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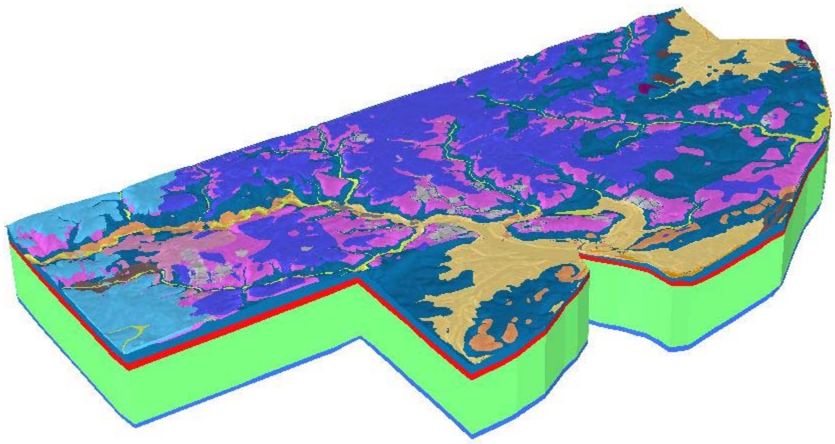
Model metadata summary report for the Colchester LithoFrame 10-50 model

Geology and Landscapes Programme

Open Report OR/13/001



BRITISH GEOLOGICAL SURVEY

GEOLOGY & REGIONAL GEOPHYSICS PROGRAMME

OPEN REPORT OR/13/001

Model metadata summary report for the Colchester LithoFrame 10-50 model.

S. Mathers

Keywords

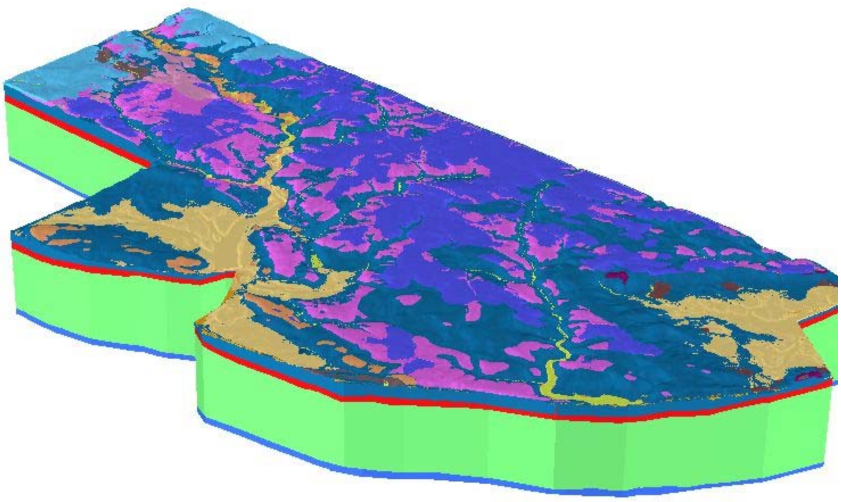
3D Modelling, metadata

Front cover& frontispiece

Cover picture the complete calculated block model of the Colchester area viewed from the southwest. *Frontispiece* the model from the southeast.without artificial deposits.

Bibliographical reference

MATHERS, S.J.2013. Model metadata summary report for the Ipswich-Sudbury LithoFrame 10-50 model. *British Geological Survey Open Report*, OR/13/001 12pp.



Keyworth, Nottingham British Geological Survey 2013

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Summary

This report is the published product of a regional GSI3D model of the Colchester area of southern East Anglia and north Essex. The model was assembled between 2006-08 concurrently with surveying of the parts of the area within the Colchester and Brightlingsea 1:50 000 mapsheets (BGS, 2010) by S.J. Mathers, the TL92 sheet was appended in 2011.

