RESOURCES FOR COTTON GROWERS ON SIPHONLESS LAYOUT DESIGNS, IMPLEMENTATION AND AUTOMATED MANAGEMENT USING SMART IRRIGATION TECHNOLOGIES

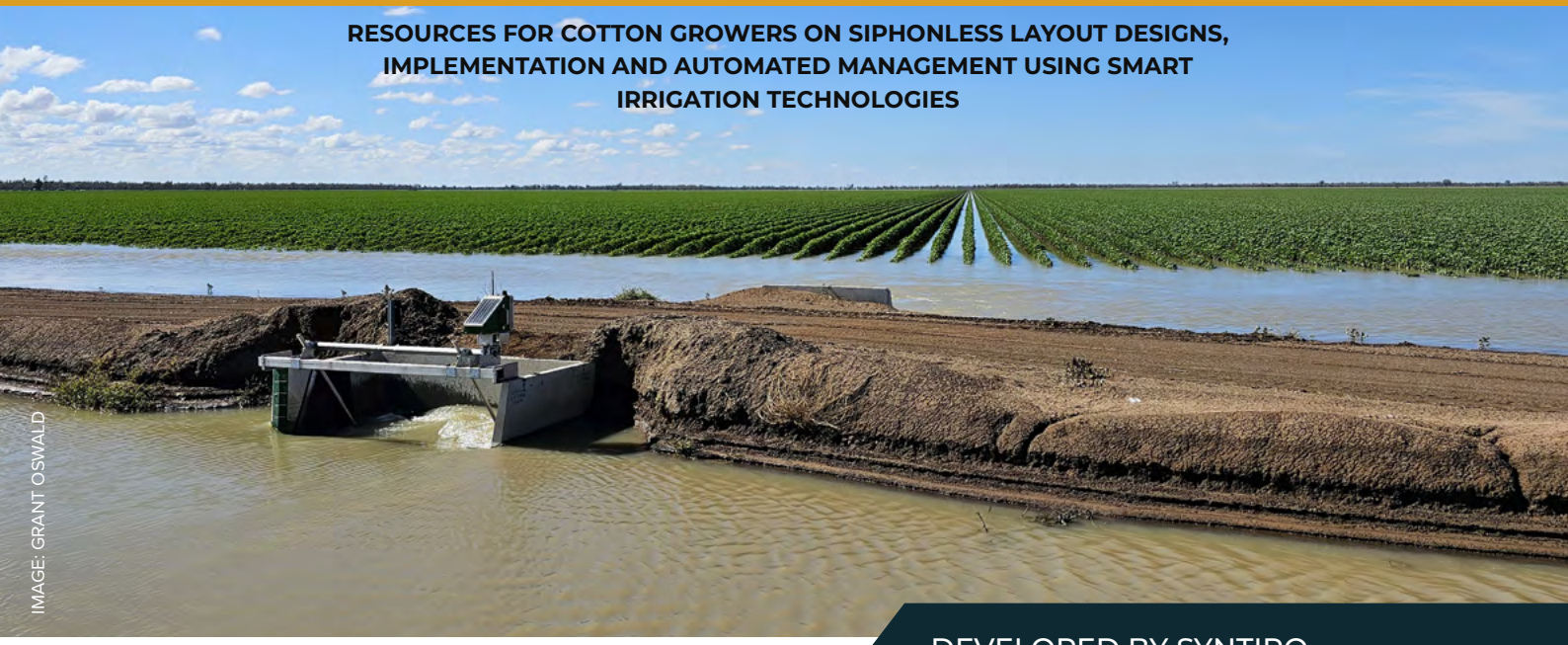

IMAGE: GRANT OSWALD

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Ashwood Farms' journey on driving water efficiency through siphonless smart irrigation systems

Farm	Ashwood Farms, St George QLD
Size	455 ha (green area), 5 fields, 38 bays
Irrigation system	*Pipes with Tailwater Backup*
Smart irrigation	Semi-automated, progressing to full automation

Ashwood Farms near St George in southern Queensland has been striving to improve water efficiency since the Brimblecombe family started farming in 1974. Over the past decade, that pursuit has driven a full conversion from hand siphon to *'Pipes with Tailwater Backup' siphonless* system, followed by a progressive adoption of smart irrigation technology.

