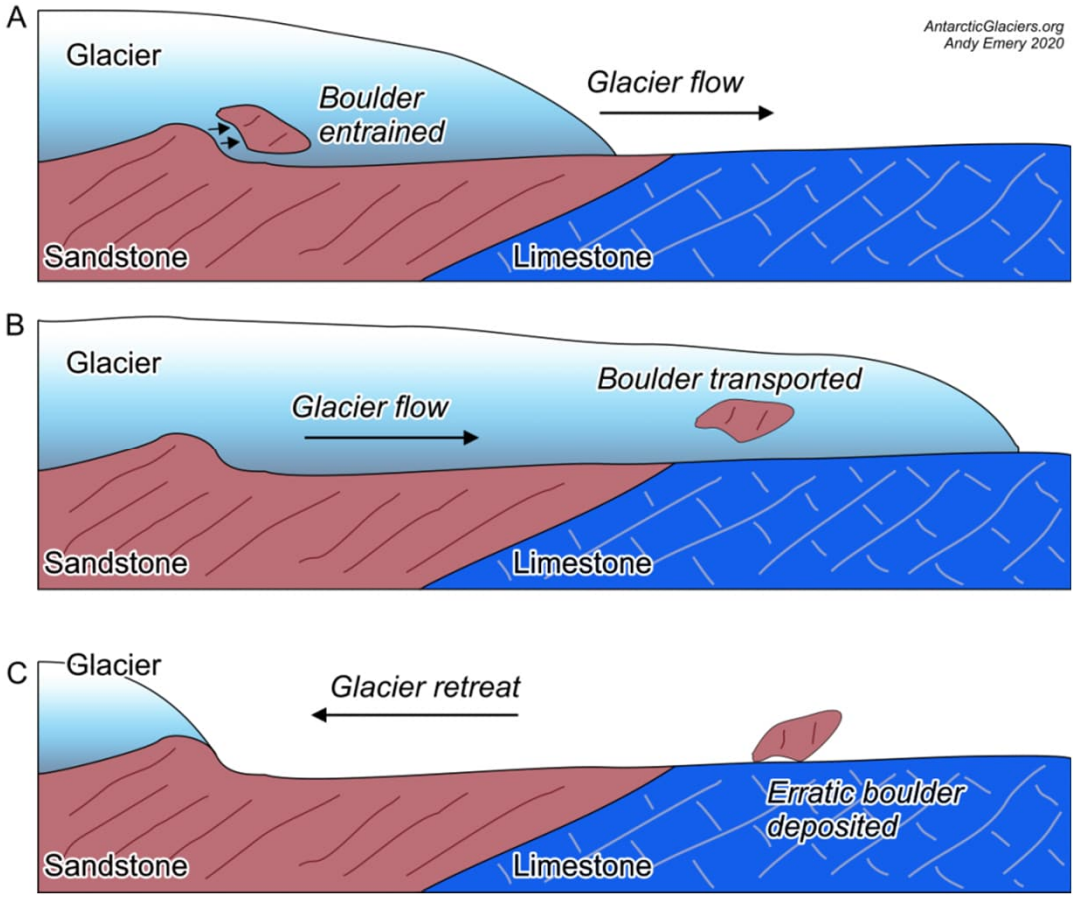


Glacial deposits

Devensian glacial extents

Glacial deposits

Erratics



https://www.antarcticglaciers.org/glacial-geology/glacial-landforms/glacial-depositional-landforms/glacial-erratics/

WMRG – Birmingham's Erratic Boulders: Heritage of the Ice Age 14 March 2023

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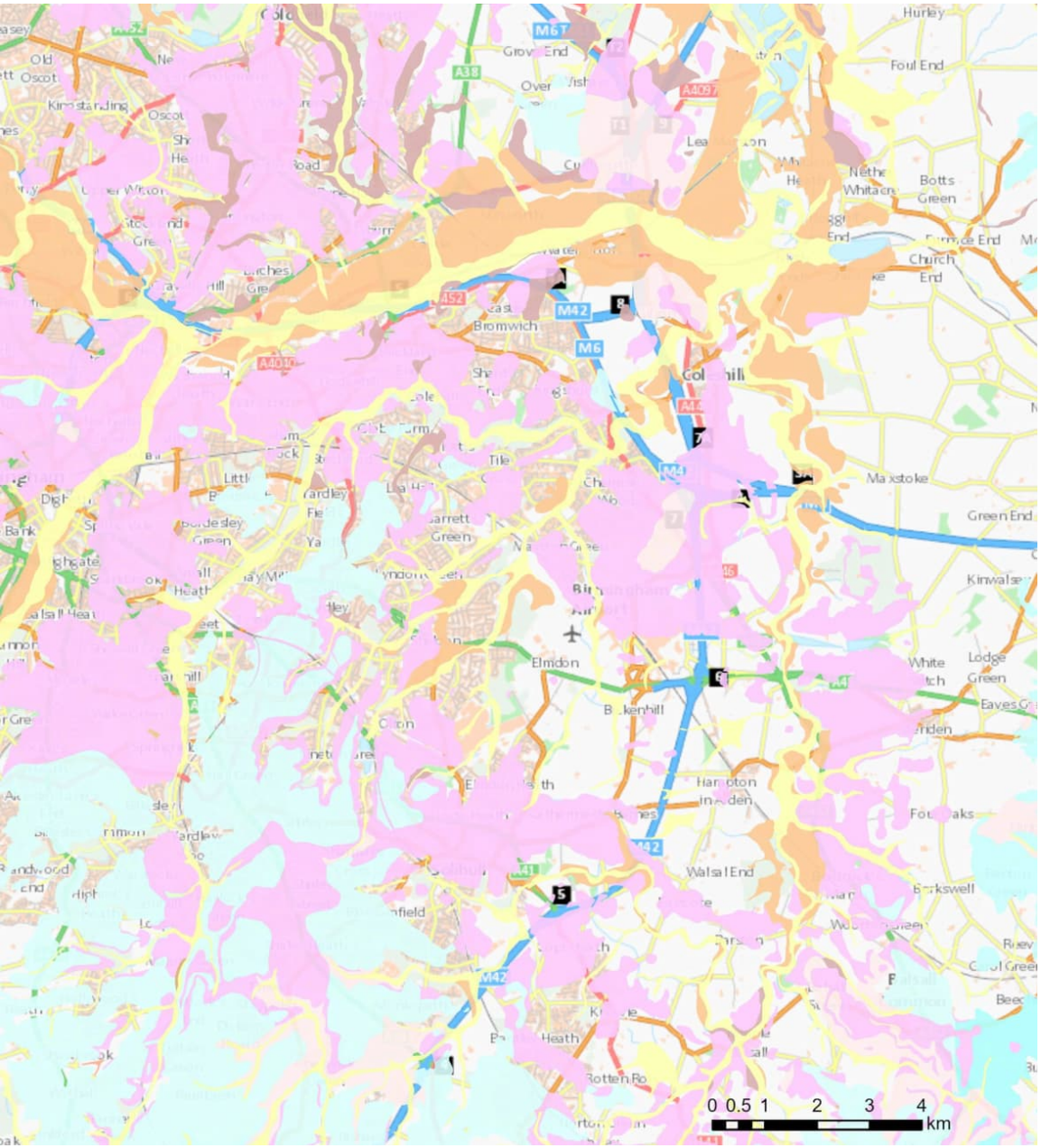
https://erraticsproject.org/

Post-glacial deposits

- **Erosion and reworking of glacial sediments**

- **Sediments deposited by rivers**
  - River Terrace Deposits
  - Alluvium (including localised Peat)
- **Mass movement**
  - Localised Head deposits



Post-glacial deposits

River Terrace Deposits

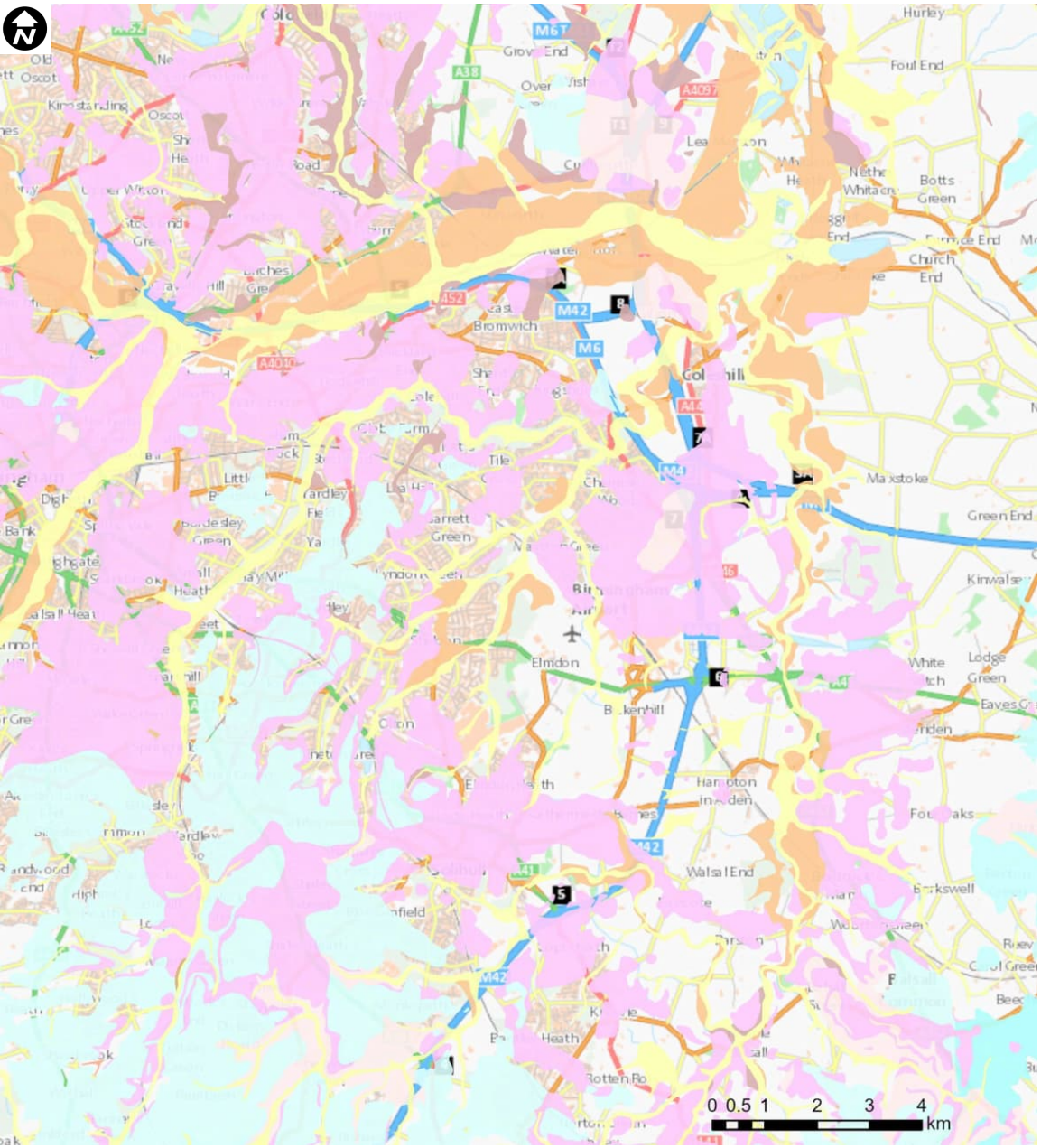
River Tame

River Rea

River Blythe

Post-glacial deposits

River Terrace Deposits



Post-glacial deposits

Alluvium

Alluvial floodplains associated with:

River Tame

River Rea

River Blythe

Post-glacial deposits

Alluvium

BS172-CP432 – Rea Alluvium

- 2 to 3m bgl: Soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse quartz.

