GeoERA RESOURCE GROUNDWATER

Resources of groundwater, harmonized at Cross-Border and Pan-European Scale

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Deliverable 6.4

Dataset to be included in the Information Platform

Version: Final

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INTRODUCTION

Although EU member states generally have a comprehensive overview of the groundwater resources in their homeland, a coherent overview of all fresh groundwater over Europe is not available for policy development and evaluation. The aim of the RESOURCE project and Work Package 6 (Pan-EU Groundwater Resources Map) is to produce a first information product at pan-European scale (for the participants, see figure 1) where available data is compiled and integrated to produce a map of the fresh groundwater resources of Europe. Work Package 6 is divided in several tasks so that this goal can be achieved:
- Task 6.1: Criteria for harmonization across Europe;
- Task 6.2: Collection of data on depths and volumes;
- Task 6.3: Compilation of the map;
- Task 6.4: First estimate of water balance of EU's principal groundwater resources;
- Task 6.5: Data exchange with the Information Platform.

Deliverable 6.4, which this document describes, is the final dataset which is to be included in the Information Platform EGDI. The deliverable itself is a NetCDF file (*Deliverable 6.4 - Dataset.nc*) which contains the information on groundwater resources that has been gathered by the participating surveys during task 6.2. More details on the reasoning behind the project and on the structure of the template and on what information was gathered is described in deliverable 6.2: Database with information on volumes and depths at 10x10 and/or 25x25 km grids (Kivits et al., 2020)[1].
During task 6.3, the templates from the participating surveys have been compiled into several maps, which are described in deliverable 6.3: Maps showing the depth and volume of fresh groundwater (Kivits et al., 2021)[2].

[1] Kivits, T., Broers, H.P., Janža, M. 2020. *Deliverable 6.2, Database with information on volumes and depths at 10x10 and/or 25x25 km grids.*

[2] Kivits, T., Broers, H.P., Berendrecht, W. 2021 *Deliverable 6.3, Maps showing the depth and volume of fresh groundwater*.

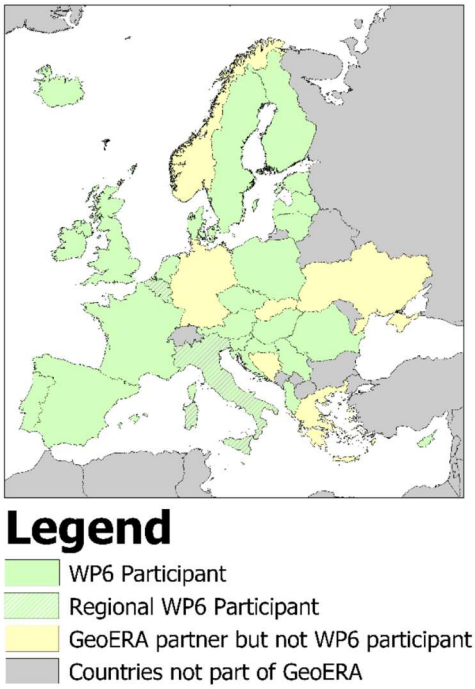

Figure 1 Resource WP6 Participants

This document describes the content of the dataset that is delivered to the Information Platform and shows the functionality of the RESOURCE WP6 dataset on EGDI. The maps on EGDI that are shown in this document come from the test server of EGDI and were made using an older version of the database. The structure of the dataset that is described here will remain the same, however, the maps are not final. The final maps will be available on EGDI at the end of the GeoERA project.

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1 DESCRIPTION OF THE NETCDF

The final dataset of RESOURCE WP6 consists of a NetCDF file with layer information that can directly be displayed on EGDI. The original ideas for delivering the data to the Information Platform can be found in deliverables 2.1: First draft of Data Management Plan (Hinsby et al., 2019A)[3] and 2.2: Definition of prioritized Information Products for the GeoERA Information Platform (Hinsby et al., 2019B)[4]. The original idea was that the templates from the participating surveys would be compiled into a single xlsx file, which the Information Platform would use to create the database. However, during the discussion on the visualization ideas with the Information Platform, it was decided that the best way of storing the data from the individual templates was in a NetCDF file format. NetCDF (Network Common Data Form) stores array-oriented data, and is often used in the geosciences the show gridded data.

