final report

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PDS Remote Water Management (Roma Region)

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Abstract

The aim of the Producer Demonstration Site (PDS) project on remote water management for the Roma region was to increase adoption of remote management technologies and to address producers' concerns about telemetry equipment e.g. reliability, serviceability and technical support while demonstrating the financial and other benefits of this technology.

The design and installation of equipment within each PDS was overseen by the Department of Employment, Economic Development and Innovation (DEEDI) who also monitored the use and quantified the benefits for each PDS. Field days that demonstrated the benefits for each producer site were well supported by local producers, financial providers and other government and non-government agencies.

The results of the PDS have shown that producers can expect to recover their investment outlay within the first year or two of adopting this technology. Those who attended the field days now have a better understanding of the costs and benefits of remote monitoring and are more likely to adopt this technology in the future.

Executive summary

For some time beef producers in the Roma area have been discussing how they could use telemetry to monitor a number of parameters and improve farm management practices, thereby potentially reducing costs, improving efficiencies and increasing productivity. With the ongoing reduction in availability of farm labour (particularly reliable, permanent staff) and the ongoing cost-price squeeze, managing the family farm is becoming more problematic.

Telemetry systems are not new and have been used by other industries for decades. However the use of this technology for grazing and other rural industries has only seen serious development in the past six or seven years. Prior to this, equipment developers tended to be small backyard enterprises producing custom-built systems with poor product reliability and questionable backup service. This resulted in negative attitudes towards telemetry systems from both producers and equipment suppliers.

There are now a number of companies that are packaging a range of electronic monitoring devices to assist farmers to reduce costs and minimise labour and vehicle usage. However, producers generally had little technical knowledge about this equipment and it's potential. This lack of knowledge and the concerns of equipment reliability and after sales service made producers reluctant to adopt this technology.

This Producer Demonstration Site (PDS) project was set up to increase adoption of electronic monitoring, for one or more labour demanding management practices, through demonstrating its on-farm set-up and use in the Roma region. Benefits that were evaluated included savings in labour and vehicle-related expenses.

At the start of the PDS, project meetings were held at Roma with producers and potential local suppliers to discuss the current development of telemetry-based monitoring and control systems, and the potential benefits of this technology for the beef industry. Three producers showed particular interest and agreed to be part of the PDS. As a consequence of the project meetings, the local pumping equipment suppliers changed their opinion of this technology which resulted in them taking on the local dealership for this telemetry equipment.

Commercially available Observant telemetry systems were installed at Charles Nason's property "Banoona", south east of Roma, and Grant Maudsley's property "Rainmoor", north of Morven. Warrick and Kell Freeman of "Meeleebee Downs", north of Wallumbilla, showed interest in the early stages but later withdrew from the project as they decided the technology would not be suited to the particular water system on "Meeleebee".

The component selection, purchasing and installation at "Banoona" was conducted by the producer and was supervised by DEEDI staff to evaluate the complexity, issues encountered and technical support available for a do-it-yourself (DIY) process. This installation was a standard Ultra High Frequency (UHF) system with the monitoring of tank levels and bore operation from a computer at the homestead on the property. The installation at "Rainmoor" was conducted by Pumps'n'Solar, the equipment supplier from Roma, and monitoring was via a modem through either the Telstra NextG network directly or a web-based server managed by Observant.

An economic analysis of the costs and benefits was conducted for each producer. The cost-benefit for each property was calculated on labour and vehicle savings directly related to visiting the remote sites but also included a management cost for accessing and interpreting the data. Each property demonstrated financial gains of $6,700 and $14,400 per year

resulting in an annual return on investment (ROI) of 58% and 96% and break even point at 1.7 years and 1.04 years for “Banoona” and “Rainmoor” respectively.

Field days were held at “Banoona” Roma, and “Holly Downs”, south east of Augathella, to inform local producers of first hand experiences and benefits of using this technology. The field days included presentations by:

- technology experts
- local beef producers
- equipment manufacturers and suppliers
- finance providers and consultants

The main objective of the field days was to have producers talk about the reasoning behind adopting this technology, any difficulties with installation, operation or equipment reliability, and the financial or other benefits experienced through using this technology.

A total of 34 producers attended the field days with 75% of feedback indicating an interest in adopting this technology in the future. Finance providers and advisors who also attended the field days gained a better understanding of the potential of this technology and indicated their support regarding access to loan funds and promotion of electronic monitoring technologies to their clients.

Improvements in animal welfare and staff safety were also identified as important additional benefits from adopting these systems. By having the ability to efficiently and regularly monitor remote watering points, and to respond quickly when serious issues occur, improves animal welfare. Observant’s web-based management service enables alarm conditions to be sent directly to a producer’s mobile phone which further improves response times and management options. Minimizing staff travelling times, and the time spent working alone in remote areas, also improves staff safety.

Contents

1 Background

1.1 Telemetry for monitoring and control in the grazing industry

In 2006 Kondinin and the Queensland Department of Primary Industries & Fisheries (QDPI &F) conducted a review of telemetry equipment or systems currently being used in the grazing industry. The results indicated that two telemetry systems were being adopted by large beef production companies whereas smaller family enterprises were not adopting and benefiting from this technology.

The GME electrophone system uses UHF radios plus an input/output printed circuit board that interfaces to the radio to enable the telemetry option that can be used to monitor digital inputs to indicate water and fuel tank levels at predetermined points and control digital outputs that allow switching pumps etc. This system is simplistic in operation and with available software can be used successfully for on-farm applications. The issue is that the overall system for each property is custom built and requires technical electronics knowledge which may be beyond the capability of many beef producers for a DIY installation.

The Observant system provides a plug and play solution for the grazing industry where a system can be purchased and installed by a producer with limited technical knowledge. This system also uses more advanced technology and offers more flexibility regarding the number and type of sensors per installation site and the accuracy of information. The Observant system can also incorporate a modem for NextG Telstra network or satellite communication for off-farm remote access.

The review also provided information about other systems used in other industries which have limited transmissions distances (approximately 10 km) and which were not being adopted by the grazing industry.

The advantages of using telemetry to monitor tank levels and control bore pumps etc. had not been quantified before, and this led to the development of this PDS project.

