Transboundary Aquifer Information Sheet

EU91-EU92-EU93 - Alluvial/Paleogene-Neogene and Oxfordian-Cenomanien Aquifers

**Geography**
- Total area TBA (km²): 19 000
- No. countries sharing: 3
- Countries sharing: Belarus, Poland, Ukraine
- Population: 1 100 000
- Climate zone: Humid Continental
- Rainfall (mm/yr): 570

**Hydrogeology**
- Aquifer type: A multi-layered system
- Degree of confinement: Unconfined and confined
- Main Lithology: Sediment/sand and Sedimentary rocks

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**Legend**
- Transboundary aquifer
- Partially confirmed aquifer boundary
- Other aquifer(s)

**Others symbols**
- Rivers
- Lakes
- Political Borders
- TBA Location

**Regional location of aquifer**

**Geological cross-section along part of the Alluvial/Paleogene-Neogene and Oxfordian-Cenomanien Aquifers**

Map and cross-section are only provided for illustrative purposes. Dimensions are only approximate.
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**TWAP Groundwater Indicators from Global Inventory**

<table>
<thead>
<tr>
<th></th>
<th>Recharge (mm/y)</th>
<th>Renewable groundwater per capita (m³/y/capita)</th>
<th>Natural background groundwater quality (%)</th>
<th>Human dependency on groundwater (%)</th>
<th>Groundwater depletion (mm/y)</th>
<th>Groundwater pollution (%)</th>
<th>Population density (Persons/km²)</th>
<th>Groundwater development stress (%)</th>
<th>Transboundary legal framework (Scores)</th>
<th>Transboundary institutional framework (Scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belarus</td>
<td>51</td>
<td>920</td>
<td>100</td>
<td>70</td>
<td>0</td>
<td>55</td>
<td>10</td>
<td>B</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>160</td>
<td>2600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>61</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ukraine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td></td>
<td></td>
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<tr>
<td><strong>TBA level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(1) Recharge: This is the long term average recharge (in m³/yr) divided by the surface area (m²) of the complete country segment of the aquifer (i.e. not only the recharge area).

(2) Natural background groundwater quality: Estimate of percentage of surface area of aquifer where the natural groundwater quality satisfies local drinking water standards.

(3) Groundwater pollution: A. No pollution has been identified; B. Some pollution has been identified; Positive number: Significant pollution has been identified (% of surface area of aquifer).

(4) Groundwater development stress: Annual groundwater abstraction divided by recharge.

(5) Legal framework: A. Agreement with full scope for TBA management signed by all parties; B. Agreement with limited scope for TBA management signed by all parties; C. Agreement under preparation or available as an unsigned draft; D. No agreement exists, nor under preparation; E. Legal Framework differs between Aquifer States (see data at National level).

(6) Institutional Framework: A. Dedicated transboundary institution fully operational; B. Dedicated transboundary institution in place, but not fully operational; C. National/Domestic institution fully operational; D. National/Domestic institution in place, but not fully operational; E. No institution exists for TBA management; F. Institutional Framework differs between Aquifer States (see data at National level).

X A value was provided in the questionnaire, but it was considered un-realistic and therefore removed from the table.

**Key parameters table from Global Inventory**

<table>
<thead>
<tr>
<th></th>
<th>Distance from ground surface to groundwater table (m)</th>
<th>Depth to top of aquifer formation (m)</th>
<th>Full vertical thickness of the aquifer (m)</th>
<th>Degree of confinement</th>
<th>Predominant aquifer lithology</th>
<th>Primary Porosity</th>
<th>Secondary Porosity</th>
<th>Transmissivity (m/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belarus</td>
<td>9**</td>
<td>49 - 240**</td>
<td>29 - 230</td>
<td>Whole aquifer unconfined</td>
<td>Sediment - Sand</td>
<td>High primary porosity fine/medium sedimentary deposits</td>
<td>No secondary porosity</td>
<td>130-150</td>
</tr>
<tr>
<td>Poland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sediment - Sand</td>
<td>High primary porosity fine/medium sedimentary deposits</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

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**Note:**

- **Transmissivity:** This value represents the ability of the aquifer to transmit water and is an important indicator of the aquifer’s potential for groundwater development and sustainability. It is measured in meters per day (m/d), reflecting how efficiently water can flow through the aquifer.

