JOHN A STEVENSON, BENTJE BRAUNS

BGS projects in Zimbabwe: Geological map update and Harare groundwater tool

British Geological Survey

1:1M Geological Map Update Project

- Funded by UK Government's Foreign and Commonwealth Development Office (FDCO) via the British Embassy, Harare. *(Views presented here do not necessarily represent UK government official policies)*
- Follow on from Scoping Study in February 2025
- Project runs from Sept 2025 to March 2026 ☹

- Aims:
  - Produce a printed, updated 1:1M Geological Map of Zimbabwe
  - Attract investment from UK and aligned mining companies
  - Train Zimbabwe Geological Survey staff to make further updates

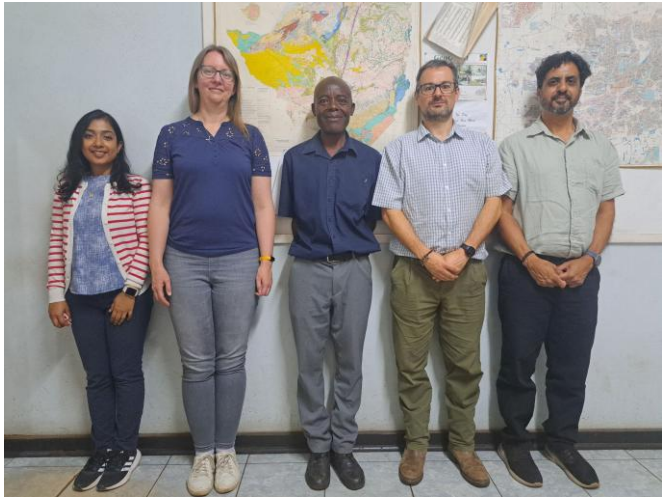
Project team

Informatics

- **John A Stevenson**: Informatics, GIS, Geological mapping
- **Jennifer Bow**: Geological GIS and data management
- **Javid Yousaf**: GIS training and map design
- Plus data engineering, remote sensing, cartography, web mapping, overseas projects

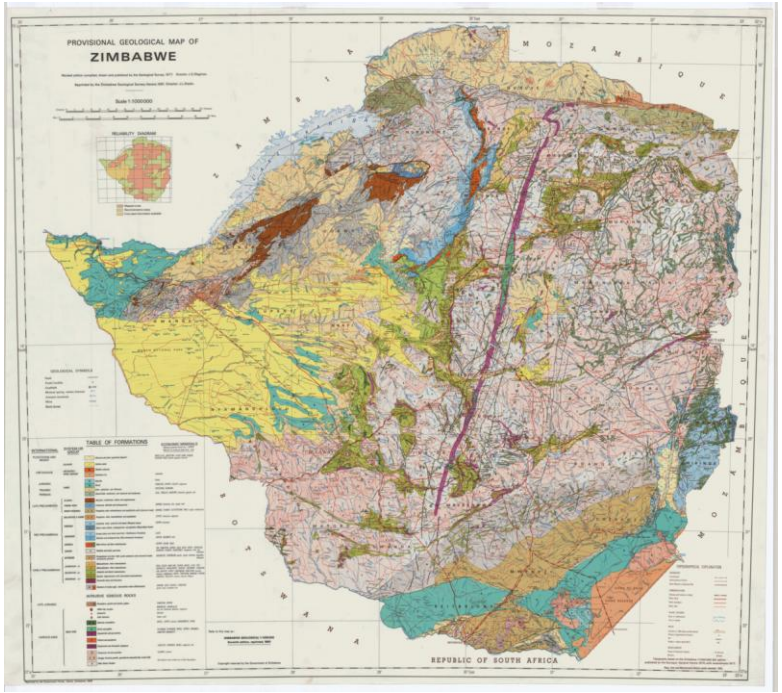
Geology

- **Priyanka Paul**: Precambrian rocks and geological mapping
- **Kathryn Goodenough**: Zimbabwe geology, critical minerals, overseas projects
- Plus digital geological map production, metamorphic geology, igneous geology

