CASE STUDY 1

LANDOWNERS' DECISION TO INSTALL A CENTRE PIVOT SYSTEM

Background

The landowner operates a 100 hectare dairy farm near Nathalia in the Murray Valley Irrigation Area of northern Victoria. A 60 hectare section of the farm on heavy soil types was well developed with laser-graded bays served by a good drainage reuse system. However, a 9 hectare section on light soil types had a layout that was too flat and an inefficient irrigation system.

The remaining area of the farm consisted of predominantly light soil types and had a poor old-style layout with many short bays on undulating topography. This section was time-consuming to irrigate and required a relatively high volume of water. The landholders wanted to improve their farm operation, especially water use efficiency, and started the re-development of their farm irrigation system.

Using the 5-Step decision-making processes, the landowners made the following assessment of their property and made an informed decision to adopt a system that best fitted their farm.

STEP 1: What do I want to achieve?

This step helped the landowners assess their goals and aspirations. The following issues led the landowners to consider re-designing their irrigation system:

- *They wanted to reduce labour input and increase efficiency of farm operation by automating their irrigation system;*
- *They wanted to re-develop the area within a short time span to minimise production losses and maintain stocking rates;*
- *They wanted to make better use of surface runoff water and dairy effluent; and*
- *They strongly believed that a centre pivot system is more water efficient than border-check irrigation and that it provides a higher productivity potential.*

STEP 2: What are my farm's features and constraints?

This step helped the landowners better understand their farm situation. They first evaluated the possibility of re-designing the border-check layout on the old-style block to modern standards. They came to the conclusion that border-check re-development would require significant earthmoving and that the work would need to be staged over two or more years to keep enough pasture in production to feed their herd.

The new layout would also require a higher supply flow rate of around 12 ML/day. They considered that the existing Goulburn-Murray Water supply channel probably could not accommodate this flow rate. There is a culvert under the road that, even under the existing conditions, is barely able to supply peak water requirements.

STEP 3: What irrigation options should I consider?

After listing the pros and cons of border-check for the light soil section of their farm, the landowners turned their attention to the option of a centre pivot irrigator. After some preliminary research they found that there was little difference between the development costs for either system and when they considered their long-term operational and business goals, they decided a centre pivot development would be the preferred option. However, more information was required to make a final decision about the design of pivot irrigation on their farm, so they moved to Step 4 in the planning process.

STEP 4: What needs to be included in my planning, design and management, and what will it cost?

Planning: No one else in the district had previously used a centre pivot to irrigate perennial pasture so there was no opportunity for the landowners to exchange ideas with their neighbours. They now needed to evaluate, in detail, the features and constraints of the land they wanted to develop.

They considered that the soils at the proposed site were suitable for centre pivot irrigation. The shape of the block would perfectly suit a semi-circle pivot design.

One of the main physical site constraints for pivot irrigation was the presence of remnant trees. The farmers applied and obtained a planning permit from the Department of Sustainability and Environment to remove these trees and put in compensation plantings. In addition they also needed to perform some earthworks because of the undulating nature of the site, so they submitted an application to Local Government to implement these works.

Another issue to resolve was the fencing configuration that best suited the existing shape of the farm section and the proposed semi-circle pivot design. After much consideration and discussion with various people including consultants and farmers, they decided to fence the 31 hectares in concentric or doughnut shapes. In this way, each of the paddocks is semi-circular and has the same width. The length of the paddocks varies with shorter paddocks near the centre to the longest on the outside of the pivot semi-circle. The area of the paddocks increase from the centre to the outside of the pivot and the landowners use temporary fencing to adjust the size for grazing.

This fencing allows the pivot towers to not cross any fences except through conventional gates at the start of the semi-circle where the machine can be parked on a laneway. The landowner did all fencing himself, but looking back he now believes "*paying someone else to do the fencing would have been a better decision".*

Water resource considerations, both in terms of *flow*, *quality* and *timeliness of application*, were other important issues the landowners had to deal with. The existing channel capacity was not large enough for a modern border-check layout but would be sufficient for pivot application.

Assessment of the quality of the water is an essential element for any irrigation system but is especially important for pressurised systems. While the quality of water supplied in the Murray Valley Irrigation Area is considered good, issues such as debris and the salinity of the water were investigated to determine their impact on pivot operation and maintenance.

The decision was made to allow for surface runoff from the border-check irrigation section of the farm, groundwater that was pumped from a spear system and dairy effluent to be collected in the drainage reuse dam. This collected water could be shandied with water delivered from the Goulburn-Murray Water supply channel. By taking this approach they improved the supply reliability and had direct control over water quality.

At the time of making these decisions, very little information was available to support the decision-making process, the landowners talked to other farmers in the district who were growing lucerne under pivots and also irrigation retailers. They visited Yarram, in Gippsland, to look at a pivot growing permanent pasture on a dairy farm.

"*We tried to compare apples with apples where we could, and in the end we had to grit our teeth and give it a try. If pasture didn't work we could at the very least grow a crop under it*" said the landowner.

Design: System capacity (the maximum rate at which water can be pumped onto the irrigated area, typically between 6 and 15 mm/day) is the most important design parameter for centre pivots. In the past, many systems were under-designed to minimise capital investment and were not able to match peak crop water requirements during summer. With a centre pivot, *how much* to apply is perhaps more important than *when* to irrigate, particularly if irrigating at a set interval, such as twice weekly.