BS167-CR422 – Tame Alluvium

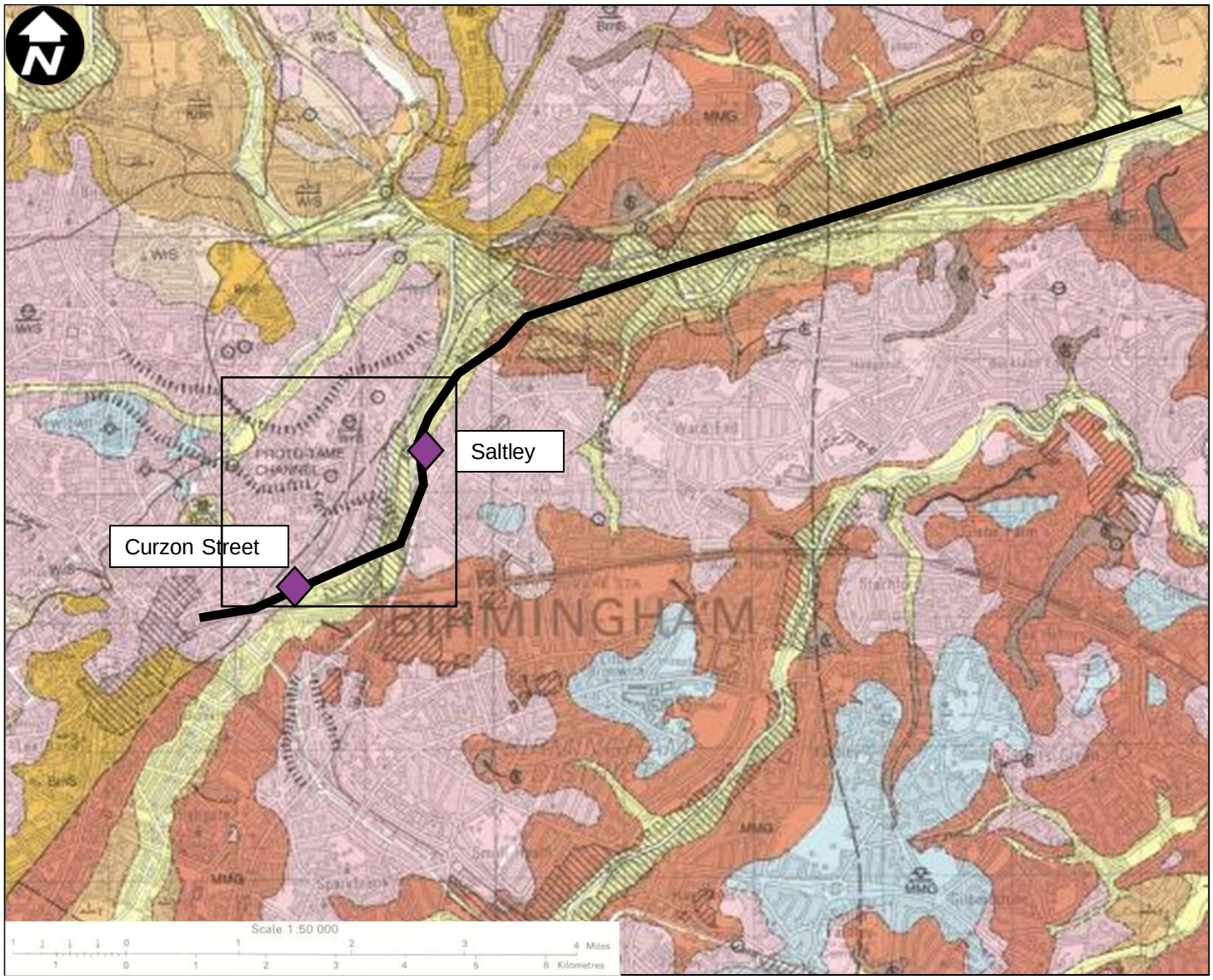
- 3.2 to 3.9m bgl: Soft to firm light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded and rounded quartzite.

ML164-CP430 – Tame-Blythe-Cole Alluvium

- 1 to 4.15m bgl: Soft to firm dark brown slightly sandy slightly gravelly CLAY with black organic matter. Sand is fine. Gravel is subangular to subrounded fine to coarse siltstone, sandstone and quartzite.

BS162-RC402 – Cole Alluvium

- 0.3 to 0.5: soft to firm dark brown slightly sandy slightly gravelly CLAY with black organic matter. Sand is fine. Gravel is subangular to subrounded fine to coarse sandstone and quartzite.
- 0.5 to 1.2: dark brown clayey GRAVEL of sandstone and quartzite.



BGS 1:50,000 map sheet 168 Birmingham (1996)