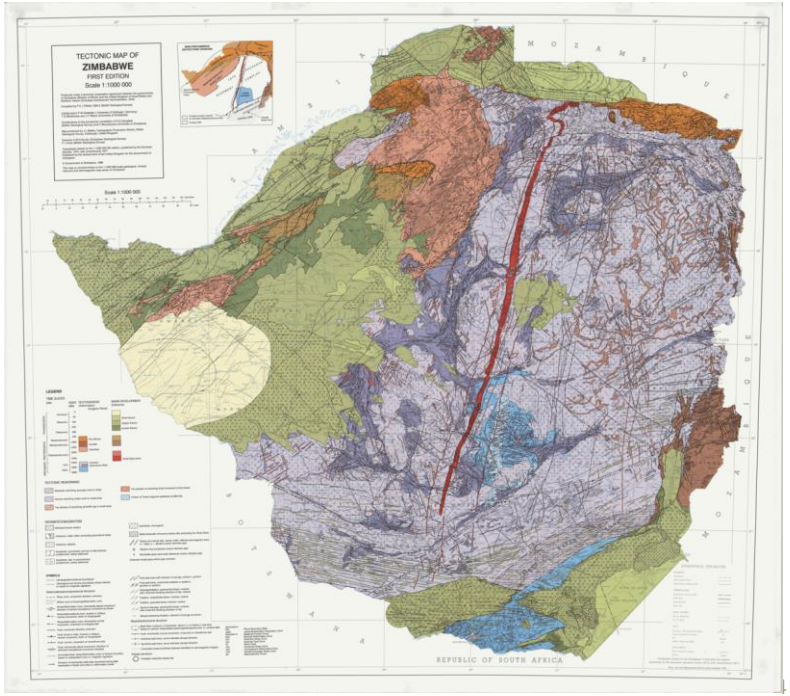


Existing 1:1M national geological maps

- 1977 Geological Map



- 1996/2010 Tectonic Map



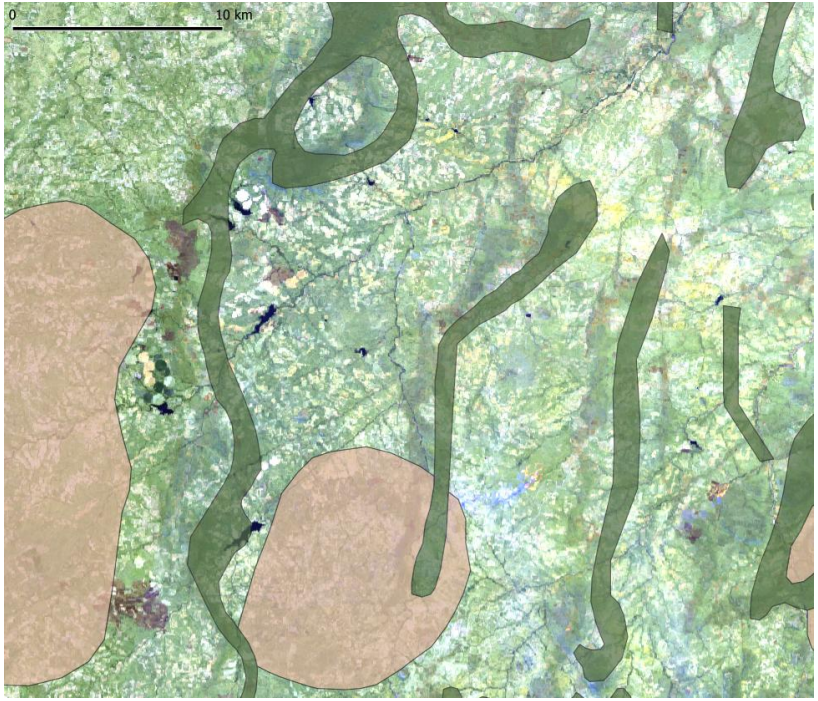
Barriers to creating a new map

Cartographic

- GIS data in obsolete file formats
- Offsets between map data and ground truth
- Difficulty reconciling 1:100k bulletin maps

Economic

- ZGS computers are old
- High staff turnover at ZGS
- Lack of funding to compile



What BGS can contribute

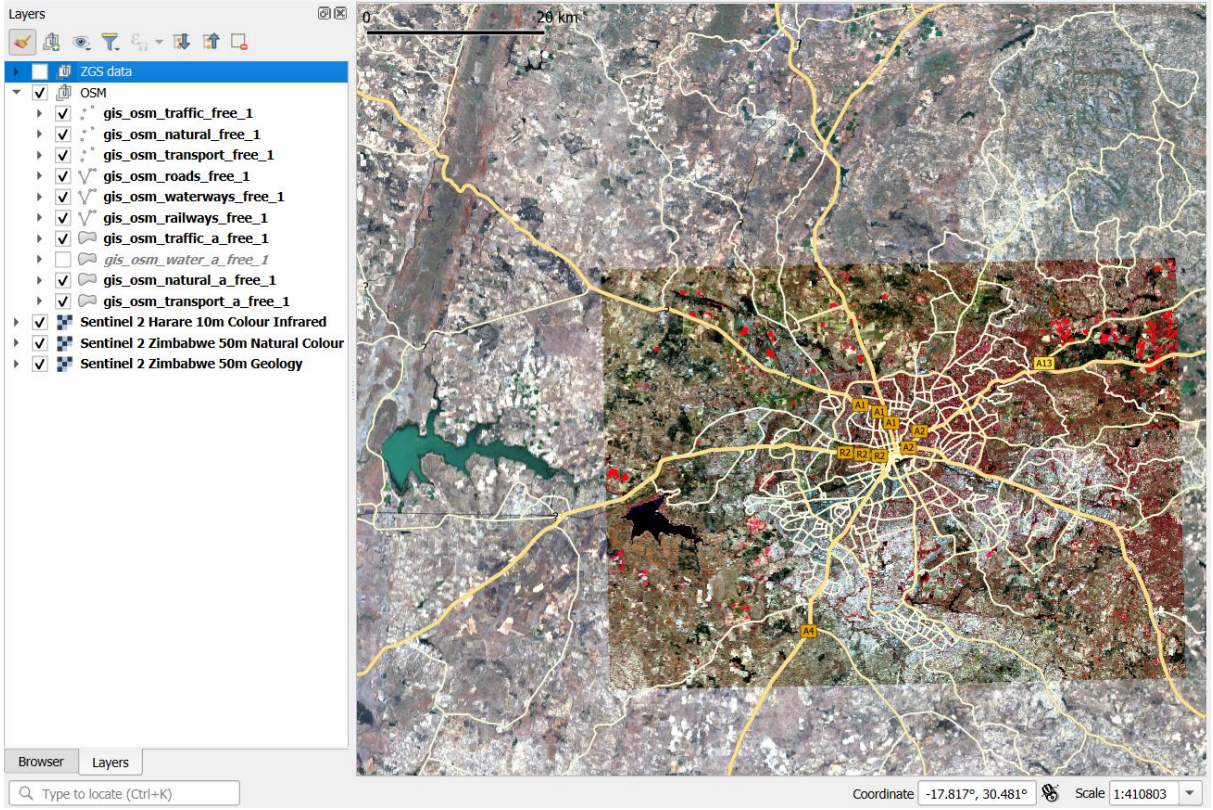
- Informatics skills to address cartographic problems
- Training, plus highlighting the importance of the national geological map to address economic problems
- Equivalent staff resources to 6 months full-time for two people