2 Project objectives

To demonstrate and evaluate, on three properties in southern Queensland, the following:

- the establishment, use and reliability of remote water monitoring systems;
- the impacts on farm costs (labour, vehicle, fuel, etc.); and
- the ability to redeploy existing labour and improve labour efficiency.

The research component of this project evaluated:

- the process of establishing remote water monitoring systems on three properties;
- the use and reliability of the system and components
- the technical support provided
- the impact on farm costs (labour, vehicle, fuel etc.)
- the ability to redeploy existing labour and improve labour efficiency

The adoption component of the project aimed to increase adoption of remote management technologies by local producers to at least 10 systems by 2014.

3 Methodology

3.1 Participant selection

The PDS required three properties to have water monitoring systems installed. To generate interest a meeting was held in Roma to discuss the capabilities and limitations of available equipment options. Five beef producers and two representatives from a pumping equipment supplier attended this meeting where the current status of development of this technology was discussed and concerns were aired. At this meeting three producers showed interest and requested more information on equipment requirements and pricing of a system to suit their property.

A second meeting was arranged in Roma to further investigate the Observant solution for interested producers. A director for Observant attended this meeting to respond to questions regarding equipment selection, operation, reliability and technical support. Practical demonstrations of the system and equipment requirements and costing were further investigated for each property.

The outcome of the second meeting was that Charles Nason, Warrick and Kell Freeman and Grant Maudsley decided to continue in the PDS project and install Observant telemetry equipment at “Banoona”, “Meeleebee” and “Rainmoor”, respectively. Mark Huntley of Pumps’n’Solar, who initially was negative because of bad experiences with telemetry systems in the 1990’s due to poor reliability and technical support, changed his opinion and decided to become a distributor for this equipment and to provide in-kind support for this project.

3.2 Property site visits

Each property was visited and implementation plans developed regarding the number of remote sites monitored and the selection of sensors/controllers for each site. Mark Huntley provided invaluable advice regarding possible efficiency improvements for the water supply systems on each property.

The three telemetry system requirements varied sufficiently to provide a range of different applications for this technology. For example:

- The PDS installation at “Banoona” - to demonstrate a typical UHF system monitored on-farm and installed by the producer.
- The PDS installation at “Meeleebee”- to demonstrate a typical UHF system monitored on-farm but installed by Pumps’n’Solar with control of electric bore pumps. This PDS would also evaluate the potential for improvement in labour and vehicle efficiencies and redeployment of the current employee for other tasks.
- The PDS installation at “Rainmoor”- to demonstrate the use of the Telstra NextG telemetry system monitored off-farm.

During additional site visits the “normal” water management practices were investigated. Although these practices were not previously documented at “Banoona” or “Rainmoor” a half day meeting with each producer enabled the project team to determine the current labour commitment and vehicle mileage. As “Meeleebee” employed a fulltime position to check the bores, tanks, turkey nests and associated plumbing, quantifying the labour costs was simplified. To quantify the vehicle and actual labour costs relating to water management a Global Positioning System (GPS) tracking device was installed on the dedicated bore run vehicle and data was recorded for a period of 6 months. Other vehicle costs e.g. fuel, servicing etc. could be determined from the GPS data. A database (Figure 1) was also developed to enable easy efficient water management data entry for each property. This database was designed to simplify data entry using dropdown lists and also enabled efficient and accurate quantification of labour and vehicle costs for pre and post instillation of the remote management telemetry systems on each property. It proved very difficult to get the producers to document their water management practices and the database was not adopted by the producers. Data for pre and post analysis was determined by personal interviews with producers.

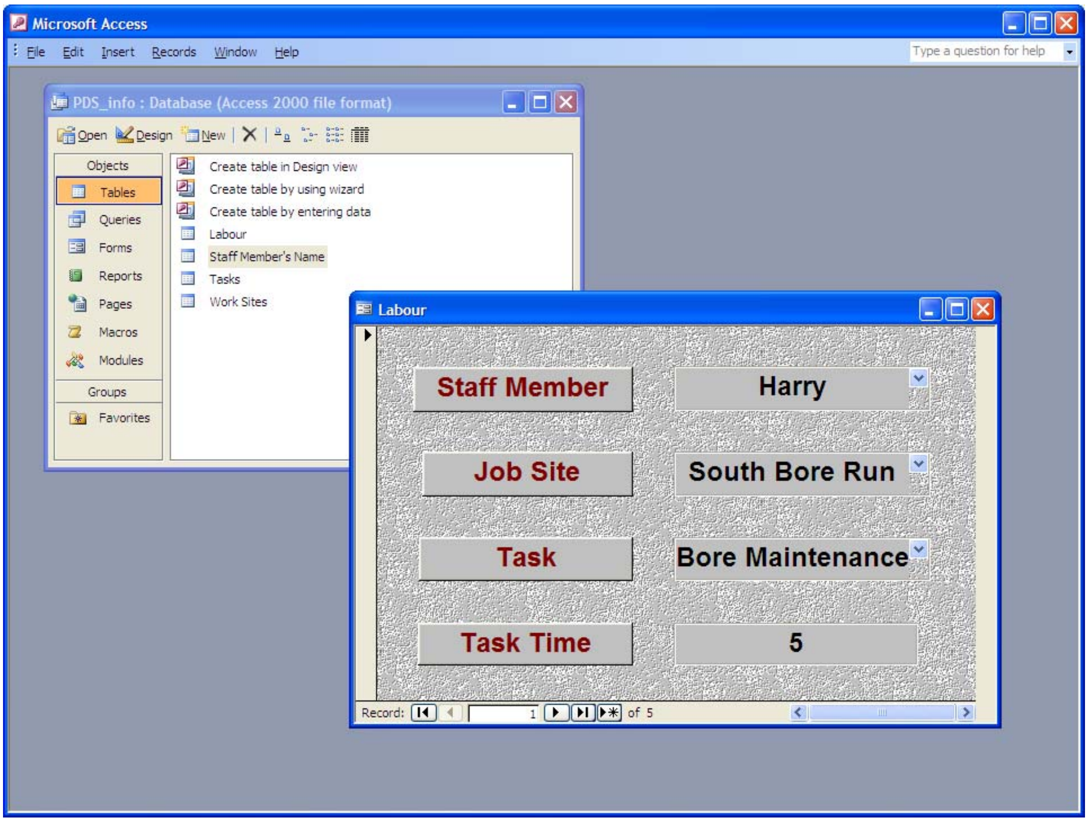

Figure 1. Database to record labour and vehicle usage

From the data provided by each producer an economic analysis of normal water management practices was conducted and reported in Milestone 2 and summarised in section 4 of the Results and Discussion chapter of this report.

