Technical and Physical Feasibility Fact Sheet
Alternative 7: Agricultural Metering

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1. Definition of Alternative

A7: Meter and manage surface water distribution flows through all irrigation systems to conserve water.

2. Summary of the Alternative Analysis

Improved irrigation water metering and flow controls, including canal gates, will result in operational efficiency improvements and a reduction in the quantity of water diverted from surface or groundwater sources. An estimate of the diversion water reduction that could result from these operational improvements is shown on Table 7A-2 (Exhibit 7A). Consumptive water use in the irrigation systems is projected to be saved under this analysis.

There are several irrigation systems in the Middle Rio Grande (MRG) planning region, the largest of which is operated and maintained by the Middle Rio Grande Conservancy District (MRGCD). The irrigation system of MRGCD spans Sandoval, Bernalillo and Valencia Counties in the planning region and other land outside the study area in Socorro County. There are also 21 community ditches and acéquias in Sandoval County (Saavedra, 1987), referred to in this analysis as "small Sandoval systems." The "study area" for this analysis includes both the MRGCD and the small Sandoval systems.

Data over the past 10 to 20 years suggest that the amount of irrigated acreage within MRGCD's irrigated area has remained fairly steady (JSAI, 2000) and no available data show a reduction in irrigated land outside MRGCD's irrigated area within the planning region. Therefore, for the purpose of this analysis it is assumed that irrigated areas will remain constant in the region over the study's time frame.

The MRGCD and community ditch systems rely mainly upon on surface water for irrigation, although some water from wells is used within and around the planning region. Irrigation water is currently used for the production of food and non-food crops, raising livestock, watering landscaped areas, and occasionally watering idle/fallow areas.

An examination of the existing irrigation systems was carried out in terms of metering irrigation water diversions from their source, flowing water within the system on main and distributory canals, water diversions to farms, and return flows from farms and to the Rio Grande. The MRGCD is currently implementing a metering and data reporting strategy that includes real-time data collection (including agri-meteorological data) and monitoring. Both MRGCD's existing meters and proposed metering program have been included in this study (see Table 7A-1 in Exhibit 7A).

Physical metering of water flow is carried out in the MRGCD systems at the main canal and drain level. At this time, most of these meters "report" data to MRGCD headquarters via radio transmission units. Most of the small Sandoval systems currently measure water using rectangular or V-notch weirs located at the intake structure or at the head of the main canal. MRGCD also uses National Oceanographic and Atmospheric Administration (NOAA) and Upper Rio Grande Water Operations Model (URGWOM) as well as other weather data available on the Bureau of Reclamation "ET Toolbox" website (http://www.usbr.gov/rsmg/awards/) to assist in system flow operations and management .

At this time, reliable flow data on the MRGCD and the small Sandoval systems are not available. The data that are available cannot be verified without significant additional field studies. A regular and formal program of flow recording, recordkeeping and reporting needs to be established within MRGCD and the small Sandoval systems. The cost of developing and implementing such a system plan is included in Table 7A-3 (Exhibit 7A).

This analysis is based on a program that would include:

- Unmanned automatic meteorological stations that provide "real-time" telemetered data to irrigation management staff. MRGCD currently has ten such weather stations. A program to add additional meters linked by radio to MRGCD could include a soil moisture probe and a datalogger to give operational staff more information to define and control flow requirements. This might also be appropriate for some of the larger Sandoval ditch systems.

- Additional unmanned automatic stage level sensors and recorders tied to automatic main canal, lateral and drain valve/gate operators that allow irrigation system management staff to adjust flows remotely or on-site as required to optimally direct flows to laterals or in the case of drainage water to escapes and existing arroyos or the Rio Grande. This would provide MRGCD with the ability to better control a rotational irrigation schedule by lateral and/or lateral sub-area.

- Data recording and reporting programs, including real-time computer-based operations and management systems, are needed. Currently, MRGCD does not use a real-time irrigation software system to manage its irrigation operations.

- Staff, material, and organizational modifications are needed to manage and maintain augmented metering and flow control programs (for both MRGCD and the small Sandoval irrigation systems).

- Unit and lump sum cost assumptions used to develop the capital and operational plan for this alternative are illustrated in Table 7A-3 (Exhibit 7A).

Proposed metering and the use of existing and future operational and performance data would be part of an improved future irrigation system management plan for all systems in the planning area. The MRGCD and the smaller irrigation systems in the study area already have existing flow measuring systems and management programs, some of which are more informal than others. However, almost no on-farm meters exist. The proposed flow metering management systems in this analysis would build on the existing equipment and procedures to enable better measurement of irrigation and return flows and better management of diverted and consumed irrigation water and return flows.

Metering flows at the farm level is addressed under this alternative only as a “spot check” activity for MRGCD. Metering all farm turn-outs would be a major undertaking for MRGCD that would not only include the purchase, placement, and maintenance of several thousand expensive meters but also the hiring of dozens of meter readers, and maintenance staff. This issue is further addressed in the fact sheet for A-10, *Irrigation Efficiency*. The spot checking of farm flow turn-outs for research purposes and where problems are suspected along with flow measurement at the lateral level would allow MRGCD to reduce wasteful and/or unauthorized farm diversions. A conceptual estimate of the staff required to manage this spot check program and the metering flow control operation at the lateral and sub-lateral level are included in the cost analysis presented in Table 7A-3 (Exhibit 7A).