1 Modelled volume, purpose and scale

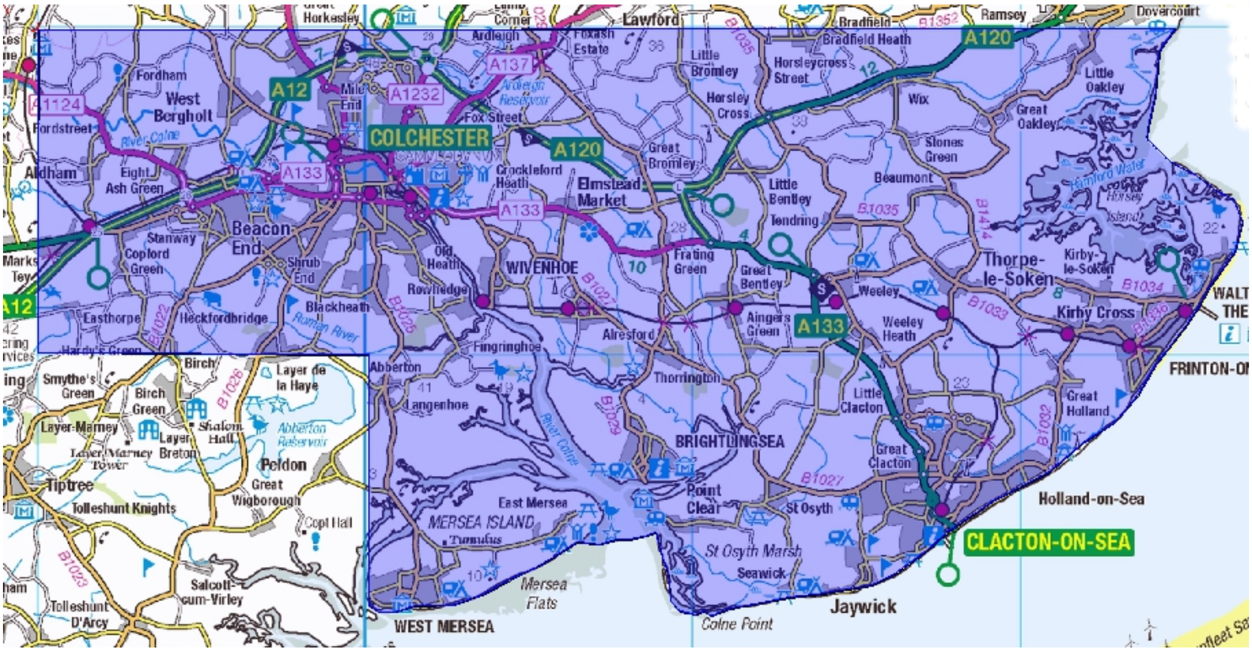

Figure 1. Extent of the Colchester model in mauve, OS topography © Crown Copyright.

The model covers the 1: 25 000 sheets TL 92 and TM 01,11,21,02,12,22, (Figure 1) covering approximately 500 km^2. It was built in 2006-08 for the six TM 25K sheets as a systematic model build using combinations of the individual tiles (01-11-21, 02 and 12-22) and then amalgamated in 2008. In 2011 TL92 was added to produce a single unified model. The model was constructed using 1: 10 000 digital linework with all the TM sheets produced as part of an integrated mapping-modelling resurvey. The TL 92 portion of the model will enabled revision of the approved 1: 10 000 superficial and bedrock linework, the simple linework means that the 50K maps of these areas included in the combined Colchester, and Brightlingsea mapsheet closely resembles the 10K dataset.

The model was funded as a science budget activity.

The model extends down to the base of the Cretaceous succession in the area at about -300m OD, the Gault Formation is the lowest modelled unit. The model contains 3 artificial 17 superficial, 5 bedrock units, and a single lens unit within the Anglian glacigenic sequence at Marks Tey.

The final project file is saved as Colchester_V21.gsipr.

No faults are modelled within the area although one single small fault has been drawn into sections as a steep ramp in the base of the affected bedrock units on the TL92 mapsheet.

The model has been calculated using GSI3D 2012 utilising the superficial (sections and envelopes) calculation option. Figure 2 below shows the arrangement of cross-sections drawn to construct this model.

