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Coherent spatial database for the EU-WATERRES platform

December 2023

The project No.2018-1-0137 "EU-WATERRES: EU-integrated management system of cross-border groundwater resources and anthropogenic hazards" benefits from a € 2.447.761 grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Regional Cooperation. The aim of the project is to promote coordinated management and integrated protection of transboundary groundwater by creating a geoinformation platform.

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Scientific Editor	Tatiana Solovey (*Polish Geological Institute - National Research Institute*)
Authors (*Polish Geological Institute –NRI*):	Tetyana Solovey, Małgorzata Przychodzka, Hanna Kolos, Anna Krysa, Rafał Łusiak
Authors *(Zahidukrgeologiya)*:	Dmytro Panov, Natalia Pavliuk, Svitlana Sokorenko, Liubov Yanush, Halyna Medvid
Authors (*Ukrainian Geological Company*):	Volodymyr Klos, Yurii Kharchyshyn
Authors (*Latvian Environment, Geology and Meteorology Centre*)	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Authors (*Geological Survey of Estonia*)	Andres Marandi, Magdaleena Mannik, Marlen Hunt, Liina Hints
Authors (*University of Latvia*)	Jānis Bikše, Inga Retike
Authors (*Norwegian Geological Survey*)	
Authors (Norwegian Water Resources and Energy Directorate)	
Project coordinator	PGI-NRI

Document summary

This operating and functional manual has been developed with the aim of providing the MapPortal user with information about the operating principle of the created geoinformation platform, available functions, operations with the thematic layers and maps. The prepared information description was prepared separately for the Polish-Ukrainian and Estonian-Latvian pilot areas

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Latvijas Vides, Ģeoloģijas un Meteoroloģijas Centrs

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Preface

The purpose of this document is to deliver knowledge necessary to understand the capabilities of the EU-WATERRES geoportal and how it can be used. The portal was created for two pilot areas: Polish-Ukrainian and Estonian-Latvian as part of the project "EU-WATERRES "EU-integrated management system of cross-border groundwater resources and anthropogenic hazards"".

Here you can find information about the hydrogeological and geological structure of the pilot area, groundwater monitoring, environmental hazards, possible groundwater pollution, etc.

Using the tools and information of the geoportal, you can independently create and print hydrogeological and other thematic maps with the content you need, on a scale that meets your needs. The portal may be of interest to a specialist in the field of geology, an entrepreneur, a government official and a citizen.

Operating and functional manual. EU-WATERRES MapPortal

Part 1. Part «Polish-Ukrainian pilot area»

Part 2. Part «Estonian-Latvian pilot area»

Part 1. Part «Polish-Ukrainian pilot area»

Table of content

1. General information ... 4
1.1. Data format ... 4
1.2. Coordinate system ... 4
1.3. The spatial extent of the data ... 4
2. Map view ... 4
2.1. Main parts of the map portal ... 4
3. Map composition ... 13
3.1. Hydrogeological units of the main useful aquifer ... 13
3.2. Depth to the main useful aquifer ... 16
3.3. Hydroisohypses of the main useful aquifer ... 17
3.4. Thickness of the main useful aquifer ... 18
3.5. Transmissivity of the main useful aquifer ... 19
3.6. Springs ... 20
3.7. Insulation degree of the main useful aquifer ... 21
3.8. Wells / Boreholes ... 23
3.9. Intakes ... 25
3.10. Groundwater damming devices ... 26
3.11. Areas of depression cones ... 27
3.12. Groundwater bodies ... 28
3.12.1. Map appearance GWB-Poland ... 30
3.12.2. Map appearance GWB – Ukraine Q ... 32
3.12.3. Map appearance GWB – Ukraine M ... 34
3.12.4. Map appearance GWB – Ukraine Cr3 ... 35
3.12.5. Map appearance GWB – Ukraine D3 ... 37
3.13. Groundwater pollution source ... 39
3.13.1. Groundwater pollution source – wastewater treatment plants ... 39
3.13.2. Groundwater pollution source - landfills ... 40
3.14. Grounwater vulnerability to pollution ... 42
3.15. Groundwater monitoring points ... 43
4. Legend ... 44
4.1. Cross-sections ... 47
4.2. Thematic layers ... 49
4.2.1. PL-UA pilot area ... 50
4.2.2. State border ... 51

4.2.3. Geological map 52
4.2.4. Conditions for location of intakes 53
4.2.5. Specific groundwater vulnerability to pollution 54
4.2.6. Groundwater vulnerability to meteorological drought 55
4.2.7. Intensity of agricultural pressure of a diffuse character 56
4.2.11. Hydroisohypses – labels 60
4.2.12. Hydrogeological units of the MUA - labels 60
4.3. State of Groundwater Bodies 61
4.4. Administration ïPoland 62
4.5. Administration ïUkraine 62
4.6. Base map 63
4.6.1. CORINE land cover 63
4.6.2. OSM (Open Street Map) 64
5. Viewing data in the monitoring points tab 65
6. Viewing data in the "Geological cross sections" tab 68
7. "Print" service 70
8. List of thematic layers & authors 72

1. General information

1.1. Data format

The portal displays images in PNG format sent by GeoSerwer via WMS services (and the background from the OSM service). The geoserver generates these images based on spatial data in the PostgreSQL database. The data for this database were imported from the received SHP files.

1.2. Coordinate system

Spatial data in the PostgreSQL database is in the WGS84 reference system. By default, the portal layout is set to EPSG 3857 (Pseudo-Mercator) so-called Google Mercator.

1.3. The spatial extent of the data

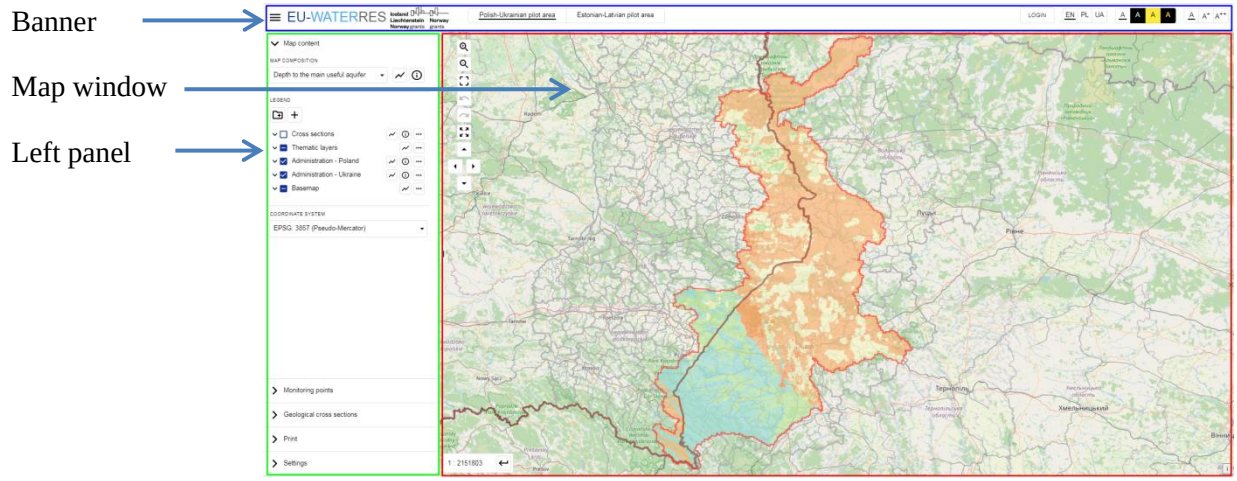
The area with the presented spatial data is located near the Polish-Ukrainian border in the south-eastern part of Poland and the north-western part of Ukraine, in the basin of the Bug, San and Dniester rivers. It covers an area of approximately 26 073 km^2. Its geographical coordinates are:

ÅLongitude from 2 2 Á 2to52' 5NÁ 0 9 ' N ;

ÅLatitude from 5 1 Á 5to44Nj8EÁ 5 9 Nj E ;

2. Map view

2.1. Main parts of the map portal



Main window of the portal

<u>Banner</u>

The menu groups tools for logging in, changing the language, choosing colors and font size.

In order for the data displayed on the map to be legible for the user, it is advisable to adjust the appearance of the application window to individual preferences using the available functions.

Function buttons on the banner

Open/close left panel

EU-WATERRES

Click to go to the project page:
- https://eu-waterres.eu/

Iceland Liechtenstein Norway grants Norway grants

Click to go to the fund page:
- https://eeagrants.org/

Polish-Ukrainian pilot area | Estonian-Latvian pilot area

Selection of Polish-Ukrainian or Estonian-Latvian pilot area.

LOGIN

Log in ïredirects the user to the login page. Logging in takes place after entering the user's login and password.

EN PL UA

Selection of the language version of the portal: EN ïEnglish, PL ïPolish, UA ïUkrainian English is selected by default.

Features related to the accessibility of the map portal:

A A A A

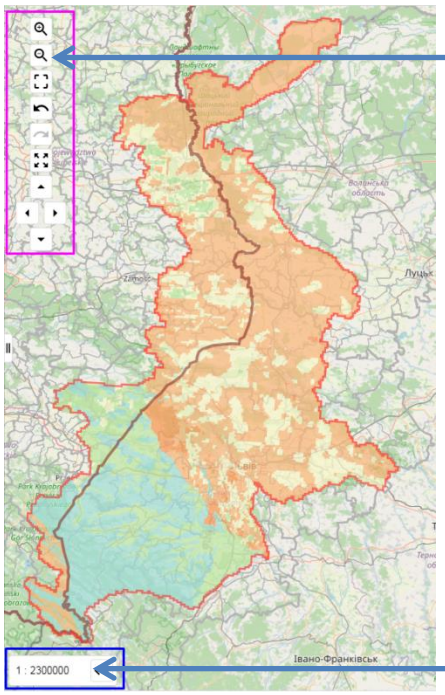
Selection of high-contrast colors:
- The default colour scheme is *black letters on a white background*
- Colour scheme *white letters on a black background*
- Colour scheme *black letters on a yellow background*
- Colour scheme *yellow letters on a black background*

A A+ A++

Font size selection buttons:
- medium
- large
- extra-large

By default, the font size is set on medium.

Polish ïUkrainian pilot area map window



Navigation bar

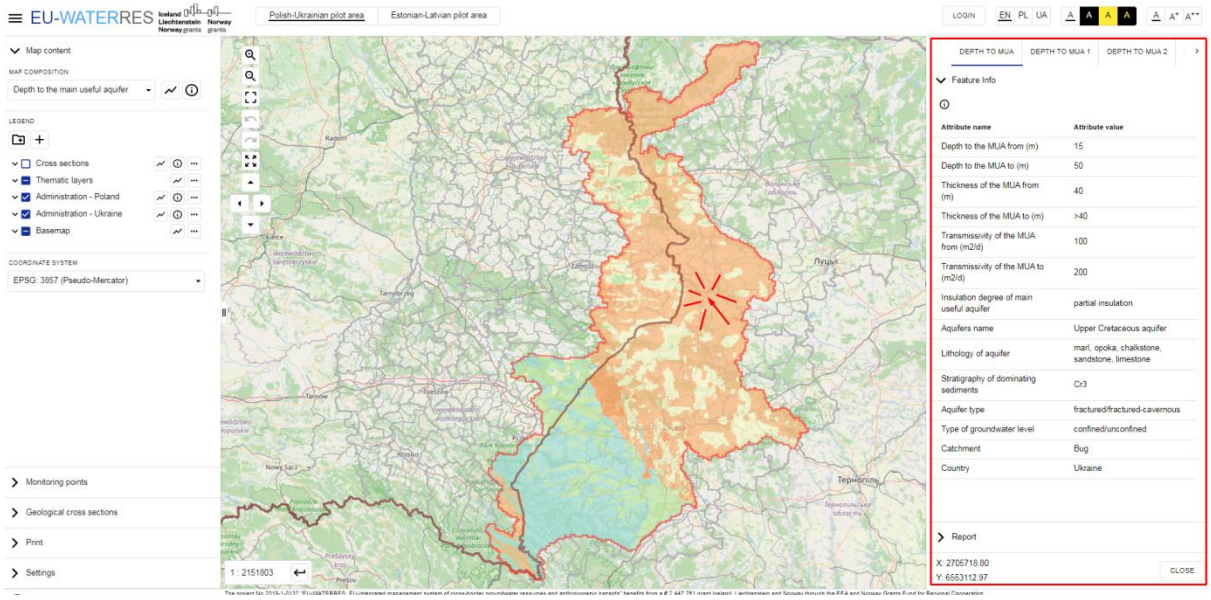
	Zoom in (scroll the mouse wheel away from you) *Zoom out* (scroll the mouse wheel towards you) The map can also be enlarged by double-clicking the left mouse button in the map window. Thus, the scale increases 2 times.
Θ **b**	A button that activates the function of enlarging the selected area on the map. a) buton inactive b) buton active To activate it, click on the (a) button and then use the mouse cursor to highlight the area to be enlarged. Pressing this button (b) again will deactivate this function.
	Undo/Redo (preview). "Undo" button to restore the previous map scale. "Redo" button to repeat the scale of the map if canceled with the "Undo" button. If there have been no scale changes, the buttons are inactive (greyed out).
	Reset zoom to default view. When you click this button, the map will be scaled to include the selected pilot area.
	Navigation buttons right/left/up/down. When you press the button, the map moves in the specified direction.

Map scale window

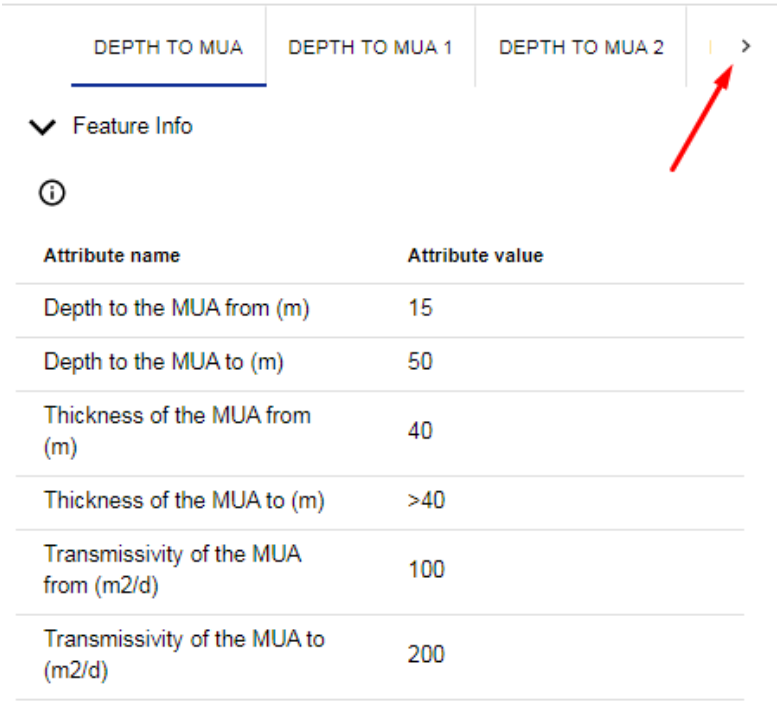
Map scale window. The number after the colon is the current map scale. You can set the scale you want. To do this, you need to write a scale and press enter or the button to the right of the numbers.

Map window functionality

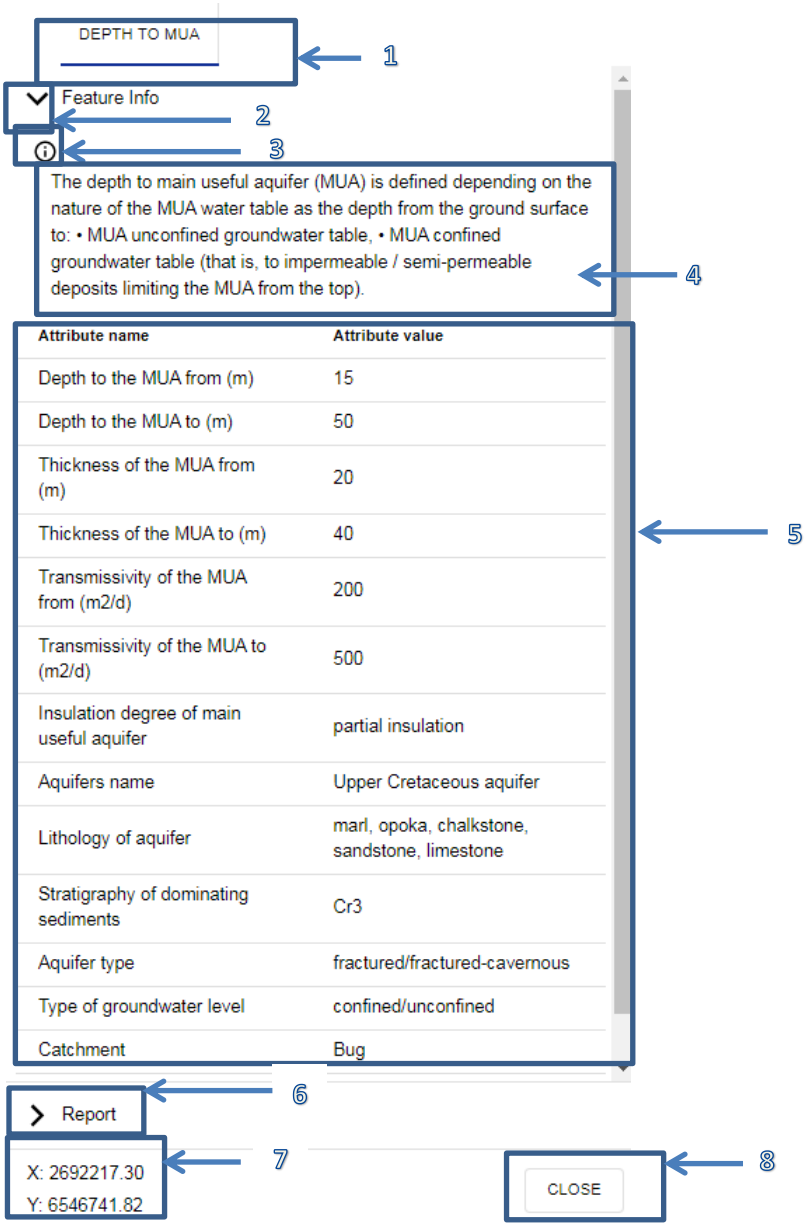
By clicking the mouse on the map, you can see the attributes of the object. To do this, click the left mouse button on the map object, and a window with information about the object will appear on the right side.



If there are several objects, you can view information about them all. You need to use the arrow and select the desired object for viewing.

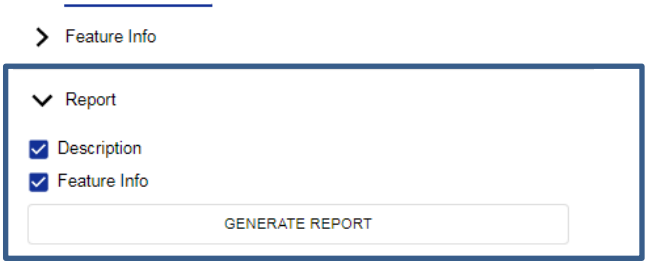


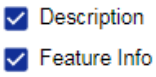
Feature info tab in the right panel



1 ï Tabs with layer names
2 ï Show or hide "Feature info"
3 ï Show layer information
4 ï Layer description. Appears when clicked ⓘ
5 ï Feature info
6 ï Report tab
7 ï The coordinates of where you clicked
8 ï "Close" button. Pressing will close the panel.

"Report" tab





Selection of report elements.
To activate/deactivate the required information in the generated report, check/uncheck the box.

"Generate report" button. Generates a file in *.pdf format.

Create a report

The depth to main useful aquifer (MUA) is defined depending on the nature of the MUA water table as the depth from the ground surface to: •
confined groundwater table (that is, to impermeable / semi-permeable deposits limiting the MUA from the top).

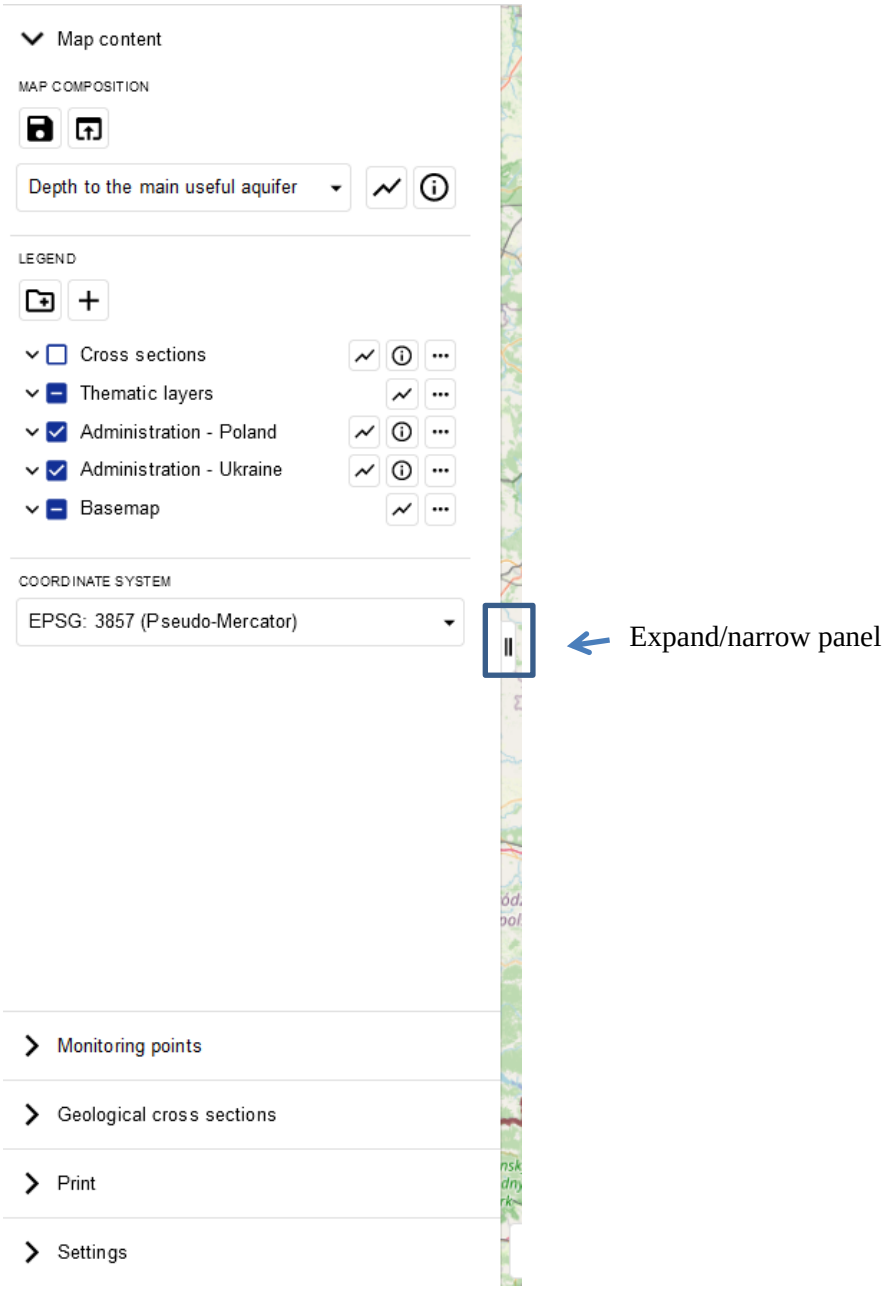
← Description

Attribute name	Attribute value
Depth to the MUA from (m)	15
Depth to the MUA to (m)	50
Thickness of the MUA from (m)	40
Thickness of the MUA to (m)	>40
Transmissivity of the MUA from (m2/d)	100
Transmissivity of the MUA to (m2/d)	200
Insulation degree of main useful aquifer	partial insulation
Aquifers name	Upper Cretaceous aquifer
Lithology of aquifer	marl, opoka, chalkstone, sandstone, limestone
Stratigraphy of dominating sediments	Cr3
Aquifer type	fractured/fractured-cavernous
Type of groundwater level	confined/unconfined
Catchment	Bug
Country	Ukraine

← Feature info

Left panel

The sidebar tools allow you to create your own map layout that can be printed in a .pdf file. Using the button ☰ on the banner, you can expand or collapse the side panel. If you hold and drag the button ⏸, you can expand or narrow the left pane while changing the width of the map window.



The side panel menu consists of 5 items:

Map content ïThe tab opens a menu with map content. The tool is used to manage the visibility of layers on the map, preview the markings applied to the map, and select the map's coordinate system.

Monitoring point ïThe tab opens the menu with monitoring points. The tool allows you to turn on the visibility of selected or all monitoring points on the map, display their attributes and create reports and charts.

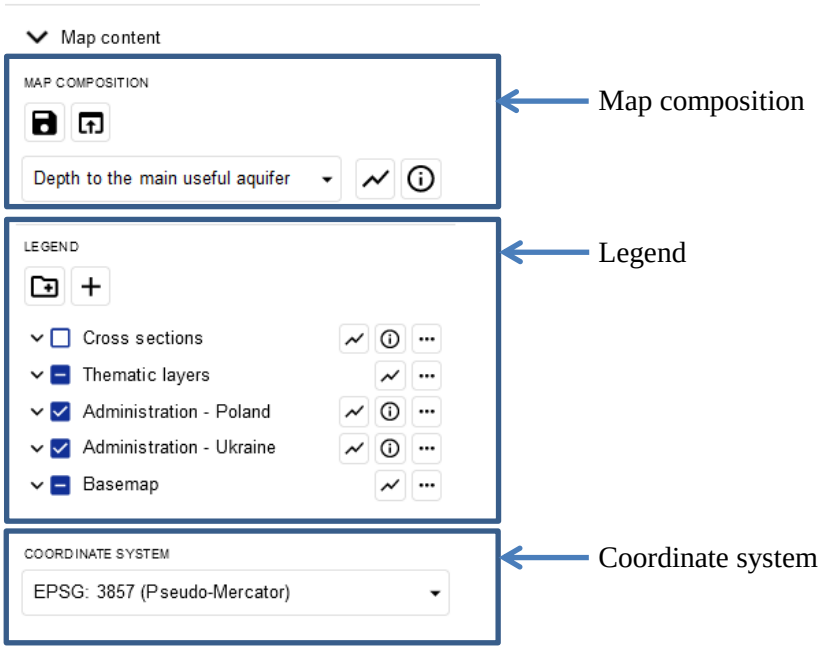
Geological cross section ïThe tab opens a menu with geological cross-sections. The tool allows you to find a selected geological cross-section and display the attributes of the selected object.

Print ïThe tab opens a menu with printing options. The tool is used to define print parameters of the created map composition.

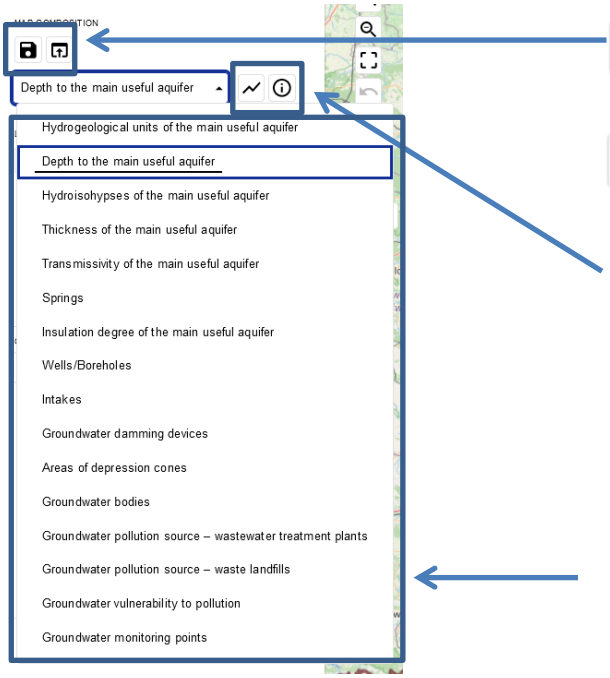
Settings ïThe tab opens a menu with portal display settings. The tool allows you to set the diagonal of the used monitor and provides the current version of the application.

çMap content ètab

Map content - the tool is used to manage the visibility of layers on the map, preview the markings used on the map, and select the map's coordinate system. It consists of three tabs: map composition, legend, coordinate system.



Allows you to select the layer that will be displayed in the map window.



Save the map composition

Open the map composition

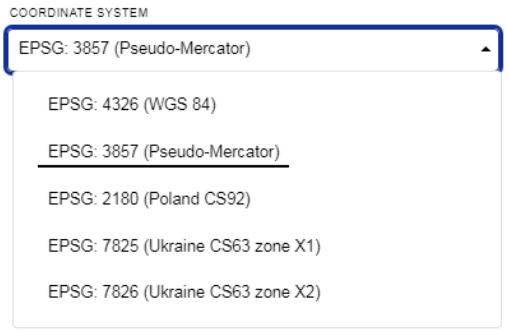
Show composition style - pressing the button displays a new window in the application with the symbols used on the map and their description.

Show information about the composition - pressing the button launches a window in which the definition of the selected layer is displayed.

You can select a thematic map to display from the drop-down list

Coordinate system menu

In the tab, it is possible to select the coordinate system in which the map composition will be displayed.



To change the coordinate system, click on the field with the name of the default coordinate system. Then a list of coordinate systems appears, from which we select one from the list. When selected, the map composition will be displayed in the changed coordinate system.

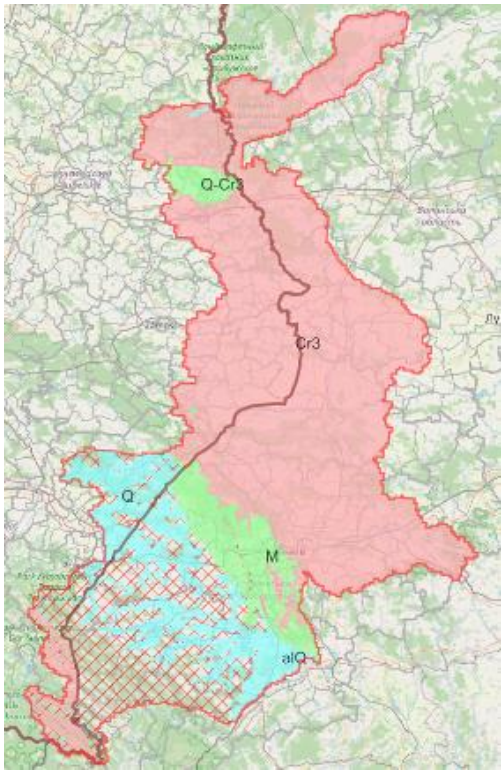
3. Map composition

The "Map composition" tab contains the following thematic layers:

- ¶ Hydrogeological units of the main useful aquifer
- ¶ Depth to the main useful aquifer
- ¶ Hydroisohypses of the main useful aquifer
- ¶ Thickness of the main useful aquifer
- ¶ Transmissivity of the main useful aquifer
- ¶ Springs
- ¶ Insulation degree of the main useful aquifer
- ¶ Wells / Boreholes
- ¶ Intakes
- ¶ Groundwater damming devices
- ¶ Areas of depression cones
- ¶ Groundwater bodies
- ¶ Groundwater pollution source ïwastewater treatment plants
- ¶ Groundwater pollution source ïwaste landfills
- ¶ Groundwater vulnerability to pollution
- ¶ Groundwater monitoring points

3.1. Hydrogeological units of the main useful aquifer

¶ Map appearance



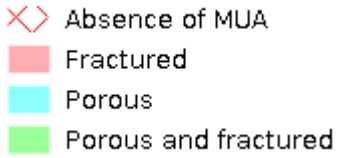
¶ Definition

An aquifer is a hydraulically continuous body of relatively permeable unconsolidated porous sediments or porous or fissured rocks containing groundwater. A useful aquifer is defined as an aquifer or group of aquifers showing good hydraulic connectivity, with the parameters of the quantity and quality of water qualifying for municipal use.

- ¶ transmissivity > 50 m^2/d,
- ¶ total thickness M 5m (with an average state of retention),
- ¶ shows a continuity of occurrence (with the accuracy of hydrogeological schematization appropriate for a map in the scale of 1: 50,000) in the area A>20 km^2 (in conditions of good identification and clear spatial differentiation of hydrogeological conditions, A>5 km^2 is allowed);
- ¶ enable the execution of a drilled well with a recharge of over 5m^3/h.

¶ Legend

The layer "Hydrogeological units of the main useful aquifer" is represented on the map by pixels with dimensions of 1000x1000 m filled with colors: pink, blue and green, which indicate hydrogeological units of the MUA: fissure, pore, pore and fissure, as well as areas where there are no MUA units filled with red grid.



¶ Attributes

Below are the attributes and vocabularies used to describe the layer "hydrogeological units of the main useful aquifer":

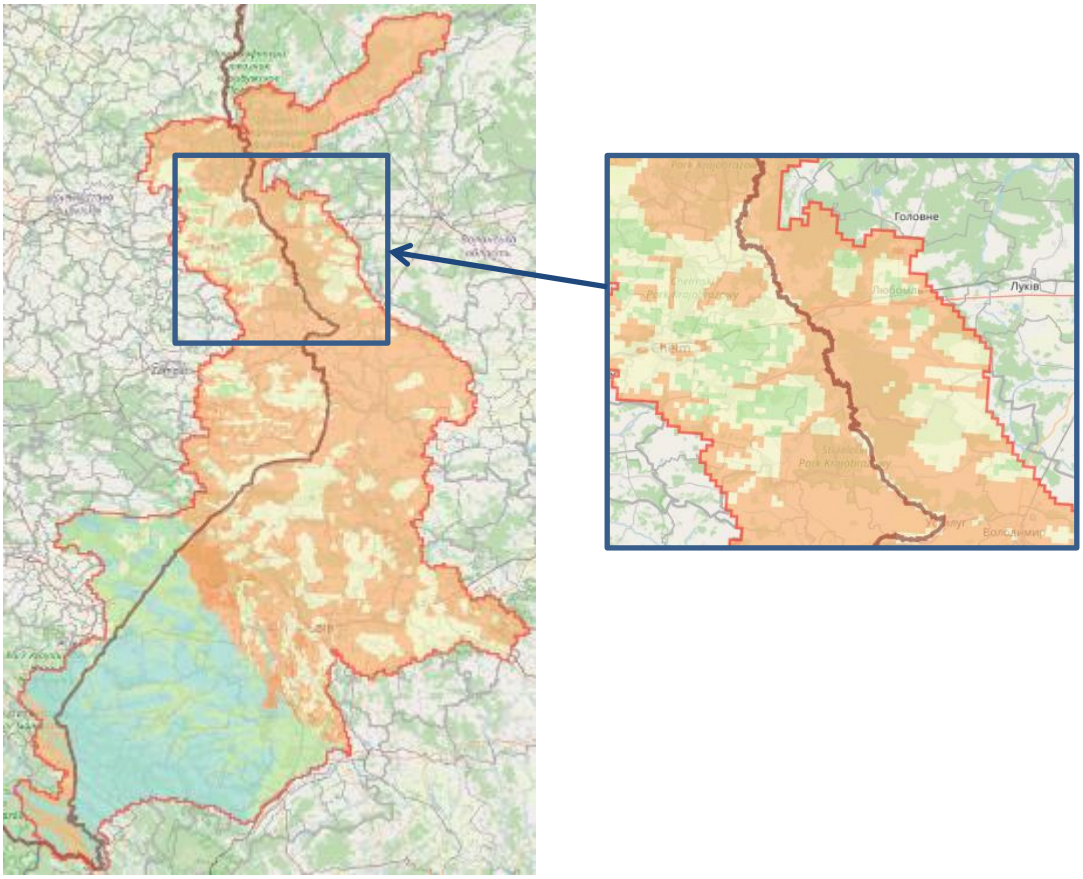
Attribute name	Attribute value
Depth to MUA from (m)	¶ 0 ¶ 2 ¶ 5 ¶ 15 ¶ 50
Depth to MUA to (m)	¶ 2 ¶ 5 ¶ 15 ¶ 50 ¶ > 50
Thickness of MUA from (m)	¶ 0 ¶ 2 ¶ 10 ¶ 20 ¶ 40
Thickness of MUA to (m)	¶ 2

	¶ 10 ¶ 20 ¶ 40 ¶ > 40
Transmissivity of MUA from (m2/d)	¶ 0 ¶ 2 ¶ 100 ¶ 200 ¶ 500
Transmissivity of MUA to (m2/d)	¶ 2 ¶ 100 ¶ 200 ¶ 500 ¶ > 500
Insulation degree of MUA	¶ no insulation ¶ dominance no insulation, subclass - partial insulation ¶ dominance partial insulation, subclass - no insulation ¶ partial insulation ¶ dominance partial insulation, subclass - total insulation ¶ dominance total insulation, subclass - partial insulation ¶ total insulation ¶ absence main useful aquifer
Aquifer`s name	¶ Quaternary alluvial aquifer ¶ Quaternary aquifer ¶ Quaternary - Miocene - Oligocene aquifer ¶ Quaternary - Upper Cretaceous aquifer ¶ Miocene aquifer ¶ Miocene - Oligocene aquifer ¶ Cretaceous - Paleogen aquifer ¶ Upper Cretaceous aquifer ¶ absence main useful aquifer
Lithology of aquifer	¶ sandstone ¶ sand, sandstone, limestone, marl ¶ sand, gravel ¶ sand, gravel, sandy clay, sandstones ¶ sand, gravel, chalkstone, marl, opoka ¶ sand, limestone, sandstone, gypsum ¶ limestone, chalkstone, marl ¶ limestone, sandstone, gypsum, gravel ¶ marl, opoka, chalkstone, sandstone, limestone ¶ absence main useful aquifer
Stratigraphy of the dominating sediments	¶ alQ ¶ Q ¶ Q-M-Ol ¶ Q-Cr3 ¶ M ¶ M-Ol ¶ Cr-Pg ¶ Cr3

Aquifer type	¶ absence main useful aquifer ¶ porous ¶ porous/fractured ¶ fractured ¶ absence main useful aquifer
Type of groundwater level	¶ confined ¶ unconfined ¶ confined/unconfined ¶ absence main useful aquifer
Catchment	¶ Bug ¶ San ¶ Dniester
Country	¶ Poland ¶ Ukraine

3.2. Depth to the main useful aquifer

¶ Map appearance



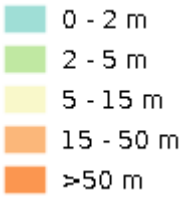
¶ Definition

The depth to main useful aquifer (MUA) is defined depending on the nature of the MUA water table as the depth from the ground surface to:

- ¶ MUA unconfined groundwater table,
- ¶ MUA confined groundwater table (that is, to impermeable / semi-permeable deposits limiting the MUA from the top).

¶ Legend

The "Depth to main useful aquifer" layer is shown in a pixel map. The blue color indicates the depth of 0-2 m, and the dark orange color indicates the greatest value of the depth to the MUA (>50 m).



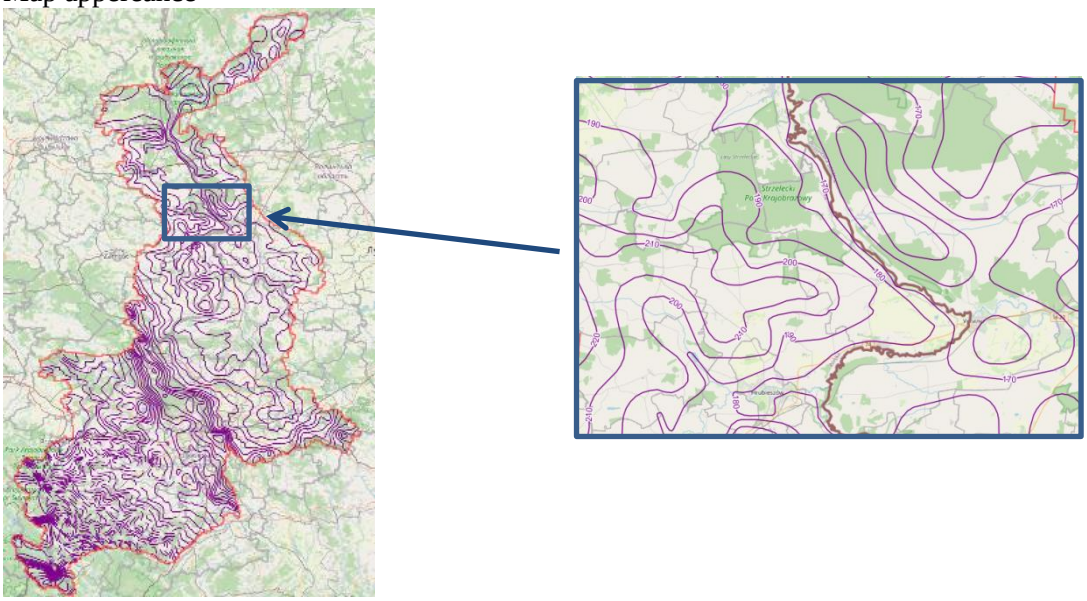
¶ Attributes

Below are the attributes and vocabularies used to describe the " Depth to main useful aquifer ":

Attribute name	Attribute value
Depth to the MUA from (m)	¶ 0 ¶ 2 ¶ 5 ¶ 15 ¶ 50
Depth to the MUA to (m)	¶ 2 ¶ 5 ¶ 15 ¶ 50 ¶ > 50

3.3. Hydroisohypses of the main useful aquifer

¶ Map appereance



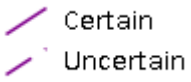
¶ Definition

Hydroisohypses ï Contour lines for connecting equal level groundwater head points of the main useful aquifer.