An improved irrigation water metering and control program will result in operational efficiency improvements and a reduction in the quantity of water diversion required at each system. An estimate of the diversion water reduction that could result from these operational improvements is shown on Table 7A-2 (Exhibit 7A). No consumptive water use in the irrigation systems is projected to be saved under this analysis.

For more information on estimated irrigation system efficiency coefficients that have been used to generate these water quantity values in this analysis, see the fact sheet for *Alternative A-9, Agricultural Water Conveyance*.

This analysis does include metering and controlling flow at the laterals and sub-laterals within the MRGCD and an operational change from *continuous irrigation flow* to *scheduled irrigation rotation*. To some extent, this will decrease evapotranspiration and seepage losses in the canal system and eliminate the use of water on an unauthorized basis by farmers. Farmer awareness will also be increased, which should also result in some improved on-farm water management. However, such an operational change will not affect needed water deliveries to farmers in terms of quantity.

Farmers need to be educated on rotational irrigation operations, with the underlying premise that better control of water will help the farmers and improve the reliability of supply in marginal-dry or drought years. Some farmers in the study area have already made on-farm water management improvements to improve efficiency and they need to be assured that system operational change does not mean less water for them. Rotational irrigation must be implemented with input from farmers and farmer organizations. Scheduling should consider the needs and practices of the farmers. For example, many weekend farmers can only irrigate on Saturday and Sunday. This issue is further examined in the analysis of Alternative A-10 (see fact sheet for A-10, *Irrigation Efficiency*). The estimated cost for this program is included in the total program cost shown in Table 7A-3 (Exhibit 7A).

For the small Sandoval systems, adding and making operational a mechanical stage recording meter and automatic gates tied to a meter at each system intake structure would allow *mayordomos* and/or irrigation system managers to better operate their systems and better understand overall system water application requirements and rates of flow. This would be especially practical for the larger of these systems.

As measuring the canal section at each location where a meter/gate combination would be placed is beyond the scope of this study, this fact sheet relies on a generic conceptual design and cost estimate for a metering program. The meters and gate structure are assumed for each lateral, lateral sub-area, and in each small Sandoval system. Table 7A-2 (Exhibit 7A) reflects these assumptions and includes an estimate of the numbers of meter/gate structures required.

Skillful use of agri-meteorological data to control irrigation flows at the lateral and sublateral level in the MRGCD system will assist in good system water management. Also, the addition of soil moisture probes within the small Sandoval systems can help managers control these smaller system flows. Small system managers should also be instructed in using the BOR's "ET Toolbox" to assist in managing systems irrigation flow. The ET Toolbox can be used by irrigation systems managers and farmers in scheduling and managing irrigation water releases so as to account for soil moisture and weather forecasts. The use of agri-meteorological data in planning irrigation releases is especially useful in early system season operations and in drought situations.

The available data for irrigated area, flows, and off-farm MRGCD irrigation efficiency are sparse and in some cases inconsistent. For the MRGCD, irrigated acreages are taken from the MRGCD, on-farm and off-farm efficiencies are taken from Wilson (1999) and consumptive irrigation use or requirement (CIR) values are assumed from SSPA and Wilson (1999). For the small Sandoval systems, the irrigated area data are from Saavedra (1987) and the efficiencies and CIR are from Wilson (1999). Figures 7A-1 and 7A-2 (Exhibit 7A), based on Wilson (1999), use these data to display estimated acre-feet per acre components of the water demand for the MRGCD system (by county) and the combined small Sandoval systems.

While it is difficult to determine which available data are most accurate, the following facts are certain:

- The MRGCD system irrigates production farms, supplemental income-generating farms, as wells as landscaped and turfed areas in subdivisions, at homes, and commercial sites. The exact amount of irrigated acreage in each of these categories in unknown No data on farmer characteristics are available; however, data on county crop production and gross earnings are available

- The MRGCD canals contribute to aquifer recharge through seepage. However, MRGCD's permit for beneficial use does not include aquifer recharge. Riparian flora along the canals is, at least in part, maintained by canal seepage.

- The MRGCD canal system supports large areas of irrigated lands and agriculture within three major Pueblos: Sandia, Isleta, and Cochiti.

Existing MRGCD flow and/or irrigated area data do not currently reflect the nature of this multi-purpose system sufficiently. In reality, all of the numbers generated as indicators of MRGCD efficiency may be flawed because overall MRGCD system benefits reflect the unique nature of this conservancy district. For example, comparing the MRGCD system to other high volume production agriculture irrigation districts may be misleading as those districts are very different form the MRGCD. Thus such comparisons may be of some value but do not encompass the complex issues of the MRGCD.

