New Electronic Technologies for Volumetric Metering of Delivered Water – Magnetic, Doppler, Vortex Shedding and Ultrasonic Flow Measurement

Goal: Provide farmers and irrigation districts with practical means of measuring the volumes of water delivered, spilled, reused, etc. This research will address the conditions for which there presently are no commercially viable solution.

Technology Path: Magnetic and ultrasonic flow measurement technologies have been installed in a few irrigation districts over the past 5 years. However, these applications have all been on large pipelines or large canals. With a cost that varies from about $5,000 - $30,000 per site (material only), they are prohibitively expensive for permanent use on individual farm turnouts. Doppler meters have been used successfully for large river and ocean flow rate measurements, but are not used in irrigation districts. Vortex shedding, to the knowledge of ITRC, is a principle that has never been used in irrigation districts. However, vortex shedding is commonly used in the petro-chemical industries.

Present Doppler, vortex shedding, magnetic and ultrasonic technologies sometimes guarantee an accuracy of better than 2%, whereas ±5% accuracy would be excellent for a farm turnout. However, the 2% accuracy on large scale has been questioned. There is a need to research devices using these technologies for large-scale measurement, and to also investigate their application on smaller turnouts.

There is some evidence that magnetic and ultrasonic technology can work economically on farm turnouts - private companies in Australia have recently promoted low-cost magnetic and ultrasonic meters to replace the old "Dethridge" water wheels that used to be popular in Victoria, Australia. Together with USGS, the USBR, and a manufacturer, ITRC is presently investigating the use of some new Doppler meter technologies in a canal at the Water Delivery Facility at Cal Poly; this technology may be applicable for smaller turnouts and large canals.

This research would examine these technologies to determine how well they work and what, if any modifications could be made to reduce the cost. ITRC will work with researchers from IMTA (Instituto Mexicano de Tecnologia Del Agua) and from the US Water Conservation Laboratory in Phoenix, AZ. Several irrigation districts have already indicated a willingness to participate in installations and data collection. Researchers in Australia who have examined some of these technologies in the last 2 years are also willing to share their results.

ITRC will meet with the various U.S. and Australian manufacturers of magnetic, vortex shedding, Doppler, and ultrasonic meters to determine the suitability of their devices in their current configuration for flow measurement on both large

canals, and in pipelines and small farm turnouts. The characteristics (including cost, robustness, and accuracy over a range of conditions) of various "off-the-shelf" units will first be tested both in the lab and in the field. In addition, brainstorming will be conducted with interested manufacturers to develop modified units that may reduce cost but still provide a "reasonable" accuracy.

Accurate flow rate measurement and control are absolutely essential for scientific management of California's water and energy resources. The technologies to be researched in this project will be used in the largest portions of California's water usage- agricultural and environment.

Principal Investigator:

Stuart Styles, CalPoly San Luis Obispo University, Irrigation Technology Research Center, is the designated project manager.