An description of contents of the original NetCDF file can be found under paragraph 3.2 in Deliverable 6.2[1]. This first version of the database contained information of all the layers that are present in the templates from the participating surveys. However, after some testing by the Information Platform this file was seemed too complicated for it's intended use. Some calculations were needed to create the maps from the NetCDF file, and it was decided that it would be better to do these calculations by RESOURCE WP6 ourselves that on-the-fly on the EGDI Platform.

The final NetCDF File that is to be included in the Information Platform contains 53 layers with all showing a distinct map. The technical details of the NetCDF file, such as the x/y dimensions and the CRS used are described in deliverable 6.2 and remain unchanged. The structure of the dataset is described below.

There are 5 "main" maps, all showing information of the total groundwater system. These layers are named total_Saturated_Volume, total_Saturated_Thickness, transmissivity, totalDepthActiveLayers, and aquiferType. These show information of the total groundwater storage, the thickness of the aquifers, the total transmissivity of the aquifers, the total depth of the fresh groundwater system and the aquifer typology. More information on how these maps are calculated can be found in Deliverable 6.2. Next to these 5 main maps, there are further selections possible for the first 3 categories (volume, thickness and transmissivity). These subselections are structured as follows:

- Based on geological age:
  - Quaternary/Tertiary/Cretaceous/Jura/Triassic and older
- Based on Hydrogeofacies:
  - Unconsolidated sedimentary/Compact sedimentary/Fissured sedimentary/Volcanic/Basement
- Based on aquifer type:
  - Unconfined/Semi-confined/Confined
- Based on aquifer characteristic:
  - Thermal/Paleo/Artesian

[3] Hinsby, K., Broers, H.P., Sanabriam M. 2019A. *Deliverable 2.1. First draft of Data Management plan*

[4] Hinsby, K., Sanabria, M., Broers, H.P., Kivits, T. 2019B. *Deliverable 2.2. Definition of prioritized Information Products for the GeoERA Information Platform.*

2 THE DATASET ON EGDI

A previous version of the database was sent to the Information Platform for testing purposes, which was uploaded to the test server on EGDI. The images shown below are from this test server, and show what the final database on EGDI will look like and what some of the functionalities will be. Since this is a test server, not yet all functionalities are included. For example, the legends of the maps are being worked on at the time of completing this deliverable. Descriptions for the legends of the maps can be found in the next chapter.

The starting screen will show one of the 5 main maps as described in the previous chapter (see Figure 2). These 5 maps can be selected using a drop-down menu on the left side on the screen (see Figure 3). When the Groundwater storage, Total thickness of saturated layers, or Transmissivity map is selected a second drop down menu appears (see Figure 4). Here, further selections can be made based on geological age, hydrogeofacies, aquifer types, and aquifer characteristics. When clicking on a cell, a pop-up appears which shows the detailed information of the different layers within the database of that particular cell (see Figure 5).