Irrigation is now semi-automated, across five fields (38 bays), with full automation the next step. This case study outlines the journey on Ashwood and offers practical insights into what a well-planned and staged adoption looks like, including the steep learning curve.

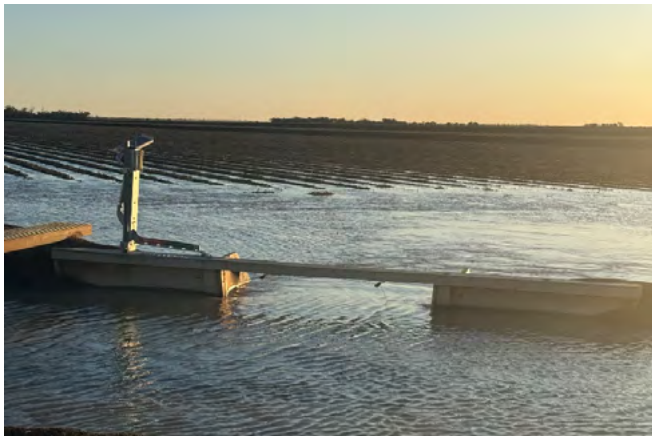
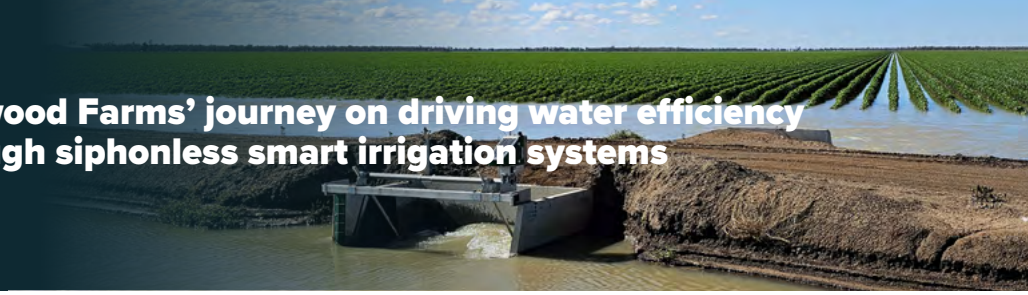


Figure 1: Ashwood farms is now 100% siphonless, after converting from hand siphons to Pipe with Tailwater Backup through the Bank layouts.

This case study is part of the *Smart Irrigation For Siphonless Systems Factsheet Series.*

SIPHONLESS CONVERSION: CAREFUL OBSERVATIONS AND CLEAR GOALS SET

Flow rate restrictions and limited cross fall on Ashwood farms meant that siphonless conversion



wasn't suitable until designers developed an affordable irrigation system for fields with an inflow of only 24 ML/day, where tailwater would be less than that of siphons.

Scott spoke with multiple early adopters of Siphonless systems and visited their farms during irrigation events. He recognised the shortcomings of large PTB's – the higher flow rates enabled faster irrigation but came with high upfront infrastructure costs, higher tail water volumes, and irrigation changes at any time of day or night. Pulling drop boards at 2am held no appeal for himself or his staff.

Scott decided he needed to convert his farm to a system where tailwater is minimised, water efficiency gains may be achieved, and the infrastructure enabled automation in the future.

Field Conversion: a staged approach

The siphonless conversion began in 2018 in only one field due to the high upfront costs and uncertainty around the outcome. Glenn Lyons was engaged to design the first siphonless field, in which 3 fields were joined together into a single field with a row length of 1,500 metres. A Padman rubber door released water into 72-metre-wide bays. Rubber doors were also installed along the taildrain so that tailwater could be backed up and then released into the next bay. According to Scott, despite the increase water efficiency, this first field conversion was *'cheap and nasty'* – requiring walking through the head ditch to wind up a winch and wind down the next. This inconvenience led to the Field 2 & 3 conversion using bubbler pipes rather than rubber doors to feed each bay, so that he could drive to the field side of the head ditch to operate the gates. Machinery efficiency was improved with the inclusion of the road and greater distance to the head ditch. Machinery could move between bays on the road, and the greater distance to the head ditch eliminated three-point turns, making field passes considerably faster.

Having completed the conversion across the farm, Scott is now planning to replace the rubber doors with bubbler pipes on the first field – using the learnings of saving wet feet, improving the ease factor and get the added machinery benefits.

