BGS INFORMATICS

User Guide: BGS newGeoSure Insurance Product (newGIP)

Open report OR/12/089

British Geological Survey

BRITISH GEOLOGICAL SURVEY

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BRITISH GEOLOGICAL SURVEY

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The London Information Office also maintains a reference collection of BGS publications, including maps, for consultation.

We publish an annual catalogue of our maps and other publications; this catalogue is available online or from any of the BGS shops.

The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as basic research projects. It also undertakes programmes of technical aid in geology in developing countries.

The British Geological Survey is a component body of UK Research and Innovation.

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Foreword

The British Geological Survey (BGS) is a world-leading geological survey, focusing on public-good science for Government and research to understand earth and environmental processes.

We are the UK's premier provider of objective and authoritative geoscientific data, information and knowledge to help society to:

- use its natural resources responsibly
- manage environmental change
- be resilient to environmental hazards

We provide expert services and impartial advice in all areas of geoscience. As a public sector organisation, we are responsible for advising the UK Government on all aspects of geoscience as well as providing impartial geological advice to industry, academia and the public. Our client base is drawn from the public and private sectors both in the UK and internationally.

The BGS is a component body of the Natural Environment Research Council (NERC), part of UK Research and Innovation (UKRI).

DATA PRODUCTS

BGS produces a wide range of data products that align to Government policy and stakeholder needs. These include baseline geological data, engineering properties and geohazards datasets. These products are developed using in-house scientific and digital expertise and are based on the outputs of our research programmes and substantial national data holdings.

Our products are supported by stakeholder focus groups, identification of gaps in current knowledge and policy assessments. They help to improve understanding and communication of the impact of geo-environmental properties and hazards in Great Britain, thereby improving society's resilience and enabling people, businesses, and the government to make better-informed decisions.

Acknowledgments

This report is the published product of a study by the British Geological Survey (BGS) to produce a digital dataset provides the potential insurance risk due to natural ground movement across Great Britain. The methods used to derive and process the data, and the compilation of this report, were determined by KA Lee, KAM Adlam, DP Boon, C Dashwood, RS Lawley, RM Lark, and J Thompson.

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The *new*GeoSure Insurance Product (*new*GIP) provides the potential insurance risk due to natural ground movement. It incorporates the combined effects of the 6 GeoSure hazards on (low-rise) buildings: landslides, shrink-swell clays, soluble rocks, running sands, compressible ground and collapsible deposits. These hazards are evaluated using a series of processes including statistical analyses and expert elicitation techniques to create a derived product that can be used for insurance purposes such as identifying and estimating risk and susceptibility. The evaluated hazards are then linked to a postcode database - the Derived Postcode Database (DPD), which is updated biannually with new releases of Ordnance Survey Code-Point® data (current version used: 2024.3). The *new*GIP is provided for national coverage across Great Britain (not including the Isle of Man). This product is available in a range of GIS formats including text (*.txt) or ArcGIS (*.shp). The *new*GIP is produced for use at 1:50 000 scale providing 50 m ground resolution.

This user guide provides the information required to enable the reader to understand and use this BGS data product. This document accompanies the release (May 2024) of the *new*GeoSure Insurance Product and included Derived Postcode Database.

For more information on the full GeoSure dataset, please refer to the ‘User Guide for the GeoSure dataset (version 8)’ (Lee, et al., 2018).

Further information on all the digital data provided by the BGS can be found on our website at http://www.bgs.ac.uk/products/home.html or by contacting:

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1 Introduction

Founded in 1835, the British Geological Survey (BGS) is the world's oldest national geological survey and Britain's premier centre for earth science information and expertise. The BGS provides expert services and impartial advice in all areas of geoscience. Our client base is drawn from the public and private sectors both in Great Britain and internationally.

Our innovative digital data products aim to help describe the ground surface and subsurface for the whole of Great Britain. These digital products are based on the outputs of the BGS survey and research programmes and our substantial national data holdings. This data coupled with our in-house geoscientific knowledge are combined to provide products relevant to a wide range of users in central and local government, insurance and housing industry, engineering and environmental business, and the British public.

The ***new*GeoSure Insurance Product** takes into consideration six different Geographical Information System (GIS) layers, with each layer representing a different natural ground stability hazard that occurs in Great Britain. The baseline information is derived from polygon (area) layers, which are described using a straightforward A to E potential hazard classification. This document provides information for insurers on the combined effects of the six ground stability hazard layers, together forming the *new*GeoSure Insurance Product.

1.1 BACKGROUND TO THE DATASET

Public understanding of the effect of ground conditions on the safety of their property and the implication for the value of their property is growing. Information about geological hazards is needed, in particular, the identification of areas with a potential for ground movement.

In response to this, The British Geological Survey initiated a development programme to produce datasets that identified and assessed potential geohazards threatening the human environment in Great Britain. Along with the GeoSure ground stability datasets, the programme also generated:

- Superficial deposit thickness models
- Scans of onshore borehole logs for Great Britain
- Scans of geology and historic topography maps
- Ground permeability data
- Susceptibility to groundwater flooding data
- Geological indicators of past flooding data
- Sustainable Urban Drainage Systems models
- Soil Parent Material Model
- Non-coal mining hazards data

1.2 DEVELOPMENT HISTORY

The GeoSure Insurance Product was first released in 2005 and is the result of a detailed interpretation process, starting with 'BGS Geology 50k' (formerly DiGMapGB-50) at the 1:50 000 scale. In 2003, the BGS first published a series of GIS digital maps identifying areas of potential natural ground movement hazard in Great Britain (not including the Isle of Man), called GeoSure. In 2005, BGS used the GeoSure maps to make an interpretation of subsidence insurance risk for the British property insurance industry, released as the **GeoSure Insurance Product (GIP)**. This represents the combined effects of the 6 GeoSure hazards on low-rise buildings in a postcode database – the **Derived Postcode Database** – which can be accompanied by GIS maps showing the most significant hazard areas. The combined hazard was represented numerically in the Derived Postcode Database as the *Total Occurrence Factor*, with a breakdown into the component hazards.

