IRRIGATION NEW ZEALAND
TECHNICAL & TRADE

CASE STUDY 4:
CENTRAL OTAGO VINEYARD

Summary

Using the Irrigation Decision Support Package to assist with obtaining designs and quotes may have led to:

- avoiding two years of poor irrigation performance ($50,000/yr);
- avoiding costs to fixing performance (consultants' fees and replacing components =$20,000);
- knowledge of how to operate and maintain the irrigation system.

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About this Property

This 57 ha property is a privately owned vineyard in Central Otago. The property is located on rolling, hill country with primarily north-west facing slopes.

There are two main soil types on this property. Lowland areas consist mostly of Molyneux stony fine sandy loams, while the upland areas consist of Manuherikia moderately deep fine sandy loams. The estimated profile available water (PAW) in these soils is 15 mm and 40 mm, respectively.

The vineyard is irrigated by a pressurised surface drip irrigation system. This system is fed by four surface pumps that take water from two small ponds near the centre of the property. Water is distributed to each irrigation block individually, by a system of solenoid valves, as required.

Irrigation Requirements

The requirement of this irrigation system is to apply enough water to each vine, without spreading water to areas where it is not needed or cannot be used. Water must be delivered at specific times and in specific quantities to obtain optimum fruit quality and yield. Drip irrigation is often used to accomplish this.

Irrigation scheduling requirements should be determined from local climate, crop, and soil properties. Table 1 summarises the irrigation requirements unique to this property.

TABLE 1: GENERAL SYSTEM SPECIFICATIONS		
PERFORMANCE INDICATOR	UNIT(S)	SPECIFICATION
System capacity	mm/day	2.5
Application depth (range)	mm	3-10
Return interval	days	1-4
Application intensity	mm/hr	≤ 50

(source: Water Requirements for Irrigation Throughout the Otago Region, Aqualinc Report No L05128/2, Oct 2006)

As is the case with many vineyards, the light soils require frequent watering at low application depths at key points throughout the season. Because the soils have a high sand content, infiltration rate is not likely to be limiting.

Designing irrigation for this property was particularly challenging because of elevation differences across the property, and the irregular shapes of many of the land parcels.

The Development Process

This irrigation development has progressed in several planned stages over a number of years, according to the schedule set out in Table 2. Pumps were added to the system, as required, during each upgrade.

TABLE 2: GENERAL SYSTEM SPECIFICATIONS					
STAGE	AREA ADDED (ha)	NUMBER OF VINES ADDED	NUMBER OF IRRIGATION BLOCKS ADDED	AVERAGE BLOCK SIZE (ha)	AVERAGE NUMBER OF VINES PER BLOCK
1	20	31,200	7	2.9	4,500
2	5	9,400	2	2.5	4,700
3	10	17,500	4	2.5	4,400
4	22	44,200	6	3.7	7,400
TOTALS	57	102,300	19	2.9	5,400

Stage 4 was planned by a different irrigation designer to the other three stages. The blocks were larger, with more vines in each.

The owners became aware of performance problems soon after Stage 4 was installed. They tried modifying the system to fix the problems themselves, but had limited success. As a result, they suffered two seasons of poor performance before they employed a consultant to conduct a performance evaluation of the system.

In the two years after the installation of Stage 4, production in several of the newer blocks was extremely poor. In both years, nearly 2 ha of grapes were dropped out due to problems directly related to poor irrigation performance. Reduced yield resulted in reduced juice volumes to the winery (the equivalent of an estimated $50,000/yr).

Measured Performance

A performance evaluation was carried out to determine the cause(s) of the poor irrigation system performance. The analysis concluded that:

- Two of the newer blocks were too big for the water supply. This was overworking the pump, resulting in low delivery pressure, and low emitter uniformity in these blocks.
- The remainder of the irrigation blocks matched the capacity of the pumps. The necessary pressure and flow rates were being delivered to the mainline.
- Several of the solenoid valves (these control the flow of water to each individual block) had been set to limit the pressure entering the blocks. As a result, blocks with large elevation changes experienced insufficient pressures at the top end, and low emitter uniformity.

  This particularly affected the newest blocks, which have a considerable elevation difference compared to the older blocks.

- All pipelines appeared to be adequately sized.

Solenoid valve (photo: Tony Davoren)

What the Owners Could Have Done Differently

Several things could have been done differently, prior to installation of the irrigation system. Had the following items been considered, the property owners could have avoided two years of reduced production (estimated at $50,000/yr), consultants' fees (approximately $10,000), and actual cost to replace pipes, solenoid valves, etc (approximately $10,000) to fix performance problems:

FINALISE IRRIGATION LAYOUT UP-FRONT
Before development began, it was known that this property would be developed in stages. One design should have been prepared for all four stages at the beginning of the process. This would have avoided:

- having to deal with designs from multiple irrigation companies;
- varying management requirements between blocks, and;
- the performance problems that were experienced because of a shift in Stage 4 away from a design that was proven during the first three stages.

INCLUDE PERFORMANCE EVALUATION IN THE CONTRACT
Verification of system performance should have been included in the contract for the supply of the system. It should have stated the criteria that needed to be met (e.g. those in Table 1), as well as who was responsible for the commissioning and testing of the system. This would have highlighted the performance issues immediately, and steps could have been taken to correct them. Two years of reduced production could have been avoided.

HAVE PLANS CHECKED BY A PROFESSIONAL
Any changes to the system should have been checked by an irrigation professional, even for basic do-it-yourself "upgrades". This would have avoided additional mistakes made by trying to fix hydraulic issues without a working understanding of them.

INCLUDE TRAINING IN THE CONTRACT
Proper training on operation and maintenance should be included as part of the supply contract for the system. Training in the operation and maintenance of the system could have helped avoid many of the performance problems discovered during the evaluation (e.g. knowing how and why to adjust the pressure to each irrigation block).

CREATE A MAINTENANCE PLAN AND CHECK PERFORMANCE
Regular measurements of water use, operating pressure, and soil moisture would have indicated performance problems sooner, meaning they could be fixed sooner.

OBTAIN ALL DOCUMENTATION
Lack of design specifications and plans was a major contributor to the cost of troubleshooting this system to fix the poor performance issues. Detailed plans showing the pipes and solenoid valves (as-installed) were not provided. These had to be determined in the field.