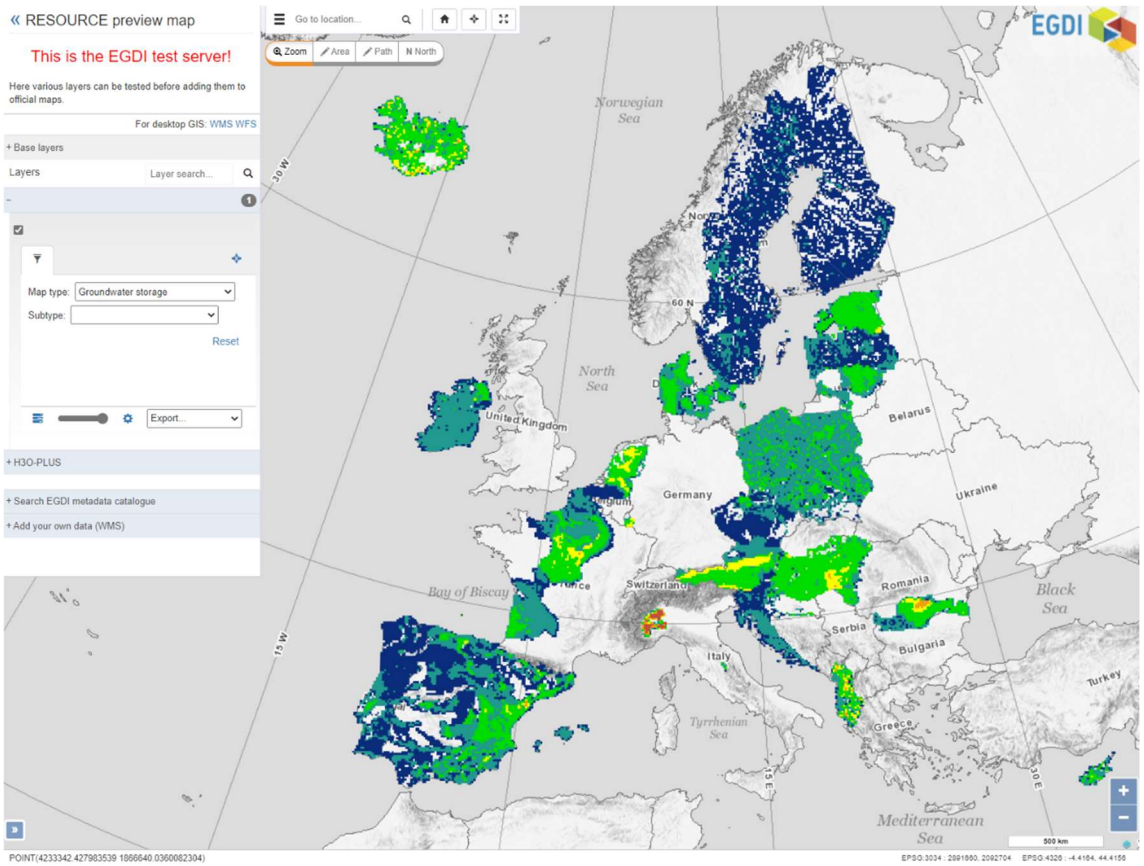

Figure 2 RESOURCE WP6 Groundwater Storage map on the EGDI test server. The final delivered NETCDF also contains data for the UK and Serbia.

