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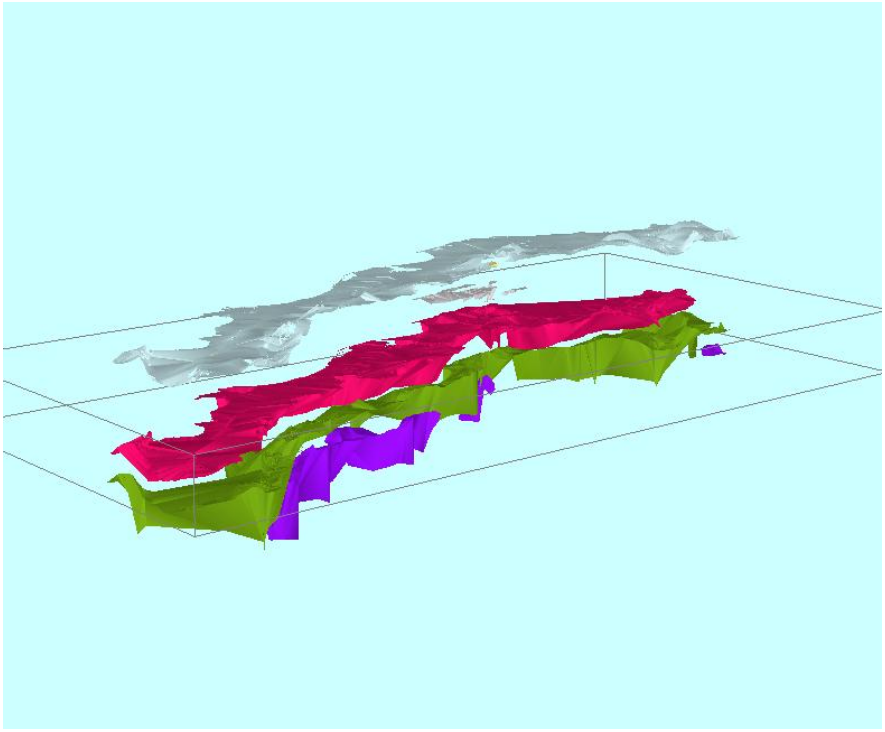
Metadata Report for the Moray Ness Regional GSI3D Model

Geology and Regional Geophysics Scotland

OR/14/065



BRITISH GEOLOGICAL SURVEY

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Model metadata report for the Moray Ness Regional GSI3D model

Finlayson, A G and Arkley, S L B

Contributor

Callaghan, E A

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SW corner 260044 831847
NE corner 342319 868995

Front cover

Geological units exploded as shown in 3D window of GSI3D, vertical exaggeration x 5, looking northeast.

Bibliographical reference

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British Geological Survey offices

BGS Central Enquiries Desk

Tel 0115 936 3143 Fax 0115 936 3276

email enquiries@bgs.ac.uk

Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG

Tel 0115 936 3241 Fax 0115 936 3488

email sales@bgs.ac.uk

Murchison House, West Mains Road, Edinburgh EH9 3LA

Tel 0131 667 1000 Fax 0131 668 2683

email scotsales@bgs.ac.uk

Natural History Museum, Cromwell Road, London SW7 5BD

Tel 020 7589 4090 Fax 020 7584 8270

Tel 020 7942 5344/45 email bgslondon@bgs.ac.uk

Columbus House, Greenmeadow Springs, Tongwynlais, Cardiff CF15 7NE

Tel 029 2052 1962 Fax 029 2052 1963

Maclean Building, Crowmarsh Gifford, Wallingford OX10 8BB

Tel 01491 838800 Fax 01491 692345

Geological Survey of Northern Ireland, Colby House, Stranmillis Court, Belfast BT9 5BF

Tel 028 9038 8462 Fax 028 9038 8461

www.bgs.ac.uk/gsni/

Parent Body

Natural Environment Research Council, Polaris House, North Star Avenue, Swindon SN2 1EU

Tel 01793 411500 Fax 01793 411501

www.nerc.ac.uk

Website www.bgs.ac.uk

Shop online at www.geologyshop.com

Contents

Figures

Tables

Summary

This report describes the GSI3D model of simplified bedrock of the Moray Ness region, from Inverness in the west to just west of Buckie in the east. The model was constructed to provide an aid in the modelling of how ground water flowed within this region.