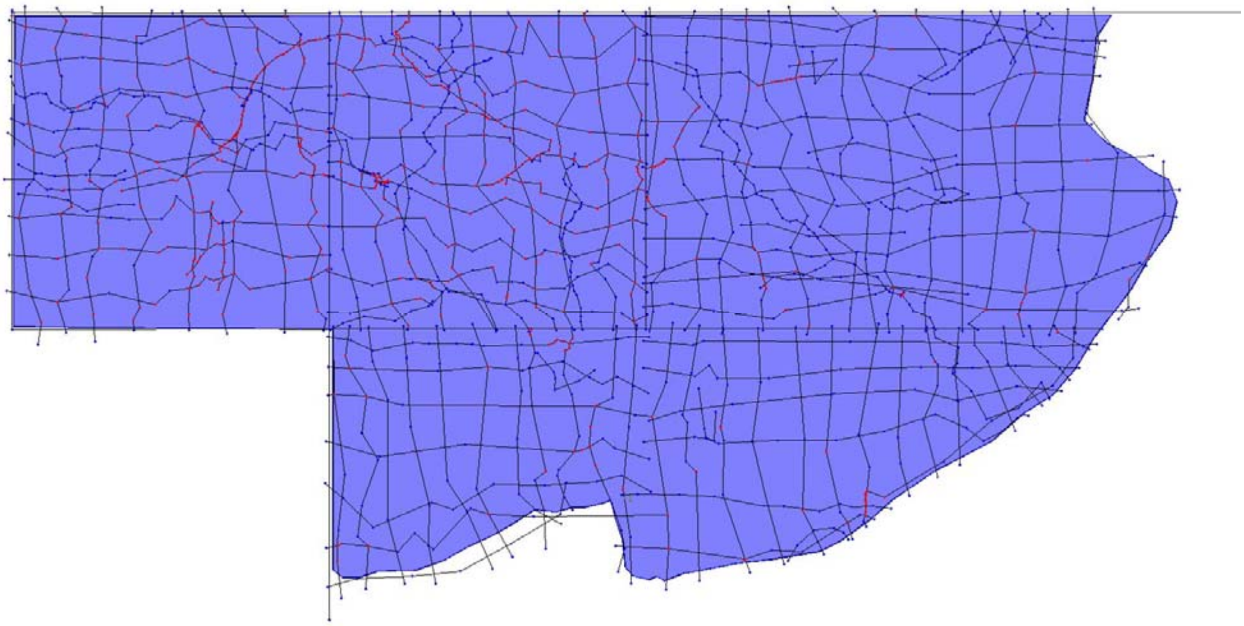

Figure 2. Cross sections in the Colchester model.

The complete model takes about 10 minutes to calculate on a Dell Precision M6700

2 Modelled surfaces/volumes

Geological units in the model are as follows

code	name
mgr	Made ground
wgr	Worked ground
wmgr	Worked and made ground
stobco	Shoreface and beach upper layer (along coast)
alv	Main Freshwater Alluvium
itdu	Intertidal Deposits undifferentiated
stob	Shoreface and beach deposits lower layer
isc	Interglacial silt and clay
head1	Head (silt reworked loess?)
brk	Brickearth (local overbank deposits on terraces)
rtdu	River Terrace Deposits undifferentiated
lde1	Lacustrine deposits (Clacton and Marks Tey)
gstc	Glacial Silt and Clay supramain till
gsg	Glacial Sand and Gravel supramain till

loft	Lowestoft Till (main sheet)
gstcb1	Glacial Silt and Clay below till 1
gsgb1	Glacial Sand and Gravel below till 1
gcd	Glacial Channel deposits
igd	Interglacial deposits (Little Oakley)
kes	Kesgrave Sand and Gravel
BEDROCK	
rcg	Red Crag Formation
tham	Thames Group
llte	Lower London Tertiaries
ck	Chalk Group undiff
glt	Gault Formation
LENS	
gsg1t	Glacial Sand and Gravel in main till sheet (top)
gsg1	Glacial Sand and Gravel in main till sheet (base)

The sequence shares a common *.gvs with the adjacent Ipswich-Sudbury area model.

Multiple layers of storm beach deposits were needed to cope with interdigitated sequences and Holocene evolution. The Anglian glacigenic sediments shown above in blue comprise the Lowestoft Formation and within them a single lens is identified (gsg1). Legend colours in many cases loosely correspond to the 50K published map sheets. The difficulty in separating the thin Thanet Sand Formation from the Reading Formation (Lambeth Group) has resulted in the use of the older Lower London Tertiaries term being used for this package of strata. The Harwich and London Clay Formations cannot be mapped out separately and are lumped together as the Thames Group.