¶ Legend

The "Hydroisohypses of the main useful aquifer" are shown on the map as purple lines. Certain hydroisohypses have been defined as solid lines. On the other hand, the uncertain hydroisohypses - as

dashed lines in areas devoid of the main usable aquifer (MUA). Each hydroisohypse was assigned a numerical value, and subsequent hydroisohypses are cut every 10 m.



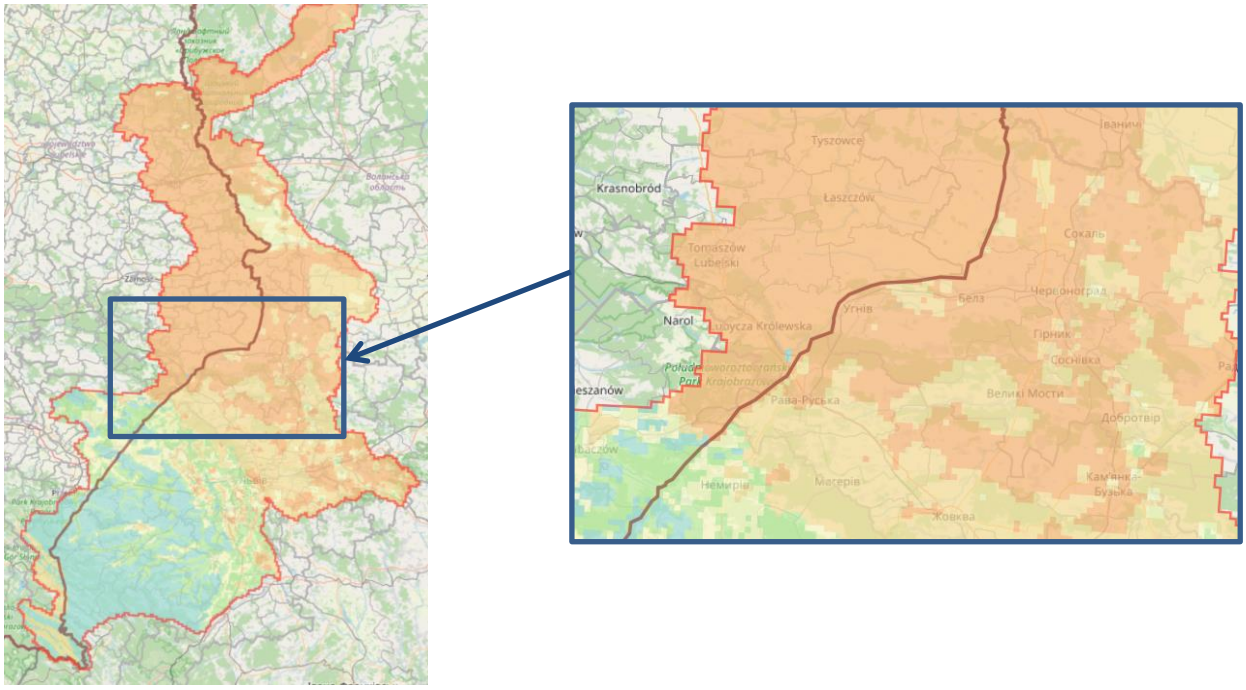
¶ Attributes

Below are the attributes and vocabularies used to describe the "Hydroisohypse of the main useful aquifer".

Attribute name	Attribute value
Value (m)	Intervals of isolines of the water head every 10 m
Type (Type)	¶ Certain ¶ Uncertain

3.4. Thickness of the main useful aquifer

¶ Map appearance

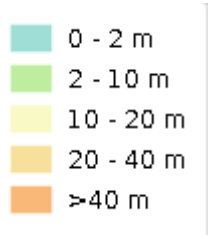


¶ Definition

Thickness of the main useful aquifer, measured between its top and bottom.

¶ Legend

The "Thickness of the main useful aquifer" layer is shown on a pixel map. Blue indicates the smallest thickness of 0-2 m, and dark orange indicates the largest value of the thickness of the main useful aquifer (>40 m).



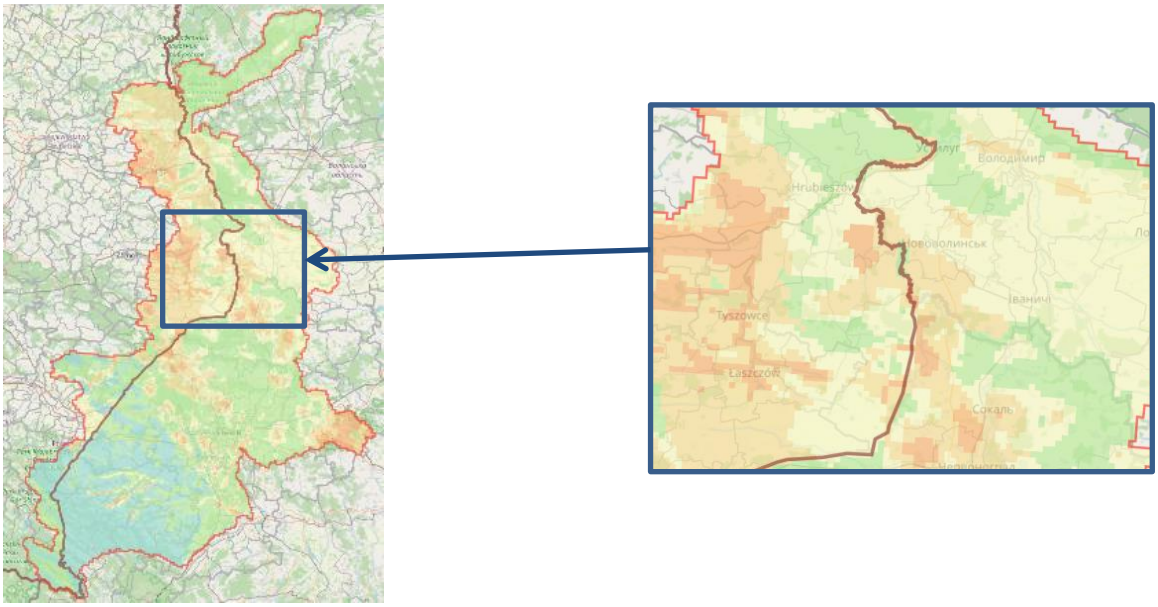
¶ Attributes

Below are the attributes and vocabularies used to describe the layer "Thickness of the main useful aquifer".

Attribute name	Attribute value
Thickness of MUA from (m)	¶ 0 ¶ 2 ¶ 10 ¶ 20 ¶ 40
Thickness of MUA to (m)	¶ 2 ¶ 10 ¶ 20 ¶ 40 ¶ > 40

3.5. Transmissivity of the main useful aquifer

¶ Map appearance

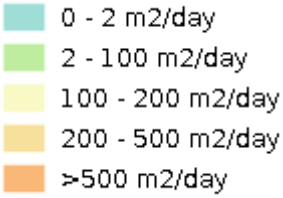


¶ Definition

Transmissivity of the MUA - the rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths.

¶ Legend

The "Transmissivity of the main usable aquifer" layer is shown on a pixel map. The blue color indicates a conductivity of 0-2 m^2/day and the dark orange color indicates the highest conductivity value of MUA (>500 m^2/day).



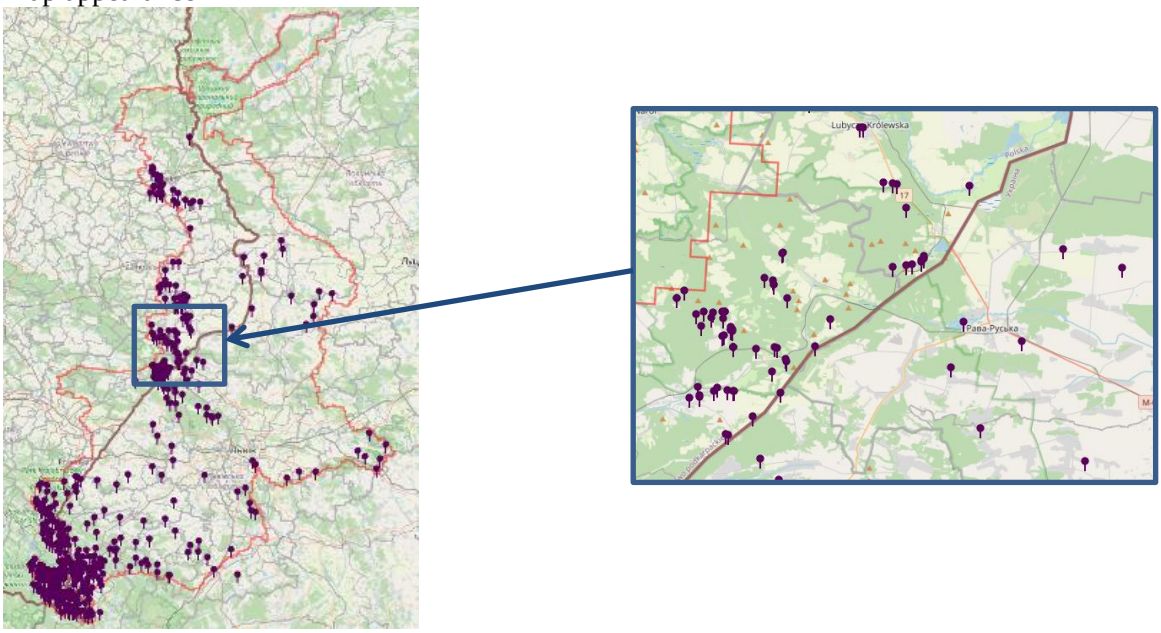
¶ Attributes

Below are the attributes and vocabularies used to describe the "Transmissivity of the main useful aquifer":

Attribute name	Attribute value
Transmissivity of MUA from (m2/d)	¶ 0 ¶ 2 ¶ 100 ¶ 200 ¶ 500
Transmissivity of MUA to (m2/d)	¶ 2 ¶ 100 ¶ 200 ¶ 500 ¶ > 500

3.6. Springs

¶ Map appearance



¶ Definition

Natural, concentrated outflow of groundwater on the ground surface.

¶ Legend

the symbol marks the spring on the map

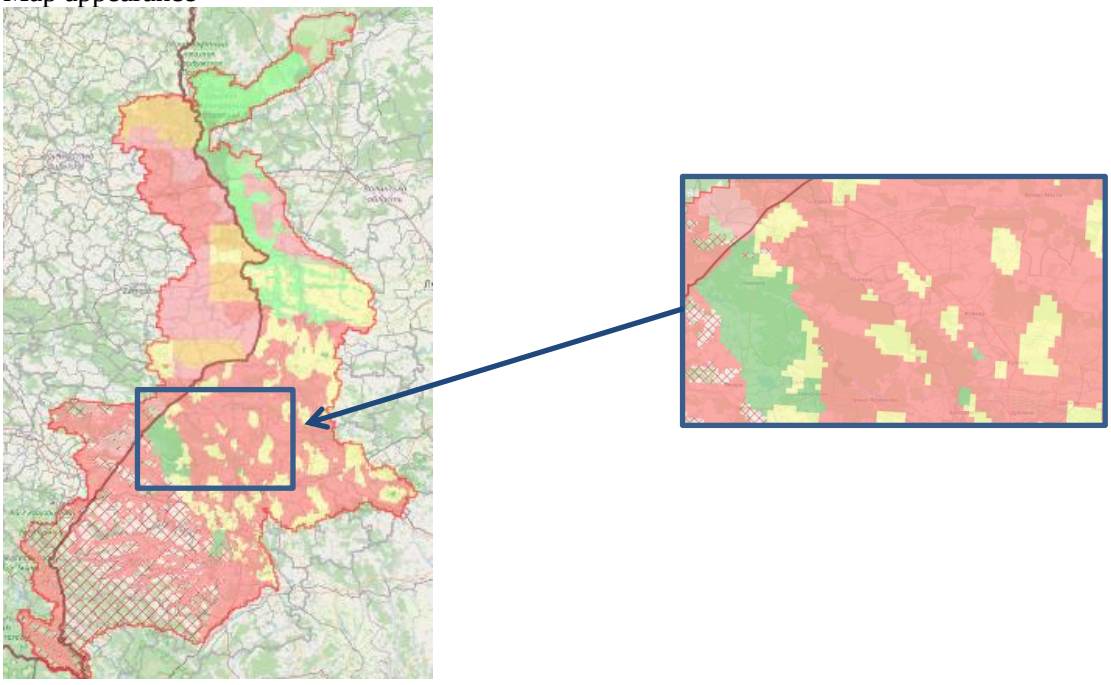
¶ Attributes

Below are the attributes and vocabularies used to describe the "Springs" layer:

Attribute name	Attribute value
Terrain elevation (m a.s.l.)	Value in m a.s.l.
Stratigraphy of aquifer	¶ alQ ïalluvial Quaternary ¶ fgQ ïfluvioglacial Quaternary ¶ Q ïQuaternary ¶ Q-Ng ïQuaternary-Neogen ¶ Q-Pl ïQuaternary-Pliocene ¶ Q-Cr3 ïQuaternary-Cretaceous ¶ M ïMiocene ¶ Ng ïNeogene ¶ Pg+Ng ïPaleogene and Neogene ¶ Pg ïPaleogene ¶ Ol ïOligocene ¶ E ïEocene ¶ Pg-Cr ïPaleogene-Cretaceous ¶ Cr3 ïUpper Cretaceous ¶ Cr ïCretaceous
Flow rate (l/s)	¶ Value in l/s ¶ no data

3.7. Insulation degree of the main useful aquifer

¶ Map appearance



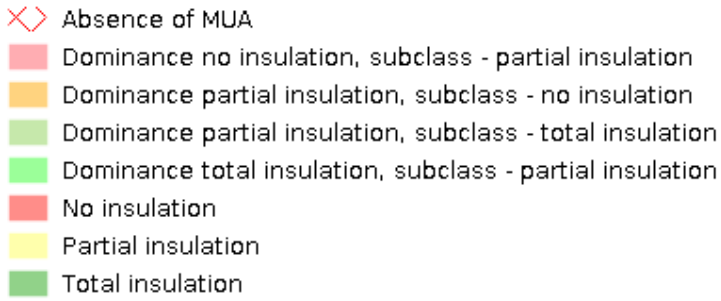
¶ Definition

The insulation degree of main useful aquifer - a qualitative index, which is established on the basis of the total thickness of low-permeable layers (k = 10^{-6}-10^{-9} m/s) and practically impermeable (k < 10^{-9} m/s) located above the main useful aquifer.

¶ Legend

The layer "Isolation degree of the main useful aquifer" is shown on a pixel map.

Areas with no insulation to MUA are marked in red, areas with partial insulation are marked in yellow, and areas with complete isolation from MUA in dark green. There are also 4 types of areas with a dominant insulation value classified into different subclasses. Apart from the symbols above and in addition to the markings on the map, areas where there is no MUA have also been marked - the area filled with a red grid.

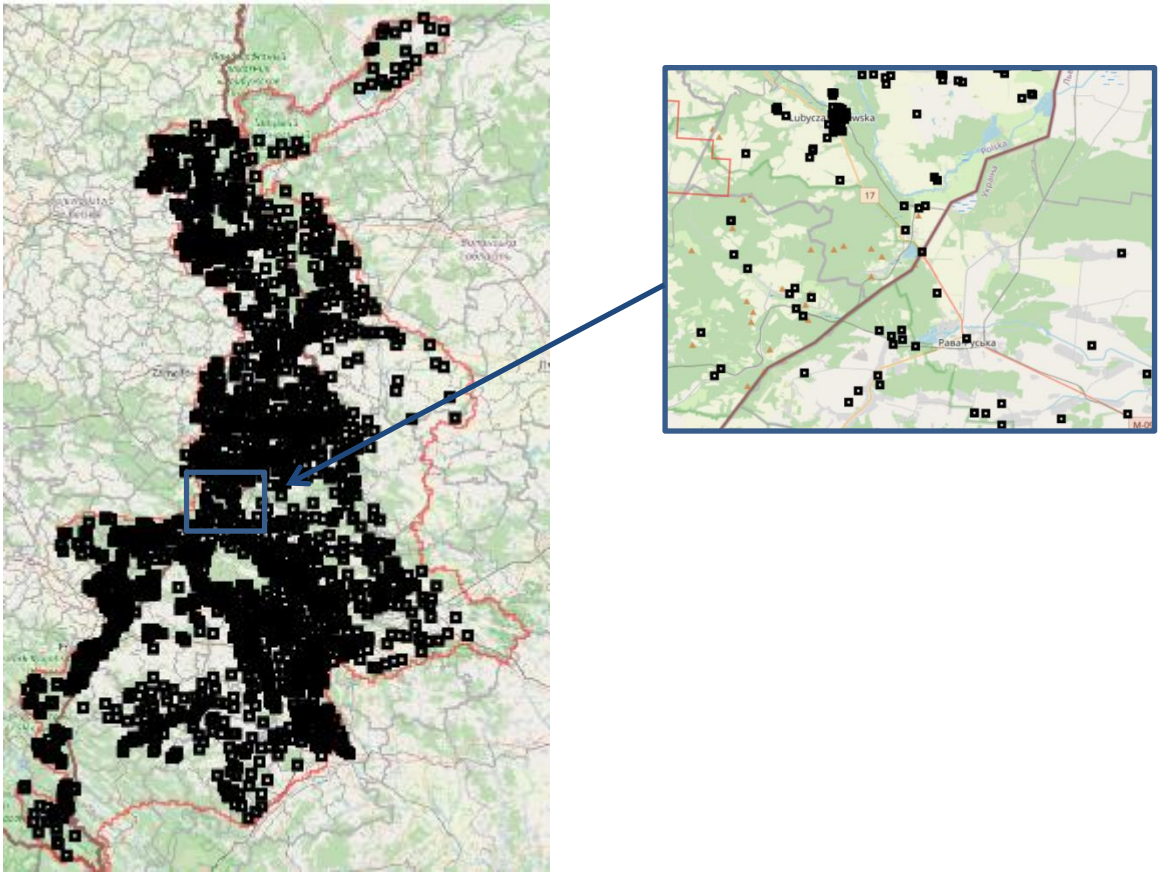


¶ Attributes

Name of the attribute	Attribute value
Insulation degree of the main useful aqifer	¶ no insulation ¶ dominance no insulation, subclass - partial insulation ¶ dominance partial insulation, subclass - no insulation ¶ partial insulation ¶ dominance partial insulation, subclass - total insulation ¶ dominance total insulation, subclass - partial insulation ¶ total insulation absence main useful aquifer

3.8. Wells / Boreholes

¶ Map appearance



¶ Definition

A borehole made to determine the hydrogeological conditions, groundwater exploitation, observation, etc.

- Legend

▪ the symbol marks a well/borehole on the map

- Attributes

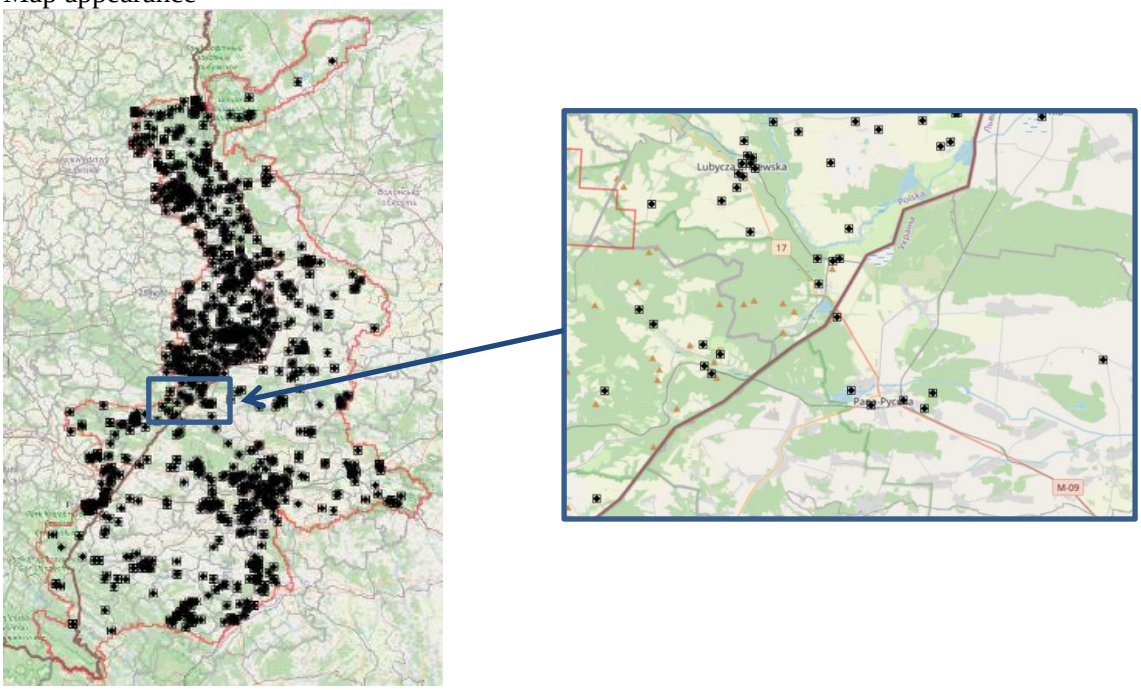
Below are the attributes and vocabularies used to describe the "Wells/Boreholes" layer:

Attribute name	Attribute value
National number of borehole	National borehole number
Type of borehole	¶ research borehole ¶ exploitation borehole ¶ observation borehole ¶ exploratory borehole
Water type	¶ ordinary ¶ medicinal
Terrain elevation	¶ value in m a.s.l.
Year when the borehole was made	Year
Borehole depth	¶ value in m b.g.l.
The depth of the screen from	¶ Q ïQuaternary ¶ Q - M ïQuaternary - Miocene

	¶ Q - Pg+Ng ï Quaternary- Paleogen and Neogen ¶ Q - Cr ï Quaternary -Cretaceous ¶ M ï Miocene ¶ M - Cr3 ï Miocene- Upper Cretaceous ¶ Pg+Ng ï Paleogen and Neogen ¶ Pg ï Paleogen ¶ Pg - Cr ï Paleogen- Cretaceous ¶ Pg - D ï Paleogen-Devonian ¶ Cr3 ï Upper Cretaceous ¶ Cr ï Cretaceous ¶ J ï Jurassic
The depth of the screen from é	value in m a.g.l.
The depth of the screen to é	value in m a.g.l.
Stratigraphy of the aquifer	¶ Q ï Quaternary ¶ Q - M ï Quaternary - Miocene ¶ Q - Pg+Ng ï Quaternary- Paleogen and Neogen ¶ Q - Pg+Ng - Cr ï Quaternary- Paleogen and Neogen- Cretaceous ¶ Q - Cr ï Quaternary- Cretaceous ¶ Q - Cr3 ï Quaternary- Upper Cretaceous ¶ M ï Miocene ¶ M - Cr3 ï Miocene- Upper Cretaceous ¶ Pg+Ng ï Paleogen and Neogen ¶ Pg ï Paleogen ¶ Pg - Cr ï Paleogen- Cretaceous ¶ Pg - D ï Paleogen-Devonian ¶ Pl ï Pliocene ¶ Cr3 ï Upper Cretaceous ¶ Cr ï Cretaceous ¶ no data
The depth of the drilled groundwater table	Depth in m b.g.l.
The depth of the static groundwater table	Depth in m b.g.l.

3.9. Intakes

¶ Map appearance



¶ Definition

Groundwater intake - a set of devices used to abstract groundwater from one point, many points or from a certain area, supplying a specific user or for a specific purpose.

¶ Legend

the symbol indicates an intake on the map

¶ Attributes

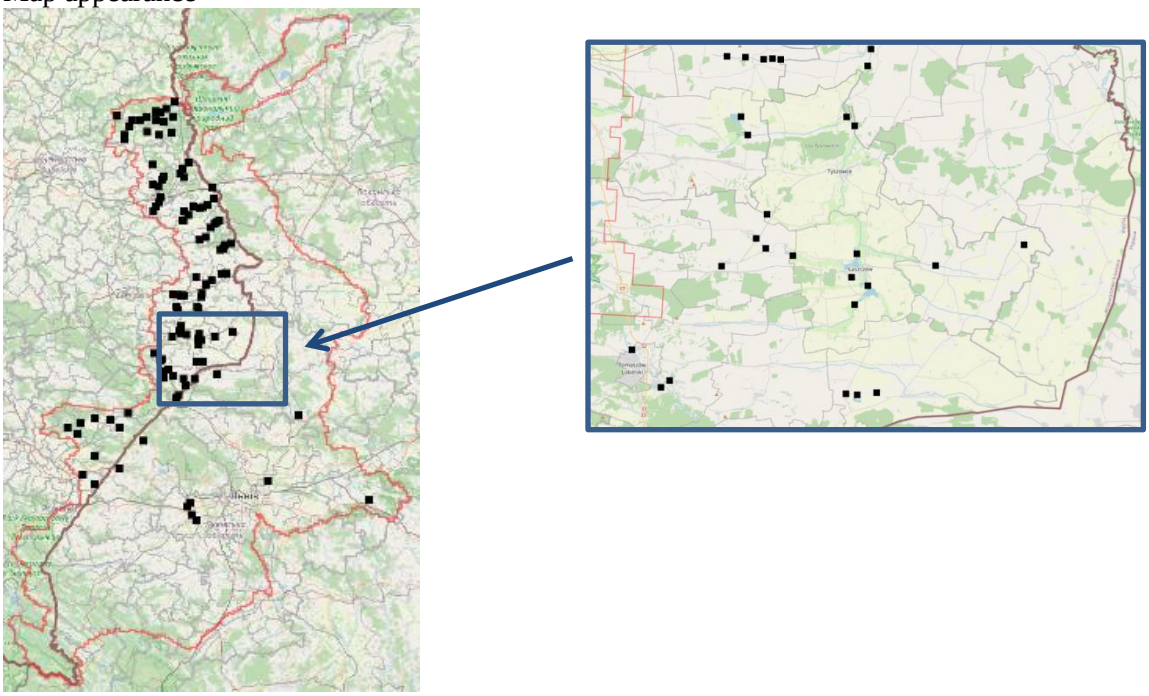
Below are the attributes and vocabularies used to describe the "Intakes" layer:

Attribute name	Attribute value
National number of intake	National intake number
Name of intake	The name of the town where the intake is located
Role of the intake	¶ Industrial ¶ Individual ¶ Communal (collective supply) ¶ Agricultural ¶ Fire-extinguishing ¶ Research ¶ Balneological ¶ Other ¶ No data
Stratigraphy of the aquifer	¶ Q ïQuaternary o Q (al) ïalluvial Quaternary o Q (Qp) ïPleistocene Quaternary o Pg+Ng ïPaleogene and Neogene o Pl ïPliocene

	○ M ïMiocene ○ Ol ïOligocene ○ E ïEocene ¶ Cr ïCretaceous ○ Cr3 ïUpper Cretaceous
Depression magnitude range for authorized resources (m b.g.l)	¶ depth value in meters below ground level (m b.g.l.) ¶ no data
Exploitation resources Q (m3/h)	¶ The volume of the exploitation resource from a Quaternary aquifer in m^3/h
Exploitation resources Pg+Ng (m3/h) (m3/h)	¶ The volume of the exploitation resource from Paleogene and Neogene aquifer in m^3/h
Exploitation resources Cr (m3/h)	¶ The volume of the exploitation resource from a Cretaceous aquifer in m^3/h
Exploitation resources Q-(Pg+Ng) (m3/h)	¶ The volume of the exploitation resource from Quaternary- Paleogene and Neogene aquifer in m^3/h
Exploitation resources Q-Cr (m3/h)	¶ The volume of the exploitation resource from Quaternary-Cretaceous aquifer in m^3/h
Exploitation resources (Pg+Ng)-Cr (m3/h)	¶ The volume of the exploitation resource from Paleogene and Neogene ï Cretaceous aquifer in m^3/h

3.10. Groundwater damming devices

¶ Map appearance



¶ Definition

Groundwater damming device, it is understood as a hydrotechnical device (dams, weirs, sills, gates - on rivers / streams) or other devices causing flow inhibition and damming of groundwater, i.e. raising of the groundwater table level.

¶ Legend

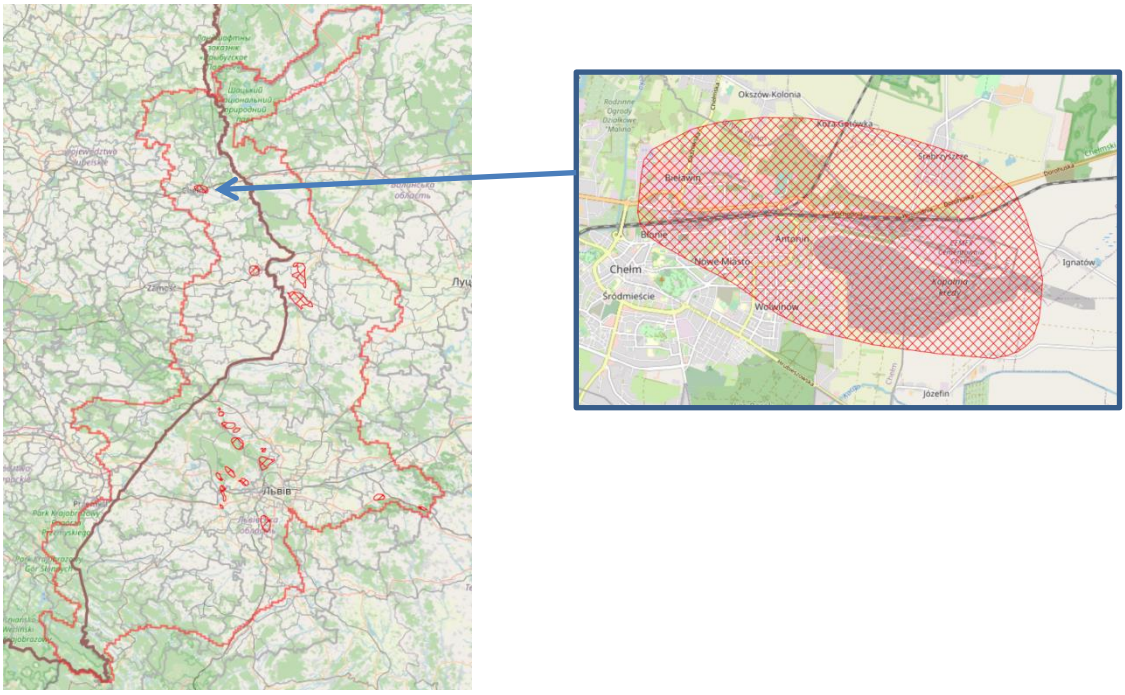
■ Location of the damming device

¶ Attributes

Attribute name	Attribute value
Function of groundwater damming device	¶ fish pond ¶ recreation, fish pond ¶ industrial ¶ irrigation
Type of groundwater damming device	¶ small earth dam ¶ weir ¶ no data
Name of the river, lake on which the hydrotechnical device exists	¶ Name of the lake, river, or reservoir
Location	The name of the settlement where it is located
Dam area	Area in km^2
Local aquifer type	¶ alQ - Quaternary alluvial ¶ Cr ïCretaceous
Reservoir type	¶ floodplain reservoir ¶ bed reservoir ¶ water damming

3.11. Areas of depression cones

¶ Map appearance



¶ Definition

Zone of lowering the piezometric surface (groundwater table) caused by pumping or drainage of aquifers by intakes, mines, etc. Depression of regional importance, with an area of more than 50 km^2 or smaller ones with a mirror depression of more than 50 m.

¶ Legend

Areas with depression cones are marked on the map - the area filled with a red grid.

¶ Attributes

Below are the attributes and vocabularies used to describe the "Areas of depression cones" layer.

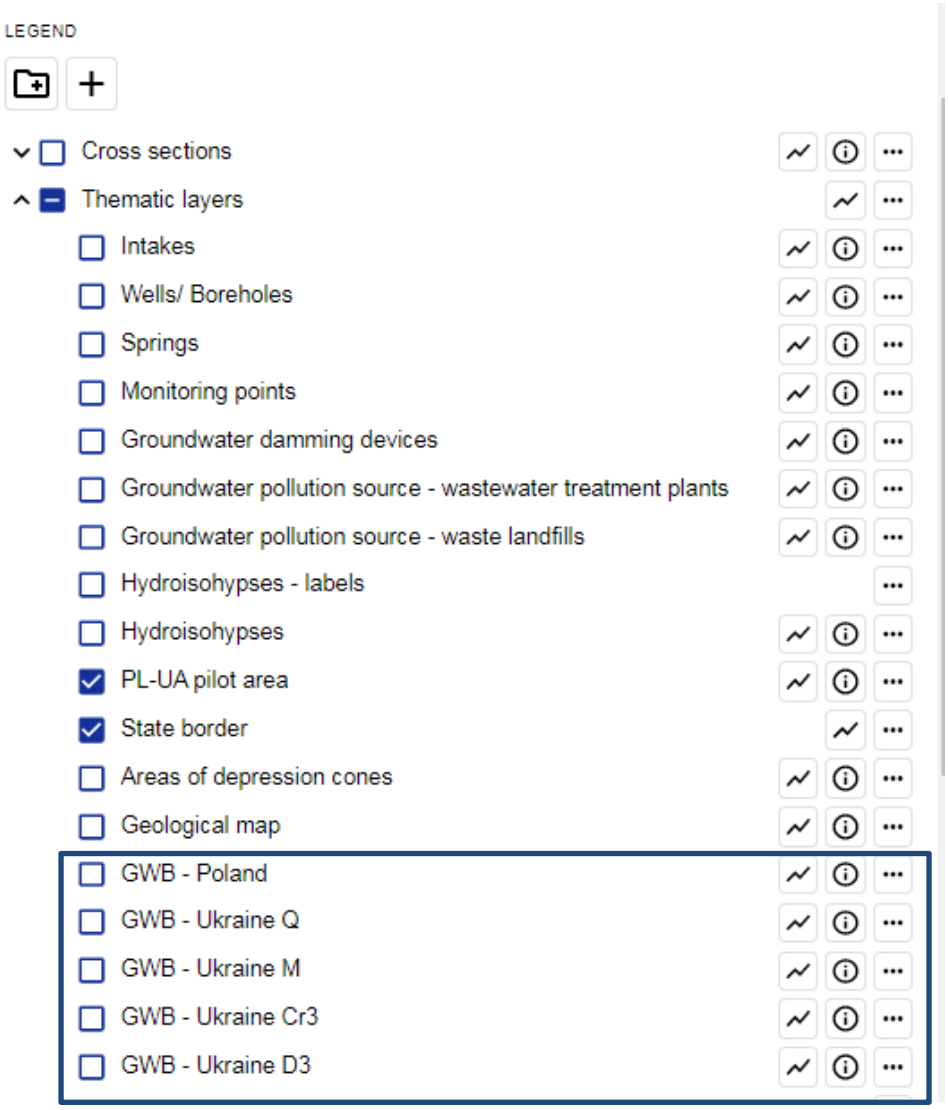
Attribute name	Attribute value
Type of lowering the groundwater level	Cone from exploitation of groundwater
Drainage facility	Name of the facility
Stratigraphy of the drained aquifer	¶ Q ïQuaternary ¶ M ïMiocene ¶ Cr3 ïUpper Cretaceous ¶ D3 ïUpper Devonian
Depression cone surface (km2)	Area in km^2
Year of update	Year

3.12. Groundwater bodies

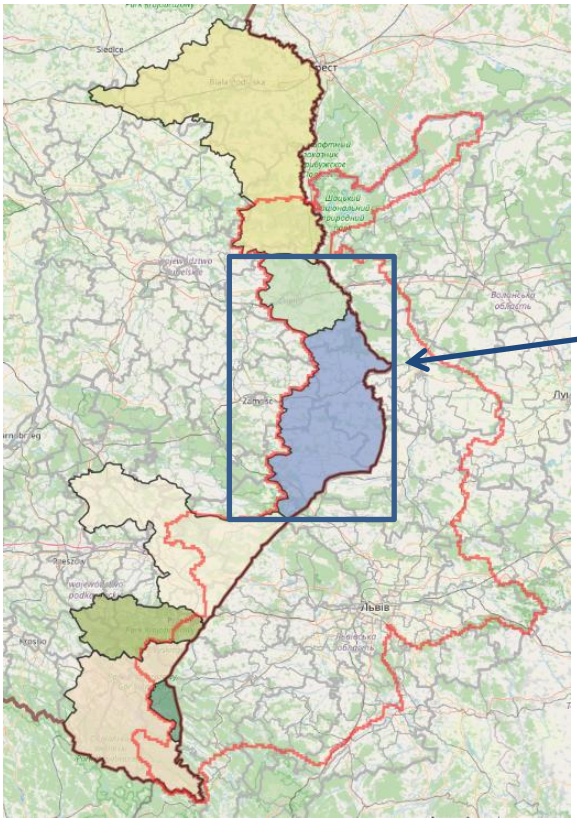
According to the definition given in the Water Framework Directive, groundwater bodies include groundwater that occur in aquifers with porosity and permeability, enabling a significant uptake in water supply to the population or flow with an intensity significant for shaping the desired state of surface water and groundwater dependent ecosystems.

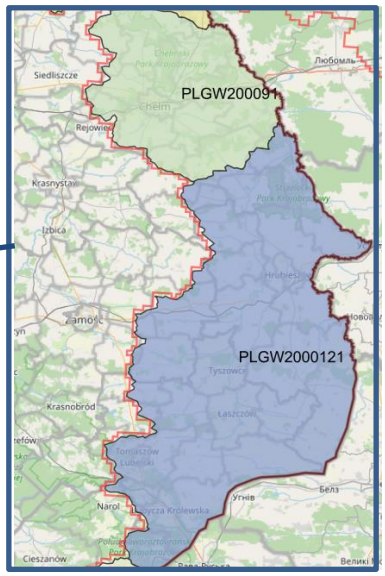
Given the fact that Ukraine and Poland have completely different methods of extraction of groundwater bodies, this shape is divided. Separately, the Polish GWB (GWB-Poland) and a group of Ukrainian GWB layers (GWB-Ukraine Q, GWB-Ukraine D3, GWB-Ukraine M, GWB-Ukraine Cr3) are shown. The definition is the same for all types of shapes. Therefore, in this instruction, we will focus on the differences, namely: how the map looks on the portal, the legend and attributes.

You can enable / disable GWB layers in the ñT check-box:


LEGEND
Cross sections
Thematic layers
Intakes
Wells/ Boreholes
Springs
Monitoring points
Groundwater damming devices
Groundwater pollution source - wastewater treatment plants
Groundwater pollution source - waste landfills
Hydroisohypses - labels
Hydroisohypses
PL-UA pilot area
State border
Areas of depression cones
Geological map
GWB - Poland
GWB - Ukraine Q
GWB - Ukraine M
GWB - Ukraine Cr3
GWB - Ukraine D3

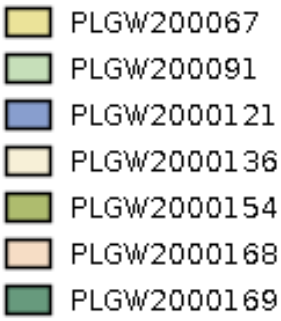
3.12.1. *Map appearance GWB-Poland*





Activated shape GWB-Poland

¶ Legend



The GWB layer is represented on the map by colored areas. Each GWB object has a unique fill color and has its own unique code (EU code of GWB), which allows unambiguous identification.