1 Modelled volume, purpose and scale

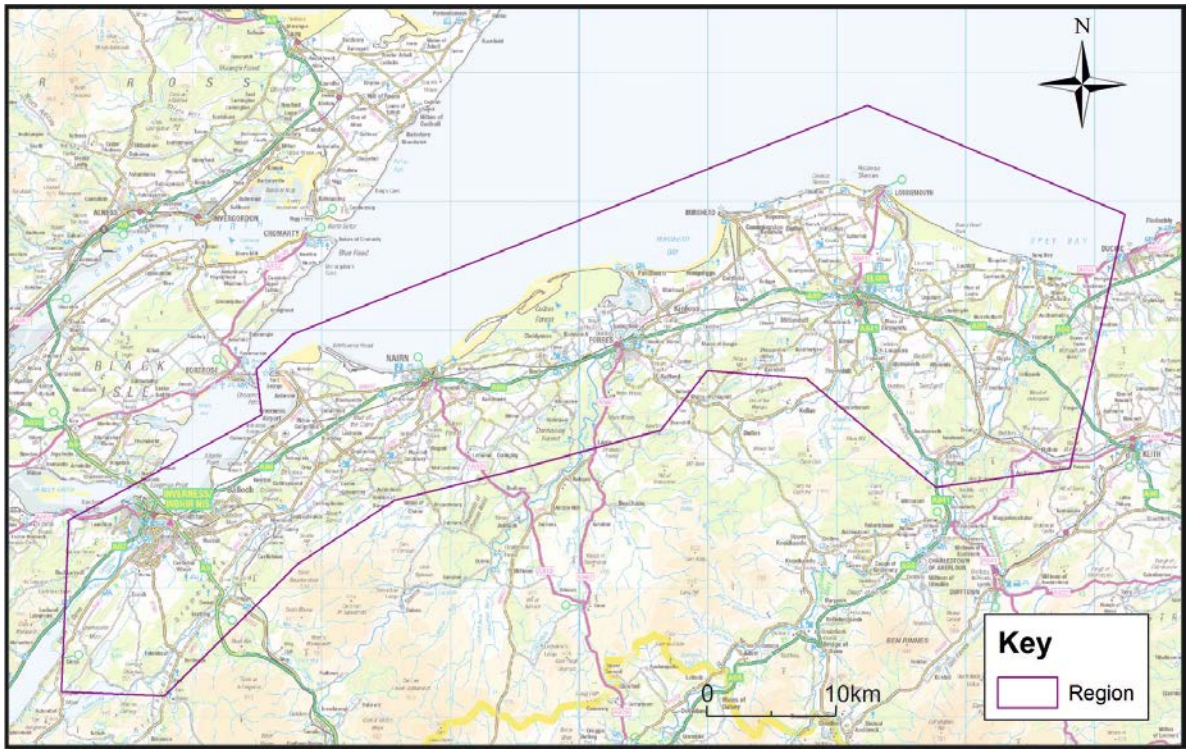

Figure 1: Map showing the extent of the modelled area, outlined in purple

The Moray Ness Regional GSI3D model covers an area of over 1200 km^2; it is bounded to the north by the Moray Firth and to the south by higher ground where basement rock outcrops at surface, (Figure 1).

The model was constructed to provide a calculated model framework for Zoom ground water flow modelling in relation to alleviating and preventing the threat of flooding in the region, see MacDonald *et al*, 2008 and Vounaki, Hughes and MacDonald, 2011.