We are treating this as a GIS problem with geological constraints

Build for the future with QGIS

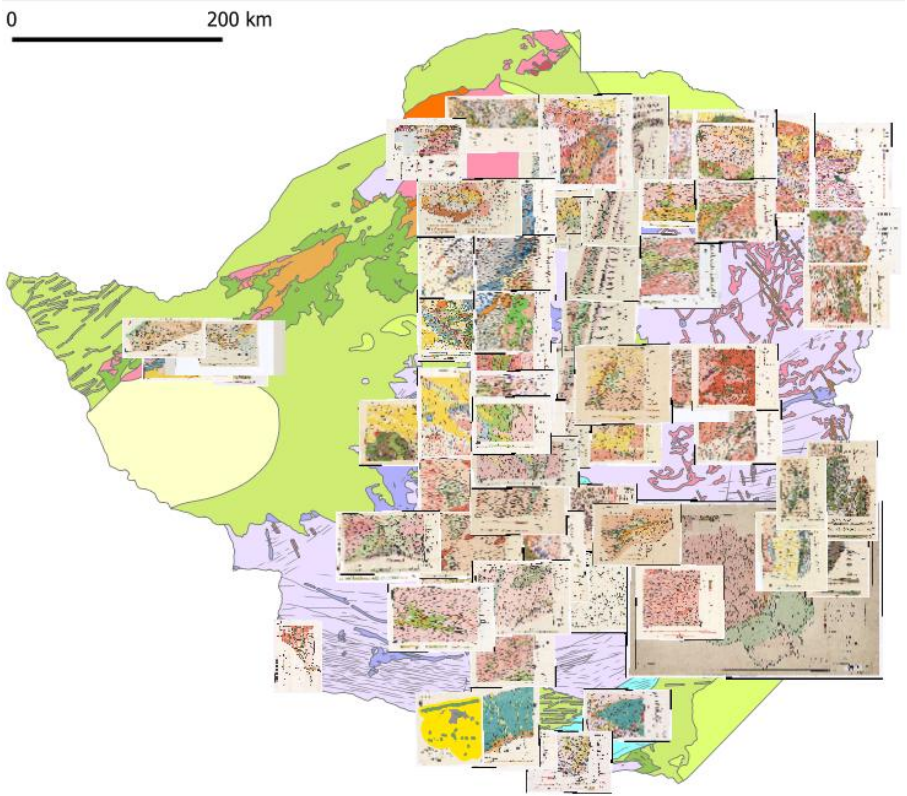
- Free/Libre Open Source GIS tool can be freely shared with collaborators
- Runs on computers with low resources
- Powerful and intuitive to use
- Used within BGS for field data capture in combination with Mergin Maps

Zimbabwe Open GIS Data



https://doi.org/10.5281/zenodo.17403772

ZGS data inputs



- 1977 Geological map linework
- 2010 Tectonic map linework
- Georeferenced scans of bulletin maps
- Linework from selected bulletin maps
- Scans of 1:500k sheets