The model abuts the Ipswich-Sudbury model to the north (Mathers, 2012), shared docker sections ensure a common interpretation along the join at northing 30.

3 Modelled faults

No faults are modelled within the area although one single small normal fault has been drawn into sections as a steep ramp in the base of the affected bedrock units on the TL92 mapsheet.

4 Model datasets

GVS & GLEG files

These files were assembled in a combination of Notepad, Wordpad and Excel and iterated as the model expanded and new units were encountered. The current files are Regional_V9.gvs and Regional_v10.gleg. The model colour schema is shown below in Figure 3.

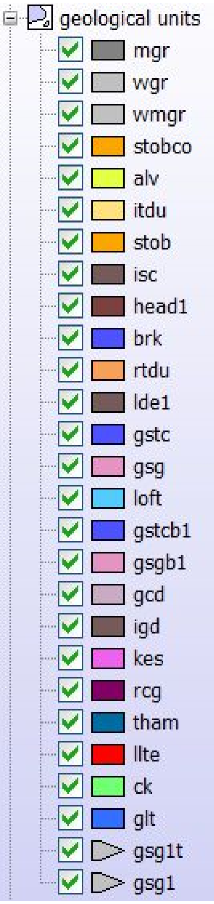

Figure 3. The colour schema used.

Boreholes

Borehole records examined as indicated below. Many start heights were revised in SOBI and some grid references corrected by the data management team. Closely clustered sets of boreholes were not all coded but the deepest and most representative were included; any significant local variation in sequence was also recorded by coding. Entries were all made directly into the corporate Boge data entry application with sjma as the interpreter in all cases.

TL92 borehole coding TL92NW 1-43 TL92NE 1-388, TL92SW 1-125 and TL92SE 1-388 were examined by S J Mathers in 2011.

TM01 borehole coding TM01NW1-7, TM01NE1-96, TM01SW 1-6 and TM01SE 1-2 were examined by S J Mathers in 2011.

TM11 borehole coding TM11NW1-8, TM11NE1-7, TM11SW 1-5, andTM11SE1-9 were examined by S J Mathers in 2011.

TM21 borehole coding TM21NW1 was examined by S J Mathers in 2011.

TM02 borehole coding TM02NW1-219, TM02NE1-139, TM02SW1-99 and TM02SE1-118 were examined by S J Mathers in 2011.

TM12 borehole coding TM12NW1-49, TM12NE1-30, TM12SW1-48 and TM12SE1-21 were examined by S J Mathers in 2011.

TM22borehole coding TM22NW1-7, TM22SW1-30 and TM22SE1-2 were examined by S J Mathers in 2011.

Rasters

Geo referenced raster backdrops taken from Figure 14 of the Braintree memoir (Ellison & Lake 1986) have been used to align and construct portions of sections Marks Tey_Section A,B and C.

Geological Linework

Modern 1: 10 000 scale digital linework was used throughout the TM sheets. Sheets TM 01 , 11, 21, 02, 12, and 22 were surveyed by S.J. Mathers in 2005-8 together with revisions of parts of TL92 NE and SE as far west as easting 98. Farther west the 1:10 560 survey data for the Braintree 1: 50 000 mapsheet (BGS 1982, Ellison & Lake, 1986) were utilised for the TL92 tile and considerably revised by the modelling. This has produced new linework for the whole of TL92 that should now be used to update the master 10K linework for both the Quaternary and bedrock themes.

DTM

Each 25K model tile was produced individually using a CEH or Nextmap DTM mainly with a 50m grid size. The merged model was initially capped by a CEH 100m dtm, this was then replaced by a Nextmap 100m and then the final models is capped but not snapped to a trimmed BGS Bald Earth dtm (with a 50m resolution) produced by combining elements of the OS Panorama dataset and the Nextmap 5M dataset. The data was extracted using the wizard provided within the software.The current file name Bald Earth_2 [TIN].