- **Degree of confinement:** This parameter is crucial for understanding the aquifer’s vulnerability to changes in water levels. It indicates how much the aquifer is confined by impermeable layers or other aquifers, affecting its capacity to store and supply water.

- **Predominant aquifer lithology:** The type of rock or sediment that constitutes the aquifer can significantly influence its properties, such as porosity and permeability, which are critical in determining the aquifer’s ability to hold and transmit water.
Transboundary Aquifer Information Sheet

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<table>
<thead>
<tr>
<th>Distance from ground surface to groundwater table (m)</th>
<th>Depth to top of aquifer formation (m)</th>
<th>Full vertical thickness of the aquifer (system)* (m)</th>
<th>Degree of confinement</th>
<th>Predominant aquifer lithology</th>
<th>Primary Porosity</th>
<th>Secondary Porosity</th>
<th>Transmissivity (m²/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ukraine</td>
<td></td>
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<td>TBA level</td>
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</tbody>
</table>

* Including aquitards/aquicludes
** These values would need revision, since a groundwater table higher than depth to top of the aquifer is un-realistic for an unconfined aquifer.
X A value was provided in the questionnaire, but it was considered un-realistic and therefore removed from the table.

Aquifer description
As most of the quantitative information was obtained from Belarus most of the quantitative values within this brief refer to the status of the TBA within the Belarus part of the system.

Aquifer geometry
The TBA that has been reported as a multi-layered system that is composed of three different aquifers (EU91: Alluvial; EU92: Paleogene-Neogene and EU93: Oxfordian-Cenomanien), with a vertical thickness greater than 100m, although the average thickness of the system within Belarus is 29 m. The transboundary aquifer definition has been generally based on lithological properties and geologic structures. Information on groundwater flow conditions which indicates piezometric features (and also the flow - no flow conditions across boundaries) and boundary conditions is lacking. A geochemical interpretation based on chemical data to support the adopted definition does not exist. The average depth to the water table/piezometric surface is 9m. The average depth to the top of the aquifer varies between 49m – 240m (EU91, EU92 and EU93 resp.). The entire aquifer is unconfined although parts are confined.

Hydrogeological aspects
EU91 and EU92 could act as a single hydraulically connected aquifer system, composed of porous media of alluvial sediments, sands and sandstones. The Oxfordian-Cenomanian part, EU93, is formed by a sandy confined aquifer system composed of multiple connected layers with groundwater flow to the Polish border (western part of the aquifer). The groundwater volume that needs to be confirmed has the largest volume in Poland. The groundwater flow direction is E-W, draining to the Polish border and shows shallow groundwater levels (average around 10m below soil surface). Transmissivities in the unconfined and the lower confined aquifers are very similar, around 130 m²/d. The average recharge, that is 100% due to natural recharge, is around 1 200 Mm³/annum in Belarus and in Poland, over an estimated recharge area of 2600 and 9400 km² respectively.

Linkages with other water systems
Recharge is from precipitation where aquifer outcrops and from river runoff in the areas where the aquifer is connected to the rivers. Discharge is through river base flow and springs. For the confined Oxfordian-Cenomanian aquifer, EU93, recharge is from overlying aquifer infiltration and discharge is to river base flow.

Environmental aspects
Approximately 1% of the aquifer water quality does not comply with drinking water standards over a considerable thickness of the aquifer system due to Fe presence of natural origin. Some pollution has been identified/ suspected but the aerial extent has not been specified. The main pressures to the
EU91-EU92-EU93 - Alluvial/Paleogene-Neogene and Oxfordian-Cenomanien Aquifers

aquifer are agriculture (presence of nitrate pollution), households and industries. Belarus reports that the whole thickness of the alluvial aquifer is affected. The confined aquifer presents similar quality problems, although as a confined aquifer it is less vulnerable to pollution. Around 75% of the aquifer within Belarus contains shallow groundwater while no groundwater dependent ecosystems were reported on. However, these reported areas may not be entirely associated with the transboundary aquifers, i.e. they may rely on other aquifers, since these are un-realistic figures for a confined aquifer.