The model is suitable for scales up to 1:625 000, down to a depth of -400 m OD.

2 Modelled surfaces/volumes

The GVS for the Moray Ness model was created from 5 bedrock geological units and 1 unit representing the Quaternary deposits, see Table 1. For export into the Regional Groundwater Model the units were combined into three groups, Superficial (QUU), Sedimentary (JURA, PRMT and ORS) and Crystalline (AZRU and UIIN).

name	lithostrat_code	code	geological_unit
quu	QUU	QUU	Quaternary_deposits
jura	JURA	JURA	Jurassic
prmt	PRNT	PRMT	Permo_Triassic
ors	ORS	ORS	Old_Red_Sandstone
azru	AZRU	AZRU	Basement
uiin	UIIN	UIIN	Igneous_Intrusion

Table 1: GVS showing geological modelled units

The modelled units were imported as ascii files.

W:\Teams\QES\QMMP\Data\MorayNessBasin_Data\Data\MorayNess-Region\RegionalModel_forGSI3d\REGIONAL_MODEL_FOR_ZOOM\GRID_EXPORTS

3 Modelled faults

Although fault geology lines were imported into the GSI3D map window, no actual fault modelling was undertaken.

4 Model datasets

General caveats regarding BGS datasets and interpretations can be described:

- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, improved databases and modelling software, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.

4.1 DATA LOCATION

W:\Teams\QES\QMMP\Data\MorayNessBasin_Data\Data\MorayNess-Region\RegionalModel_forGSI3d

Digital Terrain Model (DTM) data

The DTM used for the Moray Ness Regional GSI3D model is the NEXTMap® Digital Elevation Model (exported from the BGS data portal). The DTM was originally imported at a resolution of 10 m from the data portal but problems were incurred possibly due to the large file size. The resolution was decreased to 50 m.

Data (sections)

The cross-sections were drawn as a 'fish' diagram with a main section through the model area and 7 cross-sections dissecting the main section at 90 degrees to it. The main section was drawn roughly following the route of the A96 road; four further sections were drawn parallel, north and south of this main cross-section, see Figure 2. An additional 14 'helper' sections were drawn to aid in the construction of the GSI3D model, see Figure 3.