5 Dataset integration

The individual 25K model tiles were aggregated into two sets one for the TL sheet and one for the TM sheets as described above, these were subsequently merged into the complete model in 2011 which covers approximately 500 sq km of land area. Consistency between tiles was achieved by the use of docker sections iterated between the two tiles and then envelope merging using the polygon editing tools. The final workspace was assembled to include all sections, standard, helper and dockers, merged envelopes for all units, and a regional Nextmap 50m dtm supercede by the BGS Bald Earth model.

6 Model development log

The amalgamated model from 2011 supercedes the individual 25K sheet tiles The individual tiles in their pre amalgamation form with supporting files are stored as archived versions. The subsequent editing of the amalgamated model has not been transmitted back to the earlier individual model tiles. All entries by S J Mathers.

10 May 2011

Completed sections and imported a 50m grid to calculate the whole model **Southern_merge_v12.gsipr**

19 August 2011

Added the TL 92 tile, prepared a new dtm for enhanced area (untrimmed) and a cut back one for calculation (whole), added artificial deposits wgr, mgr, wmgr from new Colchester_Brightlingsea sheet, bedrock units are now faulted, saved as v15. Calculates well

8 January 2013

Added a BGS bald earth model at 50m resolution trimmed back to model area

Tidied the gsg1 lense at Marks Tey and produced envelope for the top this now works

Model is not totally snapped

Project saved as Southern merge_16 with faults and baselines and Southern merge_17 with the single fault stripped out and baselines converted to polygons

Calculation takes about 40 minutes

Mgr, wgr and wmgr have envelopes and are shown in sections

Several screen grabs made for this report all at VE x10

Added 2 llte helpers due to an upward bulge at Marks Tey

30-31 January 2013

Further revisions (extra sections, new dtm extent, unit name changes) following checking by Mark Barron saved as Colchester_v21.

25 April 2013

Further minor revisions following snapping by Ian Cooke saved as Colchester_v28

7 Model workflow

A standard GSI3D workflow (Kessler & Mathers, 2004; Kessler et al. 2009) for superficial geological models was followed, in the parts of the model surveyed as an integrated exercise (all TM) borehole coding was followed by the field survey, the 1: 10 000 geological lines were captured digitally by CartoGIS from field slips and/or fair drawn linework on plastic. The resulting 1:10 000 scale provisional shape files were then provided for use in modelling. Edits to the shape files were made iteratively as a result of the modelling, in particular subcrops at rockhead were revised with the benefit of a 3D visualisation of the geology.. It has been assembled and edited using the current versions of the GSI3D software since 2006 i.e. 2.0 - 2.6 - 2011 - 2012 (bedrock).

8 Model assumptions, geological rules used etc

Buried river terrace deposits were assumed to extend beneath and match of the distribution of overlying alluvium and intertidal deposits in river channels except in estuaries were more confined buried channels are found. The deposits die out upstream and are not found in the upper reaches of small streams and brooks.

Only the silt rich ?reworked Aeolian head deposits have been modelled the other head deposits shown on the mapsheeet are thin and have not been included in the modelling exercise. Worked, Made and Worked and made ground have been constructed in sections and mapped polygons have been inserted into the geological units however helper sections have not been constructed to allow 3D volumes of these areas within the model stack. calculation.

Helper sections usually only correlate the units they are intended to inform

The Chalk group is treated as a single unit

The Lower London Tertiaries comprise mainly Reading Formation overlying deposits of the Thanet Sand Formation as noted from surface outcrops and some boreholes.

9 Model limitations

- Head in most forms excluded from the calculation of the model
- Artificial deposits not modelled sufficiently to produce 3D volumes but inserted in some sections and polygons have been included in geological units.
- Chalk Group, Lower London Tertiaries and Thames Group are not subdivided in the model at this stage.
- No attempt has been made to classify levels of the River Terrace Deposits or the Kesgrave Sand and Gravel into distinct terrace levels.
- The model is suitable for use at resolutions higher than 100K but not beyond 5K or for any detailed site specific investigations.
- The model extends to the base of the Cretaceous across the whole area, in this area the Cretaceous rests with marked angular unconformity on Palaeozoic basement rocks.
- The model is not snapped between envelopes and sections