Central Birmingham

Geological setting

Holocene river network – Alluvium and River Terrace Deposits

Palaeochannels

Widespread Glaciofluvial Deposits

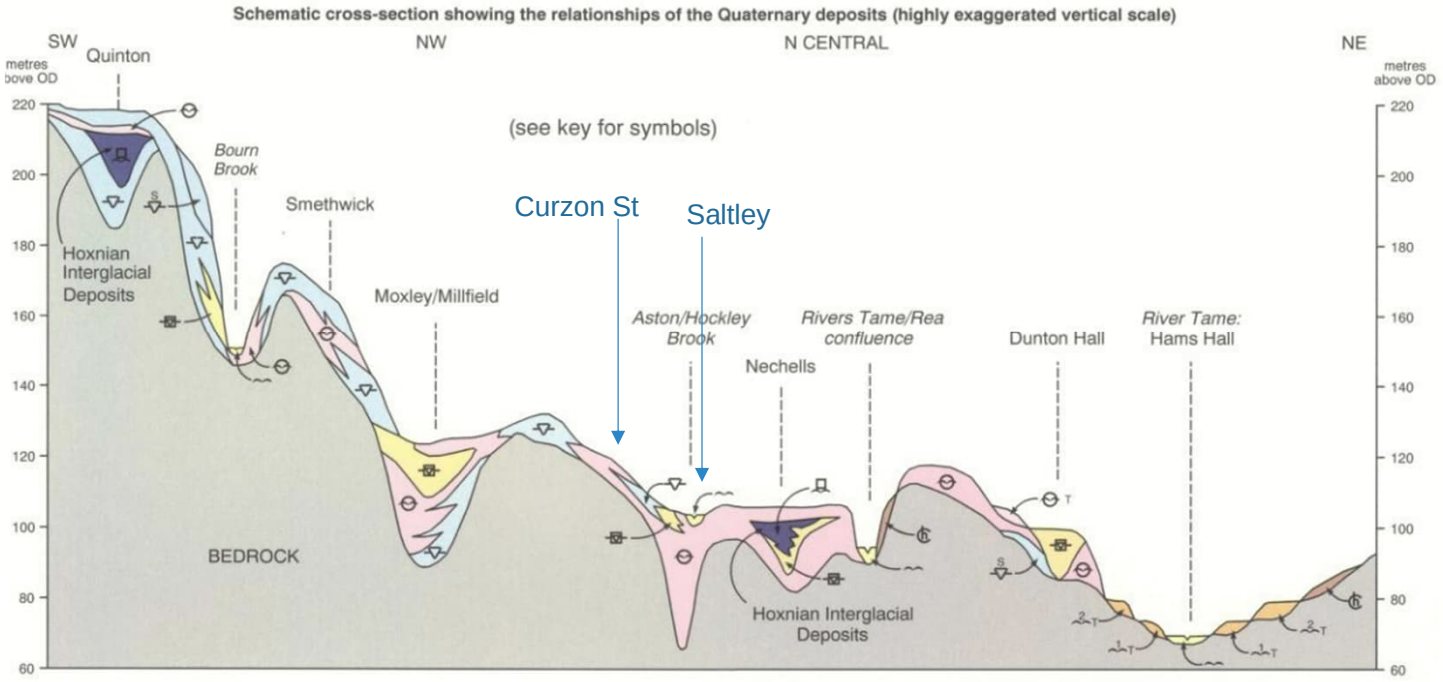
Glacial Till

Mercia Mudstone Group

Helsby Sandstone Formation

Birmingham Fault

Central Birmingham

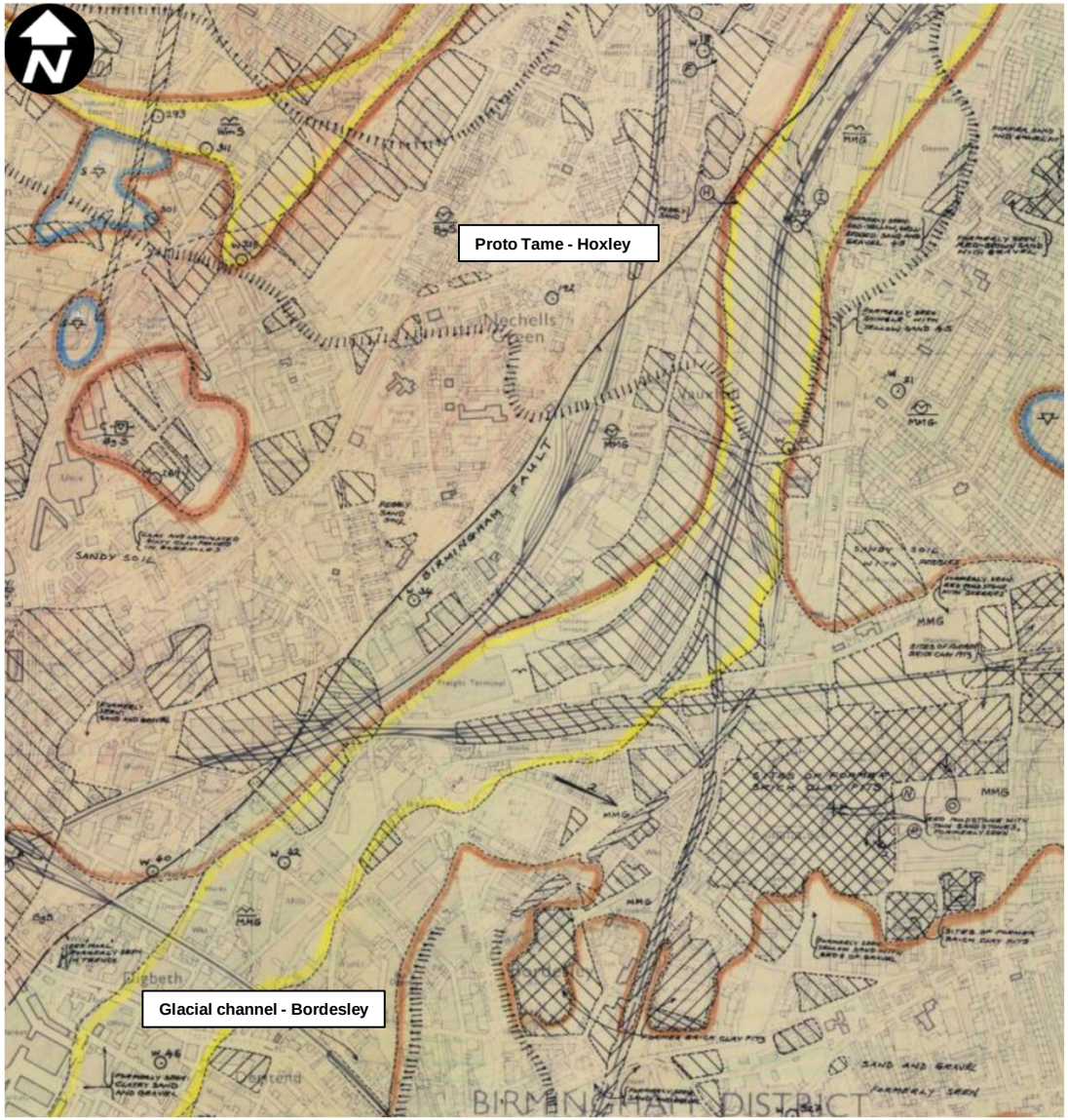


BGS 1:50,000 map sheet 168 Birmingham (1996)

Regional setting

There are deep glacial channels to the northeast and southwest of the site however this part of Birmingham is indicated to have a relatively thin cover (5-10m).

Alluvium is present to the south.



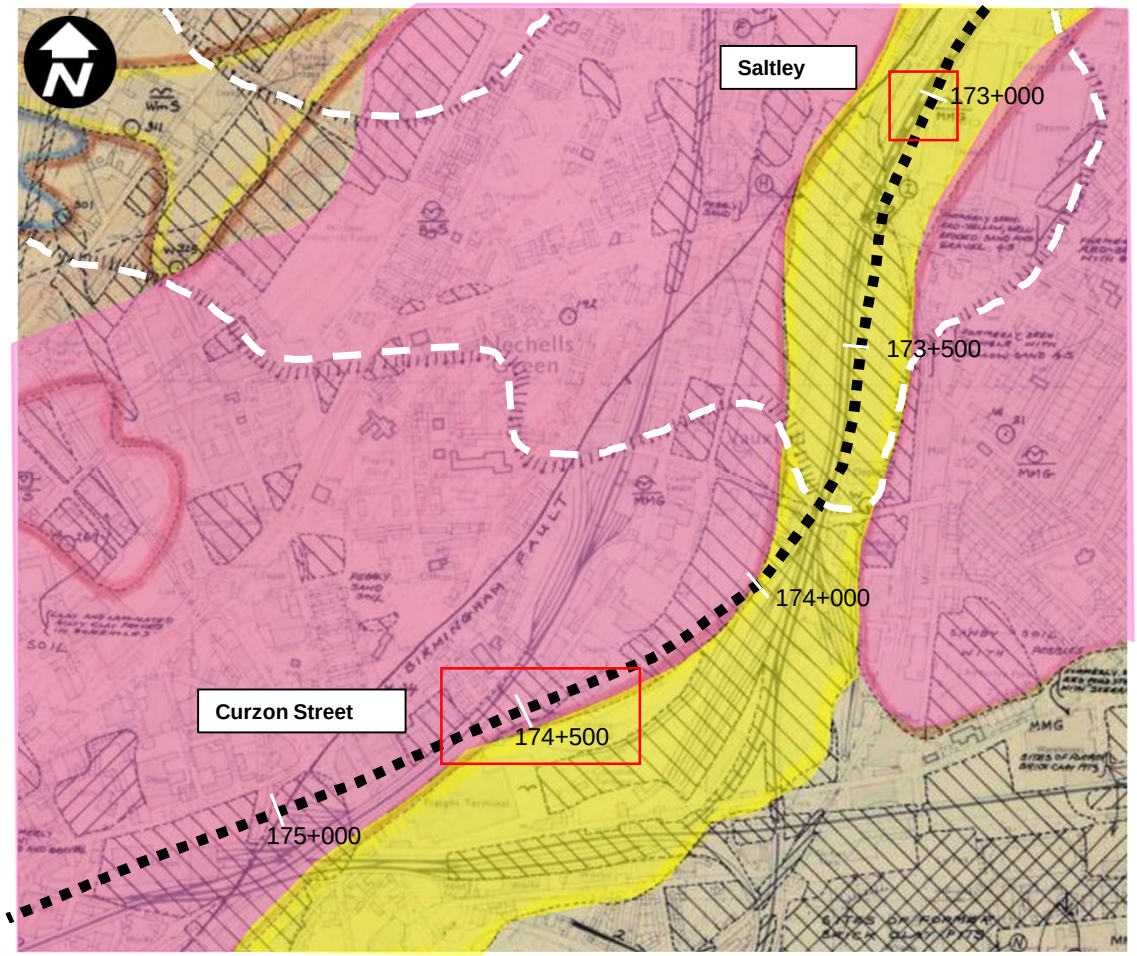
BGS 1:10,000 map sheet SP08NE Birmingham City (1993)

Central Birmingham

1:10,000 BGS mapping

BGS 1:10,000 scale mapping indicates in this area there are widespread Glaciofluvial Deposits and Alluvial channels.

Two paleo channels dominate. The large Proto Tame channel at Hoxley and a smaller channel to the south at Bordesley.



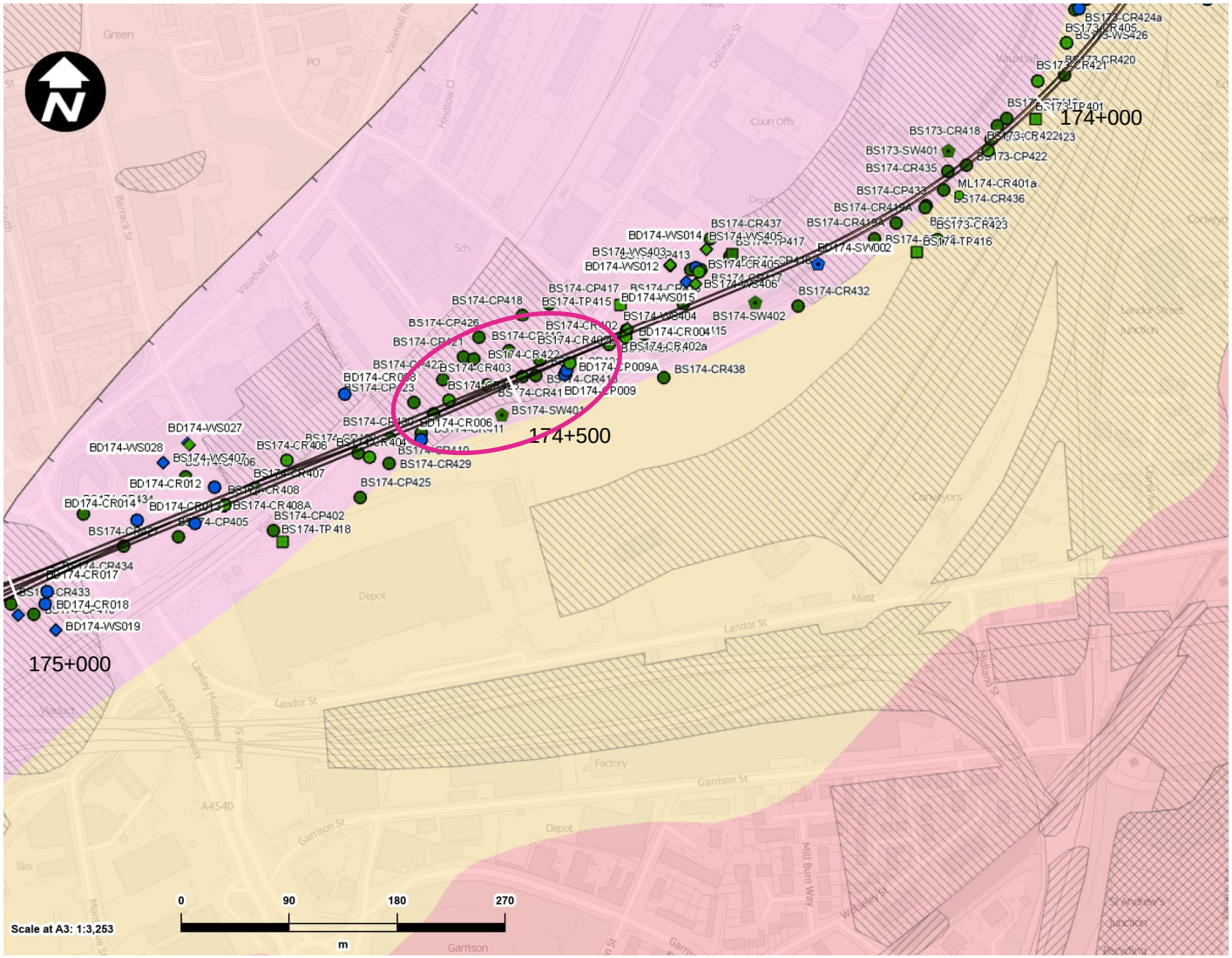
BGS 1:10,000 map sheet SP08NE Birmingham City (1993)

Central Birmingham

1:10,000 BGS mapping

173+000: falls inside the Proto Tame channel towards the eastern edge within an Alluvial Channel.

174+300: outside the mapped channels underlain by Glaciofluvial Deposits with Alluvium further south.



