



CASE STUDY 4

Cost Implications of a Collapsed Underground Pipe

OVERVIEW

Burdekin sugarcane grower John Davenport uses two pumps to furrow irrigate 52 hectares of sugarcane using a mixture of groundwater and channel water. Prior to the energy efficiency assessment, he was quite happy with the volume of water the pumps were producing, and believed that his pumps were running efficiently. An energy efficiency assessment was carried out on his open water pump. The pump was operating at an acceptable level of efficiency for the duty being performed, however concerns were raised due to the higher than expected delivery pressure and the total power consumption required to move the water to the delivery point. A total pressure equivalent to pumping over 21 metres of vertical height was measured. With an elevation of less than 7 metres from the water supply source to the top of the delivery cylinder, located approximately 50 metres away, it was clear that the operating pressure and power consumption (or pump duty) was far in excess of what would be expected. This indicated high friction losses somewhere in the system causing excessive power consumption. Further investigations found that the pipe delivering water to the cylinder had collapsed under a roadway (see figure 1).

“ I thought the pump was running quite ok. It was pumping a fair bit of water, so I just put the cost of pumping down to rising electricity prices.”

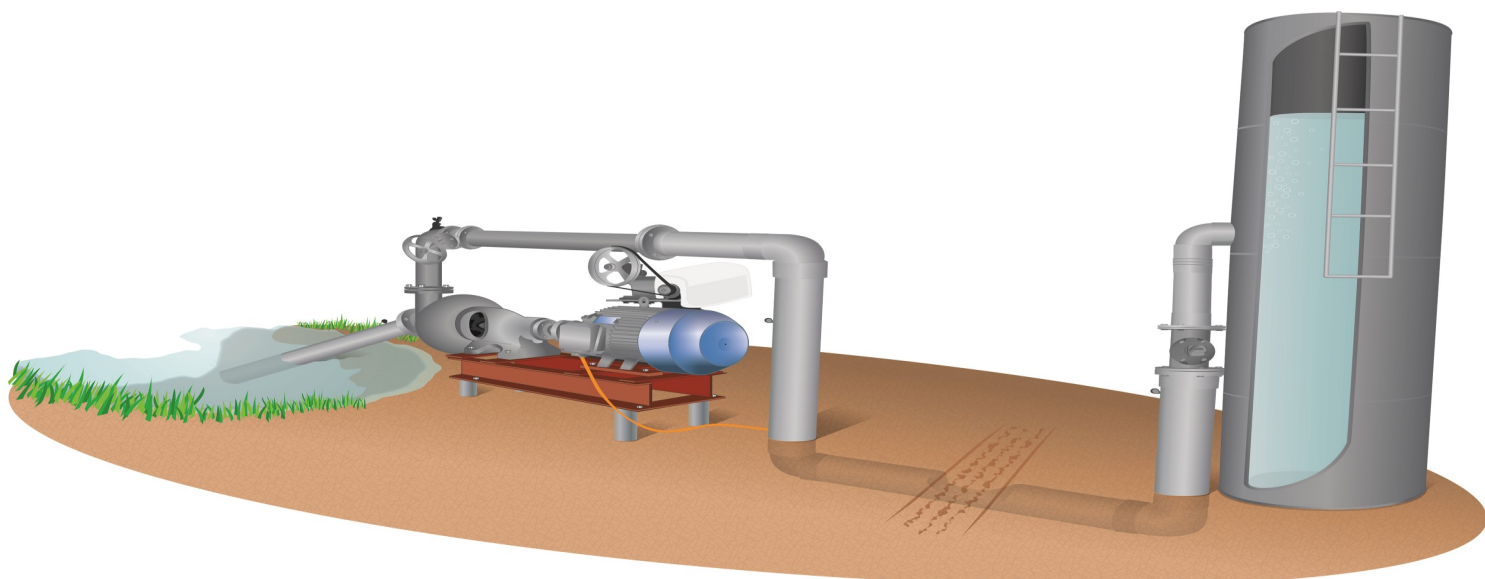


Figure 1—Graphic representation of the fault in the pipe underneath the roadway

THE ASSESSMENT

An energy efficiency assessment was undertaken on a 25hp centrifugal pump used to pump from an open water source. This assessment involved collecting inlet and outlet pressure at the pump, **water flow** (measured in litres/second using an ultrasonic flow meter), and **energy consumption** (measured in kilowatt hours (kWh) using the electricity meter on site). The pump was set to perform at its most regularly used operating duty and was allowed a period of time to stabilise before any measurement was taken. Water flow and energy consumption were measured over a one hour period to overcome any short term fluctuations.

RECOMMENDATIONS

Due to the high pumping costs, and excessive total dynamic head measured, it was recommended that the cause of the high losses be determined, and a plan implemented to make the necessary system changes. It was also suggested that the grower consider:

- an increase in the delivery pipe size and the ancillary fittings at the pump discharge to reduce the friction losses and the power requirements to operate the system;
- changing the pump to a pump more suited to the required workload; and
- the use of tariff 66.

REMEDIAL ACTIONS

As a first step in examining the cause of the high friction losses, John contracted a local plumber to investigate. The plumber inserted a camera into the discharge pipe and found that the pipe had collapsed under a roadway approximately 15 metres away from the pump. The cost of this investigation was approximately \$160.

OUTCOMES

As a result of the energy efficiency assessment, John has decided to purchase a new pump that would be better suited to the infrastructure in place and to replace all of the pipework associated with the pump. He plans to replace the entire 66 metres of six inch delivery pipe with an eight inch pipe to reduce friction losses, and to run the new pipe through a concrete cylinder under the roadway. This is estimated to cost a total of \$11,000, \$7,000 for the pipework and \$4,000 for the pump.

The only thing that John is waiting for... Is rain! He estimates that the project will take approximately 10 days to complete and therefore is waiting for enough rain to ensure that the crop will not need to be irrigated for this time. After doing a cost benefit analysis, John believes that upgrading the pipework will save him approximately \$55 per week on his electricity bill, or \$2,860 per year. Upgrading the pump will result in more savings being made. Therefore, the cost of upgrading the system will be paid back in less than four years.



From left to right; The pump the assessment was carried out on, the water cylinder the pump delivers water to, the grower with his new pipes—ready to go into the ground when rain arrives to irrigate his crop.



RESULTS

The energy efficiency assessment concluded that the pump was running quite efficiently at 70% efficiency. The pump was also pumping water at the expected rate of 59 L/s. However, the energy consumption was unusually high at 92.37 kWh/ML, resulting in an average energy cost of \$22.50/ML (Table 1). Total dynamic head was also measured to be 21.7 m, which was excessive for the distance the water was being pumped. This means the grower's irrigation was costing him \$115.53 per day.

Table 1-Measured results from the energy efficiency assessment

Flow Rate (L/s)	59
Energy Consumption (kWh/ML)	92.37
Energy Cost (\$/ML)	22.50 *

**This cost is calculated based on pump use pattern of 50% peak & 50% off peak charges based on tariff 65 charges at the time of assessment. Ergon service charge not included in cost calculation.*

ACKNOWLEDGEMENTS

BBIFMAC would like to acknowledge John Davenport (participating grower), Merv Jessen (irrigation services contractor) and Carlo Tomarchio (photographs).



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