# AS71 - Chu Basin

## Geography
- **Total area TBA (km²):** 14 000
- **No. countries sharing:** 2
- **Countries sharing:** Kyrgyzstan, Kazakhstan
- **Population:** 1 300 000
- **Climate Zone:** Semi-arid
- **Rainfall (mm/yr):** 360

## Hydrogeology
- **Aquifer type:** Multiple layers hydraulically connected and single layer
- **Degree of confinement:** Aquifer mostly confined, to unconfined – mixed
- **Main Lithology:** Sediment - gravel

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### Schematic Hydrogeological cross-section indicating recharge and discharge areas

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

**AS71 - Chu Basin**

### TWAP Groundwater Indicators from Global Inventory

<table>
<thead>
<tr>
<th></th>
<th>Kazakhstan</th>
<th>Kyrgyzstan</th>
<th>TBA level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recharge (mm/year)</td>
<td>8</td>
<td>440</td>
<td>210</td>
</tr>
<tr>
<td>Renewable groundwater</td>
<td>590</td>
<td>2300</td>
<td>2200</td>
</tr>
<tr>
<td>per capita (m³/year)</td>
<td>100</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>Natural background groundwater quality (%)</td>
<td>0</td>
<td>59</td>
<td>96</td>
</tr>
<tr>
<td>Human dependency on groundwater (%)</td>
<td>13</td>
<td>190</td>
<td>15</td>
</tr>
<tr>
<td>Groundwater depletion (mm/y)</td>
<td>15</td>
<td>15</td>
<td>D</td>
</tr>
<tr>
<td>Groundwater pollution (%)</td>
<td>D</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Population density (Persons/km²)</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Groundwater development stress (%)</td>
<td>D</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Transboundary legal framework (Scores)</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Transboundary institutional framework (Scores)</td>
<td>E</td>
<td>E</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>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>Predominant type of porosity or voids</th>
<th>Secondary Porosity</th>
<th>Transmissivity (m²/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kazakhstan</td>
<td>8</td>
<td>8</td>
<td>600</td>
<td>6. Aquifer Mostly confined, but some parts unconfined</td>
<td>Sediment - Gravel</td>
<td>1.1. High Primary porosity fine/medium sedimentary deposits</td>
<td>2.4. No Secondary porosity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>56</td>
<td>&lt;5</td>
<td>200</td>
<td>4. Aquifer Mostly unconfined, but some parts confined</td>
<td>Sediment - Gravel</td>
<td>1.2. Very high Primary porosity gravels/pebbles</td>
<td>2.2. Secondary porosity: Weathering</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

The Chui artesian basin occupies the Chui Valley, which is bounded by the Ili Mountains in the north and the Kyrgyz Range in the south, and belongs to the major Chui-Sarysu system of artesian basins. Within Kazakhstan this is a multiple 2-layered hydraulically connected system that is mostly confined, but some parts are unconfined, while within Kyrgyzstan it is a single-layered system that is unconfined and confined in parts. The average depth to the water table varies from 8m within Kazakhstan to 56m within Kyrgyzstan. The minimum piezometric level is +9 m above ground surface. The aquifer depth decreases from the foothills (170-215 m) to the Chui riverbed (few meters). The average vertical thickness is 600m in Kazakhstan and 200m in Kyrgyzstan.

Hydrogeological aspects

The main reservoir of fresh groundwater is hosted by the Quaternary aquifer that consists of boulders and pebbles with gravel and sand matrix, i.e. sediments with high primary porosity and no secondary porosity. These sediments show high permeability and storage capacity: the average transmissivity varies from 1 200 to 1 500 m²/day between the 2 countries. Groundwater recharge is estimated at 60 Mm³/annum in Kazakhstan and 2 800 Mm³/annum within Kyrgyzstan. Total groundwater volume has been estimated as 184 and 300 km³ in Kazakhstan and Kyrgyzstan respectively (these amounts should be reviewed).

Linkages with other water systems

The recharge occurs mostly in the foothills and piedmont plains (through infiltration of surface run-off and surface waters from rivers, canals and irrigated fields). The discharge is through river baseflow into the Chui River Valley and springs and seeps in some places (see Appendix).

Environmental aspects

Groundwater in the Quaternary aquifer is sweet bicarbonate-calcium water with a TDS concentration of 140 - 500 mg/l. In parts, surficial layers have elevated hardness and TDS concentrations. Only 1% of groundwater does not meet drinking water standards. In Kyrgyzstan a significant part of the aquifer has been polluted from a range of activities – households, municipalities, agricultural practices and mining activities, resulting in contamination with nitrates, pesticides, heavy metals (hexavalent chromium) and industrial organic compounds. Only about 1% of the aquifer area has shallow groundwater and 7% supports groundwater dependent ecosystems.

Socio-economic aspects

Groundwater is mainly used in household water supply systems (55%), as well as for industrial water uses (25%) and for irrigation of agricultural lands (20%). Groundwater abstraction is estimated at 10Mm³/annum in Kazakhstan and 350Mm³/annum in Kyrgyzstan. Kyrgyzstan indicates a decline in groundwater level of 0.4m/annum. The lower levels of the aquifer system are not yet well studied and are tapped by only a few boreholes.

Legal and Institutional aspects

Both countries report that there is no bi-lateral agreement and also not yet national institutions in place with a mandate for groundwater management. However, groundwater management is taking place in terms of a number of different laws.

Priority Issues

There are no transboundary problems currently. With significant groundwater use, declining water levels and pollution from a range of sources, including mining and industrial, occurring in Kyrgyzstan, this could easily become a source of future conflict. A joint, appropriate programme of monitoring of groundwater abstractions, levels and quality is seen as a priority for this TBA and a bilateral agreement should be sought.
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>
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<td></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 aquifer states provided information, allowing for a good description of the aquifer and the calculation of transboundary groundwater indicators.

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: AS71

Map coordinate system: WGS 84

Legend
- Quaternary aquifer
- Recharge zone
- Discharge zones
- Zone of groundwater pollution
- General direction of groundwater flow
- City
- CE_line

AS71 - Chu Basin (East Chu Basin)

TWAP Reference:
Map Reference: Kyrgyzstan, Kazakhstan
Area: 20305 km²
Source: ESRI; Sidorenko, 1971; Sidorenko, 1970

Chu Basin: Groundwater recharge-discharge regime
Transboundary Aquifer Information Sheet

AS71 - Chu 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.

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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