"Achieving Outcomes by Building Capability"

The AgriBusiness Group™

Affordability and Regional Economics for the Manuherikia Catchment Scheme

Prepared for: Manuherikia Catchment Water Study Group
Prepared by: The AgriBusiness Group
September 2012

Affordability and Regional Economics for the Manuherikia Catchment Study

Please Read

The information in this report is accurate to the best of the knowledge and belief of the consultants acting on behalf of the Manuherikia Catchment Water Study Group . While the consultant has exercised all reasonable skill and care in the preparation of information in this report neither the consultant nor the Manuherikia Catchment Water Study Group accept any liability in contract, tort or otherwise for any loss, damage, injury or expense, whether direct, indirect or consequential, arising out of the provision of information in this report.

Executive Summary

Background

This report is prepared by The AgriBusiness Group (TAG) to carry out Milestone 14 "On farm affordability and regional economics for the Manuherikia Study". The tasks as defined in the brief are to carry out reporting at a pre-feasibility level of:

- On farm affordability by land use.
- Financing options.
- Regional economics.

Peter Young, a local farm consultant, was engaged to carry out the creation of the four before and after farm irrigation development case studies which are based on existing farms. These were further developed into seven outcomes dependant on land use.

For this exercise the capital cost of the water is as quoted by AquaLinc at a range of different capital costs depending on which scheme that shares are held in. There is quite a variance between farms in total water access costs as a result of the existing spread of ownership of shares.

The cost of running the scheme is estimated by AquaLinc as $30 / ha / annum.

Results of on Farm Analysis

Case Study One – Mixed Sheep, Deer and Dairy Support

This is a smaller scale block which is all flat with existing irrigation of a relatively poor quality. Two different conversion options are modelled for this property.

- An increase of the current policy of mixed breeding and trading / finishing.
- Conversion to an all trading / finishing property.

For this model the first option which was virtually more of the same didn't generate much of a financial advantage from conversion. The second option generated much healthier surplus and a very satisfactory return on marginal capital.

Case Study Two – Sheep and Beef Breeding and Finishing and Dairy Support

This is a larger scale property which is half flat and half hill country. The existing irrigation is relatively efficient. This shows a very good response to irrigation conversion with a very high increase in cash farm surplus and a very satisfactory return on marginal capital.

Case Study Three – Hill Country Sheep and Beef Breeding and Finishing

This is a very large scale property with approximately one third unimproved hill country, one third improved hill country and one third flatland. About 20% of the flatland is currently in irrigation. The farm profitability results indicate marginal returns to the irrigation development under the assumed farm system adopted on this property. The increased Cash Farm Surplus returns from the development are low and are less than the cost of Debt Servicing on the additional capital required. The return to marginal capital is less than the assumed cost of borrowing. The return on total capital after the conversion shows a deterioration in the return on capital for the property.

Case Study Four – Flatland – Dairy Support

This is a medium sized flatland property with one small existing centre pivot irrigator. Two different scales of conversion are trialled on this property with one being partial development of irrigation and the other being full irrigation development. The first option which is partial development is marginal in that it only increases the Cash Farm Surplus by a relatively small amount and has a very narrow advantage once it has serviced the debt. However the full development option has a much better result in that it increases the Cash Farm Surplus and more than doubles the Cash Farm Surplus available after servicing the extra debt.

The return to marginal capital is marginally more than the cost of borrowing for the partial development option and is showing a very healthy return for the full development option. The return on total capital shows a negative response for the partial option although again the full development option shows a much superior return.

Case Study Four – Flatland – Dairy

This is the second option of full irrigation conversion and a change to Dairy Land use. The increase in all aspects of the profitability analysis are large for the Dairy Conversion option. The return to marginal capital is almost twice the assumed cost of borrowing. The return on total capital after the conversion shows a slight deterioration in the return on total capital for the property.

Case Study Five – New Conversion of Irrigation Capability – Sheep and Beef.

This is a property which prior to irrigation conversion is modeled as running a standard sheep and beef farm operation on a Dryland property which has a portion of Lucerne production. A sheep breeding and a sheep trading operation that incorporates a small amount of cattle trading is trialed for this operation post irrigation development. Case study five has a relatively high cost of conversion as a result of not having any existing irrigation. As could be expected the improvements in Cash Farm Surplus are significant for both of the options even after the provision of debt servicing of the conversion costs. The return on marginal capital is significantly higher than the cost of borrowing.

Summary of Results

- **The size and state of the existing irrigation capability has a big impact on returns as only marginal returns are gained from the full conversion of existing reasonably efficient irrigation.**

- **Continuing irrigation development based on some current land uses, particularly with low performing breeding stock, does not appear to give enough extra returns to justify the investment.**

- **Returns from higher producing land uses are significantly more than are presently being achieved and provide an attractive return from development.**

- **The higher the value of irrigated land uses the greater return from the investment.**

- **As a pre feasibility study this report would indicate that it would be financially viable to proceed to the next stage of scheme development.**

Financing Options

The most important issue around financing options for farmers is around the interest rate that they will pay. The lower the interest rate the more attractive the option will look to them.

The other important point is the terms of the loan including:

- the length of time that the interest rate is fixed for,
- the means of determining what the interest rate will change to,
- whether the loan is interest only or interest plus principal or a combination of the two spread over time,
- the period of the loan and
- the potential variability of any of the factors.

This section of the report contains a brief discussion around the issues related to each of these factors.

Regional Economics

At the pre-feasibility stage it is far too early to do any quantitative work on Regional Economics. However the following summary of the matters to consider is taken from "Water Enhancement Policy Study Five"[1] which outlines the important issues to consider in carrying out Regional Economic Studies.