At times, ideas on field conversions have evolved through the design process, leading to multiple 'paper plans'. Some unique designs were proposed by the designer to cope with sharp point rows and other challenges, ensuring all the farm was utilised, the irrigation would operate effectively and that drainage was adequate. Scott encourages other growers to spend the money on exploring design options, and talking it through with the designer, earthmover and management team. They each have a different perspective and can work together to ensure the optimal layout is chosen.

> ***"It is cheaper to change a design on paper than to move dirt. Spending a few thousand dollars on a design, to throw it out is a lot cheaper than moving dirt to build it, only to work out it isn't suitable"***
>
> **Scott Brimblecombe, Ashwood Farms**

Scott estimates the conversion to siphonless saved around 1 ML/ha. But he saw room for more savings, if irrigation changes occurred on time. To maximise the benefits of siphonless, Scott saw automation as the next step.

SMART IRRIGATION: A STEEP LEARNING CURVE

After visiting automation field days and talking with suppliers, the Ashwood team headed down the Automation path, which mirrored the staged siphonless conversion: starting with one field, understanding how the technology works, then scaling. This phased method kept risk manageable while learning and gaining confidence.

Initially, solar powered, cellular, portable controllers were installed on winch operated rubber flap outlets. They were programmed to open and close based on pre-determined time decided by the irrigator, thus acting as a remote, or semi-automated technology, rather than fully automated.

A key feature that helped with acceptance of the technology and confidence with the system was override redundancy - the ability to manually open the outlet. For staff without a smartphone, or those not interested in the technology, a button on the control device still let them open and close outlets

directly, or the controller could be removed entirely to manually open the outlet.

Persistence with the technology and working collaboratively with suppliers

The Ashwood team soon realised the potential water and lifestyle benefits of remote outlet control, however, teething issues presented. Issues understanding the programming logic, connectivity dropouts and refinements to infrastructure were frustrating - even after changing suppliers. The team considered many of these issues understandable given they were working with an emerging technology.

Initial technology constraints provided the team an opportunity to work collaboratively with suppliers to refine and improve the technology for their system and management. Scott recognises that someone has to invest time and be the guinea pig, but ultimately it leads to better outcomes for Ashwood and the broader industry.

'It's a frustrating journey – but a good one. We are in the front seat and to a certain extent help drive and shape the technology.' Scott Brimblecombe, Ashwood Farms

User error: understand programming

Controllers were initially configured to operate on a predetermined time-based schedule based on existing knowledge of run times. Much variability in row run times occurred during the first irrigation of the season, then as the season progressed, become more predictable. For the first irrigations, the team still headed to the field to confirm the irrigation change had occurred as planned. However, there was some initial confusion and frustration. A gate scheduled to close 5 hours after opening didn't, and the team assumed the system had failed and manually opened the outlets instead. After talking with the automation supplier, the cause was identified. The outlet opened at 9:00am, and took 5 minutes to fully open, after which the '5-hour irrigation' time would commence. This meant the scheduled close was at 2:05pm (not at 2.00pm when they were waiting in the field). Scott acknowledged this was not an automation or system error – rather a user error, and lack of understanding about how the backend programming worked.