3.3 Site installations

Installations were conducted at two of the three properties as Warrick and Kell Freeman chose not to install a system. Their reasons for withdrawing from the PDS is explained in a letter from them dated the 1st of April 2009. This document will be analysed in the results and discussions section.

3.3.1 Banoona:

"Banoona" is approximately 10,000 ha in area with 8 bores, 6 in use with 4 extensively used, 19 tanks and 45 troughs with approximately 900 head of cattle. The total bore run is approximately 57 km and water point inspections occurred randomly. The investment for this instillation was $11,600 which included a base station (located at the farm house) and 3 remote monitoring sites. At the 3 remote sites, water levels were monitored in 2 tanks and water flows were monitored from bores with 5 electronic flow meters. These sensors provide information about the amount of water available to cattle and water usage. The monitoring system also provides valuable data about the condition of the water system enabling early detection of faults and leaks.

The installation was conducted by the producer Charles Nason (Figure 2). There were a few small issues during installation. These issues related to difficulties in understanding technical terminology used in installation and instructions manuals, and getting the computer configured to run the Observant software. The issues relating to the computer setup were overcome by contacting Observant for technical support.

Figure 2. Charles Nason installing Observant C1 unit

For example, Observant C1 Manager needs Java installed before it will run. The installation program gives the choice of downloading Java or installing it from a compact disk (CD). This was outlined in the software installation chapter of the User Guide however Charles required assistance from Observant to install Java due to his lack of knowledge regarding security settings etc. on the computer.

Also, the first time the Observant software is run in normal operation, Windows will pop up a warning and ask for permission to run the software. For some reason the Observant software had been blocked from running and this had to be reversed before the software would successfully start. The executable file “C1Manager.exe” needed to be removed from the list of blocked programs in the Windows firewall configuration.

3.3.2 Rainmoor:

“Rainmoore” is a 6,500 ha remote property approximately 165 km from the homestead at “Nalpa Downs” with about 10 watering points and approximately 400 cattle. The equipment installed cost approximately $15,000 (including installation) and allowed remote operation of the bore pump with a motor controller, monitoring the water level in a turkey nest and water flow out of the turkey nest to troughs with 3 flow meters. It used the Telstra 3G network and the World Wide Web for data access and was accessible via a dialup modem or via an Observant server using the internet.

This system was purchased through Pumps'n'Solar (the local supplier of agricultural, electronic and pumping equipment) who also installed all components. The quality of the installation was of a very high standard with all cabling protected from potential damage via electrical conduit. Figure 3 shows the installation for the bore pump at Rainmoor.

Figure 3. Observant bore installation at Rainmoor.

The only issues regarding the installation resulted from the producer dealing directly with Telstra to organise the sim card and data plan for their 3G connection. As a result of limited knowledge and communication between the producer and Telstra staff the incorrect data plan was provided costing the producer for services that were not required. This issue took a number of months to resolve as Telstra staff in Roma had no experience with Telstra's product interfacing with these telemetry systems.

3.4 Field days

Field days were held at "Banoona" 1441 Condamine Hwy, Roma on the 29th of September 2010 and "Holly Downs" Landsborough Hwy, Augathella on the 13th of April 2011.

The purpose for the field days was to present an independent evaluation of the capabilities and benefits of remote management technologies for use on grazing properties in the Roma region. The aim was to focus on an assessment of this equipment from a producer's point of view.

At each field day three producers spoke about their own installations, including:

- how they use the system
- the reliability of their system and components
- the technical support they received
- the impact on farm costs (e.g. cost and benefits)
- understanding the data produced by the system.

4 Results and discussion

4.1 Banoona

4.1.1 Use and reliability

Apart from the initial issues with program set-up on the computer, Charles Nason has accessed the telemetry system on a daily basis over the past two years and has detected and rectified a number of water leaks as they occurred. He has learned to interpret trends, and has gained a good understanding of water usage through correlations between water flow, tank levels, stocking rates, pasture condition and climatic data.

He identified a water leak that occurred within the first two months of the monitoring operation. The leak was in an area not normally visited during a bore run, and may have continued for weeks or even months before being detected. The leak was identified and rectified within a couple of days of the fault occurring which potentially saved thousands of litres of water and the cost of electricity for increased operation of electric bore pumps to maintain tank water levels.

Although the reliability of the telemetry system has been excellent, Charles Nason experienced a problem with a flow meter and a tank level sensor. The fault with the flow meter presented as erratic flows that were inconsistent and did not correlate with the expected values represented in historical data. A phone call to Observant resulted in advice to check wiring etc. before Observant through Pumps'n'Solar (Roma) replaced the flow meter and cable at no cost. The issue regarding the reliability of the ultrasonic flow meters has led to this type of flow meter being replaced by Observant with mechanical paddle type flow meters at no cost. The tank level sensor failed and was also replaced under warranty. These have been the only equipment reliability issues for the period that the system has been in use.

4.1.2 Benefits

As Charles Nason's management system had no designated bore or water run it was difficult to quantify the effect of such a remote management system on labour or the benefits to production. However he indicated that he reduced the time that was spent checking tanks, troughs and the bores by ½ to ¾ but also indicated that he spent time learning to interpret and trust the data which has in turn changed his management practices (reduced time spent checking water levels in tanks and troughs).

Table 1 quantifies the costs and benefits based on information from Charles Nason about his previous and current water management practices. The data in the table uses a value of $30/hour for labour and a total vehicle cost per km based on the published RACQ total running costs (2009) for a 3 litre Toyota Hilux (diesel). I have chosen this vehicle as the standard for all cost-benefit comparisons.

Table 1 shows the estimated savings of $7,900 per year. However allowing for a 10% depreciation of $1,160 and on-going costs gives an annual saving of $6,731. An annual return on investment (ROI) of 58% has been calculated (assuming a 10 year life for the equipment) using equation *1*.

$$Annual\_ROI = \frac{(Anual\_Savings - Depreciation - On\_going\_\cos ts)}{Cost\_of\_Investment} \times 100\% \qquad (1)$$

Table 1. Estimated labour and vehicle cost-benefits for “Banoona”.