Regional Economics Factors to Measure	
Output	Total Output
Employment	Total Full Time Equivalents
Value Added	Total Value Added
Location of Impacts	All above by Location
Usually Resident Population	Number and % change over time
Population Age Structure	Percentage in each Age Groups
Age of Farmers	Percentage in each Age Groups
Dairy Farmers	% of Dairy Farmers
Dairy Farmer Age	Percentage of Age Groups

[1] MAF Technical Paper (2003): Water Enhancement Policy Study Five.- Economic and social assessment of community irrigation projects, - A multi objective framework.

Educational Qualifications	% with or without educational qualifications
Employment by Industry	Employment by Sector
Occupational Status	Status of Occupations
Employment Status	Employees / Employers as % of
Labour Force Status	Full time / Part time employment
Household Incomes	Median Household Income
Distribution of Incomes	% of household incomes by $ range
Schools	Numbers/ Rolls / Ages / Facilities
Community Organisations	Number / Variety / Range

1 Scope

This report is prepared by The AgriBusiness Group (TAG) to carry out Milestone 14 “On farm affordability and regional economics for the Manuherikia Study”. The tasks as defined in the brief are to carry out reporting at a pre-feasibility level of:

- On farm affordability by land use.
- Financing options.
- Regional economics.

A brief description of the investigation area is as follows. The Upper Valley (above Ophir) is where the vast majority of irrigation expansion would occur. Farmers are expected to get high to very high reliability of irrigation water and a gravity supply. Most existing irrigators will need to install new spray systems. Investigators are looking at a range of development scenarios, from 5,000 ha of new irrigation in the upper valley, through to 15,000 ha of new irrigation which would be the upper limit of development due to both water availability and land constraints.

In the lower valley (i.e. Manuherikia Irrigation Scheme) any expansion in irrigated area would come from efficiency improvements in existing systems and an improvement in reliability. For the lower valley irrigators the biggest changes will be farmers upgrading their on-farm irrigation systems

1.1 On farm affordability.

Peter Young, a local farm consultant, was engaged to carry out the creation of the before and after farm irrigation development case studies. The trading / finishing and dairy conversion options after irrigation development were created by The AgriBusiness group.

The productivity of the farm systems was modelled by AquaLinc using their AusFarm software. This reported pasture production as Kilograms of Dry Matter per Hectare (kg DM / ha) based on the soil type and climatic conditions in each location.

The group chose the case study farms to show the impacts on the 4 farming systems below.

Case Study One – Mixed Sheep, Deer and Dairy Support

This is a smaller scale block which is all flat with existing irrigation of a relatively poor quality. With irrigation conversion of the whole property to modern application methods the property is able to lift productivity from 8,721 kg DM / ha to 14,975 kg DM / ha a lift of 6,254 kg DM / ha or a 72% increase in pasture produced. Two different conversion options are modelled for this property.

- An increase of the current policy of mixed breeding and trading / finishing.
- Conversion to an all trading / finishing property.

Case Study Two – Sheep and Beef Breeding and Finishing and Dairy Support

This is a larger scale property which is half flat and half hill country. The existing irrigation is relatively efficient producing 11,466 kg DM / ha. The area under irrigation is more than doubled through development and is estimated to produce 14,695 kg DM / ha an increase of 3,249 kg DM / ha or 28% on the production from the existing irrigation area. This increase in

production is utilised through an increase in numbers and productivity of the breeding animals and an increase in the finishing performance of the progeny.

Case Study Three – Hill Country Sheep and Beef Breeding and Finishing

This is a very large scale property with approximately one third unimproved hill country, one third improved hill country and one third flatland. About 20% of the flatland is currently in irrigation with about one half of this is in spray irrigation and the other half is in flood irrigation which is producing 10,971 kg DM / ha. The area under irrigation is expanded by approximately one half and it is all converted to centre pivot irrigation producing 14,635 kg DM / ha. This is an increase of 3,663 kg DM / ha or 33% on the productivity before conversion. Breeding numbers are lifted slightly but all progeny are finished to higher live weights.

Case Study Four – Flatland – Dairy Support

This is a medium sized flatland property with one small existing centre pivot irrigator. The property is operating as a Dairy Support operation grazing Rising one and two year old dairy heifers as well as wintering dairy cows. Three different conversion options are modelled for this property.

- Partial development of another 100 ha of irrigation and continuing as a dairy support property.
- Developing the full area capable of irrigation development and continuing as a dairy support property.
- Developing the full area capable of irrigation development and converting into a dairy operation.

An additional option was modelled which is designed to show the types of returns available from a completely new development of irrigation capability. This is to demonstrate the returns possible from utilising the additional water which is available to allow a completely new area of irrigation capability through the adoption of sheep and beef breeding and finishing operations..

Case Study Five – New Conversion of Irrigation Capability – Sheep and Beef.

This is a property which is modeled as running a standard sheep and beef farm operation on a Dryland property which has a portion of Lucerne production. Two different farming systems are modeled on the property post irrigation conversion. They were chosen to represent the returns that were available from high producing sheep (90%) and beef (10%) operations.

- A sheep breeding and cattle finishing operation.
- A sheep trading and cattle finishing operation.

1.2 Reporting Affordability of Water

This is reported as:

Farm Profitability

This is displayed as:

Gross Farm Revenue – Farm Working Expenses = Cash Farm Surplus

Cash Farm Surplus – Debt Servicing = Net Cash Flow

Cash Farm Surplus increase from Dryland

Return on Capital

This is reported as the two important measures of;

- return on Total Farm Capital and
- the return to the additional or marginal capital involved in the conversion process. This is calculated by dividing the net change in Cash Farm Surplus in moving from dryland to irrigation (marginal return) by the net cost of conversion of the property, including the cost of irrigation scheme shares. The net capital cost is referred to as the marginal capital.