Central Birmingham

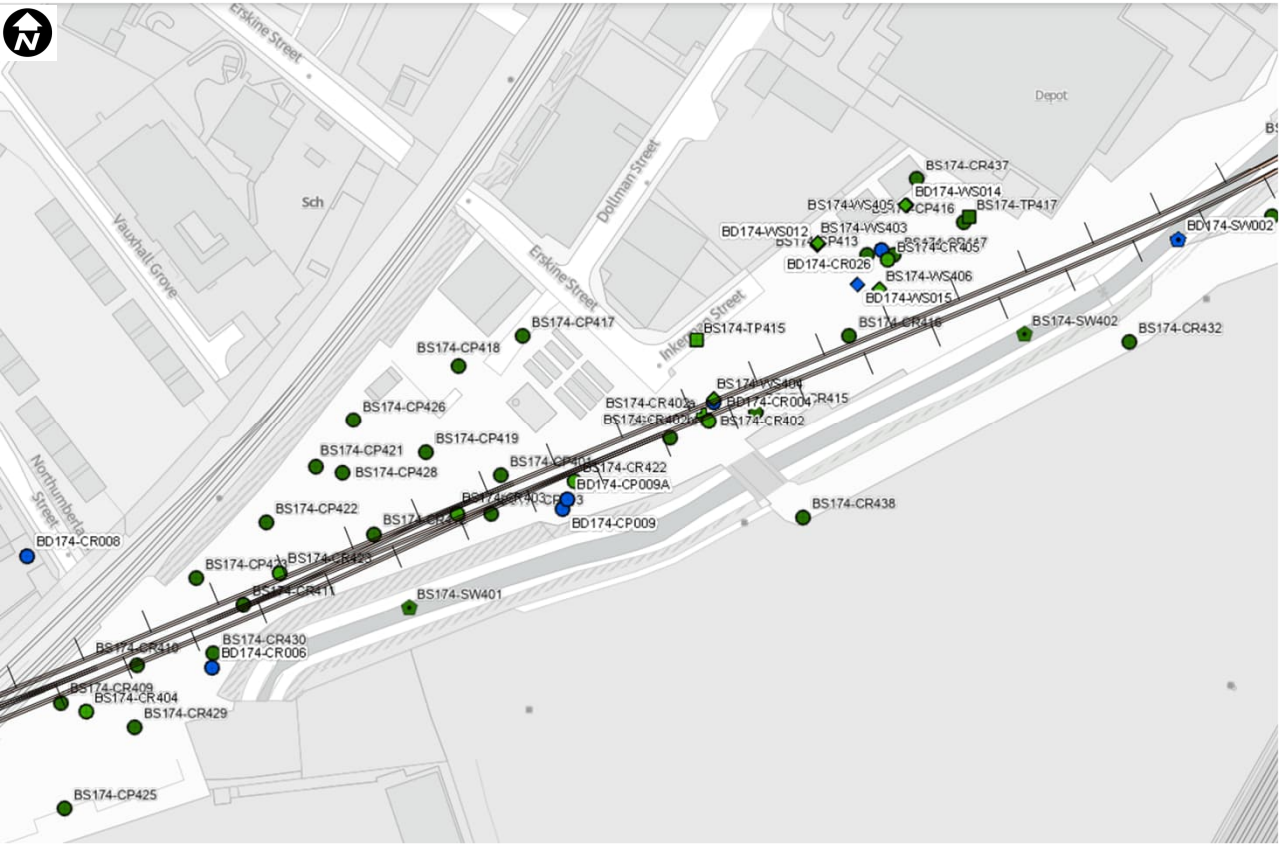
Ground investigation

This part of the route was anticipated to be underlain by ~5 to 10m of glacial deposits.

Ground investigation was undertaken during different stages of the project which identified deeper than anticipated glacial deposits.

Focus on deep boreholes in the central part of this section of alignment.

Central Birmingham



Ground investigation

Central Birmingham

Summary

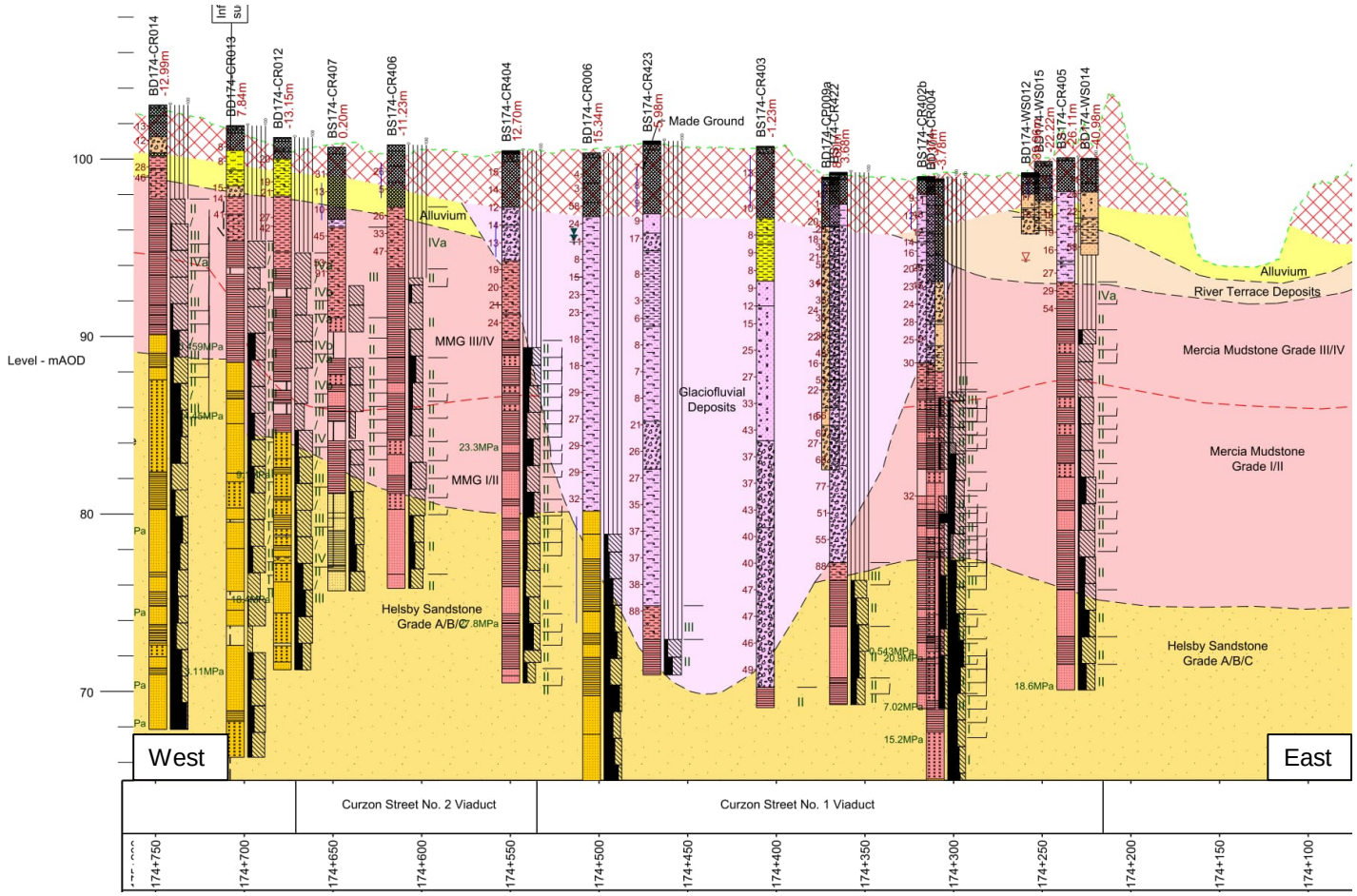
Extent unknown

Localised bulls eye feature?

Branch off and associated with larger channels?

Smaller localised channel?

Central Birmingham (Curzon Street)



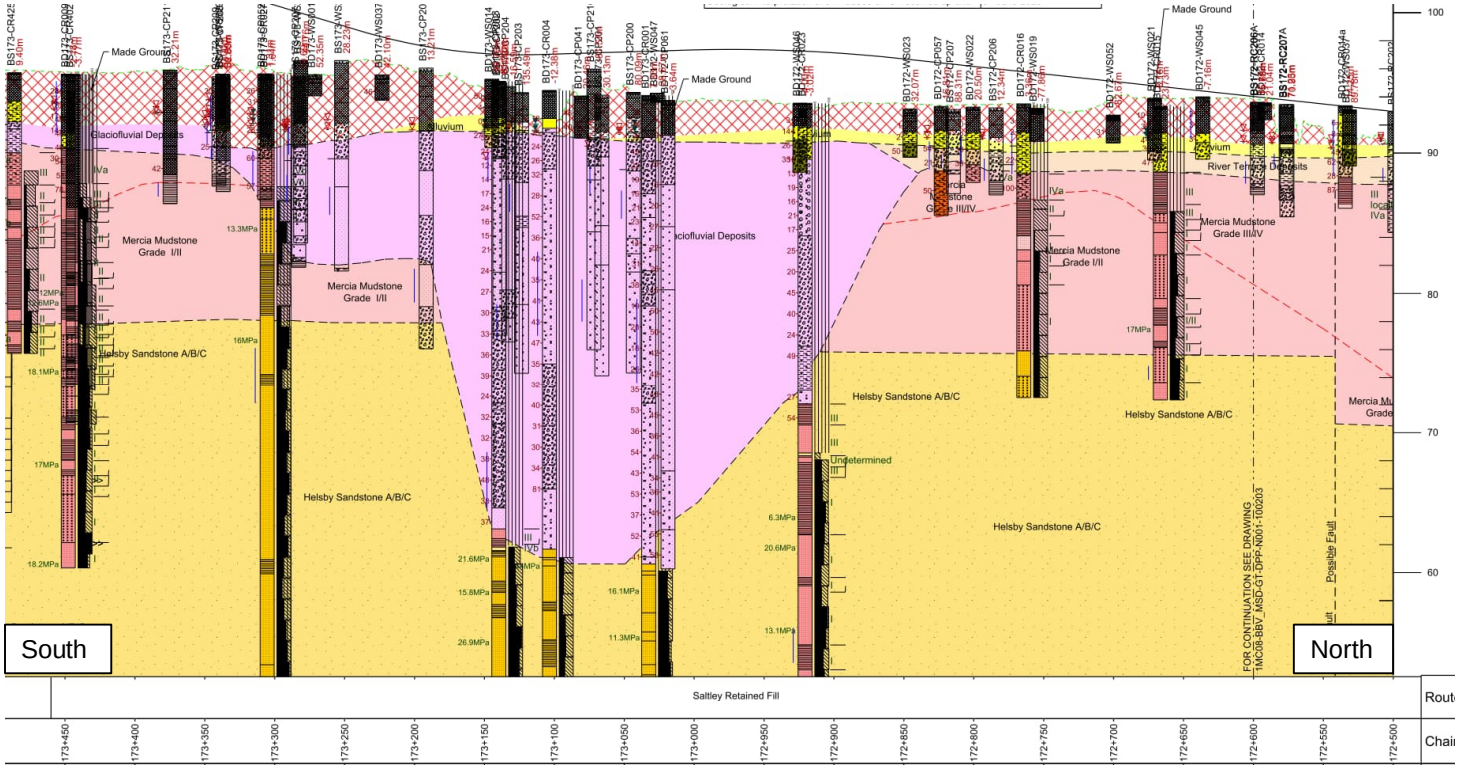
Unidentified glacial channel

Ground investigation results indicate that Glaciofluvial Deposits are present between 174+300 and 174+550 but absent elsewhere.

Well defined 250m wide channel up to 28m thick.