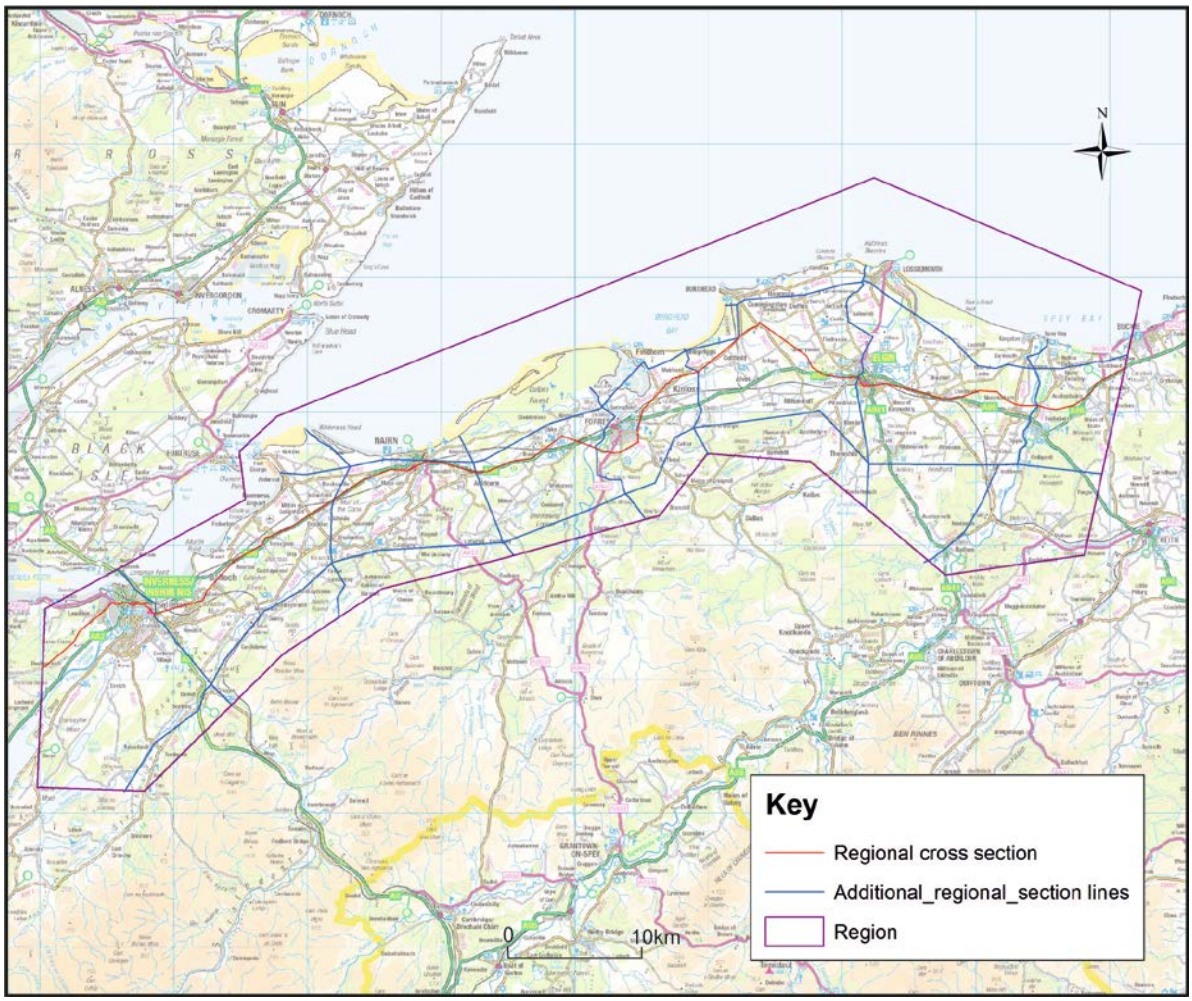

Figure 2: Cross-sections drawn for use in construction of the 3D model

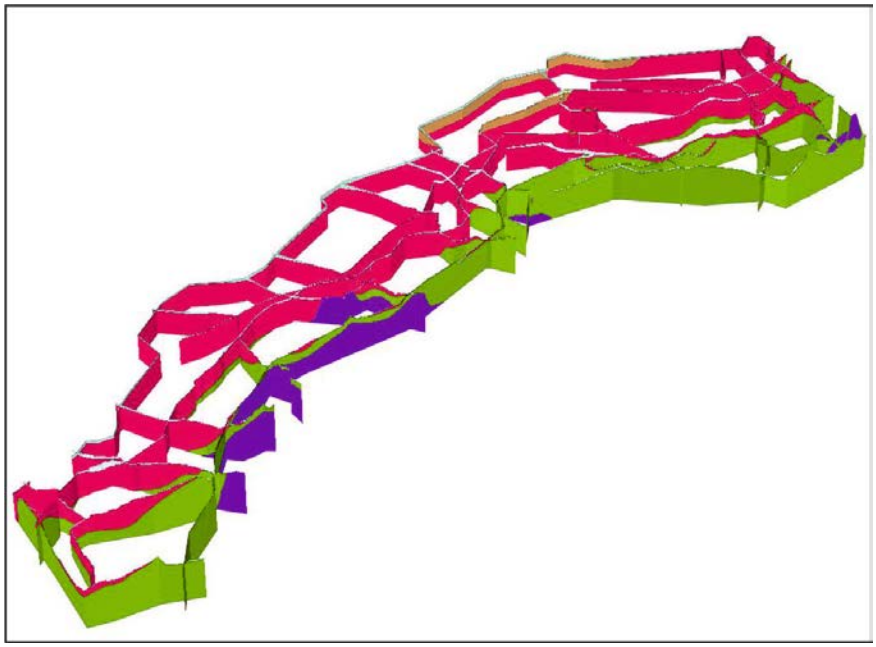

Figure 3: Construction of cross-sections as shown in 3D window, vertical exaggeration x 5