	Pre Telemetry installation			Post Telemetry installation		
	Hours	**Km's**	**$**	**Hours**	**Km's**	**$**
Labour (per week)	10		$300	2		$60
Travel (per week)		57	$49		20	$17
Management (per week)	0		$0.00	4		$120
Total Weekly Cost			**$349**			**$197**
Annual Costs			**$18,148**			**$10,244**
Depreciation						$1160
On-going cost						$0
Savings per year						**$6,731**

4.1.3 Field day

A field day was held at “Banoona” on the 29th of September 2010 with 30 attending the event. This included 17 beef producers and representatives from QRAA (1), NAB (2), QMDC (1), Observant (1), Pumps’n’solar (1) and DEEDI (4).

The format of the field day included:

1. An introduction and presentation by Les Zeller (DEEDI) about the objectives and outcomes of the PDS project.
2. Presentations by Charles Nason and Kent Morris (producers) describing what led them to invest in a telemetry monitoring system, any issues relating to installation and operation of their telemetry systems and the benefits that they have experienced by investing and using this equipment.
3. A video presentation of Richard Golding (producer) talking about the water management telemetry system he shares with three neighbours. This video also covered his experiences relating to issues and benefits of installing this equipment.
4. Mark Huntley (Pumps’n’solar – equipment supplier in Roma region) spoke about his past experiences with telemetry and the reasons why he was reluctant to be involved in this PDS. He also spoke about how his opinion and attitude changed when he attended the initial PDS information meetings and learnt about how this technology has developed.
5. Phil Witten (Observant – equipment manufacturer) answered questions and gave a demonstration of how to use the equipment.
6. John Lapworth highlighted the facts that anyone with limited computer skills can use the software to access the data, the benefits regarding animal welfare and the remote option enabling access while away on holidays or overseas.
7. NAB spoke about the bank’s acceptance of the technology as an asset and a willingness to provide loans for this technology.

4.1.4 Feedback from field day

Ten people completed the 5 questions on the generic field day feedback sheet at the completion of the day. Questions 1, 2 and 5 are the most relevant to the objectives of this PDS. Responses to Question 1 (Table 2) show that 100% of those providing feedback found that the field day provided information that was relevant and of value to their businesses. However Question 2 showed that only 50% indicated that the field day will influence their decision to change aspects of their business. Question 5 responses showed that 100% indicated that the field day was valuable, informative and worthwhile. All questions and responses are shown in table 2.

Table 2. Questions and answers as Feedback from "Banoona" field day

Question 1.	Has the field day been of value to your business. If so, how?
Responses	1. Interesting insight to an area of innovation that is speculated about often, but not have too much solid evidence to support it. Definite time/labour saver, peace of mind, fuel and driving costs. 2. Very valuable because our business owns properties in the Northern Territory and long, time and diesel consuming water runs are an issue. 3. Yes because these systems could offer peace of mind and could dramatically reduce wear and tear on our vehicles. 4. Of interest and potential value; particularly with capacity for longer distance operation. 5. Yes, saving on time, money and increases risk management 6. Yes. Could apply in our situation. Monitoring water from town. 7. Yes, provided many benefits as to how producer could improve productivity and profitability. 8. Yes, presented ideas that could be utilised in future situations. 9. Yes. Food for thought - actual costs 10. Good value - for me to have discussions with clients and their business models.
Question 2.	Has the day influenced your decision to change aspects of your business?
Responses	1. Not particularly 2. Yes but the price is an issue. 3. No response 4. Immediately no, but it has (or will) impact on future planning of watering systems. 5. Yes 6. Yes 7. Yes 8. No 9. Possibly 10. N/A
Question 3.	What were some of the most interesting things you learnt?
Responses	1. Availability of the technology to be used in conjunction with satellite technology where 3G access is limited 2. How large distances can be covered. 3. How much you can save. 4. Networks available for communication and repeating communication 5. Observant

	6. About how the system works and its benefits. 7. Benefits, cost savings, seeing it first hand. 8. Capabilities of technology 9. Extent of possible management and monitoring options 10. The various options available for technology.
Question 4.	Are there some conclusions you have drawn from what you have seen and heard?
Responses	1. 2. The expense means only the furthest most vital bores would be kitted with units. 3. No response 4. No response 5. No response 6. No response 7. Benefits, cost savings 8. No response 9. Yes - discuss the possibility of economic application 10. N/A
Question 5.	Please provide an overall comment about the field day.
Responses	1. Good information from seller and customer feedback 2. Well conducted day. 3. Worthwhile. 4. Well organised and run with appropriate speakers, presentation and content. 5. Very practical 6. Great day, very informative. 7. Very good 8. Good 9. Fantastic! 10. Valuable day.

4.2 Rainmoor:

4.2.1 Use and reliability

Grant Maudsley has two options regarding access to his remote site 165 km by road from his home property “Nalpa Downs”. One option uses his home desktop computer and a modem to have a direct connection to the Observant system at “Rainmoor” via the Telstra network. Alternatively he can access his remote equipment via an internet connection from any computer with the Observant software installed through a server managed by Observant. Initially there was an issue with Grant purchasing the Telstra data plan from Telstra in Roma. For several months Grant was charged for mobile telephone services that he did not require because the Telstra sales staff at Roma had no experience with this type of product and therefore Grant was sold the wrong product. This was a communication problem which may not have occurred if Grant had a better understanding of what service he required and if Telstra staff in Roma had better training in this area. This potential problem has been overcome by Observant now having total control of the purchasing and testing of the Telstra component of the NextG Observant system prior to delivery.

The optimum system for Grant's current situation is to utilise the Observants internet server that monitors his system and operates bore pumps etc. automatically, and sends critical system operational messages via SMS to his mobile. This system is very useful when he is away from home on business. Without the internet monitoring system, Grant's home computer needs to be connected to his remote site to control the start and stop operations of the bore pumps.

Grant's ability to remotely monitor "Rainmoor" has allowed him to act quickly when incidents have occurred that affected the management of water for his cattle. For example:

- The first incident was a column pipe that vibrated loose on the mono pump and the pump was no longer pumping water. If the pump had not been shut down by the Observant M1 motor controller, it would have resulted in the complete destruction and or loss of the submersible pump down the bore and potentially costing in excess of $10,000 to retrieve and replace.