With the continued development of the individual 6 GeoSure hazard layers resulting in modifications to methodologies and data output, it was also considered important to review the Insurance Product. This task was undertaken in 2011-13. BGS strives to provide the best

information possible at the time of development and therefore a new improved version (*new*GIP) has been developed and released.

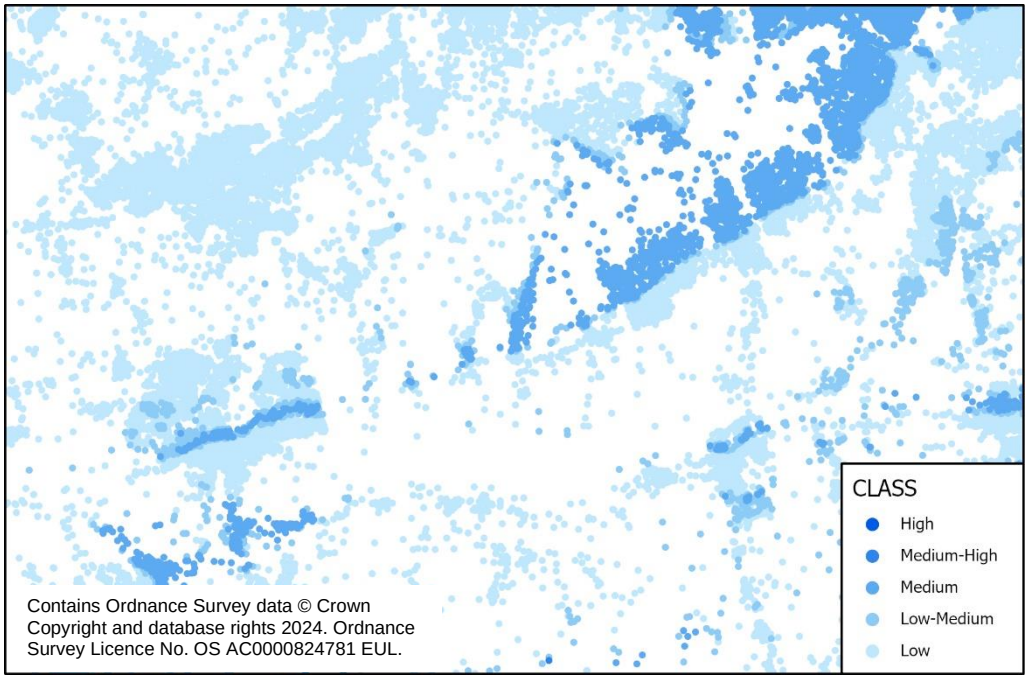

Figure 1 Example of the *new*GIP data.

1.3 WHO MIGHT REQUIRE THIS DATA?

This dataset has been specifically developed for the insurance of low-rise buildings. The GeoSure datasets have been developed to identify the potential hazard for low-rise buildings and those with shallow foundations of less than 2 m deep.

Natural ground stability hazards may lead to financial loss for anyone involved in the ownership or management of property, including developers, householders or local government. These costs could include increased insurance premiums, depressed house prices and, in some cases, engineering works to stabilise land or property. Armed with knowledge about potential hazards, preventative steps can be put in place to alleviate the impact of the hazard to people and property. The cost of such prevention may be very low, and is often many times lower than the repair bill following ground movement.

The identification of ground instability and other geological hazards can assist regional planners; rapidly identifying areas with potential problems and aid local government offices in making development plans by helping to define land suited to different uses. Other users of these data may include developers, homeowners, solicitors, loss adjusters, the insurance industry, architects and surveyors.

2 Source datasets

The *new*GIP is derived from the GeoSure ground stability data. GeoSure consists of six data layers in Geographical Information System (GIS) format that identify areas of potential hazard in Great Britain. Each layer has national coverage. These data have been produced by geologists, geotechnical specialists and information developers at the British Geological Survey and are presented as separate GIS data layers relating to the cause of the geohazard. These are explained in brief below:

2.1 SHRINK SWELL

Swelling clays can change volume due to variation in moisture, this can cause ground movement, particularly in the upper two metres of the ground that may affect many foundations. Ground moisture variations may be related to a number of factors, including weather variations, vegetation effects (particularly growth or removal of trees) and human activities. Such changes can affect building foundations, pipes or services.

2.2 LANDSLIDES (SLOPE INSTABILITY)

Slope instability occurs when particular slope characteristics (such as geology, gradient, sources of water, drainage, or the actions of people) combine to make the slope unstable. Down slope movement of materials, such as a landslide or rockfall may cause damage, such as a loss of support to foundations or services or, in rare cases, impact damage to buildings.

2.3 SOLUBLE ROCKS (DISSOLUTION)

Ground dissolution occurs when certain types of rocks, containing layers of soluble material, get wet and the soluble material dissolves. This can cause underground cavities to develop. These cavities reduce support to the ground above and can lead to a collapse of overlying rocks.

2.4 COMPRESSIBLE GROUND

Some types of ground may contain layers of very soft materials like peat or some clays. These may compress if loaded by overlying structures, or if the groundwater level changes. This compression may result in depression of the ground surface, potentially disturbing foundations and services.

2.5 COLLAPSIBLE DEPOSITS

Some kinds of rocks and soils may collapse when a load (such as a building or road traffic) is placed on them, especially when they become saturated. Such collapse may cause damage to overlying property or services.

2.6 RUNNING SAND

Some rocks and soils can contain loosely packed sandy layers that can become fluidised by water flowing through them. Such sands can ‘run’ (or flow), potentially removing support from overlying buildings and causing damage.

3 What the *new*GIP dataset shows

The ***new*GeoSure Insurance Product** uses the individual GeoSure data layers (briefly described above) and evaluates them using a series of processes including statistical analyses and expert elicitation techniques to create a derived product that can be used for insurance purposes such as identifying and estimating risk and susceptibility.

The *new*GIP is made up of 3 components:

1. Derived Postcode Dataset, which incorporates the combined hazard rating
2. Unified Hazard Vector Layer
3. Unified Hazard Grid Layer

Analysis of the distribution of the total scores concluded that there was no justification for using natural breaks to divide the data into categories. Therefore, the data is divided into 5 equal categories as shown in **Table 1** below:

Table 1 Class categories of *new*GIP

Class	Total score range
High	1600 to 2000
Medium-High	1200 to 1599
Medium	800 to 1199
Low-Medium	400 to 799
Low	0 to 399

3.1 DERIVED POSTCODE DATABASE

The Derived Postcode Database (DPD) contains generalised information at a postcode level. The DPD is designed to provide a 'summary' value representing the combined effects of the GeoSure dataset across a postcode sector area. It is available as a GIS point dataset (.shp) or a text (.txt) file format.