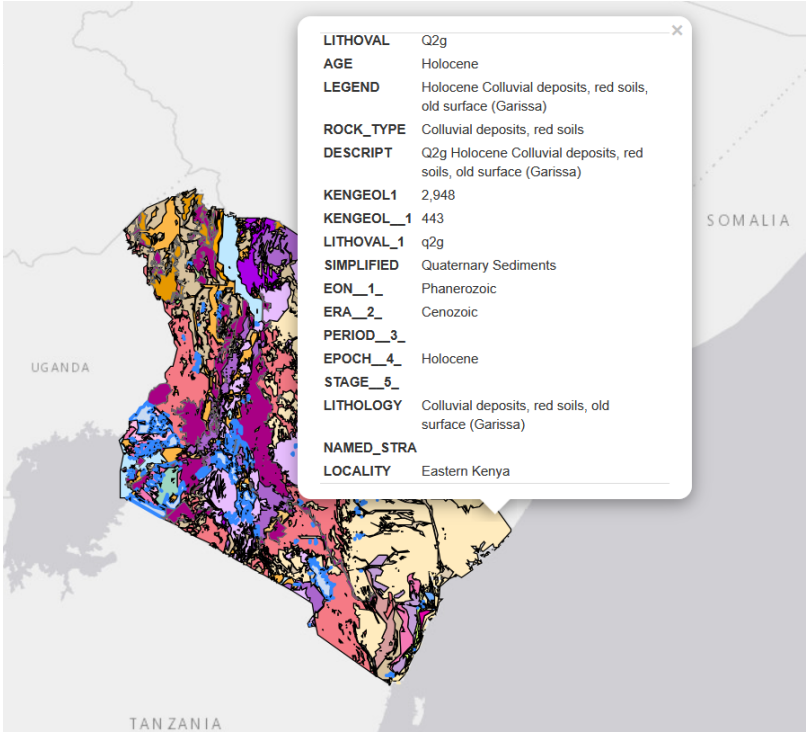
Features of a new geological map

Cartographic
Largely based on 1977 boundaries
Simplified faults and shear zones (from tectonic map)
Lithostratigraphic presentation
Rubber-sheet georeferenced against ground
OpenStreetMap base map with non-colonial place names
Digitisation errors corrected
Modernised stratigraphic table

Stratigraphic
Lower Zambezi separated into pre- and post Karoo *(as tectonic map)*
Dolerite and gabbro intrusions separated by age and Karoo dykes added *(as tectonic map)*
Greenstone belts split into Sebakwian, Bulawayan (Upper and Lower Greenstone), Shamvaian *(new change)*
Older gneiss split into Sebakwian and Tokwean *(as tectonic map)*
Greenstone slivers shown in Limpopo shear zone *(new change)*
Kalahari reflects deposits on the ground (as 1977)

Beyond a paper map

- Attributed polygons allow:
  - chronostratigraphic and lithostratigraphic styling
  - quantitative analysis e.g. landslide hazards
  - publication of interactive web maps to advertise Zimbabwe geology
- This project lays the foundations for future work



British Geological Survey

THANK YOU

What would you like to see in an updated geological map?

Enhancing Resilient, Inclusive Growth through sustainable Groundwater management in Zimbabwe (Harare)

British Geological Survey

Context of this project: Increased use of groundwater to cover Harare's water demand

WATER WOES DRIVE COMMUNITY-LED BOREHOLES

malvernmugadzikwa • SundayMail • October 13, 2024 • 0 Comments

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The Sunday Mail

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New solutions needed for Harare's drainage woes

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Under-19 playe
dominate
Zimbabwe squa
for Namibia tri-
series

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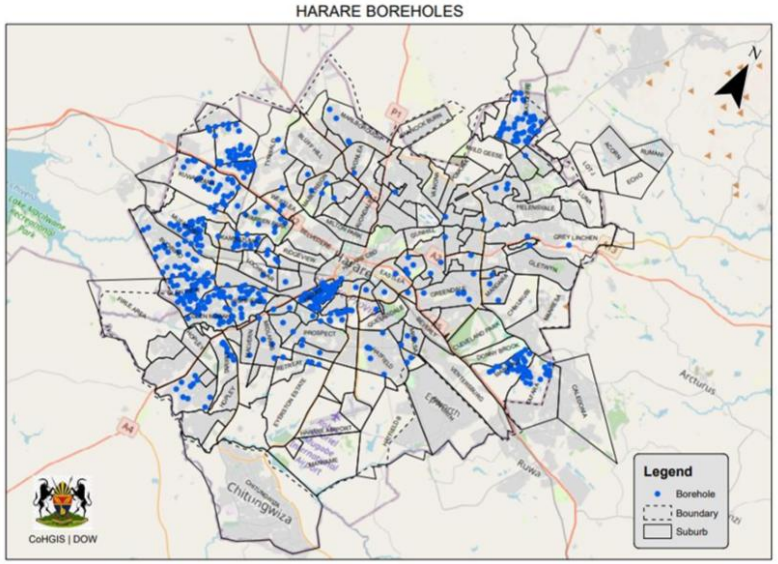
of war
championships

Key groundwater management questions?



Where are the boreholes, how are distributed and where do their pumping affect neighbouring boreholes

ELSEVIER
Physics and Chemistry of the Earth, Parts A/B/C
Volume 126, June 2022, 103107

An assessment on the effectiveness of the sanitary seal in protecting boreholes from contamination: A case of Mbare Suburb, Harare

Iginations Takavada [a b], Zvikomborero Hoko [a], Webster Gumindoga [a], Alexander Mhizha [a], Jean-Yves Nuttinck [b], Guy Faure [b], Danish Malik [b]

Show more

How safe is the borehole water in different parts of the city and well are boreholes constructed?

Example of groundwater quality in Harare: 2023 collaboration with University of Zimbabwe

