British Geological Survey

TRANSFORMING DATA FOR THE FUTURE OF OUR SUBSURFACE

BIG BOREHOLE DIG

HOW TO DIGITISE YOUR BOREHOLE

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Adam Dargan (Atkins)

OpenGround/HoleBase SI edition — July 2020

The Big Borehole Dig

The British Geological Survey (BGS) holds a database of over 1.4 million borehole records, each containing a range of information.

You can access digital scans of open data in the BGS archive via our GeoIndex viewer. Despite being held in digital format (usually PDF), the data within these documents is not yet standardised.

We believe it is essential that future generations have access to historical borehole data as Association of Geotechnical and Geoenvironmental Specialists (AGS) file format. By converting this data to AGS format, we can improve the availability and accessibility of borehole information to a wider audience and enable users to build better models, save costs on construction projects and reduce the amount of time lost due to unforeseen ground conditions.

After converting the data, we estimate that over 800 000 more downhole geology logs will be available for everyone to use. This information can feed directly into site investigations, conceptual ground models and academic projects, as well as provide the data necessary to perform even greater analyses on our subsurface in future.

The Big Borehole Dig aims to give people around the country the tools they need to digitise downhole information, create an AGS file and send it back to BGS to store, so that everyone can benefit from it. By helping us to standardise data, your contribution will help the UK take steps towards becoming a major subsurface information manager.

User requirements

Everyone reading this document and thinking about taking part in the Big Borehole Dig should ideally:

- work or study in a 'geological' context
- understand a little about what information is held in a borehole log and a borehole scan
- have access to HoleBASE SI or OpenGround
- have some knowledge of the AGS standard (not essential)

This document

This document aims to give you all the information you need to help convert data. This includes:

- installing and using the software
- accessing information
- creating geological borehole logs
- exporting the data in the right format
- submitting the data to BGS

I'm interested in helping. What next?

We invite you to read through this document, which has lots of information and guidance on converting data, then code your first boreholes and send them to us for review. To avoid too many boreholes being coded incorrectly, we ask you to please only submit a maximum of 10 to start with, then wait a few days to check that your first submission is accepted before proceeding.

If we notice any problems with your data submission, then we'll get in touch. If you don't hear from us within five days, you can assume that your submission has been accepted and you can proceed to code as many boreholes as you can. If you need any help at any point, please contact Steve Thorpe (sthorpe@bgs.ac.uk) or Adam Dargan (Adam.Dargan@atkinsglobal.com) and they will respond as quickly as possible.

With over 800 000 boreholes, we suggest that you use your hometown, or perhaps a project area that you are familiar with, to begin digitising boreholes and expand from there.

Help and support

Further help is available from BGS should you need it. Please contact Steve Thorpe (sthorpe@bgs.ac.uk) or Adam Dargan (Adam.Dargan@atkinsglobal.com) at any time during the process and we can answer your questions or provide support. Other resources are available, such as training videos, for the Bentley-Keynetix software.

The Appendix also lists some useful notes on what information to look out for and problems that are regularly encountered when working with borehole logs.

If you don't have access to OpenGround or HoleBASE, a separate document detailing the workflow using BGS's Groundhog software is also available.

Digitising borehole logs

Before you start

When digitising borehole data, we will need an AGS file for each project. If you choose a specific area and see that there are multiple boreholes drilled for the same project, please help us by digitising these into one AGS file before submitting it to us. We request that you don't produce one AGS file that contains boreholes from different projects. You can use the information on the borehole log, age and format to determine if the borehole is from the same project.

Step 1: setting up your project

When you start OpenGround Professional or HoleBASE SI, you will be presented with the 'Projects' page, which lists all the projects in your database. It is likely you will want to differentiate between the projects you are working on within your organisation and those that have been created specifically for the BGS Big Borehole Dig project. You should confirm with your database manager or administrator how to do this.

There are a few options you can consider.

Ideally, create a single project for each submission of data to BGS in which all of your project details will be specific for the BGS boreholes you are digitising, including project name, client name, project engineer, etc. (e.g. PROJ_ID: Windmill Road GI). This will mean the 'PROJ – AGS' table is correct when submitting to us. These projects can then be deleted once the boreholes are available on GeoIndex and we can be sure that the data has been digitised.

If there are issues with creating numerous projects, create one project. You can change the project details each time you are submitting to BGS to match what is described on the BGS logs that are being digitised. Update the 'PROJ – AGS' details (project name; location; client name; project engineer, etc.) each time. For example, you might code 100 boreholes to Windmill Road GI and another 100 boreholes to Church Wilne Extension. You will have to change the project details between the two submissions and ensure you submit the right boreholes with each project.

Adding project details

This needs to be set up in the 'Project Details' window (Figure 1) when creating or editing the project. The window is the same for both, possibly with additional fields that have been set up by your organisation.

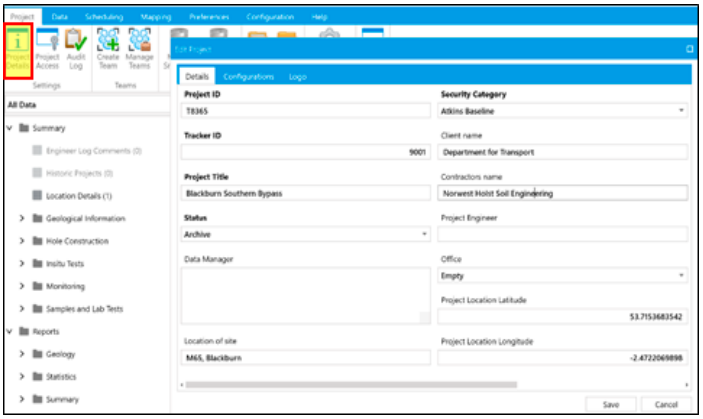


Figure 1 'Project Details' window.

At this stage, we can use the borehole scan to add the project details. The details in Table 1, which are available on the borehole scan, should be recorded.

Field name	Description
PROJ_ID	Enter any number that identifies the project on the borehole scan
PROJ_CLNT	Enter the client company/organisation indicated on the scan
PROJ_ENG	Enter the engineer/driller from the scan
PROJ_LOC	Location of the project (in general terms such nearest place or road intersection)

Table 1 Project details that should be recorded.

Don't worry if all this information is not apparent from the scan; just enter what's there.