10 Model images

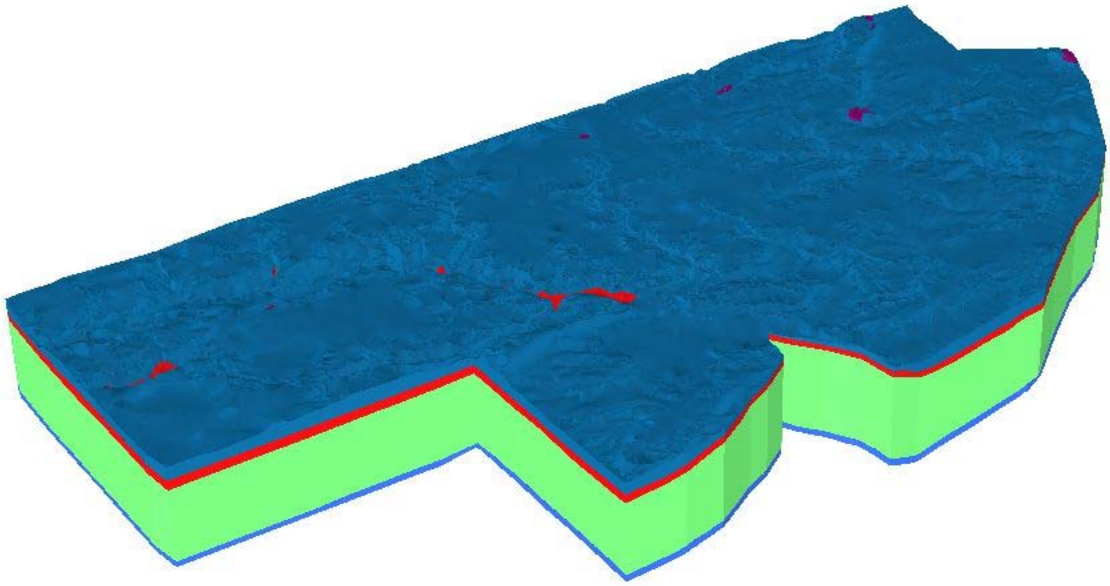

Figure 4. Bedrock geology for colours see Figure 3. (note maroon Red Crag blue Thames Group, red Lower London Tertiaries, green Chalk royal blue Gault Clay at base.). VE x10.

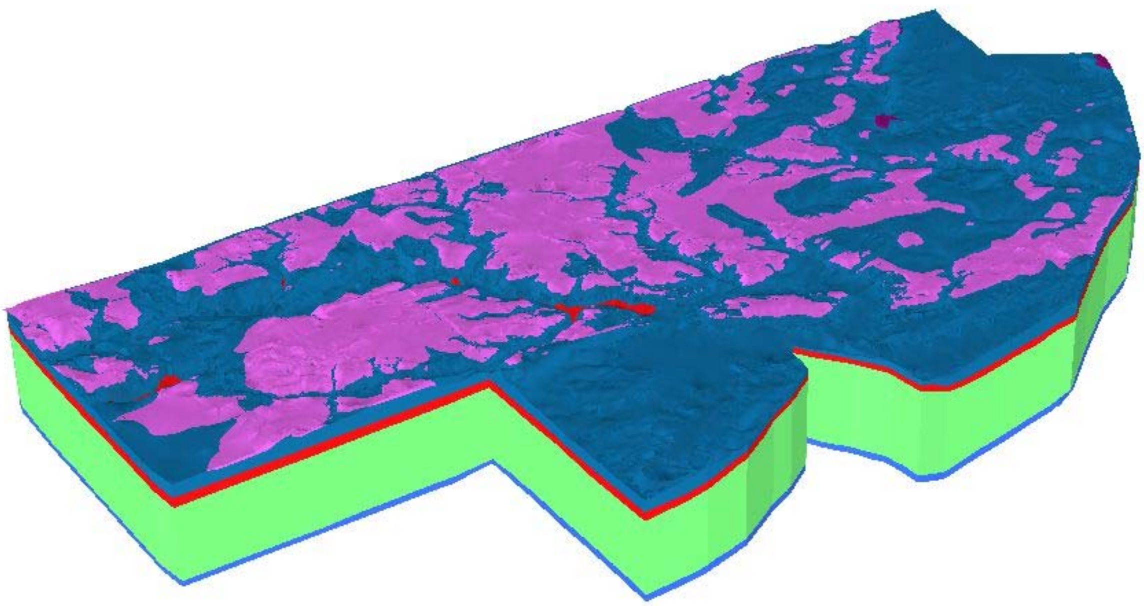

Figure 5. Pre Anglian glaciation units for colours see Figure 3.

