31 August 2016
Brief Report of Activities and Results for
Data Collection and Analysis in Support of
Improved Water Management in the Arkansas River Basin, Phase 2
1 July 2015 – 30 June 2016
Timothy K. Gates and Jeffrey D. Niemann, Colorado State University

Summary

Major field data collection and analysis activities conducted during fiscal year 2016 (1 July 2015 – 30 June 2016) are outlined below. Locations and methods of measurements and sampling are as described in Gates et al (2016). Data have been entered into the Arkansas River Basin SQL Database at Colorado State University, and have been summarized in accompanying Excel files for the Upper Arkansas River Basin (UARB), the Lower Arkansas River Basin (LARB) Upstream Study Region (USR), and LARB Downstream Study Region (DSR). Results reveal values for water table depth, flow rates, in-situ water quality parameters, and concentrations of selected water quality constituents which are similar in magnitude and variability to those reported in Gates et al (2016).

Four monitoring events were conducted in the UARB. Over these events, the average depth to the water table measured in 19 monitoring wells was 4.8 m and the average electrical conductivity (EC) of the groundwater was 0.3 dS/m. Groundwater samples gathered during a single sampling event in July 2015 revealed average uranium (U) and total dissolved solids (TDS) concentrations of 4.5 μg/L and 165.5 mg/L, respectively. Average measured EC, U, and total dissolved solids (TDS) in samples gathered from 22 surface water locations were 0.13 dS/m, 2 μg/L, and 97.2 mg/L, respectively. Additional details are provided in the accompanying Excel files.

In the USR of the LARB, the average depth to the water table measured over five monitoring events in 56 monitoring wells was 3.0 m and the average electrical conductivity (EC) of the groundwater was 3.2 dS/m. The average selenium (Se), U, and TDS concentrations in groundwater samples collected during a single sampling event in June 2016 were 83.2 μg/L, 66.0 μg/L, and 1887.1 mg/L. Average measured EC at 80 surface water locations over four monitoring events was 1.57 dS/m. Additional details are provided in the accompanying Excel files.

In the DSR of the LARB, the average depth to the water table measured over five monitoring events in 47 monitoring wells was 4.1 m and the average electrical conductivity (EC) of the groundwater was 4.2 dS/m. The average selenium (Se), U, and TDS concentrations in groundwater samples collected during a single sampling event were 40.2 μg/L, 74.7 μg/L, and 2639.9 mg/L. Over four monitoring events, average measured EC at 68 surface water locations was 2.79 dS/m. Additional details are provided in the accompanying Excel files.

UARB Activities

1 – 2, 6 – 7 July 2015

- Measurement of water table level in 19 groundwater monitoring wells (manual readings with tape and downloading of continuous water level loggers)
- Measurement of in-situ water quality parameters in 16 groundwater monitoring wells using YSI multiprobe
    - Electrical conductivity (specific conductance at 25^{o}C) (EC)
    - pH
    - Oxidation Reduction Potential (ORP)
    - Dissolved Oxygen (DO)
    - Temperature (T)
- Measurement of stream flow at 7 sites in tributaries to the Arkansas River using acoustic Doppler velocimeters (ADVs)
- Measurement of in-situ water quality parameters at 19 sites in tributaries to the Arkansas River and at 3 sites in the Arkansas River using YSI multiprobe
    - EC
    - pH
    - ORP
    - DO
    - T
- Extraction of water quality samples from 15 groundwater monitoring wells using bladder pump and low-flow sampling apparatus
    - Major salt ions
    - U

11 – 12 August 2015

- Measurement of water table level in 19 groundwater monitoring wells (manual readings and downloading of continuous water level loggers)
- Measurement of in-situ water quality parameters in 19 groundwater monitoring wells
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of stream flow at 8 sites in tributaries to the Arkansas River using ADVs
- Extraction of water quality samples from 19 sites in tributaries and 3 sites in the Arkansas River using peristaltic pump
    - Major salt ions
    - U
- Extraction of water quality samples from 7 groundwater monitoring wells

July – September 2015

- Laboratory analysis and review of major solute ion concentrations in water quality samples extracted from tributaries and the Arkansas River, and major solute ion and uranium (U) concentrations in water quality samples extracted from groundwater monitoring wells.

- Entry of UARB data into Arkansas River Basin SQL database. Processing of continuous groundwater level data.

21 – 22 November 2015

- Measurement of water table level in 18 groundwater monitoring wells (manual readings and downloading of continuous water level loggers)
- Measurement of in-situ water quality parameters in 18 groundwater monitoring wells
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of stream flow at 7 sites in tributaries to the Arkansas River using ADVs
- Measurement of in-situ water quality parameters at 16 sites in tributaries to the Arkansas River and at 3 sites in the Arkansas River
    - EC
    - pH
    - ORP
    - DO
    - T

December 2015 – January 2016

Entry of UARB data into Arkansas River Basin SQL database. Processing of continuous groundwater level data.