Step 2: add the Big Borehole Dig boreholes web map service layer to your map

Next, you'll need to add a dedicated web map service (WMS) to your map to work on the Big Borehole Dig. The Big Borehole Dig project has a very specific set of borehole data that we need to digitise, so this needs to be added to your mapping screen.

Within a project, select the 'Mapping' tab, then select 'Manage Connections' and click on 'Create'.

Copy and paste this URL into the 'URL' box:
https://map.bgs.ac.uk/arcgis/services/AGS/BigBoreholeDig/MapServer/WMSServer?request=GetCapabilities&service=WMS

Give it a name ('Big Borehole Dig') and click on 'Test Connection'. If everything is working, click on the 'Include on Map' option and click 'Save' (Figure 2).

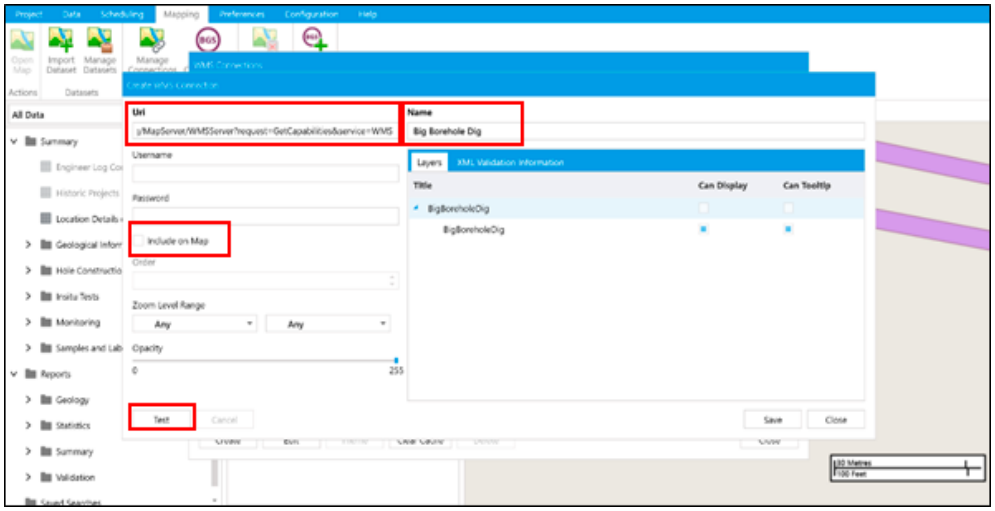


Figure 2 Saving the WMS to your map.

You can now include your Big Borehole Data WMS in your map window. Ensure you refresh your map if you have had it open. Information will be visible when you zoom in below the 5 km scale. If you have any problems, please get in touch with us.

Once loaded, this map shows you every borehole that needs coding for the Big Borehole Dig project (Figure 3). Select your chosen borehole to bring up the metadata and a link to the scan that will be used to digitise the borehole.

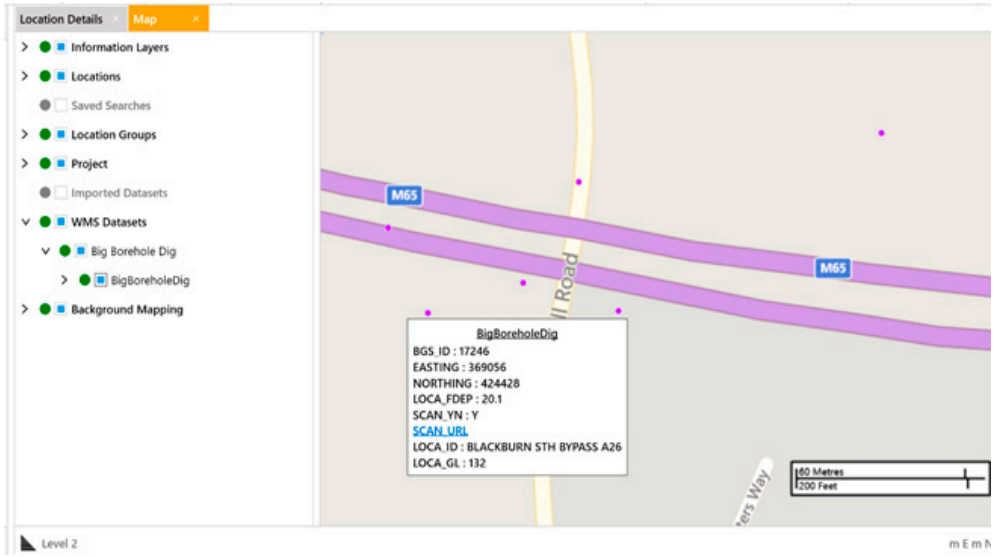


Figure 3 Loaded map layer showing all the boreholes that need digitising.

Once you have submitted your data and it has been successfully received and allocated to our borehole records, the WMS will remove the borehole and you won't see it in the layer any more.

Please note there is a slight delay in this process as boreholes can take a few days to be allocated and matched to BGS records. As you progress, we recommend that you check regularly to ensure that you don't duplicate your own work.

Step 3: digitsing boreholes

There are a number of ways you can do this.

The easiest and quickest way is using the OpenGround or HoleBASE data entry application. This can also be accessed through the 'Data' tab within your project by clicking on 'Data Entry' (Figure 4).

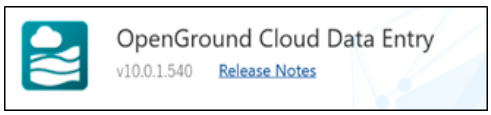


Figure 4 Data entry.

When the data entry application opens, double click on your project from the 'Your Project' list to open it. You will be asked to enter a data entry profile.

The drop-down lists different types of exploratory holes. You are welcome to choose the drilling technique if it is detailed on the borehole log but otherwise, continue with 'Cable Percussion' (Figure 5).