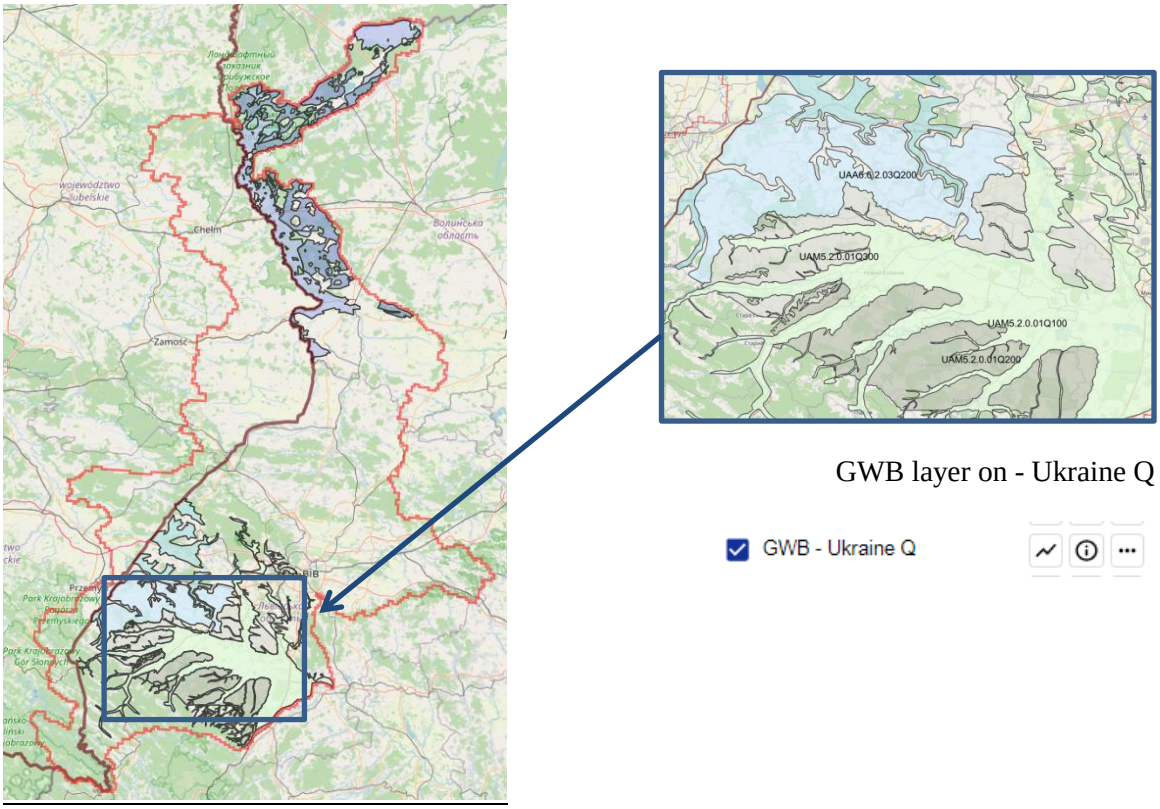
¶ Attributes

Below are the attributes and vocabularies used to describe the ñGWB-Poland òlayer.

Attribute name	**Attribute value**
European code of GWB	EU code of GWB
Area of GWB	Area in km^2
Regions of Poland	Voivodeship of Poland
Regions of Poland	Counties of Poland
River basin	Name of the river basin
Water region	Name of the water region
Water management areas	Name of the RWMA
Main River	Name of the main River Basin
Stratigraphy of the MUA	¶ Q ¶ Q-Ng ¶ Pg ¶ Pg+Ng

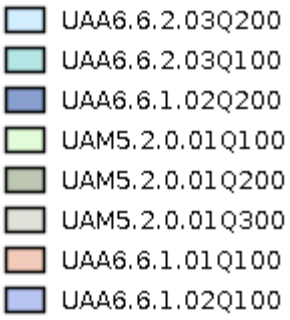
	¶ Pg+Ng (flysh) ¶ Pg-Cr ¶ Pg-Cr (flysh) ¶ Cr
Dominant chemical type of MUA waters	natural type: ¶ HCO_3-Ca ¶ HCO_3-SO_4-Ca ¶ HCO_3-Cl-Ca ¶ HCO_3-Ca-Mg ¶ HCO_3-Ca-Mg ¶ HCO_3-SO_4-Ca-Mg ¶ HCO_3-Na ¶ HCO_3-Na-Ca
Type of anthropopression	¶ depression cones ¶ cities ¶ mining drainage ¶ none
Area of groundwater dependent ecosystems (ha)	Area in ha
Area of protected areas (ha)	Area in ha
Diffuse pollution areas	¶ areas prone to nitrate pollution from agriculture ¶ urban area ¶ none
Assessment of the quantitative status of GWB	¶ good ¶ poor
Assessment of the chemical status of GWB	¶ good ¶ poor
Overall assessment of the state of the GWB	¶ good ¶ poor
Year of the most recent GWB assessment	Year of last assessment

3.12.2. Map appearance GWB – Ukraine Q



GWB layer on - Ukraine Q

¶ Legend



The Quaternary GWB layer is represented on the map by colored areas. Each GWB object has a unique fill color and has its own unique code (National GWB Code), which enables unambiguous identification.

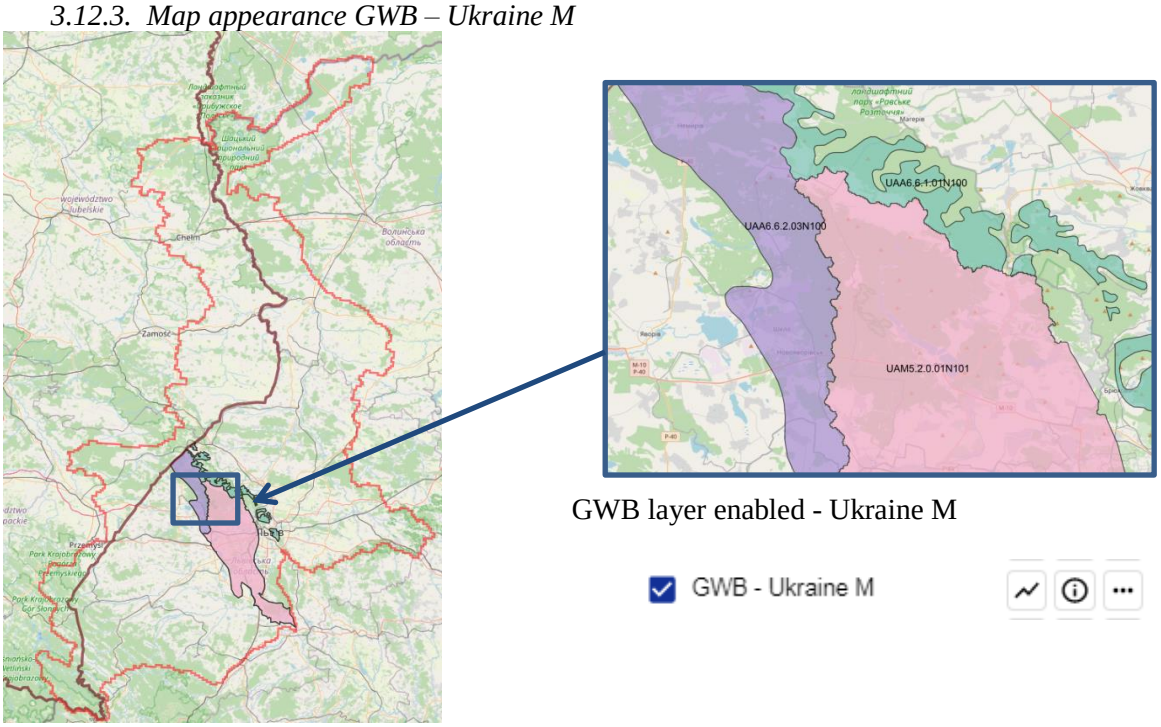
¶ Attributes

Below are the attributes and vocabularies used to describe the "GWB - Ukraine Q".

Attribute name	Attribute value
National code of GWB	National code of GWB
Regions of Ukraine	Region of Ukraine
Area of GWB (km2)	Area in km2
Districts of Ukraine	Districts of Ukraine
Territorial communities	Territorial communities of Ukraine
River basin	Name of the river basin
River Water region	Name of the river water region
Water management areas	Name of the water management area
Main River	Name of the main river
Stratigraphy of the MUA	¶ Q (PI)

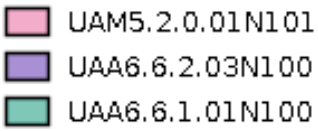
	¶ Q (PII)
	¶ Q (PIII)
Dominant chemical type of MUA waters	¶ HCO3-Ca
	¶ HCO3-SO4-Ca
	¶ HCO3-SO4-Ca, Na
	¶ HCO3-SO4-Ca, Na, K
	¶ HCO3-Cl-Ca
	¶ HCO3-Mg
Type of anthropopression	¶ Cities
	¶ Mines
	¶ Mining drainage systems
	¶ Depression cones
Area of groundwater dependent ecosystems (ha)	Area in ha
Area of protected areas (ha)	Area in ha
Diffuse pollution areas	¶ Areas prone to nitrate pollution from agriculture
	¶ Urban areas
Risk of not achieving environmental goals (quantitative factor)	¶ Not endangered
	¶ No data
Assessment of the quantitative status of GWB	¶ Good
	¶ Poor
	¶ No data
Risk of not achieving environmental goals (chemical factor)	¶ Local pollution with organic substances (nitrates, nitrites, ammonia)
	¶ No data
Assessment of the chemical status of the GWB	¶ Good
	¶ Poor
	¶ No data
Overall assessment of the state of the GWB	¶ Good
	¶ Poor
	¶ No data
Year of the most recent GWB assessment	Year of last assessment/no data

3.12.3. Map appearance GWB – Ukraine M



GWB layer enabled - Ukraine M

¶ Legend



The Miocene GWB is represented on the map by colored areas. Each GWB object has a unique fill color and has its own unique code (National GWB Code), which enables unambiguous identification.

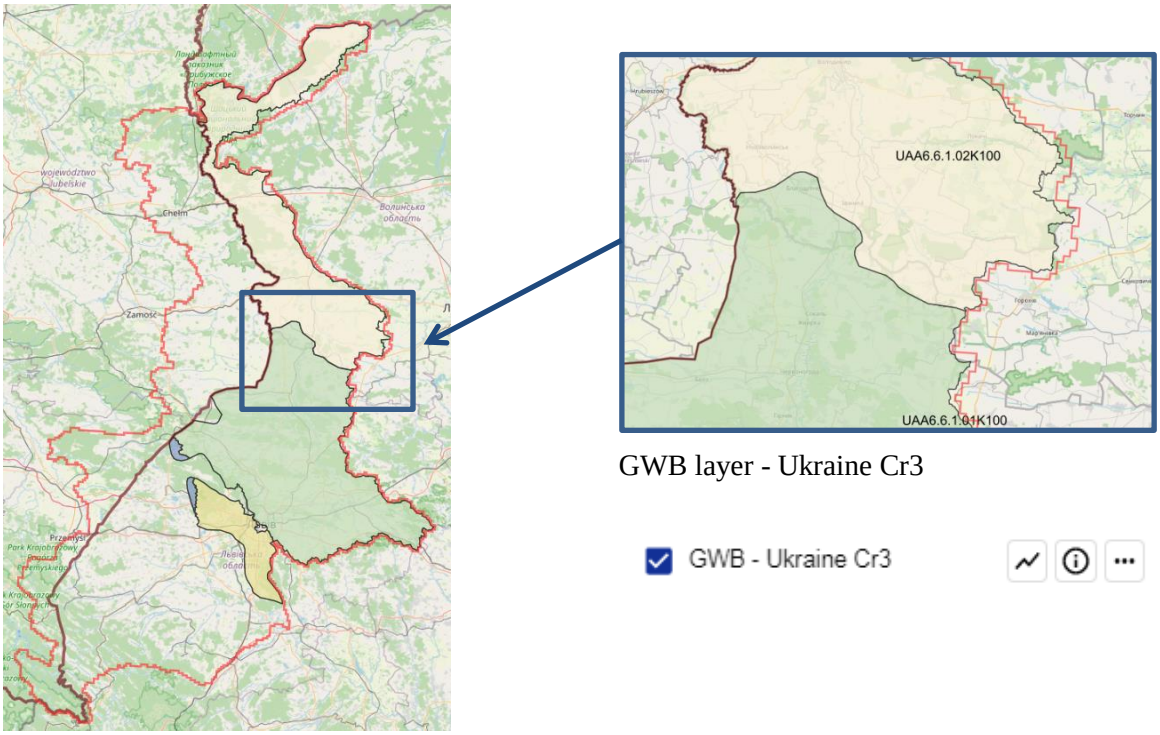
¶ Attributes

Below are the attributes and vocabularies used to describe the "GWB - Ukraine M".

Attribute name	Attribute value
National code of GWB	National code of GWB
Regions of Ukraine	Region of Ukraine
Area of GWB (km2)	Area in km^2
Districts of Ukraine	Districts of Ukraine
Territorial communities	Territorial communities of Ukraine
River basin	Name of the river basin
River Water region	Name of the river water region
Water management areas	Name of the water management area
Main River	Name of the main river
Stratigraphy of the MUA	¶ M
Dominant chemical type of MUA waters	¶ HCO3-Ca ¶ HCO3-SO4-Ca ¶ HCO3-Cl-Ca
Type of anthropopression	¶ Cities ¶ Mines ¶ Depression cones
Area of groundwater dependent ecosystems (ha)	Area in ha
Area of protected areas (ha)	Area in ha

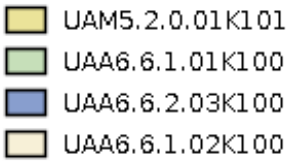
Diffuse pollution areas	¶ Areas prone to nitrate pollution from agriculture ¶ Urban areas
Risk of not achieving environmental goals (quantitative factor)	¶ Endangered. Intensive exploitation of groundwater (formation of depression cones, drainage of wetlands, formation of karst) ¶ Not endangered ¶ No data
Assessment of the quantitative status of GWB	¶ Good ¶ Poor ¶ No data
Risk of not achieving environmental goals (chemical factor)	¶ Local pollution of the territory during the extraction of native sulfur deposits ¶ Not endangered ¶ No data
Assessment of the chemical status of the GWB	¶ Good ¶ Poor ¶ No data
Overall assessment of the state of the GWB	¶ Good ¶ Poor ¶ No data
Year of the most recent GWB assessment	Year of last assessment/no data

3.12.4. Map appearance GWB – Ukraine Cr3



GWB layer - Ukraine Cr3

¶ Legend



The Cretaceous GWB layer is represented on the map by colored areas. Each GWB object has a unique fill color and has its own unique code (National GWB Code), which enables unambiguous identification.

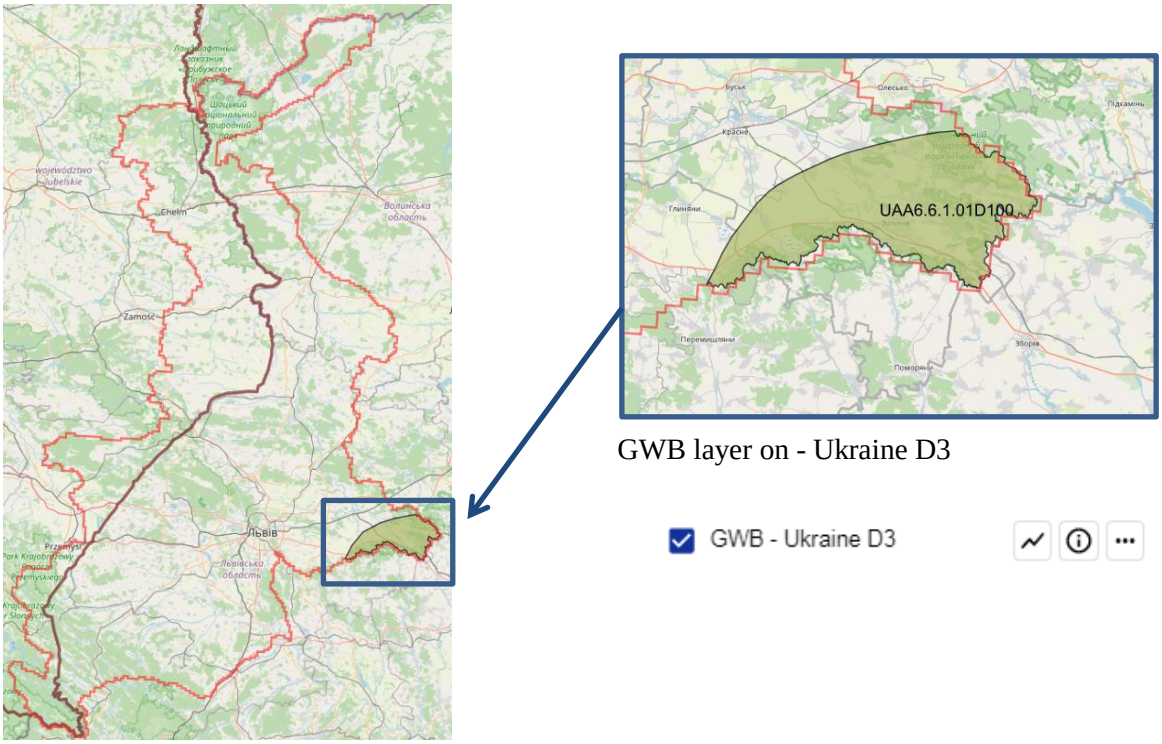
¶ Attributes

Below are the attributes and vocabularies used to describe the "GWB - Ukraine Cr3" layer

Attribute name	Attribute value
National code of GWB	National code of GWB
Regions of Ukraine	Region of Ukraine
Area of GWB (km2)	Area in km2
Districts of Ukraine	Districts of Ukraine
Territorial communities	Territorial communities of Ukraine
River basin	Name of the river basin
River Water region	Name of the river water region
Water management areas	Name of the water management area
Main River	Name of the main river
Stratigraphy of the MUA	¶ Cr3(t-m) ¶ Cr3m ¶ Cr3(s-m)
Dominant chemical type of MUA waters	¶ HCO3-Ca ¶ HCO3-SO4-Ca ¶ HCO3-SO4-Na-Ca ¶ HCO3-Cl-Ca ¶ HCO3-Cl-Ca (Na,K) ¶ Mg ¶ (Na, K)
Type of anthropopression	¶ Cities ¶ Mines ¶ Depression cones
Area of groundwater dependent ecosystems (ha)	Area in ha
Area of protected areas (ha)	Area in ha
Diffuse pollution areas	¶ Areas prone to nitrate pollution from agriculture ¶ Urban areas
Risk of not achieving environmental goals (quantitative factor)	¶ Endangered. Intensive exploitation of groundwater (formation of depression cones, drainage of wetlands, formation of karst) ¶ Not endangered ¶ No data
Assessment of the quantitative status of GWB	¶ Good ¶ Poor ¶ No data
Risk of not achieving environmental goals (chemical factor)	¶ Not endangered ¶ Pollution of the territory during the extraction of coal deposits ¶ No data
Assessment of the chemical status of the GWB	¶ Good

Overall assessment of the state of the GWB	¶ Poor ¶ No data ¶ Good ¶ Poor ¶ No data
Year of the most recent GWB assessment	Year of last assessment/no data

3.12.5. Map appearance GWB – Ukraine D3



GWB layer on - Ukraine D3

¶ Legend

UAA6.6.1.01D100

The GWB layer of the Devonian stage is represented on the map by colored areas. Each GWB object has a unique fill color and has its own unique code (National GWB Code), which enables unambiguous identification.

¶ Attributes

Below are the attributes and vocabularies used to describe the "GWB - Ukraine D3"

Attribute name	Attribute value
National code of GWB	National code of GWB
Regions of Ukraine	Region of Ukraine
Area of GWB (km2)	Area in km2
Districts of Ukraine	Districts of Ukraine
Territorial communities	Territorial communities of Ukraine
River basin	Name of the river basin
River Water region	Name of the river water region
Water management areas	Name of the water management area
Main River	Name of the main river
Stratigraphy of the MUA	¶ D3
Dominant chemical type of MUA waters	¶ HCO3-Ca ¶ HCO3-SO4-Ca ¶ HCO3-Cl-Ca
Type of anthropopression	¶ Cities ¶ Depression cones
Area of groundwater dependent ecosystems (ha)	Area in ha
Area of protected areas (ha)	Area in ha
Diffuse pollution areas	¶ Areas prone to nitrate pollution from agriculture
Risk of not achieving environmental goals (quantitative factor)	¶ Not endangered
Assessment of the quantitative status of GWB	¶ Good ¶ Poor ¶ No data
Risk of not achieving environmental goals (chemical factor)	¶ Not endangered
Assessment of the chemical status of the GWB	¶ Good ¶ Poor ¶ No data
Overall assessment of the state of the GWB	¶ Good ¶ Poor ¶ No data
Year of the most recent GWB assessment	Year of last assessment/no data

3.13. Groundwater pollution source

3.13.1. Groundwater pollution source – wastewater treatment plants

¶ Map appearance

¶ Definition

Groundwater pollution source - an object causing intentional or accidental release of undesirable substances into groundwater as a result of anthropogenic activity or for natural causes. One of the important groundwater pollution source for the research area is **wastewater treatment plants**.

¶ Legend

▲ the symbol indicates the place of groundwater pollution - the wastewater treatment plant on the map

¶ Attributes

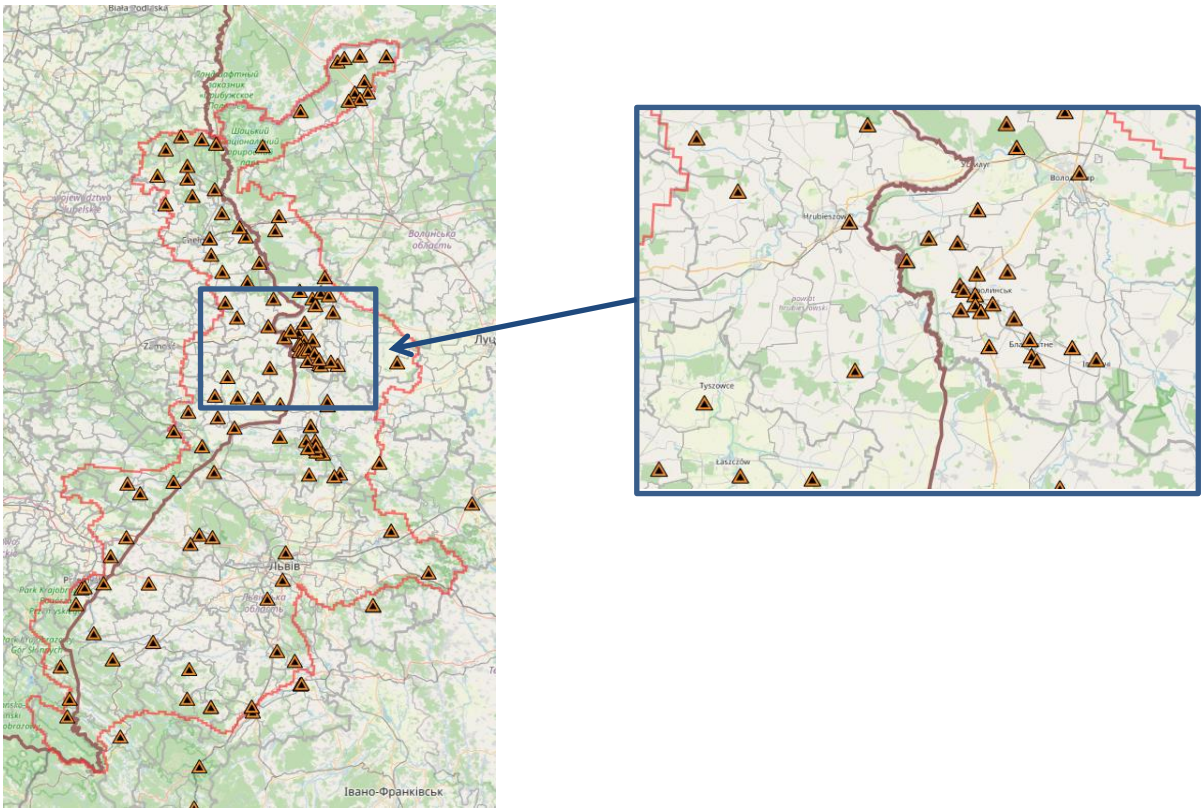
Below are the attributes and vocabularies used to describe the "Groundwater pollution source ï wastewater treatmentplants " layer

Attribute name	Attribute value
Region or Voivodeship	Voivodeship in Poland or region in Ukraine
District or County	County in Poland or district in Ukraine
Place	Name of the town where the wastewater treatment plant is located
Type of wastewater treatment plant	¶ Mechanical ¶ Biological ¶ Mechanical-biological

	¶ Mechanical-biological-chemical ¶ No data
Capacity of the wastewater treatment plant (m3/day)	Maximum amount of sewage in m^3/day
Type of wastewater	¶ Municipal ¶ Industrial ¶ Municipal-industrial ¶ No data
Wastewater receiver	Name of the river, watercourse, drainage (filtration fields)
Data source	Name of the institution
Validity of data	Year

3.13.2. Groundwater pollution source - landfills

¶ Map appearance



¶ Definition

Groundwater pollution site - artificial accumulation of pollutants (actual or potential) in groundwater. Pollution hotspots can be of various spatial nature: spot (drilling, petrol stations, warehouses), linear or strip (roads, pipelines), surface (landfills, sedimentation tanks, drainage and irrigation fields) and area (fertilization and chemicalisation of agriculture). This work focuses on the pollution hotspots that are the most important for the research area, which are: wastewater treatment plants and waste landfills, including mining heaps.

¶ Legend

▲ the symbol indicates the place of groundwater pollution - the landfill on the map

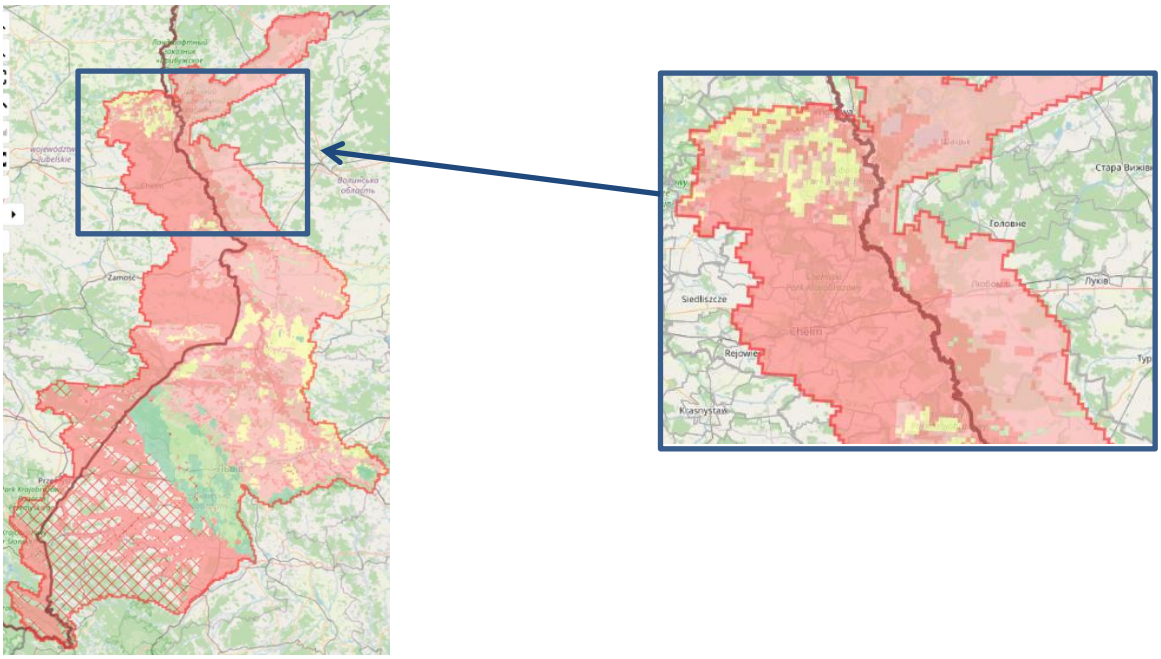
¶ Attributes

Below are the attributes and vocabularies used to describe the "Groundwater pollution source - waste landfills"

Attribute name	Attribute value
Region or Voivodeship	Voivodeship in Poland or region in Ukraine
District or Counties	County in Poland or district in Ukraine
Community or Municipality	A municipality in Poland or a community/commune in Ukraine
Place	The name of the town where the landfill is located
Landfill area (ha)	Area in ha
Waste storage method	¶ above-level ¶ sub-level ¶ mixed ¶ unselective ¶ no data
Technical security	¶ leachate drainage ¶ landfill bottom insulation ¶ lack of protection ¶ degassing wells ¶ landfill gas capture system ¶ no data
The origin of the stored waste	¶ municipal ¶ industrial ¶ municipal-industrial ¶ mining ¶ no data
Type of waste deposited hazard	¶ dangerous ¶ non-hazardous ¶ no data
The condition of the landfill	¶ open ¶ not used ¶ closed without reclamation ¶ closed during reclamation ¶ closed reclaimed ¶ closed during liquidation
Year of the landfill clousure	Year
Groundwater monitoring	¶ yes ¶ no data
Known contamination of groundwater	¶ yes ¶ no ¶ no data
Data source	Name of the institution
Validity of data	Year

3.14. Grounwater vulnerability to pollution

¶ Map appearance



¶ Definition

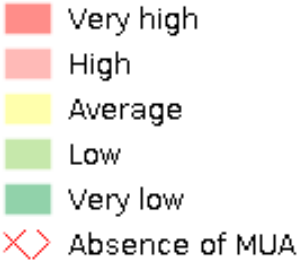
Groundwater vulnerability is based on the concept that the natural environment provides protection to groundwater. The protection provided by different (hydro)geological conditions varies from one place to another.

B i n d e m a n ô s f o r m u l a *- to calculate the time of seepage of conservative pollutants through the vadose zone.*

$$t = \frac{mWo}{\sqrt[3]{\omega^2 k_z}}$$

t – filtration time; m – thickness of the vadose zone; Wo – volumetric humidity; k_z – vertical filtration coefficient of the vadose zone; ɤ – intensity of infiltration.

¶ Legend



The "Groundwater Vulnerability to Pollution" layer is represented by a pixel map. Red means very high susceptibility to groundwater pollution, and dark green means very low susceptibility to groundwater pollution. Areas where there are no hydrogeological units of the main usable aquifer were filled with a red grid.

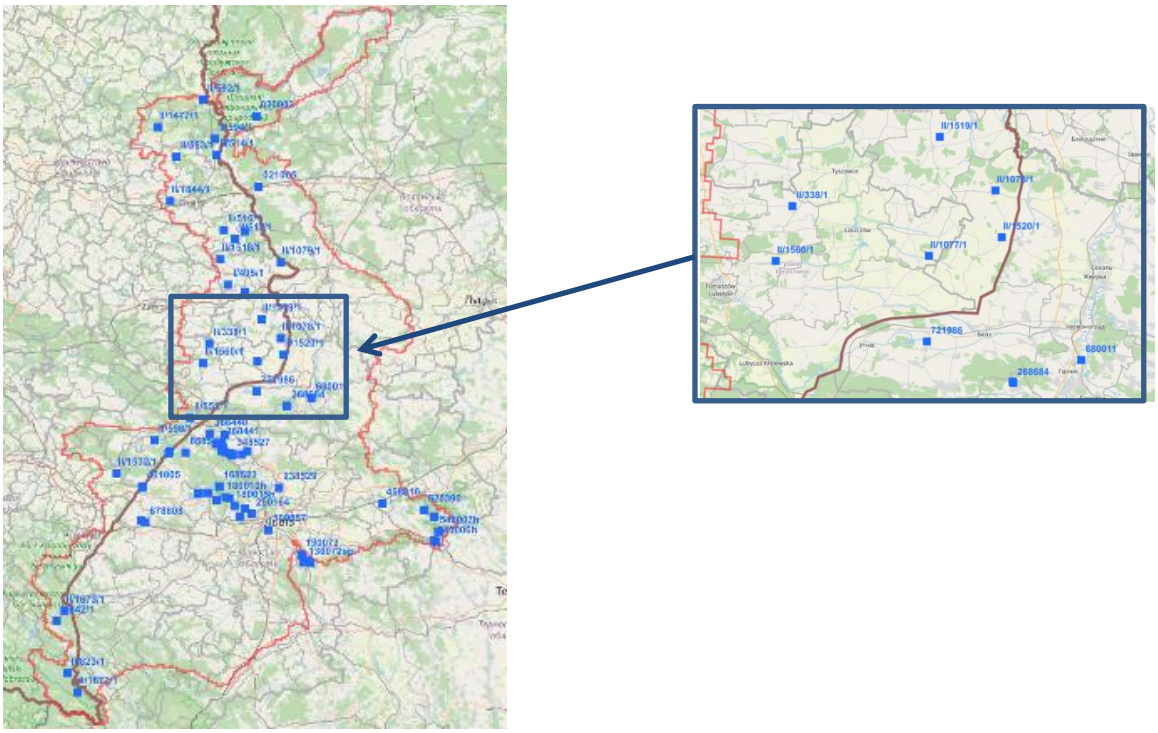
¶ Attributes:

Below are the attributes and vocabularies used to describe the "Groundwater Vulnerability to Pollution " layer.

Attribute name	Attribute value
Migration time of pollutant mass (year)	¶ value of migration time in years ¶ 0 (when there is no main usable aquifer)
Vulnerability class	¶ Absence main useful aquifer ¶ Very high ¶ High ¶ Average ¶ Low ¶ Very low

3.15. Groundwater monitoring points

¶ Map appearance



¶ Definition

Groundwater monitoring point - A station with appropriate devices for measuring and sampling groundwater for repeated hydrogeological observations carried out over a longer period.

¶ Legend:

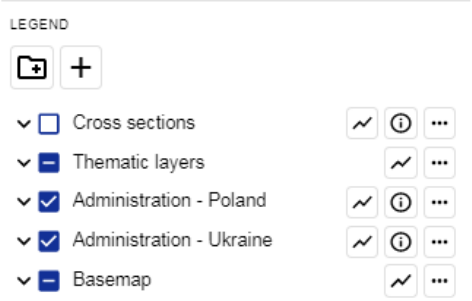
the symbol indicates the location of the groundwater monitoring point

¶ Attributes:

Below are the attributes and vocabularies used to describe the ĂGroundwater monitoring points òlayer.

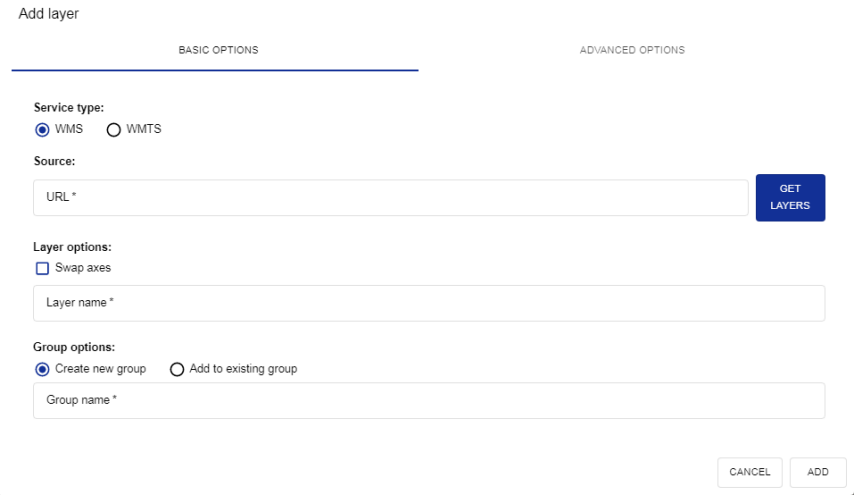
Attribute name	Attribute value
Point National Number	National point number
Point Type	¶ piezometer ¶ well ¶ spring
Groundwater level type	¶ unconfined ¶ confined ¶ spring
Location	Name of the town where the monitoring point is located
Terrain elevation	Value in m a.s.l.
Year of starting observations	Year
Type of monitoring	¶ quantitative/chemical ¶ quantitative ¶ not observed
Depth of observation well	Depth in m a.s.l.
The depth of the aquifer from	Depth in m a.s.l.
The depth of the aquifer too	Depth in m a.s.l.
Stratigraphy of the aquifer	¶ Q ïQuaternary ¶ M ïMiocene ¶ Ol ïOligocene ¶ Pg ïPaleogene ¶ Cr3 ïUpper Cretaceous ¶ D3 ïUpper Devonian
The depth of the drilled groundwater level	Depth in m b.g.l.
Recommended for transboundary monitoring	¶ Yes ¶ No

4. Legend



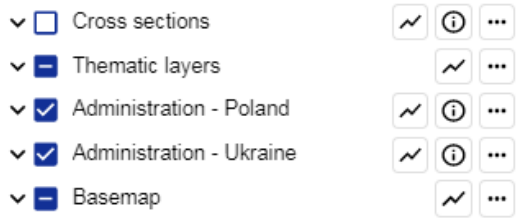
Add group - this feature allows you to create a group of layers yourself from the existing ones or adding a new layer in the form of a WMS or WMTS service to the group. After pressing the "add group" button, a window appears for entering the name of the group you want to add. Then enter the name of the group and confirm with the "add" button. We can add layers to the created group by hovering the cursor over the selected layer, pressing the right mouse button and dragging it to the created group.

Add layer - the tool is used to add a new information layer to the map in the form of a WMS or WMTS service.

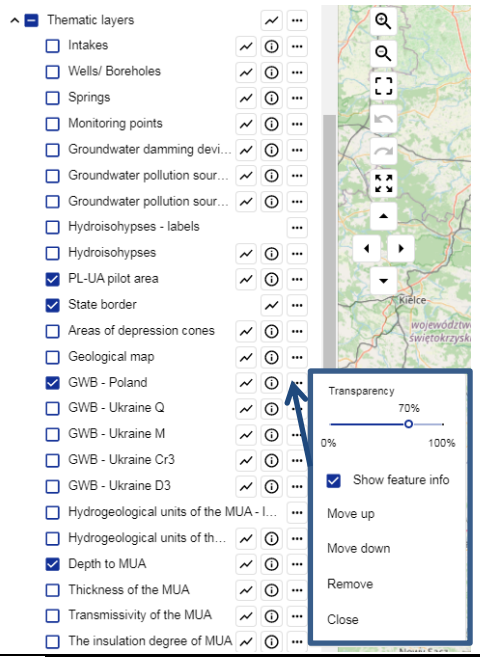


To add a new information layer to the map in the form of a WMS or WMTS service, use the "add layer" button, select the WMS or WMTS service type in the "basic options" tab, then enter the service address and press the "download layer" button. In the layer options, you can check or uncheck the "swap axes" function and give the added layer a name. You can also use the "group options" tool, which allows you to choose one of two functions:
- creating a new group,
- adding to an existing group.
If you select the "create a new group" option, enter the name of the newly created group in the window below this function. However, if you select the "add to an existing group" option, enter the name of one of the existing groups in the window.
In the advanced options in the "translation" tab, we can also complete information about the layer by adding its name and description in English, Polish and Ukrainian.

