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# SOUTH SAN JOAQUIN IRRIGATION DISTRICT TAKES THE LEAD IN 21ST CENTURY FLOW MONITORING

## California, USA

These are not easy times to run an irrigation district in California. Honing its efficiency, protecting its workers, working to comply with new water measurement regulations and facing a year of drought, the South San Joaquin Irrigation District (SSJID) is staking its future on accurate flow monitoring and automation.

"If you look at the district's first 100 years, from 1909 to 2009, we have ditch tenders out 24/7 opening gates or turning valves and looking at their watch to track water use," says Jeff Shields, general manager of the district, in his office in Manteca, California. "Now, in 2012, farmers will take out their iPhone and order their water. They'll open a secure website and get readings from soil moisture probes five feet deep, and get data from a weather station next to their turnout."

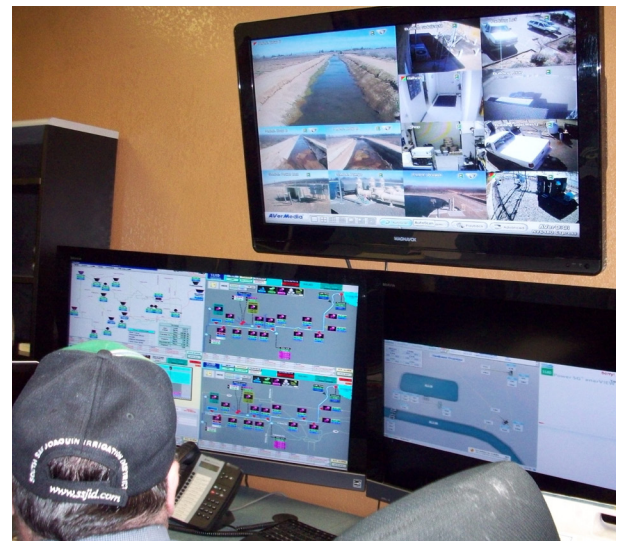
The role of ditch tender, or division manager, in the 21st century goes far beyond monitoring the system, scheduling deliveries with farmers and checking gates - now it also includes computer skills, notes Shields. His team of division managers is upgrading and maintaining the evolving system, working at the front lines of the battle to keep water flowing to the district's farms.

"Agriculture is going to have to demonstrate the efficient use of our water," Shields points out. "Agriculture is often criticized as inefficient. But it's hard to prove otherwise when you can't account for the delivery of water. In a year like this [with a predicted shortfall of 15% in the district's water allocation], it will be especially important."

Shields adds that automatic data gathering and turnout management gives him greater peace of mind than sending ditch tenders into the field in the middle of the night, where they sometimes face dangerous characters in isolated areas. "With pipelines and meters, we can secure our system," he says. "So it's not just about metering technology, but metering technology ties it all together."

### Wider Benefits

Greater efficiency in the irrigation system has far-reaching benefits, Shields adds. "First and foremost, it's to meet years when we have drought," he notes. "But we also expect to have more surpluses more often. When we have surplus, we can try to export water for other farm uses."



*BEHIND THE SCENES. A view of the South San Joaquin Irrigation District's modern canal control center, where turnout management is an impressive 21st century science.*

Conserving water throughout the system also complements SSJID's On-Farm Water Conservation Program, a \$1.2-million-per-year cost-share program that helps customers laser-level fields, install tailwater recovery systems to minimize water waste, or switch to high-efficiency drip or microsprinkler systems.

Most farmers with drip irrigation currently pump their own groundwater to feed their systems. Overdrafts of groundwater are a concern throughout the San Joaquin Valley. Groundwater is often more saline than canal water drawn from Sierra snowmelt - salts from groundwater can steadily decrease soil quality. High-horsepower groundwater pumps also burn fuel and create exhaust fumes, adding to the Central Valley's chronic air pollution problem.

By building new, pressurized irrigation systems, SSJID can supply canal water to the drip and microsprinkler systems on many farms, replacing

dozens of individual on-farm pumps with just a few central pumps, and delivering clean, low-salinity water to farmers who can use it more efficiently than ever. In fact, notes Shields, drip irrigation reduces water use in almonds and grapes by about one-third while increasing yields by 30 percent.

