Transboundary Aquifer Information Sheet

EU109 – Cambrian-Vendian-Voronka Groundwater Body / Lomonosovsky Aquifer

Geography
Total area TBA (km²): 79 000
No. countries sharing: 2
Countries sharing: Estonia, Russian Federation
Population: 3 500 000
Climate zone: Humid Continental
Rainfall (mm/yr): 670

Hydrogeology
Aquifer type: Single layered
Degree of confinement: Confined
Main Lithology: Sedimentary rocks - sandstone

Legend
Transboundary aquifer
Confirmed aquifer boundary
Other aquifer(s)

Others symbols
Rivers
Lakes
Political Borders
TBA Location

Cross-section of the aquifer showing the Initial water level and the impact on the aquifer
Map and cross-section are only provided for illustrative purposes. Dimensions are only approximate.
Transboundary Aquifer Information Sheet

EU109 – Cambrian-Vendian-Voronka Groundwater Body
/ Lomonosovskiy Aquifer

TWAP Groundwater Indicators from Global Inventory

<table>
<thead>
<tr>
<th></th>
<th>Estonia</th>
<th>Russian Federation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recharge (mm/y)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Renewable ground-</td>
<td>9</td>
<td>42</td>
</tr>
<tr>
<td>water per capita</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Natural background groundwater quality (%)</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Human dependency on groundwater (%)</td>
<td>51</td>
<td>D</td>
</tr>
<tr>
<td>Groundwater depletion (mm/y)</td>
<td>50</td>
<td>F</td>
</tr>
<tr>
<td>Groundwater pollution (%)</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Population density (Persons/km²)</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Groundwater development stress (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transboundary legal framework (Scores)</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Transboundary institutional framework (Scores)</td>
<td>F</td>
<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>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 (m²/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonia</td>
<td>48</td>
<td>130</td>
<td>37</td>
<td>Whole aquifer confined</td>
<td>Sedimentary rocks - Sandstone</td>
<td>Low primary porosity</td>
<td>No secondary porosity</td>
<td>90</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>30</td>
<td>200</td>
<td>60</td>
<td>Whole aquifer confined</td>
<td>Sedimentary rocks - Shale</td>
<td>High primary porosity</td>
<td>secondary porosity</td>
<td>Fractures</td>
</tr>
</tbody>
</table>

TBA level

* Including aquitards/aquicludes

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

Aquifer geometry
This is a single-layered confined aquifer system, shared by Estonia and the Russian Federation. The average depth to the water table varies between 30m and 48m and the average depth to the top of the aquifer varies between 130m and 200m. The average thickness of the aquifer system varies between 37m and 60m. See Appendix 1 for a cross-section.

Hydrogeological aspects
The aquifer system is composed of sandstones. Groundwater flow is from the Russian border to Estonia (E-W). It has a low to high primary porosity with some secondary porosity: fractures in parts. Furthermore it has a low to high horizontal connectivity and a low vertical connectivity. The average annual recharge, which is 100% due to natural conditions, on the Estonia part of the aquifer is 6.1 Mm³/annum. Recharge on the Russia portion of the aquifer occurs over an area of 11,000 km² (see Appendix 2). There appears to be no groundwater depletion in this shared aquifer system, although groundwater level lowering has been observed in the underlying Vendian hydrostratigraphic unit aquifer (see Appendix 1), with a cone of depression 60 m deep in the Leningrad region.

Linkages with other water systems
Recharge to aquifer occurs through an overlying leaky aquitard or from leakage through a buried valley filled by Quaternary deposits on the Estonian side and from precipitation on the Russian side. Discharge is produced to boundary aquifers.

Environmental aspects
Groundwater exploitation is limited due to the natural salinity of the aquifer on the Estonian side. No specific data on groundwater use has been provided by Russia. Within Estonia no anthropogenic pollution has been detected although there is some groundwater pollution within the Russia part of the aquifer but the amount has not been quantified. No shallow groundwater or groundwater dependent ecosystems have been recorded.

Socio-economic aspects
The total groundwater annual abstraction from the system during 2010 was 15 Mm³. The total amount of fresh water that was abstracted over the aquifer area during the same period was not recorded.

Legal and Institutional aspects
A Ratified Agreement for TBA management by Estonia-Russia has been signed (1995) and a new Agreement is in preparation (Estonia). Local management takes place under National legislation and regulations.

Priority issues
Groundwater abstraction may constitute a transboundary threat which needs to be assessed with further data.

Contributors to Global Inventory

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Country</th>
<th>E-mail</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucila Candela</td>
<td>Universidad Politécnica de Catalunya</td>
<td>Spain</td>
<td><a href="mailto:Lucila.Candela@upc.edu">Lucila.Candela@upc.edu</a></td>
<td>Regional coordinator</td>
</tr>
<tr>
<td>Rein Perens</td>
<td>Geological Survey of Estonia</td>
<td>Estonia</td>
<td><a href="mailto:perens@egk.ee">perens@egk.ee</a></td>
<td>Contributing national expert</td>
</tr>
</tbody>
</table>
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.

Both TBA countries provided information that allowed description of the system, but it was not enough to calculate the groundwater indicators for the transboundary system.

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.

Appendix 1: EU109:

Part of a cross-section - Dark blue: Cambrian Vendian Voronka aquifer
EU109 – Cambrian-Vendian-Voronka Groundwater Body
/ Lomonosovsky Aquifer

Appendix 2: EU109

Map showing Recharge zones within the Aquifer system

Colophon

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...
Transboundary Aquifer Information Sheet

EU109 – Cambrian-Vendian-Voronka Groundwater Body
/Lomonosovsky Aquifer

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.

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).

Version: December 2015