- Then there was a loss of engine oil in the diesel motor driving the bore pump. Again, without the M1 motor controller shutting down the motor, it would have continued to run until the motor seized due to oil loss. The cost of a replacement would have been more than $4,000.

Some components have required replacement as they were not reliable or not performing to specifications. For example:

- As with "Banoona" the ultrasonic flow meters have proven to be accurate for high flow rates, i.e. pump output, but inaccurate for very low flow rates i.e. water flowing to troughs where there is low pressure due to small head. Three flow meters were replaced with mechanical paddle type flow meters that are accurate for low flows.

- Communication failed on one remote C2 unit and 3G modem. This equipment was replaced under warranty and the faulty units returned to Observant.

- An issue with ants getting into the modem also created a communication fault, resulting in the modem being replaced. This problem occurred because the conduit to a water flow meter was not sealed with silicone and ants entered via the end of the conduit.

- The M1 motor controller was not contactable during the prolonged wet period at the start of 2011. Grant Maudsley communicated directly with Observant to diagnose and repair the fault. This problem arose because the capacity of the battery and solar power system was insufficient for the extended period of overcast weather. This was not a fault, as such, but a limitation of the standard system design for a solar power system.

4.2.2 Benefits

The system has well and truly paid for itself within the first 12 months as a result of detecting bore pump faults which would have potentially cost in excess of $14,000. The initial outlay was approximately $13,200 which effectively represents the replacement value of equipment saved by having this telemetry monitoring equipment during its first year of operation.

From reductions in labour and fuel derived from this installation, there is a benefit of about $14,500 per year (see Table 3) for the life of the equipment. However there are on-going costs for Observant Managed Services of $355/year (for the "Rainmoor" installation) which includes Telstra 3G connection costs and a supervisory system that is accessed via the internet and autonomously controls pumps, monitors levels and sends alarms to mobile phones.

Prior to the system installation the number of remote site visits for summer was once every 3.5 to 4 days and in winter about once per week (a conservative approximation of 64 visits per year). An estimate of the pre-equipment installation fuel and labour costs was quantified as approximately $5,000 for fuel and vehicle costs and $17,280 in labour if charged at $30/hr. It was expected that this technology would halve the number of visits to the remote property and therefore save approximately $10,000/year.

Table 3 shows the revised estimation using information provided by Grant Maudsley after using the system for approximately 2 years. This shows that the actual savings for fuel and labour were approximately $16,000/year (before accounting for depreciation and on-going costs). An annual ROI of 96% was also calculated for "Rainmoor" using equation 1. As Grant's experience and confidence in the system grows, and with increasing fuel and labour costs, the financial benefits should increase significantly over time.

Table 3. Estimated labour and vehicle cost-benefits for "Rainmoor".

	Pre Telemetry installation			**Post Telemetry installation**		
	Hours	**Km's**	**$**	**Hours**	**Km's**	**$**
Labour (per week)	14.33		$430	5		$150
Travel (per week)		350	$300		175	$150
Management (per week)	0		$0.00	4		$120
Total Weekly Cost			**$730**			**$420**
Annual Costs			**$37,960**			**$21,840**
Depreciation						$1320
On-going cost						$355
Savings per year						**$14,445**

4.2.3 Field day

A field day was held at "Holly Downs" on the 13th of April 2011 with 30 attending the event. This included 17 beef producers and representatives from QRAA (1), NAB (2), CBA (3), SWNRM (1), RFCSQSW (1), Pumps'n'solar (2) and DEEDI (3).

The format of the field day included:

1. An introduction and presentation by Les Zeller (DEEDI) about the objectives and outcomes of the PDS project.
2. Presentations by Ken Hiscock, Grant Maudsley and Kent Morris (producers) describing what led them to invest in a telemetry monitoring system, any issues relating to installation and operation of their telemetry systems, and the benefits that they have experienced by investing in and using this equipment.
3. A video presentation of Richard Golding (producer) talking about the water management telemetry system he shares with three neighbours. This video also covered his experiences relating to issues and benefits of installing this equipment.

4. Mark Huntley (Pumps'n'solar – equipment supplier in Roma region) spoke about his past experiences with telemetry and the reasons why he was reluctant to be involved in this PDS. He also spoke about how his opinion and attitude changed when he attended the initial PDS information meetings and learnt about how this technology has developed.
5. Daniel Wingett from South West Natural Resource Management (SWNRM) spoke about what the Company does, and the opportunities the Company offers communities throughout South West Queensland. For example, SWNRM is funding a *Holly Downs* Devolved Grant project to further expand property telemetric water installations as part of a broader holistic management approach.

4.2.4 Feedback from field day

Ten people completed the 5 questions on the generic field day feedback sheet at the completion of the day. Responses to Question 1 (Table 4) for this field day showed that 100% of respondents found the field day provided information that was relevant and of value to their business. Further, responses to Question 2 showed that 90% indicated that the day will influence their decision to change aspects of their business. Question 5 responses showed that 90% indicated that the field day was valuable, informative and worthwhile. The questions and responses are shown in Table 4.

Table 4. Questions and answers as Feedback from "Holly Downs" field day

Question 1.	Has the field day been of value to your business. If so, how?
Responses	1. Yes. Help with a better understanding for customers to enjoy a more sustainable existence. 2. Yes. Opened up eyes to new technology. 3. Yes. Don't have a business, however my mum does & I believe this technology would be very beneficial. 4. Yes, currently implementing water system. 5. Yes, shows improvements you can make. 6. Yes. Has been great to showcase a business that is thinking outside the box and an opportunity for people in the region to see. 7. Yes. More information about the system 8. Yes. Increased knowledge of the technology and gives solutions to current problems within our business. 9. Yes. Opened the mind. 10. Yes. Reduction in FTE and cost saving potential.
Question 2.	Has the day influenced your decision to change aspects of your business?
Responses	1. Yes 2. Yes cost savings. 3. Yes. Taught me to look outside the box and look into technology 4. Yes 5. Yes 6. Yes. Good figures to show. Return on investment is verified. 7. Yes 8. Yes. The day has brought water management to the forefront of our business development. 9. Yes 10. No response