Asset Value

One of the most significant impacts of the conversion process is to change the whole asset structure of the farming business. The change in net worth of the land owner is an important consideration in irrigation conversion. This is reported in general terms as there is considerable difficulty establishing market values, especially for dryland properties at present.

1.3 Financing Options

The section on financing options is a summary of previous work done for other similar schemes. This will depend greatly on the cost of the off farm works. If this cost is relatively low then financing it is not difficult or complicated to arrange. If it is high then it becomes more problematic and a range of options should be considered.

1.4 Regional Economics

As it is too early to estimate the likely land use changes this part of the report discusses the likely sorts of general changes that we could see in the Regional economy. This includes changes in the income and expenditure patterns on converted farms and the likely changes that would result in flow on industries like processing and servicing sectors. An estimate of the likely changes in on farm employment and the impacts that this will have can also be made.

2 On farm Costs to Irrigate

There are two areas of cost associated with irrigation development on farm. The first is the capital cost involved in converting the property to irrigation while the second is the ongoing costs of operating the irrigation equipment and applying the water.

2.1 Capital Conversion Costs

Capital conversion costs will vary significantly from property to property according to the nature of the property and the infrastructural improvements already in place. The conversion costs reported here are for a "greenfields" type development of the property to a new land use or intensification of land use. This entails the removal of much of the existing infrastructure to facilitate the irrigation development and replacement of the infrastructure. Some properties will choose to stage this approach over time, or soften the development to an approach which integrates existing infrastructure into the development. In this case the upfront capital costs can be reduced considerably from those reported. Irrigation system choice is one of the biggest determinants of total capital costs because of the variation in installation costs of systems.

Capital conversion items to be considered include:

- Clean Up
- Irrigation System
- Cow Shed
- Electricity
- Housing
- Other Buildings
- Fencing and Lanes
- Stockwater
- Fertiliser
- Regrassing
- Machinery
- Livestock

Typical ranges of capital costs are shown in Table 1. The costs reported have been taken from actual conversions and costing exercises.

Table 1: Capital Conversion Costs ($/ha)

Cost Item	Low	Typical	High
Clean Up	0	50	250
Irrigation System	1,900	3,000	7,000
Cow Shed	2,000	3,000	5,000
Electricity	50	110	300
Housing	0	500	1500
Other Buildings	0	75	150
Fencing and Lanes	50	200	300
Stockwater	0	60	250
Fertiliser	0	300	500
Regrassing	0	500	750
Machinery	0	100	600

Total livestock costs will depend on existing livestock owned and the farming mix adopted. In some cases there may be a net gain from the sale of livestock; in others like dairying, it could be as high as $7,000 / ha.

In many instances changes or intensification of land use leads to a requirement to purchase new or additional shares in businesses involved in the supply of goods (e.g. fertiliser companies) or the purchase of outputs (e.g. Fonterra or meat processors). This analysis doesn't include any share costs. In the case of dairy farming the cost of the purchase of shares has not been included as there is the option to supply a company that doesn't require capital purchases of shares.

For this exercise the capital cost of the water is as quoted by AquaLinc for each scheme area as follows:

Table 2: Off-farm costs for existing Manuherikia Valley irrigators with reliable water (existing water).

Option	Supply area	Cost/ha
Omakau Irrigation (main race only)	3,350	$2,500
Blackstone Irrigation	600	$1,800
Manuherikia Irrigation (unpressurised)	1,400	$1,000
Manuherikia Irrigation (fully pressurised)	900	$3,500
Galloway Irrigation (fully pressurised)	550	$4,300
Other irrigators (incl. other Omakau irrigators)	2,500	$700
Total	9,300	

Table 3: Irrigation development potential in the Manuherikia Catchment (new water)

Option	New Irrigation	Cost/ha(1)
Raise Falls Dam 27m	14,500	$5,500
Lower Manuherikia efficiency improvements	1,500	$4,000(2)
Hope Creek Dam	3,000	$5,000(3)
Mt Ida Dam (pressurised supply)	2,200	$11,000
Total	21,000	

The total cost is calculated and listed in the conversion costs as Water Access costs. There is quite a variance between farms as a result of the existing ownership of shares with properties having a range of ownership of shares at present ranging from ownership of shares in a number of different schemes alongside private irrigation rights.

Examples of actual property conversion costs used in this modelling exercise are shown in Table 4.

Table 4: Conversion Costs of Individual Case Study Farms ($ / ha)

Item	Case Study One Breeding	Case Study One Finishing	Case Study Two	Case Study Three	Case Study Four Partial	Case Study Four Full	Case Study Four Dairy	Case Study Five Breeding	Case Study Five Finishing
Clean Up	100	100	100	100	100	100	100	100	100
Irrigation System	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Cow Shed	-	-	-	-	-	-	3,500	-	-
Electricity	-	-	-	-	-	-	100	-	-
Housing	-	-	-	350	-	350	500	350	350
Other Buildings	50	50	50	50	50	50	125	50	50
Fencing and Lanes	200	200	200	200	200	200	250	200	200
Stockwater	60	60	60	60	60	60	60	60	60
Fertiliser	300	300	300	300	300	300	300	300	300
Regrassing	500	500	500	500	500	500	500	500	500
Machinery	150	150	150	150	-	-	500	150	150
Livestock	285	-1,088	951	188	285	-	6,962	2,835	-759
Water Access	996	996	1,545	2,066	4,480	5,037	5,037	5,500	5,500
Total	**6,641**	**5,268**	**7,856**	**7,964**	**9,975**	**10,597**	**21,934**	**14,045**	**10,451**

The cost of $4,000 for irrigation includes the cost of the pump, power, irrigation supply lines as well as the irrigator.