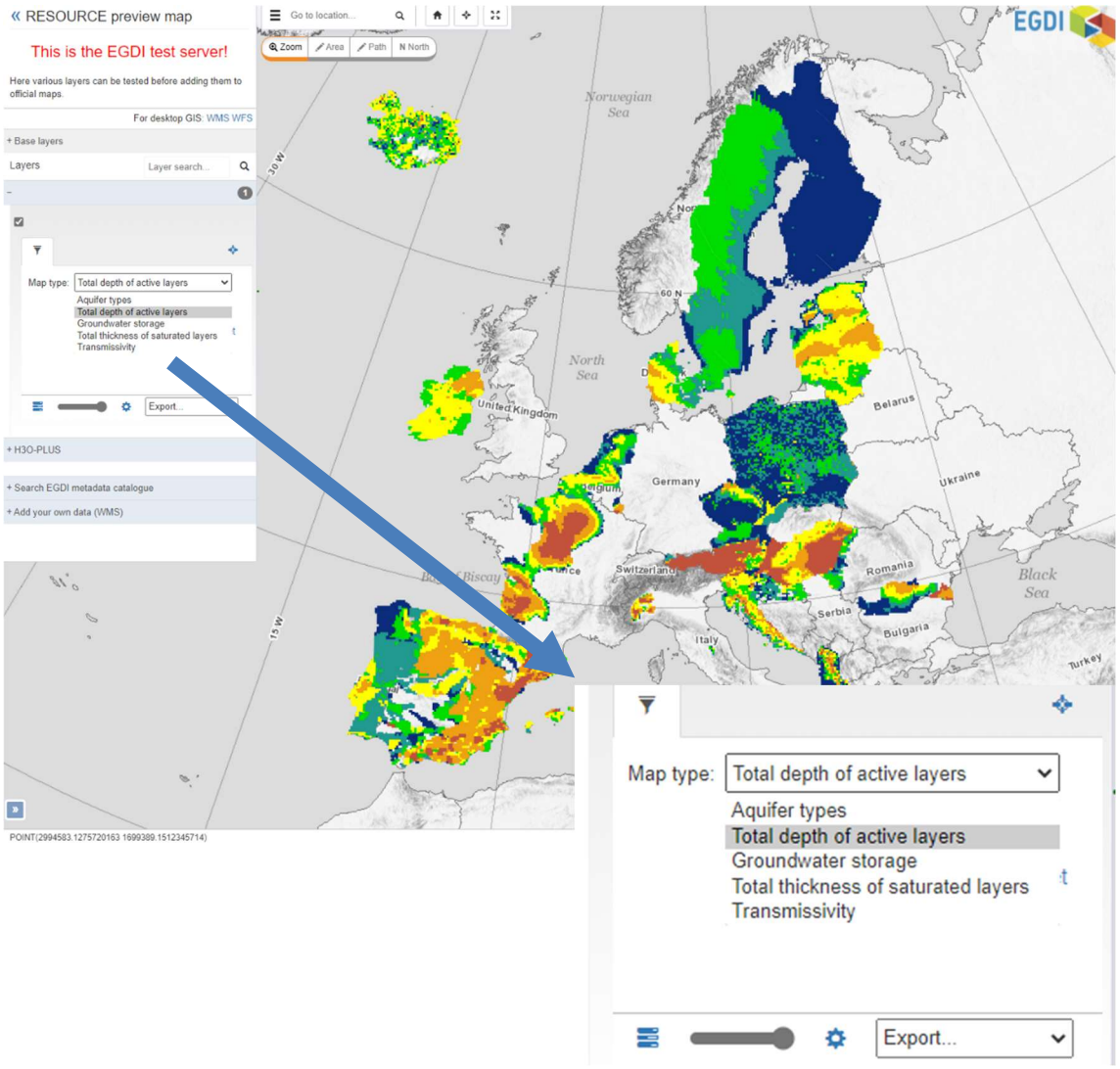

Figure 3 Map showing the total depth of the active system, with a crop-out of the drop down-menu where the 5 main maps can be selected.