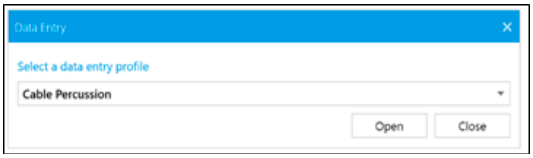
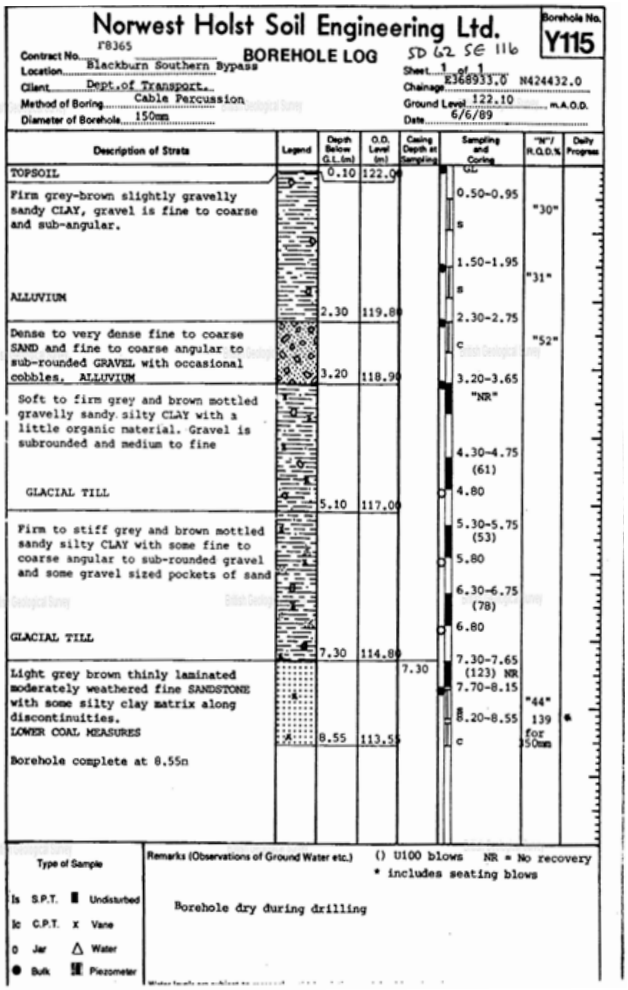


Figure 5 Enter a data entry profile.



Norwest Holst Soil Engineering Ltd.

Borehole No. Y115

Contract No. F8365 BOREHOLE LOG SD 62 SE 116

Location Blackburn Southern Bypass Sheet 1 of 1

Client Dept. of Transport. Chainage E368933.0 N424432.0

Method of Boring Cable Percussion Ground Level 122.10 m.A.O.D.

Diameter of Borehole 150mm Date 6/6/89

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.10	122.0		GL		
Firm grey-brown slightly gravelly sandy CLAY, gravel is fine to coarse and sub-angular.					0.50-0.95	"30"	
					1.50-1.95	"31"	
ALLUVIUM		2.30	119.8		2.30-2.75	"52"	
Dense to very dense fine to coarse SAND and fine to coarse angular to sub-rounded GRAVEL with occasional cobbles. ALLUVIUM		3.20	118.9		3.20-3.65	"NR"	
Soft to firm grey and brown mottled gravelly sandy silty CLAY with a little organic material. Gravel is subrounded and medium to fine					4.30-4.75	(61)	
GLACIAL TILL		5.10	117.0		4.80		
Firm to stiff grey and brown mottled sandy silty CLAY with some fine to coarse angular to sub-rounded gravel and some gravel sized pockets of sand					5.30-5.75	(53)	
					5.80		
					6.30-6.75	(78)	
GLACIAL TILL		7.30	114.8		6.80		
Light grey brown thinly laminated moderately weathered fine SANDSTONE with some silty clay matrix along discontinuities. LOWER COAL MEASURES				7.30	7.30-7.65	(123) NR	
					7.70-8.15	"44"	
					8.20-8.55	139 for 150mm	
Borehole complete at 8.55m		8.55	113.5				

Type of Sample: Is S.P.T. ■ Undisturbed; Ic C.P.T. x Vane; ○ Jar △ Water; ● Bulk ▣ Piezometer

Remarks (Observations of Ground Water etc.) () U100 blows NR = No recovery * includes seating blows

Borehole dry during drilling

Figure 6 Example borehole scan.

Step 4: adding borehole details

Selecting a borehole from the WMS map layer will bring up the metadata, which also gives you access to the borehole scan stored on the BGS website. In this example, we will be digitising the borehole in Figure 6.

Please note:

- If the borehole scan does not contain any geological depth information to code, send the borehole details to Steve Thorpe (sthorpe@bgs.ac.uk).
- If the borehole is not legible (either the scan is poor quality or the handwriting is bad) send the borehole details to Steve Thorpe (sthorpe@bgs.ac.uk).

Location details

Click 'Add' to begin digitising your first borehole (Figure 7).

Use the metadata to enter:/

- Location ID (LOCA_ID): please ensure that you use the LOCA_ID shown on the log, e.g. Y115 on Figure 6.
- Location Type (LOCA_TYPE): taken from borehole scan if known. If nothing is entered then use CP (Cable Percussion).
- Remarks: use this syntax to record the BGS_ID from the metadata: 'BGSID = [from metadata, e.g. 17320]. Digitised as part of The Big Borehole Dig 2020.'
- Ground Level (LOCA_GL): if no start height is given in the metadata then check the scan. If nothing is listed there then leave this blank.
- Easting (EASTING)
- Northing (NORTHING)
- Final Depth (LOCA_FDEP)

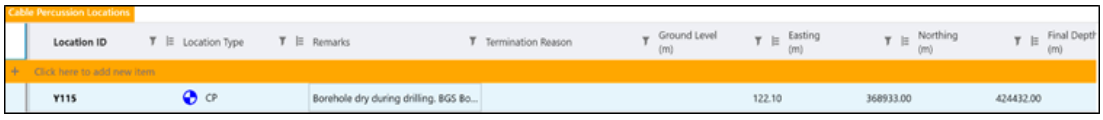


Figure 7 Adding borehole details.

You can use the tab button to go through each field. When done, press 'Enter' to save the location.

Use the right arrow highlighted in Figure 8 to work through the additional tables. You can also navigate through the tables using the dropdown box for 'Step'.

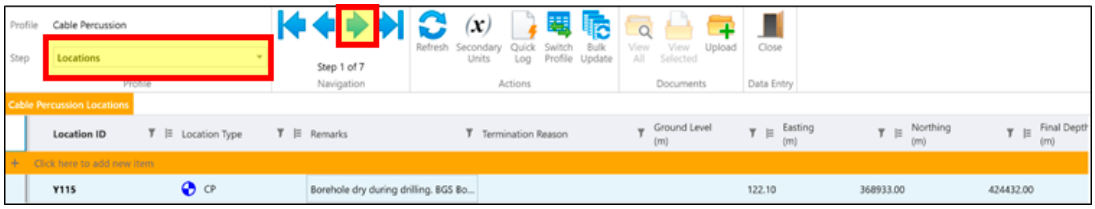


Figure 8 Navigation.