2.2 Operating Costs

AquaLinc advise that they estimate that the scheme will cost approximately $30 / ha for running the off farm infrastructure. On farm costs used have been $75 / ha for schemes that are supplied at pressure and an additional $150 / ha for the energy required to apply the water for properties that are supplied water at the farm gate unpressurised.

3 Conversion Economics

These models are used to demonstrate the physical and financial performance of farms in the Manuherikia District. They have been constructed for demonstration purposes only. It is quite likely that farmers will adopt different combinations of farming systems according to their own particular property and financial circumstances. The models demonstrate average conversion costs and physical and financial performances. The figures used by individuals may vary considerably from those shown here.

3.1 Whole Farm Economics

The economic value of irrigation can be considered from a number of perspectives;

- Farm Profitability
- Return on Capital
- Asset Value
- Cash Flow

This section reports the results of the economic analysis of the conversion to increased irrigation both in terms of improved efficiency on existing areas and the addition of new area.

3.1.1 Farm Profitability

The farmers were chosen to cover the range of farming systems in the area. The profitability parameters were taken as a long term average expectation taken from the MAF publication of Situation and Outlook for New Zealand Agriculture and Forsetry. They are an average of the actual figures for the previous four years (year ending 30th June 2009 to 2012) and the estimates for the future four years. The only exception is the value used for dairy grazing which is set at an average of figures being paid and asked at present. Some of the key parameters are shown in Table 5 .

Table 5: Price Series

Item	Price
Milksolids Price ($/ kg milksolids)	6.38
Lamb Price ($/kg)	5.91
Wool Price ($/kg)	5.10
Beef Price ($/kg)	4.12
AP Stag	7.58
Dairy Support ($ / kg DM)	0.23

Farm profitability is reported as **Cash Farm Surplus**. That is Gross Farm Revenue minus Farm Working Expenses. This reports the amount of money that is available for interest payments, tax, wages of management, capital expenditure and profit. The Farm Working Expenses used include both variable and fixed overhead expenses at a level that will fully maintain the assets.

If we then consider the cost of debt servicing of the additional capital expenditure required to achieve irrigation development or any capital contribution towards the purchase of irrigation scheme shares. In calculating this we have used a debt servicing cost of 6%.

3.1.2 Return on Capital

The important measure of return on capital is the return to the extra capital involved in property conversion called the **Return on Marginal Capital**. This is calculated by dividing the net change in Cash Farm Surplus in moving from dryland to irrigation (marginal return) by the net cost of conversion of the property, including the cost of irrigation scheme shares. The net capital cost is referred to as the marginal capital.

The **Return on Total Capital** is also reported.

3.1.3 Asset Value

One of the most significant impacts of the conversion process is to change the whole asset structure of the farming business. The **Change in Net Worth** of the land owner is an important consideration in irrigation conversion.

The following analysis assumes that there is no existing debt on the dryland property but that the additional cost of conversion and irrigation scheme shares will all be funded by debt.

The values used in this exercise were provided by Peter Young as shown in Table 6. Obviously they are very general values that can be used for demonstration purposes but will not accurately reflect the value of land in many instances.

Table 6: Land Values Used ($ / ha)

Item	Price
Dryland	6,000
Current Irrigation	9,000
After Irrigation Development	18,000
Dairy ($ / kg milksolids)	30

3.2 Farm Results

3.2.1 Case Study One

Case study one has the lowest cost of conversion as a result of already having significant irrigation area. The total cost is $6,641 / ha for continuation of the current system but is lower for the full trading and finishing system as a result of the sale of existing livestock at $5,268 / ha.

The farm profitability results for Case Study One are shown in Table 7. The left hand three columns show the change in Cash Farm Surplus that occurs with the additional irrigation. The right had three columns show the surplus after debt servicing of the cost of conversion.

Table 7: Farm profitability for Case Study One

Before	Case Study One Breeding	Case Study One Finishing		Case Study One Breeding	Case Study One Finishing
Gross Farm Revenue	379,822		Cash Farm Surplus	197,825	297,656
Farm Working Expenses	298,456		Debt Servicing	81,910	66,343
Cash Farm Surplus	81,366		**Surplus After Debt Servicing.**	**115,915**	**231,312**
After					
Gross Farm Revenue	797,055	1,016,729			
Farm Working Expenses	599,230	719,073			
Cash Farm Surplus	197,825	297,656			
Increase	**116,459**	**216,290**			

For Case Study One we can see that for the Breeding option the increase in Cash Farm Surplus is not much greater than the current operation once the cost of debt servicing is paid for. However if the operation is changed over to a complete Finishing situation then the return is much higher and would justify the expense.

In Table 8 the return to marginal capital is shown in the left hand columns and the return to total capital is shown in the right hand columns.

Table 8: Return on Capital for Case Study One

	Case Study One Breeding	Case Study One Finishing		Case Study One Breeding	Case Study One Finishing
Marginal Capital	1,365,173	1,105,723	Before	5.1%	5.1%
Marginal Return	116,459	216,290			
Return on Marginal Capital (%)	8.5%	19.6%	After	5.8%	8.7%

The return to marginal capital is more than the cost of borrowing for the breeding option and is showing a very healthy return for the finishing option. The return on total capital shows healthy improvements for both options although again the finishing option shows a much superior return.

Table 9 shows the theoretical capital value of the farms before and after the conversion.