The landowners admit that they had limited knowledge about their system's capacity at the time of installation. Looking back they believe some of the following questions would have been useful to ask the designer:

- *What is the supply system capacity for my farm and can it match the new pivot's capacity?*
- *What is my new pivot's design capacity and can it supply enough water during periods of peak demand in hot weather?*
- *What type of sprinklers do I need?*
- *What pressure does the system require?*
- *Should I choose a hydraulic or an electric drive system?*
- *Will I be getting uniform application of irrigation on my farm?*
- *What will be the up-front and the on-going running cost for my centre pivot system?*

Cost: The landowners costed a fully lasered and automated border-check irrigation system and compared that to a pivot system.

The costing of the pivot included:

- extending three-phase electricity to the area being developed,
- pivot,
- pump,
- tree removal and re-planting, and
- minimal earth works.

The running costs of using diesel or electric and off-peak and peak rates were also considered. After carefully weighing these options they decided to use electrical supply because of ease of operation, lower maintenance requirements, less noise and lower running costs.

Off-peak electricity is available in Victoria from 11pm to 7am each week night and 11pm Friday to 7am Monday over the week-ends, or 88 hours out of the 168 hours in a week. Off-peak electricity costs about $7.50 per megalitre pumped compared to peak rates $20.50 per megalitre of water pumped (these costs vary per system; electricity rates are subject to change so check with your power supplier).

Usage of off-peak electricity obviously requires irrigation to occur in these times. In this case the landowners believed that using off-peak electricity was the right decision and a good cost-saving strategy. Their final decision to install a centre pivot, rather than improving their border-check layout, was based on this detailed economic and operational analysis.

Management: The landowners now irrigate almost completely on off-peak electricity. Over summer, they typically aim to apply 36 mm over the weekend, with a light irrigation of 5-6 mm overnight mid-week. The mid-week irrigation ensures that the pasture does not dry out before the weekend irrigation and returns the pivot to its starting point. Being a half-circle, the pivot has to reverse to return to its start each cycle. The adopted strategy is convenient for the site's operation.

Pivots require some attention to run smoothly without breakdown. Wheel ruts (*bogging*) is a common phenomenon on pivots operating on poorly drained soils and can cause the machines to stop (Figure 1).

Figure 1: A wheel rut

Figure 2: Built up track

At the time of the installation of their system, there was no information available about the risks of wheel rutting for the soil types at the landowners' property. They now believe it is one of the major management issues that needs careful consideration before a system is installed. Options to rectify wheel rut problems have become available since the system was installed and these owners have now installed half-throw sprinklers either side of the towers (known as a *"dry-wheel pack"*) to prevent water from hitting the tower and running onto the wheel tracks. They also placed sand and gravel in the wheel ruts to create a firmer track (Figure 2).

STEP 5: What option best meets my goals?

Following the 5-Steps, the landowners made an informed decision to select a system that best met their goals and aspirations. After resolving some initial teasing problems, particularly rutting, their selected centre pivot option fits well with their farm situation (Figure 3), both current and long-term goals and they are very happy with their investment. Compared to border-check irrigation on other parts of their property, they believe that the pivot area productivity is higher and that it uses water more efficiently. In addition, considerable labour savings have been achieved.

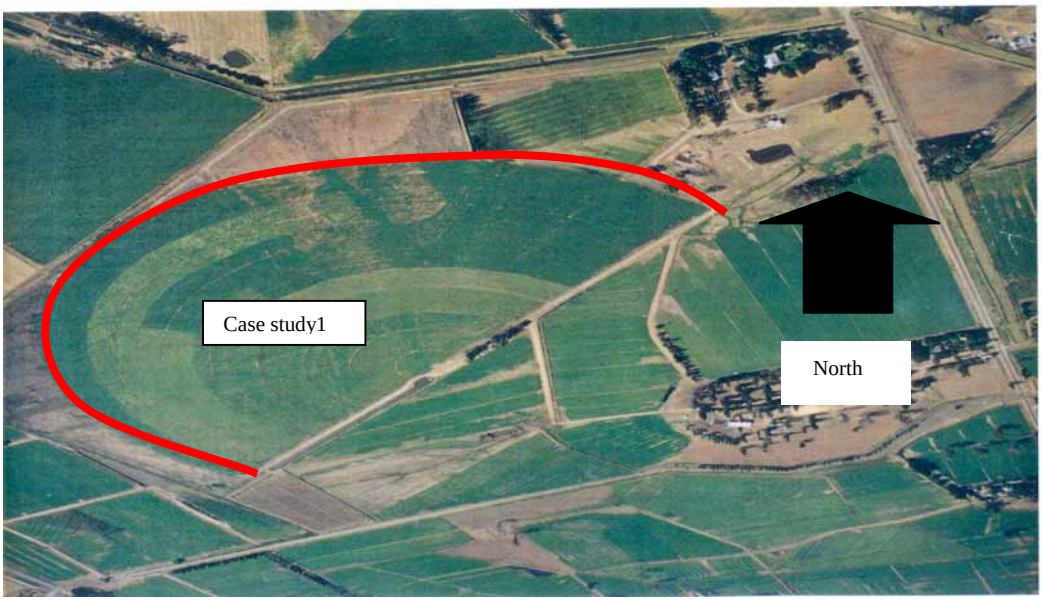

Figure 3: Aerial photo of Case Study 1 site