CASE STUDY: SEWER LIFT STATION MONITORING

INTRODUCTION:

Lifting and conveying sewage through gravity sewerage systems and force mains requires monitoring to ensure that system capacities are not under or over-utilised. Moreover, the amount of effluent entering, being treated and discharged from sewer treatment plants is a critical measure.

The FloPro is an ideal instrument for use throughout the transfer and treatment systems of municipal departments. For use in lift stations, the MACE FloPro provides an extremely accurate and inexpensive solution. By using a MACE insertion velocity sensor, the MACE FloPro can be used in pipes from 100 mm (4") to 2.5 m (100") in diameter. Furthermore, with a Series3 FloPro, up to five pumps can be monitored using one meter. A very cost effective innovation when more than a single pump is used at a pump station. In addition, the FloPro can use any of its digital inputs to monitor float switches and the like to alarm, low and/or high levels in wet wells.

Because the MACE insertion velocity sensor provides very little obstruction to the flow and has no moving parts, the whole system is virtually maintenance free.

The FloPro can be used throughout the whole treatment process. Inflows on rising mains can be monitored with the full-pipe insertion sensor, whilst in process flows traditionally measured using flumes, can be recorded using a depth sensor (either submerged or ultrasonic) and the FloPro's inbuilt flume/weir look-up tables.. Volumes of discharges from the treatment process can be equally measured using either full or partially-full pipe sensors and assessed using water quality sensors attached to the various analogue or digital inputs.

THE PROBLEM:

MidCoast Water is an authority responsible for the provision of 11 billion litres of water a year and sewerage services to 35,000 households spread over an area of 7000 square kilometres along the mid-north coast of NSW, Australia. MidCoast Water runs 18 sewage treatment plants (STP's) in their network.

MidCoast Water established a monitoring program whereby the volume of effluent would be measured at the final pump lift station in a sewer catchment, as well as at the rising main of the STP. Due to the often long distance between the two monitoring points, this information was required to detect any inflow, infiltration or leakages and ensure that treatment plant capacities were not over-extended. MidCoast Water already measured the amount of effluent entering STP's to comply with local EPA regulations. Typically, full bore magnetic flow meters were used in this application. However, the cost of full bore magnetic flow meters was deemed to be unacceptable for the intermediate lift station requirements and a suitable meter was required. The meter needed to be interfaced to the SCADA network so that any divergence in the flow measurements at either monitoring point could be alarmed and investigated.

Figure 1: *A Typical Mid North Coast lift pump-station near Kempsey, NSW.*

The MACE solution is on the following page

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THE MACE SOLUTION:

MidCoast Water installed four MACE Series3 FloPro's on lift stations near Forster, NSW. A typical station had a 600mm (24") pipe-line diameter and the average flow was 12ML/day (4.9 cfs). A MACE 2" insertion sensor was installed in the pipe. The installation was carried out through a "wet-tap" which meant that the sensor could be installed without shutting down the lift station or costly pipe work. A 4-20mA output (proportional to flow rate) was interfaced to the SCADA network to enable remote monitoring and alarming.

Figure 2: *A Typical Mid North Coast sewer treatment plant (STP) near Kempsey, NSW.*

"MidCoast Water report an installation saving of at least $35,000 per pump station. Additional savings of at least $20,000 were made for each pump station on the upfront price of the Series3 FloPro when compared to the purchase of a suitably sized electromagnetic flow meter...."

Figure 3: *MACE 2" insert sensor suitable for full pipes between 100mm to 2.5m (4" to 100")*

THE MACE FLOPRO BENEFITS:

1. MidCoast Water report massive savings in the up front meter costs and associated installation costs of the FloPro installation when compared to the purchase and installation of an electromagnetic flow meter. The installation of the insertion sensors via a "wet tap" method meant that the whole flow meter was extremely easy and economic to install as the pump station did not require shutting down, major pipe-work or flanges. Furthermore, because the insertion sensor can be buried without the need for a meter "pit", MidCoast Water report an installation saving of at least $35,000 per pump station. Additional savings of at least $20,000 were made for each pump station on the upfront price of the Series3 FloPro when compared to the purchase of a suitably sized electromagnetic flow meter.
2. 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.
3. The MACE insertion velocity sensor provides very little obstruction to the flow and has no moving parts. With the high solid loads in the effluent the whole system is virtually maintenance free.
4. Flow recording allows MidCoast Water to analyze exactly when effluent was transferred to the STP as well as providing the "auditing" check of the volume.
5. Because the same insertion sensor can be used in any pipe sized from 4" to 100", should the pump station be upgraded in the future, the same flow meter can be used.
6. At pump stations where multiple pumps are present, the Series3 FloPro with the ability to accept multiple flow sensors, is an extremely cost-effective solution to the monitoring problem.
7. The Series3 FloPro includes an Input/Output card which allows MidCoast Water to use a 4-20mA output as a SCADA interface and also have the ability for additional sensors (such as wet well level) to be interfaced in the future.