Case study: Managing water for the farm and environment with Jeppesen Farming Co.

Tony and Mandy Jeppesen, along with sons Ben and Sam, own and manage a cane farm in the Whitsunday region, Queensland. Over the past decade, the Jeppesens have implemented changes across the farm to improve water management.

The farm

The Jeppesen Family has been farming near Bloomsbury since 1921, with Tony now a 4th generation cane farmer. They are also part of a local business that provides contracting services for a wide range of in-field operations, such as harvesting and laser levelling.

Tony and Mandy have made many changes to their farming practices over the past decade to ensure a productive farm with improved environmental benefits.

Tony explains, '**We have adopted a wide range of improved management practices on the farm. This includes moving to a controlled traffic system to improve soil health and reduce sediment loss**'.

The Jeppesens are implementing a nutrient program that ensures they match crop requirements within blocks accurately to avoid over fertilising and minimise the risk of nutrient loss. They are also replacing residual (long term control) herbicides like diuron and atrazine with alternative options such as glyphosate, which is a knockdown chemical and has less environmental risk if lost off farm.Tony adds, '**this is good economically for the farm and hopefully also has some water quality improvement benefits**'.

High priority—water

Improving their water management was a high priority because limited irrigation capabilities on the farm meant there were plenty of times that plant cane and even ratoons (what the crop is called once it regrows after harvest) would die due to lack of water.

Tony says, '**we wanted to improve our irrigation management but first needed to secure water to be able to ensure that any investment in infrastructure could see a return**'.

To improve their water management, the Jeppesens looked at water availability and flows throughout the whole farm and built this into an overall water management plan. Using this plan they prioritised what was needed to improve water management and identified a number of key locations on-farm where new structures should be built. The Jeppesens made sure to contact the regional Department of Natural Resources and Mines office in Mackay and confirm their planned activities were not disturbing natural wetlands or significantly impacting overland flow, therefore negating any need for Water Act approvals.

About the property

- 250ha property located near Bloomsbury, 80km north west of Mackay, Queensland
- 180ha under cane (Proserpine milling area)
- Located near Horse Creek in the O'Connell River catchment which flows into Repulse Bay and the Whitsunday section of the Great Barrier Reef Marine Park

As the photo below shows, there are a number of structures, described in more detail in the following sections, that are now in place on the cane farm to manage water as it moves across their property.

Satellite image showing current water structures and drainage on the farm and surrounding areas:

1—existing dam

2—constructed wetland

3—detention basin – *smaller structure that traps run-off and sediment off a set area of the farm*

4—ring tank – *larger structure that needs to have water transferred into it as it has no catchment*

5—Horse Creek

6—O'Connell River

Photo: Reef Catchments

Existing dam

One of the first actions the Jeppesens completed was to link an existing dam (1) with new irrigation infrastructure to allow some of the trapped water to be transferred and utilised around the farm. This dam provides a variety of natural features and not all of the water is used for irrigation. This ensures there is some available for habitat and wildlife refuges during dry periods.

The existing dam provides water for irrigation, biodiversity and water quality outcomes. Photo: QDAFF

Constructed wetland

In 2007, the Jeppesens received funding from the Queensland Government to construct a wetland. One of the aims of the wetland was to provide water quality outcomes through increased detention time by allowing the settling of sediments and removal of nutrients and pesticides. Tony says, '**we could also reuse the water and transfer it around the farm to retain any pollutants within the system**'. This is more of an 'as required' action and he adds, '**removal will always stop once a level of 3m is reached in the deep section to leave something for the fish**'.

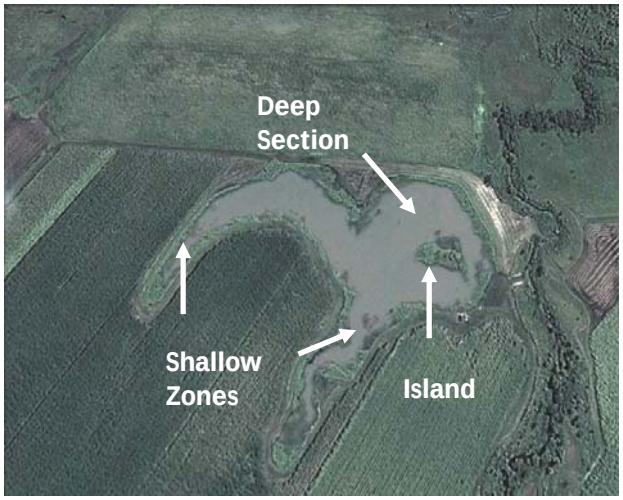
The wetland had a range of biodiversity and water quality treatment features:

- **Island**—this was planted with native trees to provide extra shelter for wildlife
- **Habitat variety**—a number of shallow and deep water sections provide a variety of habitat zones
- **Deep section**—an important refuge during the dry season for fish and other aquatic animals that help to control mosquito breeding
- **Shallow zones—**favoured by many of the native birds that use the wetland. These areas were also designed to promote the growth of macrophytes

Wetland constructed in 2007. Photo: QDAFF

- **Macrophytes—**reeds, rushes and sedges which help slow down the water flow, increase the structure's detention time and are a key part of the process in how a wetland breaks down and removes nutrients from the water

The key management objective is to make sure that the water depth in these shallow macrophyte zones does not exceed 600mm for extended periods, otherwise the plants may die. Normally a high flow bypass is included in the design, but was not possible at the site, so instead maintenance and the reuse of water are important management actions to ensure the wetland is able to provide water quality outcomes.



Satellite image of the constructed wetland showing key features. Photo: Reef Catchments

Drains and detention basin

The Jeppesens also worked to improve the drainage network around the farm and to build some detention basins in key locations as part of their irrigation planning.