Question 3.	What were some of the most interesting things you learnt?
Responses	1. How the technology worked 2. No response 3. How it works & how easy it is. Good to see real life examples showing pro's and con's. 4. Existence of a system which can in turn benefit the bottom line of my business. 5. Cost benefit – fuel and time. 6. How telemetry works. 7. How it all works. 8. The support available, where the technology is available and other producers applications of water monitoring systems. 9. Technology 10. No response
Question 4.	Are there some conclusions you have drawn from what you have seen and heard?
Responses	1. There are more sustainable ways to run a property. 2. No response 3. That technology needs to be implemented to make business run more efficiently. 4. Keep moving forward – water system that has the ability to help our business in many different ways. 5. Beneficial in long term. 6. No response 7. They are relatively reliable. Save you a lot of time & fuel/wear 8. The cost saving potential of the technology is utilised and set up correctly 9. Very useful tool 10. No response
Question 5.	Please provide an overall comment about the field day.
Responses	1. No response 2. Great 3. Great day. Learnt a lot & appreciate not being sold/ spoken to by sales people. 4. Very informative and well worth the time. 5. Very good. More information from Les required on background & budget (this was at Banoona field day) 6. Was a great day and thanks for the opportunity to be part of it. 7. Very useful, positive experience, great opportunity to make contacts with people. 8. Very informative and worthwhile to attend. 9. Well worth the drive. 10. Pleasing to see that DEEDI's interests focus on reducing cost of production, high labour costs and improving overall profitability of the industry and that field days like this actively encourage producers to make changes. Also gives the producers the opportunity to learn.

4.3 Discussion of "Meeleebee" withdrawal from PDS

Warrick and Kell Freeman provided a thorough description and analysis of their water system and the reasons why they decided that remote monitoring and operation of bores was not likely be the best option for "Meeleebee" (Appendix 1). They raised a number of important points, several of which are discussed further below.

4.3.1 Staffing for Boreman role

The point was made that staff suitable for the Boreman role prefer to work independently with little supervision, and often have little interest in, or knowledge of, computers. This created a need for someone else to access the data, monitor the system and provide supervision. However with the management service now provided by Observant the Boreman would now be able to view the data from any computer with internet access or receive alarm information on tank levels or excessive water flow rates via sms messages on a mobile phone. Discussions with Observant may prompt extra functionality to enable regular text data being sent directly to a mobile phone eliminating the need for a computer or associated skills. The fact that this role can become prone to taking shortcuts is justification to employ remote monitoring technologies as reducing the workload of the Boreman should allow more time and therefore more effective visual inspections each week.

4.3.2 Ongoing need for visual checks and maintenance.

The need for visual checking of turkey nests to estimate water level and determine filling time and the need to manually travel to the bore when the turkey nest is full is eliminated with remote monitoring and automatic remote bore operation. The time saved not travelling and climbing the banks of turkey nests could be used to clean troughs or do other necessary repetitive tasks. The use of remote technologies would not be to eliminate visual inspections but historical data from water levels and flow rates can help to identify anomalies plus appropriate fencing of turkey nests could eliminate the opportunity for dead animals in the water or burrowing animals comprising the integrity of storage walls. Where a boreman is employed to do, say, two bore runs per week, a reduction of bore runs to once a week could reduce the workload by one to two days allowing other work to be performed.

4.3.3 Cost Benefit

The cost benefit described in the attached letter (Appendix 1) is based on labour savings e.g. one day per week equating to $6,000 per year. The ability to redeploy this existing labour enables one day a week of additional labour at no extra cost while also providing opportunities to upgrade skills and increase variety and therefore improve staff retention. What was not calculated in the cost benefit was the reduction in vehicle costs. Data captured during GPS tracking of the "Meeleebee" bore run vehicle for the month of July 2008 showed 2,240 km travelled. Using the same vehicle cost per km based on the published RACQ total running costs (as in Tables 1 & 3) this equates to a monthly vehicle cost of $1,920. Therefore if the bore runs were reduced to once per week and bores were controlled remotely the vehicle costs could be reduced by approximately $1,000 per month or $12,000/year giving a total saving of $18,000 per year.

4.3.4 Conclusion

Through a number of meetings with Warrick and Kell Freeman and analysis of existing water systems it was evident that savings could be made. For example, an evaluation and recommendation to automate one water system at "Meeleebee" that included an electric bore feeding 5 turkey nests, was to incorporate a small timer/controller to control the bore and replace gate valves with float valves. This would eliminate 5 round trips for the Boreman to turn the bore on and off and to operate valves manually at each turkey nest.

However the quoted cost to monitor and control one third of the water system for approximately $40,000 was considered too high, based on perceived benefits at the time.

5 Success in achieving objectives

5.1 Research

This section describes the level of success to which the objectives were achieved.

Establishment of remote water monitoring systems on three grazing properties:
Remote water monitoring systems were installed on two grazing properties with the third property withdrawing from the project after several site visits and 6 months of pre-installation bore run data was collected at this property.

The use and reliability of the system and components:
After two years of use, both producers use the system daily in most cases and have indicated that it was money well spent and has given them peace of mind that their cattle always have sufficient water. The systems have proved to be reliable, however there were incidences, for example, where water flow meters did not perform during periods of low flows and have been replaced. Other issues mainly related to oversights during installation, for example, ants making their way into the electronics through unsealed conduits. Overall the producers are happy with the reliability of their systems.

The level of technical support provided by the equipment manufacturer and supplier:
Both producers have indicated that the technical support provided by the equipment manufacturer and supplier has been of a very high standard. There have been a number of occasions with respect to water flow meters where technical support was provided promptly and the issue resolved. For “Rainmoor”, Pumps’n’solar provided a high quality installation and have continued to supply this high standard of workmanship for other producers in the area. The comment in 2010 by Grant Maudsley “The remote technical backup by Observant is an excellent service which reinforces my confidence in system support” is further evidence of the manufacturer’s and supplier’s commitment to technical support.

