Efficiency and Innovation at Westlands Water District

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Formed in 1952, Westlands Water District encompasses more than 600,000 acres of farmland in western Fresno and Kings counties in Central California. In contract with the U.S. Bureau of Reclamation, water is conveyed to Westlands through the Central Valley Project. It is pumped from the Sacramento-San Joaquin Delta, and delivered 70 miles through the Delta-Mendota Canal to San Luis Reservoir during the winter months when there is an abundance of water in the system. During spring and summer, the water is delivered to Westlands farmers through the San Luis and Coalinga canals. Once it leaves the federal project canals, water is delivered to farmers through 1,034 miles of underground pipe and more than 3,300 water meters.

Unlike water agencies with more abundant supplies, Westlands must ration water to its farmers, even in the wettest years. The district's primary annual contract entitlements from the Central Valley Project total 1,150,000 acre-feet. The annual safe yield of the regional confined aquifer adds another 135,000 to 200,000 acre-feet. Thus, the total water available falls about 215,000 acre-feet (15 percent) short of the 1,500,000 acre-feet required to irrigate the entire district. Since 1991 when the district last received a water contract supply near 100 percent, the delivered water has decreased to about 65 or 70 percent of the contract amount. District farmers must cope with uncertainties of contract supply, groundwater, and short-term water transfers when they make their cropping decisions, while dealing with economic uncertainties of the farming economy. As a result, at least 10 percent of the district is put to fallow annually.

Efficient Irrigators

As a federal water user, the district must prepare a water management plan, and the guidelines suggest a goal of 85 percent efficiency. That is, 85 percent of the water applied to crops is used for evapotranspiration (ET) and other plant uses, with the balance lost to deep percolation. In fact, the average district-wide seasonal application efficiency has averaged about 84 percent over the past 25 years. Improved efficiency generally requires water users to invest in improved irrigation systems. Since 1985, adoption of drip/micro-irrigation systems has doubled every five years to a current total of over 120,000 acres or about 22 percent of irrigable acreage. Virtually all permanent crops are drip-irrigated, and more field crops are being irrigated with drip systems every year.

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District irrigators have adopted new technologies as their benefits are demonstrated. Land leveling with laser equipment is now routinely utilized for surface irrigation. Since the district does not have any outflow, tailwater reuse is a must, and all water users must prevent tailwater from impacting their neighbors. Pre-irrigation of recently tilled lands before planting is routinely accomplished with hand-moved aluminum sprinklers rather than with the furrow system, which cannot control the depth of water applied.

Photo: Lynn Betts

Drip irrigation on California grapes. Photo from USDA-ARS, 2000.

With the availability of GPS satellite positioning, precision agriculture is rapidly taking hold. GPS-controlled tractors can have smaller engines, saving fuel. Ground preparation can occur 24 hours a day, requiring fewer tractors to be maintained. Precision tilling reliably permits beds to be

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located over buried drip-irrigation systems. Automated yield monitoring during harvesting is becoming common. Variable-rate application of soil amendments, fertilizers, and other inputs makes possible tighter management and control.

Even a uniform irrigation system with good control over the depth of water applied will not perform to its capabilities without good management. The Water Conservation Program at Westlands has worked for over 25 years to provide information to its water users that allows them to manage their allocations as efficiently as possible.

ET Data Help Determine Irrigation Volume

Real-time crop ET data specific to Westlands has been mailed weekly to all water users since 1978. Now the data obtained from the district's weather stations are faxed, e-mailed, and posted on the district's Web site daily. Originally, ET information was primarily used to facilitate irrigation scheduling, which had to be planned well in advance so the cumbersome irrigation equipment could be moved into place. But as drip systems were adopted and irrigation events became more frequent and easier to initiate, water scheduling has increasingly emphasized applying the proper amount of water rather than scheduling the date for the next irrigation.

In the 1980s, Westlands staff used neutron probe soil moisture monitoring data to develop specific crop coefficients for determining ET rates. However, satellite imagery is now available that provides a large amount of ET data at a minimal cost compared to earlier methods. Thus district staff today are utilizing 2003 and 2004 satellite imagery to develop and update crop coefficients in order to produce real-time ET rates. Farmers can determine how much water to apply to a particular crop on a particular day by using the ET measurements to calculate water lost from the root zone since the last irrigation, when the soil was presumably saturated. This water balance approach helps prevent water loss to deep percolation while ensuring the crops receive sufficient moisture.

Satellite Imagery Used

Lack of uniformity in the irrigation system has always been compensated for by applying additional water so that drier parts of a field receive enough. Since 2003, however, Westlands has provided water users with satellite imagery on its Web site that can be used to identify areas of uneven distribution. The Normalized Difference Vegetative Index (NDVI) imagery provides a sensitive measure of the vegetative mass and water status of a crop and is usually available within three or four days from the date of overflight. With this information and investment in improved technology, issues of nonuniform distribution can be addressed.

District water users have found other uses for satellite imagery. Consider the tomato farmer in his field who receives a cellular telephone call from the cannery, saying that he must stretch out his deliveries. However, tomatoes spoil from water stress if not harvested in time. The farmer can log on to the district's Web site and look at the imagery for his field – which may be only a week old – and proceed to harvest first the parts of the field that are not expected to hold well.

Variable-rate application services for various agricultural inputs are being routinely offered by suppliers to water users in the district. Satellite imagery and yield monitoring are now being used to develop maps that guide variable application rates of soil amendments, fertilizer, growth regulators, and defoliants.

New technology is continually being developed to improve water-use efficiency in agriculture and elsewhere. Westlands provides information and data to its water users to help them take advantage of that technology.

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mid-April. The NMISC is finalizing details for the design of a complementary well field located in the middle RAB. Some water rights purchased will be transferred to the well fields.

NEPA: Two environmental impact statements (EIS) are being completed by the NMISC as a joint-lead agency with the Bureau of Reclamation. The Carlsbad Operations and Conservation EIS that proposes to re-operate Sumner Dam for the benefit of the Pecos bluntnose shiner fish will be completed in June 2006. The Long-Term Miscellaneous Purposes Contract EIS proposes to change Carlsbad Project water from irrigation to other purposes (in this case, state line delivery) and should be completed in March 2006.

Conclusion

As a result of signing the Carlsbad Project Settlement, adjudication costs have been drastically reduced and the adjudication process has been expedited. However, the settlement has not yet been fully implemented. Currently, it is estimated that an additional $63.6 million will be required for full implementation. The settlement may ultimately fail if the funding to support the acquisition program is not provided. This may leave strict priority administration as the only means to remedy a net delivery shortfall. Priority administration will be costly, difficult, and highly contentious. It will require significant expenditures for administration, enforcement, and litigation with unpredictable and potentially disastrous results for Pecos River water users and the state of New Mexico.

Any opinions or positions expressed in this article are the authors' and do not necessarily represent the opinions or positions of the New Mexico Interstate Stream Commission or the state of New Mexico. Contact Rebecca King at rking@ose.state.nm.us or Elisa Sims at esims@ose.state.nm.us.

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