Drilling type table

Next is the drilling type. The drop-down menu highlighted in Figure 9 allows you to switch between exploratory boreholes when you have created more than one in the location table.

In this table, all you need to add is the top depth (0.00 m) and whatever the bottom depth is, along with the type of drilling technique. If you have information on the borehole scan detailing the different types of borehole techniques used you can add this information, however, this is not compulsory.

Press 'Enter' to save and click the 'next' arrow.

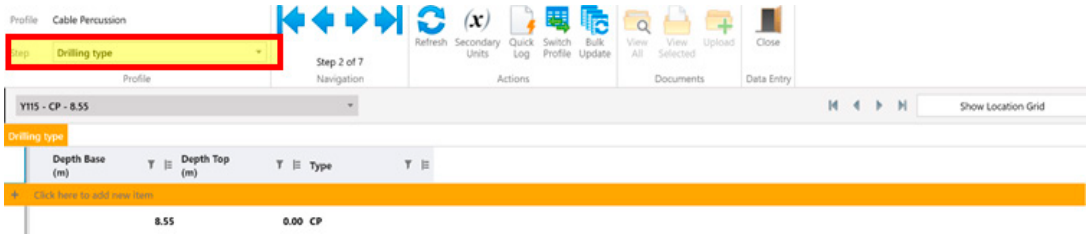


Figure 9 Switch between boreholes.

Step 5: adding geology to the borehole

Geology table

This step allows you to add the geology details from the borehole log (Figure 10). Enter the depth top and bottom of each geological description. No interpretation is required, just enter only what you can see on the log. Enter everything, test, check spelling and do not shorten any words. Use the tables in the Appendix to determine an appropriate legend code. Add the full description for the legend code. Press 'Enter' to save each row.

Note: the geology code should be kept empty to avoid any geological interpretation.

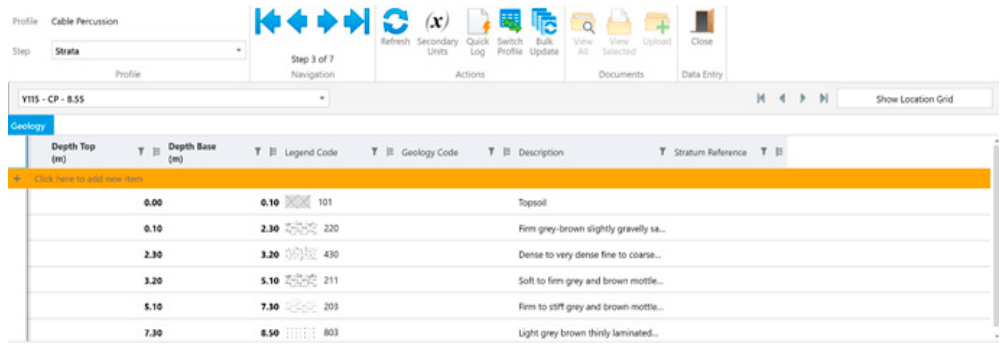


Figure 10 Add the geology details from the borehole log.

The bottom table, 'Detail Description' used for any specific descriptions given on the log. These are not compulsory but provide useful information and you are welcome to add these in. Examples (from a different borehole) are shown in Figure 11.

Press 'Enter' to save each row and click the 'next' arrow.

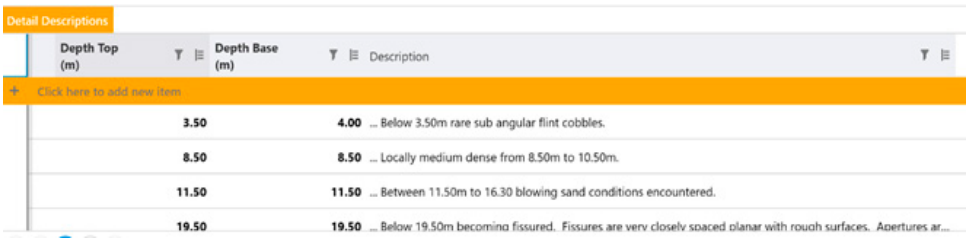


Figure 11 Examples of borehole descriptions.

Samples table

No information is required in this table so click the 'next' arrow.

In situ table

For those with experience and knowledge of SPT data, feel free to add in the raw SPT N values. However, these are not compulsory and it is recommended that you do not add these if you are not confident of the SPT test data. There is no requirement to add information on the 'in situ vane'

Click the 'next' arrow.

Wells and water table

For those with experience and knowledge of groundwater strike details, you are welcome to add any groundwater strikes. However, these are not compulsory and it is recommended that you do not add these if you are not confident on groundwater strike details. No details are required in 'Backfill', 'Standpipe Locations' or 'Standpipe Details'. Please leave these blank.

Water strike details table

No information is required in this table, so click the next arrow. This will take you back to Step 1 and the location table. You can now add the next borehole you wish to digitise.

Well done! Your first borehole is digitised!

These boreholes are added automatically into your project in OpenGround Professional/HoleBASE. When you open the project, you will find all of your digitised boreholes in the location details table and that all of the information has been distributed within the tables of the data tree, on the left side.

Step 6: checking your work using a quick borehole log of data

To check how your digitised data is presented in a borehole log form, click on 'Quick Log' as highlighted in Figure 12. This will bring up a borehole log of your digitised data (Figure 13) and is an excellent way to check against the historical BGS borehole log. If you need to amend anything, you can go through the steps to amend a table.