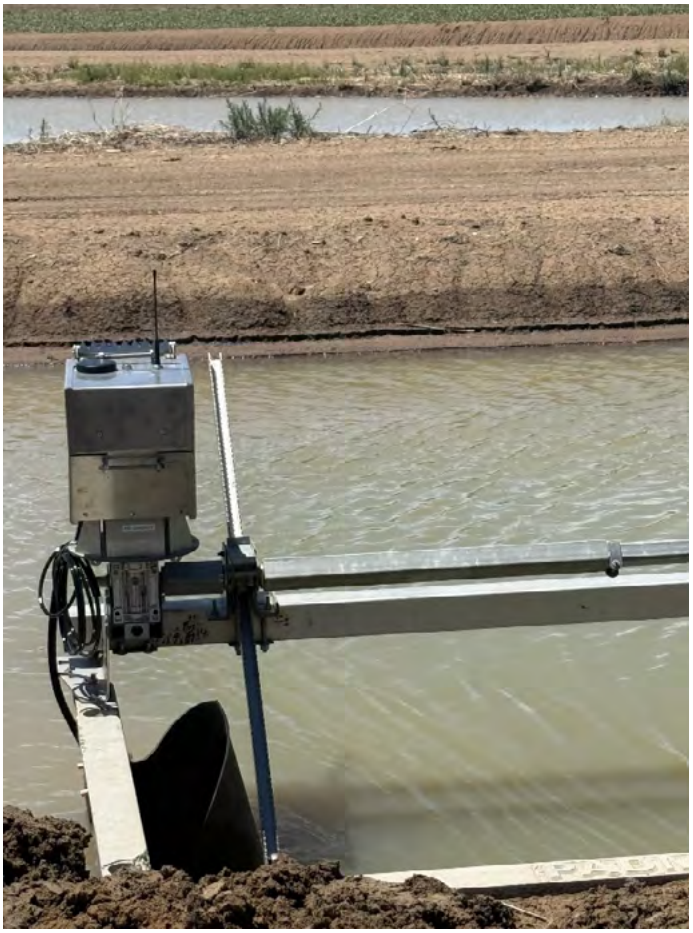
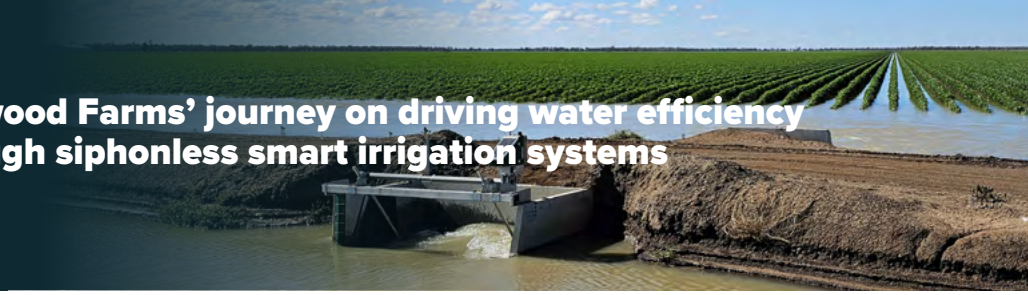


Figure 2: A rack and pinion system is used on large outlets after finding winch systems were unreliable and control devices too high above the ground – at risk of being hit by sprayers.

Refining infrastructure

Scott had deliberately converted his fields with winch-controlled structures to enable a clear path to automation. However, for larger outlets, winches were found to be unsuitable. The controllers were quite high above the ground – posing a risk of being hit by spray-rigs, causing machinery downtime and costly damage. The cables have been found to stretch over time or would get tangled with cotton trash. As Ashwood has scaled smart irrigation technology, they have moved to a horizontal rack and pinion system for larger outlets for greater reliability, and less likely to be hit by machinery.

A key learning from Scott's journey is that while advancements in smart irrigation technology are continually being refined, talk to automation suppliers before locking in outlet types to make sure they match their technology and controllers going forward.



Gaining trust in the technology

Introducing water height sensing in channels helped staff gain greater trust in the system by providing remote oversight, as well as the opportunity for better decision making and further automation. A concern was that if an outlet didn't open when it should – banks and channels may burst. Real-time sensing in channels with text message alerts has alleviated this stress.

Scott recognises that farmers adopting automation now won't have the same level of frustration as a lot of the issues have been ironed out by the early adopters.

"Those adopting automation now will need to invest some time, but will reap big benefits. The technology has built, tested and refined, making it an easier adoption journey". Scott Brimblecombe, Ashwood Farms

What a typical irrigation looks like now

Today the team uses both an app and web interface to set up and monitor time-based irrigation changes, with remote monitoring of water height sensors in the channel. To lower annual operating costs as they scaled controllers and sensors, they moved to a LoRaWAN gateway, meaning only paying for one connection, rather than individual device connectivity.

The team has found the first irrigation events of the season take longer and timing is less predictable. By irrigation four or five, the team has accumulated enough data to run a predominantly timer-based system with confidence and monitor remotely rather than going out to the field. The Flow Connect feature of the Agri-Mation Ag Yak platform means Ashwood staff load a template, which pre-loads the thresholds and data from a previous irrigation event, meaning it only needs a quick check, before starting an irrigation event. This has taken the guesswork out of command scheduling and sensor height threshold setting as well as reducing human error with settings.