Though adoption of drip technology was nearly unanimous among farmers in SSJID's first pressurized system service area, not every field along the pressurized pipeline is on drip or microsprinkler. Some growers will continue to flood some of their land, either because it's a less expensive way to manage row crops like corn, or because one or two floods per year help control root-eating rodents in orchards and vineyards. Flood irrigators along the pressurized system will benefit from the upgrade, too, enjoying improved scheduling for water deliveries.

## Good Sensors Are Vital

In an average year, the South San Joaquin Irrigation District imports 300,000 acre-feet (370 million cubic meters) of water by gravity from the New Melones Dam on the Stanislaus River to three storage reservoirs. The water supplies farmers on 49,000 acres of land – most planted with almonds, grapes or annual row crops like corn – in San Joaquin County. The district's main canal feeds 28 laterals, which account for hundreds of miles of ditches, pipes and gates throughout the county.

In turn, laterals are linked by a network of interceptor pipelines and retention ponds that allow managers greater flexibility in transporting and delivering water through the system. Over the past decade, infrastructure improvements have also included monitoring and automation innovations throughout the district.

The district's commitment to monitoring and automation has put SSJID on track for compliance with the California Water Resources Act, a statute enacted in 2012 that requires irrigation districts to start billing farmers on their cumulative water use. The result is mandated flow monitoring. The law requires volumetric measurement for every property – about 1,200 measurement points across the South San Joaquin district, and as many as 30,000 throughout northern California. Just as important, operating such a refined system will demand constant monitoring of water throughout the network of canals and pipelines that service each grower.

"We're not just transporting water from point A to point B," notes Frank Avila, SSJID's telemetry systems/SCADA system supervisor. "Deliveries are being applied. By the time you get halfway down a lateral, you might only have one-third of the water you started with, and velocities are always changing – they're not consistent." Avila emphasizes the importance of reliable metering equipment at every level of the system.

"Automation can't be done unless we get good data from the field," he says. "Although we have good communications, good HMI [human-machine interface] programs and good PLCs [programmable logic



*The district's main canal feeds 28 laterals, which account for hundreds of miles of ditches, pipes and gates throughout the county. Blossoming in the background are acres of almond trees, one of the region's primary crops.*



*The SonTek-IQ can accurately measure flow in as little as 3 inches of water is extremely valuable to SSJID when measuring smaller canals or drains.*



controllers], we still depend on the sensors in the water to give us good data that we can make good decisions from.”

## SonTek-IQ: Compact and Easy

Over the years, Avila has deployed three SonTek Argonaut-SW acoustic Doppler velocimeters and six Argonaut-SL side-looking velocimeters in the district’s main canals and big laterals. The introduction of the new SonTek-IQ flow monitor – with its compact profile and five-beam pulsed Doppler design – allows him to take the next step in tracking flow in smaller laterals, drainage ditches and pipelines.

The SonTek-IQ is capable of accurate measurements in as little as 3 inches of water – a huge benefit compared to older technology, notes Avila. Small and efficient, the SonTek-IQ is ideal for remote locations, where bigger equipment would be unwieldy and manual observations would be impractical, he adds. With a simple mounting flange and two bolts, the IQ is easy to deploy without earthworks. The instrument’s all-in-one design requires no converters to collect data, so it efficiently connects to a datalogger, SonTek Flow Display, or telemetry unit. Avila connects SSJID’s IQs to radio transmitters broadcasting to his control center.

“This meter, right out of the box, is going to give you a good measurement,” he says. “SonTek has put something together that’s actually a pleasure to work with. It’s a really simple tool to put together, and you get your results right away. With a couple of wires, you can get your data to your radio and back to the data center – the view panel gives you 4 to 20 mA out so you can do what you need to do.”

That simplicity of set-up, reliability and low power demand the SonTek-IQ draws only 0.5 watts – will also make the compact IQ a big tool for monitoring SSJID’s growing inventory of pipelines, Avila predicts.