(note Kesgrave Sand and Gravel dark pink). VE x10

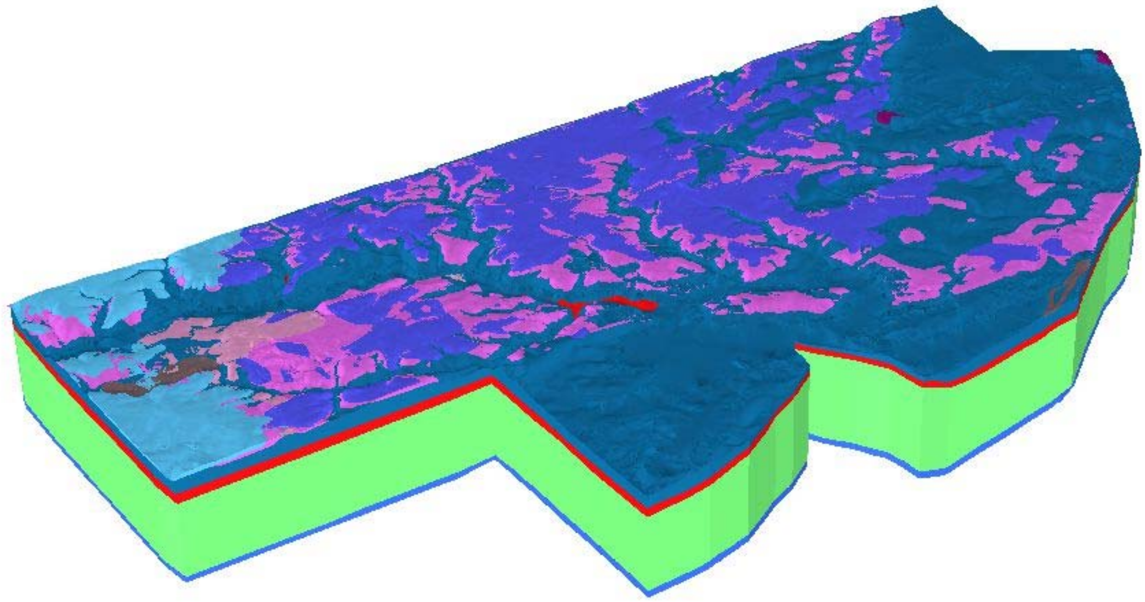

Figure 6. Including Anglian glaciation and Marks Tey and Clacton Hoxnian interglacial deposits for colours see Figure 3. (note Lowestoft Till sky blue, Glacial sand and gravel layers all pale pink and Glacial Silt and Clay layers blue, lacustrine deposits at Marks Tey brown) VE x10.

