CASE STUDY: OPEN CHANNEL AQUACULTURE MONITORING

INTRODUCTION:

Historically, the measurement of flow in open channels has been undertaken using civil structures such as flumes and weirs. Whilst these structures do provide a reasonably accurate measure of the stream flow, in practice, flumes and weirs often suffer from neglect over time and provide less than favourable conditions for flow measurement with stage measurements and rating tables. This may be particularly the case for structures that are several years (if not decades) old, and were designed for measuring different flow rates than may exist today.

The use of "area-velocity" methods, such as that provided by the Doppler ultrasonic MACE AgriFlo to measure flow in open channels, not only negates the need for costly civil structures, but also increases the overall accuracy of the measurement. Furthermore, with a MACE AgriFlo, it is possible to measure flow in open channels of an irregular shape, such as earthen channels or those cast *in situ*.

Where sites exist that have less than favourable hydraulics for accurate flow measurement, the MACE AgriFlo can be calibrated with FloCom+ software for even greater accuracy.

THE PROBLEM:

A large *Tilapia* farm based near Cañas, Costa Rica has irrigation water delivered via a large earthen trapezoidal canal (approximately 8m (25 ft) 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 *Tilapia* farm operation. The operation sought a device that could accurately measure their farm water usage whilst also being able to withstand exposure to Costa Rican heat and humidity. Furthermore, the device needed to be impervious to the very high trash loads of the delivered water.

Figure 1: *A large Tilapia farm based near Cañas, Costa Rica. The delivery channel is in the foreground of the photo.*

THE MACE SOLUTION:

The Costa Rican *Tilapia* farm installed a combined depth/velocity sensor on the side wall of their delivery channel. The cables were routed to a Series3 AgriFlo which was powered by a solar panel mounted on a pole. As the delivery channel was earthen and had a slightly non-uniform structure, MACE FloCalc was used to describe the channel shape and a polynomial equation was generated to minimize flow rate errors induced by poor cross-sectional area calculations.

Figure 2: *A Series3 AgriFlo installed on the delivery channel of the Costa Rican Tilapia farm.*

Figure 3: *The MACE combined depth/velocity sensor on the right of the picture.*

THE MACE AGRIFLO BENEFITS:

1. With MACE continuous wave advanced spectrum Doppler processing, each sensor "sees" velocities through the whole cross-section of the open channel and calculates the true average flow rate.
2. The MACE combined depth/velocity sensor provides very little obstruction to the flow and has no moving parts. With the high solid loads in the delivery channel the whole system is virtually maintenance free.
3. The versatile nature of the combined depth/velocity means it can be mounted on the side of the channel away from the effects of silting.
4. Flow recording allows the *Tilapia* farm operators to know exactly what volume of water was used and the duration of irrigation events.
5. The ability for the AgriFlo to be mounted in a remote location (away from mains power) meant that flow readings could be taken where they were most required – at the farm delivery structure.
6. The Series3 AgriFlo can be retro-fitted with a MACE FloSI telemetry card which will allow data to be remotely accessible in the future.