

INTRODUCTION:

Lateral diversions are generally deep underground with limited access and even more limited metering options. Combined with silt and trash-laden stream flows, the large pipes often associated with lateral diversions used by irrigation water-supply companies to distribute water usually mean either expensive meters or no meter at all.

The MACE AgriFlo provides a simple and cost-effective solution to the measurement of these flows. Firstly, a "strap-mount" velocity sensor can be installed inside the pipe (from 6" to 100" /150mm to 2.5 m diameter) without the need for excavation work to access the outside of the pipe wall. Alternatively, a 2" insertion sensor can be installed from the outside of the pipe. Cables are routed either underground and/or through the mounting pole to the AgriFlo electronics module, providing an extremely tamper and vermin resistant design. A solar panel is used to charge the internal battery, thus making the AgriFlo a truly remote electronic flow meter.

Many large lateral diversions monitored by irrigation districts have multiple pipes that need to be monitored. With the Series3 AgriFlo, up to three pipes can be measured with the same unit, providing even greater overall water management at an extremely affordable price.

Because the MACE velocity sensors provide very little obstruction to the flow and have no moving parts, the whole system is virtually maintenance free.

THE PROBLEM:

Quail Mesa Ranch is a large irrigation ranch based near Ehrenberg, Arizona, USA. The irrigation water that is delivered to the ranch by the US Bureau of Reclamation (USBR) is distributed along a large concrete lined trapezoidal canal (approximately 35 ft (10.5m) in width). Technologies available to measure flows in large canals are generally either multi-path transit time or side-looking Doppler ultrasonic devices. Whilst both these technologies deliver highly accurate results, they were both prohibitive in cost for the Quail Mesa operation.



Figure 1: The outlet of the large USBR supply canal at Quail Mesa Ranch, AZ.

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THE MACE SOLUTION:

Upon inspection of the site by MACE staff, it was noticed that the water in the canal is actually diverted on farm through three, large diameter (47" or 1200mm) pipes. In the past, the metering of these pipes was considered, but later dismissed as being too expensive for non-mechanical methods and too important for mechanical meters that foul up with trash.

With the advent of the MACE Series3 AgriFlo, these pipes could now be metered with highly accurate Doppler ultrasonic technology, whilst also meeting the budgetary constraints of the irrigation enterprise. A 2" insertion sensor was installed in each of the three 47" pipes and routed through conduit to the solar powered AgriFlo electronics module. An optional MACE FloSI – telemetry interface card will allow the data to be transmitted to a remote collection site in the future.



Figure 3: The Series3 MACE AgriFlo unit installed on Quail Mesa Ranch. A 2" insertion sensor is installed in each of the three 47" pipes.



Figure 2: MACE 2" insert sensor suitable for full pipes between 100mm to 2.5m (4" to 100")



Figure 4: The Series3 MACE AgriFlo unit installed on Quail Mesa Ranch. Note the 3 sensor cables entering the AgriFlo enclosure.

THE MACE AGRIFLO BENEFITS:

- 1 With MACE continuous wave advanced spectrum Doppler processing, each sensor "sees" velocities through the whole cross-section in each pipe and calculates the true average flow rate. This is unlike any other insertion device such as electromagnetic or mechanical, which only sense velocities in a "tennis ball" sized area and then use complex algorithms to attempt to calculate an average flow rate. Because of this technological difference, MACE Doppler technology has a shorter straight-run requirement than other devices.
- 2 The MACE insertion velocity sensor provides very little obstruction to the flow and has no moving parts. With trash loads in the delivery canal the whole system is virtually maintenance free.
- 3 Flow recording allows the Quail Mesa Ranch to analyze exactly when water was extracted from the canal system. Furthermore, the data can be used by the rancher to provide historical usage data to the USBR.
- 4 The installation of the insertion sensors meant that the whole flow meter was extremely easy and economic to install as no major pipe-work was required.
- 5 Because the same insertion sensor can be used in any pipe sized from 4" to 100", should the off-take be upgraded in the future, the same flow meter can be used.
- 6 At off-takes where multiple pipes are present, the Series3 AgriFlo with the ability to accept multiple flow sensors is an extremely cost-effective solution to the monitoring problem.