Table 9: Calculation of Asset Value of Case Study One ($ / ha)

Before	Case Study One Breeding	Case Study One Finishing
Valuation Before	1,611,000	1,611,000
Valuation After	3,402,000	3,402,000
Increase	1,791,000	1,791,000
New Debt	1,311,373	1,311,373
Change in Net Worth	479,627	479,627

.

3.2.2 Case Study Two

Case Study Two has a higher cost of conversion at $7,856 / ha as a result of a much larger area of new irrigation conversion.

Table 10: Farm profitability for Case Study Two

Before	Case Study Two		Case Study Two
Gross Farm Revenue	549,453	Cash Farm Surplus	649,318
Farm Working Expenses	348,100	Debt Servicing	188,540
Cash Farm Surplus	201,353	**Surplus After Debt Servicing.**	**460,778**
After			
Gross Farm Revenue	1,231,418		
Farm Working Expenses	582,100		
Cash Farm Surplus	649,318		
Increase	**447,965**		

This result is very positive with more than a doubling of the surplus created after debt servicing from approximately $200,000 to approximately $460,000.

Table 11: Return on Capital for Case Study Two

	Case Study Two		Case Study Two
Marginal Capital	3,142,333	Before	6.5%
Marginal Return	447,965		
Return on Marginal Capital (%)	14.3%	After	9.0%

The return to marginal capital at 14.3 % is more than the cost of borrowing. The return on total capital after the conversion at 9.0% shows a healthy improvement.

Table 12: Calculation of Asset Value of Case Study Two ($ / ha)

Before	Case Study Two
Valuation Before	3,099,000
Valuation After	7,248,000
Increase	4,149,000
New Debt	2,761,833
Change in Net Worth	1,387,167

Case Study Two shows a significant difference in the Net Asset Value position before and after conversion of approximately $1.4m.

3.2.3 Case Study Three

Case Study Two has a similar cost of conversion at $7,964 / ha.

The farm profitability results for Case Study Three are shown in Table 13.

Table 13: Farm profitability for Case Study Three

Before	Case Study Three		Case Study Three
Gross Farm Revenue	1,645,250	Cash Farm Surplus	910,323
Farm Working Expenses	942,000	Debt Servicing	222,209
Cash Farm Surplus	703,250	**Surplus After Debt Servicing.**	688,114
After			
Gross Farm Revenue	2,172,698		
Farm Working Expenses	1,262,375		
Cash Farm Surplus	910,323		
Increase	**207,073**		

The farm profitability results for Case Study Three indicate marginal returns to the irrigation development under the assumed farm system adopted on this property. The increased Cash Farm Surplus returns from the development are pretty low at $200,000 and are marginally less than the cost of Debt Servicing on the additional capital required.

Table 14: Return on Capital for Case Study Three

	Case Study Three		Case Study Three
Marginal Capital	3,703,483	Before	5.1%
Marginal Return	207,073		
Return on Marginal Capital (%)	5.6%	After	4.9%

The return to marginal capital at 5.6% is less than the assumed cost of borrowing. The return on total capital after the conversion at 4.9% shows a deterioration in the return on capital for the property.

Table 15: Calculation of Asset Value of Case Study Three ($ / ha)

Before	Case Study Three
Valuation Before	13,770,000
Valuation After	18,450,000
Increase	4,680,000
New Debt	3,615,983
Change in Net Worth	1,064,017

Case Study Three shows a relatively healthy difference in the Net Asset Value position before and after conversion of approximately $1m.

3.2.4 Case Study Four – Partial and Full Conversion

Case study four which is a Dairy Support property has the highest cost of conversion as a result of having very little irrigation area at present. The total cost is $9,975 / ha for partial irrigation of the farm and is higher at $10,597 / ha as a result of the need for more expensive water and the need to pay for housing of new employees.

Table 16: Farm profitability for Case Study Four

Before	**Case Study Four Partial Development**	**Case Study Four Full Development**		**Case Study Four Partial Development**	**Case Study Four Full Development**
Gross Farm Revenue	519,965		Cash Farm Surplus	322,575	663,714
Farm Working Expenses	280,720		Debt Servicing	80,433	217,589
Cash Farm Surplus	239,245		**Surplus After Debt Servicing.**	242,142	446,125
After					
Gross Farm Revenue	794,465	1,527,789			
Farm Working Expenses	471,890	864,075			
Cash Farm Surplus	322,575	663,714			
Increase	**83,330**	**424,469**			

The first option which is partial development is marginal in that it only increases the Cash Farm Surplus by a relatively small amount and has a very narrow advantage once it has serviced the debt. However the full development option has a much better result in that it increases the Cash Farm Surplus by approximately $446,000 and more than doubles the Cash Farm Surplus available after servicing the extra debt.

Table 17: Return on Capital for Case Study Four

	Case Study Four Partial Development	**Case Study Four Full Development**		**Case Study Four Partial Development**	**Case Study Four Full Development**
Marginal Capital	1,340,544	3,626,480	Before	8.6%	8.6%
Marginal Return	83,330	424,469			
Return on Marginal Capital (%)	6.2%	11.7%	After	7.0%	9.3%

The return to marginal capital is marginally more than the cost of borrowing for the partial development option at 6.2% and is showing a very healthy return of 11.7% for the full development option. The return on total capital shows a negative response for the partial option although again the full development option shows a much superior return.

Table 18: Calculation of Asset Value of Case Study One ($ / ha)

Before	Case Study Four Partial Development	Case Study Four Full Development
Valuation Before	2,775,000	2,775,000
Valuation After	4,626,000	7,116,000
Increase	1,851,000	4,341,000
New Debt	1,291,583	3,626,480
Change in Net Worth	559,417	714,520

The change is positive in both options but is higher in the full development option.