Data (Boreholes)

Borehole data were entered into the BGS corporate database, BGS Borehole Geology according to the project GVS. The borehole information was extracted via the Data Portal (07/08/2009) for the model area using interpreter 'ECAL' and in total there were 392 boreholes and trial pits. Boreholes were generally hung according to the DTM used, however where the DTM was affected by artefacts, e.g. trees, the boreholes were aligned with the contour values.

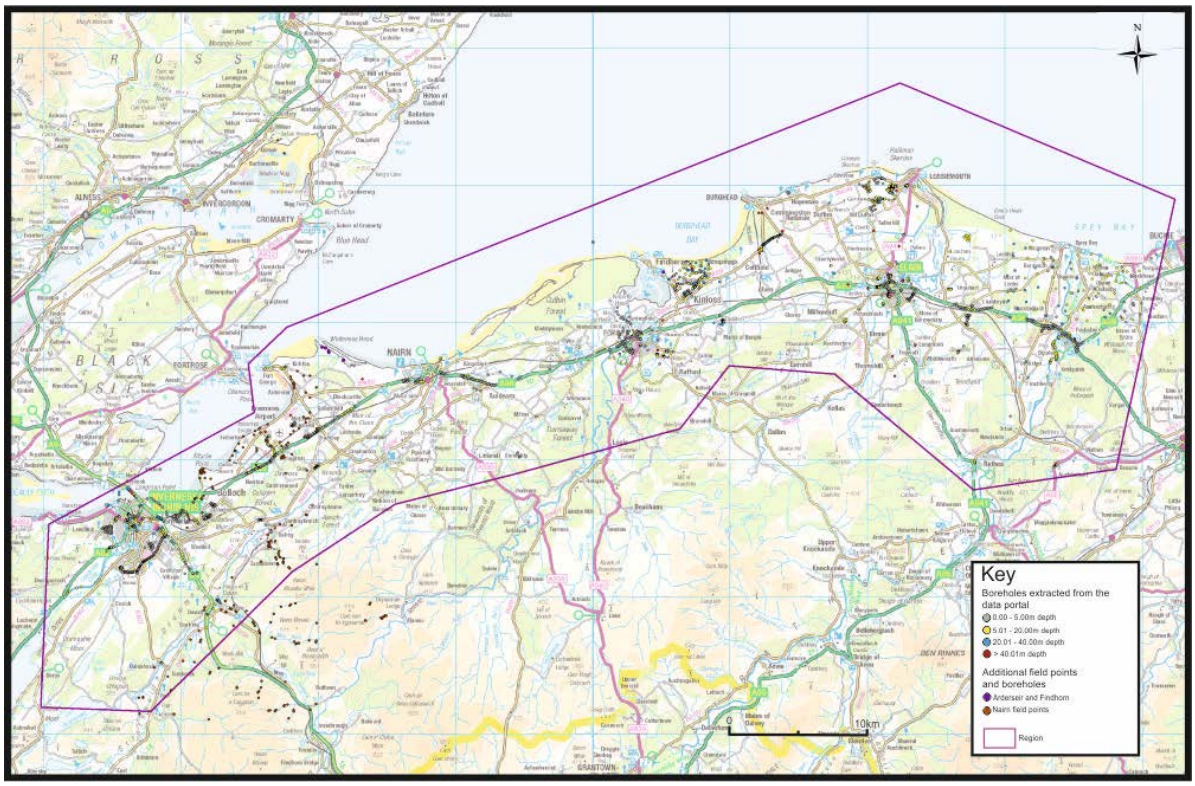

Figure 4: Location of boreholes (including field points and trial pits)