"The first few runs take longer early in the season, so you still need human intervention. By irrigation four or five, you get a feel for it and you can step back, but in the future it will probably be even more hands off."

Scott Brimblecombe, Ashwood Farms

Benefits from semi-automated irrigation control and future plans

Scott estimates an additional 0.5ML/ha savings in water use has come from remote irrigation control. Substantial lifestyle benefits have been achieved with reduced travel to the field at unsociable times. This year is the first winter crop grown at Ashwood, 'because we can' from the greater ease of managing a siphonless and semi-automated system.

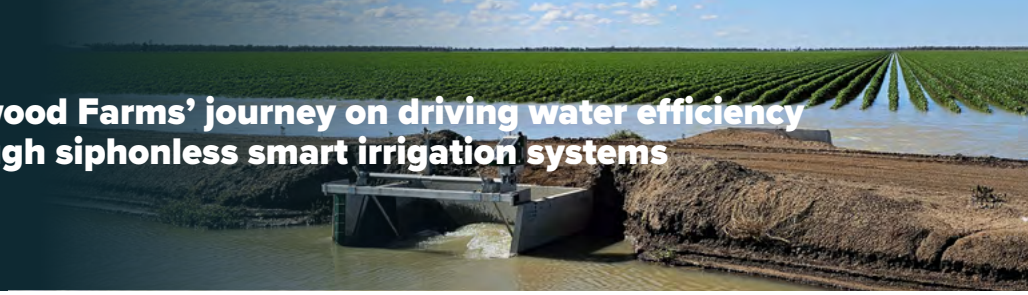
Scott thinks automation has the potential to deliver even more water savings depending on how precisely 'irrigation changes' are managed across the season. Even a two-minute improvement across 38 bays for 10 irrigation events, will quickly start to accumulate water saving benefits, although it is likely the improved precision will be more the 2 minutes per bay. Going forward, the team want to refine the use of sensors or even using AI for irrigation scheduling rather than remaining predominantly timer based.

"The technology works. It is now about how we use the data. For example, when water hits a trigger in the tail drain or in a row, do we change it now, or in 1 or 2 hours. How do we refine this to make more precise management decisions." Scott Brimblecombe, Ashwood Farms

Key tips for growers

Scott's key tips from his own adoption journey:

- Start with the end goal in mind when designing layouts and infrastructure – get the right products for your flow rate.
- Visit other farms in your district during an irrigation event.
- Trust the designer, get your layouts right first and understand how the field irrigates.
- Engage with various smart-irrigation providers and go to see their equipment working on farm, work out what you need for your system.
- Start with one field. Understand the technology in your specific system before scaling.
- Expect to invest time understanding the system. Be prepared to go on a learning curve.
- Work closely with your supplier to refine management for your system



Footnotes

[1] Small PTBs still require two-meter rotobucks. Whilst offering labour saving benefits, they retain most similarities to manual hand siphon systems and therefore are excluded from general siphonless system comparisons in this guide.

[2] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[3] Grower Case Study 'Norwood' Moree. CottonInfo, 2024.

[4] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[5] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[6] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[7] Irrigation systems, designs and scheduling options. GVIA. 2022.

[8] Grower Case Study 'Norwood' Moree. CottonInfo, 2024.

[9] Bankless channels- Bullamon Plains. More Profit Per Drop. 2011.

[10] WATERpak a guide for irrigation management in cotton and grain farming systems. CRDC. 2012.

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CONTRIBUTORS:

Matt Champness led the project and developed the smart irrigation content, with review and editing of siphonless system design content. **Harriet Brickhill** developed the siphonless systems content and provided review and editing of smart irrigation technologies content. **Glenn Lyons** provided technical input and review of siphonless system content.

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REPORT LIMITATIONS

This guide is an educational resource that has collated current information on siphonless irrigation systems and smart irrigation technologies. It provides general layout designs and description of terms to guide discussions between industry and best practice principles for planning and developing new layouts. However, this information is not prescriptive. Performance outcomes and benefits are site-specific and will vary based on individual farm conditions, management capacity, and technology choices. Growers should adapt this information to their specific circumstances.

Smart irrigation technologies are rapidly evolving. Inclusion of specific products, features, photos and suppliers does not constitute endorsement. Growers should conduct their own due diligence before making investment decisions.