With these considerations in mind, data from Papadopulos (2002) and Wilson (1999) are used to generate indicators of efficiency improvements that will lead to some projected diversion water reduction. The focus of this fact sheet is on the potential level of diversion water reduction that might be feasible while still supporting the various types of irrigated agriculture taking place within the MRGCD.

3. Alternative Evaluation

3.1 Technical Feasibility

Enabling New Technologies and Status

No new technology is proposed as a part of this analysis. The ability to design, build and operate the equipment and facilities presented in this alternative analysis exists within the study area today. Moving from continuous irrigation flow operations to a scheduled irrigation rotation within MRGCD and the larger Sandoval systems is technically feasible but may require the design and use of new MRGCD irrigation system management software tied to meters and flow control equipment and plans.

Infrastructure Development Requirements

The proposed program to provide, install and implement a modern metering/flow control system within MRGCD and the small Sandoval systems including total conceptual cost and estimated diverted water savings is shown on Tables 7A-2 and 7A-3 (Exhibit 7A).

Total Time to Implement

It is estimated that a program to bring improved system management, recordkeeping, and reporting to irrigation systems as conceptually outlined in this analysis might take five years to design and implement.

3.1.1 Physical and Hydrological Impacts

Effect on Water Demand

The primary effect from this alternative will be a reduction in diversions. Minor potential changes in consumptive use are described under water savings/lost.

Effect on Water Supply (Surface and Groundwater)

Changing irrigation operations from more continuous flow to a scheduled rotation would allow the MRGCD to reduce river diversions. The question of what happens to the water that is no longer being diverted would be determined by legal considerations. From a practical perspective, fewer water diversions would mean that more water stays in El Vado reservoir, which stores water used for irrigation in the MRGCD. If less water is needed for irrigation in the MRGCD, less water would be released from the reservoir Water in the reservoir could be used to extend the irrigation season and provide farmers with a full water supply.

Water Saved/Lost (Consumption and Depletions)

As discussed above, the primary result from this alternative is a reduction in diversions. Anecdotal information exists that seems to indicate farmers will do more to manage on-farm water application and control when conservation measures are taken upstream from farms. This might result in a small consumptive use reduction.

Incidental off-farm conveyance depletions are on the order of 3 percent of the total diversions (Wilson, 1999). With improved efficiencies due to scheduling, 42,800 acre-feet of reductions in diversions are estimated (Table 7A-2). A 3 percent reduction of this amount would result in about 1,300 acre-feet per year of savings due to reduced evaporation and evapotranspiration. Once a metering program is in place and a better understanding of current depletions is developed, potential savings could be more accurately estimated.

Impacts to Water Quality (and mitigations)

This alternative is not anticipated to impact water quality.

Watershed/Geologic Impacts

Further study is needed to evaluate the impact of seepage reduction on the Rio Grande bosque.

3.1.2 Environmental Impacts

Impact to Ecosystems

Changes in recharge to the shallow aquifer due to changes in flows through canals may impact the bosque and the types of ecosystem that may be established in the canals and drains of the MRGCD. However, flows in the system are already intermittent due to the seasonal nature of irrigation.

Increased water in storage could be released to enhance ecosystem functions, depending on ownership of the water.

Implications to Endangered Species

This alternative would affect endangered species only if increased water in storage is released to enhance aquatic and riparian ecosystems that support certain endangered species (silvery minnow, southwestern willow flycatcher).

3.2 Financial Feasibility

3.2.1 Initial Cost to Implement

The cost for implementing the proposed metering program would be approximately $7 million, which would result in a per-acre cost of $160 to reduce diverted water by 42,800 acre-feet.

3.2.2 Potential Funding Source

Federal programs administered by the Bureau of Reclamation, the U.S. Department of Agriculture and the National Resources Conservation Service might provide funding for part or all of a metering program. Special federal appropriations might also be available. Funding from the U.S. Army Corps of Engineers and the State of New Mexico through the ISC might also be available through the existing acéquia improvement and construction assistance program. Special funding appropriations can also be made available through the state legislation. User (farmer) water rates can also be increased to cover the cost of such a program.

3.2.3 Ongoing Cost for Operation and Maintenance

Operation and maintenance costs, projected at approximately $450,000, are presented in Table 7A-3 in Exhibit 7A.

References/Bibliography

John Shomaker & Associates, Inc. (JSAI) and Pioneerwest. 2000. *Historical and current water use in the Middle Rio Grande Region.* Prepared for MRGCOG. April 2000.

S.S. Papadopulos & Associates, Inc. 2002. *MRGCD efficiency and metering program*. Prepared for the NM Interstate Stream Commission. December 2002

Saavedra, P. 1987. *Surface water irrigation organizations in New Mexico*. New Mexico State Engineer's Office, Report TDDC-87-2. March 1987.

Wilson, B. 1999. *New Mexico counties irrigated acreage in 1999*. (Database obtained through private correspondence). New Mexico State Engineer Office.

Wilson, B. 1997, *Water use by categories in New Mexico counties and river basins and irrigated acreage in 1995.* New Mexico State Engineer Office, Technical Bulletin No. 49.