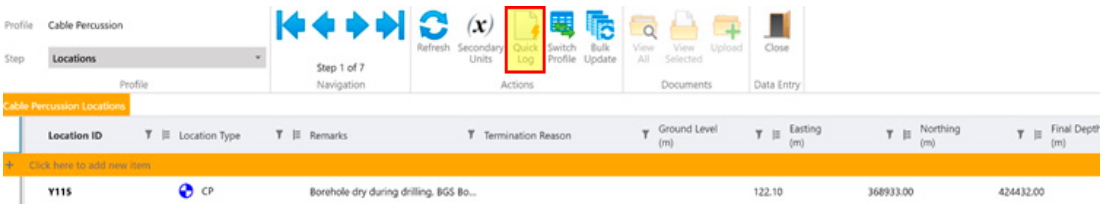
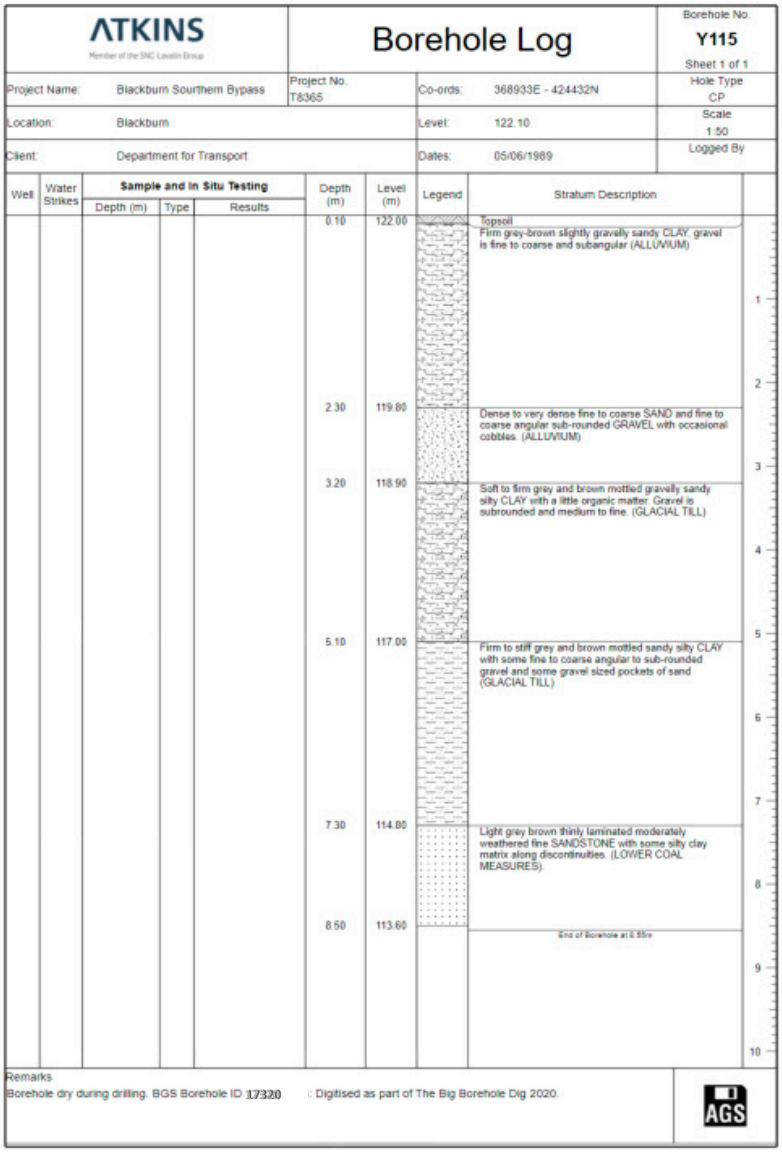


Figure 12 'Quick Log' button.



ATKINS
Member of the SNC-Lavalin Group

Borehole Log

Borehole No.
Y115
Sheet 1 of 1

Project Name:	Blackburn Southern Bypass	Project No. T8365	Co-ords:	368933E - 424432N	Hole Type CP
Location:	Blackburn		Level:	122.10	Scale 1:50
Client:	Department for Transport		Dates:	05/06/1989	Logged By

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.10	122.00		Topsoil Firm grey-brown slightly gravelly sandy CLAY, gravel is fine to coarse and subangular (ALLUVIUM)
					2.30	119.80		Dense to very dense fine to coarse SAND and fine to coarse angular sub-rounded GRAVEL with occasional cobbles. (ALLUVIUM)
					3.20	118.90		Soft to firm grey and brown mottled gravelly sandy silty CLAY with a little organic matter. Gravel is subrounded and medium to fine. (GLACIAL TILL)
					5.10	117.00		Firm to stiff grey and brown mottled sandy silty CLAY with some fine to coarse angular to sub-rounded gravel and some gravel sized pockets of sand (GLACIAL TILL)
					7.30	114.80		Light grey brown thinly laminated moderately weathered fine SANDSTONE with some silty clay matrix along discontinuities. (LOWER COAL MEASURES).
					8.50	113.60		End of Borehole at 8.55m

1 2 3 4 5 6 7 8 9 10

Remarks
Borehole dry during drilling. BGS Borehole ID 17320 : Digitised as part of The Big Borehole Dig 2020.

AGS

Figure 13 Borehole log generated from digitised data entries.

Once you have coded all your boreholes, they can be exported from OpenGround/ HoleBASE and uploaded to BGS in two ways:

- Use the BGS plug-in within OpenGround/HoleBASE itself (Figure 14). Click on the 'Data' tab and click 'Submit to BGS'. The requirements for depositing the data are the same as for Step 8, so please follow those instructions, which explain which metadata should be captured when depositing data.

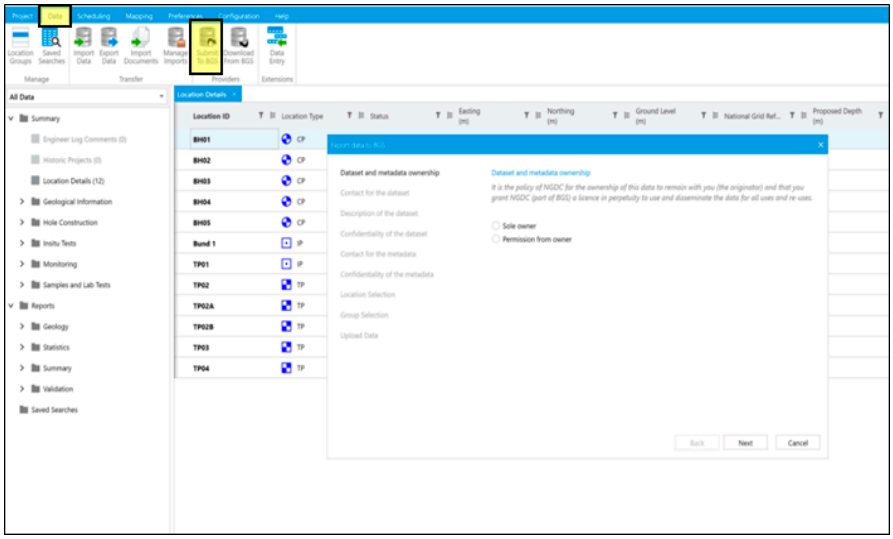


Figure 14 Submit to BGS via the BGS plug-in.

