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Introduction and Background

Seed Consulting Services (Seed) (supported by Atnik Solutions) installed water blending equipment at Moonee Hills Pastoral, near Field (5265) on the Coorong SA. The site was selected because water from SA Water mains is delivered to a centrally located water tank (hilltop location) and blended with two saline bore water sources (wedge holes) to create a single source of water for stock watering purposes. Salinity management is an issue, as is the cost of SA Water mains.

Figure 1
Water Blending Unit and components

The intent of the trial was to determine if salinity blending could be achieved that created time and cost savings by fully automating the process.

Materials and Methods

An automated blending valve was installed at the existing blending tank (receival point for SA Water, and two groundwater supplies). The blending valve was connected to a microprocessor controller, with power supplied by a battery and solar panel.

The list of components used is as follows:

Automated blending trial		
Water sources: Mains water and saline groundwater		
Equipment Used		quant
Salinity (EC) probe	Conductivety sensor 4-20mA output	1
Blending valve	Electric actuated ball valve - proportional control (4-20mA)	1
PLC controller	Allen Bradley Mictologix PLC 1100	1
HMI touch screen 4"	Allen Bradley HMI PV800 4"	1
Enclosure	Steel power coated cabinet 500 x 400 x 210	1
Relays	24 VDC coils	2
Battery 24 VDC	2 x 18 Ahr	2
Solar panels 24 VDC	2 x 60 watt	2
Solar regulator	10 amp	1
9..30/24VDC power supply		1
Circuit breaker	10A	1
Pushbutton		1
2 position switch		1
Ethernet patch cables	1m	2
Terminals		15
Antenna	900 MHz dipole	1
Concrete and steel		
Float switch	10m of cable	1
Pipe fittings Butlers		
Pipe fittings Meningie		

The system was pre-configured and tested by Atnik Solutions and then constructed onsite by Nick Cumming (Atnik Solutions) and Andy Chambers (Seed). The system was connected to a 3G modem to enable remote monitoring, settings change and data download and upload.

Figure 2
Alamil Pastoral company was selected for the water blending trial due to the high cost of SA Water and existing use of simple, but uncontrolled blending technology to mix two sources of groundwater with the SA Water mains