2023 collaboration with University of Zimbabwe

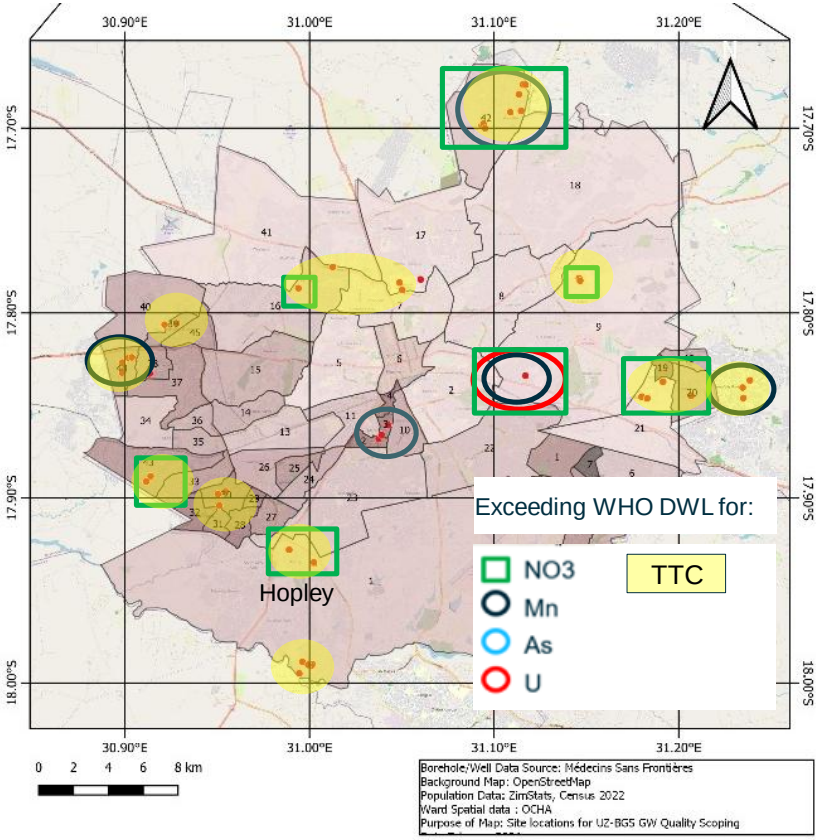
- Water samples from 21 locations for analysis of:
  - field parameters
  - Stable water isotopes
  - Inorganic chemistry
  - Coliforms

Borehole site (BH) n=16

Handpumps (HP) n=5

Previous work undertaken in Harare

- Quality issues varied by location
- Both boreholes and handpumps have quality issues
- No clear predictors, but a number of possible indicators, incl.
  - current/previous land use
  - sewer connections
  - **geology (for U)**
  - maintenance of water points (chlorinators)



IN SUMMARY:

Enhancing Resilient, Inclusive Growth through sustainable Groundwater management in ZW:

Creating a Groundwater resource assessment tool for cities in Africa

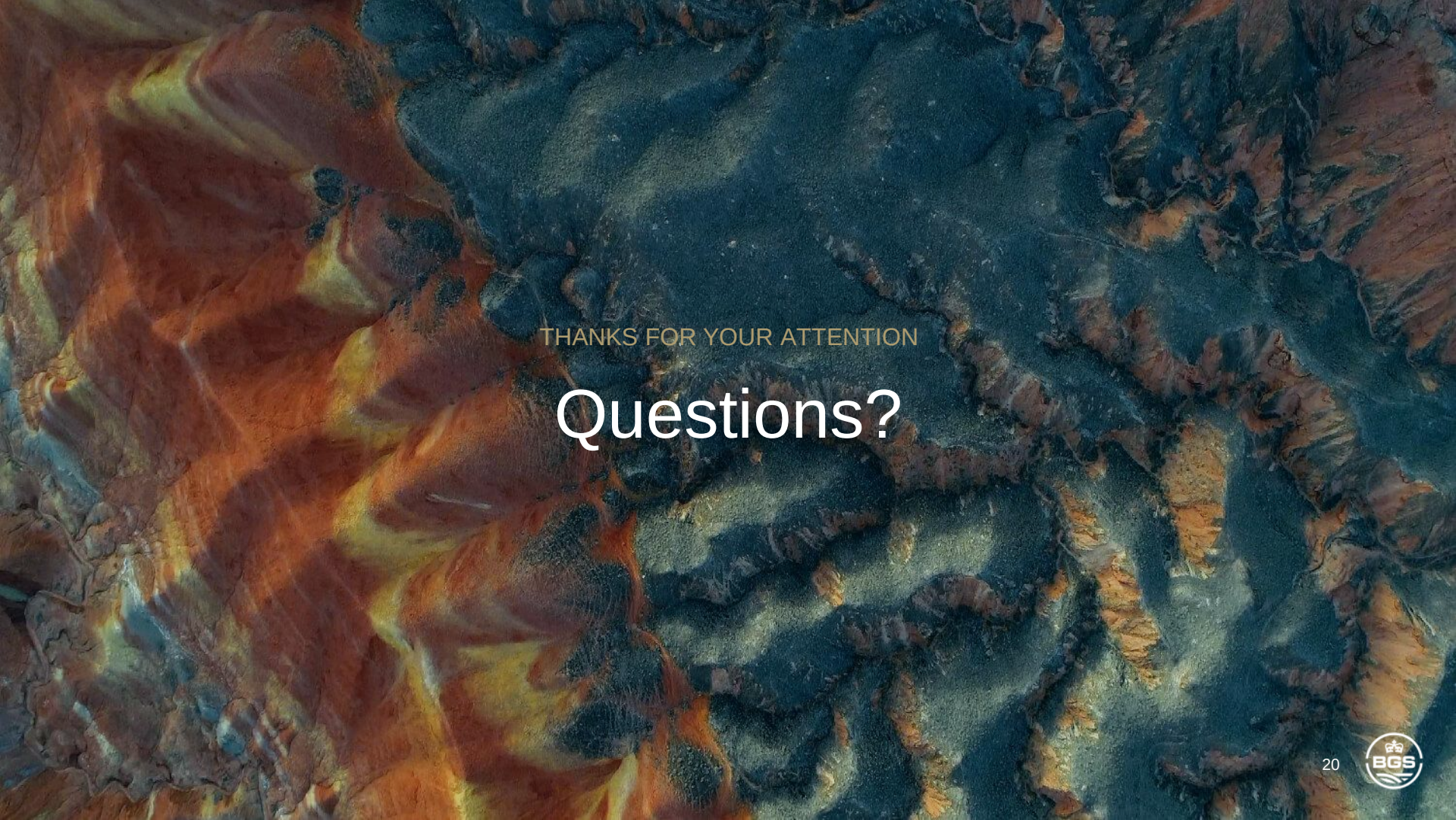
Motivation – Groundwater underpins water resource security and economic growth across Africa and there is a need to quantify, at the city scale, groundwater resources for effective conjunctive use