Socio-economic aspects
In the case of EU 91 and 92, the main groundwater use is for drinking water supply; no changes in water resources by aquifer exploitation have been reported so far and potential exploitation still remains high. Only Belarus reports on groundwater abstraction of 50 Mm³/annum compared to the overall fresh water abstraction of 70 Mm³/annum. In the case of EU 93, groundwater exploitation is also mainly for drinking water, but here there is water resources depletion, estimated for 2000-2010 at 0.003 km³/annum due to groundwater exploitation near the Polish border. Abstraction zones and groundwater flow towards these are shown in Appendix 1.

Legal and Institutional aspects
Not all countries have provided information. Belarus reports that a limited Bilateral Agreement that was already signed in 2001, covering all three aquifers. Belarus also reports on a National Institution with a limited mandate for groundwater regulation. No Transboundary Institutions have been established.

Priority issues
Localised high abstractions constitute the most important threat for this aquifer at this stage - lowering of the groundwater levels and the interconnected surface waters, affecting river base flow in the transboundary aquifer. Pollution from a variety of sources also needs to be monitored and managed. It is important to move to a formal Multi-lateral Agreement for the management of the transboundary aquifer between the four countries.

Contributors to Global Inventory

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<thead>
<tr>
<th>Name</th>
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**Considerations and recommendations**

Most data in the tables and text above have been provided by national and regional experts (listed above) or have been derived from the global WaterGAP model. See colophon for more information, including references to data from other sources.

Only one of the three transboundary countries provided adequate information to describe the combined aquifer system. Information on interlinkage between the three aquifers is still largely missing.

Data gaps and also differences between data from national experts (Global Inventory) and data derived from WaterGAP highlight the need for further research on transboundary aquifers.
This Transboundary Aquifers information sheet has been produced as part of the Groundwater Component of the GEF Transboundary Water Assessment Programme (GEF TWAP). GEF TWAP is the first truly global comparative assessment of transboundary groundwater, lakes, rivers, large marine ecosystems and the open ocean. More information on TWAP can be found on: www.geftwap.org. The Groundwater component of TWAP carried out a global comparison of 199 transboundary aquifers and the groundwater systems of 41 Small Island Developing States. The data used to compile this transboundary aquifer information sheet has been made available by national and regional experts from countries involved in the TWAP Groundwater project. For aquifers larger than 20,000 km² and which are not overlapping, additional data are available from modelling done by the Goethe University Frankfurt (Germany) as part of TWAP Groundwater. All data were compiled by UNESCO-IHP and the International Groundwater Resources Assessment Centre (IGRAC – UNESCO Category II Institute). Values given in the fact-sheet represent an approximate guide only and should not replace data obtained from recent local assessments. The editors of this information sheet are not responsible for the quality of the data.

For more information on TWAP Groundwater and for more data, please have a look at the TWAP Groundwater Information Management System which is accessible via www.twap.isarm.org or www.un-igrac.org.

Request:
If you have additional data or information about this transboundary aquifer that can improve the quality of this information sheet and the underlying database, please contact us via email at info@un-igrac.org. If appropriate, the information will be uploaded to the database of transboundary aquifers and will also be used in new versions of this information sheet.
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References:
- Climate: Climate indicates the major climate zone which occurs in the aquifer area. If more than 1 climate zone is present the zone with the largest surface area was selected. Source climate data: ArcGIS Online (2015), Simplified World Climate zones. Owner: Mapping Our World GIS Education. Original map: National Geographic World Atlas for Young Explorers (1998).
- All other data: TWAP Groundwater (2015).

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