The impact on farm costs (labour, vehicle, fuel etc.):
The impact on on-farm costs is reflected by both producers wanting to invest in expanding their systems. The savings in time, fuel and vehicle costs for Grant Maudsley is evident by the reduction in the number of visits to his remote property (350 kms per trip). The amount of time for management of each installation has decreased by 50% over time due to increased knowledge of software, interpretation of data and confidence in the system. Charles Nason’s statement in 2010 indicates that there are other additional savings: “I have reprogrammed the Hydrovar pumps resulting in reduced electricity costs. Producers mostly only factor in the initial capital costs and often omit to include their ongoing running costs in any economic evaluation”.

The ability to redeploy existing labour and improve labour efficiency:
For both PDS sites the ability to either utilise casual staff better (Charles Nason) or reduce travelling time (Grant Maudsley) provides evidence of improvements in labour efficiencies.

5.2 Adoption

As of the completion of this PDS project there are currently nine remote water management telemetry systems installed and being used in the Roma region serviced by Pumps’n’solar.

Of these nine, five systems can be directly attributed to the PDS field days and the remaining four systems have been sold and installed by Pumps'n'solar who became a service agent because of meetings held in the early stages of this PDS. Therefore sales indicate that the aim to increase adoption of remote management technologies by local producers to at least 10 systems by 2014 will easily be achieved.

6 Impact on meat and livestock industry – Now and in five years time

6.1 Current Impact

The impact of this PDS is that more producers in the Roma region have a better understanding of the capabilities and potential savings of remote management technologies. Adoption of this technology in the Roma region has increased to nine systems as a consequence of meetings and field days associated with this PDS. From the economic analysis of savings for the two PDS's, it is reasonable to estimate that producers in the Roma region could expect to have a net benefit, from installing a remote management system for stock water, of between $6,700 and $14,450 per year.

6.2 Future impact

The future impact of remote monitoring will increase quickly as the technology becomes accepted as the standard method for water use monitoring, with bore runs being for maintenance in conjunction with other stock activities. These telemetry systems could also incorporate other monitoring and control applications. Examples of these are stock activity using RFID and stock condition monitoring including weighing and drafting. There is also the potential for individual animal control applications, eg. monitoring animal health, and autonomous provision of supplementary nutrition at watering points.

7 Conclusions and recommendations

7.1 Research

The research component to evaluate the process of establishing remote water monitoring systems on three properties resulted in successfully overseeing the design, installation and operation of 2 PDSs in the Roma region. The withdrawal of "Meeleebee" (the third PDS) is evidence that, despite the apparent advantages of the technology, its net benefits for some situations may be more difficult to estimate.

This project identified some use and reliability issues that have resulted in an evolution of the Observant equipment to provide a supervisory product for off farm installations using the Telstra NextG network. Also some third party components, for example, ultrasonic water flow meters have shown to be inaccurate and unreliable for very low flows and have been replaced as the preferred option with mechanical paddle type flow meters.

From discussions with six current users of the Observant system in the Roma region, the technical and after sales support has proved to be of a very high standard.

From the economic evaluation, based on labour and vehicle costs alone, for the two PDSs in this project, estimated savings (including depreciation over 10 years) in the range of $6,700 to $14,450 per year can be expected in the Roma region. The MLA "Northern beef situation analysis 2009" report (Mitchell region) indicates that the percentage of gross product for paid and unpaid labour is approximately 12%. Both properties in the PDS experienced reductions in labour of approximately 40% which effectively reduced the percentage of gross product for paid and unpaid labour to about 7%. The annual return on investment (RTO) from using remote management technologies for each property was estimated to be 58% for "Banoona" and 96% for "Rainmoor", resulting in a very short payback period.

7.2 Adoption of this technology

During the process of conducting this PDS it became evident that there is still limited knowledge and understanding in the Roma region of the potential of this technology. In total, 34 producers (representing 22 cattle properties) attended the field days and their feedback indicated that they see value in this technology. About 75% of the field day survey respondents indicated that information gained during the day would influence their decision to change aspects of their businesses. To date the field days have directly influenced the installation of 5 telemetry water monitoring systems in the Roma region. A total of 9 systems are now installed and being used in the Roma area which indicates that the goal of 10 systems installed in the region by 2014 will be exceeded.

7.3 Recommendations

The PDS field days have been successful in delivering information to producers in the Roma region with some already deciding to invest in this technology. To further increase adoption of telemetry systems and reduce production costs for the grazing industry there needs to be on-going promotion of existing technology, as well as research to investigate other sensors and applications, thereby adding value to the technology. This technology provides a platform for other monitoring and control applications, for example, on-farm silo fumigation monitoring, fence integrity, cattle movement and selective drafting using RFID etc.

Feedback to DEEDI staff in Charleville indicated that there is a need for more field days of a similar format. Attendees of the field days in this PDS indicated that presentations from other producers about their experiences using remote monitoring systems provided unbiased information without the hard sell.

8 Bibliography

McCosker, T, McLean, D & Holmes, P 2010, *Northern beef situation analysis 2009*, B.NBP.0518, Meat & Livestock Australia Limited, Sydney.

9 Appendices

9.1 Appendix 1

WA & KE Freeman

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"Meeleebee Downs", Wallumbilla, Qld, 4428
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1 April 2009

Mr L Zeller
Research Scientist
Emerging Technologies Delivery
Department of Primary Industries and Fisheries
TOOWOOMBA QLD 4350

Dear Les

We would like to advise we have decided not to continue with an installation for the Remote Technology Water Management Project on "Meeleebee Downs", Wallumbilla, as explained herein.

Property Description & Enterprise Structure:
"Meeleebee Downs" is 24,280 Hectares running approximately 5,000 adult equivalent cattle in a normal season. We employ a Working Manager, Stock Camp, Cook, Boreman and Machinery Operator to run to enterprise. Our roles are strategic and administrative, and include management of two other cattle properties which we travel between.

Water System Background:
Our water system is primarily twenty bores and fifteen dams equipped with mono pumps and mills pumping to forty Turkeys Nests, which as well as gravitating to troughs gravitate to an additional twenty-seven Turkeys Nests. Dams are fenced. Mono pumps are equipped with timers. Cattle water from approximately 150 troughs fed from the Turkeys Nest system, or one trough per 160 Hectares.

Borerun Schedule:
The borerun circuit is completed twice weekly year round. Each circuit is done in three legs, over two days including return trips to turn siphons off. The Boreman, as well as performing water maintenance, fixes small breaks in fences and reports larger breaks and unusual cattle movements to the stock camp.