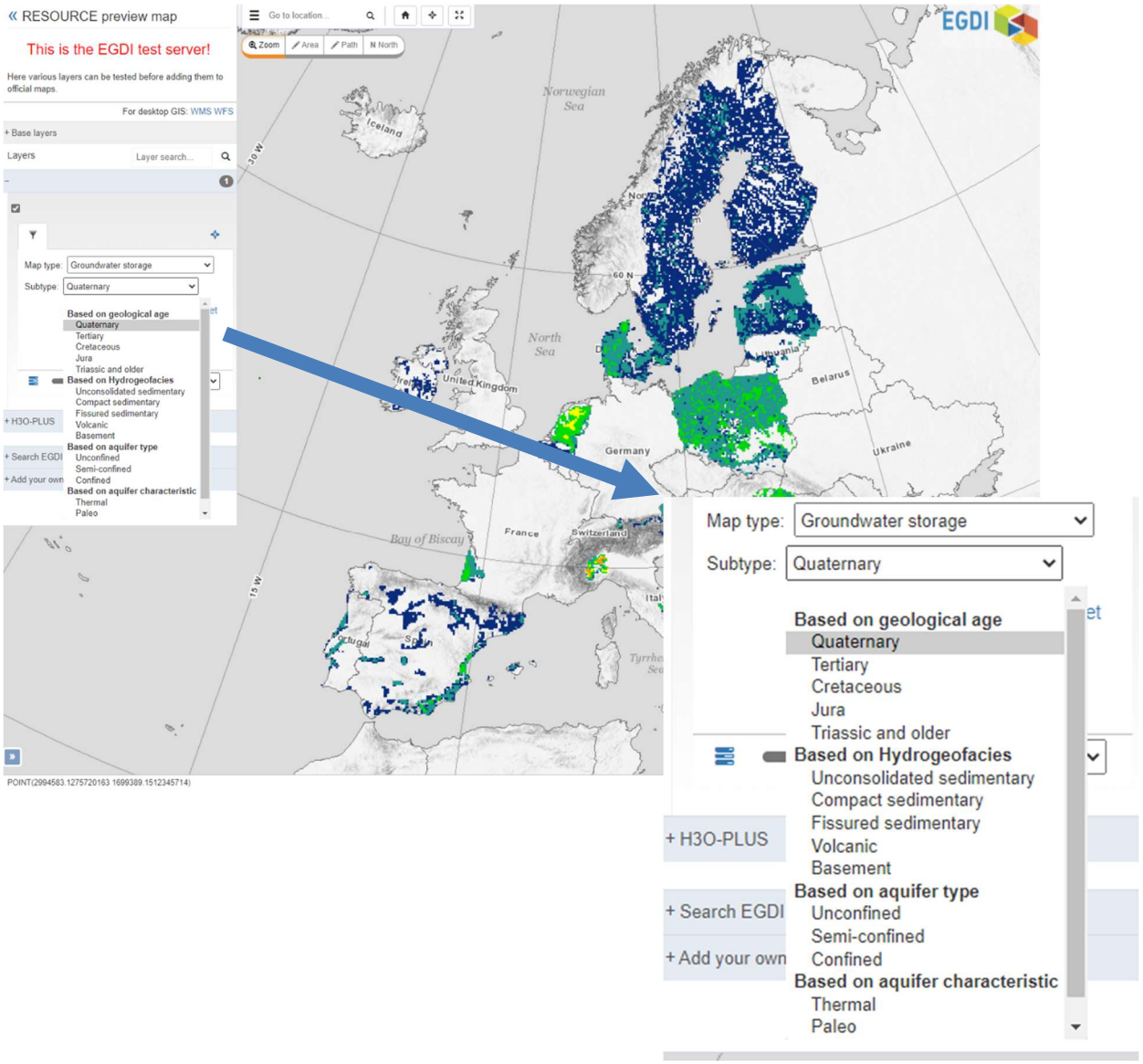

Figure 4 *Map showing the groundwater storage in Quaternary aquifers, with a crop-out of the second drop down menu where selections based on geological age, hydrogeofacies, aquifer types, and aquifer characteristics can be made.*