- If you experience issues using the plug-in, you can use the alternate method of exporting the data as an AGS file and upload using the BGS Deposit Portal in Step 8. To do this, go to the 'Data' tab, click on 'Export Data' and go through the workflow to save your AGS file.

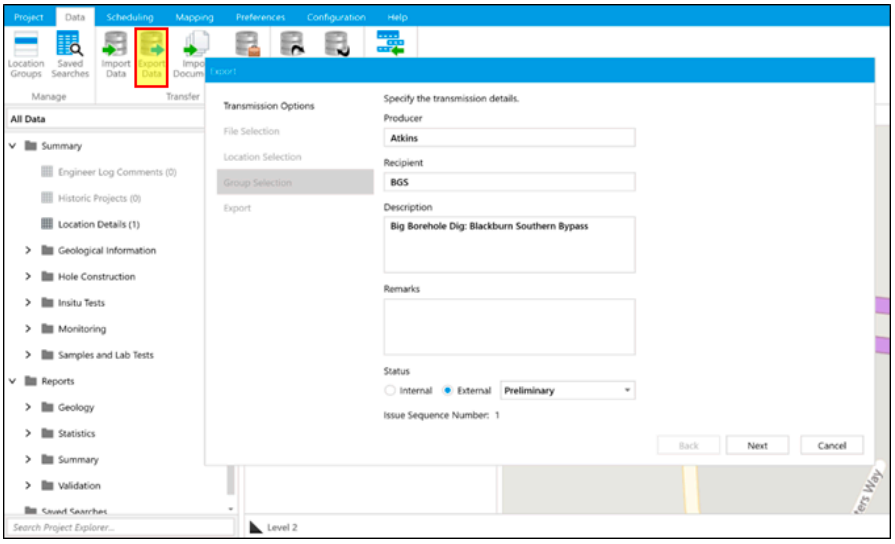


Figure 15 Exporting the data as an AGS file.

Step 8: sending your data to BGS

If you use the BGS plug-in within OpenGround you will follow a similar process to this. Note the confidentiality of dataset and metadata should be 'Open'.

One useful tool that you can use to check your AGS file is to use BGS's online AGS validation tool.

To send your AGS files to BGS for storage in the national archives you will use the ingestion portal. The portal has a few stages for you to provide some metadata for your deposit.

Stage one: identification

Enter your name and email address.

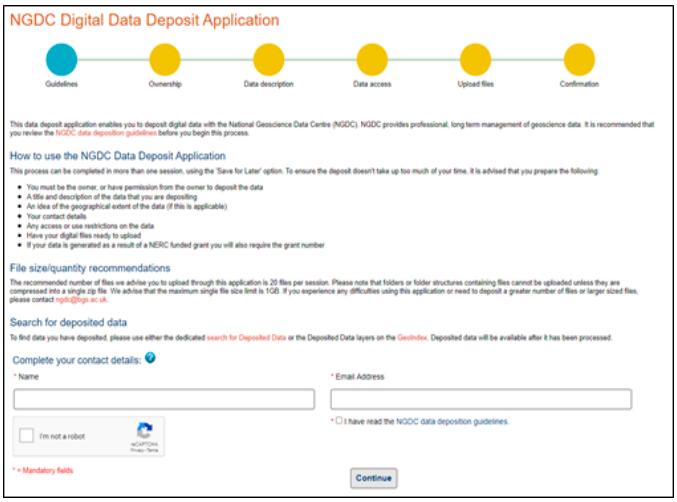


Figure 16 Name and email address.

Stage two: contact details

Enter your organisation (this can be your workplace or your personal address). Ensure to tick 'I am the owner of this data' as it is you that generated the AGS file (Figure 17).

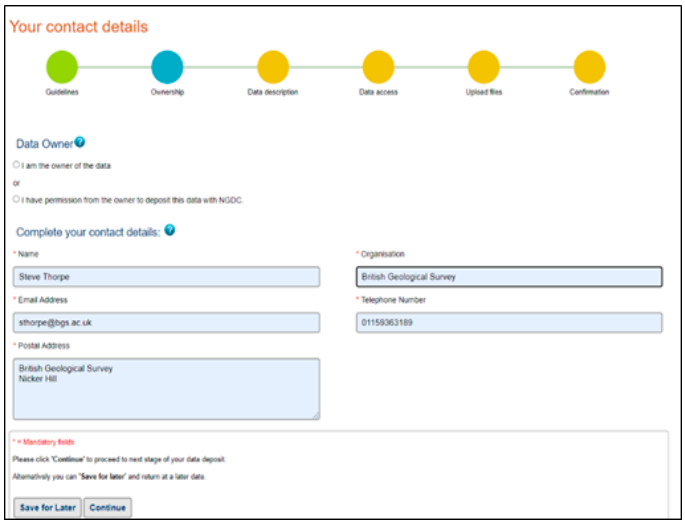


Figure 17 Organisation.

Stage three: data description

Please enter the following information in the boxes shown in Figure 18:

- Data source: volunteer
- Data title: name of the project layer containing the boreholes
- Data description: please enter this exact phrase — '[Number of boreholes in the AGS file] generated by Groundhog V2.0 for the Big Borehole Dig project 2020. AGS file contains only geology table'
- Keywords: AGS, Boreholes, Geology
- Geographical extent: nearest town or grid reference for the borehole/middle of the project