“I’ll run a cable all the way to a vent pipe or whatever I have access to,” he explains. “I usually crawl in there and look for a bottom that looks clean, where sand and materials are washed away, so I know I’ll get a nice linear flow over the sensor. Then the sensor does the rest.”

Avila points out that the SonTek-IQ delivers unprecedented accuracy in flow measurement right from the start.

“It’s been a quest of mine to have a sensor you could take out of the box, put in a location where you want to use it, test it one or two times and be within two percent of the flow,” Avila adds. “In industry or science, two percent may seem like a lot of variation, but in my world, it’s a great thing.”



*SonTek Product Manager Mike Cook and HydroScientific West representative Diego Davis prepare a SonTek-IQ installation site in one of the SSJID laterals. User friendly mounting brackets allow them to install the SonTek-IQ by simply inserting two bolts 12.7 cm (5 in) apart along the center line of the channel. The orientation of the slots on the mounting plate to allows users to orient the instrument in the direction of flow. Ultra-low power consumption allows for smaller solar panels and batteries – making monitoring less conspicuous.*



*The SonTek-IQ is a multi-beam acoustic flow meter with five 3.0 MHz transducers. Redundant water level data are recorded from the vertical beam and pressure sensor. Data download and communication are available via RS232, Modbus or SDI-12. Flow rates and total water volumes are computed internally based upon a user supplied survey of the channel shape and instrument location.*

## Shape of the Future

Monitoring flow in open channels and pipelines - with the ability to accurately report on flows in depths ranging from several feet to just a few inches - is a vital element in managing a scarce and highly scrutinized resource, notes Shields.

Instead of the old practice of flood irrigation every 10 days - which subjected crops to root-choking floods followed by days of drought stress in the summer - farmers are learning to direct water at the root zone at the ideal time and rate, he explains. Growers can also inject fertilizers and some crop protection chemicals into the irrigation water with drip or microsprinkler systems, making applications more precise and reducing the number of tractor trips through the field or orchard.

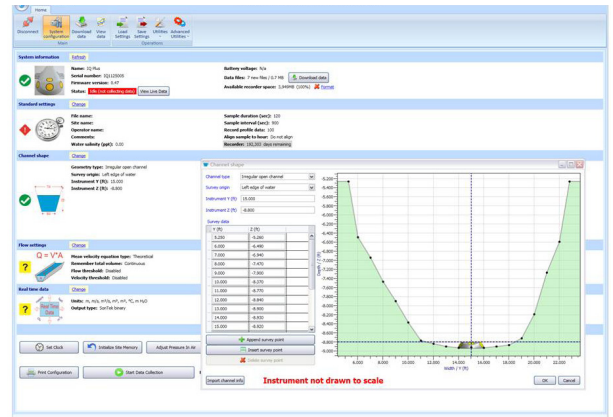
The bottom line is yield increases of up to 30 percent, more precise farming and significant improvements in water efficiency - each a vital achievement in today's environment.

## Second Century of Service

Meeting farmers' needs for increased precision, frequency and reliability in water deliveries requires the district to manage its water much more closely than ever. SonTek-IQs deployed throughout the maze of canals, ditches and pipes that course through south San Joaquin County will be providing vital data to help SSJID achieve the accuracy and efficiency that will help carry the district through its second century of service.

The first phase of SSJID's pressurized irrigation system - 19 miles of pressurized pipeline servicing 3,600 acres of orchards and vineyards - is online, and future phases are planned for other areas of the district. The district's monitoring and automation system is expanding steadily until it reaches the turnout at every farm, improving reliability and efficiency for each field the district serves. It's all part of the district's long history of preparing for a vibrant future in one of the world's most productive farming regions.

"The key for us is we've been here for 100 years," Shields notes. "We're going to be here for another hundred. We're going to have to irrigate with the best available technology. We don't look at this as a one- or two-year payback or return on investment. One hundred years ago, people invested in building this system. We owe it to them to make these investments in the future."



An example screen shot of the SonTek-IQ SmartPage. Simply input the channel geometry using the intuitive SonTek-IQ software and you are outputting flow data in minutes.

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