16 – 17 March 2016

- Measurement of water table level in 19 groundwater monitoring wells (manual readings and downloading of continuous water level loggers)
- Measurement of in-situ water quality parameters in 18 groundwater monitoring wells
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of stream flow at 8 sites in tributaries to the Arkansas River using ADVs
- Measurement of in-situ water quality parameters at 16 sites in tributaries to the Arkansas River and at 3 sites in the Arkansas River
    - EC
    - pH
    - ORP
    - DO
    - T

March - April 2016

Entry of UARB data into Arkansas River Basin SQL database. Summary of UARB data in Excel spreadsheet. Processing of continuous groundwater level data.

LARB Activities

18 – 20 August 2015

- Measurement of water table level in 51 groundwater monitoring wells in the Upstream Study Region (USR) and 45 groundwater monitoring wells in the Downstream Study Region (DSR) using manual tape
- Measurement of in-situ water quality parameters in 51 groundwater monitoring wells in the USR and 45 groundwater monitoring wells in the DSR using YSI multiprobe
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of in-situ water quality parameters at 82 sites in canals and tributaries to the Arkansas River and at 11 sites in the Arkansas River in the USR, as well as at 60 sites in canals and tributaries to the Arkansas River and at 8 sites in the Arkansas River in the DSR
    - EC
    - pH
    - ORP
    - DO
    - T

August – September 2015

Entry of LARB data into Arkansas River Basin SQL database.

7 – 8, 14 – 15 November 2015

Replaced bentonite clay seal around the annulus of all of the monitoring wells in the USR and DSR.

23 – 24 November 2015

- Measurement of water table level in 54 groundwater monitoring wells in the USR
- Measurement of in-situ water quality parameters in 54 groundwater monitoring wells in the USR
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of in-situ water quality parameters at 34 sites in canals and tributaries to the Arkansas River and at 11 sites in the Arkansas River in the USR,
    - EC
    - pH
    - ORP
    - DO
    - T

17 – 18 December 2015

- Measurement of water table level in 38 groundwater monitoring wells in the DSR
- Measurement of in-situ water quality parameters in 38 groundwater monitoring wells in the DSR
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of in-situ water quality parameters at 32 tributary and canal sites and at 8 sites in the Arkansas River in the DSR
    - EC
    - pH
    - ORP
    - DO
    - T

January - February 2016

Entry of LARB data into Arkansas River Basin SQL database.

12 – 15 March 2016

- Measurement of water table level in 56 groundwater monitoring wells in the USR and 44 groundwater monitoring wells in the DSR
- Measurement of in-situ water quality parameters in 50 groundwater monitoring wells in the USR and 35 groundwater monitoring wells in the DSR
    - EC
    - pH
    - ORP
    - DO
    - T
- Measurement of in-situ water quality parameters at 42 sites in canals and tributaries to the Arkansas River and at 11 sites in the Arkansas River in the USR, as well as at 43 sites in canals and tributaries to the Arkansas River and at 8 sites in the Arkansas River in the DSR
    - EC
    - pH
    - ORP
    - DO
    - T

19 – 22 May 2016

- Measurement of water table level in 52 groundwater monitoring wells in the USR and 46 groundwater monitoring wells in the DSR
- Measurement of in-situ water quality parameters in 51 groundwater monitoring wells in the USR and 41 groundwater monitoring wells in the DSR
    - EC
    - pH

    - ORP
    - DO
    - T
- Measurement of in-situ water quality parameters at 80 sites in canals and tributaries to the Arkansas River and at 11 sites in the Arkansas River in the USR, as well as at 68 sites in canals and tributaries to the Arkansas River and at 8 sites in the Arkansas River in the DSR
    - EC
    - pH
    - ORP
    - DO
    - T

25 – 27 June 2016

- Measurement of water table level in 25 groundwater monitoring wells in the USR and 25 groundwater monitoring wells in the DSR
- Measurement of in-situ water quality parameters in 25 groundwater monitoring wells in the USR and 25 groundwater monitoring wells in the Downstream Study Region (DSR)
    - EC
    - pH
    - ORP
    - DO
    - T
- Extraction of water quality samples from 25 groundwater monitoring wells in the USR and 25 wells in the DSR using bladder pump and low-flow sampling apparatus
    - Major salt ions
    - Se
    - U

March – June 2016

- Laboratory analysis and review of major solute ion concentrations in water quality samples extracted from the Arkansas River and from groundwater monitoring wells in the USR and DSR of the LARB.
- Entry of LARB data into Arkansas River Basin SQL database. Summary of LARB data in Excel spreadsheet.

Reference

Gates, T. K., Steed, G. H., Niemann, J. D., and Labadie, J. W. 2016. "Data for improved water management in Colorado's Arkansas River Basin: Hydrological and water quality studies." Special Report No. 24, Colorado Water Institute, Colorado State University, Fort Collins, CO.