



Improving Water Measurement with H2oTech's RemoteTracker

For irrigation district operators, water deliveries can function more like an art than a science. In districts where infrastructure dates back decades, even a century, operator experience and his “feel” for the water delivery system are used to determine the volume of water a farmer receives. But 10 acre-feet for one operator may be not be 10 acre-feet for another. And 10 acre-feet with an imprecise measurement tool may not match what an experienced operator knows to be 10 acre-feet.

H2oTech is working to take some of the guesswork out of water delivery measurement. After years of testing its technology in the rice fields of Northern California, the company has developed the RemoteTracker System. The RemoteTracker is an integrated turnout flow measurement, data management, and volumetric accounting system for agricultural water system operators.

THE SYSTEM

The RemoteTracker System consists of a wirelessly controlled water velocity sensor, a ruggedized tablet PC for the operator’s vehicle, and a database running on a computer connected to the Internet. The tablet interface enables operators to view real-time flow data from the wirelessly controlled water velocity sensor while adjusting flows at turnout gates. Field data automatically transfer over a wireless wide area network to a cloud-based storage system and then load into a custom database. The database performs quality control and quality assurance procedures on the data and develops daily volumes for each turnout with a district.

The device requires very little input by the operator. The device identifies the turnout where it is being deployed based on GPS location, and pulls the associated turnout attributes from a database. Once installed at a turnout, the operator can see the flow rate change as he is adjusting the gate. Instead of guessing what gate setting is needed, measuring, and then readjusting the gate, an operator can stand at the gate and adjust it until the requested flow rate is achieved.

H2oTech continually works to improve the system. It is refining the RemoteTracker by integrating a different velocity sensor that enables measurements in open channels and partially full pipes, in addition to the sensor piloted at Reclamation District No. 108 (RD108), Biggs–West Gridley Water District (BWGWD), and Richvale Irrigation District (RID), which measures in full pipes. H2oTech has also recently released RemoteTracker LT, which provides the same flow and order data management platform as RemoteTracker, with the main difference being that flow data are collected and entered manually (e.g., meter gate, weir) instead of via the wireless water velocity sensor.

INITIAL IDEA

The genesis of the RemoteTracker was a series of studies in the rice fields of the Sacramento Valley, where H2oTech looked at alternative methods of measuring flows for agricultural water providers. In 2009, the California legislature passed a comprehensive water package that set forth a planning framework through which urban and agricultural water suppliers will reduce water use. Senate Bill No. x7-7, Water Conservation Act (WCA), required improved delivery measurement at the farm level.

Prior to the passage of the bill, RID, BWGWD, and RD108 hired H2oTech to evaluate and assess district measurement infrastructure in light of the then-pending legislation. The RD108 pilot tests involved testing alternative field turnout measurement methods, including (1) existing orifice gates, (2) weirs set in precast boxes, and (3) the RemoteTracker. The pilot test revealed that the weirs were not able to meet the new accuracy standards in the regulation, while delivery gates and the RemoteTracker did achieve those standards.

CALIFORNIA'S WATER CONSERVATION ACT OF 2009

Touted as a truly bipartisan effort, the WCA requires all California agricultural water suppliers to implement certain “efficient water management practices.” Suppliers serving 25,000 irrigated acres or more must prepare and adopt agricultural water management plans, update those plans by the end of 2015, and then update every five years. Additionally, they must report aggregated farm-gate delivery data to the state, and adopt water price structures based at least in part on the volume of water delivered to customers.

New regulations (California Code of Regulations, title 23, §597 et seq), promulgated pursuant to the WCA, mandate accurate delivery volumes. The measured volume



H2oTech President Jeff Davids using an acoustic Doppler device to measure flow in a small lined channel in Arizona.

of water delivered at each farm turnout must be no greater than 12 percent more, or 12 percent less, than the actual volume delivered. Additionally, any new or replacement measurement devices installed must be accurate to within ± 5 percent by volume in the laboratory if using a laboratory certification, or ± 10 percent by volume in the field if using a nonlaboratory certification.