You can also manage the "Legend" tab using the options available for individual layers or groups consisting of several layers:



The "legend" tab displays the layers that make up the map composition. Unchecking the name of a layer or layer group disables the visibility of the layer/layer group on the map. After the name of the layer or group of layers, there are function buttons that allow you to control the order and visibility of individual layers, and displaying the definition of the selected layer. A detailed description of the tools used is presented below:

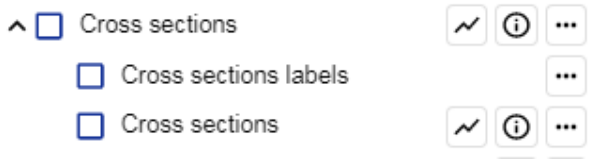
	Show map composition style - pressing the button displays a new window with the symbols used on the map and their description.
	Show info about layer group - pressing the button opens a window in which the definition of the selected layer is displayed.
	**More actions** - pressing the button launches a window in which we can select from 4 to 6 functions that allow you to manage the visibility and create your own map compositions. The following features are available: **Transparency** - allows you to set the transparency of the layer by moving the slider. **Show feature info** - unchecking the check box in front of the layer or layer group name disables the visibility of information about objects. If the checkbox is selected, then after moving the cursor over the selected object from the displayed layer, you can use the left mouse button to open the window with the attributes of the selected object. **Move up** - moves the layer up relative to other layers in the map composition. **Move down** - moves the layer down relative to other layers in the map composition. **Remove** - the tool allows you to delete layers. **Close** ïcloses the window
 	Expand the layer group Collapse the layer group
   	Check/uncheck boxes - Enable/disable layer visibility Make the layer visible Make the layer invisible There are visible and invisible layers in the group of shapes

Tabs in the Legend menu

The Legend menu is presented in 5 groups of data:

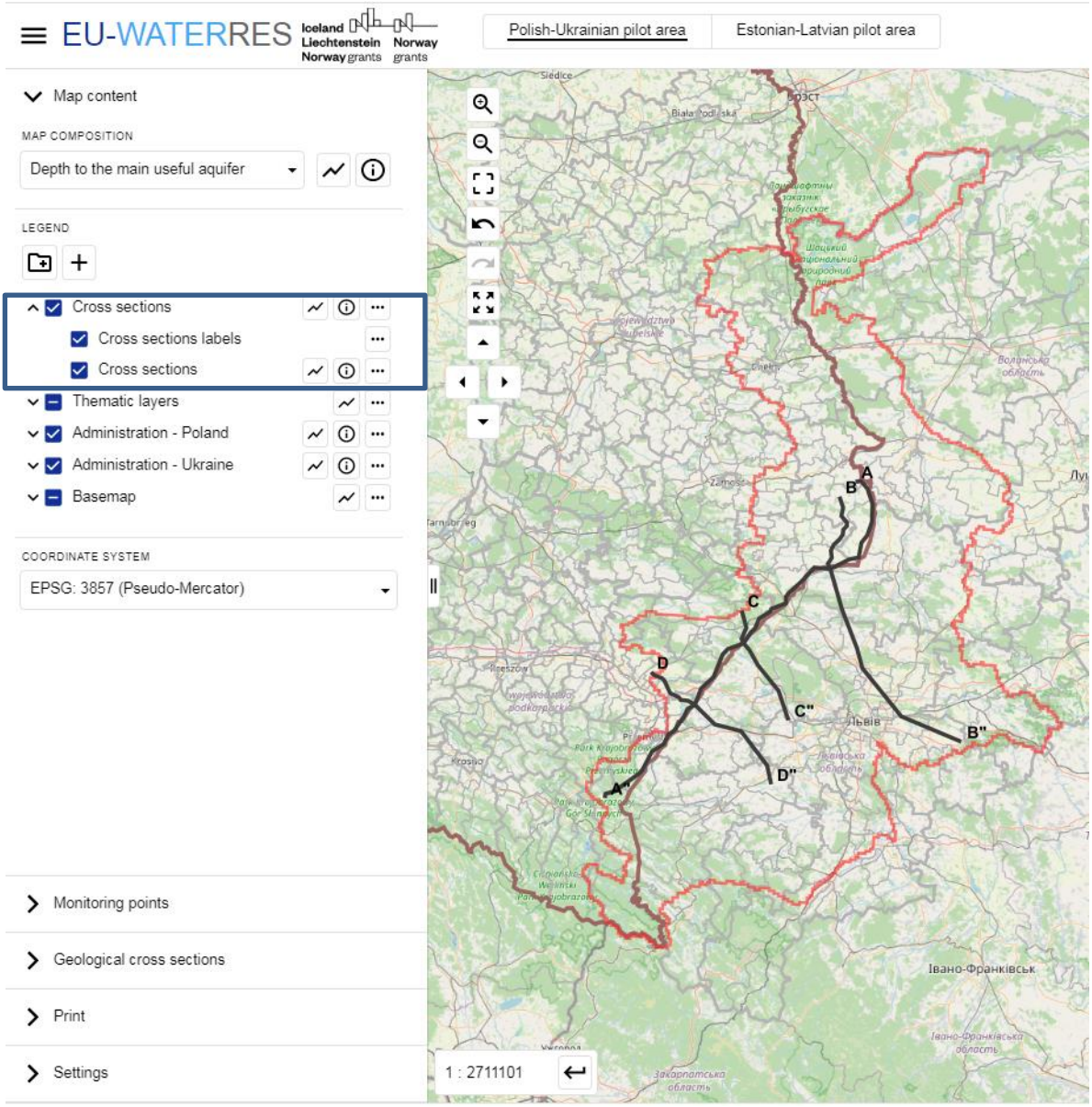
Each of them has been discussed:

4.1. Cross-sections



The "Cross sections" tab consists of two layers:

- "Cross sections labels" are the labels for the section lines;
- "Cross sections" are the sections lines.



By selecting the "Cross sections" and "Cross sections - labels" checkboxes, lines of geological cross-sections and their descriptions will appear on the map.

¶ Definition:

The hydrogeological cross-section is a graphic representation of the hydrogeological conditions along the selected vertical plane due to the geological structure.

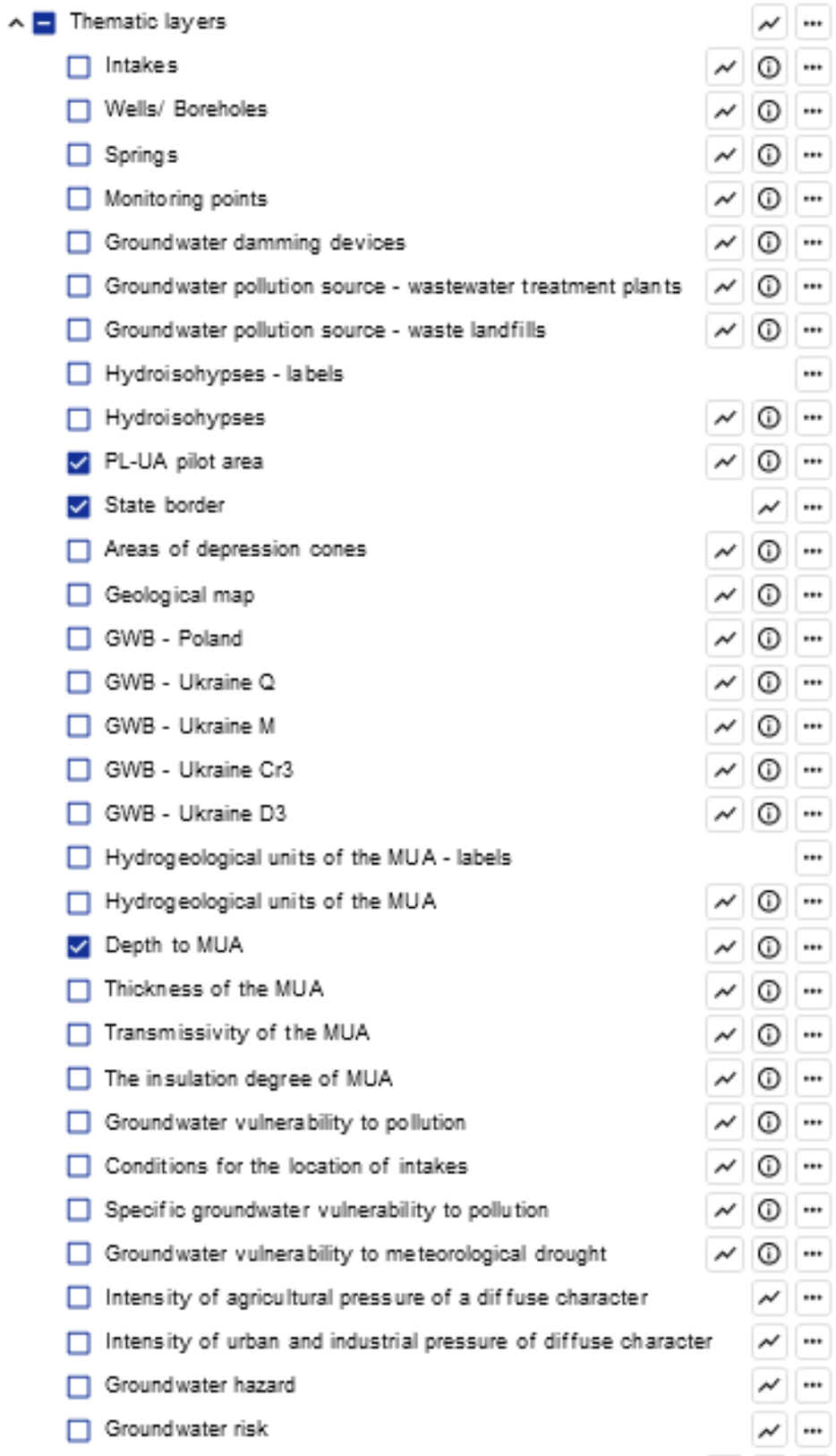
¶ Legend:

The line on the map represents the cross-section line

¶ Attributes:

Attribute name	Attribute value
Name	Name of cross section: AA" BB" CC" DD"
Length (km)	Length of the cross-section in km
Cross section	Represented by an icon, after clicking which the user is redirected to a new browser tab, where a geological cross-section is displayed in *.jpg format.

4.2. Thematic layers



Most of the layers in the "Thematic layers" tab have been described in the "Map composition" chapter. Here, the focus is on those that are not included in this list, namely:

- PL-UA pilot area
- State border
- Geological map
- Conditions for location of intakes
- Specific groundwater vulnerability to pollution
- Groundwater vulnerability to meteorological drought
- Intensity of agricultural pressure of a diffuse character
- Intensity of urban and industrial pressure of a diffuse character
- Groundwater hazard
- Groundwater risk

4.2.1. PL-UA pilot area

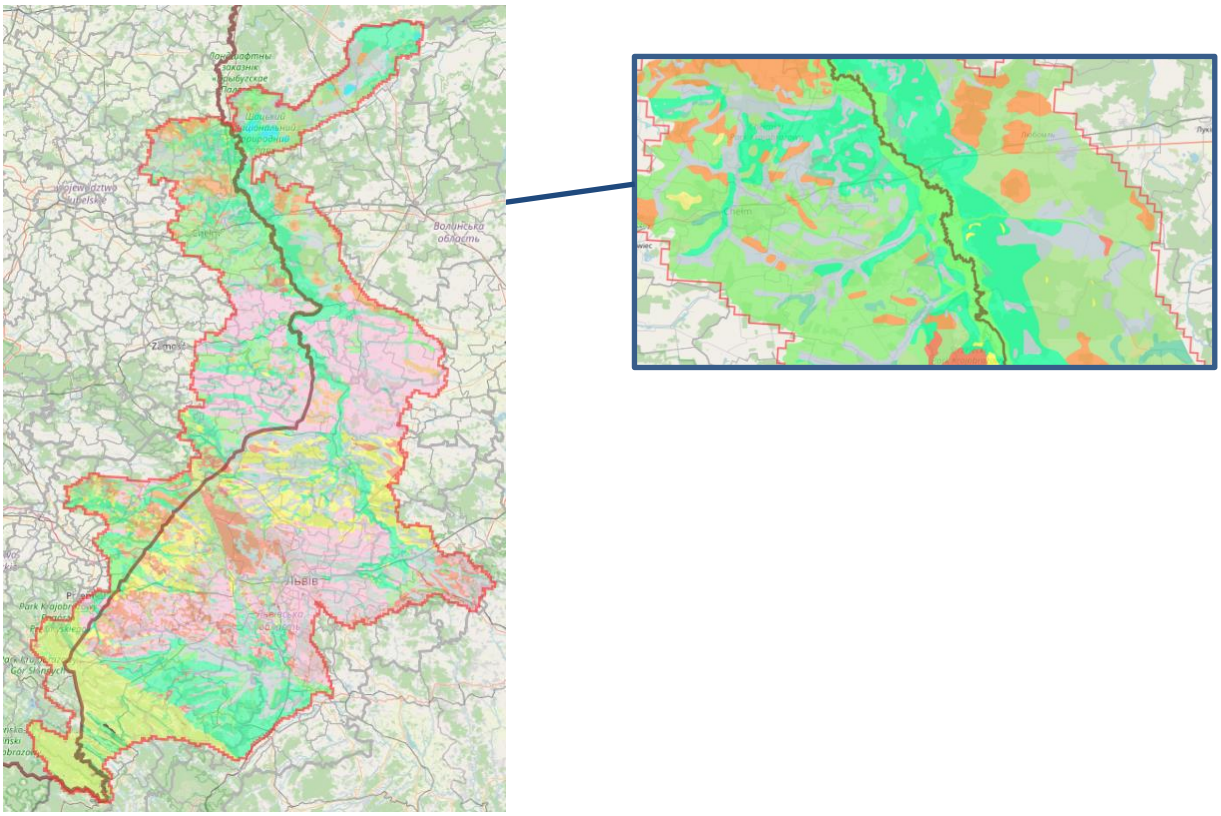
This layer is the contour of the Polish-Ukrainian area of pilot research. Within this contour, thematic maps were made.

4.2.2. State border

This layer is the state border between Poland and Ukraine.

4.2.3. Geological map

The layer is a geological map of surface formations.



Legend:

ch,tH	Chemogenic and antropogenic sediments. Limestone tuffs (travertine), clays, loams, rubble, boulders, sands
bH	Quatenary system. Holocene series. Biogenic sediments. Peat, peat soils.
aH	Quatenary system. Holocene series. Aluvial sediments of floodplains. Silty sands, loams, gravel, pebbles
a,bH	Quatenary system. Holocene series. Aluvial+biogenic sediments. Organic silts, silty sands
dH	Quatenary system. Holocene series. Deluvial deposits of accumulative slopes.Landy loams, loams, gravel
aE-H	Quatenary system. Eopleistocene-Holocene series. Aluvial sediments of floodplain terraces. Sands, gravels, loamy sands, loams, pebbles.
aE-P1	Quatenary system. Eopleistocene series. Alluvial deposits of ancient longitudinal river valleys. Pebbles, rubble, loam, boulders.
dc,d,dp,dz,edP-H	Quatenary system. Pleistocene- Holocene series. Deluvial-colluvial, deluvial-proluvial, landslide, eluvial-deluvial deposits of accumulative slopes. Sands, sandy loam, loams, clays, gravel, rubble, boulders.
vP-H	Quatenary system. Pleistocene- Holocene series. Aeolian sediments of hills, dunes. Sands, loamy sands, loams.
vd,eP	Quatenary system. Pleistocene series. Aeolian-deluvial, eluvial cover sediments of loess accumulative-denudation uplands. Loess soil, loamy sands, loams
fP	Quatenary system. Pleistocene series. Fluvioglacial sediments of outwasch denudation plains and lake sediments. Sands, sandy loams, loams.
gP	Quatenary system. Pleistocene series. Glacial (moraine) sediments of hills and plateaus. Glacial sands and gravels, moraine clays, gravel, boulders.
alP	Quatenary system. Pleistocene series. Alluvial-lake sediments. Clays, loams, loamy sands
N1-2	Neogene system. Miocene series. Shallow coastal-marine terrigenous and evaporite sediments. Organodetrites and sulfur-containing limestones, sandstones, gypsum, gravel, stratification of clays, argillites, sandstones and siltstones
N1-1	Neogene system. Miocene series. Deep sea sediments conglomerates, siltstones. Layering of argillites, siltstones, sandstones.
K2-Pg	Upper Cretaceous-Paleogen system. Deep flysch deposits. Rhythmic gray flysch (sandstones, argillites, siltstones)
K2	Upper Cretaceous system. Terrigenous carbonate deposits of the epicontinental shelf. Marls, chalk, opoka, spongiolites, clay limestones.
K1-2	Lower-Upper Cretaceous system. Deep-water flysch terrigenous-carbonate deposits. Thin-plate marls, limestones, argillites, black silicon argillites, siltstones, sandstones, siderite inclusions, conglomerate lenses, layers of multicolored and fine-grained flysch.
surface waters	Surface waters

4.2.4. Conditions for location of intakes

The conditions for location of new groundwater intakes layer is a derivative of 4 parametric layers - depth and transmissivity of the main useful aquifer, the presence of intakes and depression cones. A validation method was used, the result of which is a qualitative assessment of conditions divided into three classes.

$$X = \frac{A * B * C * D}{54} 100\%$$

X ï value of the parameter for Ă Location of intakes ò

Value of X (%)	Condition class for intakes location
0-33	Poor
33-66	Average
66-100	Good

A - depth of the main useful aquifer

Depth in m b.s.l.	Points
<15	3
15-50	2
>50	1

B ï transmissivity of the main useful aquifer

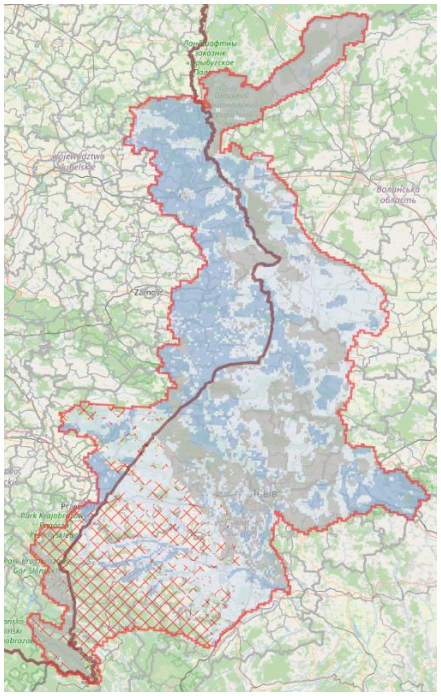
Transmissitivity (m^2/day)	Points
Absence of MUA	0
<100	1
100-200	2
>200	3

C- intakes

Number of intakes in a calculation block	Points
0	3
1-3	2
>3	1

D ï area of depression cones

Presence of depression cones in a calculation block	Points
yes	1
no	2



Legend:

4.2.5. Specific groundwater vulnerability to pollution

The specific vulnerability of groundwater to pollution was determined using the ranking method, taking into account three parameters considered decisive: 1) the presence of groundwater pollution hotspots, 2) the degree of isolation of the main useful aquifer, 3) the nature of land use - Corine Land Cover. Specific groundwater vulnerability to pollution has been divided into 5 classes.

$$X = \frac{A * B * C}{27} 100\%$$

X ï value of the p groundwater vulnerab

Value of X (%)	Class of the specific groundwater vulnarability to pollution
0-20	Very low
20-40	Low
40-60	Average
60-80	High
80-100	Very high

A - degree of insulation of the main useful aquifer

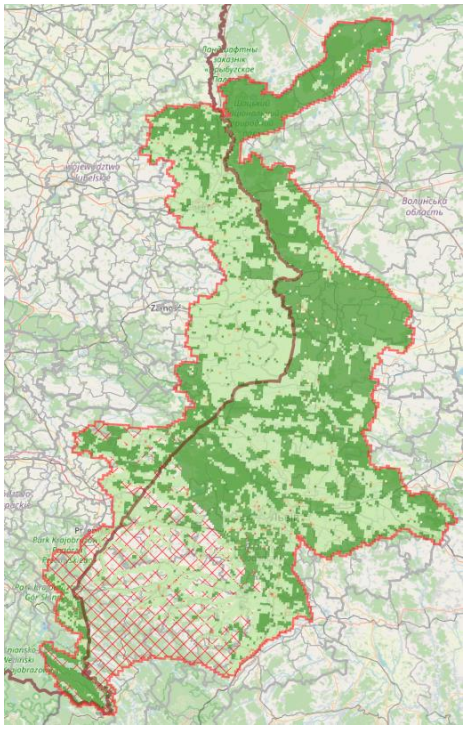
Insulation degree	Points
C	1
b, bc, cb	2
a, ab, ba	3

B ïnature of land use ïCorine Land Cover

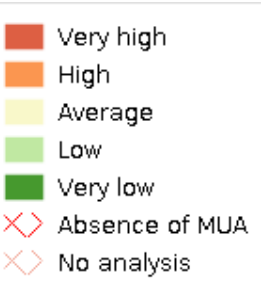
Class	Points
Forest and semi-natural areas	1
Wetlands	1
Water bodies	1
Agricultural areas	2
Artificial surfaces	3

C ï groundwater pollution hotspots (wastewater treatment plants + landfills)

Presence of groundwater pollution hotspots in a calculation block	Points
yes	3
no	1



Legend:



4.2.6. Groundwater vulnerability to meteorological drought

Groundwater vulnerability to meteorological drought was determined using the rank method, taking into account five parameters that are considered decisive: 1) amplitude of groundwater level fluctuations; 2) the number of existing water intakes; 3) areas of depression cones; 4) type of groundwater level; 5) thickness of the main useful aquifer.

$$X = \frac{A * B * C * D * E}{162} 100\%$$

X - value of the parameter "groundwater vulnerability to meteorological drought ò

Value of X (%)	C l a s groundwater Ă vulnerability to meteorological drought ò
0-20	Very low
20-40	Low
40-60	Average
60-80	High
80-100	Very high

A - amplitude of groundwater level fluctuations at the nearest monitoring point with an unconfined groundwater table in a given catchment

Amplitude of fluctuations	Points
Higher than the catchment average	2
Lower than the catchment average	1

B ïintakes

Number of intakes in calculation block	Points
0	1
1-3	2
>3	3

C ïareas of the depression cones

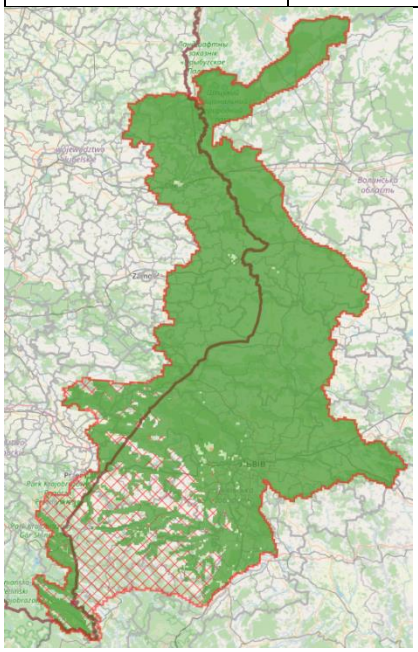
Presence of depression cones in the calculation block	Points
YES	3
NO	1

D - Hydrogeological units of the main useful aquifer

Character of groundwater table	Points
n a p i ň t	1
swobodne	3

E ïThickness of the main useful aquifer

Thickness of MUA	Points
<10	3
10-20	2
>20	1

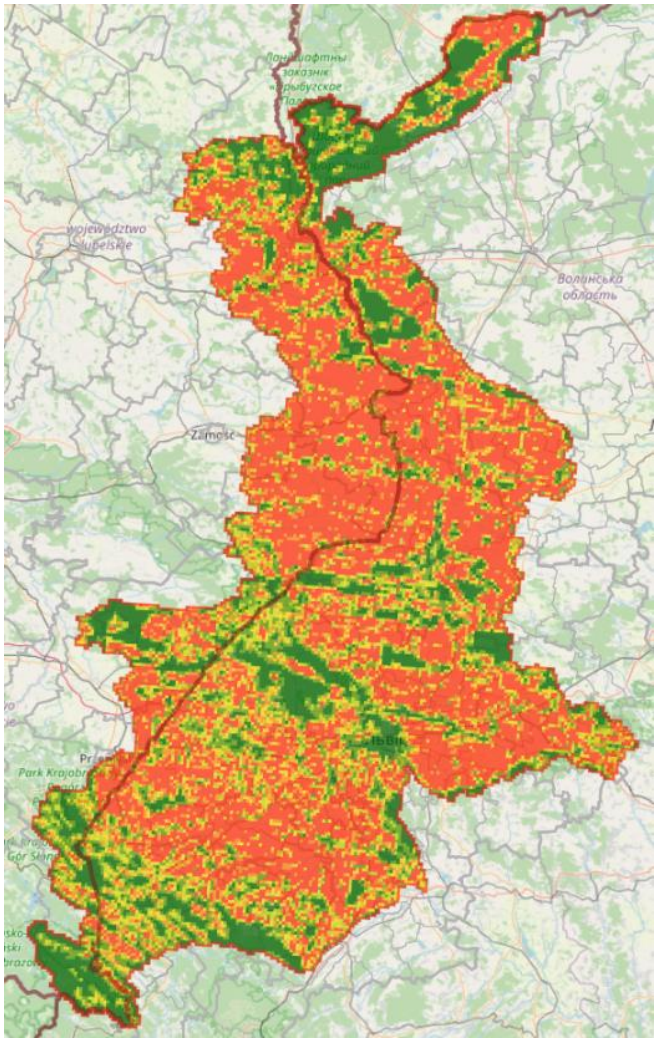


Legend:

High
Average
Low
Very low
Absence of MUA

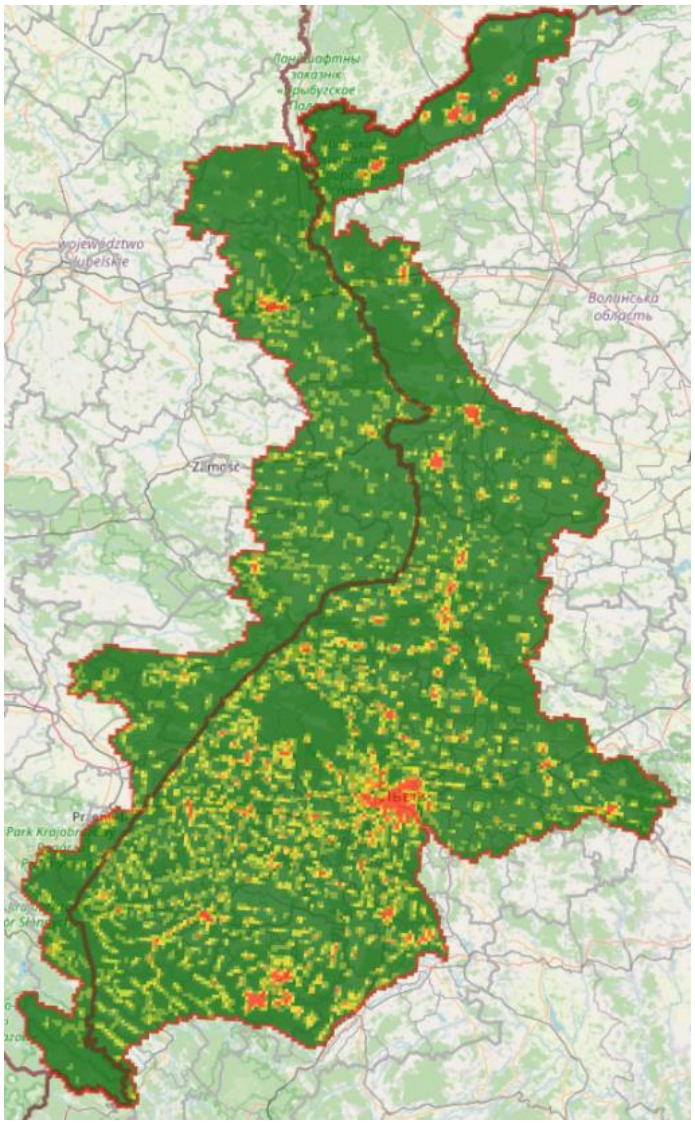
4.2.7. Intensity of agricultural pressure of a diffuse character

This layer is presented on the map as pixels measuring 1x1 km. Agricultural pressure is calculated from the "CORINE land cover" layer as the share of the area (from 0 to 1) of agricultural land in the calculated pixel



4.2.8. Intensity of urban and industrial pressure of a diffuse character

This layer is presented on the map in the form of pixels measuring 1x1 km. Urban-industrial pressure is calculated from the "CORINE land cover" layer as the area fraction (from 0 to 1) of artificial surfaces (cities, industrial facilities) in the calculated pixel.



4.2.9. Groundwater hazard

The cumulative pressure rating (GW hazard) within each computing cluster was estimated by the formula:

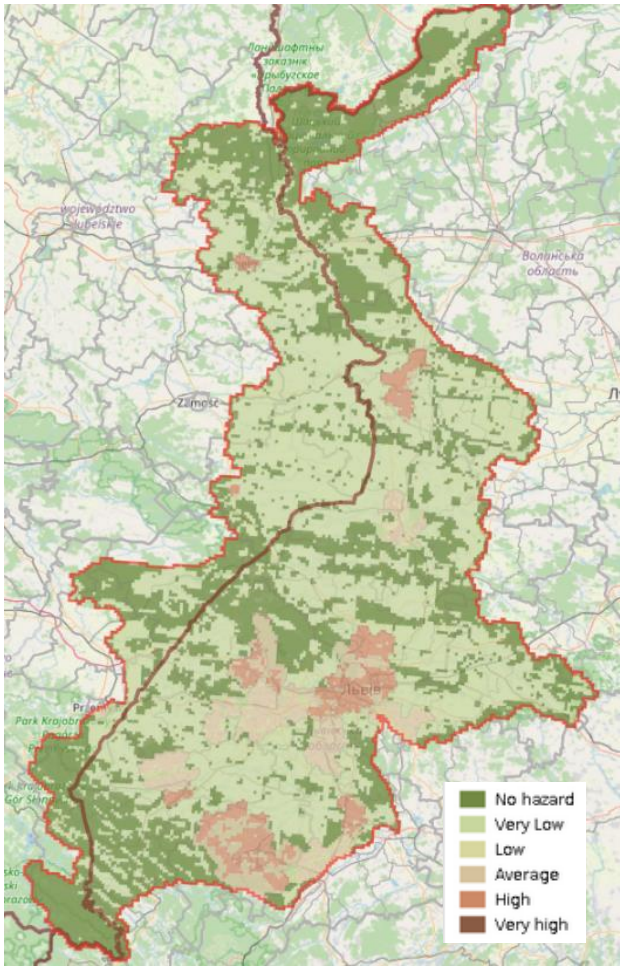
$$GW\ hazard = ((\sum HI_i \times F) + (\sum W \times R))/n,$$

HI_i – Hazard indices of diffuse pollutants for land use categories;
F – share in the computational cluster area of a given land use category,
W – point impact index weight;
R – rank of the point impact index;
n – number of indicators included in the assessment in a given cluster.

The details of the parameters included in the calculation formula can be found in the report https://eu-waterres.eu/nextcloud/index.php/s/zL3DHaQsMtwjY6c

The assessment has been made according to the following scale

Groundwater hazard	index
No hazard	0 – 0,10
Very Low	0,11 – 0,20
Low	0,21 – 0,30
Average	0,31 – 0,50
High	0,51 – 0,70
Very High	0,71 – 1,00



4.2.10. Groundwater risk

The groundwater risk assessment map was created by combining the groundwater vulnerability to pollution map and the groundwater hazard map, as the groundwater risk depends on both, potential diffuse pollutions and the vulnerability of aquifers

GW Risk = HI x Index GW vulnerability

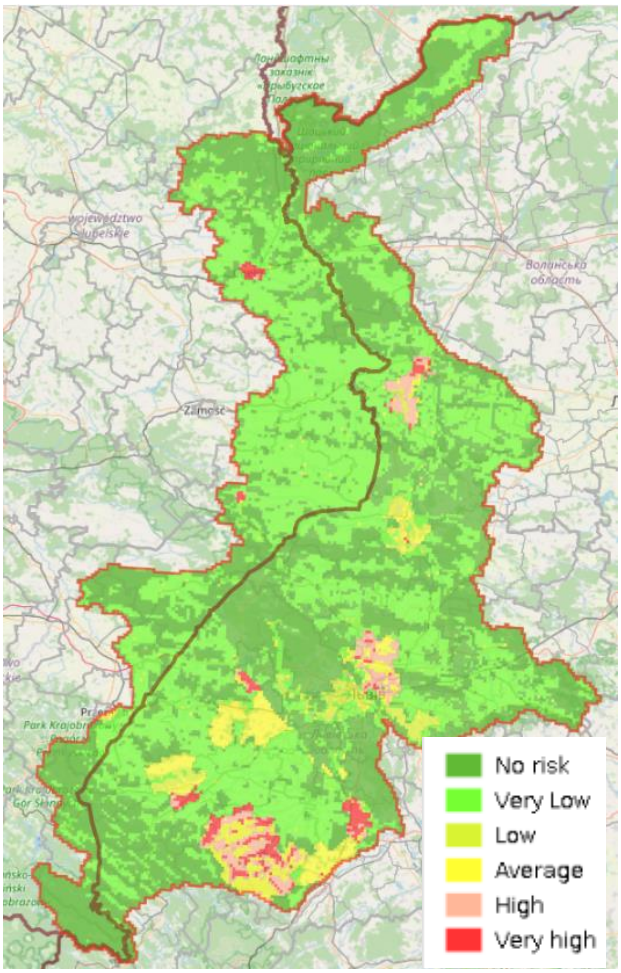
The details of the parameters included in the calculation formula can be found in the report

https://eu-waterres.eu/nextcloud/index.php/s/zL3DHaQsMtwjY6c

Risk assessment according to the index:

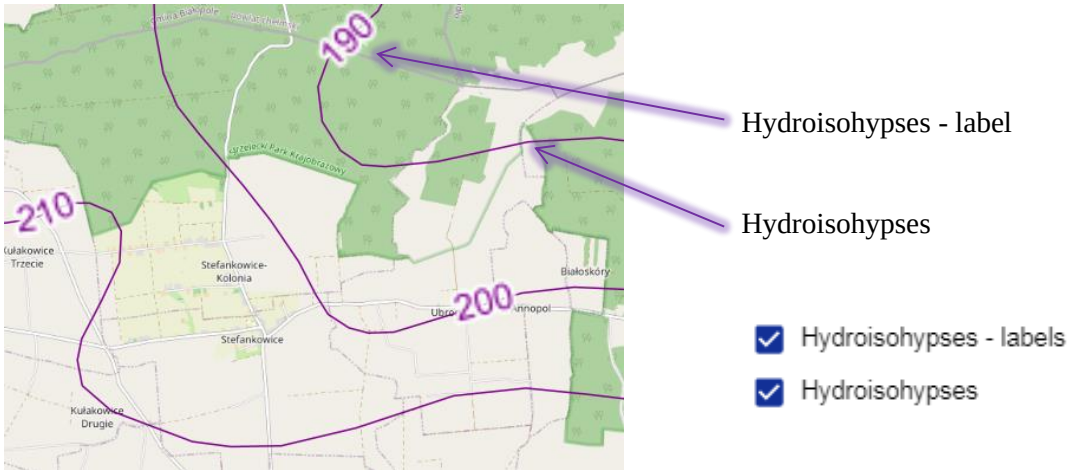
Groundwater risk	Індекс
No risk	0,0 - 0,5
Very Low	0,51 - 1,0
Low	1,1 - 1,5
Average	1,51 - 2,0
High	2,1 - 2,5
Very High	2,51 - 3,9

Map view



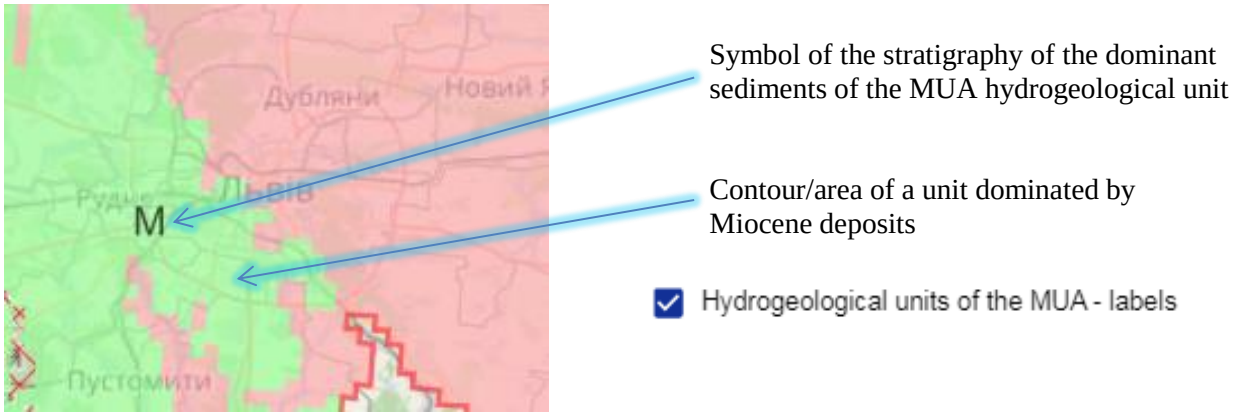
4.2.11. Hydroisohypses – labels

This is an auxiliary layer that shows the hydroisohips values on the map. It is advisable to use together with the shape of hydroisohips.



4.2.12. Hydrogeological units of the MUA - labels

This is an auxiliary layer that shows the stratigraphy of the dominant sediments of the MUA hydrogeological units on the map. It is advisable to use the MUA together with the contour/area of the hydrogeological unit.

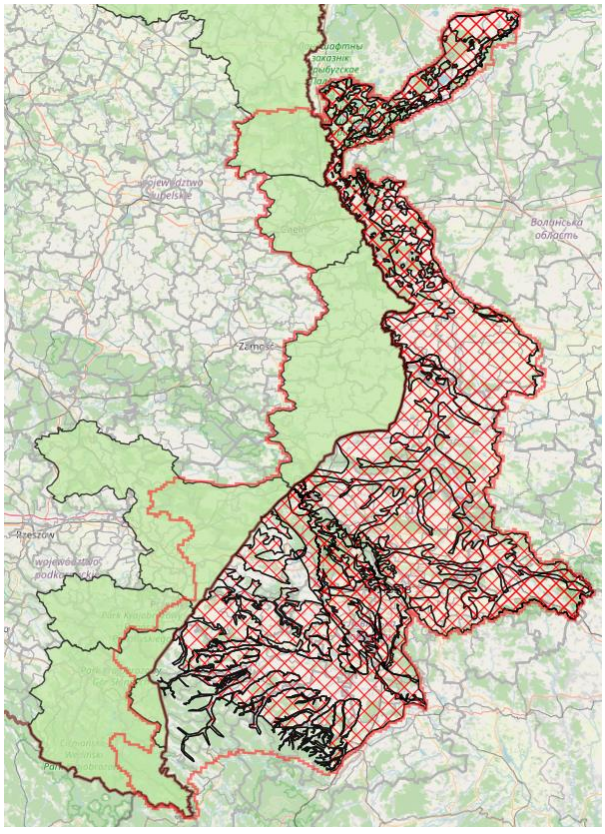


4.3. State of Groundwater Bodies

By selecting the "groundwater bodies" tab from the map composition, an additional layer appears with the assessment of the status (quantitative and qualitative) of groundwater bodies.

The map shows the current assessment of the status of groundwater bodies with a gradation of "good" (green) or "poor" (orange).

For the territory of Ukraine, no such assessment has been carried out at present, therefore the area is marked with a red box with the annotation "no data".



Legenda:

4.4. Administration ïPoland

Administrative units of Poland

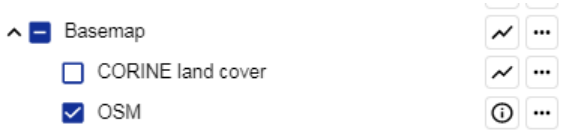
Administrative units of Poland: voivodeships, counties, municipalities.

4.5. Administration ïUkraine

Administrative units of Ukraine

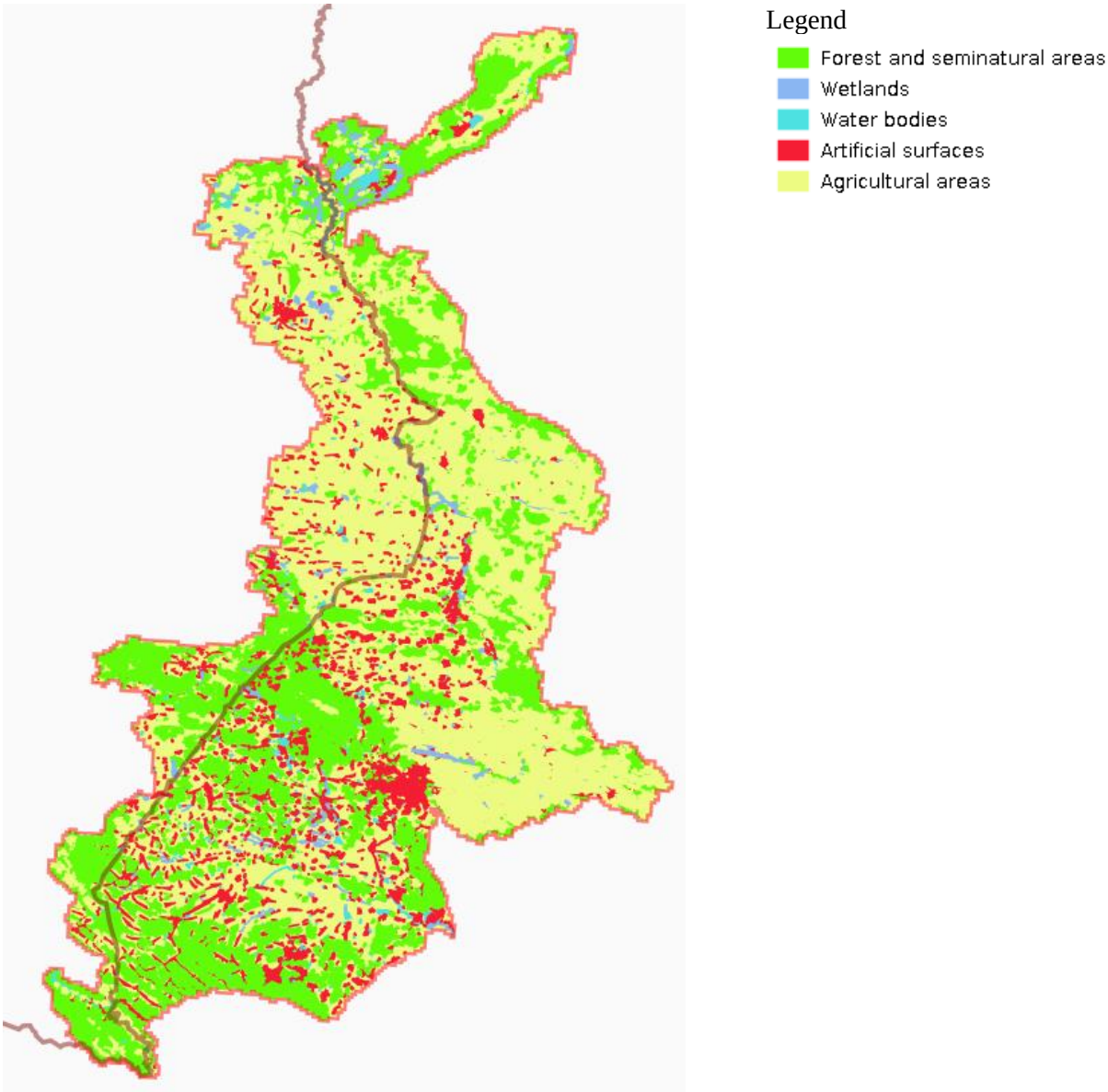
Administrative units of Ukraine: regions, districts, territorial communities.

