URNRD Groundwater Modeling Project

Annual Report, March 2023

Water Sustainability Fund Application #5184

The Upper Republican Natural Resources District (URNRD) was awarded a $243,000 grant by the Natural Resources Commission in 2018 to develop a groundwater model to help evaluate future water supplies under different pumping scenarios decisions and inform district decisions and policies regarding volumes and locations of groundwater pumping.

Progress

Significant progress towards final development of the model was made in 2022, and at the time of this writing the model is nearly complete. We expect to issue a final report on the project to you relatively soon.

Following is a brief summary of model work that the primary consultant on the project, Olsson Associates, did in 2022:

- Development of model stress input files – Specifically formatted MODFLOW groundwater model input files were developed that represent groundwater sources and sinks on a cell-by-cell basis.
- Steady state model calibration – The model was calibrated using a parameter estimation tool (PEST). Calibration targets and pilot points were defined, and PEST was used to produce simulated water levels from pumping scenarios. These simulated water levels compared very favorably to actual, observed water levels in the URNRD from some of the approximately 400 wells the URNRD annually measures. This provided confidence that the model was a good representation of the hydrologic system in the URNRD. The calibration results from PEST were used to adjust the modeling parameters of the hydrologic system throughout the URNRD and the surrounding area.
- Development of transient model files – Specifically formatted MODFLOW input files with monthly, cell-by-cell values representing the groundwater system were produced. The files were made for all model inputs that have the potential for time-varying information.
- Transient model calibration – After aquifer properties were calibrated in a steady-state model, stream geometry and hydraulic information was adjusted to refine the model calibration. Doing so provided a more accurate representation of the hydrologic system.
- Modeling report – A report documenting and detailing the development and calibration of the model was written, and the results discussed.

We are near the culmination of efforts that began in 2018 and changed course significantly in 2020 when we began using Modflow in Olsson Associates Groundwater Evaluation Toolbox (GET).

Future Efforts for URNRD model

A previous groundwater model was used by our district to evaluate requests to transfer groundwater use from one location to another. URNRD rules allow the transfer of certified irrigated acres in close proximity with similar hydrologic conditions. But distant transfers are subject to evaluation and approval by the Board of Directors who take into consideration such things as the impact of a transfer on aquifer life ad neighboring wells at both the point where water use is proposed to be transferred from, and the location at which the transfer is proposed to occur.

The new model will improve our ability to do such evaluations, and will also inform policy-related decisions such as allocations designed to slow groundwater declines in the district. We look forward to using the completed model in 2023 for those and other purposes.

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