This product uses Code-Point® Open data to relate postcodes to Ordnance Survey grid references. The use of Code-Point® Open data is governed by the OS OpenData™ licence and is subject to the terms at www.ordnancesurvey.co.uk/opendata/licence. The DPD contains a normalised hazard rating for each of the 6 GeoSure themes hazards (i.e. each GeoSure theme has been balanced against each other) and a combined unified hazard rating for each postcode in Great Britain. The combined hazard rating for each postcode is available as a standalone product.

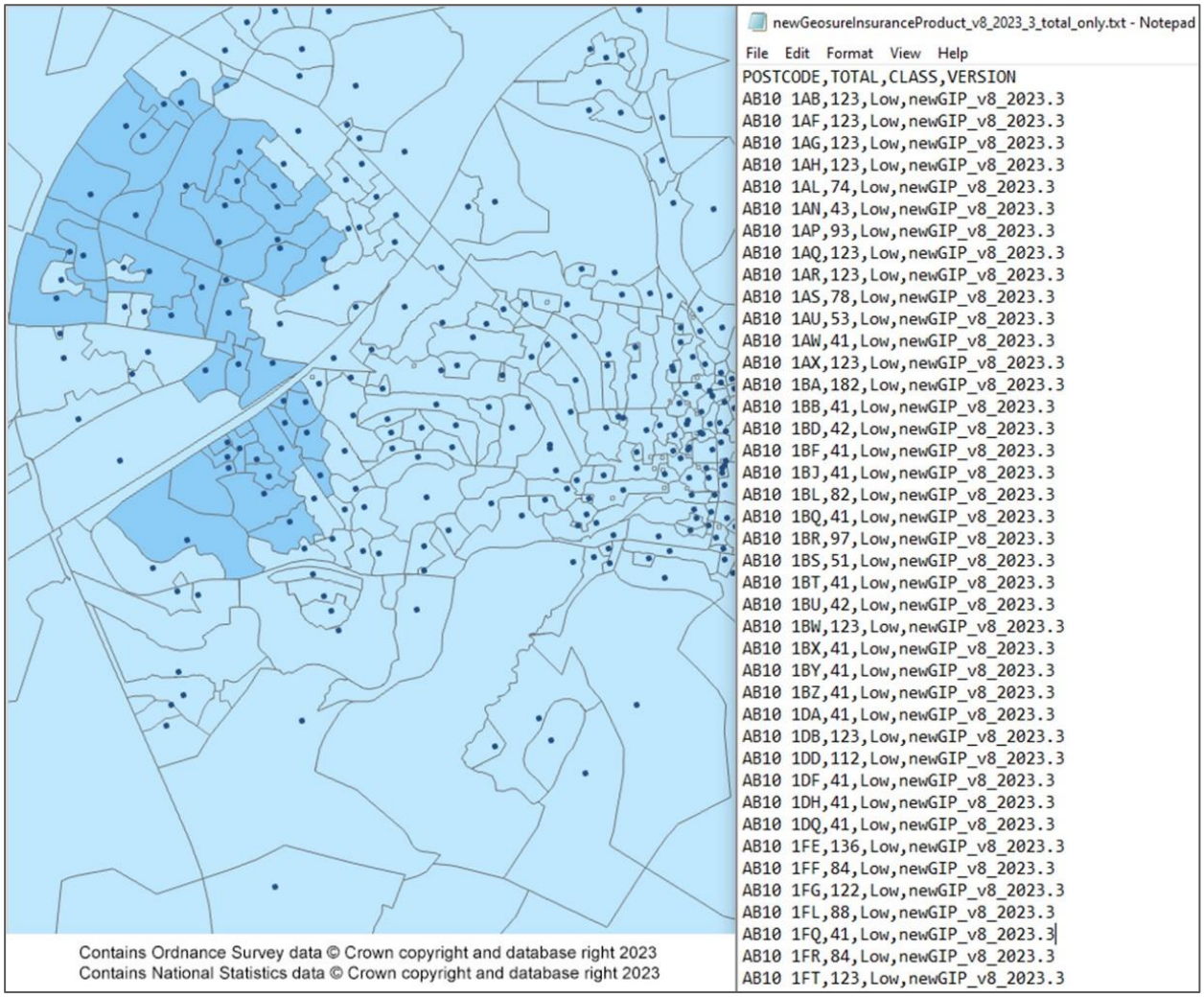

Figure 2 Snapshot from the Derived Postcode Database

3.2 VECTOR DATASET (UNIFIED HAZARD DATA LAYER)

This is a detailed vector dataset (**Figure 3**) providing spatial GIS information that can be used for more specific analysis at a higher resolution (e.g. site/address specific at 1:50 000 resolution). This dataset also has additional attributes outlining the type and scale of the potential hazards at any one location (see section 4.3.1).

