

Western Water and Power Solution Bulletin

Research and Development Office — Denver, Colorado

Bulletin No. 52
September 2011

Determining the Effects of Terracing and Small Reservoirs on Water Supplies

New understanding of how these conservation practices impact water supplies improves Reclamation's water operations

What Is the Problem?

Land terraces control runoff to prevent erosion and allow water to soak into the ground. Small reservoirs or stock ponds catch and store water for use by livestock and wildlife. These conservation projects directly impact surface water supplies, but they can also affect ground water recharge and have a resulting impact on surface flows for years into the future. Construction of land terraces and small reservoirs over the last 30 - 40 years has had a significant but unmeasured impact on river basin water supplies. A complete accounting of water use in a river basin may need to include depletions due to land terracing and small reservoirs.

In the Republican River Basin, about 2.2 million acres of terraced fields and several thousand small water impoundments are depleting the natural water supply of the basin. The Republican River compact settlement requires a study to determine their impact on streamflow depletion in the basin. Although the design of terraces and reservoirs and their estimates of water capture is well understood, the "as built and operating" impacts basin wide have not been studied. Moreover, the actual magnitude, timing and location of these depletions is not well understood—thus, a crucial piece of water use information is missing.

What Is the Solution?

This Science and Technology (S&T) Program research project partnered with the States of Colorado, Kansas, and Nebraska to provide new insights and tools to assess impacts on surface water supplies from the development and operation of land terraces and small reservoirs.

The study collected up to five years of field data from specific terraces, including precipitation, inflows and outflows from terrace channels, temperatures, and soil moisture changes. Water levels in reservoirs were also monitored. This five-year period covered wet, dry, and average water years. We used the data to understand how these conservation practices changed the water balance. Based on this, we built a water balance model that we could apply to the entire basin. The data and the basin model suggest that these water conservation practices increase net evapotranspiration by an average of 36,000 acre-feet annually, decrease streamflow by an average of 63,000 acre-feet annually, increase recharge by an average of 88,000 acre-feet annually, and decrease stream transmission loss by an average of 61,000 acre-feet annually. These are average data over a 59-year period.

Who Can Benefit?

Information gained from this study will assist with improving overall water management of the limited water supply in the

basin and ensure a more appropriate allocation of water among the States of Colorado, Nebraska, and Kansas.

Furthermore, terraces, small reservoirs, and other upstream depletions are issues common to other Reclamation watersheds. Water managers can leverage this increased understanding and modeling for these water supply impacts in other basins.

Where Have We Applied This Solution?

Knowledge of the depletion effect of these water conservation practices will lead to better overall water management—including the management of existing and future conservation practices for an increased basin-wide benefit.



Operating terraces in the Republican River watershed.

Future Development Plans

The information about the study was presented to the Republican River Compact Administration at their annual meetings in Burlington, Colorado on Aug 30 and 31, 2011. The States of Colorado, Kansas, and Nebraska are considering ways to apply this new understanding of terraces and reservoir water balances to other watersheds within their respective states.

For More Information

Publications and dissertations from our partner universities summarize the methods used to develop these findings. Republican River Compact Administration Conservation Committee 2011. Summary Report of Preliminary Findings to the Republican River Compact Administration summarizes the findings.

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Collaborators

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