Data (Field Information/Points)

Additional information was added to the borehole data extracted from the Data Portal, two different sources of information were collated, these being; field observation points which were collected during a period of re-surveying of sheet 84E, Nairn, see Figure 4 and Table 2, and also additional boreholes which had not been entered into the Single Onshore Borehole Index (SOBI), see Figure 4 and Table 3. Information on the deposits and thicknesses of these additional points were compiled into Excel tables and converted into '.bid' and '.blg' files for use in the modelling.

BORE_NAME	EAST	NORTH
E5 (N) Sileage pit, Ballone	267250	832650
E3 (N) Pit in side of gravel ridge, degraded	266950	832660
E4 (N) Trial pit, Ballone	267260	832700
E7(N) Scar on valley-side	269260	833200
E1(N) 8m-high section in end of esker	269050	834200
E6 (N) Old gravel pit, Beachan	268070	834880
E19 (S) River cliff: Allt na Fuar-ghlaic	270980	835250
E18 (S) Forestry Commission gravel pit	270150	835350
E1 (S) Mid Lairgs Pit (East)	271400	836730
E3 (S) Mid Lairgs Pit (West)	270700	836880
E21 (S) Mid Lairgs Gravel Pit	271450	836900
E7 (N) Roche mountonee	271310	837560
E17 (N) Excavation for new reservoir	273820	837920
E6 (N) Degraded sand pit beside forestry track	271920	838750
E12 (N) Cutting opposite E11	273250	838890
E11 (N) Roadside cutting	273310	838910
E16 (N) River cliff: Craggie Burn	274060	838910
E20 (N) Trackside cutting	274780	839000
E4 (N) Daviot Quarry	271680	839060
E10 (N) Temporary excavation	272950	839080
E14 (N) River cliff: Craggie Burn	273680	839110
E5 (N) Daviot Quarry	271720	839240
E9 (N) small gravel pit and sileage pit	273850	839420
E8 (N) Small natural section at top of steep-sided side-valley	273230	839720
E1(S) Disused gravel pit	273710	841420
E17(S) River cliff; Allt Carn a? Ghranndaich	277940	842080
E26(S) River cliff; Allt Cromachan	277050	842450
E33 (S) River cliff; Allt Carn a? Ghranndaich	277460	842490
E13(N) River cliff; Allt Carn a? Ghranndaich	277420	842540
E21(N) River cliff; Allt Ruidhe Moire	275840	842580
E12 (N) River cliff; Allt Carn a? Ghranndaich	277470	842600
E25(N) River cliff; Allt Cromachan	276950	842750
E35(N) River cliff; Allt Tarsuinn		
Small exposure a few meters above burn	277470	842810
E28(N) River cliff; Allt Cromachan	276900	842850
E19(N) High river cliff; Allt Carn a? Ghranndaich	277230	842900
E18(N) High river cliff; Allt Carn a? Ghranndaich	277130	843020
E20(N) High river cliff; Allt Carn a? Ghranndaich	277100	843200
E30a(N) River cliff; Allt Carn a? Ghranndaich Northern third of section	277140	843370
E30b(N) River cliff; Allt Carn a? Ghranndaich Middle third of section	277140	843370
E30c(N) River cliff; Allt Carn a? Ghranndaich Southern third of section	277140	843370
E23(N) Trackside section	276540	843630
E7 (N) River bank; Cassie Burn		
Peacock?s Clava Site I (?)	276380	843680
E8(N) River bank; Cassie Burn		
Peacock?s Clava site II (?)	276380	843690
E34(N) River cliff: Cassie Burn		
Peacock?s Clava Site IV	276370	843740
E10(N) River cliff; Cassie Burn		
Peacock?s Clava site V.	276400	843770
E11(N) High river cliff; Cassie Burn		
Peacock?s site VI.	276460	843860
E3(N) Small exposure in bank of Cassie Burn.	276380	844010
E4 (N) Small exposures at site of British Association?s former ?small excavation 160 yards SW of the ?Ma	276460	844020
E2(N) Degraded river cliff; Allt Carn a Ghranndaich	276880	844080
E5 (N) ?Main Pit? of Clava.	276580	844110
E20(S) Ditch Section	270450	845060
E5(S) Pit dug in terrace which passes downstream into meltwater channel	278060	845230
E18(S) Long ditch section	270620	845670
E17(S) River cliff	270530	845830