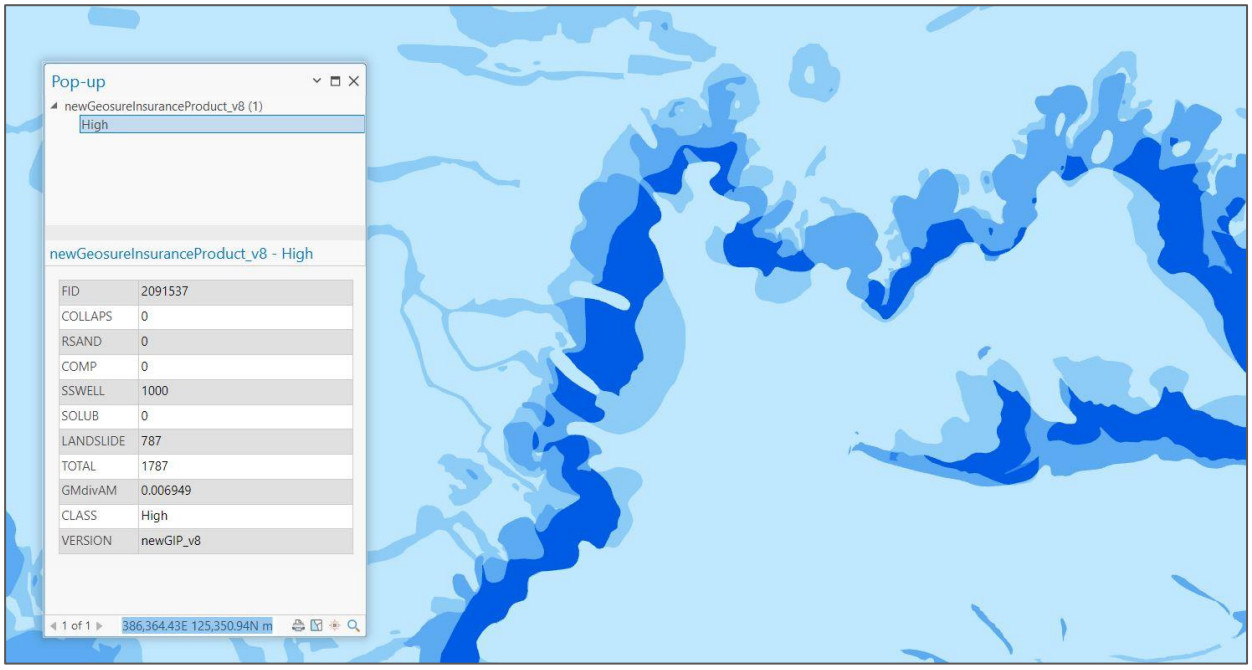

Figure 3 Example from the detailed Vector Dataset

3.3 GRID DATASET (UNIFIED HAZARD DATA LAYER)

This dataset (**Figure 4**) consists of a raster grid, spatially similar to the principal vector dataset, however due to the raster grid format the grid only carries limited attribution. (See section 4.3.1).

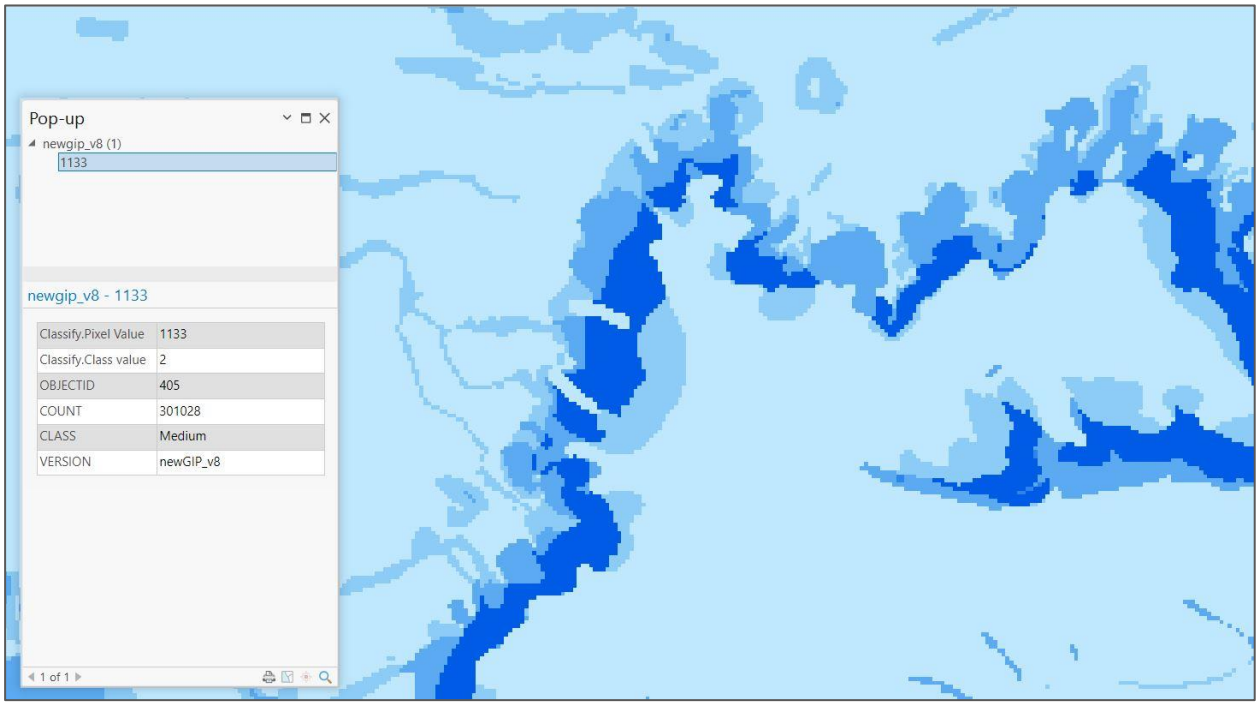

Figure 4 Example from the Grid Dataset

4 Technical information

4.1 DEFINITIONS

Hazard A potentially damaging event or phenomenon.

Risk The impact of the hazard on people, property or capital.

The *new*GeoSure Insurance Product dataset (*new*GIP) takes the six hazard potential layers from GeoSure and brings them into a comparable scale using a measure of expected impact through expert elicitation. It is designed to provide the geological input to a more detailed insurance risk model.

4.2 SCALE

The *new*GeoSure Insurance Product dataset is produced for use at 1:50 000 scale providing 50m ground resolution.

4.3 FIELD DESCRIPTIONS

4.3.1 *new*GeoSure Insurance Product: Vector Dataset (non postcode)

Field descriptions.