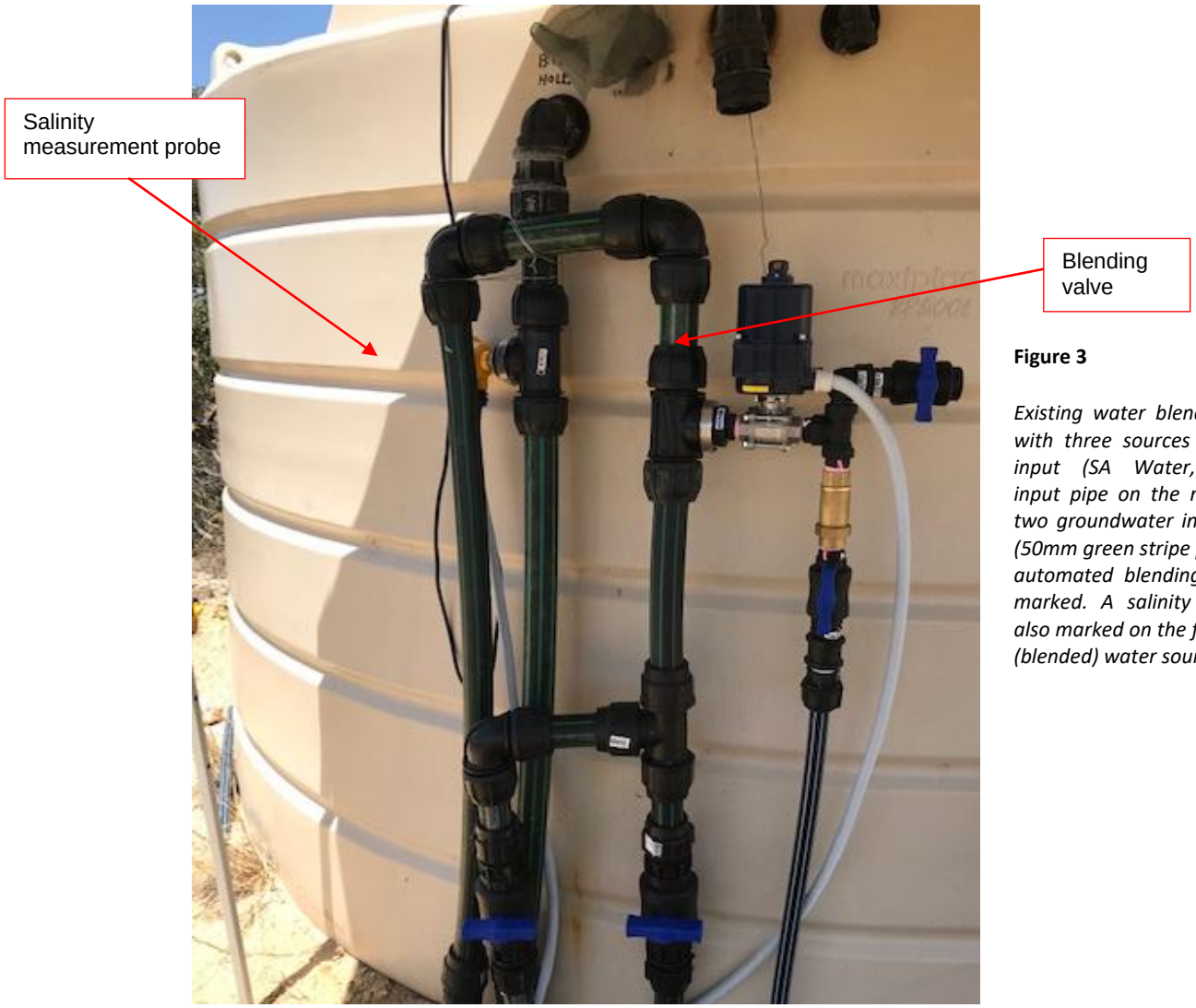

Figure 3

Existing water blending tank with three sources of water input (SA Water, smaller input pipe on the right) and two groundwater input pipes (50mm green stripe poly). The automated blending valve is marked. A salinity probe is also marked on the final input (blended) water source.

Figure 4

Control box located adjacent to the blending tank indicating the solar panels providing power to the system battery (See Figure 5).

Figure 5

Control box showing the power supply battery, microprocessor control equipment and modem for remote connection.

Results

Indicative flow rates and salinities from the three sources of water and estimates for cattle water needs are as follows:

	uS	L/min	Hrs per day	L / day	
Big wedge hole	5100	25	8	12,000	
Small wedge hole	3500	31	8	14,880	
SA water	300	15	24	21,600	
			Total inflow	**48,480**	
				550	head of cattle
				100	L / head
				55,000	L / day required

Following system install, configuration, and testing the system was actively monitored for a period of 2 weeks to ensure security of water supply.

Initial data downloads are indicated in the following figures (Figure 5).

Coorong water blend

Date	Time	EC	Valve	Battery
23-Jan	13	4493	96	294
23-Jan	14	4615	101	305
23-Jan	15	4750	100	304
23-Jan	16	5116	100	311
23-Jan	17	5397	100	303
23-Jan	18	5067	100	299
23-Jan	19	4054	100	283
23-Jan	20	940	1	265
23-Jan	21	952	1	264
23-Jan	22	965	1	262
23-Jan	23	965	1	262
24-Jan	0	965	1	261
24-Jan	1	1001	1	260
24-Jan	2	1038	1	260
24-Jan	3	1050	1	259
24-Jan	4	1013	1	258
24-Jan	5	1026	1	258
24-Jan	6	1013	1	257
24-Jan	7	1038	1	257
24-Jan	8	5519	100	257
24-Jan	9	6166	100	258
24-Jan	10	5665	100	271
24-Jan	11	3651	65	279
24-Jan	12	4017	14	301
24-Jan	13	3712	6	303
24-Jan	14	4298	15	310
24-Jan	15	4054	13	316
24-Jan	16	3663	20	307
24-Jan	17	4151	23	299
24-Jan	18	4432	30	296
24-Jan	19	672	1	269
24-Jan	20	427	1	265
24-Jan	21	342	1	264
24-Jan	22	342	1	263
24-Jan	23	305	100	262
25-Jan	0	269	100	262
25-Jan	1	269	100	261
25-Jan	2	281	100	260
25-Jan	3	281	100	259
25-Jan	4	293	100	259
25-Jan	5	281	100	258
25-Jan	6	317	100	257
25-Jan	7	330	99	257
25-Jan	8	3800	58	264