Challenge – lack of accessible data & fragmented data

Funding –Green Cities, Infrastructure and Energy Programme (GCIEP), by the Foreign & Commonwealth Development Office (FCDO)

Aims:

- Collect and digitise hydrogeology-related datasets
- Develop an integrated data platform to better enable groundwater management
- Capacity building


THANKS FOR YOUR ATTENTION
Questions?

Expected activities or outputs

- Compiling existing/published groundwater/geology data
- Collecting GW monitoring data and expanding monitoring network (with designated sub-catchment authorities)

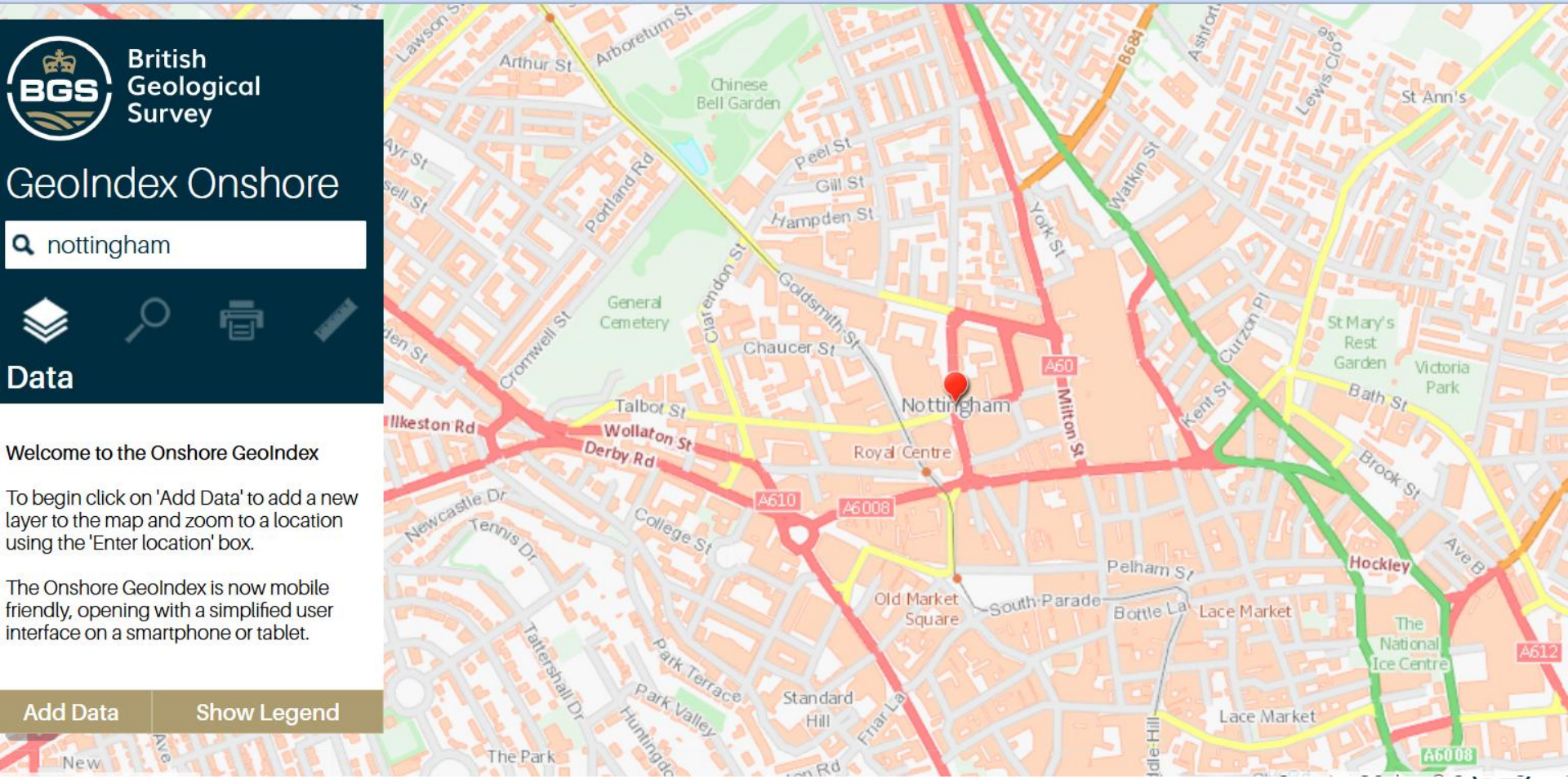
- Re-evaluation of geological/hydrogeological domains
- Stakeholder engagement with drillers and collecting drilling data/expertise from drillers and NGOs
- Integration of hydrogeological datasets to develop a groundwater resources tool/map interface to inform GW resources development