Field name	Field description	Individual hazard score ranges*
COLLAPSE	The individual hazard score value for collapsible deposits.	0 - 18
RSAND	The individual hazard score value for running sand	0 - 22
COMP	The individual hazard score value for compressible ground.	0 - 148
SSWELL	The individual hazard score value for shrink swell.	0 - 1000
SOLUB	The individual hazard score value for soluble rocks (dissolution).	0 - 73
LANDSLIDE	The individual hazard score value for landslide.	0 - 787
TOTAL	The total combined score of all 6 hazards.	0 - 2000
GMdivAM	The ratio between geometric and arithmetic means.	0> GM/AM <1
CLASS	Classification of the insurance hazard potential.	(Low-High)
VERSION	Dataset name and version number.	e.g.“newGeosureInsurance Product_v8_2024_3” (GeoSure v8 & OS Postcode Data v2024.3)

*The ranges shown in the right-hand column in the table above show the scores for each individual hazard after rescaling to a maximum of 1000. These scores, defined by the elicitation process, are not given units. They are measures of expected impact which are comparable between hazards. They can be summed over all hazards to give a meaningful total score for a given site. Both the individual scores and total scores are provided in the detailed vector dataset. See section 4.5 for further information.

4.3.2 *new*GeoSure Insurance Product: Derived Postcode Database Field descriptions

Field descriptions.

Field name	Field description
POSTCODE	The individual postcode.
SSWELL	The individual hazard score value for shrink swell.
COMP	The individual hazard score value for compressible ground.
LANDSLIDE	The individual hazard score value for landslide.
SOLUB	The individual hazard score value for soluble rocks (dissolution).
RSAND	The individual hazard score value for running sand.
COLLAPSE	The individual hazard score value for collapsible deposits.
TOTAL	The total combined score of all 6 hazards.
CLASS	Classification of the insurance hazard potential.
VERSION	Dataset name and version number.

4.3.3 *new*GeoSure Insurance Product: Grid Dataset

Field descriptions.

Field name	Field description
ROWID	Generated id within the dataset GIS.
VALUE	The total combined score of all 6 hazards.
COUNT	The ESRI pixel count showing number of cells in each class.
CLASS	Classification of the insurance hazard potential (0 Low - 4 High).
VERSION	Dataset name and version number.

4.3.4 newGeoSure Insurance Product colour look-up table.

Colour symbology for the newGIP dataset.

Data Classification	RED	GREEN	BLUE	HEX	LOOKS LIKE
CLASS	This cell shows the colour as intended	This cell shows the colour as intended	This cell shows the colour as intended	This cell shows the colour as intended	This cell shows the colour as intended
High	0	92	230	#005CE6	
Medium-High	45	133	235	#2E85EB	
Medium	92	171	242	#5CABF2	
Low-Medium	140	204	247	#8CCCF7	
Low	191	232	255	#BFE8FF	

4.4 STATISTICAL ANALYSIS OF THE VECTOR DATASET (GM/AM)

This layer is provided ***on request*** as additional information should users wish to analyse their data in more detail. This supplementary data layer is created by calculating the Geometric Mean divided by the Arithmetic Mean of the hazard scores.

Statistical information in the form of the ratio of Geometric to Arithmetic means is included the detailed product as a raster grid. The scores are plotted against the ratio between geometric mean and arithmetic mean in order to indicate how evenly or not the individual hazards contribute to the total score. This ratio provides a further level of information, indicating whether the total hazard score is dominated by one or a few hazards or has more or less uniform contributions from different hazards at a site. A ratio of 1 indicates that each geohazard has the same score; ratios approaching 0 indicate a total score comprising predominantly of one geohazard.

The ratio is only used in the detailed *new*GIP product (unified hazard data), not in the postcode based product. This is because the ratios are not additive and so it is not straightforward to give an interpretation to an area weighted average of the GM/AM ratio that is consistent with values used in the detailed products. The GM/AM ratio could be computed for scores across a postcode, but this would also have a different interpretation to the ratio in the detailed products.

Figure 5 Example from the GM/AM Raster Grid.

Field descriptions.

Field name	Field description
PIXEL VALUE	The GM/AM score. Ranges from 0.00339805 to 0.665277
STRETCHED VALUE	The values stretched to fit the range for display purposes

4.5 CREATING THE DERIVED POSTCODE DATASET

Reattribution of a spatially constrained geohazard onto an artificial spatial framework such as postcode areas presents a statistical conundrum. Postcodes are a collection of dwellings on a delivery ‘round’ and their shape is a simple Voronoi/neighbourhood fit of delivery points. Upscaling geo-hazards onto postcode areas begins to pose a significant problem when dealing with sparse populations (i.e. large postcode areas with few houses, widely spread geographically), because as postcode area increases, the likelihood of spatially intersecting a

higher susceptibility geohazard disproportionally increases (i.e. 30 houses scattered over 0.5 km^2 would be statistically weighted differently from 30 houses scattered over 50 km^2). To resolve this issue, for small postcode areas (where low rise buildings cover much of the area, i.e. urban areas), the area weighted average of the full postcode polygon gives a more accurate representation of the risk within that postcode. However, in larger postcodes (usually rural locations), where low rise buildings occur in isolated locations, it was felt that a circle of fixed diameter around a postcode polygon centroid (which is itself based on the location of dwellings) would provide a better representation of the risk to the dwellings themselves. Therefore, different methods are used for small and large (or urban and rural) postcodes. An area weighted average of the full postcode polygon is calculated for urban areas and 'rural' areas are calculated as buffered centroids.

4.6 INTERPRETATION OF THE HAZARD ZONES

4.6.1 Total hazard score divisions

The data is divided into five equal hazard score categories as shown in **Table 1** (see section 3).

4.6.2 Hazard class descriptors

A description and explanation for each hazard category is provided in the dataset and outlined below. They include examples of the type of geohazard that might be expected and the associated geological conditions possible.

The *new*GeoSure Insurance Product is essentially 'geological' in nature, indicating the potential for natural ground movement. Any indication of potential for levels of insurance risk due to ground movement are necessarily qualitative and could only be tested quantitatively against external insurance datasets (e.g. claims data) or the experience of insurance professionals.

Table 2 Hazard descriptor for the 'High' class

Class	High
Total Hazard Score	1600 to 2000
Description	High scores for two or more geohazards and/or medium scores for several geohazards.
Explanation	Many of the scores in this category relate to those areas with a high GeoSure rating for shrink-swell together with a high GeoSure rating for landslides. This combination occurs very rarely and does so when an area of high-plasticity clay occurs on a slope; examples of this can be found in the London area on soils derived from London Clay bedrock. The very highest Total Hazard Scores occur where alluvium overlies London Clay in an area where the Chalk is close to the ground surface; this combination results in high to medium hazard scores for compressible ground, landslides, running sand, shrink-swell and dissolution.
Note	Reference to the individual Hazard Scores in the GIS should indicate to users which of the hazards are present.