Tony explains, '**between 2006 and 2010, many of the farm drains were re-surveyed and levelled out to improve water flowing between blocks. We have them all grassed and directed into at least one of the treatment structures on the farm'**.

The priority was to fix up drainage paths to improve flow throughout the farm. Photo: QDAFF

In 2006, the Jeppesens secured funding from the Natural Resource Management Group, Reef Catchments, to build a detention basin. This was designed to act like a sediment trap and able to capture a first flush event (30mm of run-off) from 30ha of cane blocks (around 9ML capacity). It was located so that it could also act as a sump for a larger ring tank (refer next section) allowing captured water to be transferred to the ring tank, freeing up the detention basin to catch the next run-off event.

Detention basin acting as both a sediment trap and a sump for a larger ring tank. Photo: QDAFF

Water re-use

To help with the re-use of the water, in 2009 the Jeppesens sacrificed some cane land to build a large ring tank, with a holding capacity of 150ML. The aim was to transfer some of the run-off that goes into the detention basin and wetlands into the larger structure so that it can be utilised after the wet season for irrigation to improve crop production. This also means that there is less dependence on getting water from the O'Connell River during low flow periods.

Tony says, '**we are now able to irrigate all of our home farm via flood and high pressure overhead application. The paddocks that are suitable for flood irrigation are within the system so if there is any tailwater it will be captured and reused on farm'.**

Satellite image of detention basin and ring tank. Photo: Reef Catchments

Improving productivity and profits

There have been a number of benefits from all of this work the Jeppesens have implemented on their farm.

- **Reduced water logging**—with improved drainage there is less impact from water logging
- **Improved access after rain**—quicker access to headlands and blocks after wet periods
- **Increased water security**—ability to irrigate more of the farm and longer into the season
- **Increased irrigation water**—the farm now has water available to improve the crop.

An economic analysis was conducted to determine the costs and benefits of the work undertaken. A summary of the analysis is presented in Table 1.

The impact on farm operating return was assessed by comparing operating return without irrigation to three alternatives:

1. Irrigation with existing dam (Option 1)
2. Irrigation with existing dam, constructed wetland and detention basin (Option 2)
3. Irrigation with existing dam, constructed wetland, detention basin and 150ML ring tank (Option 3).

Table 1 indicates that, over the entire project (i.e. beginning with no irrigation and moving to Option 3), the productivity benefits have resulted in the Jeppesen's increasing yield by 30.2%, which means a **$168,189** annual increase in revenue. This change has also increased the Jeppesen's annual operating costs as they now spend an additional **$71,000** per year on electricity, labour and maintenance of irrigation

equipment. This equates to an **$97,189/year** increase in-farm operating return since before irrigation.

Table 1 also indicates the initial cost of implementing the changes, the rate of return on investment and the number of years it would take for the investment to be paid back (payback period). For example, under Option 3 the rate of return on investment is 5%. By comparison, Option 2 has a relatively larger rate of return, 15%, and a payback period of 8 years.

Table 1: Costs and benefits of changing from no irrigation to irrigation—Options 1, 2, and 3

	Option 1	Option 2	Option 3
	Irrigation with existing dam	*Option 1* + constructed wetland + detention basin	*Option 2* + ring tank
Cost of implementation ($)	$155,000	$327,000	$997,000
Change in operating costs ($/yr)	$14,750 (irrigating 0.3ML/ha)	$27,000 (irrigating 0.6ML/ha)	$71,000 (irrigating 2ML/ha)
Change in revenue* ($/yr)	$36,150 (yield increased by 7.7%)	$82,992 (yield increased by 15.4%)	$168,189 (yield increased by 30.2%)
Change in gross margin ($/yr)	$21,400	$55,992	$97,189
Net Present Value** ($)	$39,909	$182,970	-$111,815
Internal Rate of Return (%)	11%	15%	5%
Payback Period (years)	11 years	8 years	n/a
Assumptions	*Sugar price $440, harvest cost $8/tonne, all options have equal hectares under cane. **Based on discount rate of 7% over 15 years		

Environmental outcomes

Water quality—There has been a significant reduction in the amount of sediment lost from the farm as it is now trapped and able to be reused back on farm. Improved land management practices and the ability to now detain and reuse run-off within the system will also reduce the risk of nutrient or pesticide losses into the local creek and then into the Great Barrier Reef Marine Park.

Biodiversity—Improving water management throughout the farm has helped the local wildlife. From fish and turtles which inhabit the deeper pools to the amazing variety of birds that feed amongst the water plants.

Tony says, '**it is great to see the win-win situation that doing all of this work has created and I love sharing it with the whole family**'.

Detention basin and grassed headland showing sediment being trapped from recent flow event. Photo: QDAFF

What's next?

To keep it all working properly, there is always maintenance or repair work on all of the structures. This is often the case after large run-off events and can include removing captured sediment or extra weed control. The Jeppesens will continue to always look at how they can improve their farming practices and are open to the idea of building more wetlands.

Brolgas gathering in block next to wetland. Photo: QDAFF

Further information

Further information can be found in the Wetland Management in Agricultural Production Systems series: http://wetlandinfo.ehp.qld.gov.au/wetlands/management/wetland-management/

The Queensland Wetlands Program supports projects and activities that result in long-term benefits to the sustainable management, wise use and protection of wetlands in Queensland. The tools developed by the Program help wetlands landholders, managers and decision makers in government and industry. The Queensland Wetlands Program is currently funded by the Queensland Government.

Contact wetlands@ehp.qld.gov.au
or visit www.wetlandinfo.ehp.qld.gov.au

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