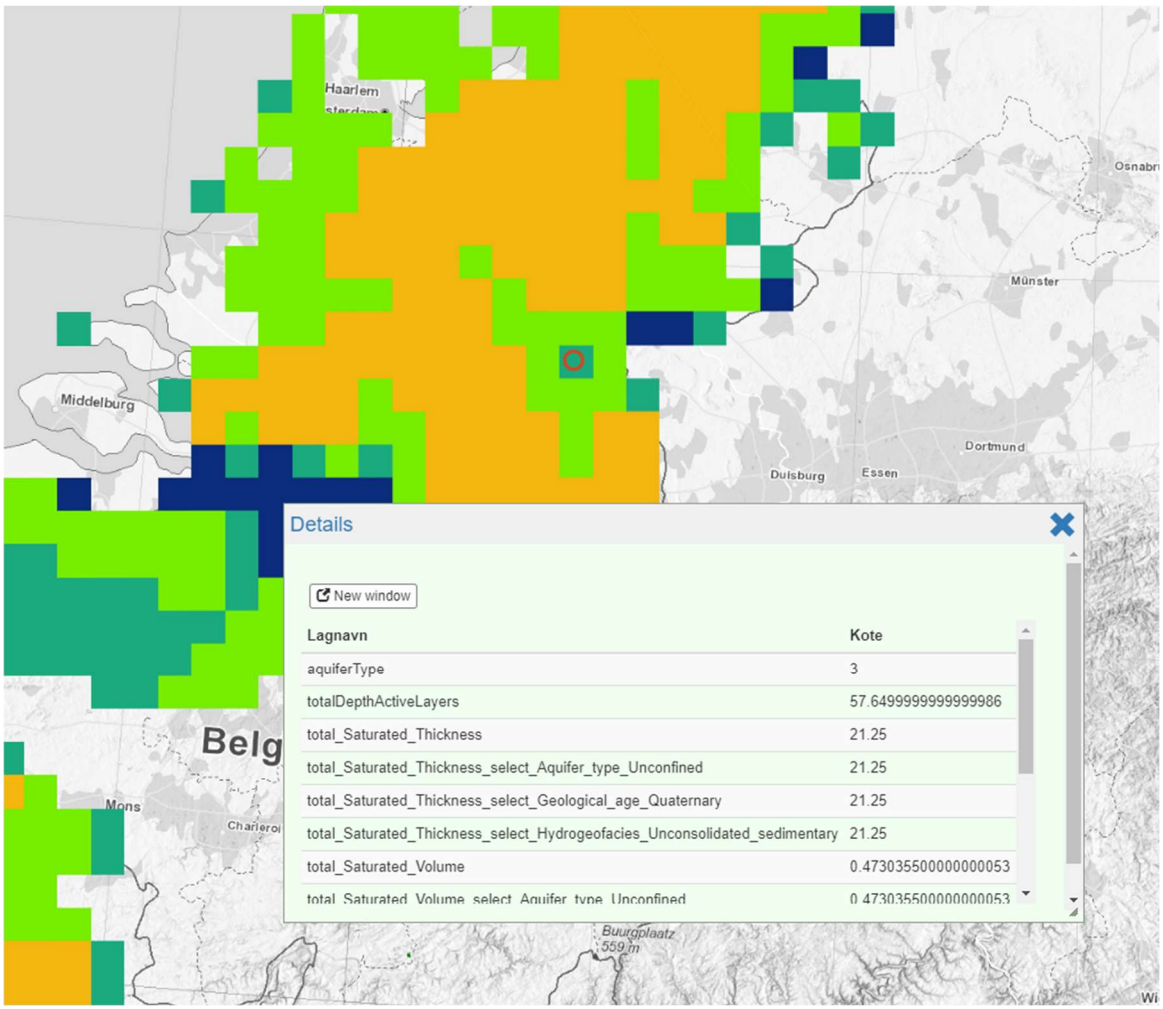

Figure 5 Pop-up with detailed information that shows up when you click on a cell.

3 LEGENDS OF THE MAPS TO BE INCLUDED ON EGDI

The tables below show the information for the legends of the maps that will be included on EDGI. In the tables, class number are given, together with minimum and maximum values for that cell, with a label and hex colour code for that class. For the aquifer type map, a text label is given that correspond with the class numbers that are included in the database. When choosing one of the subselections as described in chapter 1 the legend of the map will remain the same as the corresponding "main" map.

Table 1 Legend for the Groundwater Storage maps

Title	Groundwater Storage			
Unit	km^3 per 10x10 km grid cell			
Class	**Min value**	**Max value**	**Label**	**hex**
1		0.1	<0.1	0B2C7A
2	0.1	1	0.1 - 1	20998F
3	1	5	1 - 5	00DB00
4	5	10	5 - 10	FFFF00
5	10	30	10 - 30	EDA113
6	30		>30	C2523C

Table 2 Legend for the maps showing the Thickness of the Saturated Layers

Title	Thickness of Saturated Layers			
Unit	m			
Class	**Min value**	**Max value**	**Label**	**hex**
1		25	<25	0B2C7A
2	25	50	25 - 50	198090
3	50	100	50 - 100	16B569
4	100	200	100 - 200	20E000
5	200	400	200 - 400	D6FA00
6	400	800	400 - 800	F5C60B
7	800	1600	800 - 1600	E18321
8	1600		>1600	C2523C

Table 3 Legend for the maps showing the Transmissivity

Title	Weighted Transmissivity			
Unit	m^2/d			
Class	**Min value**	**Max value**	**Label**	**hex**
1		50	<50	0B2C7A
2	50	200	50 - 200	1BAA7D

3	200	1000	200 - 1000	77ED00
4	1000	10000	1000 - 10.000	F2B60E
5	10000		>10.000	C2523C

Table 4 Legend for the Total Depth of Active Layers Map

Title	Total Depth of Active Layers			
Unit	m below surface level			
Class	**Min value**	**Max value**	**Label**	**hex**
1		50	<50	0B2C7A
2	50	100	50 - 100	20998F
3	100	200	100 - 200	00DB00
4	200	400	200 - 400	FFFF00
5	400	800	400 - 800	EDA113
6	800		>800	C2523C

Table 5 Legend for the Aquifer Types map.

Title	Aquifer Types		
Unit			
Class	**Value**	**Label**	**hex**
1	1	Minor aquifers with essentially no groundwater	FFD37F
2	2	Minor aquifers with little groundwater	FFAA00
3	3	Locally productive intergranular aquifers	73B2FF
4	4	Highly productive intergranular aquifers	0070FF
5	5	Locally productive fissured aquifers	A3FF73
6	6	Highly productive fissured aquifers	38A800