Table 3 Hazard descriptor for the 'Medium-High' class

Class	Medium-High
Total Hazard Score	1200 to 1599
Description	A combination of medium and high scores across several geohazards with varying impact levels.
Explanation	Examples within this category include units susceptible to dissolution (such as chalk or units containing salt) which occur together with deposits susceptible to other hazards (such as shrink-swell clays or compressible Made Ground).
Note	Reference to the individual Hazard Scores in the GIS should indicate to users which of the hazards are present.

Table 4 Hazard descriptor for the 'Medium' class

Class	Medium
Total Hazard Score	800 to 1199
Description	A combination of low, medium and high scores across several geohazards with varying impact levels.
Explanation	Examples within this category include stable bedrock overlain by peat or mudstones that have shrink-swell properties.
Note	Reference to the individual Hazard Scores in the GIS should indicate to users which of the hazards are present.

Table 5 Hazard descriptor for the 'Low-Medium' class

Class	Low-Medium
Total Hazard Score	400 to 799
Description	A combination of low and medium scores across several geohazards with varying impact levels.
Explanation	Examples within this category include stable bedrock overlain by alluvium or other unconsolidated superficial deposits.
Note	Reference to the individual Hazard Scores in the GIS should indicate to users which of the hazards are present.

Table 6 Hazard descriptor for the 'Low' class

Class	Low
Total Hazard Score	0 to 399
Description	Mostly low scores across several geohazards with varying impact levels.
Explanation	Examples within this category include stable bedrock with heterogeneous superficial deposits.
Note	Reference to the individual Hazard Scores in the GIS should indicate to users which of the hazards are present.

4.7 HOW DO WE VALIDATE THE GIP OUTPUTS?

Validation of the GIP methodology is through two routes, initially Expert Elicitation in assessing the potential damage to a building and the probability of occurrence, and secondly through user validation. This is whereby insurers assess the BGS data in-house, against their own books and provide feedback to BGS.

The underlying GeoSure datasets are validated against event databases (e.g. karst, landslides), geological databases (e.g. geotechnical engineering database), lab test results, and peer reviewed research. In addition, when natural events occur, we regularly assess the accuracy of the datasets.

We are also happy to work with organisations to assess our GIP data against specific claims data, on request.

4.8 DATA HISTORY

BGS has continually surveyed and interpreted the geology of Britain, improving and updating the geological data. These updates are made to 'BGS Geology 50k' periodically as new information becomes available. As GeoSure is based upon the most up to date information available, each new version of 'BGS Geology' prompts a new version of GeoSure. BGS is

committed to improving the GeoSure Insurance Product as more information becomes available. Additional enhancements are made to the datasets for each new version.

The GeoSure Insurance Product is re-issued approximately every 6 months following updates to the Ordnance Survey Code-Point® Open database.

The name of the output files contain information on the version of the GeoSure data and the version of the postcode data used in the calculations. For example, *newGeoSure_Insurance_Product_V8_2024_3* means that the GeoSure version 8 and Ordnance Survey Code-Point® Open version 2024.3 were used in its production.

The six Hazard Visualisation layers are no longer included as a separate layer; this information is available within the Unified Hazard data layers.

4.9 COVERAGE

Data for the *new*GeoSure Insurance Product is provided for national coverage across Great Britain (not including the Isle of Man). The scales of map data available to create this dataset are shown in Appendix 1.

4.10 DATA FORMAT

The Derived Postcode Database is available in a point data format, and text file format. It is also available as an ArcGIS (*.shp) or text file (*.txt). More specialised formats may be available but may incur additional processing costs.

The newGeoSure Insurance Product dataset has been created as vector data but is also available as a raster grid. This is also available as an ArcGIS (*.shp) or text file (*.txt). More specialised formats may be available but may incur additional processing costs.

4.11 GEOSURE INSURANCE PRODUCT: PACKAGE BANDS

A range of bundles of data are available depending on detail and resolution required. A comparison of these is provided below

GIP Bundle level	Bundle datasets included	Highest level of attribution
BGS *new*GIP (GOLD) the full national coverage vector dataset plus all the derived data versions	BGS New GeoSure Insurance Product (GOLD) newGeoSure_Insurance_Product **1. Unified Hazard Vector layer** 2. Unified Hazard Grid layer 3. Derived Postcode Database 4. Postcode Total Occurrence Factor	The full vector attributes contain all individuals hazard scores, total score, class 1:50,000 scale vector polygons
BGS *new*GIP (SILVER) the full national coverage raster grid dataset. The total combined score of all 6 hazards	BGS New GeoSure Insurance Product (SILVER) newGeoSure_Insurance_Product **1. Unified Hazard Grid layer** 2. Derived Postcode Database 3. Postcode Total Occurrence Factor	The grid attributes contain total hazard scores, class 25m grid cells
BGS *new*GIP (BRONZE) Postcode Database Table (including individual hazard scores at a postcode level)	BGS New GeoSure Insurance Product (BRONZE) newGeoSure_Insurance_Product **1. Derived Postcode Database** 2. Postcode Total Occurrence Factor	The postcode database contains generalised individual hazard score per postcode, total score Point spatial dataset, CSV table

Note: Postcode data

The GIP Postcode database provides a generalised score per postcode. It includes a score for each hazard type and a total score. GIP Bronze – includes the total occurrence factor, plus the 'derived postcode database' which gives a breakdown of the score for all of the geohazards, so you can see if a higher score is for a particular geohazard, for example landslides (e.g. AB10 1AL shows the 'Total' as 74, plus the breakdown of that score: 'SSWELL' 33, 'COMP' 0, 'LANDSLIDE' 35, 'SOLUB' 0, 'RSAND', 3, 'COLLAPSE' 3. This is supplied as a point spatial dataset as well as a table.

5 Licensing information

The British Geological Survey does not sell its digital mapping data to external parties. Instead, BGS grants external parties a licence to use this data, subject to certain standard terms and conditions. In general, a licence fee will be payable based on the type of data, the number of users, and the duration (years) of a licence.

