AS143 - Basalt Aquifer System (South): Azraq-Dhuleil Basin

Geography
- Total area TBA (km²): 8500
- No. countries sharing: 3
- Countries sharing: Jordan, Syria, Saudi Arabia
- Population: 340 000
- Climate zone: Arid
- Rainfall (mm/yr): 110

Hydrogeology
- Aquifer type: Multiple 4-layered, hydraulically connected
- Degree of confinement: Mostly unconfined, some parts confined
- Main Lithology: Crystalline/ sedimentary rocks

Map and cross-section are only provided for illustrative purposes. Dimensions are only approximate.
**Transboundary Aquifer Information Sheet**

**AS143 - Basalt Aquifer System (South): Azraq-Dhuleil Basin**

**TWAP Groundwater Indicators from Global Inventory**

<table>
<thead>
<tr>
<th></th>
<th>Jordan</th>
<th>Saudi Arabia</th>
<th>Syrian Arab Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBA level</td>
<td>4</td>
<td>110</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>130</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>54</td>
<td></td>
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<tr>
<td></td>
<td>43</td>
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<tr>
<td></td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
<td></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>Jordan</th>
<th>Saudi Arabia</th>
<th>Syrian Arab Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from ground surface to groundwater table (m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth to top of aquifer formation (m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full vertical thickness of the aquifer (system)* (m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of confinement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predominant aquifer lithology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predominant type of porosity or voids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Porosity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmissivity (m²/yr)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Including aquitards/aquicludes

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

AS143 - Basalt Aquifer System (South): Azraq-Dhuleil Basin

Aquifer description

Aquifer geometry
The Azraq-Dhuleil Basin extends over the south-eastern part of the Jebel al Arab basalt field in south-western Syria and north-eastern Jordan. Surface water divides have been used to define the boundary of the basin. This aquifer system comprises 4 hydraulically connected layers. It is mostly unconfined although some parts are confined. The thickness of the aquifer system, including aquitards, varies from 100m to 500m.

Hydrogeological aspects
The predominant aquifer lithology consists of crystalline and sedimentary rocks – basalt and limestone. System replenishment is medium to low (2-100 mm/annum), amounting to an average annual recharge of about 37Mm³ from natural sources. Water percolates mainly through several volcanic layers in a recharge area of approximately 7000 km². A secondary type of porosity is predominant that allows for low vertical connectivity between the layers. Transmissivity values recorded across the aquifer states range between 30 m²/d and 1300 m²/d.

Linkages with other water systems
Recharge is mainly through precipitation over the aquifer area while discharge takes place via a number of springs as well as natural seepage to the surface to form swamps (see Appendix 1).

Environmental aspects
Groundwater is mainly fresh, brackish in some areas and the quality does not satisfy local standards in about 20% of aquifer area (see Appendix 2). This natural salinity affects only the superficial layers of the aquifer system. These layers are also subject to groundwater pollution from agricultural practices as evidenced by salinization, nitrogen species and pesticides.

Socio-economic aspects
A total of about 50Mm³/annum of groundwater is abstracted by the two aquifer states, mainly for agricultural and domestic purposes. The bulk of this water is withdrawn in Jordan. A groundwater depletion of 0.46m/annum is reported. Discharge from springs in the Azraq area ceased completely after the creation of a large well field in the area in 1980 (see Appendix 1). Groundwater quality has deteriorated as a result of the infiltration of irrigation return flows in downstream areas where intensive irrigation takes place.

Legal and Institutional aspects
National institutions for the management of groundwater exist in both aquifer states but no formal Transboundary Agreement has been made. In December 2010, the Jordanian Ministry of Water and Irrigation issued an Amendment to the Groundwater Control Regulation, which outlines an increase in water tariffs for drinking and agricultural water. Other initiatives in Jordan, such as the Highland Water Forum aim to encourage sustainable groundwater management practices in the basin (UN-ESCWA and BGR, 2013).

Hot spot
Annual abstraction from this groundwater system significantly exceeds annual replenishment. The main issue at this stage is the drying up of major springs, which has severely affected the wetlands and is destroying a unique desert oasis in the Azraq area inside Jordan. The Jordanian Government decided to keep the oasis alive by feeding it with pumped groundwater. This, however, has led to an increase in groundwater salinity as the hydraulic system of the oasis was reversed from a point of discharge to a point of recharge. Re-assessment of the transboundary aquifer management programme with a basin-wide scope and based on a Bi-lateral Agreement is essential.
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>Abdelkader Dodo</td>
<td>Observatoire du Sahara et du Sahel</td>
<td>Tunisia</td>
<td><a href="mailto:abdelkader.dodo@oss.org.tn">abdelkader.dodo@oss.org.tn</a></td>
<td>Regional coordinator</td>
</tr>
<tr>
<td>Lamine Babasy</td>
<td>Observatoire du Sahara et du Sahel</td>
<td>Tunisia</td>
<td><a href="mailto:lamine.babasy@oss.org.tn">lamine.babasy@oss.org.tn</a></td>
<td>Regional coordinator</td>
</tr>
<tr>
<td>Yusuf Al-Mooji</td>
<td></td>
<td>Lebanon</td>
<td><a href="mailto:mooji46@yahoo.com">mooji46@yahoo.com</a></td>
<td>Regional coordinator</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.

For the transboundary aquifers of Western Asia, data are only available at the level of the complete aquifer and not of the country segments. All this data as well as information elements in the aquifer description are coming from a comprehensive, United Nations-led inventory to catalogue and characterize transboundary surface and groundwater resources in the Middle East (Source: UN-ESCWA and BGR (United Nations Economic and Social Commission for Western Asia; Bundesanstalt für Geowissenschaften und Rohstoffe). 2013. Inventory of Shared Water Resources in Western Asia. Beirut).

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.
Map showing groundwater flow directions within part of the Basalt Aquifer System (South): Azraq-Dhuleil Basin
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Appendix 2: AS143

Groundwater salinity map - TDS of the Basalt Aquifer System (South): Azraq-Dhuleil Basin

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.
Transboundary Aquifer Information Sheet

AS143 - Basalt Aquifer System (South): Azraq-Dhuleil Basin

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.

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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