Either side of channel generally has <8m aligning with published information

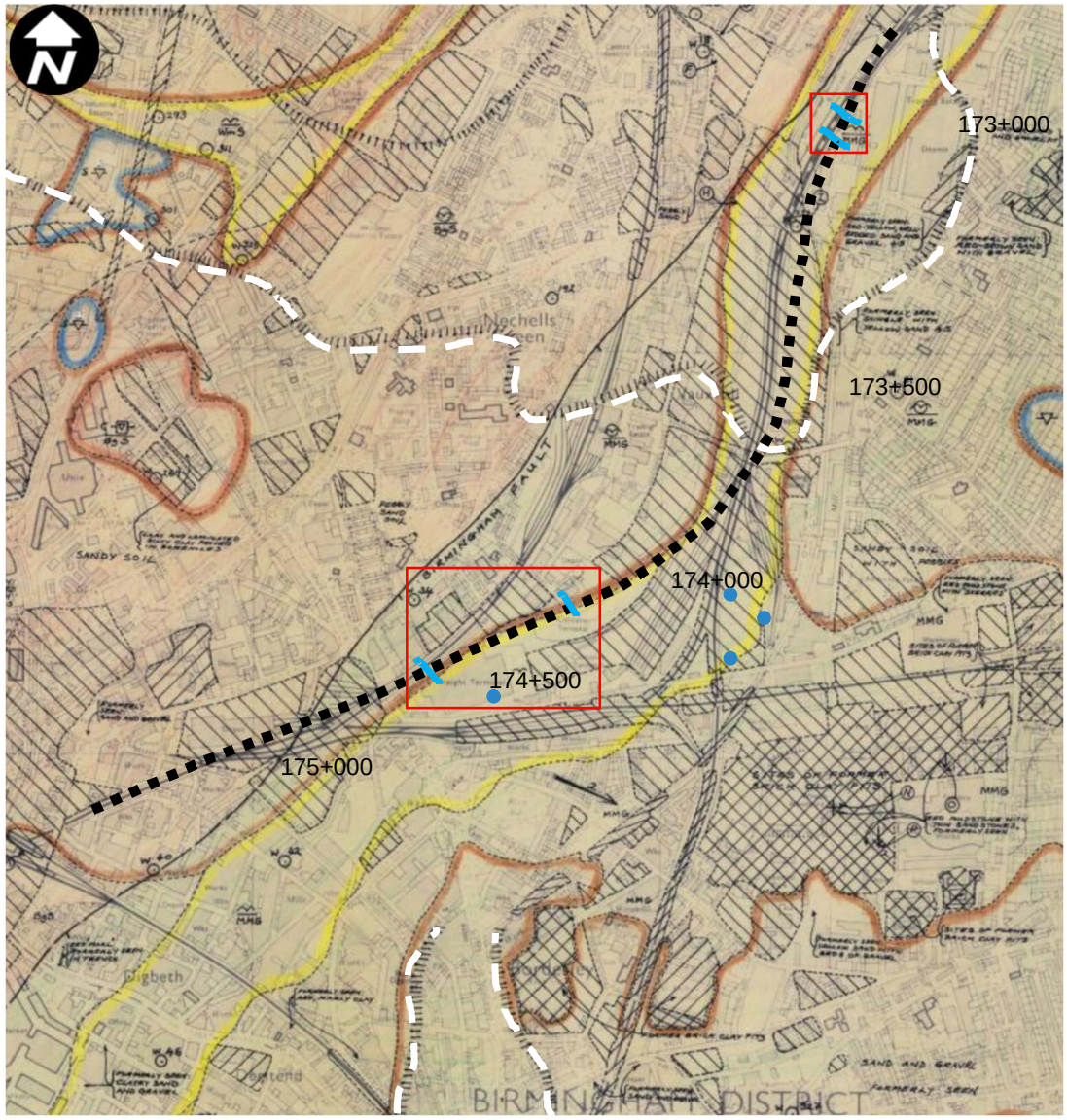
Central Birmingham (Saltley)



Glacial channel

Ground investigation results indicate that Glaciofluvial Deposits are present between 172+850 and 173+500.

A stepped side to the south and a steeper side to the north.

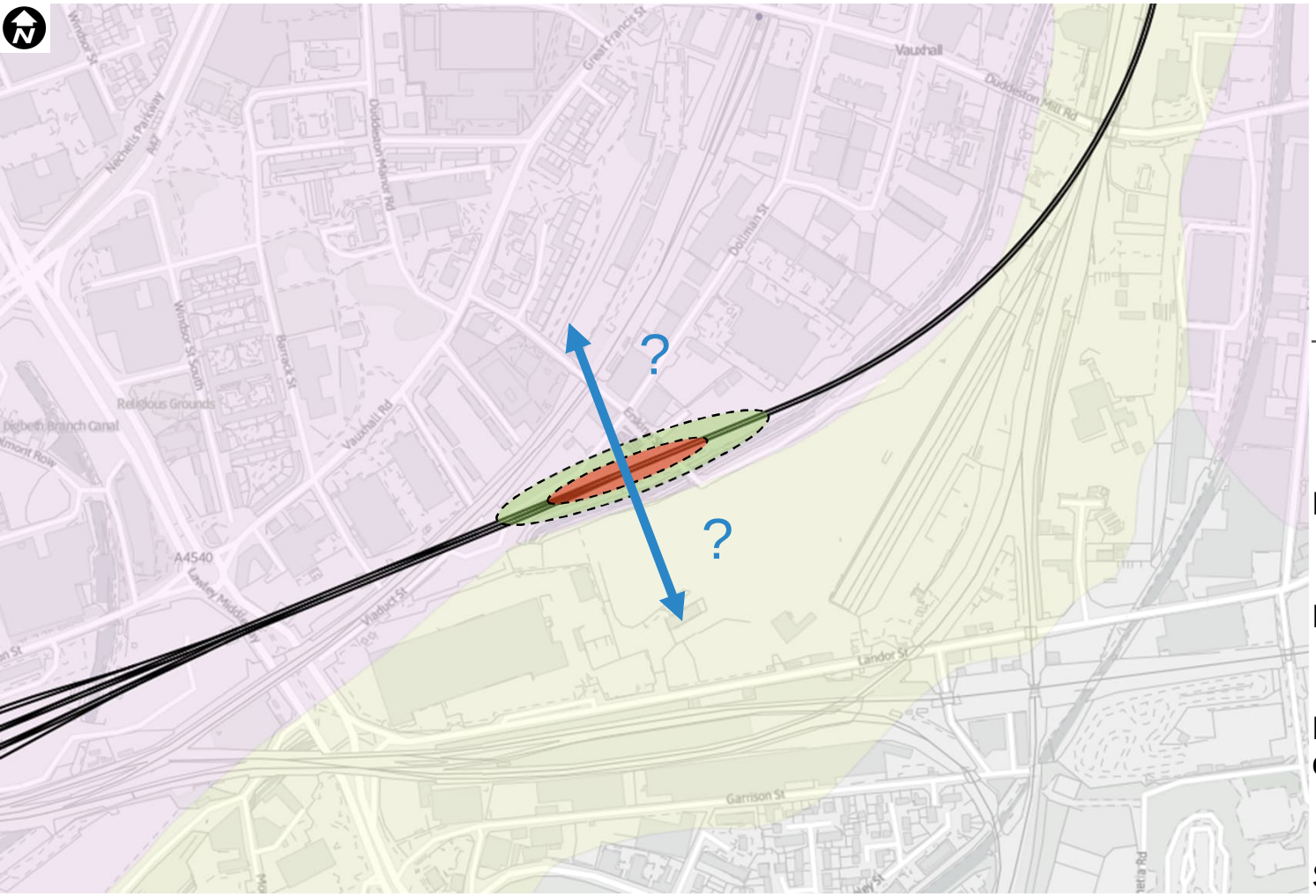


Central Birmingham

Summary

Channel up to 30m thick within the eastern part of the Proto Tame channel – expected and validates information in the literature.

Steep sided channel up to 28m thick between the Proto Tame and Bordesley channel. Unexpected as within an area of mapped deposits typically 5-10m thick.