3.2.5 Case Study Four – Dairy Conversion

Case Study Four – Dairy Conversion has the highest cost of conversion at $21,934 / ha which includes approximately $7,000 for livestock purchases.

The farm profitability results for Case Study Three are shown in Table 19.

Table 19: Farm profitability for Case Study Four – Dairy Conversion

Before	Case Study Three		Case Study Three
Gross Farm Revenue	519,965	Cash Farm Surplus	1,168,394
Farm Working Expenses	280,720	Debt Servicing	474,887
Cash Farm Surplus	239,245	**Surplus After Debt Servicing.**	693,508
After			
Gross Farm Revenue	3,176,483		
Farm Working Expenses	2,008,089		
Cash Farm Surplus	1,168,394		
Increase	**929,149**		

The increase in all aspects of the profitability analysis are large for the Dairy Conversion option. This results in an increase in Cash Farm Surplus of approximately $930,000 / ha. The surplus after debt servicing is high at approximately $700,000.

Table 20: Return on Capital for Case Study Four – Dairy Conversion

	Case Study Three		Case Study Three
Marginal Capital	7,914,780	Before	8.6%
Marginal Return	929,149		
Return on Marginal Capital (%)	11.7%	After	8.1%

The return to marginal capital at 11.7 % is almost twice the assumed cost of borrowing. The return on total capital after the conversion at 8.1% shows a slight deterioration in the return on capital for the property.

Table 21: Calculation of Asset Value of Case Study Four – Dairy Conversion ($ / ha)

Before	Case Study Three
Valuation Before	2,775,000
Valuation After	14,385,866
Increase	11,610,866
New Debt	5,269,180
Change in Net Worth	6,341,686

The change in Nett Asset Value for Dairy Farming is quite large with greater than $ 6 m increase in the value of the property as a result of the conversion.

3.2.6 Case Study Five

Case study five has a relatively high cost of conversion as a result of not having any existing irrigation. The total cost is $14,045 / ha for the breeding system but is lower for the trading and finishing system as a result of the sale of existing livestock at $10,451 / ha.

The farm profitability results for Case Study One are shown in Table 7. The left hand three columns show the change in Cash Farm Surplus that occurs with the transition to irrigation. The right had three columns show the surplus after debt servicing of the cost of conversion.

Table 22: Farm profitability for Case Study Five

Before	Case Study Five Breeding	Case Study Five Finishing		Case Study Five Breeding	Case Study Five Finishing
Gross Farm Revenue	241,988		Cash Farm Surplus	705,990	557,167
Farm Working Expenses	119,947			379,202	282,186
Cash Farm Surplus	122,041		Debt Servicing		
			Surplus After Debt Servicing.	**326,788**	**274,981**
After					
Gross Farm Revenue	1,615,530	2,372,752			
Farm Working Expenses	909,540	1,815,585			
Cash Farm Surplus	705,990	557,167			
Increase	**583,949**	**435,126**			

For Case Study Five we can see that for both options the change in Cash Farm Surplus is significantly positive. The Breeding option is superior to the finishing option.

In Table 8 the return to marginal capital is shown in the left hand columns and the return to total capital is shown in the right hand columns.

Table 23: Return on Capital for Case Study Five

	Case Study Five Breeding	Case Study Five Finishing		Case Study Five Breeding	Case Study Five Finishing
Marginal Capital	6,320,027	4,703,095	Before	4.5%	4.5%
Marginal Return	583,949	435,126			
Return on Marginal Capital (%)	9.2%	9.3%	After	8.7%	6.9%

The return to marginal capital is more than the cost of borrowing for both options and is showing a very healthy return. The return on total capital shows healthy improvements for both options although the breeding option shows a much superior return.

Table 9 shows the theoretical capital value of the farms before and after the conversion.

Table 24: Calculation of Asset Value of Case Study Five ($ / ha)

Before	Case Study Five Breeding	Case Study Five Finishing
Valuation Before	2,700,000	2,700,000
Valuation After	8,100,000	8,100,000
Increase	5,400,000	5,400,000
New Debt	5,044,500	5,044,500
Change in Net Worth	355,500	355,500

The change is positive in both options.

3.3 Cash flow.

Although it is not possible to create a cash flow for each of the enterprises because there is tremendous variability between properties as to the starting cash flow position and the timing of the expenditure occurring it is possible to make the following general comments on the cash flow of each enterprise.

Irrigated Dairy

Generally the cash flow is reasonably good for a July / June year with the start of the season payout being approximately 70 % of the end of season expectation at that point. The season starts at the beginning of August with the first payment being made on the 20th of September. As the season progresses the proportion of end of season payout increases as does the expectation. However the season finishes at the end of May and the final payouts are made through until September. Generally this profile is quite good and some of the large items such as fertiliser can be delayed until there is sufficient cash in the system.

Irrigated Sheep and Lamb

Depending on the system adopted the cash flow for finishing can be quite good. There is the expenditure that goes into buying the stock to be finished but the turn over for the stock can be relatively quick and therefore the cash flow can be quite quick. The idea with the irrigated system is constantly having stock on hand to be finished with a higher proportion in the winter months than normal farming with higher returns.

Irrigated Dairy Support

Irrigated dairy support is made up of grazing young stock, selling silage to the milking platform and dry cow grazing in the winter. The cash flow of this depends upon the combination of these adopted. Grazing of young stock is the best for cash flow as a payment

is received on a monthly basis. Selling of silage is also pretty good as payment is received as soon as it is bought. Winter grazing is the least reliable from a cash flow point of view as the silage has to be made and stored and the green feed crops grown well in advance of the approximately 10 week period from the beginning of June when the cows are on the grazing.