4.6. Base map



4.6.1. CORINE land cover

For the Polish part of the pilot area, the reference layer Corine Land Cover (CLC2018) was used. The Corine base layer is dedicated only to European Union countries. For the Ukrainian part of the pilot area, an author's version was created based on the automatic classification of satellite data using a similar methodology for creating the Corine Land Cover reference map.



4.6.2. OSM (Open Street Map)

https://www.openstreetmap.org/

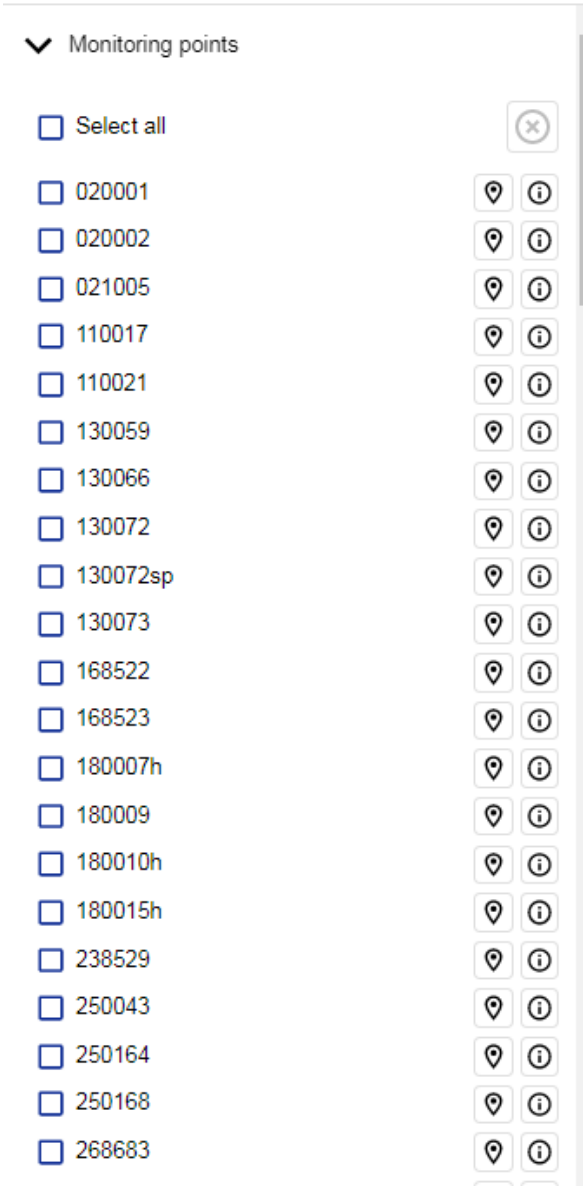
Free online map

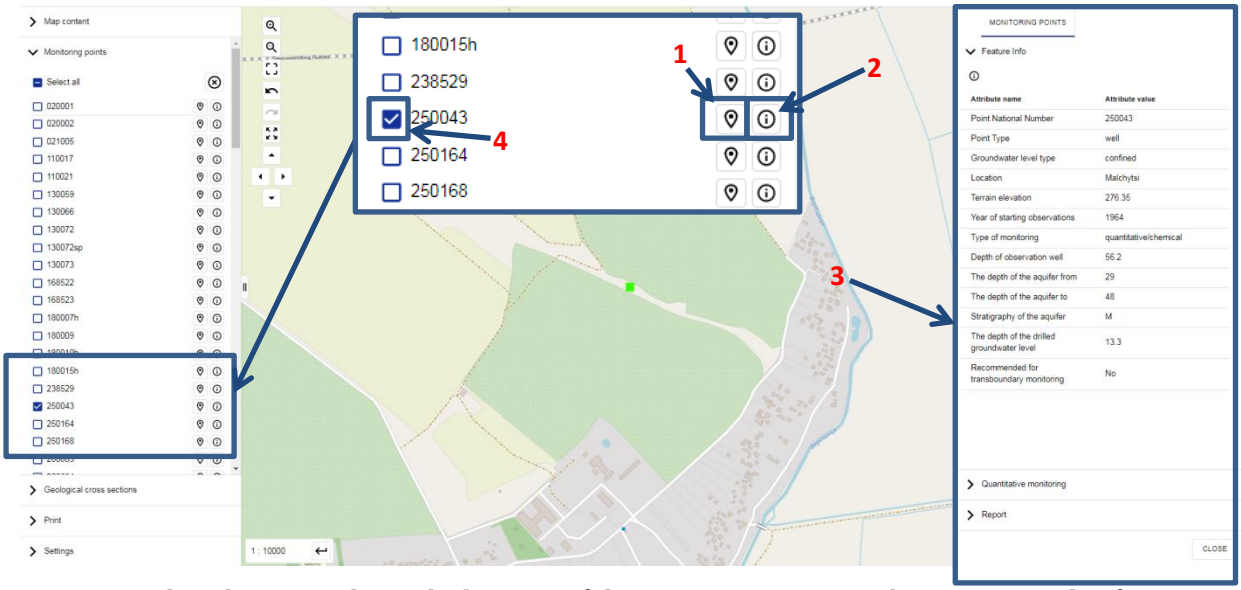
5. Viewing data in the monitoring points tab

The ñMonitoring pointsò tab contains the followi

- selection of monitoring point(s);
- quick determination of the location of a specific monitoring point;
- viewing information on the monitoring point;
- creating and printing specifications/characteristics in *pdf format.

This tab opens the list of monitoring points contained in the "Monitoring points" layer.



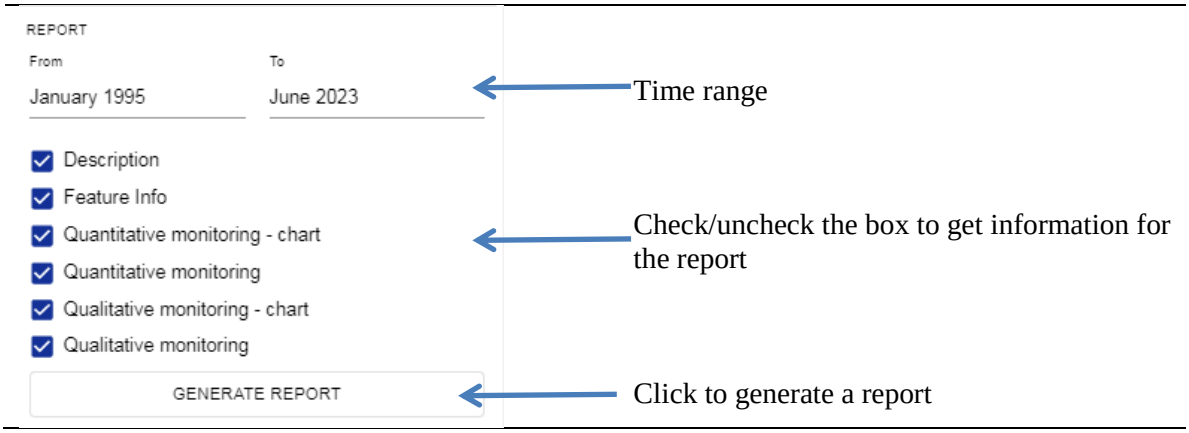


1. Show location. Shows the location of the monitoring point on the map at a scale of 1:10,000.

2. After clicking on the icon, on the right side of the map window, a table of attributes/detailed characteristics for this monitoring point will be displayed (**3**).

4. Monitoring point selection field. You can select one or more monitoring points and generate a report in *.pdf format.

To generate a report, it is necessary to scroll down the list of monitoring points to the "report" option (next figure).

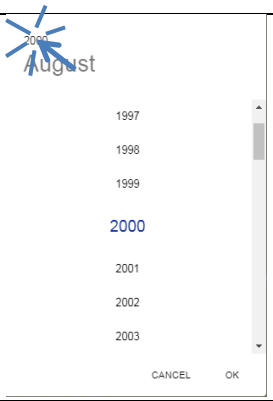


The following options are available:

- selection of monitoring time frames;
- report content - select from the following criteria: description, attributes/characteristics of the facility, quantitative monitoring - chart, quantitative monitoring, qualitative monitoring - chart, qualitative monitoring.

When selecting a time period, click on the date in the "From" and "To" fields. A window will appear with the possibility of quick selection of the year and month of starting/ending research at this monitoring point.

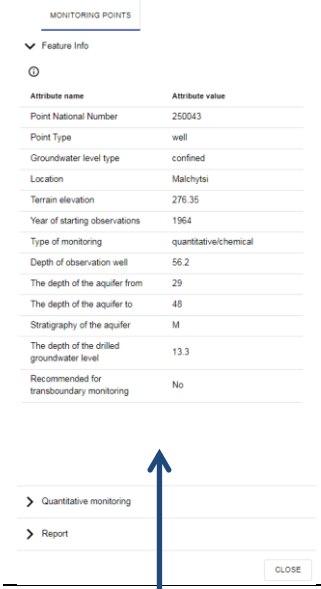
To select a month, click on the month caption and select the required month from the table.



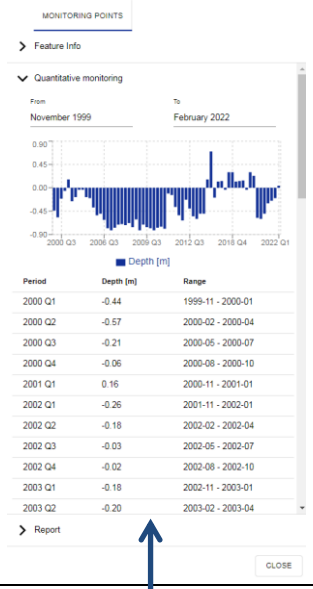
To select a year, click on the year and select the desired year from the list.

To define the content of the report, check or uncheck the checkboxes and click the "GENERATE REPORT" button. A *.pdf file will be generated for selected monitoring points with information specified in the "REPORT" form.

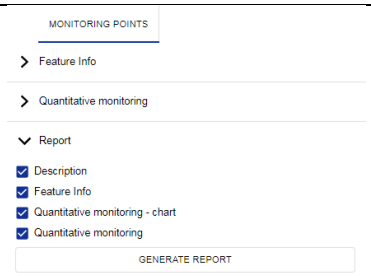
The same report can be generated using the right panel "monitoring point information". However, in this case the generated report will concern only one monitoring point.



information on the selected monitoring point

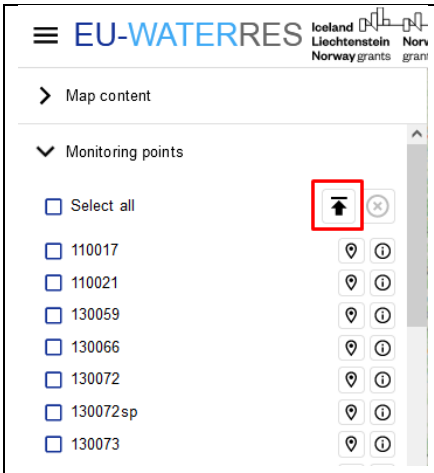


data on the quantitative monitoring of the selected point



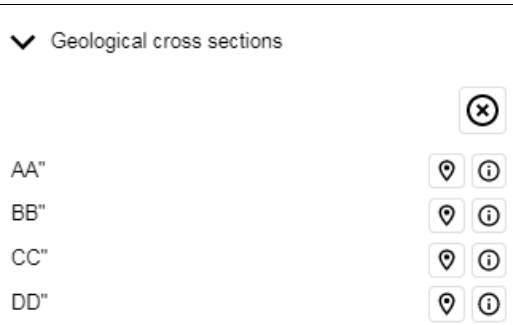
"GENERATE REPORT" button for creating a report in *pdf format. You can specify the content of the report from the specified criteria.

Features available for logged in users

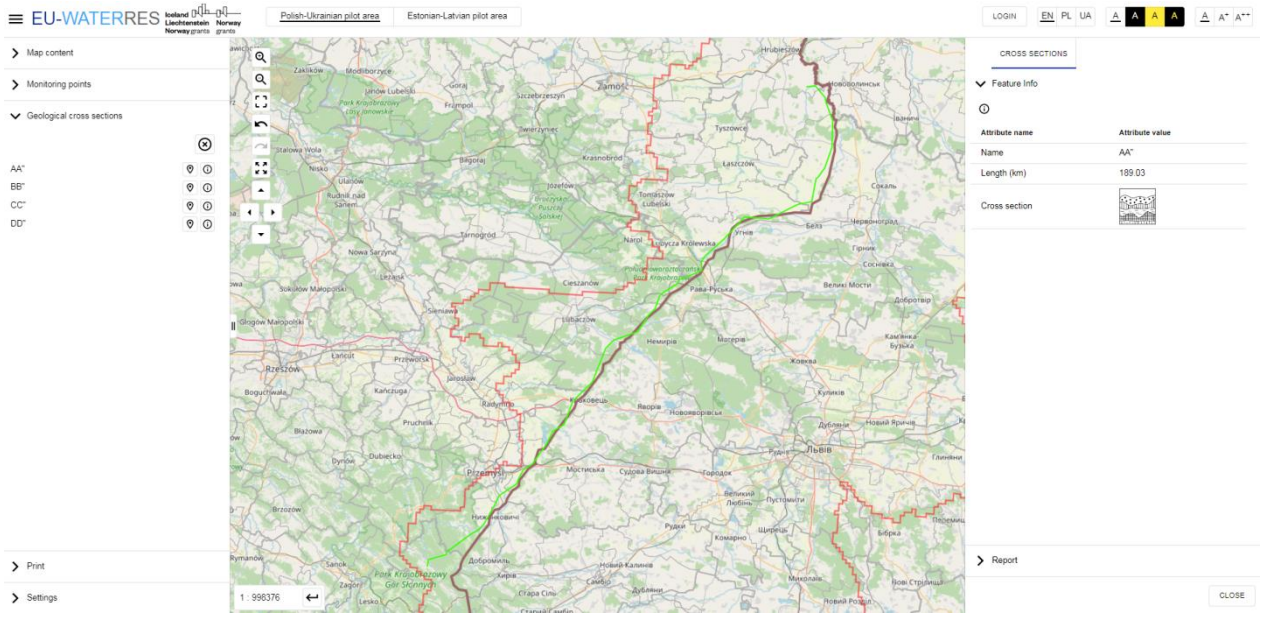
	This feature is only available to logged in users. It allows you to import data from quantitative or qualitative monitoring for points that are in the database. The data must be prepared in *.csv files with a fixed structure. During import, the data already existing in the database for a given point are updated with data from the *.csv file.

6. Viewing data in the "Geological cross sections" tab

In this tab you will find information on the geological structure along the given cross-section lines. After expanding the "Geological sections" tab, a list of profile lines will appear:

	- shows the course of the profile line on the map - displays "layer information" for a given profile line on the right side of the map window - closes the given profile line

General view of the window with the selected profile line selected:

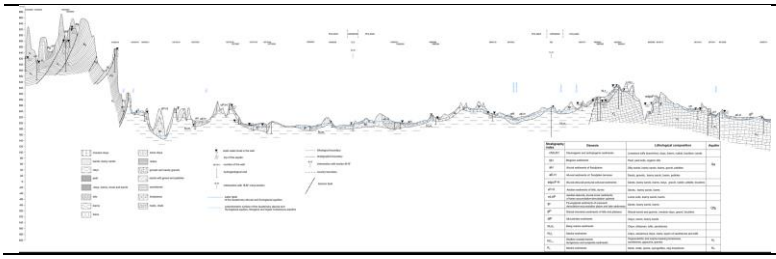


After clicking the icon next to the section line, it appears at maximum scale for full preview

Attribute name	Attribute value
Name	AA"
Length (km)	189.03
Cross section	

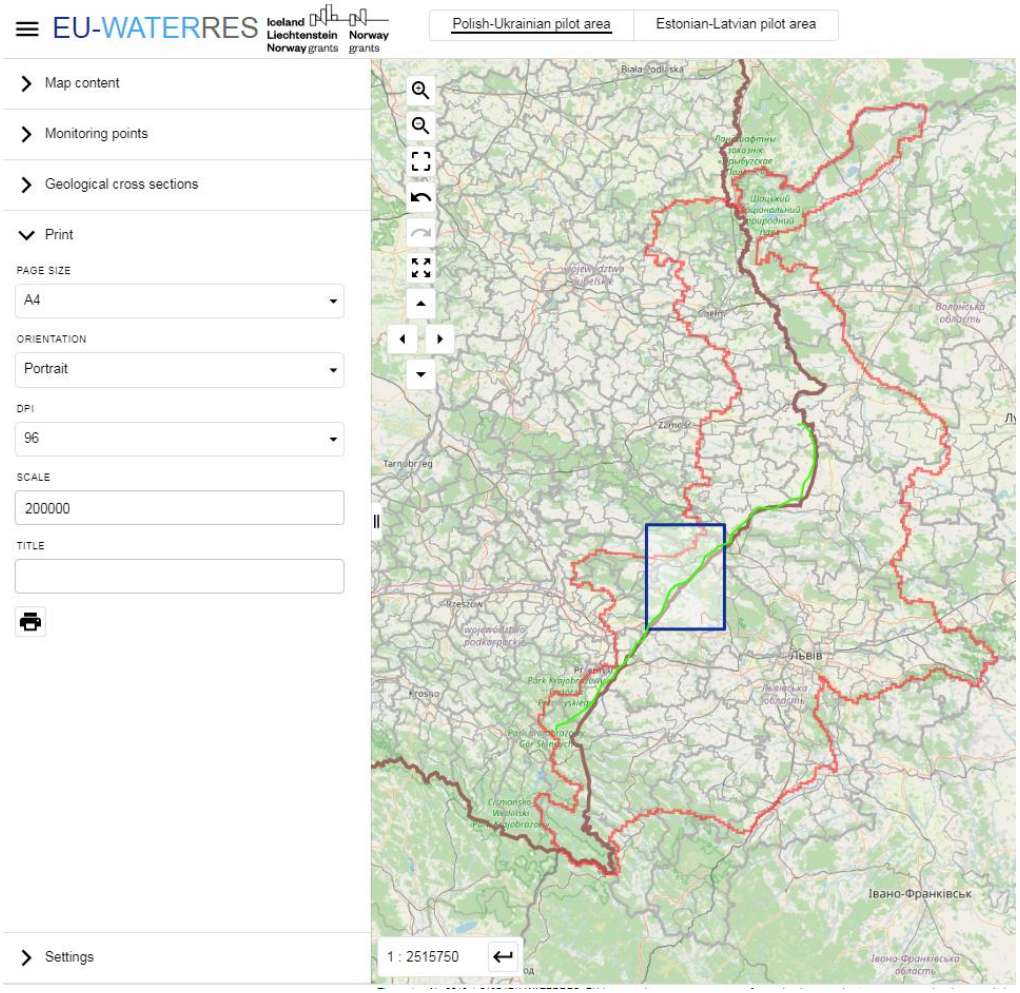
Displays profile line attributes on the right side of the map

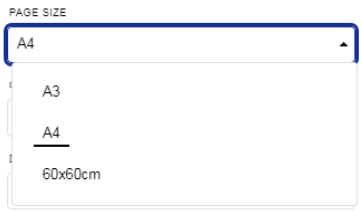
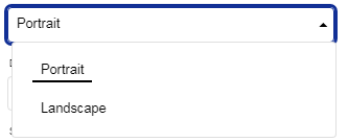
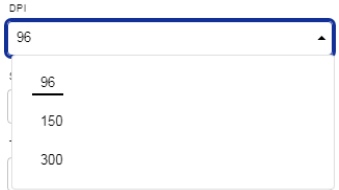
The "cross section" icon generates the entire cross-section in *jpg format, which appears in a new browser tab (see image below)

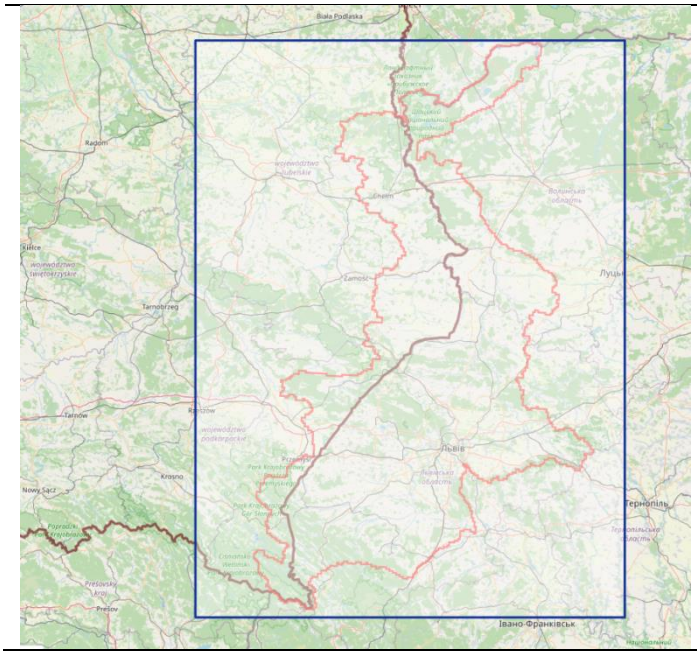


Geological section in *jpg format

7. "Print" service



	Page size selection
	Selection of the page orientation
	Selection of print resolution
	Map scale
	Space for map title/pdf file name
	Button to generate a map in *pdf format



The blue rectangle defines the printing area.
Increasing or decreasing the print area is done by changing the scale in the print window.
The print area (blue rectangle) can be moved around the map with the mouse.

8. List of thematic layers & authors

Thematic layer	Polish authors	Ukrainian authors
Hydrogeological units of the main useful aquifer	Nidental Magdalena, Mordzonek Grzegorz, W ň g l D a r o t a z	Harasymchuk Vasyl, Yanush Liubov, Turuchko Leonid, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Depth to the main useful aquifer	Mordzonek Grzegorz, W ň g l D a r o t a z	Harasymchuk Vasyl, Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Hydroisohypses of the main useful aquifer	Nidental Magdalena	Harasymchuk Vasyl, Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Thickness of the main useful aquifer	Mordzonek Grzegorz, W ň g l D a r o t a z	Harasymchuk Vasyl, Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Transmissivity of the main useful aquifer	Mordzonek Grzegorz, W ň g l D a r o t a z	Harasymchuk Vasyl, Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Springs	Ğ u s R a k ğ , Krysa Anna	Yanush Liubov, Kharchyshyn Yurii
Insulation degree of the main useful aquifer	Nidental Magdalena, Mordzonek Grzegorz, W ň g l D a r o t a z	Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Wells / Boreholes	S t a r o A ŝ e t a i a k	Harasymchuk Vasyl, Medvid Halyna, Teleguz Olga, Liakh Zoriana, Sokorenko Svitlana, Ryvak Tetyana, Pavliuk Natalia, Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Intakes	Ğ u s R a k ğ , Krysa Anna	Liakh Zoriana, Ryvak Tetyana, Sokorenko Svitlana, Yanush Liubov, Turuchko Leonid, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Groundwater damming devices	S t a r o A ŝ e t a i a k	Harasymchuk Vasyl, Yanush Liubov
Areas of depression cones	Ğ u s R a k ğ ,	Yanush Liubov,

	Krysa Anna	Liakh Zoriana, Turuchko Leonid, Kharchyshyn Yurii
Groundwater bodies	Starostiak Aneta	Pavliuk Natalia, Yanush Liubov
Groundwater pollution source ï wastewater treatment plants	Gusiatnikov Rafał, Krysa Anna	Medvid Halyna, Yanush Liubov, Kharchyshyn Yurii
Groundwater pollution source ï waste landfills	Gusiatnikov Rafał, Krysa Anna	Medvid Halyna, Yanush Liubov, Kharchyshyn Yurii, Kolos Hanna, Klos Svitlana
Groundwater vulnerability to pollution	Nidental Magdalena	Yanush Liubov
Groundwater monitoring points	Galczak Michał, Gidziński Tomasz	Pavliuk Natalia, Yanush Liubov, Turuchko Leonid, Klos Volodymyr
Cross sections	Janik Michał	Harasymchuk Vasyl, Medvid Halyna, Teleguz Olga
PL-UA pilot area	Janica Rafał, Solovey Tatiana	Yanush Liubov
State border	Reference layer	Yanush Liubov
Geological map	Janica Rafał, Solovey Tatiana	Harasymchuk Vasyl, Yanush Liubov, Panov Dmytro, Klos Volodymyr, Kharchyshyn Yurii, Kolos Hanna
Conditions for location of intakes	Janica Rafał, Solovey Tatiana, Brzezińska Agn	-
Specific groundwater vulnerability to pollution	Janica Rafał, Solovey Tatiana, Brzezińska Agn	-
Groundwater vulnerability to meteorological drought	Janica Rafał, Solovey Tatiana, Brzezińska Agn	-
Intensity of agricultural pressure of a diffuse character	Janica Rafał, Solovey Tatiana, Kolos Hanna	
Intensity of urban and industrial pressure of a diffuse character	Janica Rafał, Solovey Tatiana, Kolos Hanna	
Groundwater hazard	Janica Rafał, Solovey Tatiana, Brzezińska Agn	Yanush Liubov, Medvid Halina
Groundwater risk	Janica Rafał, Solovey Tatiana, Brzezińska Agn	Yanush Liubov, Medvid Halina
Administration ïPoland	Reference layer	-
Administration ïUkraine	Reference layer	Yanush Liubov, Medvid Halyna
CORINE land cover	Reference layer	Melnychenko Tetiana

Part 2. Part «Estonian-Latvian pilot area»

Table of content

1. General information 1
1.1. Data format 1
1.2. Coordinate system 1
1.3. The spatial extent of the data 1
2. Map view 1
2.1. Main parts of the map portal 1
3. Map composition 10
3.1. Hydrogeological units of the main useful aquifer 10
3.2. Depth to the main useful aquifer 12
3.3. Hydroisohypses of the main useful aquifer 13
3.4. Thickness of the impermeable layer over main useful aquifer 14
3.5. Transmissivity of the main useful aquifer 15
3.6. Springs 17
3.7. Thickness of the main useful aquifer 18
3.8. Wells / Boreholes 19
3.9. Intakes 20
3.10. Buried valleys 21
3.11. Areas of depression cones 22
3.12. Groundwater bodies 23
3.13. Groundwater pollution sites 25
3.14. Vulnerability to groundwater pollution 26
3.15. Groundwater monitoring points 27
3.16. Groundwater mineralization for main useful aquifer 29
4. Legend 30
4.1. Cross-sections 32
4.2. Thematic layers 34
4.2.1. LAT-EST pilot area 35
4.2.2. State border 35
4.2.3. Pollution risk of Quaternary aquifer 36
4.2.4. Pollution risk of main useful aquifer 37
4.2.5. State of groundwater bodies 38
4.2.6. Hydroisohypses – labels 41
4.2.7. Hydrogeological units of the MUA - labels 41

4.3. Administration – Latvia 42
4.4. Administration – Estonia 42
4.5. Base map 42
5. Viewing data in the monitoring points tab 44
6. Viewing data in the "Geological cross sections" tab 47
7. "Print" service 49
8. List of thematic layers & authors 51

1. General information

1.1. Data format

The portal displays images in PNG format sent by GeoSerwer via WMS services (and the background from the OSM service). The geoserver generates these images based on spatial data in the PostgreSQL database. The data for this database were imported from the received SHP files.

1.2. Coordinate system

Spatial data in the PostgreSQL database is in the WGS84 reference system. By default, the portal layout is set to EPSG 3857 (Pseudo-Mercator) so-called Google Mercator.

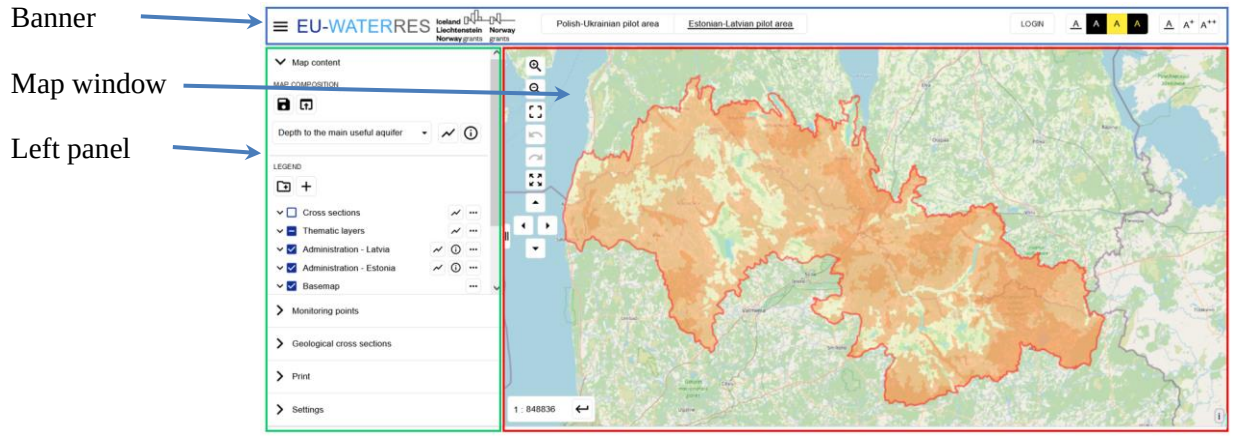
1.3. The spatial extent of the data

The area with the presented spatial data is located near the Estonian-Latvian border in the south part of Estonia and the north part of Latvia, in the basin of the Gauja/Koiva and Salaca/Salatsi rivers. It covers an area of approximately 9,500 km^2. Its geographical coordinates are:

- Longitude from 57°14'N to 58°15'N;
- Latitude from 24°20′E to 27°26′E;

2. Map view

2.1. Main parts of the map portal



Main window of the portal

Banner

The menu groups tools for logging in, changing the language, choosing colors and font size.

In order for the data displayed on the map to be legible for the user, it is advisable to adjust the appearance of the application window to individual preferences using the available functions.

Function buttons on the banner

Open/close left panel

EU-WATERRES

Click to go to the project page:
- https://eu-waterres.eu/

Iceland Liechtenstein Norway grants

Click to go to the fund page:
- https://eeagrants.org/

Polish-Ukrainian pilot area | Estonian-Latvian pilot area

Selection of Polish-Ukrainian or Estonian-Latvian pilot area.

LOGIN

Log in – redirects the user to the login page. Logging in takes place after entering the user's login and password.

EN PL UA

Selection of the language version of the portal: EN – English, PL – Polish, UA – Ukrainian
English is selected by default.

Features related to the accessibility of the map portal:

A A A A

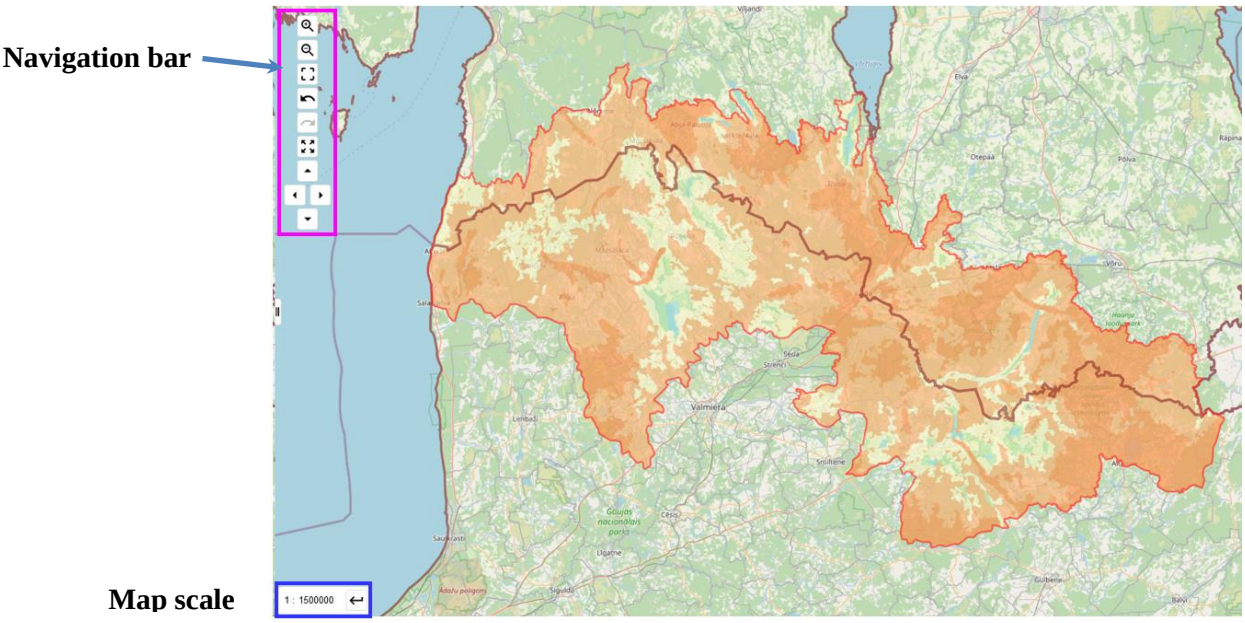
Selection of high-contrast colors:
- The default colour scheme is *black letters on a white background*
- Colour scheme *white letters on a black background*
- Colour scheme *black letters on a yellow background*
- Colour scheme *yellow letters on a black background*

A A+ A++

Font size selection buttons:
- medium
- large
- extra-large

By default, the font size is set on medium.

Estonian-Latvian pilot area map window



Navigation bar

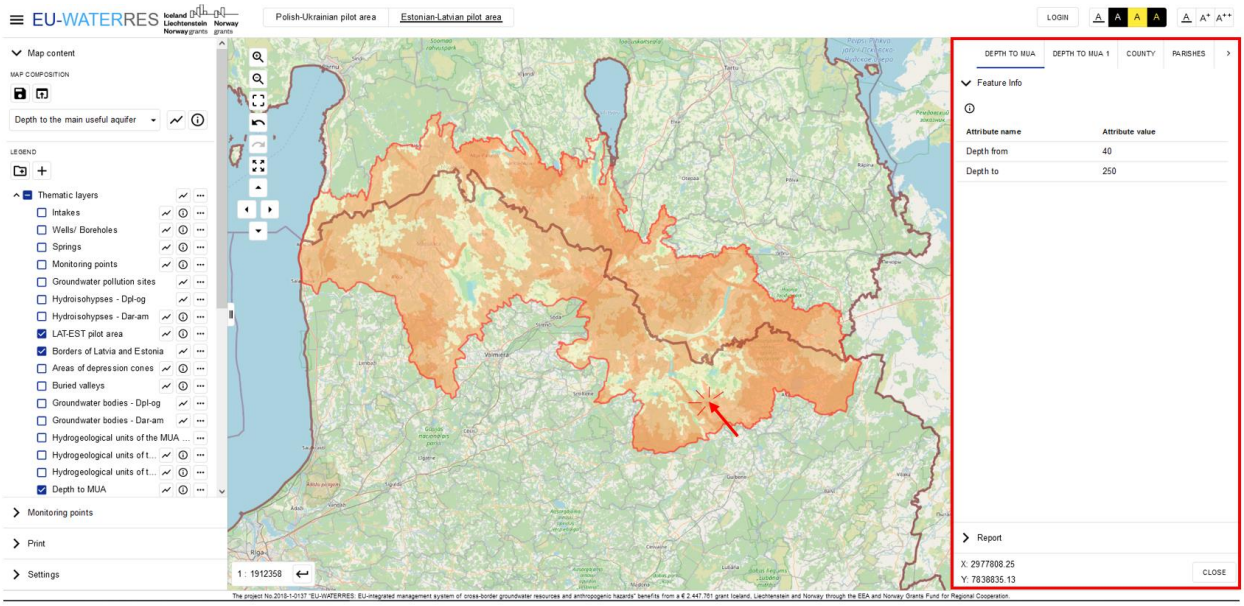
	Zoom in (scroll the mouse wheel away from you) *Zoom out* (scroll the mouse wheel towards you) The map can also be enlarged by double-clicking the left mouse button in the map window. Thus, the scale increases 2 times.
a **b**	A button that activates the function of enlarging the selected area on the map. a) button inactive b) button active To activate it, click on the (a) button and then use the mouse cursor to highlight the area to be enlarged. Pressing this button (b) again will deactivate this function.
	Undo/Redo (preview). "Undo" button to restore the previous map scale. "Redo" button to repeat the scale of the map if canceled with the "Undo" button. If there have been no scale changes, the buttons are inactive (greyed out).
	Reset zoom to default view. When you click this button, the map will be scaled to include the selected pilot area.
	Navigation buttons right/left/up/down. When you press the button, the map moves in the specified direction.

Map scale window

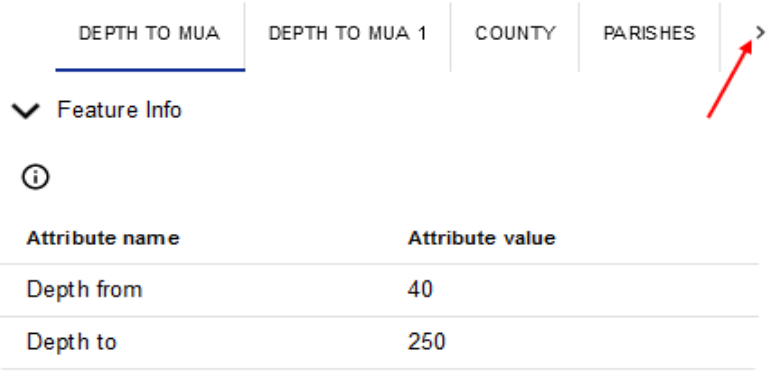
Map scale window. The number after the colon is the current map scale. You can set the scale you want. To do this, you need to write a scale and press enter or the button to the right of the numbers.

Map window functionality

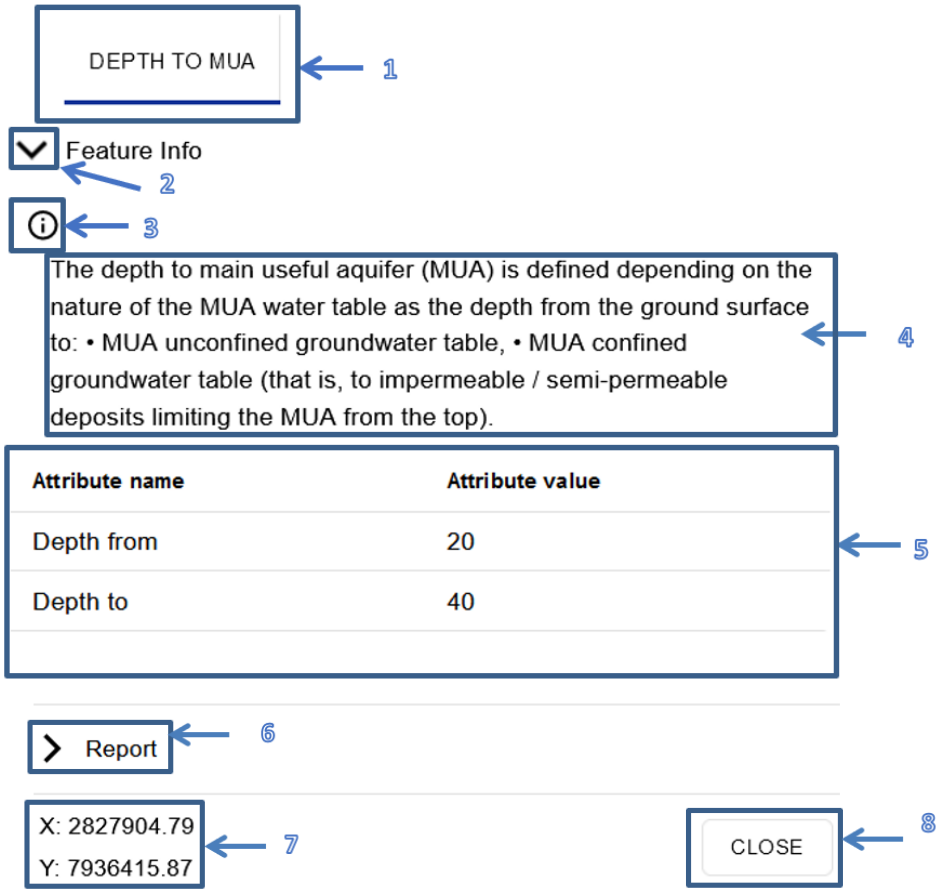
By clicking the mouse on the map, you can see the attributes of the object. To do this, click the left mouse button on the map object, and a window with information about the object will appear on the right side.



