Irrigation district modernization

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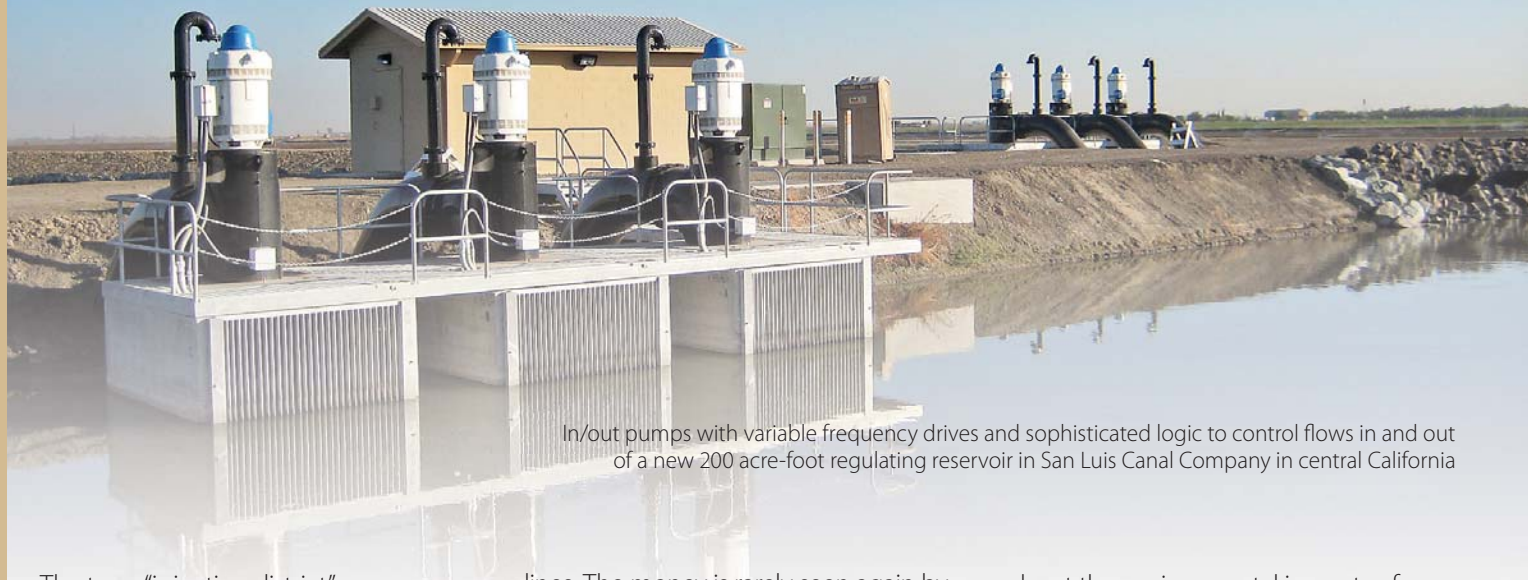

In/out pumps with variable frequency drives and sophisticated logic to control flows in and out of a new 200 acre-foot regulating reservoir in San Luis Canal Company in central California

The term "irrigation district" or "agricultural water district" in the Western United States generally refers to some type of public agency organized similar to a county. By state water code, a district has rules to follow (i.e., voting, transparency, organization, etc.) and is allowed to perform specific functions (e.g., distribute irrigation water, generate power, provide drainage, etc.). Board members may be elected by all registered voters in the district or by votes proportional to acreage farmed or some other arrangement specified in the code. The Board members hire a professional staff to run the district.

Districts in the West range in size from about 500,000 irrigated acres (e.g., Imperial, Idaho) down to many the size of 10,000 – 20,000 acres. Smaller sizes are generally difficult to maintain as economically viable units, and small districts tend to consolidate.

With the exception of Canada, Australia and some Latin American countries, there are very few viable "water user organizations" with structures and functions that closely resemble those of U.S. irrigation districts. Typically, international water user associations are top-down organizations that are formed by the government to collect money from farmers and to provide maintenance of government-owned canals and pipelines. The money is rarely seen again by farmers, and farmers are not especially enthusiastic about the arrangement. This aspect, plus the lack of good water laws, lack of enforcement of regulations, corruption, issues with right-of-ways and land ownership, and dozens of other challenges, add up to fairly dysfunctional organizations in many countries.