4 Financing Options

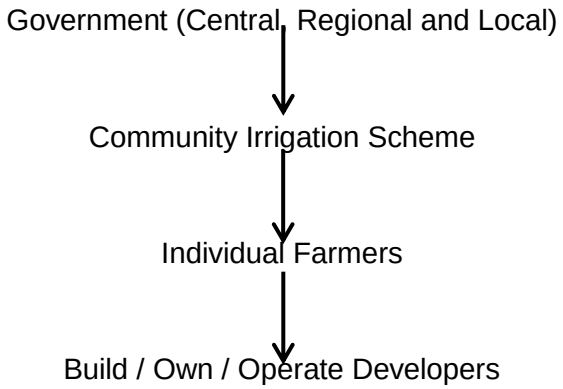
The most important issue around financing options for farmers is around the interest rate that they will pay. The lower the interest rate the more attractive the option will look to them.

The other important point is the terms of the loan including:

- the length of time that the interest rate is fixed for,
- the means of determining what the interest rate will change to,
- whether the loan is interest only or interest plus principal or a combination of the two spread over time,
- the period of the loan and
- the potential variability of any of the factors.

4.1 The Interest Rate

The interest rate that a loan is set at is primarily set by the amount of risk that the lender perceives is involved in the loan. This is generally set by the status of the person that they are lending to and normally increases as it goes through the grouping below.



Government

Central Government can access money at the cheapest rate of all. However it has been the policy of Governments for the past twenty or so years to not lend money to or sponsor irrigation development. However recently a budget sum has been set aside to assist irrigation development. It is anticipated that this sum will be used to support schemes that have not got complete farmer buy in and need some financing to get the scheme started with assistance with payment for the unsold shares. It would be anticipated that these shares would be sold fairly soon after commissioning of the scheme.

Regional and Local government also have the ability to provide funding for irrigation scheme development relatively cheaply. In Canterbury local Government has been a strong supporter of irrigation scheme development because of the on-going economic and social benefits that they can gain from the development of such schemes. Although this assistance has been primarily in the early stages of development it is feasible for local government to set up a special rating district and fully fund development of an irrigation scheme.

Community Irrigation Scheme

Depending on the size and nature of the scheme set up Schemes themselves can often get relatively cheap loans. This will primarily depend on the nature of the supply agreement that

they have over the water and the surety that they have over repayment of the loan. In most cases in New Zealand funding of scheme development over the last twenty years has primarily been achieved by the Scheme borrowing the money under contracted supply agreements with those wishing to use the water.

This sort of arrangement is usually made with a Bank, or consortium of Banks, at favourable terms and conditions.

Individual Farmers

The ability of individual farmers to offer sufficient low risk lending is considerably hampered by the need to also borrow large sums of money to carry out the on farm development also required at the same time as scheme development. This will obviously depend on the financial status of the individual farmer. Experience with recent development of irrigation schemes would indicate that offering the opportunity for farmers to self fund their scheme shareholding has resulted in very few taking up that option.

Build Own Operate Developers

Build Own Operate (BOO) developers come in many different forms with the most attractive being those that sell the scheme back to the water users after a time when the capital outstanding has been reduced to a level that the farmers could afford. Although these operators have the ability to borrow money relatively cheaply their desire to make a profit out of the operation of such a scheme generally means that the net cost of capital with these developers is higher than would otherwise be experienced.

For many reasons other than the cost of capital this may be an attractive means of getting an irrigation scheme developed. None are in operation at present but some potential schemes are proposing to use these sorts of developers.

4.2 Loan Terms

Much of the discussion around the potential terms of a loan are determined by the size of the loan required. As the size of the loan gets bigger the ability to pay it off quickly diminish. As the length of the term increases details such as the fixed term of the interest rate, the time period until capital repayments are made all become more crucial in order to avoid any high costs in the future.

At the potential amounts of capital required for the Manuherikia Scheme ($5,000 / ha) there will most probably be a long time frame until the loan is paid off (30 years +). Therefore at lot of the additional terms of the loan will be just as important as the interest rate that it is struck at initially.

5 Regional Economics

At the pre-feasibility stage it is far too early to do any quantitative work on Regional Economics. However the following summary of the subject is taken from "Water Enhancement Policy Study Five"[2] which outlines the important issues to consider in carrying out Regional Economic Studies. Much of the discussion around social indicators concentrates on data gathering. We wold point out that these measures can also be estimated for new or potential schemes based on what has occurred on older schemes.

Regional Economics Factors to Measure	
Output	Total Output
Employment	Total Full Time Equivalents
Value Added	Total Value Added
Location of Impacts	All above by Location
Usually Resident Population	Number and % change over time
Population Age Structure	Percentage in each Age Groups
Age of Farmers	Percentage in each Age Groups
Dairy Farmers	% of Dairy Farmers
Dairy Farmer Age	Percentage of Age Groups
Educational Qualifications	% with or without educational qualifications
Employment by Industry	Employment by Sector
Occupational Status	Status of Occupations
Employment Status	Employees / Employers as % of population
Labour Force Status	Full time / Part time employment
Household Incomes	Median Household Income
Distribution of Incomes	% of household incomes by $ range
Schools	Numbers/ Rolls / Ages / Facilities
Community Organisations	Number / Variety / Range

Output

Output is the value of sales at point of sale. Typically the output is valued at farm gate, factory door, or f.o.b. Output of itself is not a particularly interesting measure because it tells us little about the level of actual physical economic activity. The point of interest is whether

[2] MAF Technical Paper (2003): Water Enhancement Policy Study Five.- Economic and social assessment of community irrigation projects, - A multi objective framework.

people are better off, which is generally dependent on having additional jobs or earning greater income[3].

