The National Centre for Engineering in Agriculture (NCEA) received funding from SRA to investigate the automation of furrow irrigation in the sugar industry. The first phase involved a review of potential commercially available control hardware, sensors and radio systems. The most suitable combination of automation equipment was selected and automation systems on three Burdekin farms were installed. These farms were chosen because they represented three different, but common, types of irrigation infrastructure.

The sites are: delta farm (Airville) with multiple pumps, interconnected pipelines and recycling; BRIA farm (Upper Haughton) with channel supply and no pumping or recycling; BRIA farm (Leichhardt) with river pumps and recycling.

All three farms are using WiSA radio equipment and software which can enable the control of existing butterfly valves and pumps and can interface with a wide variety of monitoring devices.

This is a computer-based system which stores all the information on the grower’s own computer – as opposed to a web based program that stores data online (the cloud).

Radios are used to convey information and instructions between the computer/base station and the field. Sensors can be used to detect problems in the supply system and notify the grower or shut the system down if desired. End of row sensors can be added to enable the system to self adjust run times to manage tail-water volumes.

The system design and equipment required is different for each farm, and this affects the cost. For the project sites, the total cost per hectare ranges from $600/ha at the Upper Haughton site to $2,200/ha at the Airville site. This is largely a reflection of the area supplied by each valve and the number of pumps. Each of the growers has contributed to the system with their own funding, in addition to the funding provided by Sugar Research Australia (SRA).

The equipment that has been installed on the project farms is designed to be modular. That is, different areas can be automated as time and funds permit. It is not necessary to automate the whole farm at one time.

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### Overview

**Site details**

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### Equipment description

**Base station and computer**

Communicates with all field radios, is generally a once-off cost regardless of the size of the system.

**Pump controller**

For remote starting and stopping of pump.

**Pressure transducer**

Provides a way to monitor the system e.g. if the pressure rises above a calibrated level then it is likely that one of the valves hasn’t opened.

**Actuator control radios**

Controls the opening and closing of the valves (hydrants). Each radio is capable of controlling at least two actuators, each must be located within 10m of the radio.

**Linear actuators**

Open and close the butterfly valves.

**Advance/Drainage monitoring radios**

To relay data from the advance/drainage sensors so that either the farmer can be notified or can be used to automatically start the next irrigation set.

**Advance sensors**

Buried soil sensor to detect water advance before it reaches the end of the field.

**Drainage sensors**

Sensor to detect water level in the end of field drain.
The following table contains a breakdown of costs for each site. The figures reflect a best estimate of these costs at a commercial rate installed in the field rather than simply raw component costs.

<table>
<thead>
<tr>
<th>Site</th>
<th>Upper Haughton</th>
<th>Leichhardt</th>
<th>Airville</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation delivery system</td>
<td>Gravity feed</td>
<td>River pumps and recycling</td>
<td>Bores, open water and recycling pumps</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>82</td>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td>Total cost</td>
<td>$49,700</td>
<td>$63,365</td>
<td>$59,700</td>
</tr>
<tr>
<td>Cost/ha</td>
<td>$606</td>
<td>$1,290</td>
<td>$2,211</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment installed at each site</th>
<th>No.</th>
<th>Cost</th>
<th>No.</th>
<th>Cost</th>
<th>No.</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base station, pc &amp; software</td>
<td>1</td>
<td>$6,900</td>
<td>1</td>
<td>$7,700</td>
<td>1</td>
<td>$7,700</td>
</tr>
<tr>
<td>Pump controller &amp; installation</td>
<td>0</td>
<td></td>
<td>2</td>
<td>$7,000</td>
<td>1</td>
<td>$3,500</td>
</tr>
<tr>
<td>Pressure transducer</td>
<td>1</td>
<td>$800$^1</td>
<td>2</td>
<td>$800$^2</td>
<td>1</td>
<td>$800$^1</td>
</tr>
<tr>
<td>Water meter &amp; installation</td>
<td>0</td>
<td></td>
<td>2</td>
<td>$11,465</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Actuator control radios</td>
<td>5</td>
<td>$15,000</td>
<td>6</td>
<td>$18,000</td>
<td>5</td>
<td>$15,000</td>
</tr>
<tr>
<td>Actuators, brackets &amp; fitting</td>
<td>5</td>
<td>$4,500</td>
<td>11</td>
<td>$9,900</td>
<td>8</td>
<td>$7,200</td>
</tr>
<tr>
<td>Advance monitoring radios</td>
<td>3</td>
<td>$9,000</td>
<td>2</td>
<td>$6,000</td>
<td>5</td>
<td>$15,000</td>
</tr>
<tr>
<td>Advance sensors &amp; installation</td>
<td>5</td>
<td>$8,500$^3</td>
<td>3</td>
<td>$2,500$^4</td>
<td>6</td>
<td>$5,500$^4</td>
</tr>
<tr>
<td>System commissioning</td>
<td>1</td>
<td>$5,000</td>
<td>1</td>
<td>$5,000</td>
<td>1</td>
<td>$5,000</td>
</tr>
</tbody>
</table>

Notes

(1) 4m submersible transducer

(2) 4m external transducer

(3) In-field sensors – extra cabling and trenching required

(4) Drain sensors

For more information

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