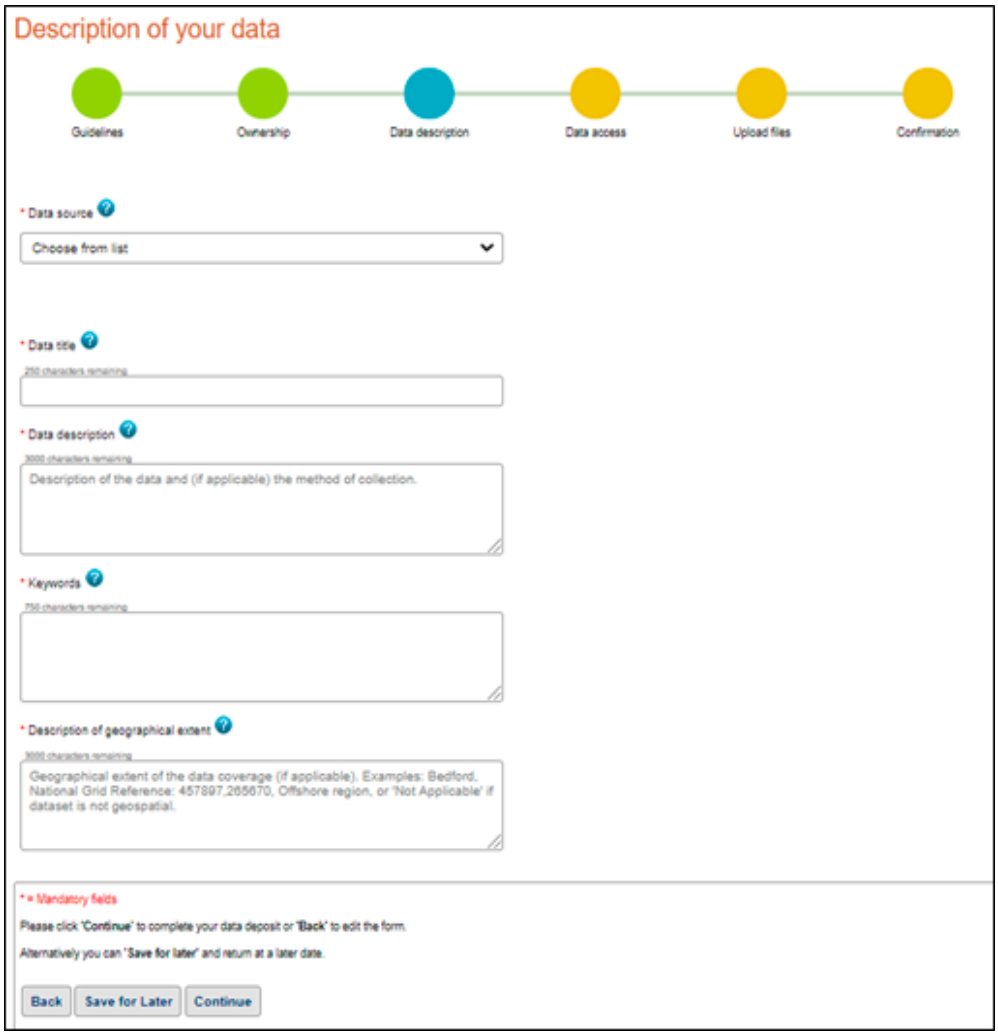


Figure 18 Data details.

Stage four: data access

Leave 'Restrictions' as 'Open'. All data generated has come from openly available boreholes.

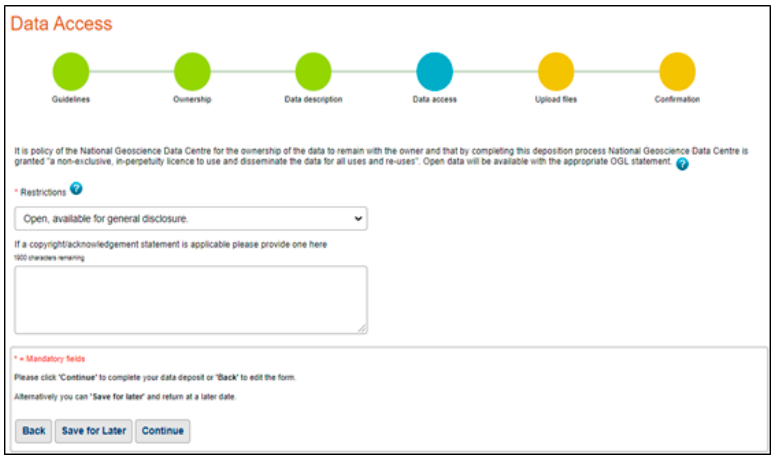


Figure 19 Data restrictions.

Stage five: upload

Upload your AGS file.

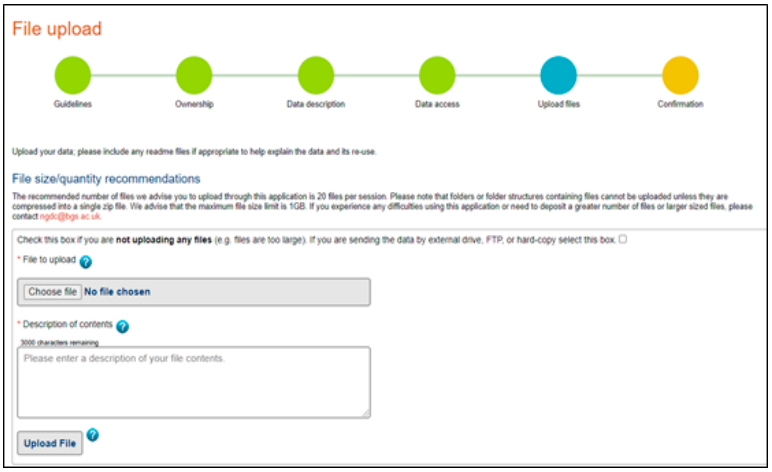


Figure 20 Upload the AGS file.

Stage six: confirmation

You should receive an email letting you know that your deposit has been submitted successfully. Due to volume, BGS will not follow up with a success of ingestion, so we recommend that you keep your own record of progress.

However, after a few days you should see that the Big Borehole DIG WMS layer will no longer show your boreholes. After two weeks, the boreholes should appear on the AGS layer in the GeoIndex.

Appendices

AGS fields to include

Some AGS fields need to be included with each borehole (where info allows), ensure that these entries are included for each of your projects.