If there are several objects, you can view information about them all. You need to use the arrow and select the desired object for viewing.

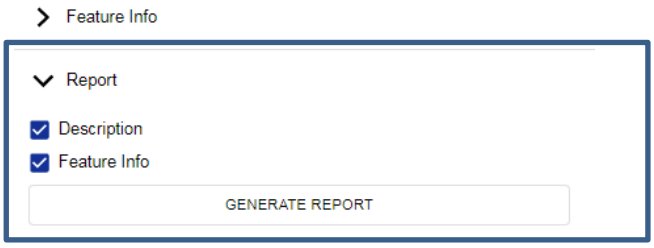


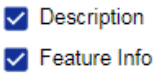
Feature info tab in the right panel



1 – Tabs with layer names
2 – Show or hide "Feature info"
3 – Show layer information
4 – Layer description. Appears when clicked ⓘ
5 – Feature info
6 – Report tab
7 – The coordinates of where you clicked
8 – "Close" button. Pressing will close the panel.

"Report" tab

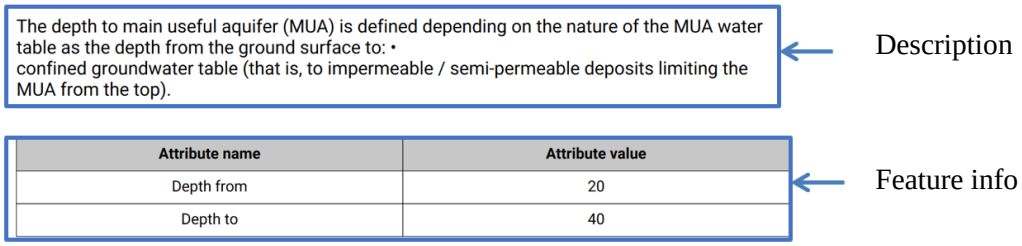




Selection of report elements.
To activate/deactivate the required information in the generated report, check/uncheck the box.

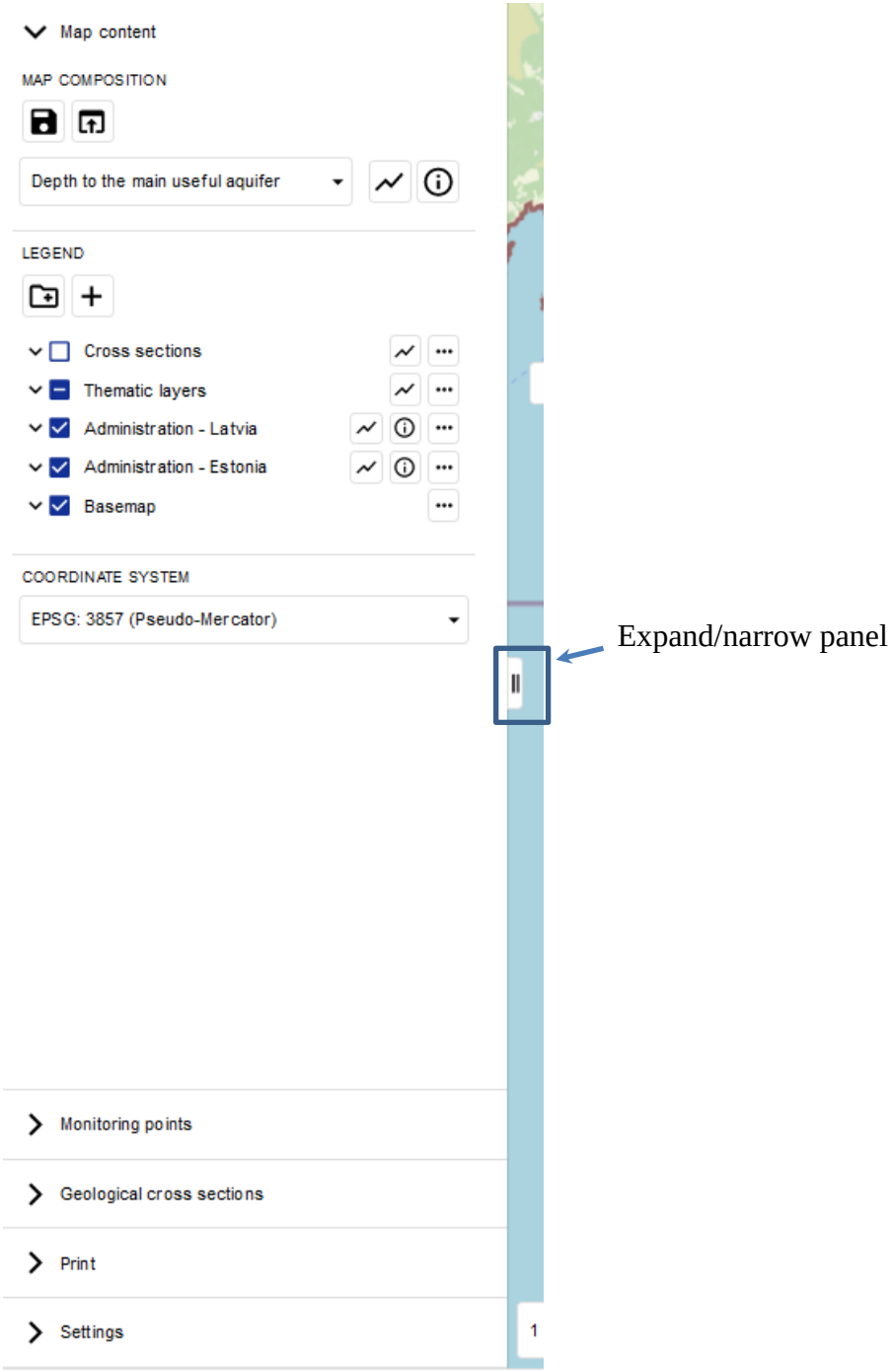
"Generate report" button. Generates a file in *.pdf format.

Create a report



Left panel

The sidebar tools allow you to create your own map layout that can be printed in a .pdf file. Using the button ☰ on the banner, you can expand or collapse the side panel. If you hold and drag the button ⏸, you can expand or narrow the left pane while changing the width of the map window.



The side panel menu consists of 5 items:

Map content **–** The tab opens a menu with map content. The tool is used to manage the visibility of layers on the map, preview the markings applied to the map, and select the map's coordinate system.

Monitoring point – The tab opens the menu with monitoring points. The tool allows you to turn on the visibility of selected or all monitoring points on the map, display their attributes and create reports and charts.

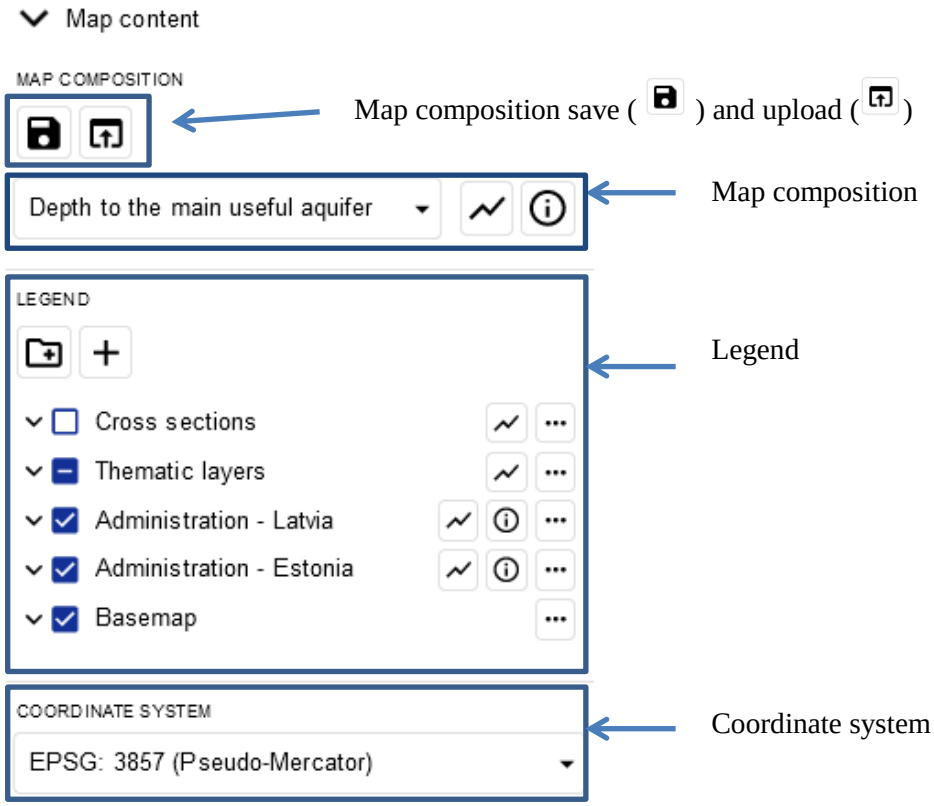
Geological cross section **–** The tab opens a menu with geological cross-sections. The tool allows you to find a selected geological cross-section and display the attributes of the selected object.

Print **–** The tab opens a menu with printing options. The tool is used to define print parameters of the created map composition.

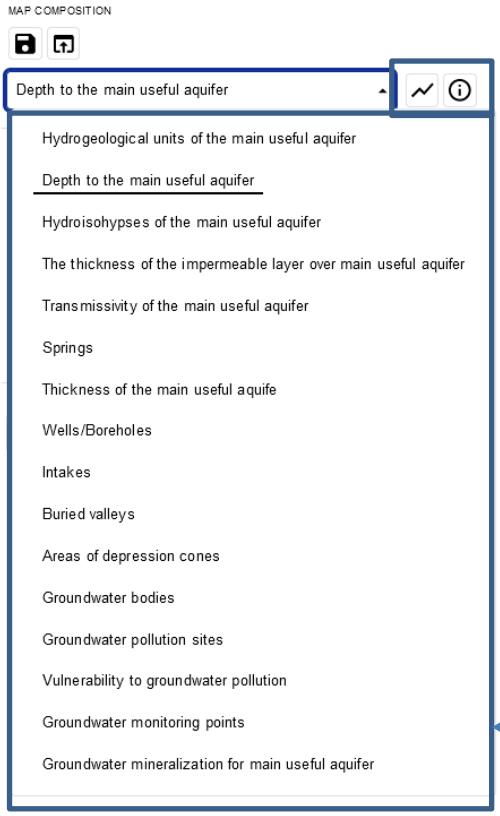
Settings **–** The tab opens a menu with portal display settings. The tool allows you to set the diagonal of the used monitor and provides the current version of the application.

«Map content» tab

Map content - the tool is used to manage the visibility of layers on the map, preview the markings used on the map, and select the map's coordinate system. It consists of three tabs: map composition, legend, coordinate system.



Allows you to select the layer that will be displayed in the map window.



Show composition style - pressing the button displays a new window in the application with the symbols used on the map and their description.

Show information about the composition - pressing the button launches a window in which the definition of the selected layer is displayed.

You can select a thematic map to display from the drop-down list

Coordinate system menu

In the tab, it is possible to select the coordinate system in which the map composition will be displayed.

To change the coordinate system, click on the field with the name of the default coordinate system. Then a list of coordinate systems appears, from which we select one from the list. When selected, the map composition will be displayed in the changed coordinate system.

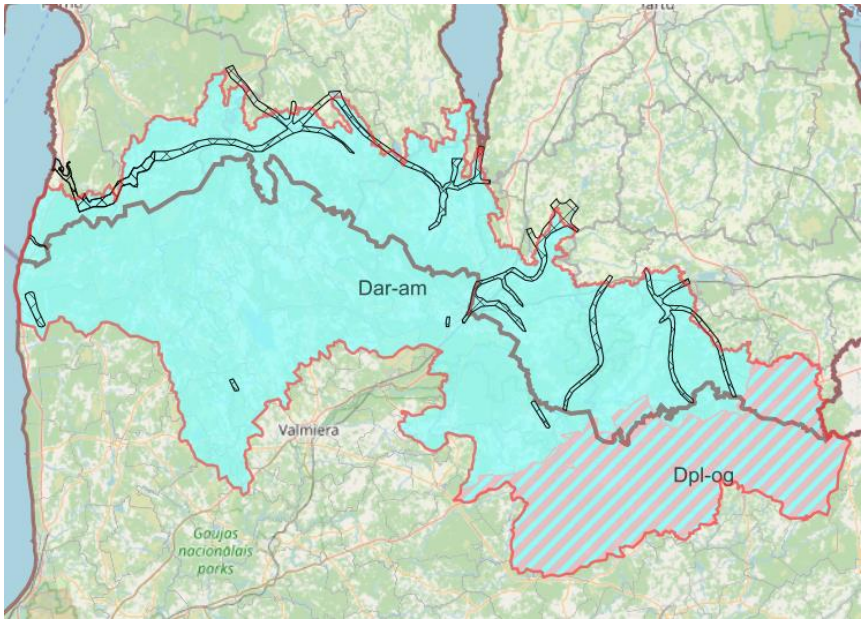
3. Map composition

The "Map composition" tab contains the following thematic layers:

- Hydrogeological units of the main useful aquifer
- Depth to the main useful aquifer
- Hydroisohypses of the main useful aquifer
- The thickness of the impermeable layer over main useful aquifer
- Transmissivity of the main useful aquifer
- Springs
- Thickness of the main useful aquifer
- Wells / Boreholes
- Intakes
- Buried valleys
- Areas of depression cones
- Groundwater bodies
- Groundwater pollution sites
- Vulnerability to groundwater pollution
- Groundwater monitoring points
- Groundwater mineralization for main useful aquifer

3.1. Hydrogeological units of the main useful aquifer

- Map appearance



- Definition

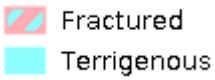
An aquifer is a hydraulically continuous body of relatively permeable unconsolidated porous sediments or porous or fissured rocks containing groundwater. A useful aquifer is defined as an

aquifer or group of aquifers showing good hydraulic connectivity, with the parameters of the quantity and quality of water qualifying for municipal use.

- transmissivity > 50 m^2/d,
- total thickness M 5m (with an average state of retention),
- shows a continuity of occurrence (with the accuracy of hydrogeological schematization appropriate for a map in the scale of 1: 50,000) in the area A>20 km^2 (in conditions of good identification and clear spatial differentiation of hydrogeological conditions, A>5 km^2 is allowed);
- enable the execution of a drilled well with a recharge of over $5m^3/h$.

- Legend

The layer "Hydrogeological units of the main useful aquifer" is represented on the map by pixels with dimensions of 1000x1000 m filled with colors: blue and hatched pink, which indicate hydrogeological units of the MUA: fractured or terrigenous.



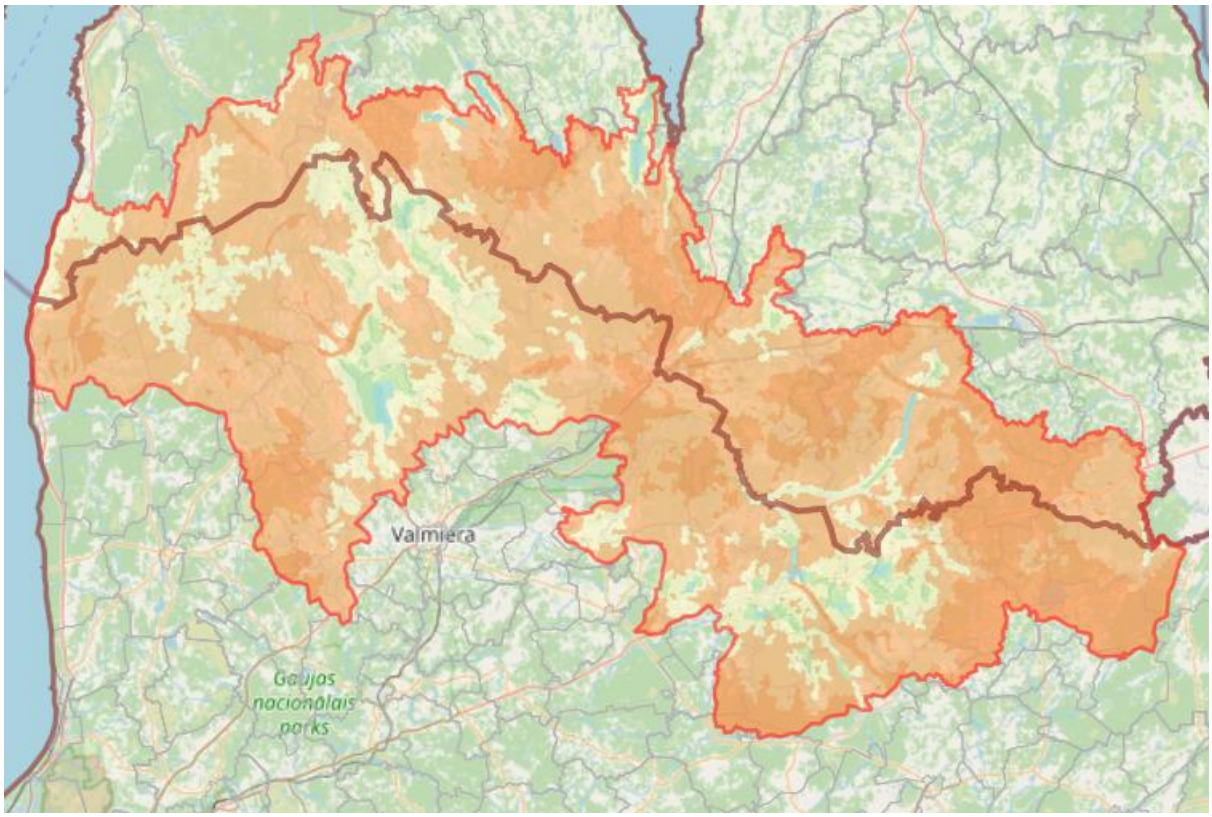
- Attributes

Below are the attributes and vocabularies used to describe the layer "hydrogeological units of the main useful aquifer":

Attribute name	Attribute value
Aquifer	• Quaternary aquifer • Devonian Plavinas-Ogre aquifer system • Devonian Aruküla-Amata aquifer system
Lithology of aquifer	• sandstone with siltstone interlayers • dolomite with dolomitic marl
Stratigraphy of the dominating sediments	• Q • Dpl-og • Dar-am • Dpl-og • Dar-am
Aquifer type	• Terrigenous • Fractured • Fractured-cavernous

3.2. Depth to the main useful aquifer

- Map appearance



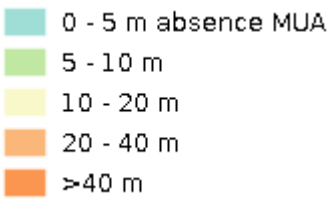
- Definition

The depth to main useful aquifer (MUA) is defined depending on the nature of the MUA water table as the depth from the ground surface to:

- MUA unconfined groundwater table,
- MUA confined groundwater table (that is, to impermeable / semi-permeable deposits limiting the MUA from the top).

- Legend

The "Depth to main useful aquifer" layer is shown in a pixel map. The blue color indicates the depth of 0-5 m, and the dark orange color indicates the greatest value of the depth to the MUA (>40 m).



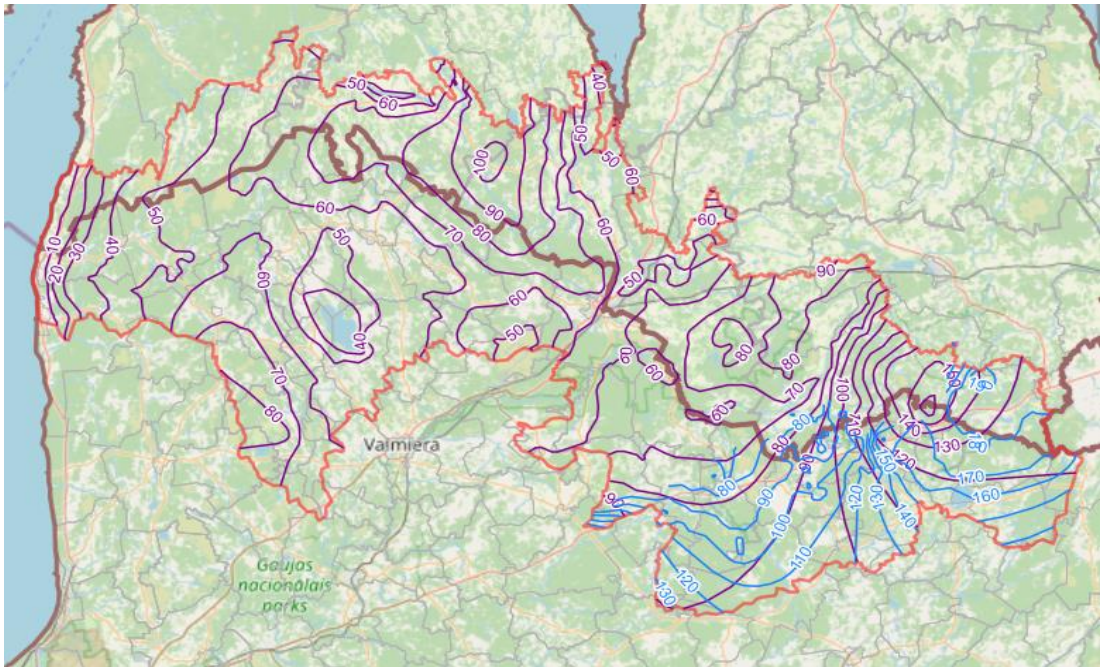
- Attributes

Below are the attributes and vocabularies used to describe the " Depth to main useful aquifer ":

Attribute name	Attribute value
Depth from (m)	• 0 • 5 • 10 • 20 • 40
Depth to (m)	• 5 • 10 • 20 • 40 • > 40

3.3. Hydroisohypses of the main useful aquifer

- Map appereance



- Definition

Hydroisohypses – Contour lines for connecting equal level groundwater head points of the main useful aquifer.

- Legend

The "Hydroisohypses of the main useful aquifer" are shown on the map as purple lines. Certain hydroisohypses have been defined as solid lines. On the other hand, the uncertain hydroisohypses - as dashed lines in areas devoid of the main usable aquifer (MUA). Each hydroisohypse was assigned a numerical value, and subsequent hydroisohypses are cut every 10 m.

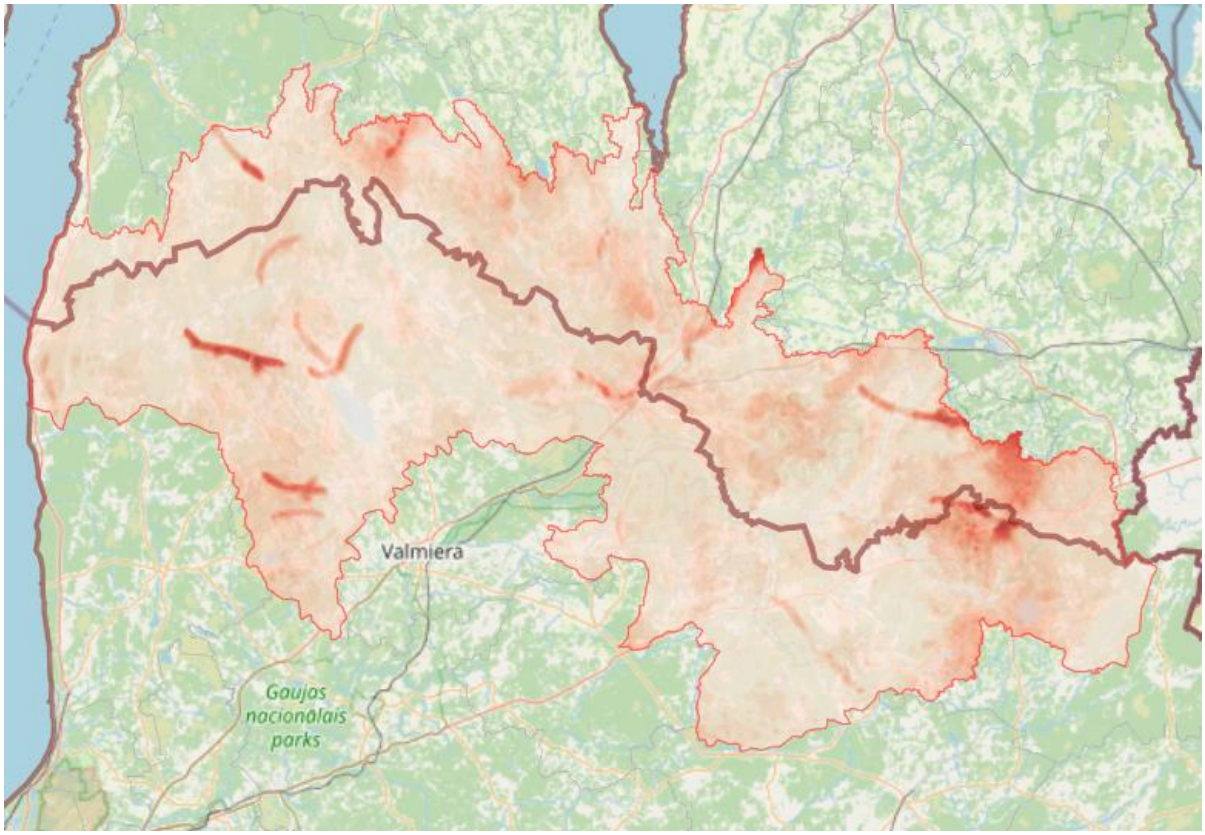
- Attributes

Below are the attributes and vocabularies used to describe the "Hydroisohypse of the main useful aquifer".

Attribute name	Attribute value
Value (m)	Intervals of isolines of the water head every 10 m

3.4. Thickness of the impermeable layer over main useful aquifer

- Map appereance

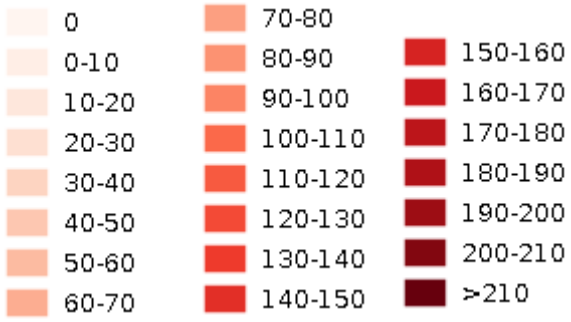


- Definition

The layer contains polygons for the thickness of the impermeable layer over main useful aquifer.

- Legend

The “Thickness of the impermeable layer” is shown in a pixel map. The colors indicate the thickness, the darker the color, the thicker the layer over the main useful aquifer.



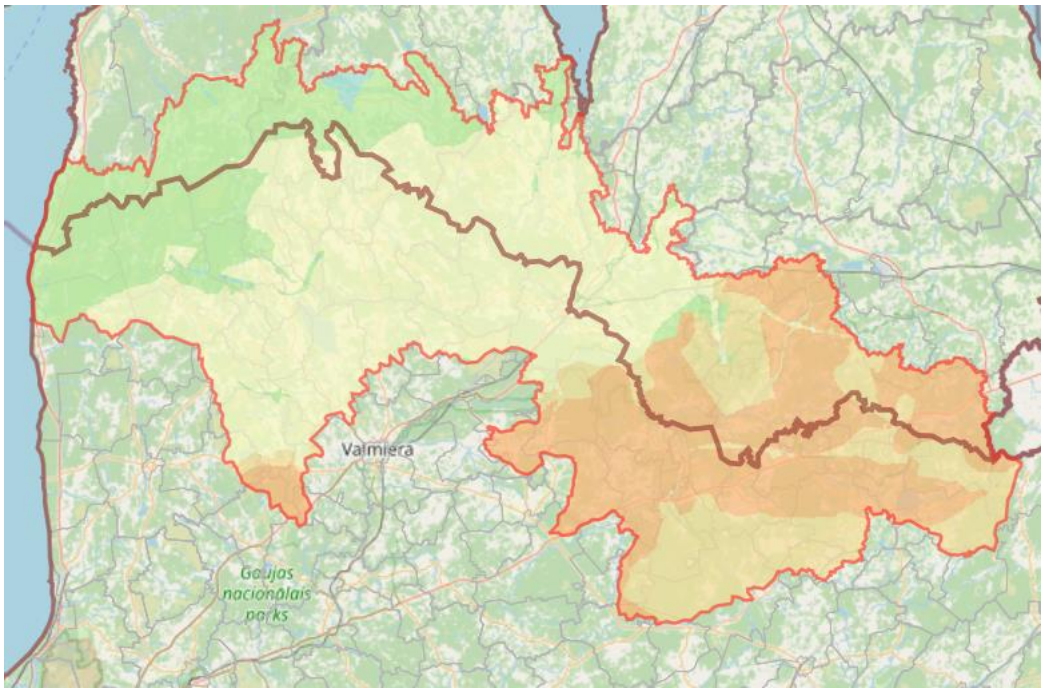
- Attributes

Attribute name	Attribute value
Intervals of the thickness of the impermeable layer	• Intervals of the thickness of the impermeable layer in every 10 m

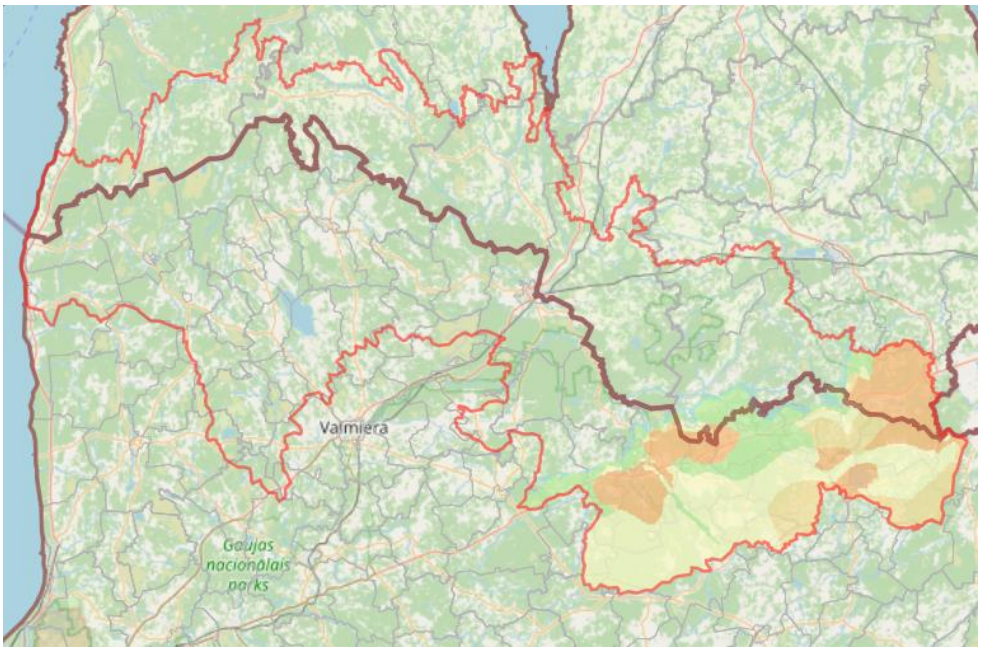
3.5. Transmissivity of the main useful aquifer

- Map appearance

Transmissivity of the D*ar-am* aquifer



Transmissivity of the D*pl-og* aquifer

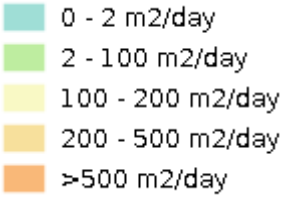


- Definition

Transmissivity of the MUA - the rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths.

- Legend

The "Transmissivity of the main usable aquifer" layer is shown on a pixel map. The blue color indicates a conductivity of 0-2 m^2/day and the dark orange color indicates the highest conductivity value of MUA (>500 m^2/day).



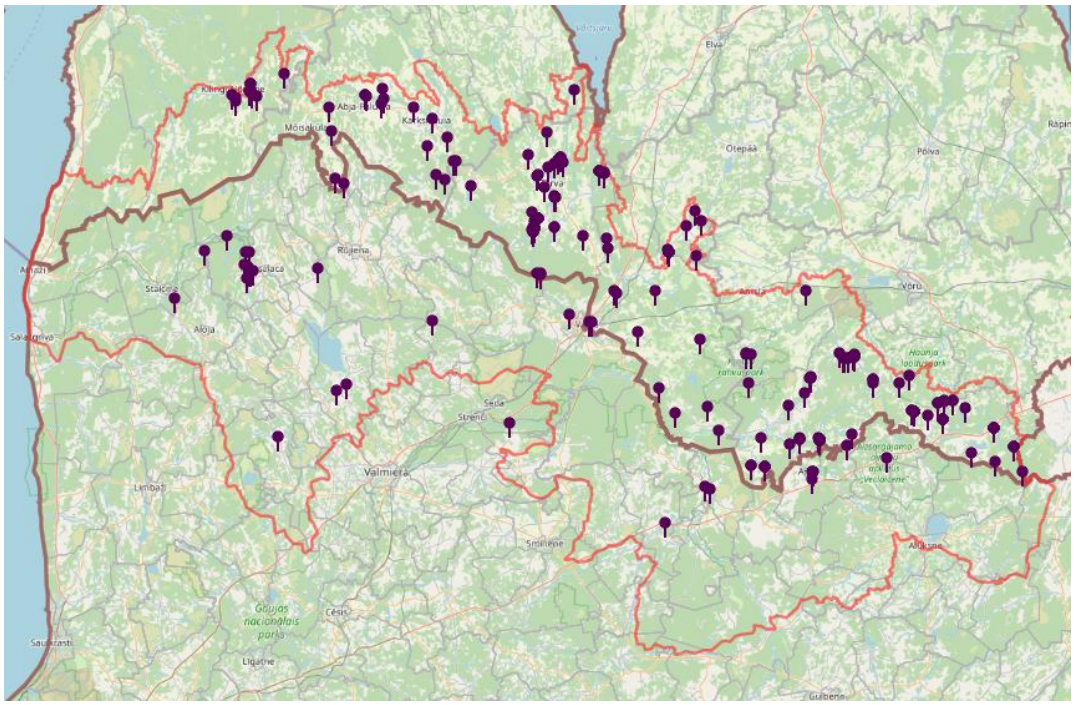
- Attributes

Below are the attributes and vocabularies used to describe the "Transmissivity of the main useful aquifer":

Attribute name	Attribute value
Intervals of the transmissivity of the main useful aquifer	• 0–2 m^2/d • 2–100 m^2/d • 100–200 m^2/d • 200–500 m^2/d • > 500 m^2/d

3.6. Springs

- Map appearance



- Definition

Natural, concentrated outflow of groundwater on the ground surface.

- Legend

the symbol marks the spring on the map

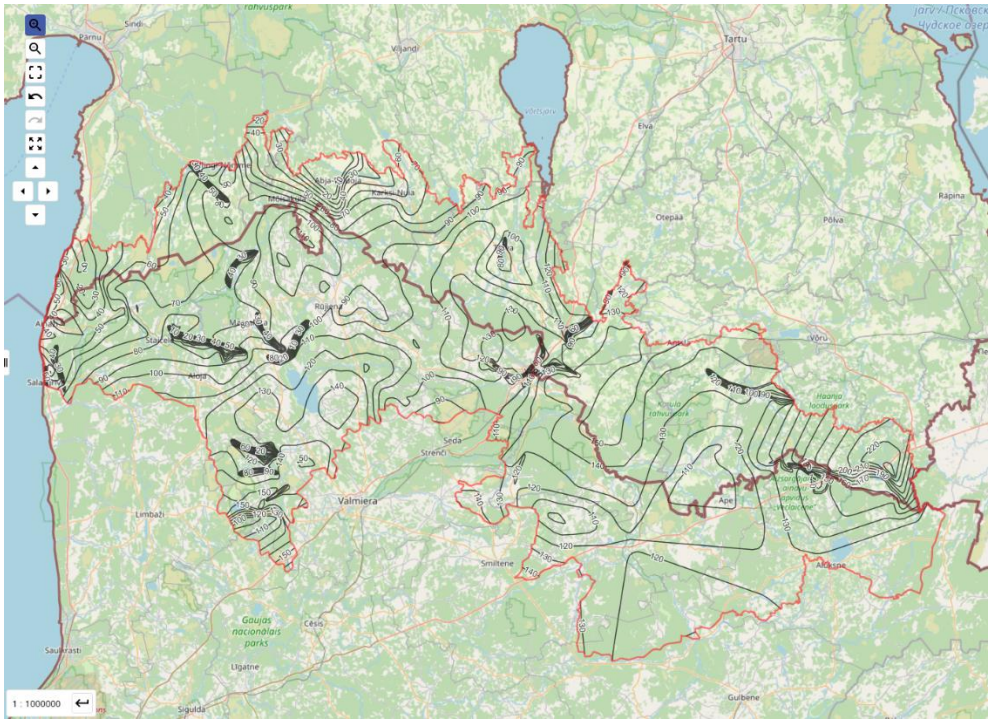
- Attributes

Below are the attributes and vocabularies used to describe the "Springs" layer:

Attribute name	Attribute value
Terrain elevation (m a.s.l.)	• Elevation in m a.s.l
Stratigraphy of aquifer	• Q / Dpl-og / Dar-am / Dar-am and Dpl-og
Flow rate (l/s)	• Flow rate in l/s
Name	• Name of the spring
Attachment	• Link to spring database

3.7. Thickness of the main useful aquifer

- Map appearance



- Definition

Thickness of the main useful aquifer, measured between its top and bottom.

- Legend

The "Thickness of the main useful aquifer" layer is shown as black polylines indiating the intervals of the thickness.

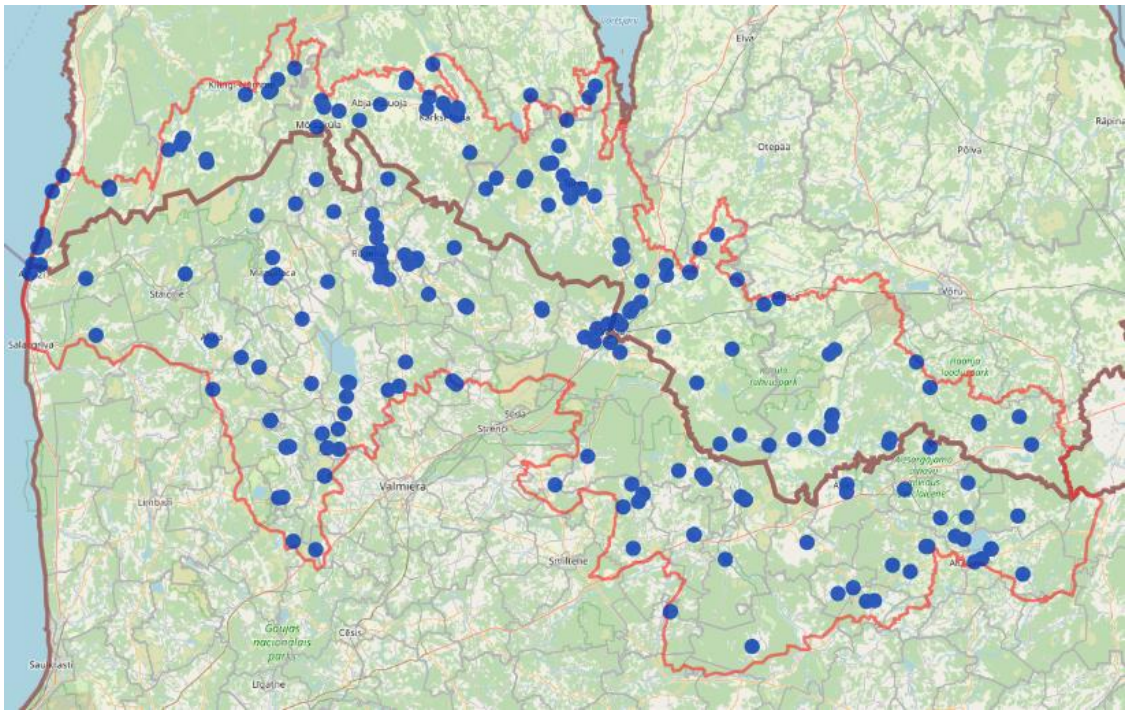
- Attributes

Below are the attributes and vocabularies used to describe the layer "Thickness of the main useful aquifer".

