

OR/15/002 Technical information

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Ó Dochartaigh B É, Doce D D, Rutter H K and MacDonald A M. 2015. User Guide: Groundwater Vulnerability (Scotland) GIS dataset, Version 2. Revised Report. *British Geological Survey Internal Report*, OR/15/002.

Definitions

Groundwater vulnerability is the tendency and likelihood for general contaminants to move vertically through the unsaturated zone and reach the water table after introduction at the ground surface. It therefore accounts for intrinsic properties of the vertical pathway in the unsaturated zone (above the water table), whether within an aquifer or its overburden (superficial deposits and/or soil). It does not account for the movement of contaminants through the saturated zone of an aquifer after reaching the water table.

Scale

The groundwater vulnerability (Scotland) Version 2 dataset is produced for use at 1:100 000 scale. The dataset is not designed to be used to assess groundwater vulnerability at a single point. All spatial searches of the map/dataset should be conducted using a minimum 100 m buffer.

Methodology used to create dataset

The groundwater vulnerability dataset was produced in ArcGIS by combining a range of environmental datasets (Table 2). A detailed description of the methodology for developing the groundwater vulnerability Version 1 dataset is given in Ball et al. (2004)^[1]. This new dataset, Version 2, was produced along largely the same lines, with some small methodological changes to simplify the assessment procedure, but using updated input datasets.

A rule-based method for combining the various input datasets to define a vulnerability classification has been used, which has been modified only slightly from that used for Version 1. The method is described in detail in Appendices 2 and 3.

Input datasets

The input datasets used to produce Version 2 of the dataset are listed and described briefly in Table 2. More detail on how they have been amended from Version 1 is given in Appendix 1.

Table 2 Data fields and parameter values used in the creation of the groundwater vulnerability (Scotland) Version 2 map: input datasets and final groundwater vulnerability class.

Parameter name	Description	Dataset derivation
BR_FLOWTYPE	Flow type (flow mechanism) in bedrock aquifers: Significantly Intergranular; mixed Intergranular/Fracture; or Fracture.	From BGS's Bedrock Aquifer Productivity (Scotland) map (Ó Dochartaigh et al. 2015 ^[2])

BR_MAXPERM	Maximum permeability of bedrock: Very High; High; Moderate; Low; or Very Low.	From BGS's Permeability Dataset for Great Britain (Bedrock) (British Geological Survey 2010)
SD_MAXPERM	Maximum permeability of superficial deposits: Very High; High; Moderate; Low; or Very Low.	From BGS's Permeability Dataset for Great Britain (Superficial Deposits) (British Geological Survey 2010)
SD_THICK	Superficial deposits are only mapped where >1m thick. Thickness of superficial deposits was coded as follows: 1 (1-3m), 2 (3-10m), 3 (10-30m), 4 (>30m).	Based on the first version of BGS's superficial deposits thickness map (which was interpolated from borehole records) but modified applying expert knowledge to particular areas. For more information see Ball et al. (2004) ^[1] .
CLAY	Delineating those areas known to contain at least 5m thickness of clay within the superficial deposits sequence, either as a single unit or the sum of more than one unit.	Derived from lithological log data held in BGS's Single Onshore Borehole Index (SOBI) database. For more information see Ball et al. (2004) ^[1] .
SD_DTW	Depth to groundwater level in superficial deposits aquifers. This dataset is based primarily on a surface representing the depth from ground level to the river base level, which is modelled based on a digital terrain model (DTM) and the locations of major rivers, combined with HOST data showing areas where the water table is <2m. Four classes of depth to groundwater level are defined: 1 (< 3m), 2 (3 - 10m), 3 (10 - 30m), and 4 (> 30m).	Developed by BGS for the purposes of the groundwater vulnerability map. For more information see Appendix 1 and Ball et al. (2004) ^[1] .
BR_DTW	Depth to groundwater level in bedrock aquifers. This is defined only for aquifers with significant intergranular flow. Four classes of depth to groundwater level are defined: 1 (< 3m), 2 (3 - 10m), 3 (10-30m) and 4 (>30m).	Developed by BGS for the purposes of the groundwater vulnerability map.
HOST_CLASS	HOST (Hydrology of Soil Types) Class. Digital soils data at 1:250 000 scale. The following groups of HOST classes were used at different stages of creating the groundwater vulnerability map: <ul style="list-style-type: none"> • HOST class = 9, 16, 18, 24, 26, 28 or 29, to define low permeability soils • HOST class = 22 or 27, to define thin soils • HOST class = 10 or 12, to define areas where groundwater is present within 2m of ground level (see also below, 'Depth to groundwater level in superficial deposits') 	From the James Hutton Institute (formerly the Macaulay Institute) (Boorman et al 1995; http://www.macaulay.ac.uk/host/).