Central Birmingham

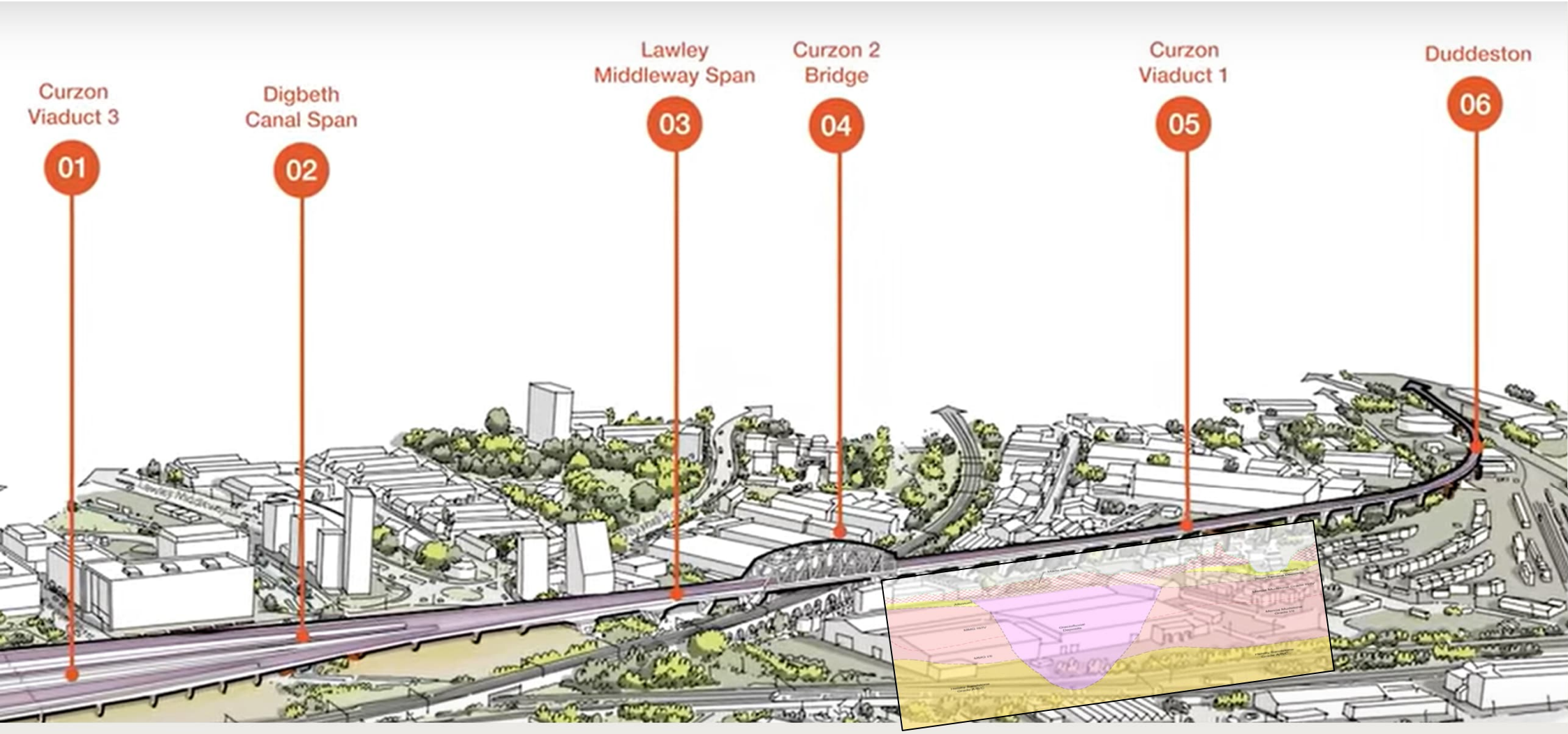
Summary

Extent unknown

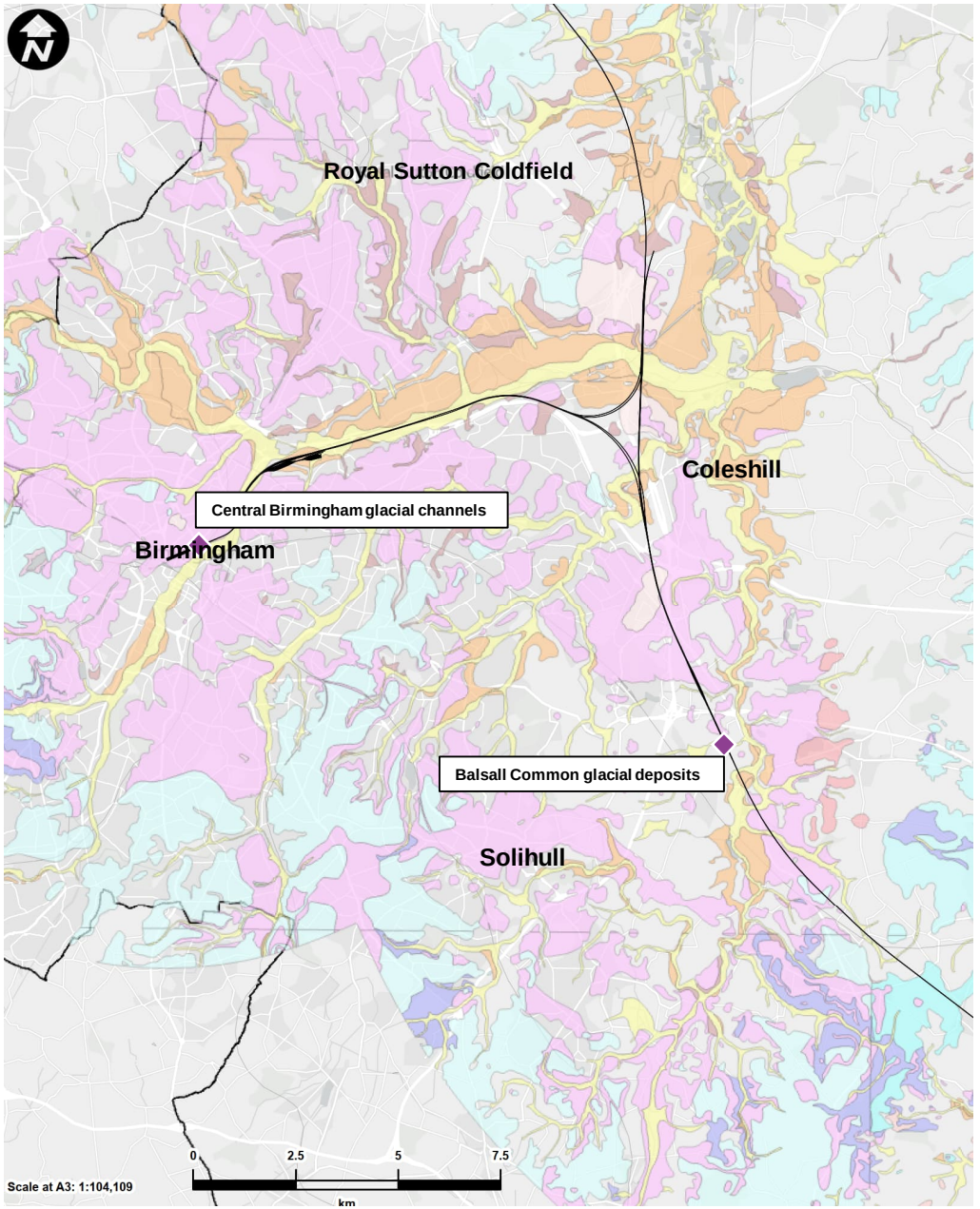
Localised bulls eye feature?

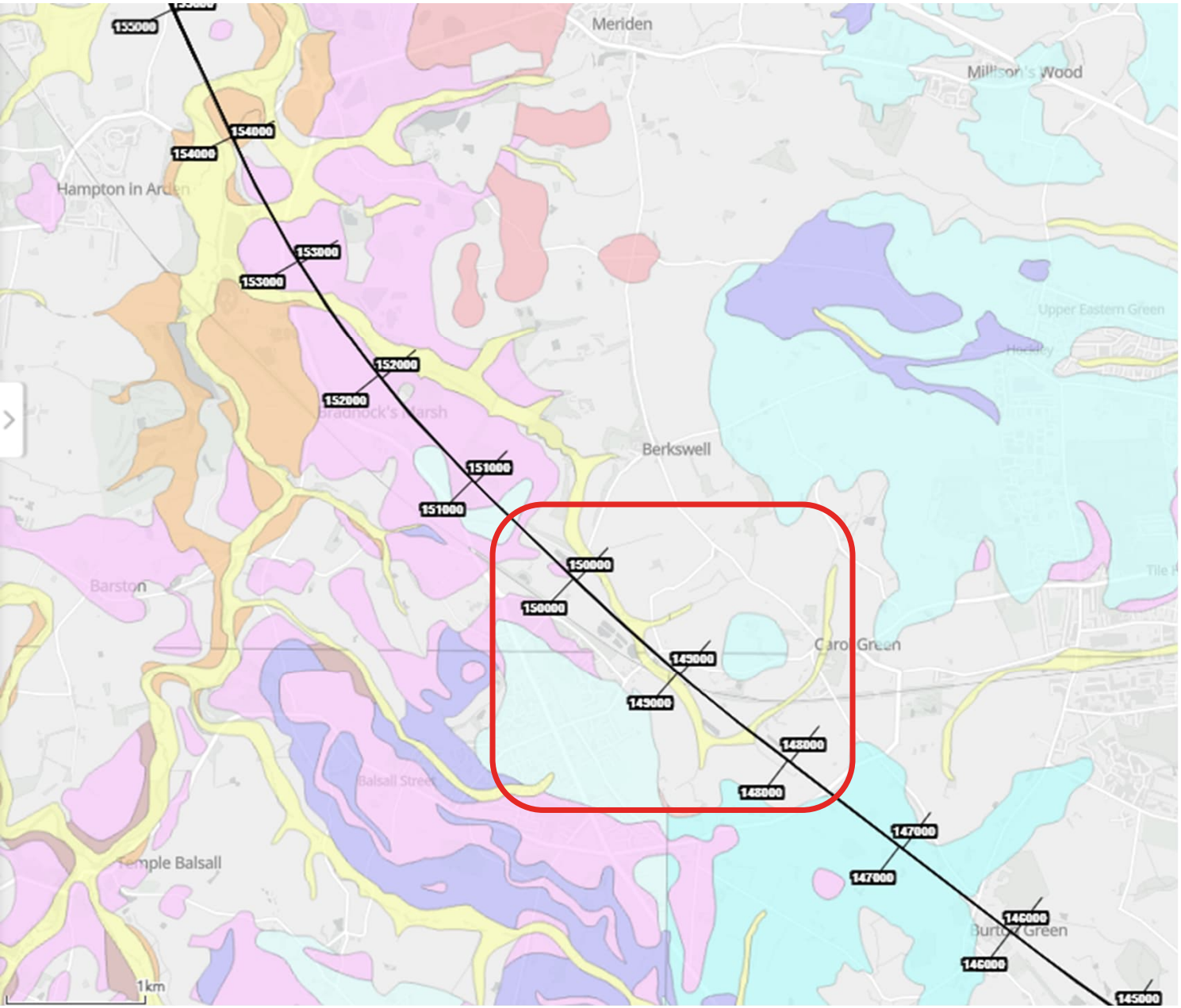
Branch off and associated with larger channels?

Smaller localised channel?



https://www.hs2.org.uk/building-hs2/viaducts-and-bridges/curzon-viaducts-and-the-lawley-middleway-viaduct/

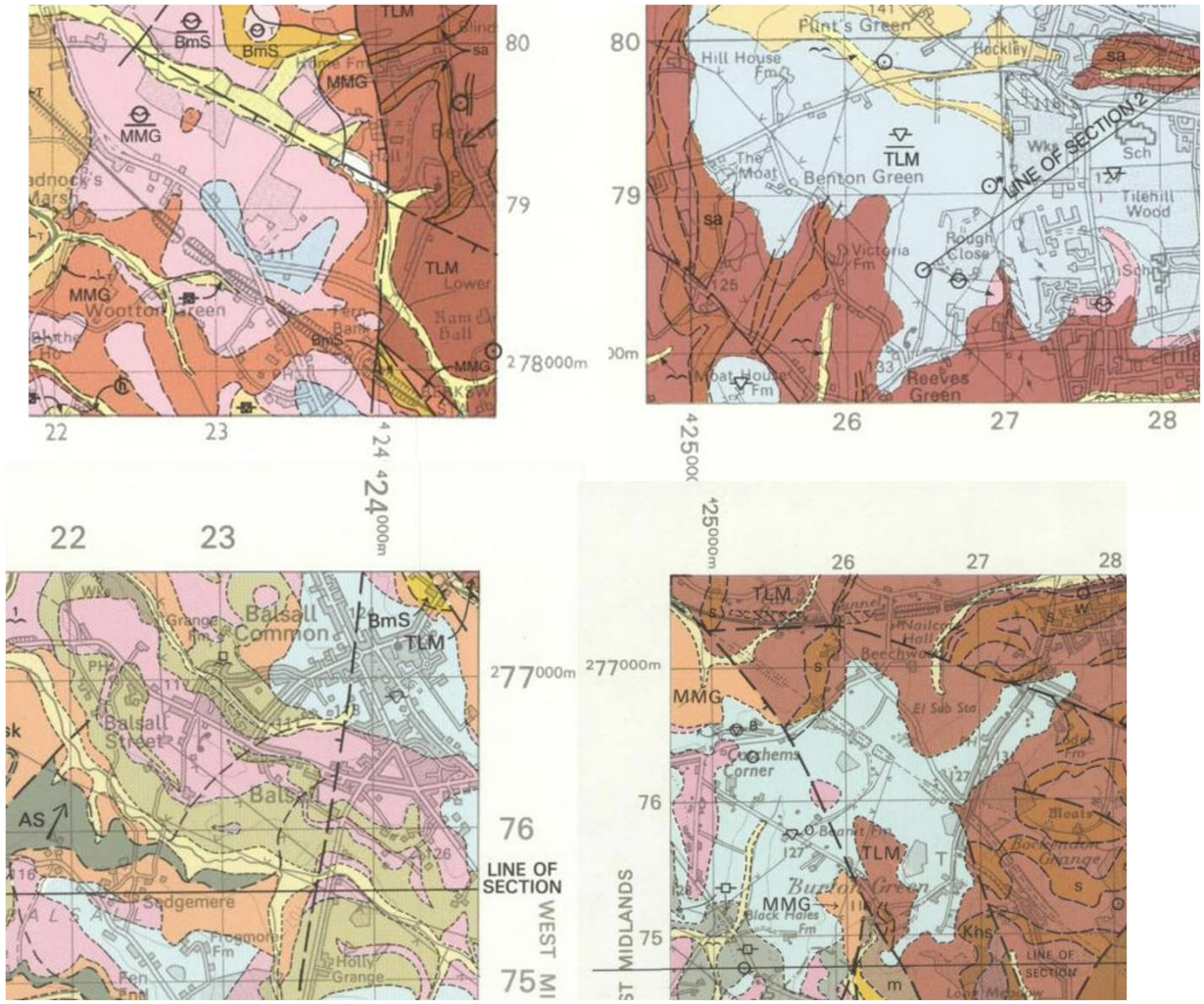

Royal Sutton Coldfield
Coleshill
Central Birmingham glacial channels
Birmingham
Balsall Common glacial deposits
Solihull
0
2.5
5
7.5
km
Scale at A3: 1:104,109