Attribute name	Attribute value
Thickness of MUA from (m)	• 0 • 2 • 10 • 20 • 40
Thickness of MUA to (m)	• 2 • 10 • 20 • 40 • > 40

3.8. Wells / Boreholes

- Map appearance



- Definition

A borehole made to determine the hydrogeological conditions, groundwater exploitation, observation, etc.

- Legend

the symbol marks a well/borehole on the map

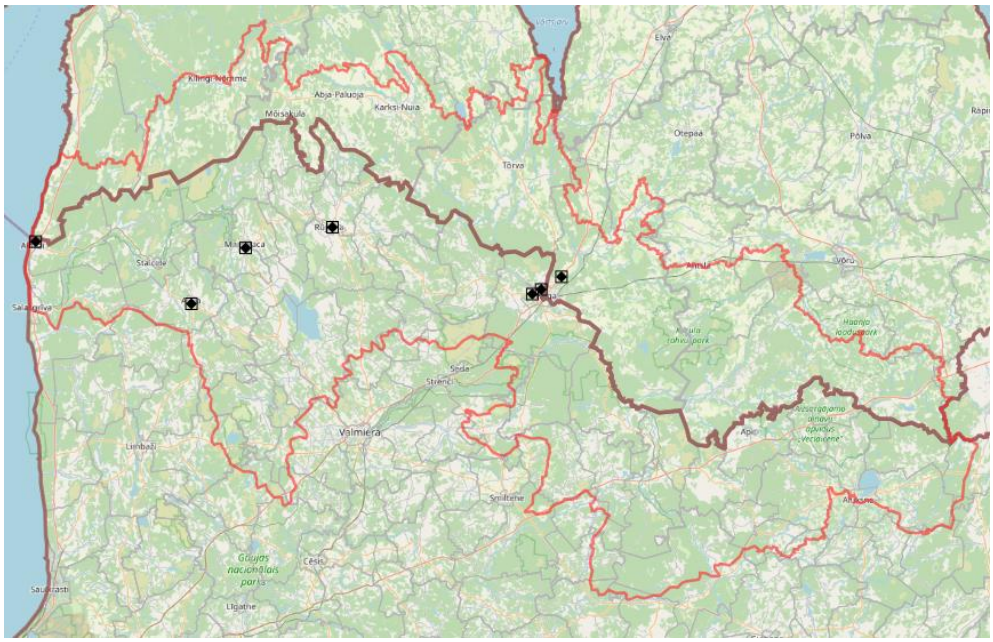
- Attributes

Below are the attributes and vocabularies used to describe the "Wells/Boreholes" layer:

Attribute name	Attribute value
Type of borehole	• research well • exploitation well
Terrain elevation	• value in m a.s.l.
Year when the borehole was made	• Year
Borehole depth	• value in m b.g.l.
The depth of the static groundwater level	• value in m b.g.l
Groundwater level	• value in m a.s.l.

3.9. Intakes

- Map appearance



- Definition

Groundwater intake - a set of devices used to abstract groundwater from one point, many points or from a certain area, supplying a specific user or for a specific purpose.

For the Estonian-Latvian pilot area, this parameter shows fields with approved water resources. In Latvia, the water resources are approved for abstractions over 100 m3/d; in Estonia, over 500 m3/d.

- Legend

the symbol marks an intake on the map

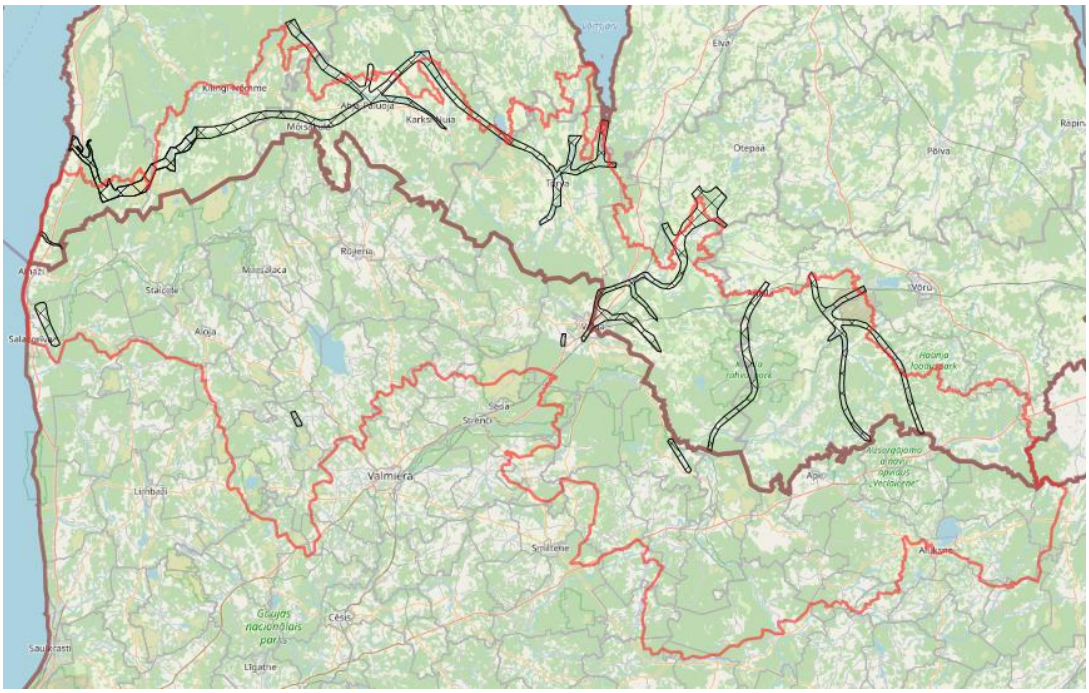
- Attributes

Below are the attributes and vocabularies used to describe the "Wells/Boreholes" layer:

Attribute name	Attribute value
Name of intake	• Name
Role of the intake	• Communal (collective supply) / industrial / individual
Exploitation resources (m^3/d)	• Value in (m^3/d)
Capture zone/Protection zone (km^2)	• Value in km^2

3.10. Buried valleys

- Map appearance



- Definition

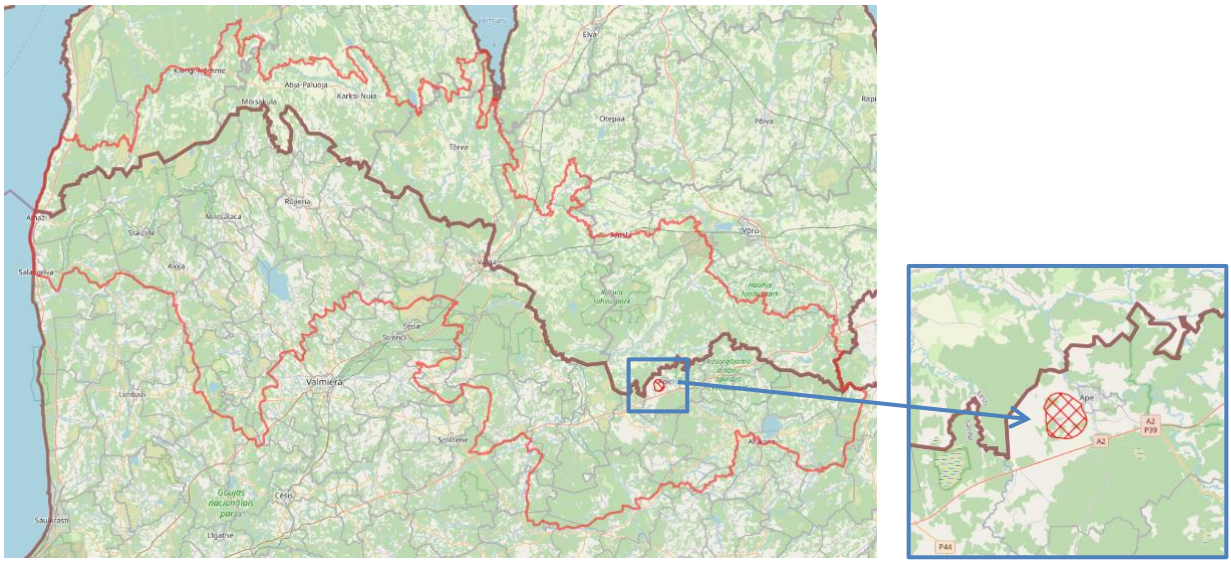
Area layer showing valleys filled with different sediments.

- Legend

the symbol marks a buried valley on the map

3.11. Areas of depression cones

- Map appearance



- Definition

Zone of lowering the piezometric surface (groundwater table) caused by pumping or drainage of aquifers by intakes, mines, etc. Depression of regional importance, with an area of more than 50 km2 or smaller ones with a mirror depression of more than 50 m.

- Legend

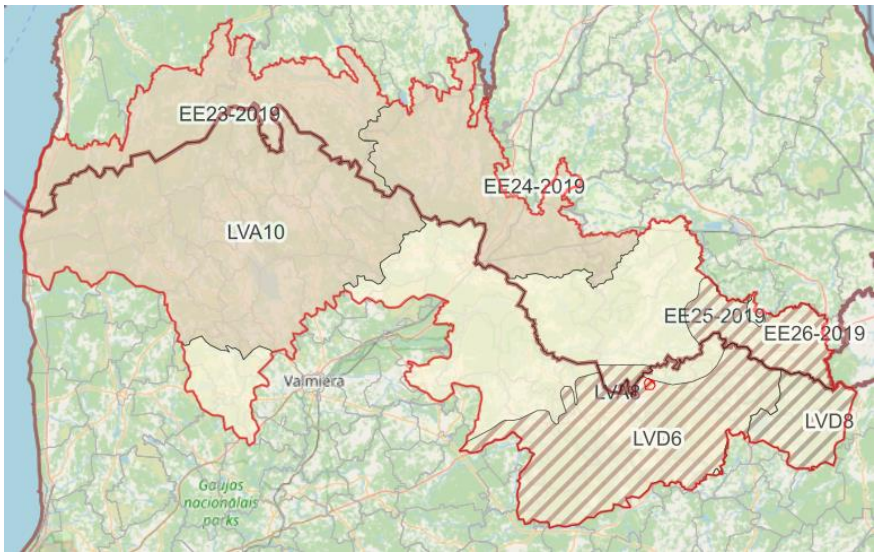
the symbol marks an area of depression cone on the map

- Attributes

Attribute name	Attribute value
Type of lowering of the groundwater level	• Cone from the exploitation of groundwater / Cone from mining drainage / decrease from melioration / decrease from land drainage
Drainage facility	• Name of the facility: water intake, mining plant, etc.
Depression cone surface	• Area in km²

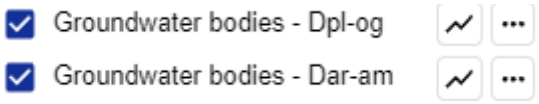
3.12. Groundwater bodies

- Map appearance



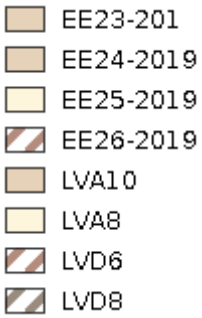
- Definition

According to the definition given in the Water Framework Directive, groundwater bodies (GWB) include groundwater that occur in aquifers with porosity and permeability, enabling a significant uptake in water supply to the population or flow with an intensity significant for shaping the desired state of surface water and terrestrial ecosystems.



GWBs of both Estonia and Latvia are shown and they are divided into Dar-am and Dpl-og.

- Legend



The GWB layer is represented on the map by colored areas. Each GWB object has a unique fill color and has its own unique code (EU code of GWB), which allows unambiguous identification.

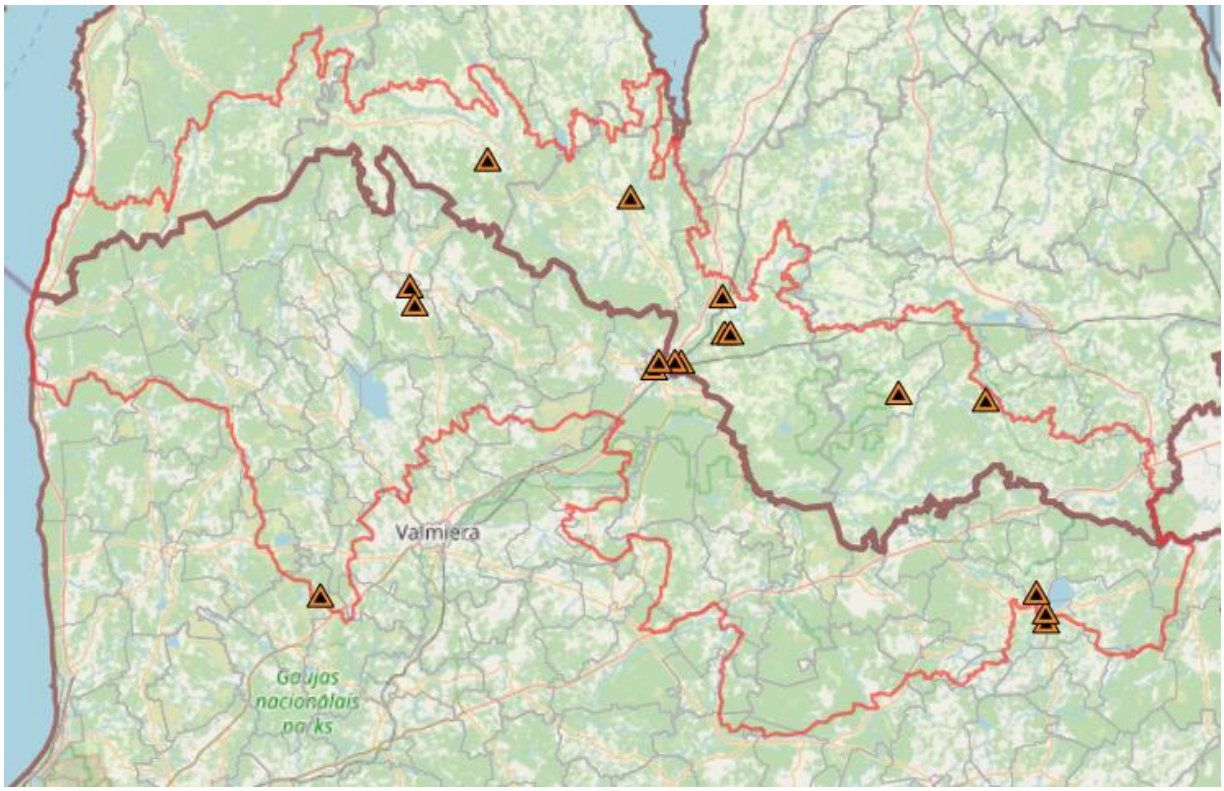
- Attributes

Below are the attributes and vocabularies used to describe the groundwater bodies layer.

Attribute name	Attribute value
European code of GWB	EU code of GWB
Area of GWB	Area in km^2
River basin	Name of the river basin
Main River	Name of the main River Basin
Stratigraphy of the MUA	Q+Dar-am / Q+Dpl-og /Dar-am and Dpl-og
Dominant chemical type of MUA waters	Natural type (HCO3-Ca) / A type deviating from the natural (HCO3-SO4-Cl-Ca)
Threat of pressures	Yes / No
WFD pressure types	Point / Diffuse / Anthropogenic pressure – Other / Anthropogenic pressure – Unknown / Anthropogenic pressure – Historical pollution
Area of groundwater dependent ecosystems (ha)	Area in ha
Area of protected areas (ha)	Area in ha
Diffuse pollution areas	areas prone to nitrate pollution from agriculture urban area none
Assessment of the quantitative status of GWB	good poor
Assessment of the chemical status of GWB	good poor
Overall assessment of the state of the GWB	good poor
Year of the most recent GWB assessment	Year of last assessment
Risk assessment of failure to achieve environmental goals	Endangered / not endangered

3.13. Groundwater pollution sites

- Map appearance



- Definition

Groundwater pollution source - an object causing intentional or accidental release of undesirable substances into groundwater as a result of anthropogenic activity or for natural causes.

For both the Estonian and Latvian side of the transboundary area, spatial data prepared for RBMP (Pressure types in WFD Reporting Guidance 2022) was used for this parameter and attribute table modified according to the attributes required for this parameter.

- Legend

the symbol indicates the place of groundwater pollution

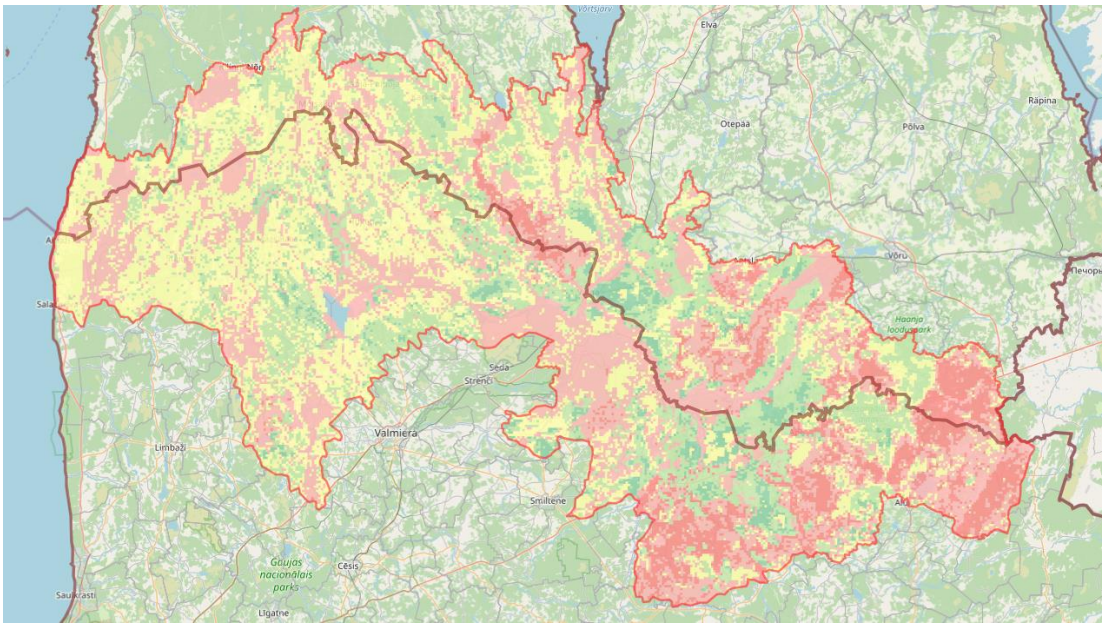
- Attributes

Below are the attributes and vocabularies used to describe the Groundwater pollution site layer.

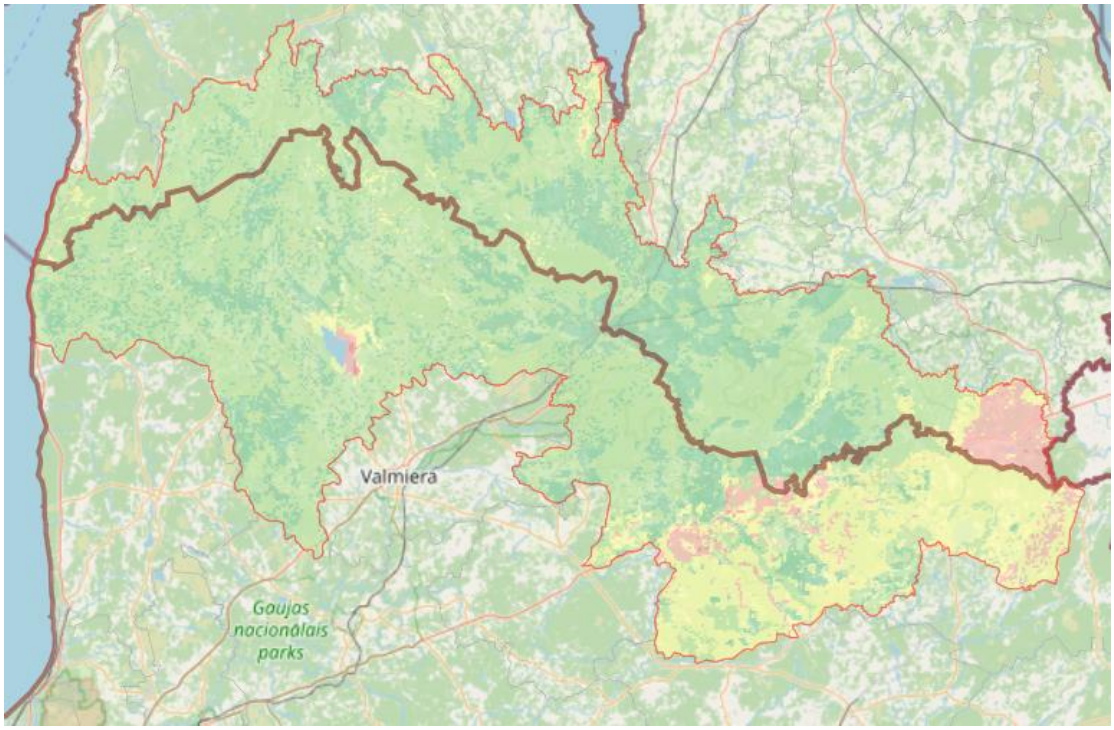
Attribute name	Attribute value
Pressure type	Pressure type from WFD Reporting Guidance

3.14. Vulnerability to groundwater pollution

- Map appearance – vulnerability of the Quaternary aquifer



- Map appearance – vulnerability of the main useful aquifer



- <u>Definition</u>

Groundwater vulnerability is based on the concept that the natural environment provides protection to groundwater. The protection provided by different (hydro)geological conditions varies from one place to another.

- Legend

The "Groundwater Vulnerability to Pollution" layer is represented by a pixel map. Red means very high susceptibility to groundwater pollution, and dark green means very low susceptibility to groundwater pollution. Areas where there are no hydrogeological units of the main usable aquifer were filled with a red grid.

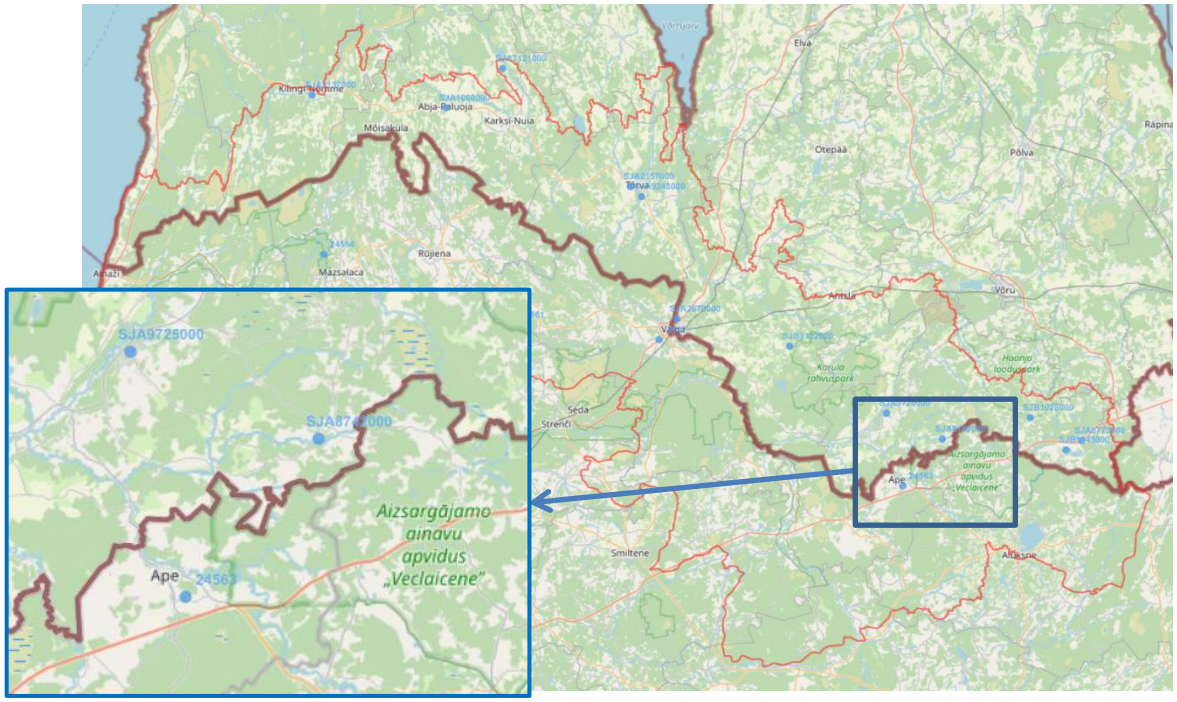
- Attributes:

Below are the attributes and vocabularies used to describe the "Groundwater Vulnerability to Pollution " layer.

Attribute name	Attribute value
Vulnerability class	• Unprotected • Weakly protected • Moderately protected • Relatively well protected • Well protected

3.15. Groundwater monitoring points

- Map appearance



Definition

Groundwater monitoring point - A station with appropriate devices for measuring and sampling groundwater for repeated hydrogeological observations carried out over a longer period.

- Legend:

the symbol indicates the location of the groundwater monitoring point

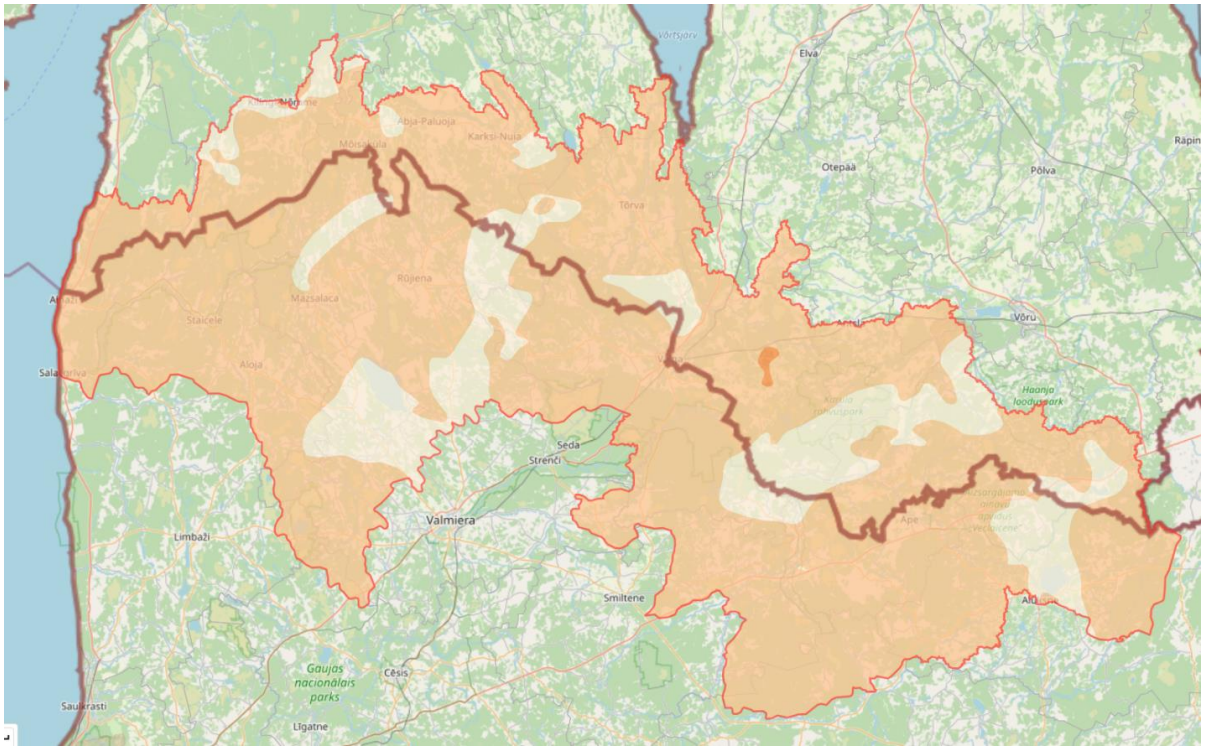
- Attributes:

Below are the attributes and vocabularies used to describe the „Groundwater monitoring points" layer.

Attribute name	Attribute value
Point National Number	National point number
WFD code	International code (WFD)
Point Type	• piezometer • well • spring
Groundwater level type	• unconfined • confined • spring
Terrain elevation	Value in m a.s.l.
Year of starting observations	Year
Type of monitoring	• quantitative/chemical • quantitative
Depth of observation well	Depth in m b.g.l.
The depth of the screen from	Depth in m b.g.l.
The depth of the screen to	Depth in m b.g.l.
Stratigraphy of the aquifer	• Q • Dar-am • Dpl-og • Dar-am and Dpl-og
The depth of the drilled groundwater level	Depth in m b.g.l
The depth of the stabilized groundwater level	Depth in m b.g.l
Groundwater level	m a.s.l

3.16. Groundwater mineralization for main useful aquifer

- Map appearance



- Definition

Values of the mineralization in groundwater in the main useful aquifer, displayed by polygons for both the Dpl-og and Dar-am aquifers.

- Legend

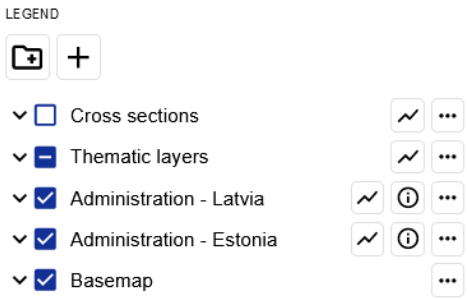
200 mg/l
400 mg/l
600 mg/l

the colors indicate the intervals of groundwater mineralization

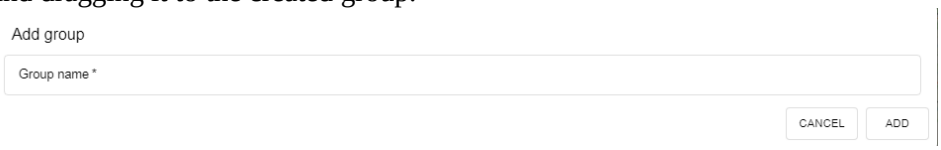
- Attributes

Attribute name	Attribute value
Intervals of isolines of mineralization	• 200 mg/l, 400 mg/l, 600 mg/l

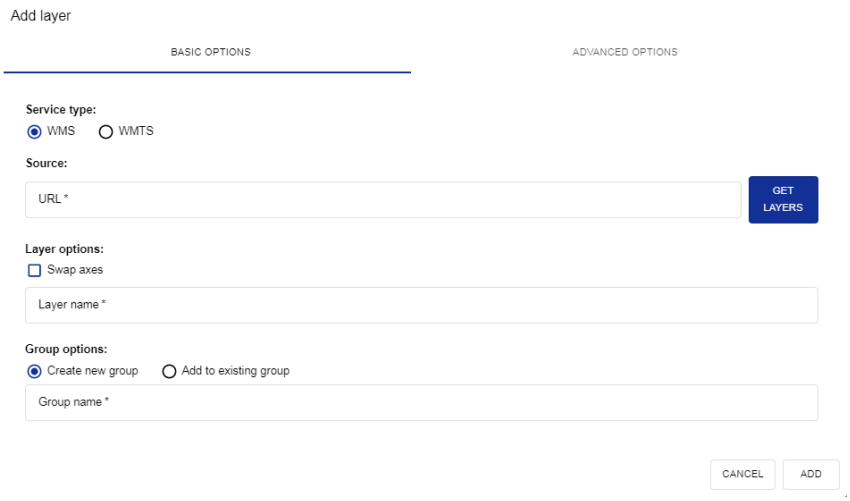
4. Legend



Add group - this feature allows you to create a group of layers yourself from the existing ones or adding a new layer in the form of a WMS or WMTS service to the group. After pressing the "add group" button, a window appears for entering the name of the group you want to add. Then enter the name of the group and confirm with the "add" button. We can add layers to the created group by hovering the cursor over the selected layer, pressing the right mouse button and dragging it to the created group.



Add layer - the tool is used to add a new information layer to the map in the form of a WMS or WMTS service.

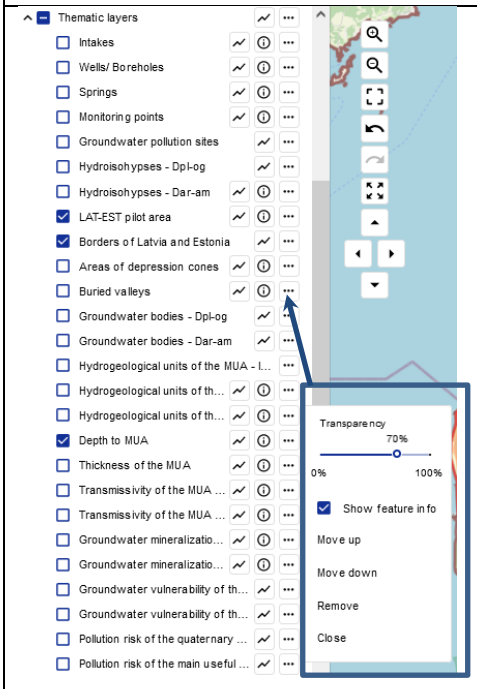


To add a new information layer to the map in the form of a WMS or WMTS service, use the "add layer" button, select the WMS or WMTS service type in the "basic options" tab, then enter the service address and press the "download layer" button. In the layer options, you can check or uncheck the "swap axes" function and give the added layer a name. You can also use the "group options" tool, which allows you to choose one of two functions:
- creating a new group,
- adding to an existing group.
If you select the "create a new group" option, enter the name of the newly created group in the window below this function. However, if you select the "add to an existing group" option, enter the name of one of the existing groups in the window.

In the advanced options in the "translation" tab, we can also complete information about the layer by adding its name and description in English, Polish and Ukrainian.

You can also manage the "Legend" tab using the options available for individual layers or groups consisting of several layers:

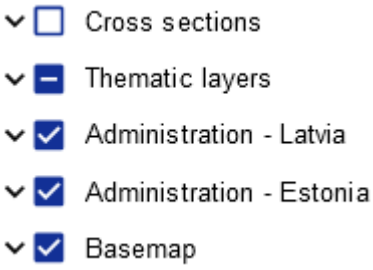
The "legend" tab displays the layers that make up the map composition. Unchecking the name of a layer or layer group disables the visibility of the layer/layer group on the map. After the name of the layer or group of layers, there are function buttons that allow you to control the order and visibility of individual layers, and displaying the definition of the selected layer. A detailed description of the tools used is presented below:

	Show map composition style - pressing the button displays a new window with the symbols used on the map and their description.
	Show info about layer group - pressing the button opens a window in which the definition of the selected layer is displayed.
	**More actions** - pressing the button launches a window in which we can select from 4 to 6 functions that allow you to manage the visibility and create your own map compositions. The following features are available: **Transparency** - allows you to set the transparency of the layer by moving the slider. **Show feature info** - unchecking the check box in front of the layer or layer group name disables the visibility of information about objects. If the checkbox is selected, then after moving the cursor over the selected object from the displayed layer, you can use the left mouse button to open the window with the attributes of the selected object. **Move up** - moves the layer up relative to other layers in the map composition. **Move down** - moves the layer down relative to other layers in the map composition. **Remove** - the tool allows you to delete layers. **Close** – closes the window

	Expand the layer group Collapse the layer group
	Check/uncheck boxes - Enable/disable layer visibility Make the layer visible Make the layer invisible There are visible and invisible layers in the group of shapes

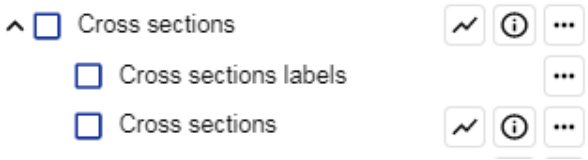
Tabs in the Legend menu

The Legend menu is presented in 5 groups of data:



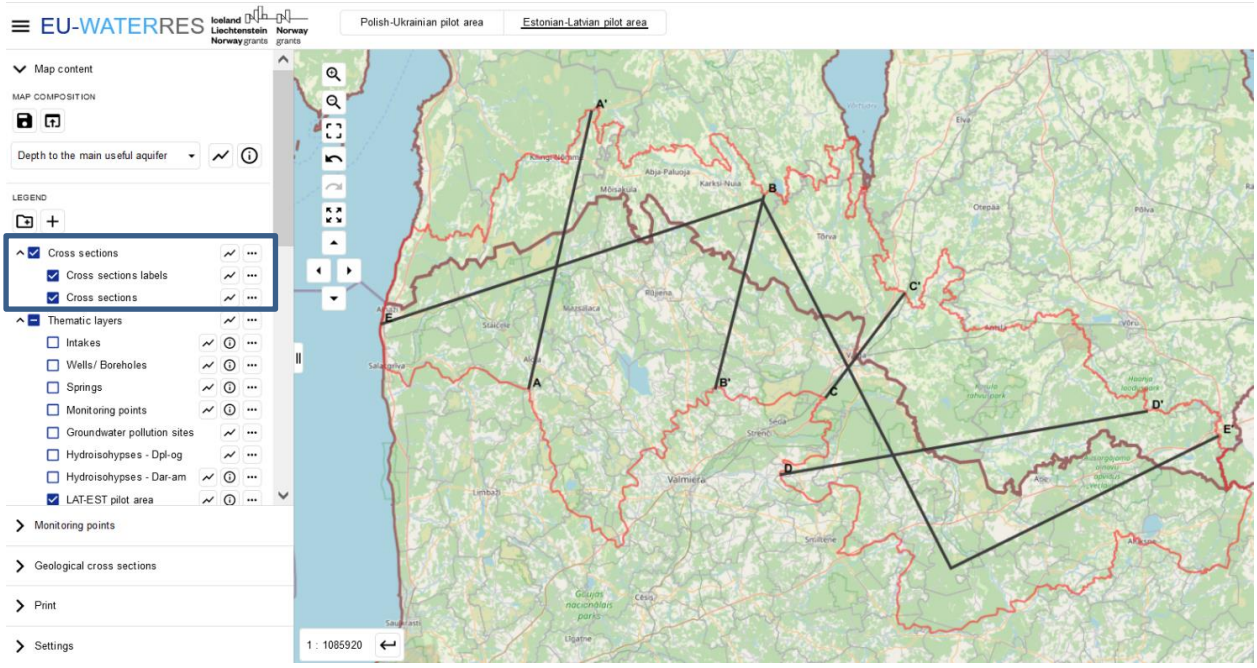
Each of them has been discussed:

4.1. Cross-sections



The “Cross sections” tab consists of two layers:

- „Cross sections – labels” – are the labels for the section lines;
- „Cross sections” – are the sections lines.



By selecting the "Cross sections" and "Cross sections - labels" checkboxes, lines of geological cross-sections and their descriptions will appear on the map.

- Definition:

The hydrogeological cross-section is a graphic representation of the hydrogeological conditions along the selected vertical plane due to the geological structure.