Today's needs

In the Western United States, many districts were constructed over a hundred years ago when on-farm irrigation was very simple, when there were no environmental laws or agencies and when a large percentage of citizens had seen a cow sometime in their lives. The primary function of an irrigation district until about 1980 was simple: maintain facilities and distribute water to farmers. Furthermore, the attitude was more or less that the farmers needed to follow the district rules because the district was in charge. There was usually not a conscious service attitude by district employees. It was also acceptable to divert a whole river into a large canal, run the river through the irrigation project and then discharge any nonconsumptive uses back into the river channel at the downstream end of the project. Everyone understood that the water was not wasted — it didn't disappear — but no one was thinking about the environmental impacts of drying up stretches of river.

The almost explosive growth of environmental specialists in recent decades has resulted in the recognition of numerous problems — often with regulations that do not solve those problems and which have little or no consideration of local economics and technical abilities. For example, a district may be pressured to increase water-use efficiency. However, inefficiencies within an irrigation district are often the only source of groundwater for a district's neighbors. During years of drought, farmers within the district may also depend on wells that recycle this groundwater. On the other hand, allowing deep percolation from fields runs the danger of polluting the groundwater with nitrates. All facets of the situation must be examined, because both the problems and the solutions are complex.

Today, irrigation districts must continually respond to external pressures related to losing some of their water rights (a huge issue in California), basin-wide challenges such as groundwater overdraft, environmental regulations related to their drainage outflows, urbanization, and so on. Districts must deliver a high percentage of their diverted surface water, measure all deliveries and outflows with a high degree of accuracy, prevent environmental damage and provide

water to farmers in a flexible and equitable manner. Note that this statement of "provide water to farmers in a flexible and equitable manner" has been preceded by many statements that have nothing to do with helping farmers utilize their drip or sprinkler systems better.

Defining modernization

Modernization specifically refers to "technical, managerial and organizational upgrading, as opposed to mere physical rehabilitation, of irrigation schemes with the objective to improve resource utilization (labor, water, economics, environmental) and water delivery service to farms." Modernization investment focuses on the details of the inner workings of an irrigation project as opposed to traditional simple and broad-brush investments in canal lining or rehabilitation.

Modernization is a *process* that sets specific objectives and selects specific actions and tools to achieve them. Managers and engineers for irrigation projects frequently confuse practices such as canal lining and automation with modernization. Such tools may be very important, but they may also be the lowest priority if one examines the entire process that impacts performance.

As an irrigation and drainage engineer, I have worked on several hundred modernization projects throughout the United States and internationally. In the United States, a modernization project is typically driven by external pressures such as conforming to new environmental discharge requirements or reducing energy consumption. In all cases of good modernization projects, every attempt is made to consciously improve irrigation water delivery service to agricultural fields while meeting those other objectives.

Modernization costs

The cost of a modernization project in an irrigation district is huge. It is not uncommon to identify a modernization cost of $15 million – $150 million for a district of 50,000 acres. In most cases that budget will not provide a complete overhaul of a district's operation and efficiency. But, the crops and incomes from many irrigation projects cannot provide those levels of funding. In August 2017, the United States Bureau of Reclamation listed about $25 million in grants to irrigation districts, which is helpful — but obviously does not begin to meet the needs. Some states provide funds, and water transfers have often funded modernization efforts. But, the needs far outstrip the available financial resources.

Modernization engineering

Modernization of irrigation districts is a special type of engineering that requires knowledge of on-farm irrigation requirements. It also requires an understanding of basin water balances, flow measurement, pumps, salinity, groundwater, automation, supervisory control and data acquisition, economics, and the special equipment and theory used to control flows in pipelines and canals and water levels in canals. Furthermore, it requires a systems approach to a whole project — rather than just looking at a single structure. Social and political aspects are almost always involved. Those who are interested in learning more about the subject can find reports and papers at www.itrc.org.

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Modernization of an old canal check structure with new automated structures and special control logic