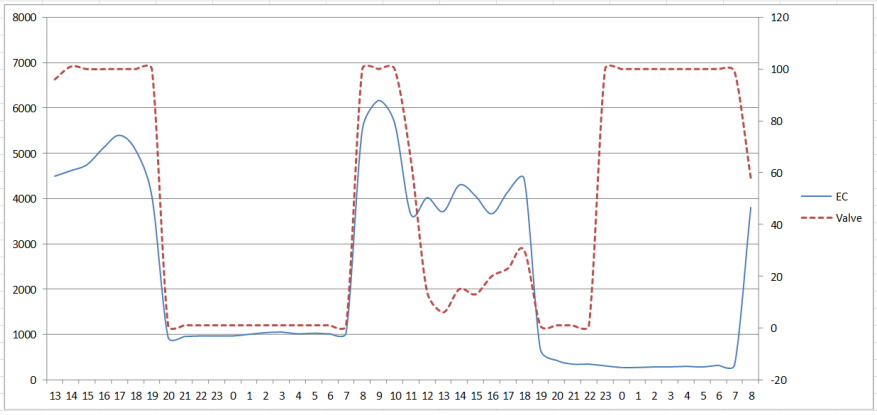

Figure 6 *Indicative salinity (EC) data as the automatic valve cycled through seeking to achieve a constant salinity (to tank) of 3500 EC*

As the trial progressed it become apparent that there was limited pressure available through the SA Water supply (some 50m+ head) to the header tank located on top of the hill, to the extent that there was insufficient flow to compete against the higher flows and higher salinities of the two groundwater supplies.

As a consequence it was very difficult to maintain the desired salinity output from the blending valve to the storage tank.

Some battery voltage and software command issues were experienced which resulted in the valves switching off for a period of time. Componentry was swapped out (replaced) but the key issue maintained to be lack of flow and pressure from the SA Water supply to achieved the desirable salinity outcome i.e. approx 3500 EC.

The equipment has now been removed and a second site is been sought to trial different flow rates. Reinstallation will occur during Autumn 2020.

In March 2020 two field days were held to demonstrate the equipment. The water blending equipment was installed on two display stands and the potential of the equipment and installation learnings was discussed with field day participants.

Figure 7

Discussing water blending equipment with field day participants (Coomandook SA, 6/3/20)

Figure 8

Control box showing the power supply battery, microprocessor control equipment and modem for remote connection.

RESULTS

Key Learning

There is a need to establish pressure and flow rates of all input sources prior to installation. Seeking landholder input into establishing these parameters before contemplating installation is needed. Blending equipment, flows and pressures and tank storages then need to be matched accordingly.

Some situations will not be suitable for this type of automated water blending due to either a lack of mains water pressure or flow, or the inability to shandy source water (highly saline groundwater) sufficiently. This will be site and source dependant (e.g. source and flow of saline water).

Radio telemetry and cellular networks are important in terms of the efficient running and management of an automated system. There were some problems with the equipment with poor quality capacitors not functioning properly which resulted in the SA Water mains being switched off in hot weather, requiring the property owner to manually open the valve. This is not ideal and led to some loss of confidence in the equipment on the trial site. Lack of pressure from solar pumps and valves also resulted in the system switching off. These aspects have now been resolved and will be tested again in a second installation.

The Business Case

The total cost of componentry and installation was approximately $15,000. There is evidence that a number of landholders in the region are using between $50,000 and $100,000 of SA Water (main water) for stock watering purposes. In these cases a saving of 5% per annum of expensive mains water would provide a 3 year payback (return on investment) which is considered reasonable for this type of operation.

For landholders using $5,000-$10,000 mains water per year, the cost savings and return on investment (ROI) maybe marginal. Other factors such as remoteness, desired salinity level (for stock) and work flow aspects may influence decision making.

There is also a time and knowledge saving benefit for use of automated shandying equipment. In particular reducing regular travel to water points to open valves manually and check salinity levels. This saving in time is viewed beneficially by landholders and cannot be discounted as a valuable cost benefit.

Overall the trial appears to demonstrate that automated salinity blending is possible using simple automation equipment, software and radio telemetry and cellular networks. Further testing is needed to ensure that equipment is fully functional and that troubleshooting can be simple and effective. The equipment is soon to be reinstalled and testing will continue outside of the project with view to developing a commercial unit.

The response from landholders was very positive and enquiries have been received with a view to install commercial units.

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