Balsall Common

Regional setting

This section of interest falls on the boundary between four BGS paper 1:50,000 scale maps



Balsall Common

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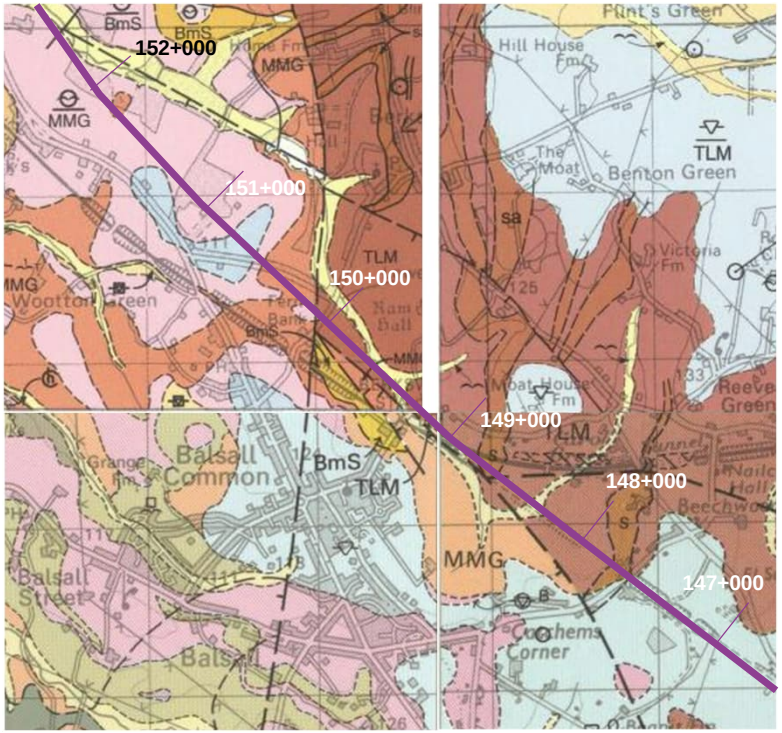

Balsall Common

Regional setting

The northernmost 1.5km of the area of interest is shown to be underlain by Glaciofluvial Deposits with some Glacial Till.

Middle 2.7km does not have Superficial Deposits mapped.

Glacial Till to the south and beyond.

Balsall Common

Regional setting

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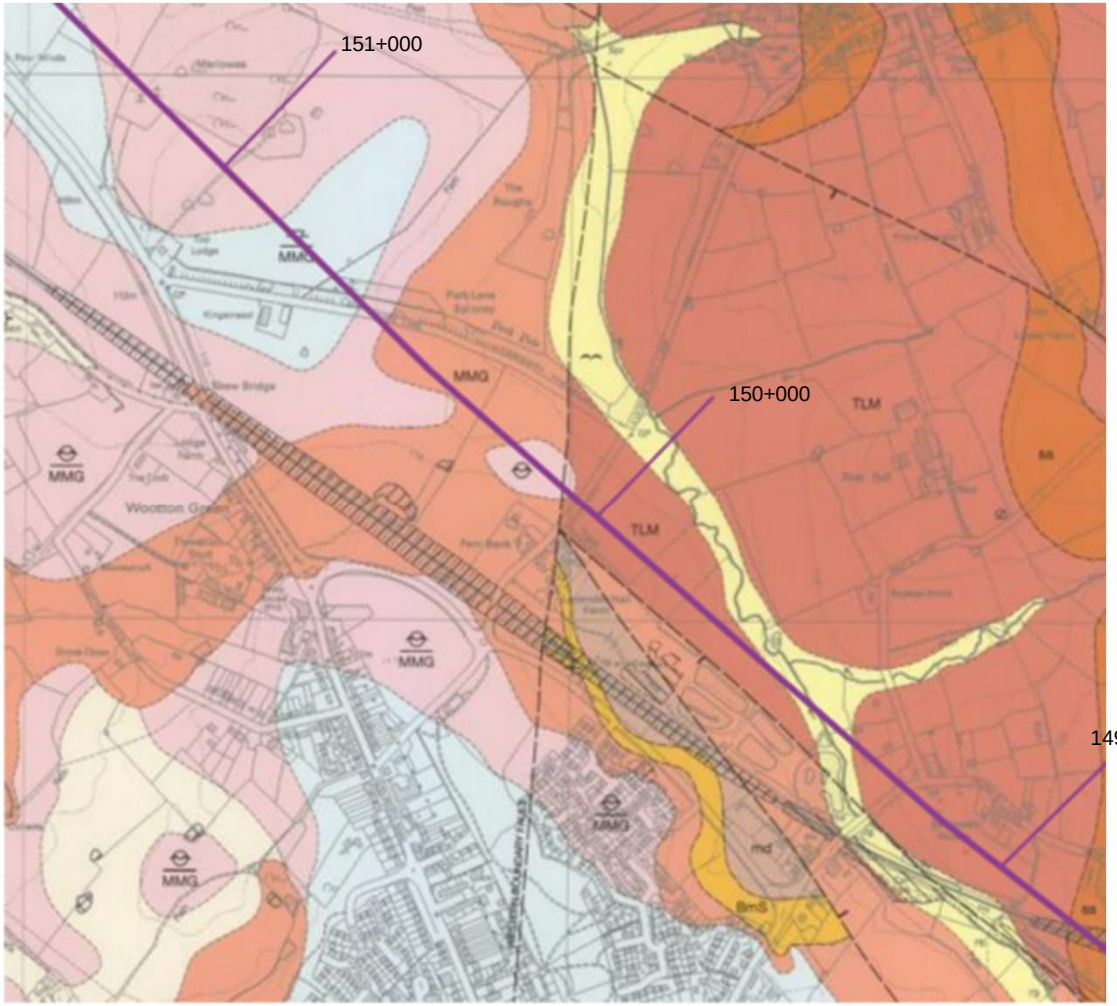
Middle 2.7km does not have Superficial Deposits mapped.

Glacial Till to the south and beyond.



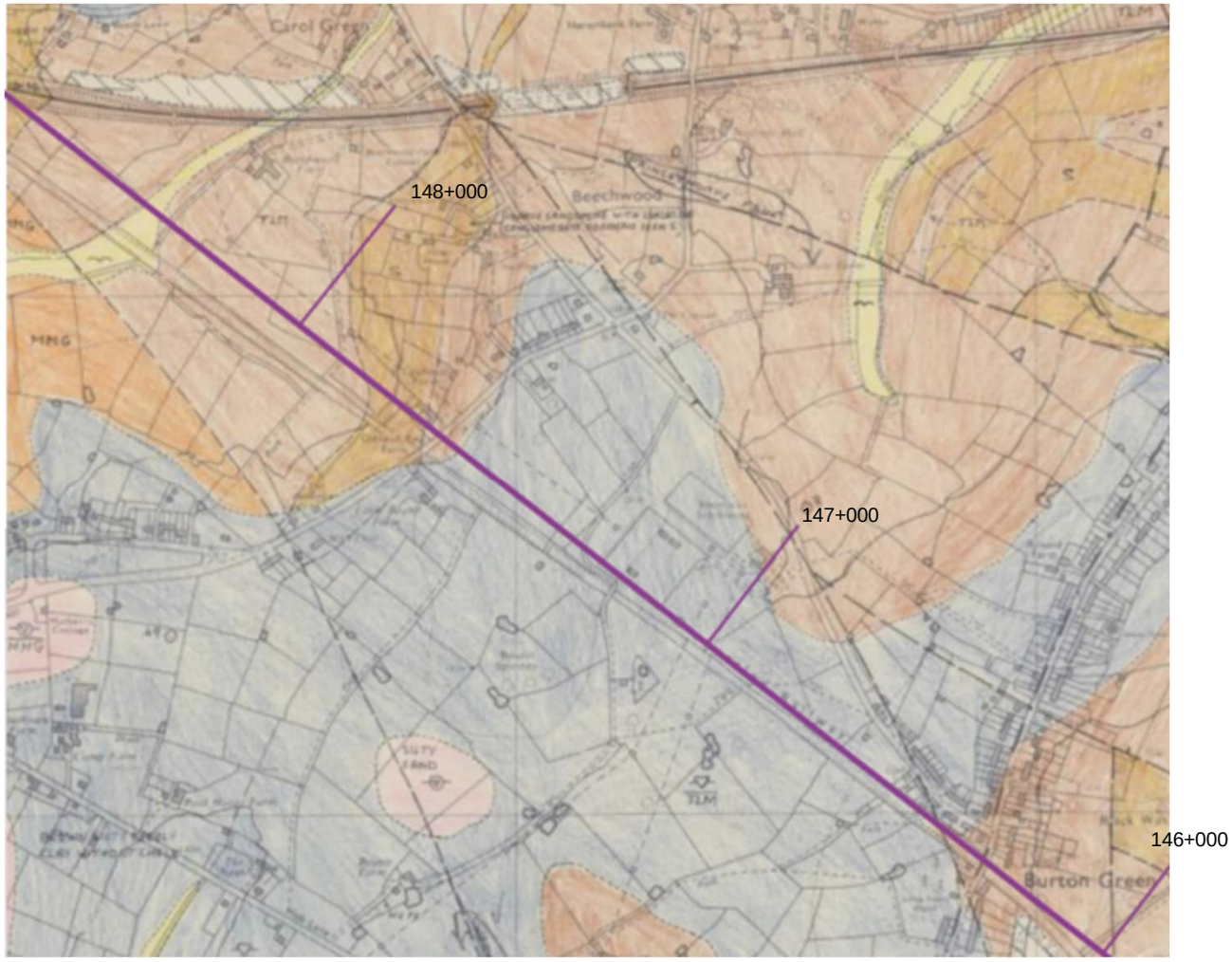
Balsall Common

1:10,000 BGS mapping

BGS 1:10,000 scale mapping indicates the section of HS2 from 150+500 to 148+300 are not underlain by Superficial Deposits.