Field name	Description
PROJ_ID	Project ID
PROJ_NAME	Project name
PROJ_LOC	Project location
PROJ_CLNT	Project client
PROJ_CONT	Project contractor
PROJ_ENG	Project engineer

GEOL_LEG codes

Code	Description
101	TOPSOIL
102	MADE GROUND
103	Bituminous Material
105	Undefined
201	CLAY
202	Silty CLAY
203	Sandy CLAY
204	Gravelly CLAY
205	Cobbly CLAY
206	Bouldery CLAY
207	Silty sandy CLAY
208	Silty gravelly CLAY
209	Silty cobbly CLAY
210	Silty bouldery CLAY
211	Silty sandy gravelly CLAY
212	Silty sand cobbly CLAY
213	Silty sandy bouldery CLAY
214	Silty sandy gravelly cobbly CLAY
215	Silty sandy gravelly bouldery CLAY
216	Silty sandy gravelly cobbly bouldery CLAY

Code	Description
217	Silty sandy organic CLAY
218	Silty sandy gravelly organic CLAY
219	Silty organic CLAY
220	Sandy gravelly CLAY
221	SILT/CLAY
222	Sandy cobbly CLAY
223	Sandy bouldery CLAY
224	Sandy gravelly cobbly CLAY
225	Sandy gravelly bouldery CLAY
226	Sandy gravelly cobbly bouldery CLAY
Code	Description
227	Sandy organic CLAY
228	Sandy gravelly organic CLAY
229	Organic CLAY
230	Sandy gravelly cobbly SILT/CLAY
231	Sandy gravelly bouldery SILT/CLAY
232	Sandy gravelly cobbly bouldery SILT/CLAY
233	Sandy peaty SILT/CLAY
234	Sandy gravelly peaty SILT/CLAY
235	Peaty SILT/CLAY
301	SILT
302	Clay/Silt
303	Sandy SILT
304	Gravelly SILT
305	Organic SILT
306	Peaty SILT
307	Gravelly SILT
308	Sandy gravelly SILT
309	Bouldery SILT
310/312	Sandy gravelly SILT
314	Clayey sandy gravelly organic cobbly SILT
316	Sandy cobbly SILT
317	Sandy bouldery SILT

Code	Description
318	Sandy organic SILT
319	Sandy gravelly organic SILT
320	Sandy gravelly cobbly SILT
321	Sandy gravelly organic cobbly SILT
322	Gravelly cobbly SILT
323	Gravelly bouldery SILT
324	Gravelly organic SILT
Code	Description
325	Gravelly organic cobbly SILT
326/329	Cobbly SILT
327	Cobbly bouldery SILT
328	Organic cobbly SILT
330	Peaty SILT
331	Bouldery SILT
332	Peaty CLAY/SILT
333	Gravelly CLAY/SILT
334	Sandy gravelly CLAY/SILT
335	Bouldery CLAY/SILT
336	Sandy gravelly CLAY/SILT
337	Sandy gravelly peaty CLAY/SILT
338	Cobbly CLAY/SILT
339	Peaty CLAY/SILT
401	SAND
402	Clayey SAND
403	Silty SAND
404	Gravelly SAND
405	Cobbly SAND
406	Bouldery SAND
407	Clayey silty SAND
408	Clayey silty gravelly SAND
409	Clayey silty gravelly cobbly SAND
410	Clayey gravelly SAND
411	Clayey gravelly cobbly SAND

Code	Description
412	Silty gravelly SAND
413	Silty gravelly cobbly SAND
414	Silty gravelly cobbly bouldery SAND
415	Gravelly cobbly SAND
416	Gravelly cobbly bouldery SAND
417	Gravelly bouldery SAND
418	Cobbly bouldery SAND
430	SAND and GRAVEL
431	Organic SAND
432	Clayey peaty SAND
433	Silty organic SAND
434	Gravelly organic SAND
435	Cobbly organic SAND
436	Bouldery organic SAND
437	Clayey silty peaty SAND
438	Clayey silty gravelly peaty SAND
501	GRAVEL
502	Clayey GRAVEL
503	Silty GRAVEL
504	Sandy GRAVEL
Code	Description
505	Organic GRAVEL
506	Cobbly GRAVEL
507	Bouldery GRAVEL
508	Clayey silty GRAVEL
509	Clayey sandy GRAVEL
510	Clayey cobbly GRAVEL
511	Clayey bouldery GRAVEL
512	Clayey organic GRAVEL
513	Clayey silty sandy GRAVEL
514	Clayey silty cobbly GRAVEL
515	Clayey silty bouldery GRAVEL
516	Clayey silty peaty GRAVEL

Code	Description
517	Clayey sandy organic GRAVEL
518	Clayey silty sandy bouldery GRAVEL
519	Clayey silty sandy peaty GRAVEL
520	Silty sandy GRAVEL
521	Silty cobbly GRAVEL
522	Silty bouldery GRAVEL
523	Silty organic GRAVEL
524	Silty organic sandy GRAVEL
525	Sandy cobbly GRAVEL
526	Sandy bouldery GRAVEL
527	Sandy organic GRAVEL
528	Silty sandy cobbly GRAVEL
601	PEAT
602	Clayey PEAT
603	Silty PEAT
604	Sandy PEAT
605	Gravelly PEAT
606	Cobbly PEAT
607	Clayey silty PEAT
608	Clayey sandy PEAT
609	Clayey gravelly PEAT
610	Clayey silty sandy PEAT
611	Clayey silty sandy gravelly PEAT
612	Silty sandy PEAT
613	Silty sandy gravelly PEAT
614	Sandy gravelly PEAT
701	COBBLES
702	Clayey COBBLES
703	Silty COBBLES
704	Sandy COBBLES
705	Gravelly COBBLES
706	Organic COBBLES
707	Clayey silty COBBLES

Code	Description
708	Clayey sandy COBBLES
709	Clayey gravelly COBBLES
710	Clayey silty sandy COBBLES
711	Clayey silty gravelly COBBLES
712	Clayey silty gravelly sandy COBBLES
713	Silty sandy COBBLES
714	Silty gravelly COBBLES
715	Silty organic COBBLES
716	Silty gravelly sandy COBBLES
717	Silty sandy organic COBBLES
718	Silty sandy gravelly organic COBBLES
719	Sandy gravelly COBBLES
720	Sandy organic COBBLES
721	Gravelly organic COBBLES
725	COBBLES and BOULDERS
730	BOULDERS
731	Gravelly cobbly BOULDERS
801	MUDSTONE
802	SILTSTONE
803	SANDSTONE
804	LIMESTONE
805	CHALK
806	COAL
807	BRECCIA
808	CONGLOMERATE
809	Fine grained IGNEOUS
810	Medium grained IGNEOUS
811	Coarse grained IGNEOUS
812	Fine grained METAMORPHIC
815	Pyroclastic (Volcanic Ash)
816	Gypsum, Rocksalt
817	Shale
901	Sand Backfill

Code	Description
902	Gravel Backfill
903	Bentonite
904	Grout
905	Arisings
906	Concrete
988	Bentonite or Grout
997	Undefined
999	Void