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For all data and licensing enquiries please contact:

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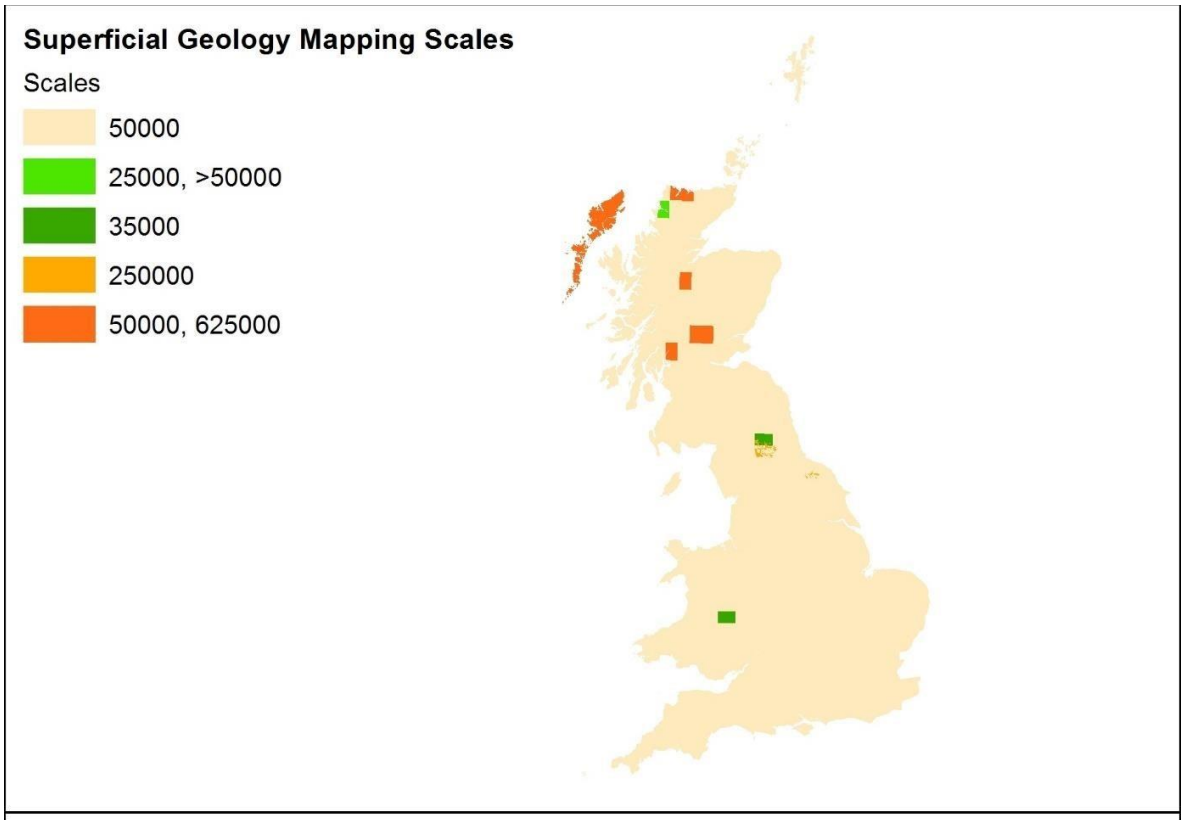
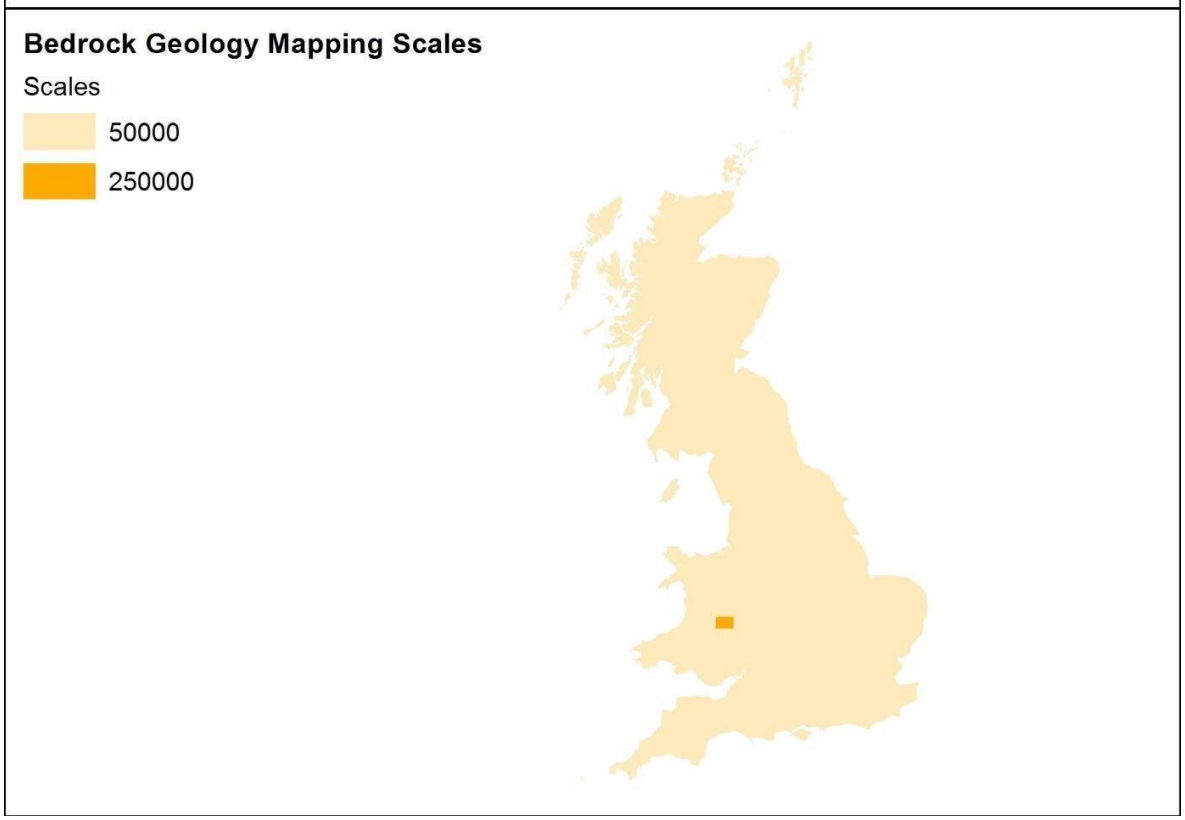
6 Limitations