Glaciofluvial Deposits and Glacial Till are present to the northwest and southeast.

Alluvium associated with River Blythe tributaries



Balsall Common

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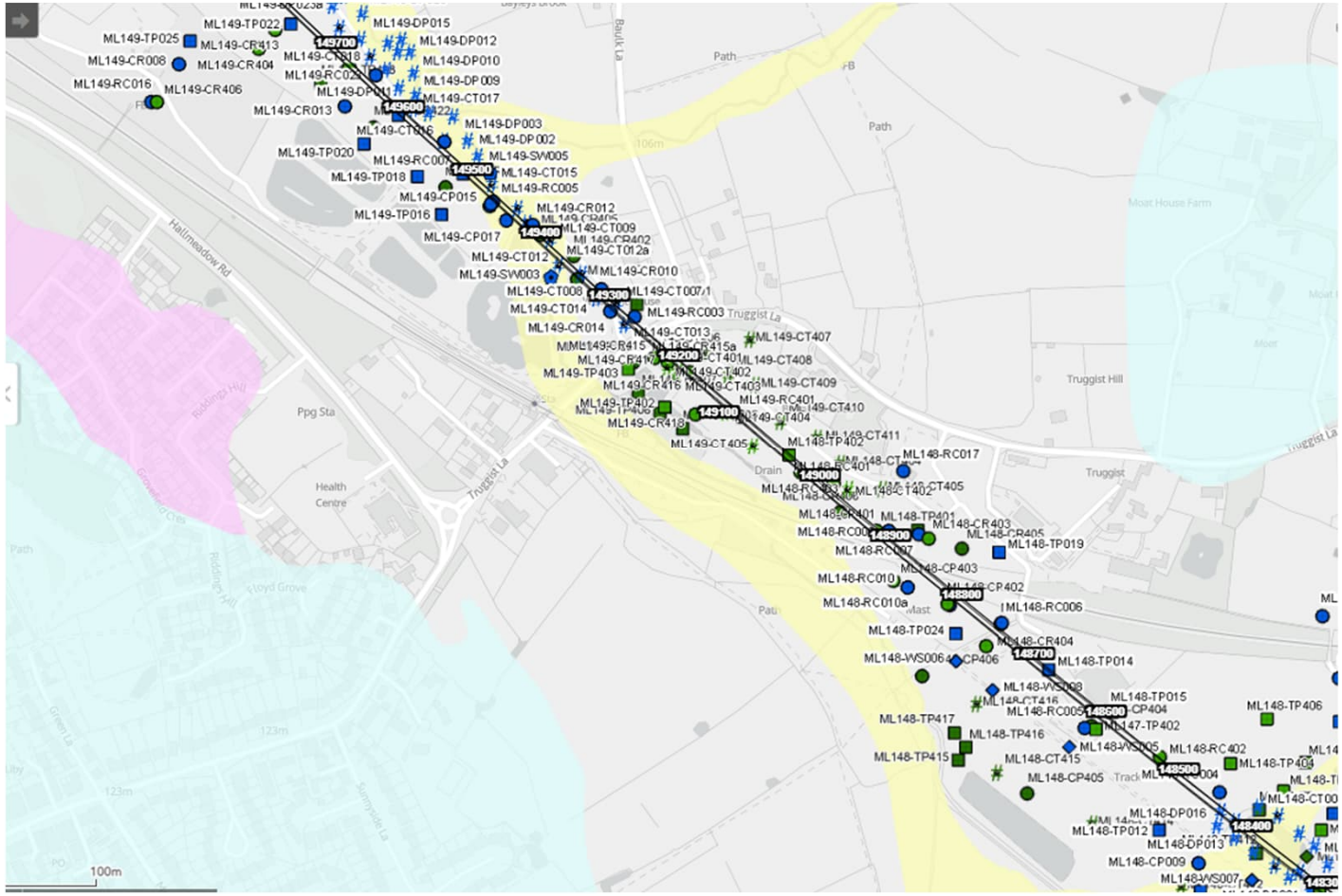
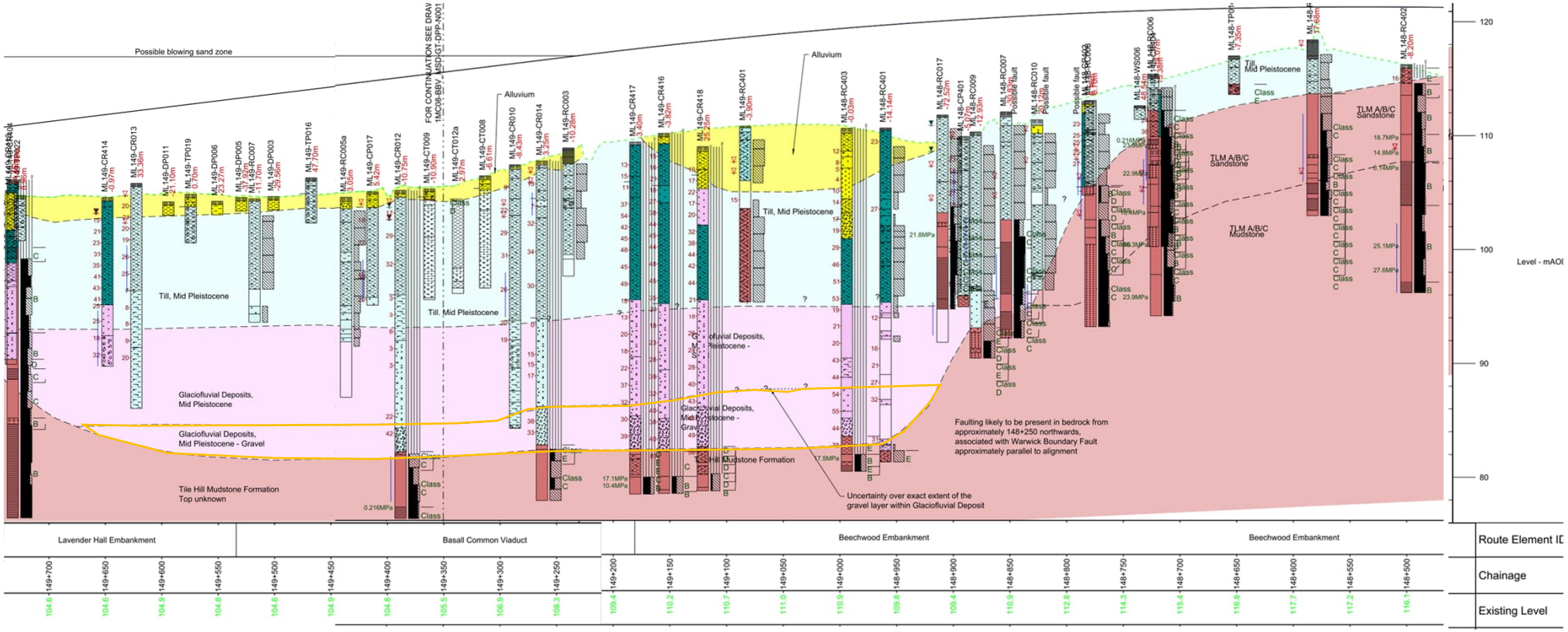


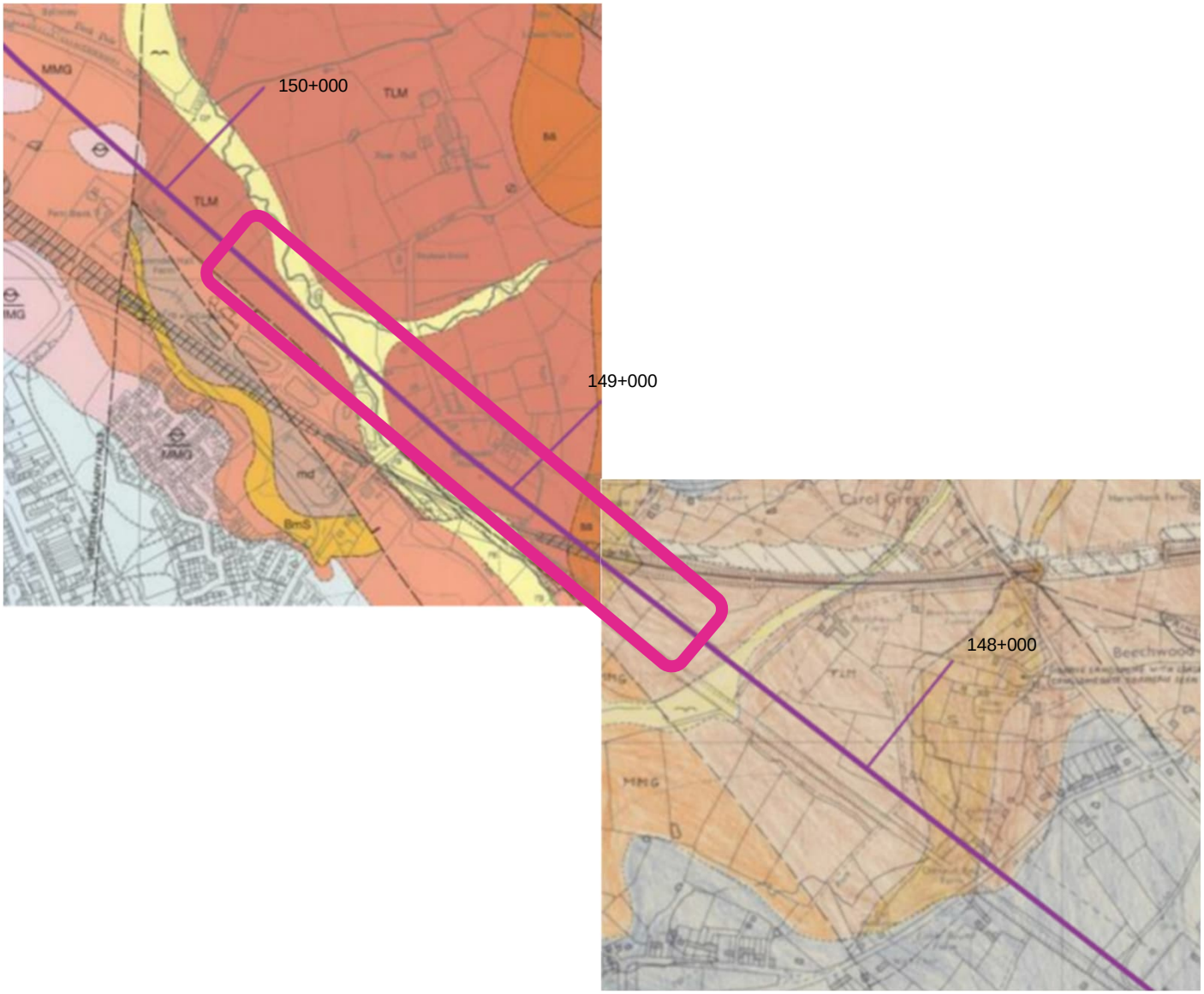
Balsall Common

Ground investigation

Balsall Common

Unidentified glacial deposits





Balsall Common

Summary

MOTT MACDONALD

Thank you