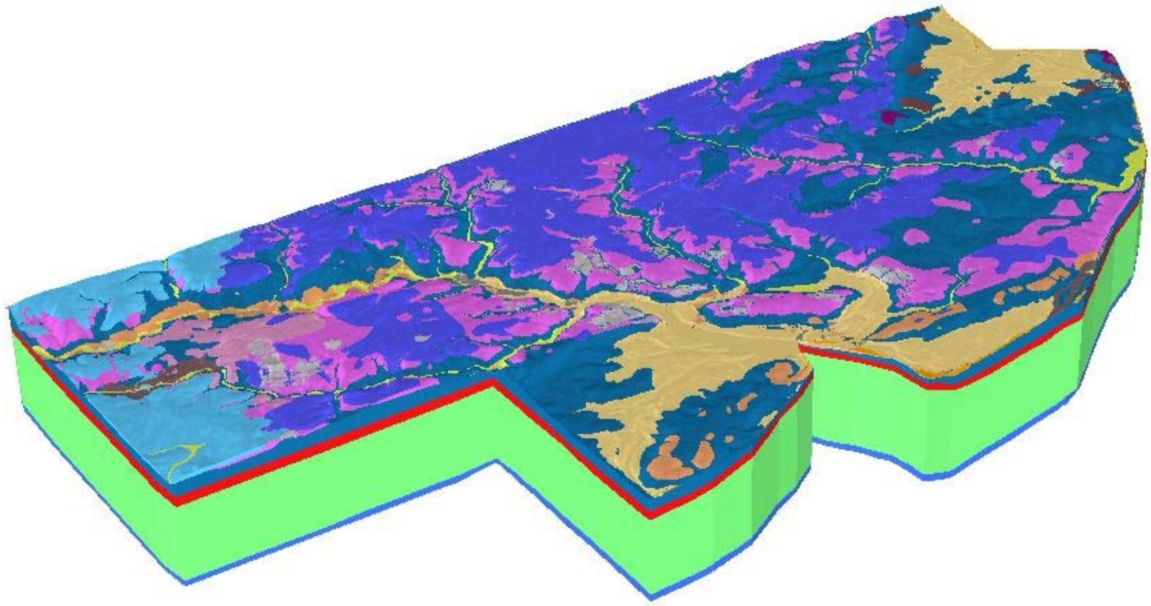

Figure 7. The Complete model from the southwest for colours see Figure 3. VE x10

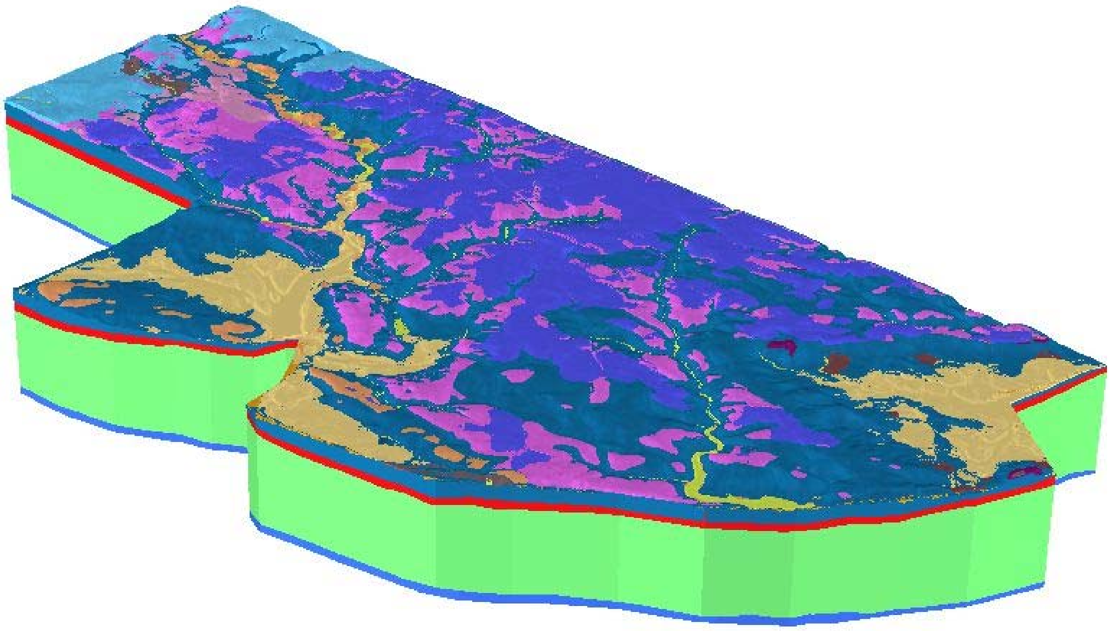

Figure 8. The model without artificial deposits from the southeast for colours see Figure 3. VE x10.

11 Model uncertainty.

To-date no attempt has been made to quantify the uncertainty in this model

Glossary

DTM	Digital Terrain Model – Model of surface of the solid Earth (generally the boundary between geosphere and atmosphere or hydrosphere). This is traditionally derived from OS contours and spot heights and should therefore exclude all buildings, trees, hedges, crops, animals etc. Sometimes also referred to as 'bald earth' models
Envelope	Defined here as the extent of a geological deposit in plan view (2D): forming a distribution map of the particular unit, a presence – absence map.
GSI3D	Geological Surveying and Investigation in 3D

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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