- The validation of the GIP data product is done through a range of channels including analysis against BGS databases, lab test results, peer reviewed research and science expert elicitation processes. The BGS are not able to access large volumes of claims data to use as validation due to access limitations and privacy. However, some claims data over small areas (geographically), have been assessed for validation during research. In addition, the national Association of British Insurers datasets have also been accessed.
- The spatial resolution of the data is the same as the GeoSure data they are derived from, which, therefore, requires that a **minimum search radius of 50 m** around a site or property be utilized in any application (in addition to any site, property or other search area).
- GeoSure is concerned with potential ground stability related to NATURAL geological conditions only. GeoSure does NOT cover any man-made hazards, such as contaminated land or mining. The only exception to this is the Compressible Ground hazard layer, which does consider man-made ground e.g. landfill.
- GeoSure is based on, and limited to, an interpretation of the records in the possession of The British Geological Survey at the time the dataset was created.
- An indication of natural ground instability does not necessarily mean that a location will be affected by ground movement or subsidence. Such an assessment can only be made by inspection of the area by a qualified professional.
- The *new*GIP is designed to produce a dataset that can be used to indicate the potential insurance risk for natural ground instability to be active at a site. Singularly, it is not a full 'risk' model, but is designed to provide a potential geological risk analysis and intended for incorporation (along with a full set of other risk factors) into more detailed insurance risk models.
- The *new*GIP is intended for use based on the 5 hazard classes assigned to the data (see section 4.6.2). Any variation on this usage or manipulation of categories is the sole responsibility of the user.
- A difference in the number of records may exist between the .txt (text) output and the .shp (shapefile) output. This is expected, due to the processing methods required behind the creation of the GIP Scores that are attributed to the text file output. The text file is then intersected with the OS CodePoint with Polygons dataset, which is the basis of the shapefile.

Appendix 1

MAPPING SCALES





Glossary

Based on Fell et al., 2008 (developed for landslide hazards but can be translated into other hazards).

Term	Explanation
Acceptable risk	A risk for which, for the purposes of life or work, society is prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable. (Fell et al., 2008)
Consequence	The outcomes or potential outcomes arising from the occurrence of a landslide expressed qualitatively or quantitatively, in terms of loss, disadvantage or gain, damage, injury or loss of life.
Danger	The natural phenomenon that could lead to damage, described in terms of its geometry, mechanical and other characteristics. The danger can be an existing one (such as a creeping slope) or a potential one (such as a rock fall). The characterisation of a danger does not include any forecasting.
Elements at risk	The population, buildings and engineering works, economic activities, public services utilities, infrastructure and environmental features in the area potentially affected by landslides.
Exposure (E)	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses (UN/ISDR, 2009). Exposure is sometimes referred to as ‘elements at risk’.
Frequency	the number of occurrences of an event in a given time.
Hazard	A condition with the potential for causing an undesirable consequence. For example, the description of landslide hazard should include the location, volume (or area), classification and velocity of the potential landslides and any resultant detached material, and the probability of their occurrence within a given period of time.
Geological hazard	Geological process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. (UN/ISDR, 2009). Geological hazard includes internal earth processes, such as earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements: landslides, rockslides, rockslides, surface collapses and debris or mud flows. Hydrometeorological factors are important contributors to some of these processes. (UN/ISDR, 2009).
Landslide susceptibility	A quantitative or qualitative assessment of the classification, volume (or area) and spatial distribution of landslides which exist or potentially may occur in an area. Susceptibility may also include a description of the velocity and intensity of the existing or potential landsliding.
Peril	Insurance companies generally use the term peril when discussing risk related insurance policies. Insurers provide risk management advice to their customers, and will apply policy

	conditions or exclusions to the risks they accept, in order to encourage customers to take precautions. They will also start to reduce exposure. In this context a peril is a specific risk or cause of loss covered by an insurance policy, such as fire, windstorm, flood, or theft. A named peril policy covers the policyholder only for the risks named in the policy in contrast to an all risk policy, which covers all causes of loss except those specifically excluded (Home Insurance Guide, 2011).
Probability	A quantitative measure of the chance that an event will occur under some model of randomness which takes values between zero (impossibility) and 1.0 (certainty). A probability distribution function can be used to compute the probability that a random variable (such as the bulk density of a soil sample at a randomly selected site) will fall in a specified interval. There are two main interpretations: In the frequency interpretation the probability of an event is identified with the expected frequency with which that even occurs in a series of independent trials, the value to which the observed frequency in a set of such trials will converge as the number of trials increases. A second interpretation is in terms of subjective or personal probability: a measure of the strength of belief that a particular uncertain outcome will occur.
Qualitative risk analysis	An analysis which uses word form, descriptive or numeric rating scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur.
Quantitative risk analysis	An analysis based on numerical values of the probability, vulnerability and consequences, and resulting in a numerical value of the risk.
Risk	A measure of the probability and severity of an adverse effect to health, property or the environment. Risk is often estimated by the product of probability × consequences. However, a more general interpretation of risk involves a comparison of the probability and consequences in a non-product form.
Risk analysis	The use of available information to estimate the risk to individuals, population, property, or the environment, from hazards. Risk analyses generally contain the following steps: Scope definition, hazard identification, and risk estimation.
Susceptibility	see Landslide susceptibility.
Temporal-spatial probability	The probability that the element at risk is in the area affected by the hazard e.g. landsliding, at the time of the landslide.
Vulnerability	The degree of loss to a given element or set of elements within the area affected by the landslide hazard. It is expressed on a scale of 0 (no loss) to 1 (total loss). For property, the loss will be the value of the damage relative to the value of the property; for persons, it will be the probability that a particular life (the element at risk) will be lost, given the person(s) is affected by the landslide.

References

The 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 https://envirolib.apps.nerc.ac.uk/olibcgi.

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