- Stakeholder engagement piece with sub-catchment authorities, ZINWA, SADC to embed use of tool and improved monitoring/integration of datasets

Partners:
Upper Manyame Catchment Councial and UZ

Kick-off workshop: End Oct ‘25

Data workshop: End Nov’25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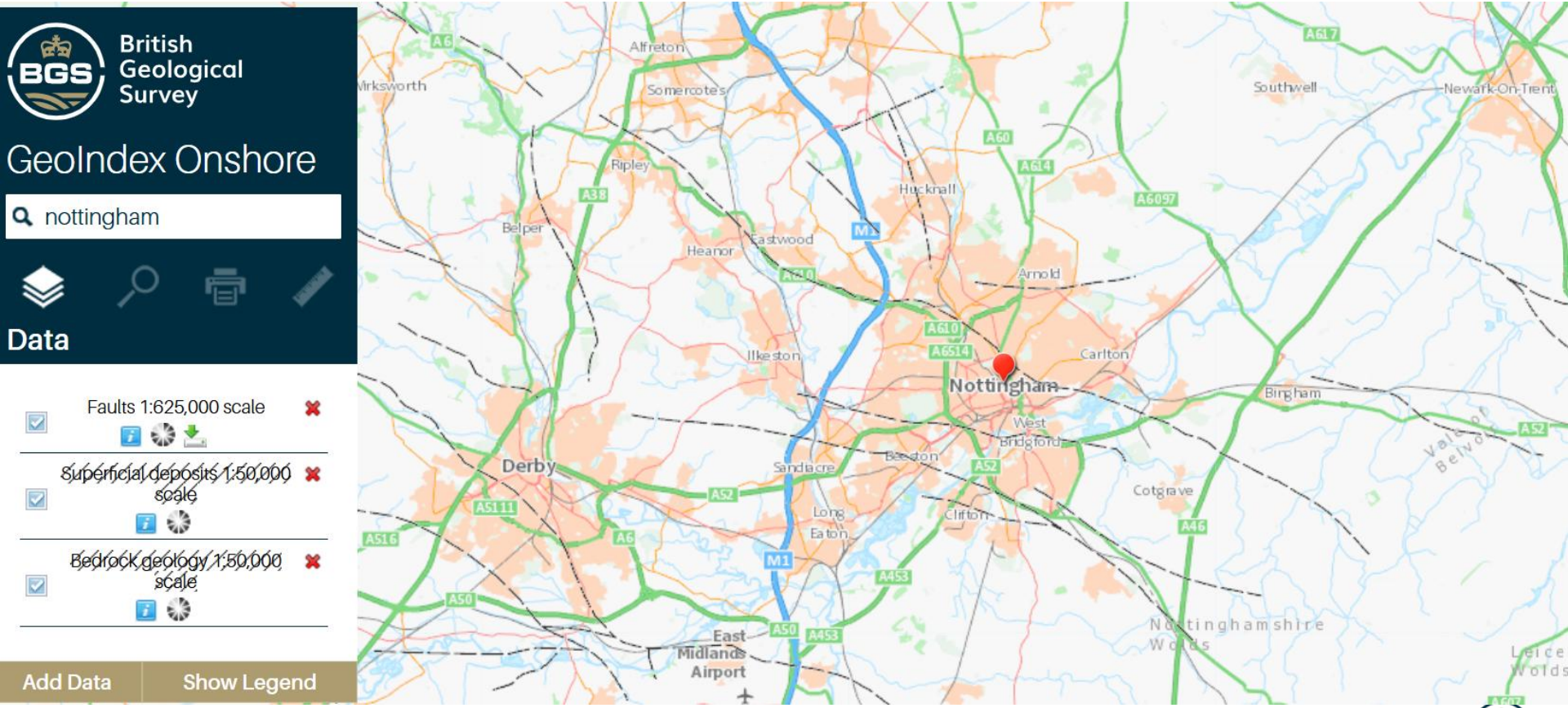
nottingham
Data
Welcome to the Onshore GeoIndex
To begin click on 'Add Data' to add a new layer to the map and zoom to a location using the 'Enter location' box.
The Onshore GeoIndex is now mobile friendly, opening with a simplified user interface on a smartphone or tablet.
Add Data
Show Legend
Nottingham
Royal Centre
Old Market Square
Lace Market
Chaucer St
Talbot St
Wollaton St
Derby Rd
A610
A6008
A60
Mitton St
Goldsmith St
Clarendon St
Hampden St
Peel St
Gill St
York St
Watkin St
Curzon Pl
Kent St
Bath St
Brook St
Pelham St
South Parade
Bottle La
Hockley
A612
St Mary's Rest Garden
Victoria Park
St Ann's
Chinese Bell Garden
General Cemetery
Arthur St
Arboretum St
Portland Rd
Cromwell St
Ilkeston Rd
Newcastle Dr
Tennis Dr
College St
Park Terrace
Park Valley
Standard Hill
The Park
Lace Market
The National Ice Centre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Data
Faults 1:625,000 scale
Superficial deposits 1:50,000 scale
Bedrock geology 1:50,000 scale
Add Data
Show Legend
Alfreton
Somercotes
Ripley
Belper
Heanor
Eastwood
Hucknall
Arnold
Ilkeston
Carlton
Nottingham
West Bridgford
Bingham
Derby
Sandiacre
Beeston
Long Eaton
Clifton
Cotgrave
East Midlands Airport
Nottinghamshire Wolds
Southwell
Newark-On-Trent
A6
A38
M1
A60
A614
A6097
A610
A6514
A52
A46
A453
A50
A516
A5111