Table 2: Additional observation points collected during re-survey of Sheet 85E, Nairn.

QUARTERSHE	NAME	STARTHEIGH	SE	EASTING	NORTHING	DEPTH	LITH	STRAT
NH85NW1A.	Ardersier Platform Construction Yar	2	10543	280780	857830	25	DRFTU	QUU
NH85NW14.	Ardersier Platform Construction Yar	1	10543	280750	857940	30	DRFTU	QUU
NH85NW13.	Ardersier Platform Construction Yar	3	10543	281860	857290	15	DRFTU	QUU
NH85NW15.	Ardersier Platform Construction Yar	1	10543	280520	858180	30	DRFTU	QUU
NH85NW2.	Ardersier Platform Construction Yar	5	10544	280290	858230	10	DRFTU	QUU
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	2	FILLU	MGR
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	10	S	RMDF2
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	12	S	RTFDD
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	18	Z	ARDS
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	26	SC	TILL6
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	30	V	GSG _LENS
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	31	CS	TILL6
NJ06SE1.	Findhorn Foundation	7	0	305130	863710	42	SDST	SDST1

Table 3: Additional boreholes not previously entered into SOBI.

Data (Geological)

The superficial polygons were taken from the DigMap digital files:

- sc0095 Elgin and Buckie superficial
- sc085w Knockando superficial
- sc094e Findhorn superficial
- sc083e Beauly superficial
- sc084e Nairn superficial
- sc084w Fortrose superficial
- sc085e Glenfiddich superficial

The bedrock polygons were interpreted from recent mapping projects and the knowledge gained from the senior geologist for the area.

Data (rasters and shapefiles)

Topographic maps at 1:1 000 000 scale were extracted for the project area.

5 Dataset integration

All data were brought together in the GSI3D modelling software where it can be viewed and interrogated in 2D and 3D.

6 Model development log

The model was largely completed before the introduction of the new metadata format and a detailed log was not kept. Checks were undertaken throughout the construction of the GSI3D model and on completion the sections were checked before the model was released see Table 4.

Section Names	Checks?	Date snapped to crossing sections and outcrops	Initials
Main_section	Slight change to AZRU envelopes	23/10/2013	klwi
Regional_NS_1	Slight change to AZRU envelopes	23/10/2013	klwi
Regional_NS_2		23/10/2013	klwi
Regional_NS_3		23/10/2013	klwi
Regional_NS_4		23/10/2013	klwi
Regional_NS_5	Slight change to UIIN envelope and sea level	23/10/2013	klwi
Regional_NS_6	Unsure about PRNT unit - screen print provided	23/10/2013	klwi
Regional_NS_7		23/10/2013	klwi
Regional_WE_1	Unsure about PRNT unit - screen print provided	23/10/2013	klwi
Regional_WE_2	Deleted a small QUU unit within QUU unit	23/10/2013	klwi
Regional_helper_1		23/10/2013	klwi
regional_helper_2	Deleted duplicate ORS unit which was outwith section	23/10/2013	klwi
Regional_helper_3		23/10/2013	klwi
regional_helper_4		23/10/2013	klwi
Regional_helper_5		23/10/2013	klwi
regional_helper_6		23/10/2013	klwi
regional_helper_7	Added very small area of QUU unit	23/10/2013	klwi
regional_helper_8		23/10/2013	klwi
regional_helper_9		23/10/2013	klwi
regional_helper_10		23/10/2013	klwi
regional_helper_11		23/10/2013	klwi
offshore_1		23/10/2013	klwi
regional_helper_12		23/10/2013	klwi
regional_helper_13		23/10/2013	klwi
regional_helper_14	Section did not exist in REGIONAL_FOR_ZOOM_15TH_JAN_10h.GSIPR		

