Hydrology and Water Quality of the Arkansas River Basin in Southwest Kansas

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Upper Arkansas Regional Advisory Committee
Garden City, Kansas
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The High Plains Aquifer
Annual Water Level Measurement Program

≈1400 wells measured in High Plains aquifer in 2019
Index Well Program - 29 wells with continuous recorders
≈ 27,700 wells with totalizing flowmeters in High Plains aquifer
(over 95% of non-domestic pumping wells)
Percent Change in Aquifer Thickness, Predevelopment to Average 2016-2018, Kansas High Plains Aquifer

27%

32%

33%

<1%

Estimated Decrease in Aquifer Thickness (%)
- Increase
- 0 to 15
- 15 to 30
- 30 to 45
- 45 to 60
- Over 60

Primary extent of the saturated portion of the High Plains Aquifer
Pumping over time has created a closed basin.

Difference in Arkansas River Flow between Syracuse and Dodge City Adjusted for Irrigation Diversions
Evapotranspiration in the area of irrigation diversions and reservoirs in eastern Colorado substantially decreases the river flow before it enters Kansas. A smaller extent of irrigation ditches also divert river water in southwest Kansas.
Estimated 10 tons of uranium in 2017.
SOURCE OF SALINITY AND URANIUM IN RIVER

Main natural source: Weathering of marine Cretaceous shales containing gypsum and sulfides in Colorado.

Human sources: Insignificant.

CAUSE OF HIGH SALINITY AND URANIUM LEVELS

Human: Concentration of dissolved salts by consumption of water by evapotranspiration associated with extensive irrigated agriculture and shallow reservoirs.

Natural: In absence of human activities, salinity and uranium concentration would be 3 to 4 times lower.
Sulfate Concentration for the High Plains Aquifer in the Upper Arkansas River Corridor in Southwest Kansas

EXPLANATION

Ranges of sulfate concentrations in mg/L

- Under 50
- 50 - 100
- 100 - 250
- 250 - 500
- 500 - 1000
- Over 1000

High Plains aquifer extent:

- Wells with water quality samples
- Arkansas River
- Quaternary alluvium

- Area of little or no saturated thickness
- Missing aquifer due to outcrop of older rocks
- Area having some saturated thickness where sulfate concentrations are not shown
Difference in Arkansas River Flow between Syracuse and Dodge City Adjusted for Irrigation Diversions.
ACKNOWLEDGMENTS

This work was supported, in part, by funding from the Kansas Water Office and the Kansas Water Plan (Ogallala Technical Support Program of the KGS).

RELEVANT REPORTS


**Open-file Rept. 2000-73**, Ground-water quality of the Arkansas River Corridor in southwest Kansas, by D.O. Whittemore

**Open-file Rept. 2000-72**, Sulfate concentration maps, Upper Arkansas River Corridor, southwest Kansas, by D. O. Whittemore


Last three reports available on KGS web pages for Upper Arkansas River Corridor Study [http://www.kgs.ku.edu/Hydro/UARC/index.html](http://www.kgs.ku.edu/Hydro/UARC/index.html)
# Arkansas River near Colorado-Kansas Line
1963-2010 for all data except 2009-2010 for U

<table>
<thead>
<tr>
<th></th>
<th>Flow ft³/sec</th>
<th>TDS mg/L</th>
<th>SO4 mg/L</th>
<th>Cl mg/L</th>
<th>U µg/L</th>
<th>Gross α pCi/L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
<td>244</td>
<td>3,260</td>
<td>1,960</td>
<td>137</td>
<td>63.5</td>
<td>57.6</td>
</tr>
<tr>
<td><strong>Number of samples</strong></td>
<td>554</td>
<td>486</td>
<td>553</td>
<td>551</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td><strong>Drinking water standard, MCL or (recommended)</strong></td>
<td>-</td>
<td>(500)</td>
<td>(250)</td>
<td>(250)</td>
<td>30</td>
<td>15</td>
</tr>
</tbody>
</table>
North-south cross section of ground-water levels across the Arkansas River corridor in eastern Kearny County near the Finney County line

Well distance south of Arkansas River, mile

Ground-water level relative to Arkansas River, feet
Sulfate Concentration for the Quaternary Alluvial Aquifer in the Upper Arkansas River Corridor in Southwest Kansas

EXPLANATION

Ranges of sulfate concentrations in mg/L
- Under 100
- 100 - 250
- 250 - 500
- 500 - 1000
- 1000 - 1500
- 1500 - 2000
- Over 2000

Wells with water quality samples

Arkansas River

Quaternary alluvium where sulfate concentrations are not shown

High Plains aquifer extent:
- Area of little or no saturated thickness
- Missing aquifer due to outcrop of older rocks
- Area having some saturated thickness where sulfate concentrations are not shown