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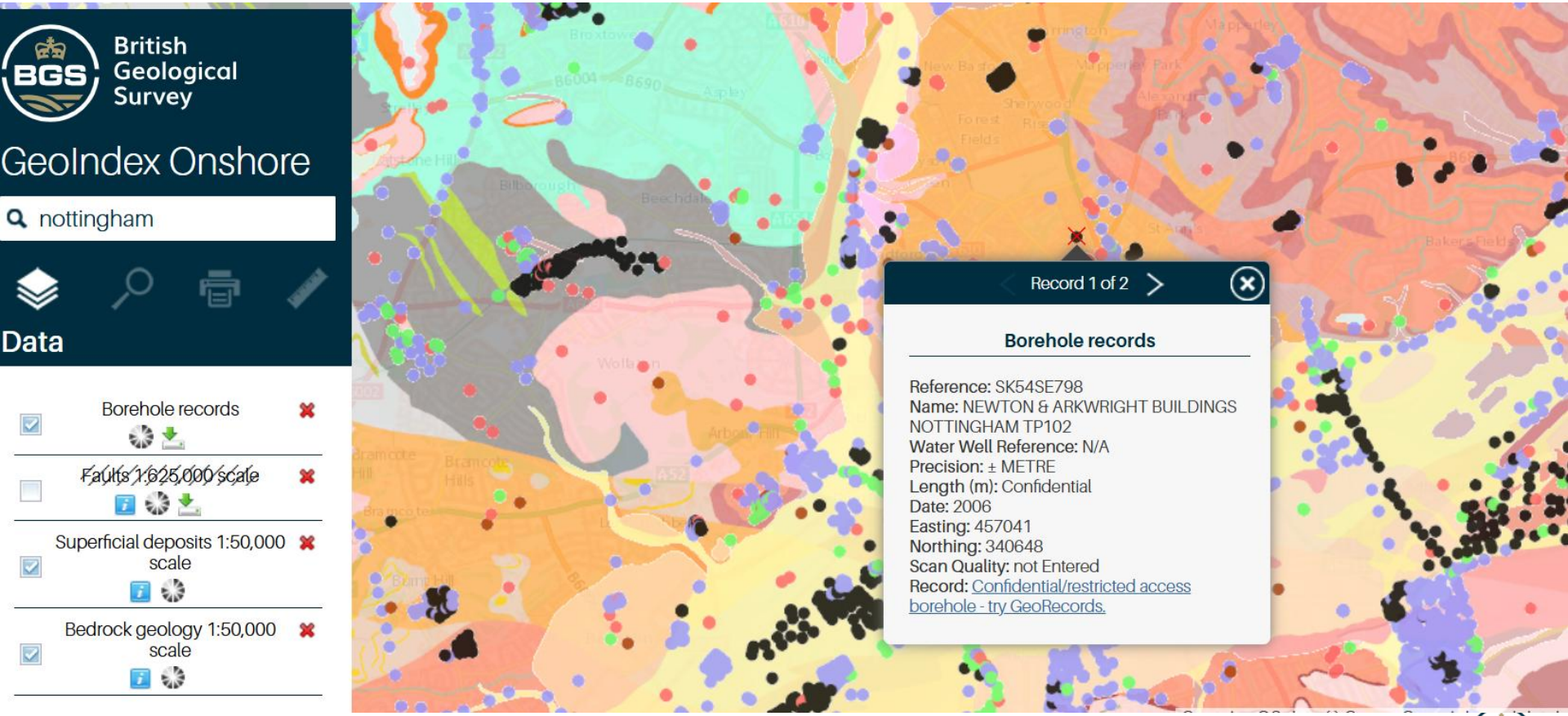
Data
Superficial deposits 1:50,000 scale
Bedrock geology 1:50,000 scale
Add Data
Show Legend
Record 1 of 1
Bedrock geology 1:50,000 scale
Description: CHESTER FORMATION - SANDSTONE, PEBBLY (GRAVELLY)
More Information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Data
Borehole records
Faults 1:625,000 scale
Superficial deposits 1:50,000 scale
Bedrock geology 1:50,000 scale
Record 1 of 2
Borehole records
Reference: SK54SE798
Name: NEWTON & ARKWRIGHT BUILDINGS NOTTINGHAM TP102
Water Well Reference: N/A
Precision: ± METRE
Length (m): Confidential
Date: 2006
Easting: 457041
Northing: 340648
Scan Quality: not Entered
Record: Confidential/restricted access borehole - try GeoRecords.

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