Staffing Remote Operation of Water System:
In our experience staff suitable for the Boreman role are independent, preferring to work alone. They favor little supervision. The work is repetitive, and they can become prone to taking shortcuts. Non-adherance to procedure may not be noticed until a problem becomes

obvious, such as a Turkeys Nest wall leaking, which by that stage requires expensive repair. They are motivated by regular reinforcement of a job well done. No-one who has performed this job in the past has had any computer experience or interest.

Visual Checks:
Our water system cannot be made remote from borerun duties such as visual inspections and trough cleaning.

Visual inspections of Turkeys Nests identify dead animals in the water, Dab Chicks nesting on outlets, Pigs rooting on walls, Echidnas digging in walls, and Cane Toads in pipes. Proactively attending to these problems is essential, and identify problems could only be achieved remotely with high resolution full-scope visual aids.

We currently ensure visual checks are made by requiring the Boreman to climb the banks of the Turkeys Nests to check the water level in order to determine how long it will take to fill. We believe if water levels were regulated by float valves, the visual checks could be omitted and potential problems would not be addressed in a timely fashion, leading to expensive repairs.

Troughs are cleaned every six to eight weeks in cooler months (4-7 troughs per borerun day), and every four to six weeks in warmer months (6-10 troughs per borerun day). Each trough takes approximately 15 minutes to clean. Troughs are cleaned by scraping and emptying the trough. Blue Stone is added to the water to reduce algae growth.

Visual inspections of Turkeys Nests could be reduced to once per week, which would reduce the staff time taken each week, fuel and vehicle wear; but remote technology could not remove the need for visual inspections, and could not ensure visual inspection are made.

Innovation Adoption:
We are open to investing in improvements where an advantage is feasible. In the past three years, we have installed sixty grids at a cost of approximately $60,000. This has reduced the bore-run time by approximately six hours per week, and made the job more attractive by relieving the Boreman of the tedious opening and closing of gates. It has also resulted in reducing the tendency to ‘skip’ water points to avoid gates.

We have investigated installing concave mirrors or external water-level-indicators on floats, to make water levels visible from the vehicle, allowing the Boreman to determine water levels without having to climb the Turkeys Nest walls every circuit. The mirrors proved unworkable as the quality of the reflection was inadequate; and the possibility that float-operated water-level-indicators may result in visual checks being omitted was of concern.

Installation Quote:
The quote prepared for this project to install Remote Technology Water Management to one-third of our water system was approximately $40,000. (See Appendix A). An estimate for a reduced number of sites covering one bore, and five Turkeys Nests, was between $4,000 to $8,000 (per Les Zeller email, Feb 6 2009).

Cost/Benefit Ratio:
If one half day per week was gained this would save approximately $3,000 worth of man hours per annum; if a full day, $6,000 per annum. We have found it difficult to quantify the savings in staff time, fuel and equipment use we may be able to achieve, remembering that

the proposal was to apply the remote management to one third of the water-run only. Staff time saved on the borerun circuit may equally be traded for time spent in the office, by the Manager or ourselves.

If a Turkeys Nest wall develops a serious leak, it may be necessary to replace the Nest at a cost of $30 - 45,000.

Because of the ongoing requirement for visual inspections, and the concern that visual inspections will not be made if avoidable, we have not been persuaded there would a positive cost/benefit ratio in our situation.

Conclusion:

In order to proceed with installing Remote Technology for water management we would need to believe a positive cost/benefit ratio exists between work hours and equipment saved, to the expenses of installation and maintenance. We would expect to redeem our investment over time while maintaining a workable system, which leads us to our major concern, staff management.

In an owner-operator or family situation where a computer literate person has ownership of the water system set-up, and commitment to all borerun roles, computerised monitoring of aspects of the water system may be attractive and viable, reducing travel and tedious repetitive jobs, and be cost effective. However, we do not believe the staff available are suitable, they would not be capable of operating a computerised water management system.

Further, any time that may be saved for the Boreman would be transferred to ourselves or other staff to monitor the computerised element, and there would be a duplicity of training needed for periods of absence and at staff change over.

In Summary:

We have decided not to proceed with the installation of Remote Technology Management of the water system on “Meeleebee Downs”, Wallumbilla for the following reasons:

1. Regular visual checks of water point integrity, and an on-going trough cleaning schedule, reduce the possibility of time that may be saved.
2. Adherance to visual checks may be compromised if not essential.
3. Non-adherance of visual checks would not be obvious until a problem occurs, and problems resulting could be serious and expensive to fix.
4. Staff have no computer knowledge, and may be not capable of, or not interested in, learning to use computerised remote water management.
5. No water point on the property is remote from other watering points and there are no geographical impediments to reaching water sources.
6. The cost/benefit ratio has proven difficult to quantify.
7. The Boreman lives on the property and monitors the water system in our absence.

Alternate Site Installation:

Our involvement in this project has given us confidence in the viability of installing Remote Technology Water Management at an alternate site on, “Dourialla”, in the Arcadia Valley.

“Dourialla” is a 2,800 Hectare property running approximately 1,300 adult equivalent cattle per annum. It is watered by one underground bore at a remote location, approximately 10 km from the station house, and one river bore approximately 10 km in the opposite direction. Both bore pumps sites are powered by 240 volt mains power. Four Turkeys Nests feed direct to troughs, and to polyurethane water storage tanks in paddocks which are controlled by floats and equipped with troughs.

The property is staffed by one full-time manager and casual staff as required. Turkeys Nest visual inspections are performed regularly with staff at management level having a high commitment to all borerun roles to avoid potential problems. Our manager is computer literate.

The ability to check water levels and operate bores from a remote location would be an advantage with no back-up staff in the manager's short-term absences.

Project Participation:
We are thankful to have been involved in the Remote Technology Water Management project managed by Les Zeller, Research Scientist Emerging Technologies Delivery, at the Department of Primary Industries and Fisheries in Toowoomba. The support and guidance Les provided enabled us to learn; to delevop an appreciation of the possibilities remote management of water systems offer; to recognise the potential for this at a location with different parameters; and we appreciate his efforts. We are also grateful to Mark Huntley and staff, of Pumps & Solar Water Solutions, Roma, for their collaboration, research and system design.

Yours faithfully

Warrick and Kell Freeman
per Kell Freeman