The regulation also requires that an accuracy certification be performed by either (1) field testing of a random and statistically representative sample of existing farm turnouts, (2) field inspections and analysis of every existing farm turnout, with the testing or inspections documented by a registered engineer, or (3) a laboratory certification if accuracy is within 5 percent.

PILOT PROGRAMS

During the 2012 irrigation season, H2oTech piloted the RemoteTracker with the same three agricultural water providers with whom the initial investigations had been performed. All three pilot programs were successful, and each district has adopted the RemoteTracker as its preferred delivery measurement system. H2oTech is currently helping the districts implement the RemoteTracker system over the next three years: RD108 is about one-third of the way through outfitting its 650 turnout locations; RID is about two-thirds of the way through; and BWGWD, about 15 percent.

Based on the research done with RD108, H2oTech found that the amount of water going out of the turnouts matches the difference between what was put into the canal and what spilled out. RemoteTracker's overall volume measurement accuracy, including operator error, was determined to be just 3.7 percent on average over the course of the irrigation season. Additionally, a peer-reviewed uncertainty analysis of the volumetric accuracy of RemoteTracker spot measurements shows that the expected volumetric accuracy for each turnout is 4.6 percent. These results indicate that RemoteTracker can qualify as a lab-certified device for purposes of California regulations.

A BENEFICIAL, USER-FRIENDLY TECHNOLOGY

Right now there is little on the market that makes delivery measurement easy and affordable. Current metering devices require significant data input and are meant for engineers. The RemoteTracker simplifies that process by linking the device to GPS and making an easy-to-use interface on a tablet PC. The touchscreen RemoteTracker interface does not feature menus or a mouse. Jeff Davids, H2oTech president, noted that "[H2oTech] was initially concerned about giving these measurement tools to people who were not comfortable with computers. . . . So the biggest surprise was all the positive feedback regarding ease of use." Lewis Bair, general manager



RemoteTracker user interface on a Panasonic Toughbook CF-19. The last flow measurement and any pending flows (i.e., orders) for a site are shown on the home tab. The CF-19 is one of the only tablet PCs that comes with a Class 1 Bluetooth radio, which enables long-range communications (300 feet) between the tablet PC and the wireless water velocity sensor.

of RD108, was happy with the results. "We didn't have any reliability issues. . . . And our guys loved the device because it performed so well."

For irrigation districts, there is a range of benefits to using the RemoteTracker.

CAPITAL COSTS

Most alternative measurement methods require an installation at every single delivery point, which can run anywhere from \$5,000 to \$15,000 each. And, there can be maintenance and vandalism issues with permanent electronics deployed at each delivery point.

With the RemoteTracker System, a district with 300 delivery points and three operators would only need to buy three devices (one per operator). The RemoteTracker costs roughly \$30,000 per operator—depending on how much data a district has for its delivery points—totaling less than \$100,000. In contrast, an alternative measurement device at \$10,000 per delivery point would run up a bill of over \$3 million.

The RemoteTracker does require some infrastructure modifications depending on the type of delivery point, but the costs of those changes are less than permanent electronic installations. On the basis of the pilot study, RD108 created a cost estimate for the necessary infrastructure changes to accommodate testing with the RemoteTracker. RD108 estimated it would cost \$2.1 million to retrofit the district's 650 turnouts with concrete boxes and implement the system software. The district's board of directors and farmers recently approved the plan.

LABOR AND TIME MANAGEMENT

Because the RemoteTracker can be lab certified, districts can save time and labor by undertaking the arduous task of collecting water volume data at individual delivery points. Moreover, the data stay digital all the way through the measurement process. Operators do not have to take notes in the field and then enter them into the computer in the office, reducing the time operators spend accounting for numbers as well as the chance of error being introduced into the database.

Ultimately, the RemoteTracker ratifies operator experience with advanced measurement. As Lewis Bair stated, "The best barometer for the effectiveness and reliability of the RemoteTracker system is the buy-in of our operators. The guys are confident in the device."

For more information on the RemoteTracker, please contact Jeff Davids at (530) 588-3064 or jeff@h2otechonline.com.