VULN Code representing relative groundwater vulnerability, from 1 (very low vulnerability) to 5 (very high vulnerability). See [Table 1](#) for how to interpret the codes.

Dataset history

The groundwater vulnerability (Scotland) dataset, Version 1, was produced in 2004 by the British Geological Survey (BGS) and the Macaulay Institute (now the James Hutton Institute) on behalf of the Scottish Environment Protection Agency (SEPA), funded by the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER). The dataset comprised a GIS- based groundwater vulnerability screening tool and an associated report describing the groundwater vulnerability screening methodology (Ball et al. 2004^[1]).

This revised version (Version 2) uses updated input data and a slightly modified methodology to develop new GIS-based maps.

Coverage

The dataset covers all of Scotland (Figure 2).

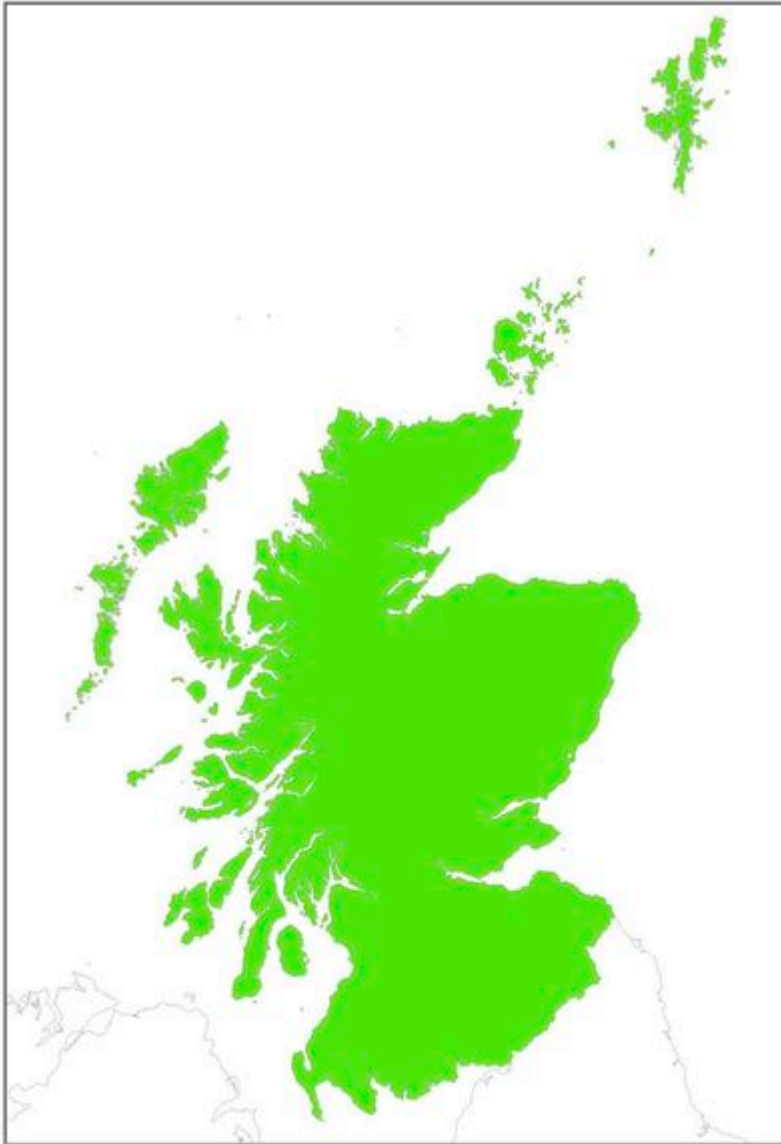


Figure 2 The coverage of the groundwater vulnerability (Scotland) dataset.

Data format

The groundwater vulnerability (Scotland) Version 2 dataset is available as a vector dataset that contains the final groundwater vulnerability classification only (Table 3, [Table 1](#)).

Field	Description	Values
Vuln	Groundwater vulnerability code	As Table 1
Key	Explanation of groundwater vulnerability code	As Table 1
Version	Version	Version number for the dataset: Version 2

Limitations

The groundwater vulnerability map is designed to be used at a scale of 1:100 000, and not to assess conditions at a single point. All spatial searches of the map and dataset should be conducted using a minimum 100 m buffer.

The map provides only an approximate description of ground conditions. Use of the map should be

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