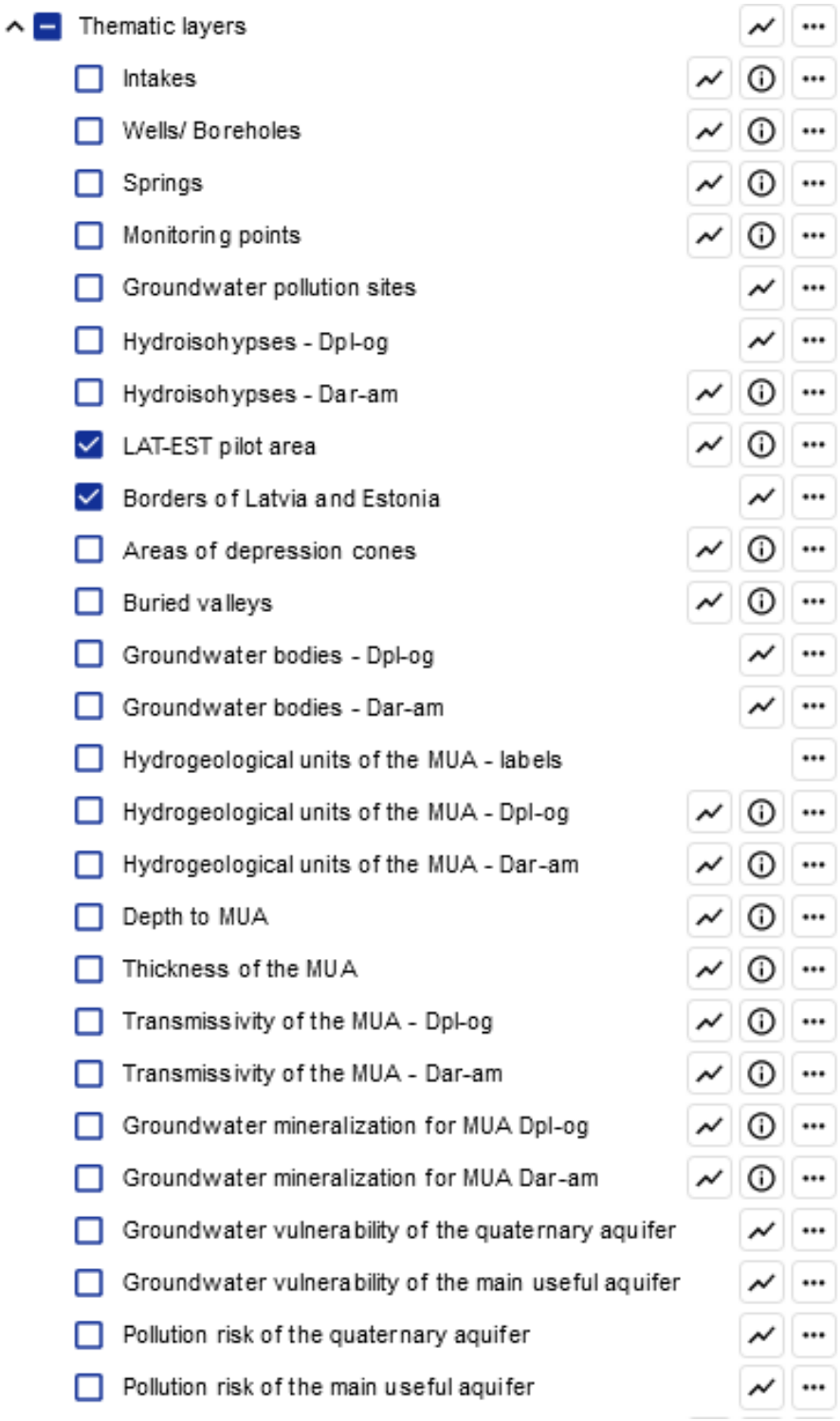
- Legend:

The line on the map represents the cross-section line

- Attributes:

Attribute name	Attribute value
Name	Name of cross section: AA" BB" CC" DD" EE"
Length (km)	Length of the cross-section in km
Cross section	Represented by an icon, after clicking which the user is redirected to a new browser tab, where a geological cross-section is displayed in *.jpg format.

4.2. Thematic layers

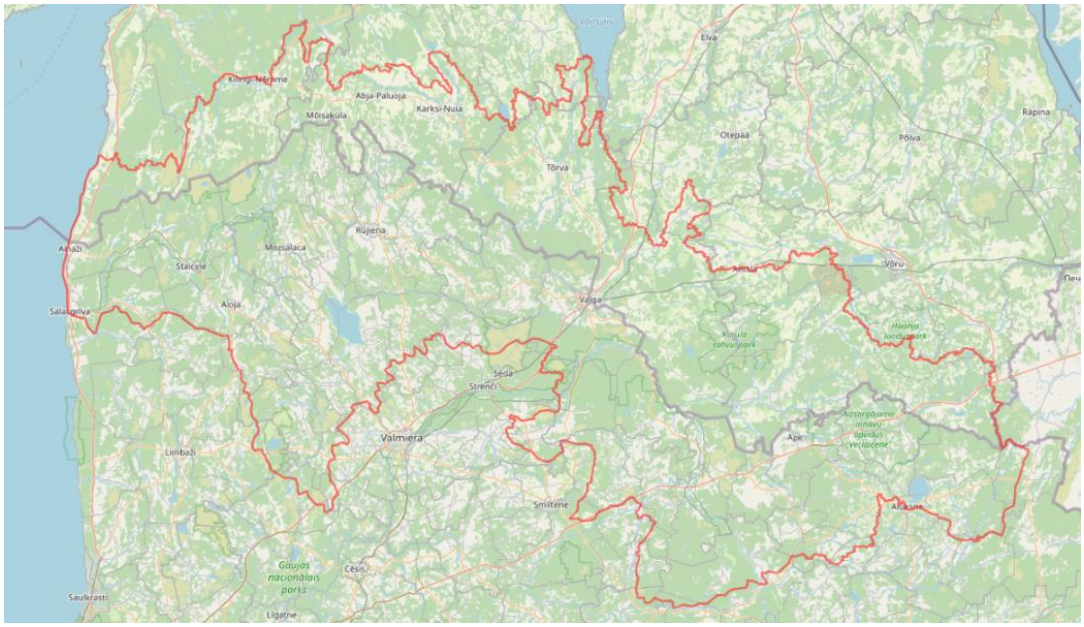


Most of the layers in the "Thematic layers" tab have been described in the "Map composition" chapter. Here, the focus is on those that are not included in this list, namely:

- LAT-EST pilot area;
- Borders of Latvia and Estonia;
- Pollution risk of the quaternary aquifer;
- Pollution risk of the main useful aquifer.

4.2.1. LAT-EST pilot area

This layer is the contour of the Latvian-Estonian area of pilot research. Within this contour, thematic maps were made.

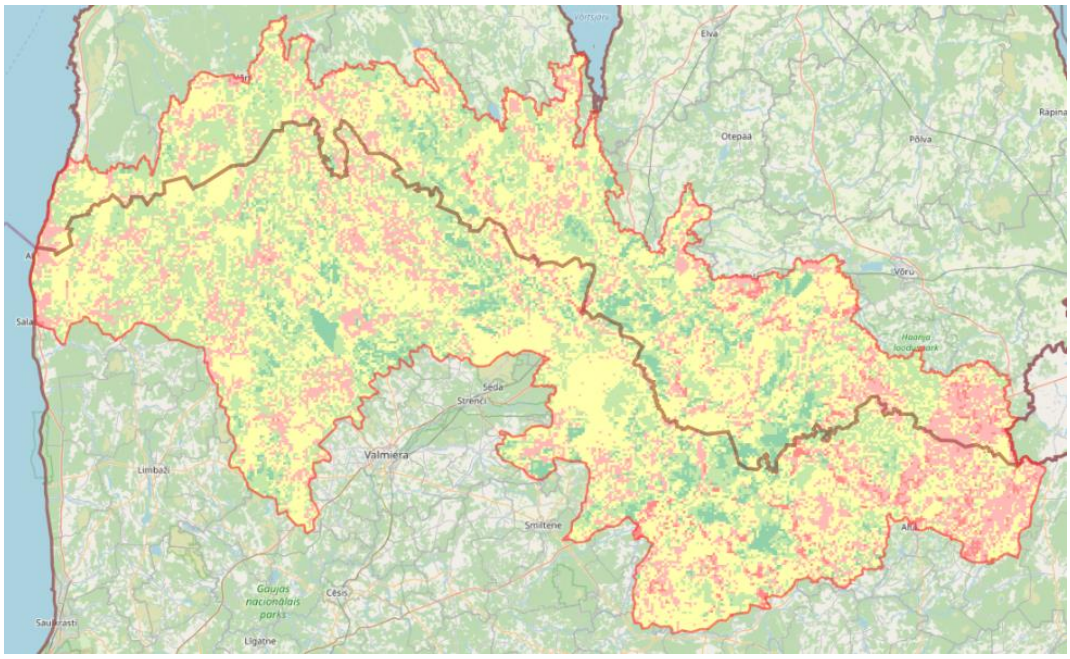


4.2.2. State border

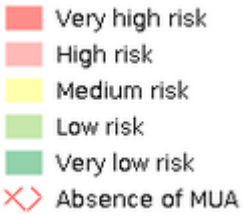
This layer is the state border between Latvia and Estonia.

4.2.3. Pollution risk of Quaternary aquifer

The layer of developed pollution risk map for Quaternary aquifer



- Legend:

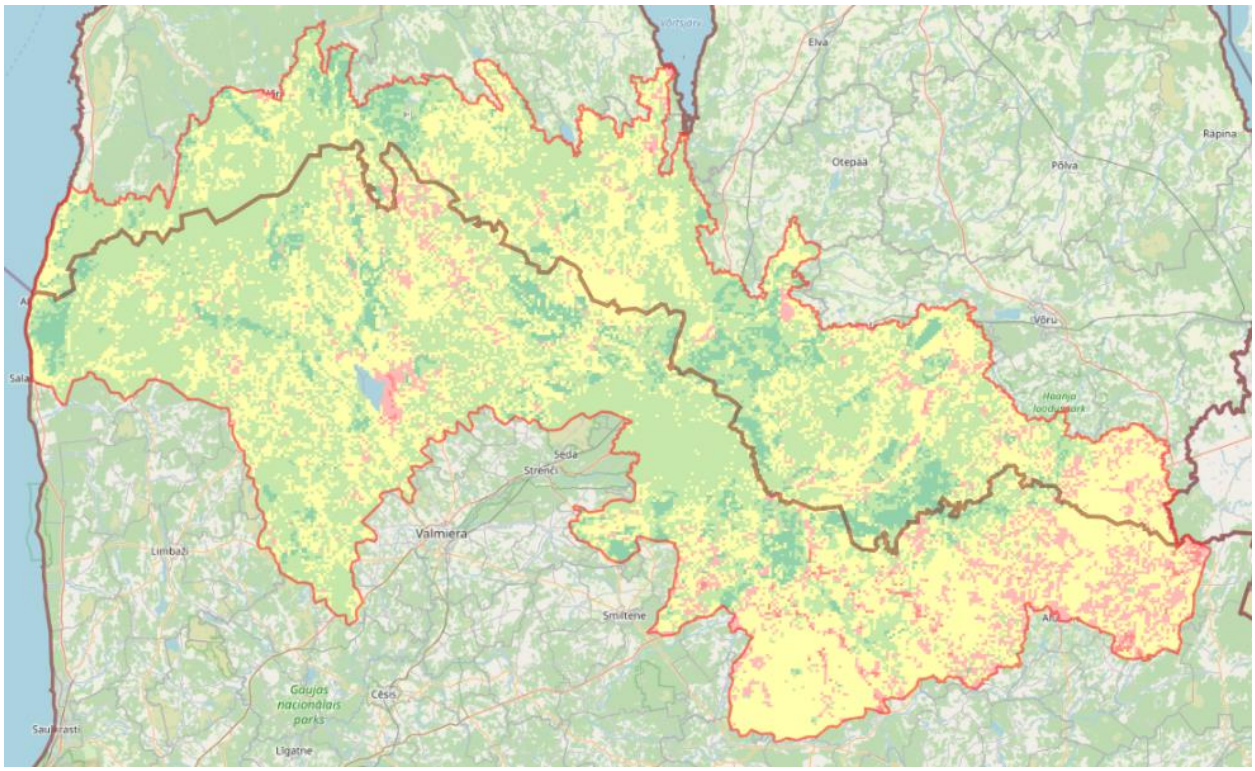


- Attributes:

The map shows areas with potential pollution risk. Map is classified into 5 risk classes - from very low risk to very high risk of pollution.

4.2.4. Pollution risk of main useful aquifer

The layer of developed pollution risk map for main useful aquifer



- Legend:

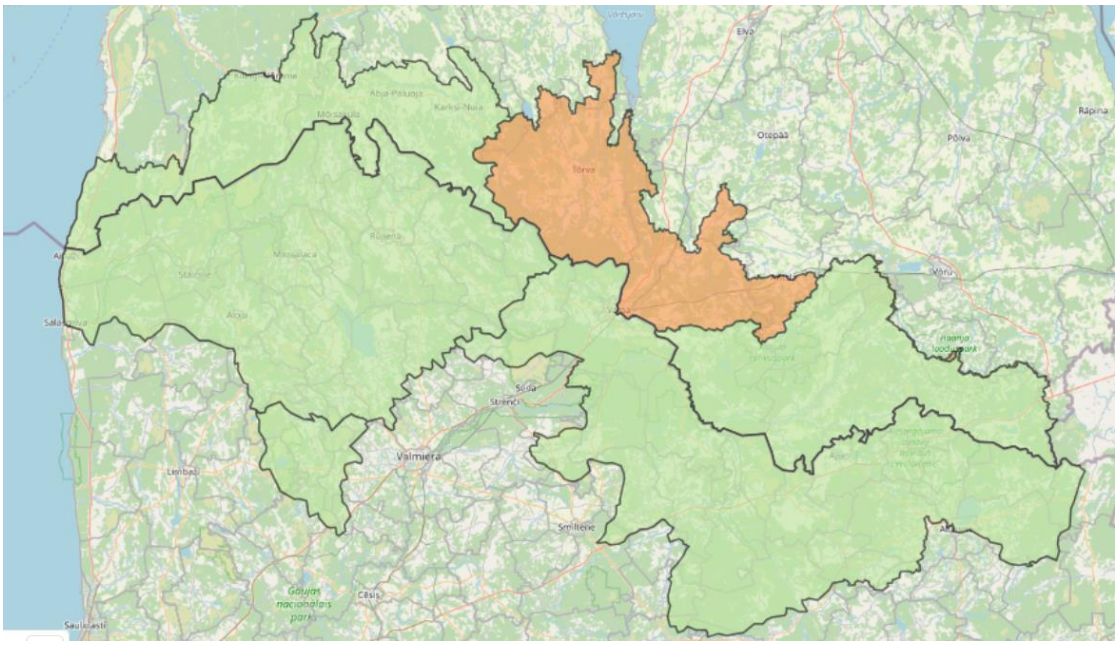
Very high risk
High risk
Medium risk
Low risk
Very low risk
Absence of MUA

- Attributes:

The map shows areas with potential pollution risk. Map is classified into 5 risk classes - from very low risk to very high risk of pollution.

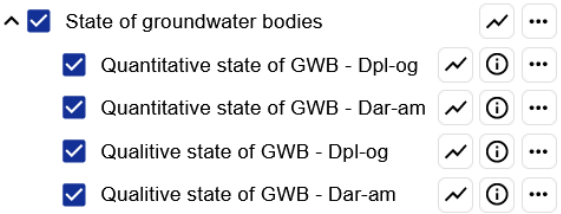
4.2.5. State of groundwater bodies

The layer “State of groundwater bodies” will be visible only if you choose a “Groundwater bodies” layer in Map composition section.



- Definition

Assessment of the quantitative status of groundwater bodies.



Quantitative and qualitative status of groundwater bodies are shown and they are divided into Dar-am and Dpl-og aquifers

- Legend

The "State of groundwater bodies" layer is shown on a polygon map. The green color indicates a groundwater bodies which are at good status. Orange color indicates a groundwater body which are at poor status

- Attributes

Attributes are the same as thematic layer “Groundwater bodies”

4.2.6. Hydroisohypses – labels

This is an auxiliary layer that shows the hydroisohips values on the map. It is advisable to use together with the shape of hydroisohips.

Hydroisohypses - label

Hydroisohypses

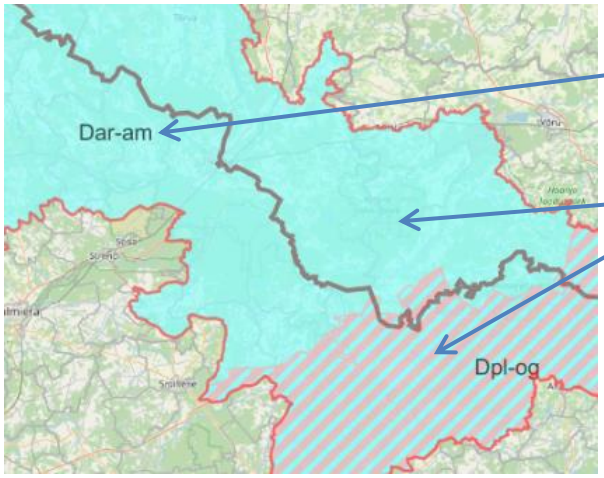
- Dpl-og -
- Dar-am -

Hydroisohypses - Dpl-og

Hydroisohypses - Dar-am

4.2.7. Hydrogeological units of the MUA - labels

This is an auxiliary layer that shows the stratigraphy of the dominant sediments of the MUA hydrogeological units on the map. It is advisable to use the MUA together with the contour/area of the hydrogeological unit.



Symbol of the stratigraphy of the dominant sediments of the MUA hydrogeological unit

Map shows labels of two main useful aquifers:

- Dar-am Terrigenous
- Dpl-og Fractured

Layer in MapPortal:

Hydrogeological units of the MUA - labels

4.3. Administration – Latvia

Administrative units of Latvia

Administrative units of Latvia: counties, parishes.

4.4. Administration – Estonia

Administrative units of Estonia

Administrative units of Estonia: municipalities, counties.

4.5. Base map

OSM (Open Street Map)

https://www.openstreetmap.org/

Free online map

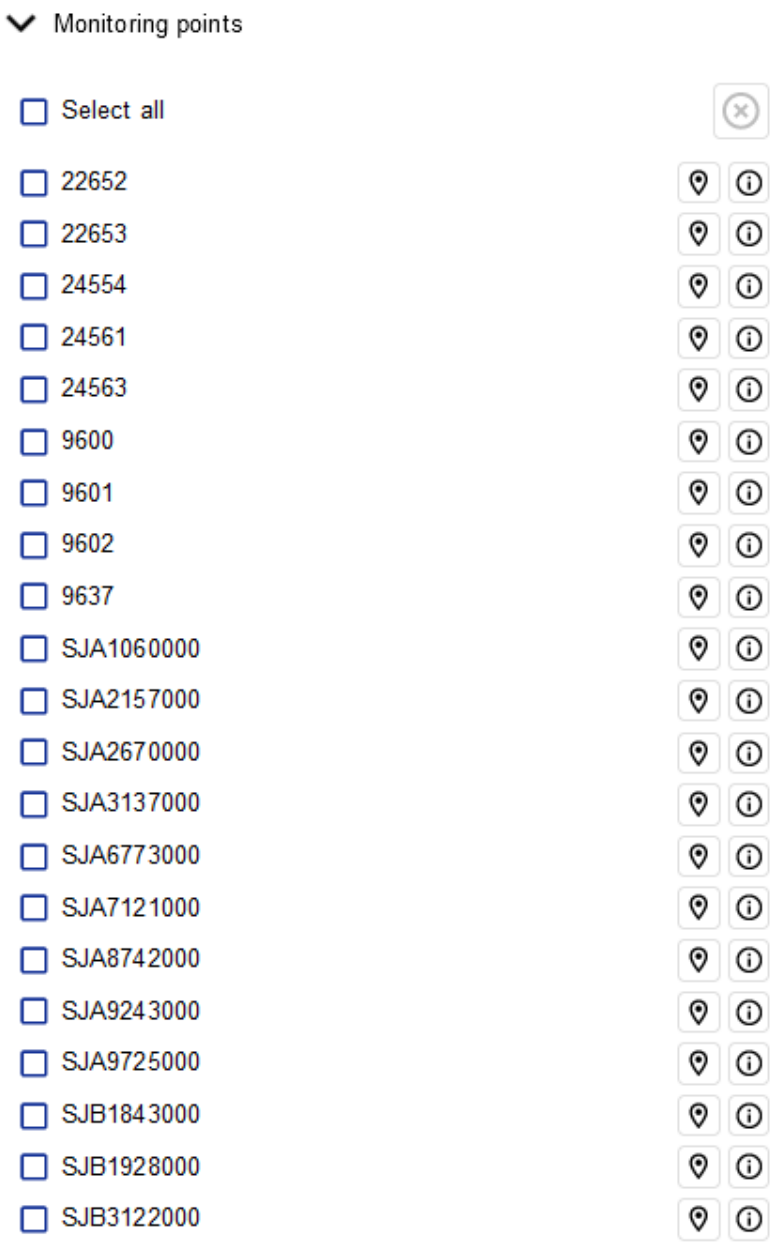
Valmiera
Gaujas
nacionālais
parks

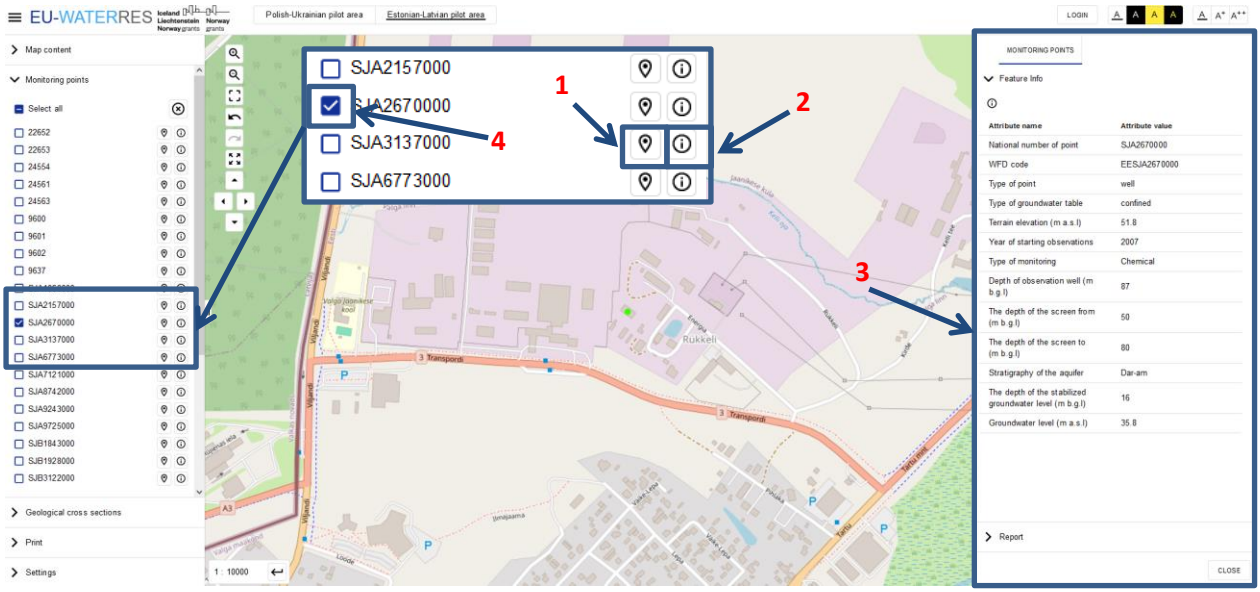
5. Viewing data in the monitoring points tab

The “Monitoring points” tab contains the following information:

- selection of monitoring point(s);
- quick determination of the location of a specific monitoring point;
- viewing information on the monitoring point;
- creating and printing specifications/characteristics in *pdf format.

This tab opens the list of monitoring points contained in the "Monitoring points" layer.



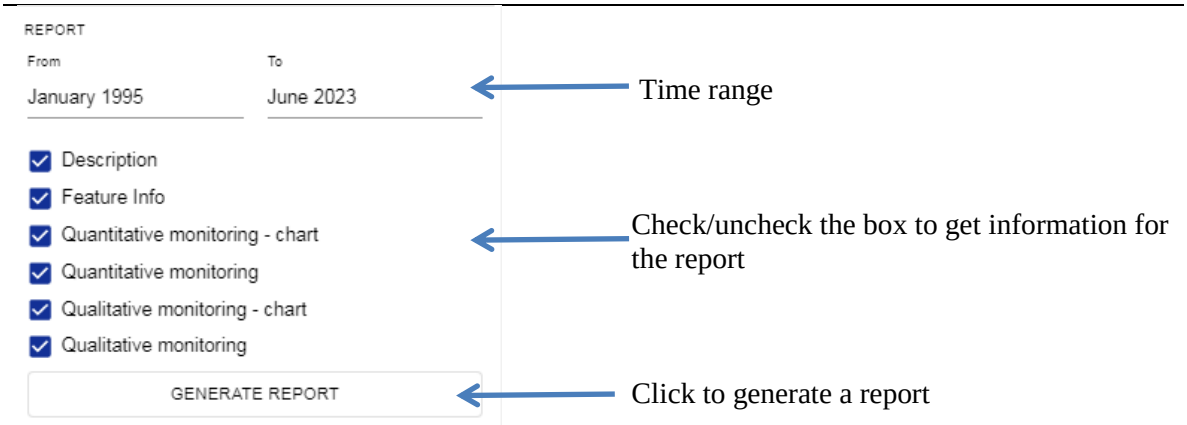


1. Show location. Shows the location of the monitoring point on the map at a scale of 1:10,000.

2. After clicking on the icon, on the right side of the map window, a table of attributes/detailed characteristics for this monitoring point will be displayed (3).

4. Monitoring point selection field. You can select one or more monitoring points and generate a report in *.pdf format.

To generate a report, it is necessary to scroll down the list of monitoring points to the "report" option (next figure).

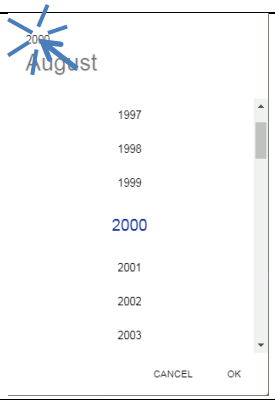


The following options are available:

- selection of monitoring time frames;
- report content - select from the following criteria: description, attributes/characteristics of the facility, quantitative monitoring - chart, quantitative monitoring, qualitative monitoring - chart, qualitative monitoring.

When selecting a time period, click on the date in the "From" and "To" fields. A window will appear with the possibility of quick selection of the year and month of starting/ending research at this monitoring point.

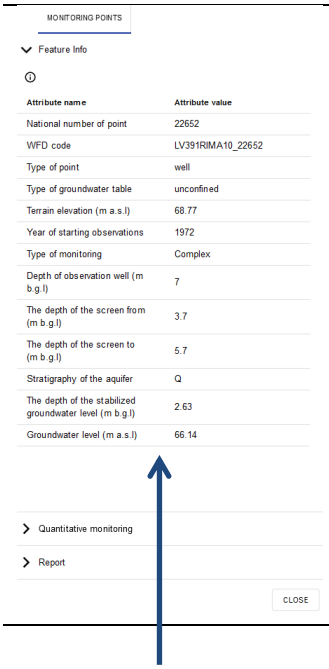
To select a month, click on the month caption and select the required month from the table.



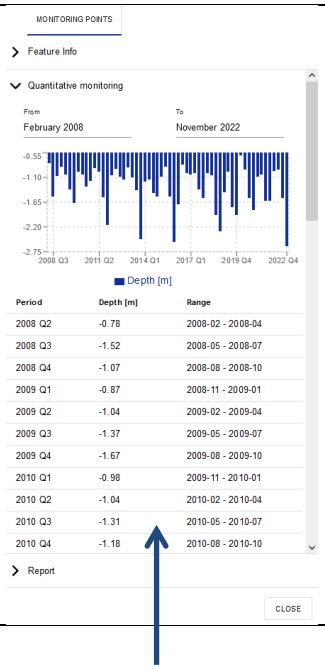
To select a year, click on the year and select the desired year from the list.

To define the content of the report, check or uncheck the checkboxes and click the "GENERATE REPORT" button. A *.pdf file will be generated for selected monitoring points with information specified in the "REPORT" form.

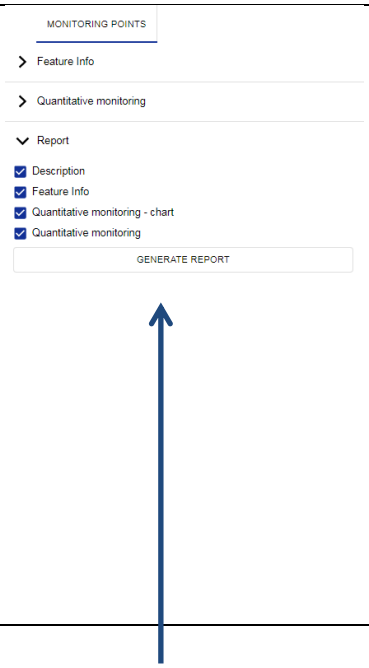
The same report can be generated using the right panel "monitoring point information". However, in this case the generated report will concern only one monitoring point.



information on the selected monitoring point



data on the quantitative monitoring of the selected point



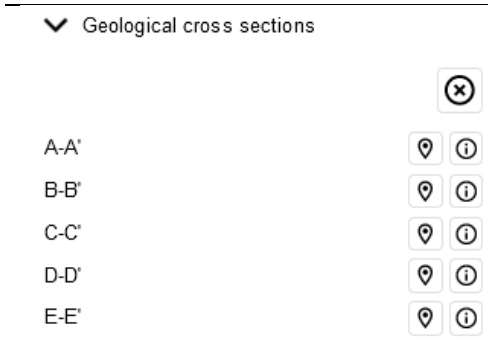
"GENERATE REPORT" button for creating a report in *pdf format. You can specify the content of the report from the specified criteria.

Features available for logged in users

This feature is only available to logged in users. It allows you to import data from quantitative or qualitative monitoring for points that are in the database. The data must be prepared in *.csv files with a fixed structure. During import, the data already existing in the database for a given point are updated with data from the *.csv file.

6. Viewing data in the "Geological cross sections" tab

In this tab you will find information on the geological structure along the given cross-section lines. After expanding the "Geological cross sections" tab, a list of profile lines will appear:

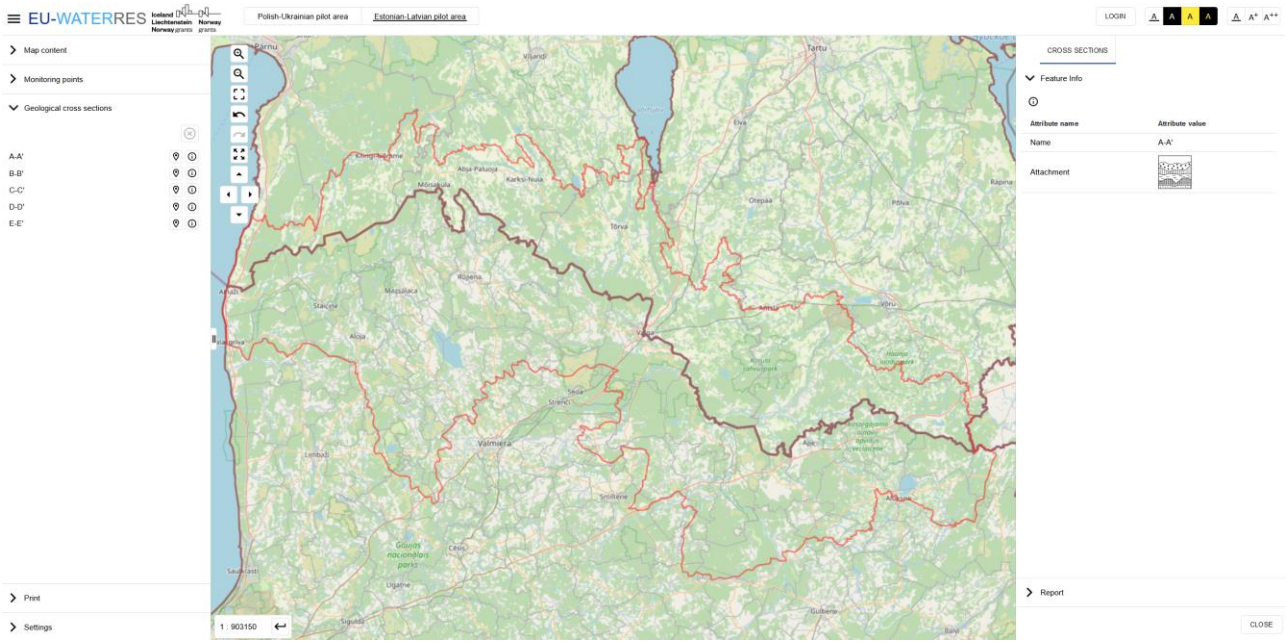


- shows the course of the profile line on the map

- displays "layer information" for a given profile line on the right side of the map window

- closes the given profile line

General view of the window with the selected profile line selected:

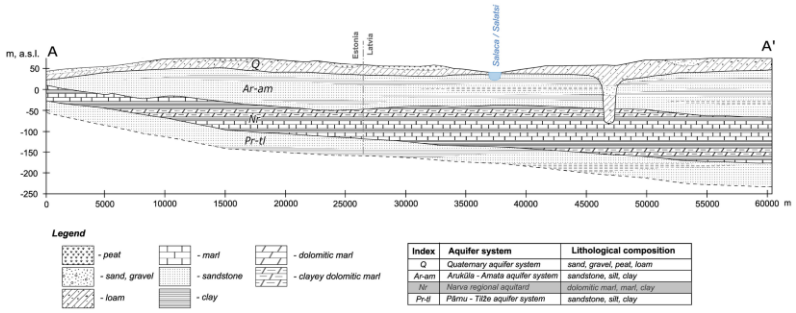


After clicking the icon next to the section line, it appears at maximum scale for full preview

Attribute name	Attribute value
Name	AA"
Length (km)	189.03
Cross section	

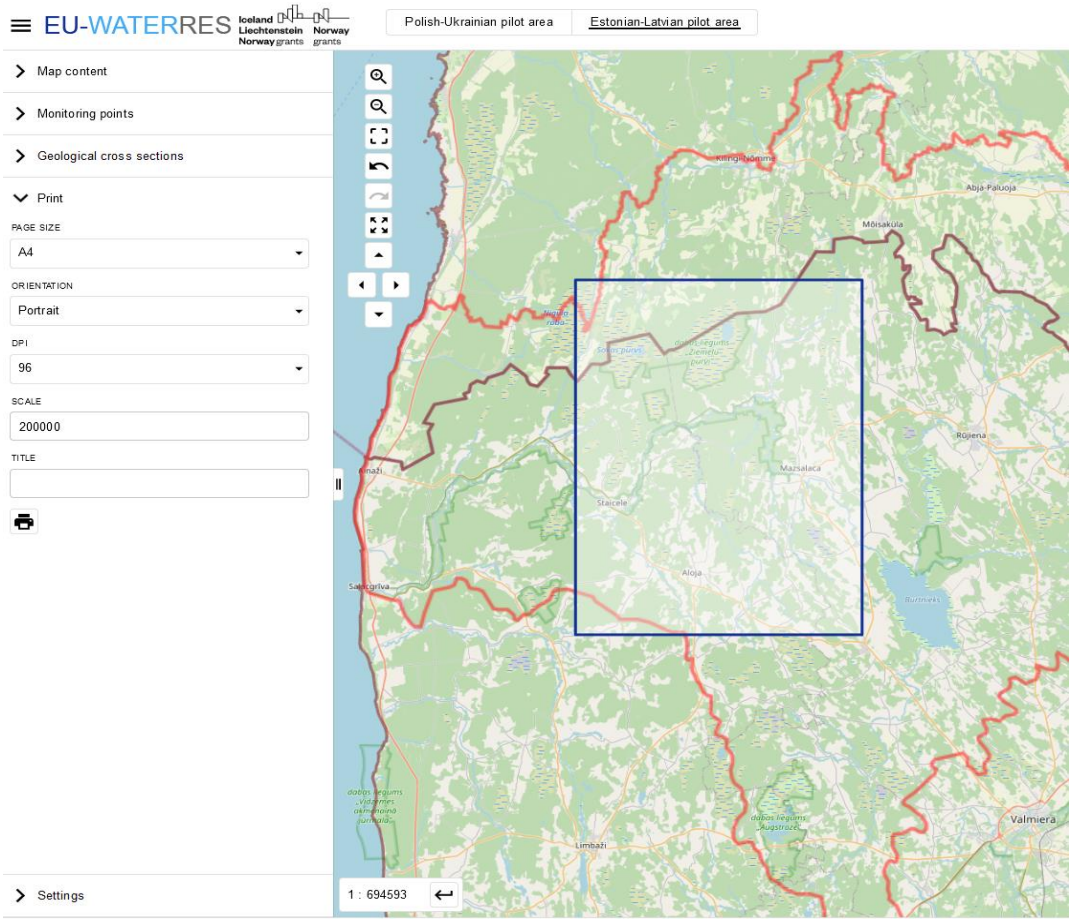
Displays profile line attributes on the right side of the map

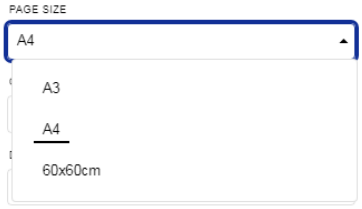
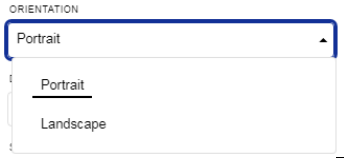
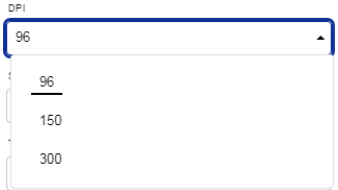
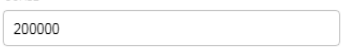
The "cross section" icon generates the entire cross-section in *jpg format, which appears in a new browser tab (see image below)

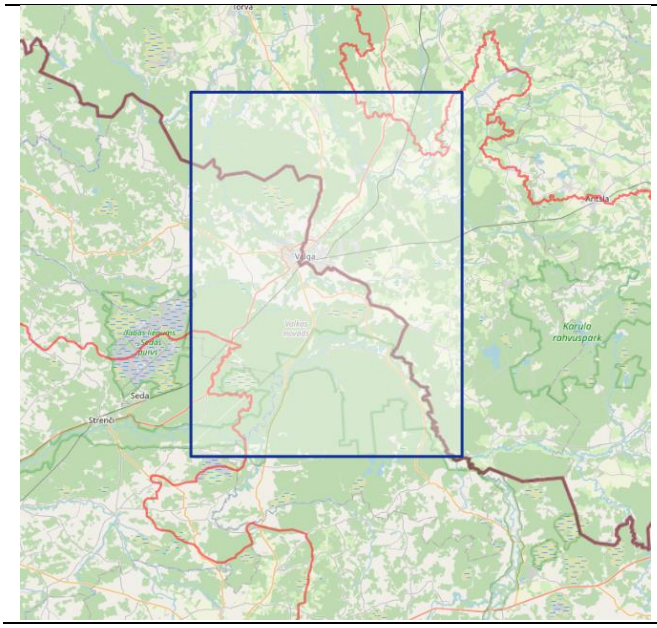


Geological section in *jpg format

7. "Print" service



	Page size selection
	Selection of the page orientation
	Selection of print resolution
	Map scale
	Space for map title/pdf file name
	Button to generate a map in *pdf format



The blue rectangle defines the printing area.
Increasing or decreasing the print area is done by changing the scale in the print window.
The print area (blue rectangle) can be moved around the map with the mouse.

8. List of thematic layers & authors

Thematic layer	Estonian authors	Latvian authors
Hydrogeological units of the main useful aquifer	Magdaleena Männik, Liina Hints, Marlen Hunt	Jānis Bikše
Depth to the main useful aquifer	Liina Hints	Jānis Bikše
Hydroisohypses of the main useful aquifer	Liina Hints	Jānis Bikše
Thickness of the impermeable layer over main useful aquifer	Magdaleena Männik	Jānis Bikše
Transmissivity of the main useful aquifer	Marlen Hunt	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Springs		Jānis Bikše
Thickness of the main useful aquifer	Liina Hints	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Wells / Boreholes	Magdaleena Männik, Liina Hints, Marlen Hunt	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Intakes	Magdaleena Männik, Liina Hints, Marlen Hunt	Krišjānis Valters
Buried valleys	Magdaleena Männik	Jānis Bikše
Areas of depression cones	Marlen Hunt	-
Groundwater bodies	Magdaleena Männik, Liina Hints, Marlen Hunt	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Groundwater pollution sites	Magdaleena Männik, Liina Hints, Marlen Hunt	Dāvis Borozdins
Vulnerability to groundwater pollution	Magdaleena Männik	Jekaterina Demidko
Groundwater monitoring points	Magdaleena Männik, Liina Hints, Marlen Hunt	Jekaterina Demidko
Groundwater mineralization for main useful aquifer	Liina Hints	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Pollution risk of the Quaternary aquifer	Magdaleena Männik	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Pollution risk of the main useful aquifer	Magdaleena Männik	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Cross sections	-	Dāvis Borozdins
LAT-EST pilot area	Magdaleena Männik, Liina Hints, Marlen Hunt, Andres Marandi	Dāvis Borozdins, Jekaterina Demidko, Krišjānis Valters
Borders of Latvia and Estonia		Reference layer
Administration – Latvia		Reference layer
Administration – Estonia		Reference layer