Table 4: List of cross-sections which have been checked.

7 Model workflow

The methodology for construction of models in GSI3D is described in detail by Kessler et al. (2008; http://nora.nerc.ac.uk/3737/1/OR08001.pdf). It principally involves construction of cross-sections between the best quality borehole data, (Figure 4), followed by envelope construction around the limits of the geological units.

8 Model assumptions and limitations

- The model was produced for a hydrogeological modelling software package and the limitations were set by the users of this software, that is requesting only 4 units to be modelled.
- The model does not reflect the full complexity of the superficial and bedrock geology. The model was constructed to show a simplified geological model for use in other modelling software and as such shows a basic interpretation of superficial and bedrock geology within the project area.
- The NEXTMap® Digital Elevation Model may contain artefacts such as trees or artificial structures such as pylons. If any of these artefacts were found during the modelling then the effects of these were minimised in the model as much as possible.

9 Model images

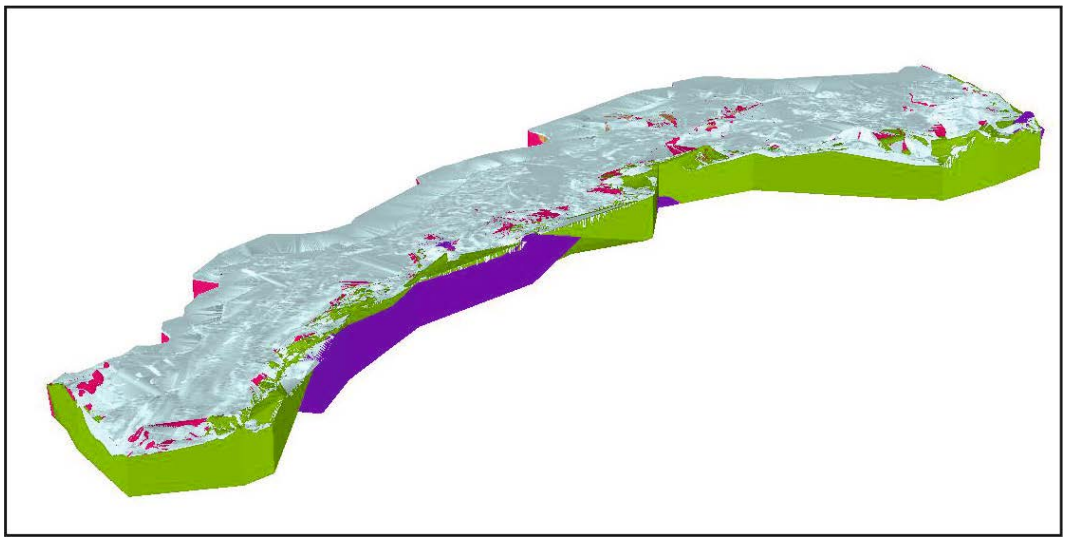

Figure 5: Final model as seen in 3D window, the Quaternary unit (blue) occurs over nearly all of the area. Looking northwards, vertical exaggeration x5

Figure 6: Final model exploded as seen in 3D window to show all layers. Looking northwards, vertical exaggeration x5.

References

British Geological Survey holds most of the references listed below, and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at: http://geolib.bgs.ac.uk.

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