Measure – Total output ($ million)

Employment

The number of people employed, expressed in Full Time Equivalents (FTEs, one full time equivalent is a person working more than 35 hrs per week) is the standard measure of employment. Because labour is "lumpy", what typically happens is that as output increases, some businesses cope with the extra demand without an increase in labour, and others employ an extra person, even though their extra output may not be sufficient to fully occupy another person, but they simply cannot cope with the demand without one.

Measure – Total FTE'S

Value Added

Value added is the difference between output value and the cost of inputs (other than labour and capital). Value added is hence what is left for the business owner to pay wages to employees, interest, depreciation, and also leave a return for the owner's time and investment. Value added is analogous to GDP (gross domestic product).

Measure – Total value added. ($ million)

Location of Impacts

The location of impacts is important if decision makers care where impacts occur. Given that a policy objective is often to generate employment either in rural communities (a central government objective) or in specific regions (a local government objective), it is important to establish where impacts occur. In this paper, a "local" impact is defined as one which occurs within the area of the scheme, and is generally equivalent to the local spending by farm families and a few additional flow-on effects. A district impact is one which occurs in the local authority district, and a regional impact is one which occurs in the area defined as the Region.

Measure – All impact parameters by location.

There has being a considerable amount of assessment of the social impacts of irrigation development of rural communities carried out over the years. However the majority of this assessment work has been based on qualitative and observational research techniques applied to the area being studied. Interpretation of this information has being regarded as providing more anecdotal type evidence and information of impacts. This has been difficult for decision makers to incorporate into their decision-making framework when they have to balance it against more quantitative data from economic analysis.

The parameters developed in this report are in five sections;

- Population Trends

[3] Businesses with equivalent value of sales may have hugely different levels of employment or value added.

- Occupation Trends
- Employment Type
- Income Status
- Qualitative

Population Trends

Usually Resident Population

Changes in the usually resident population of an area indicate whether there has been an inflow or exodus of people into the area which in certain circumstances is associated with changes in the local economy. These types of population movements are characteristic of rural districts with natural resource based industries that are subject to commodity price cycles. In an area where a community irrigation scheme has been introduced it would be reasonable to expect that the intensified use of the land would at least arrest population decline or even result in a moderate rate of population growth.

The usually resident population figure provides a better indicator of population growth than the total population figure which is also recorded by the census because it excludes people who are only temporarily visiting the area, and includes residents of the area who are elsewhere in New Zealand on the night of the census.

Measure - Number and percentage change in usually resident population over time.

Population Age Structure

The age composition of the usually resident population provides information about the proportions of children and senior citizens living in an area, and the proportion of people of working age (15-64 years) who may be available for employment in the local economy. As the age composition of an area's population changes over time the pattern of demand for particular educational, health, and community services will change. Thus the arrival of young families in a district to work on dairy farms, for example, may subsequently boost school rolls. Moreover, any decline in the proportion of people of working age may indicate that this segment of the population has to leave the area to find employment.

Measure - Percentage of age groups. – 14 years and under

- 15 to 64 years.

Occupation Trends

Age of Farmers

An examination of the ages of farmers and farm workers indicates whether there have been any changes in the age structure of residents directly involved in agricultural production. Sometimes changes in the age composition of farmers and farm workers indicate that there has been a major shift in land use in a particular area. These shifts in land use occur as a result of a combination of international, national, regional and local factors such as commodity prices, government policies, interest rates and irrigation schemes.

Measure - Percentage of Farmers and Farm Workers under 30 years of age.

Dairy Farmers

Changes in the proportion of dairy farmers and dairy workers among the broader occupational group of farmers and farm workers reveals the extent to which particular areas have either taken up or opted out of this type of agricultural production. Although irrigation allows farmers to intensify their existing farming practices, there are often further waves of innovation as older farmers move out of the area, and the younger farmers who replace them convert their properties to other forms of land use. By examining census data about particular farming occupations over a period of twenty years the magnitude of that shift in land use can be quantified.

Measure – Percentage of Dairy Farmers in the Farm Workers Occupational Group

Dairy Farmer Age

As dairy farmers and dairy workers have become a growing proportion of the farmers and farm workers occupational group in the study areas so their age structure has altered not only the demographic characteristics of farmers and farm workers in general, but has also influenced the cultural values and practices of farming itself. Thus an examination of the age structure of dairy farmers and dairy workers provides an indicator of the cultural gap between dairying and other forms of agricultural production.

Measure – percentage of Dairy farmers under 30 years of age.

Educational Qualifications

The educational qualifications held by residents provide information about the quality of human resources available to employers in a particular area. Jobs earning high incomes demand skills that generally require higher educational qualifications than jobs which provide moderate or low incomes. An analysis of the highest educational qualifications held by residents would indicate whether a better educated workforce was a feature of irrigated areas.

Measure - percentage of population with or without tertiary or educational qualifications.

Employment by Industry

Employment by industry records the numbers of residents of a particular area employed by major industrial sectors. This information reveals the variety of industries in which residents are employed. It also provides a profile of the local economy, although that profile may not entirely be accurate as some residents work outside their area of residence and other workers employed in local industries reside outside the area. Over the long term (i.e. 15 to 20 years) changes in employment by industry may indicate how residents of an area have become more or less dependent on specific industries for their employment.

Measure – Percentage of residents employed outside the primary sector.

Employment Type

Occupational Status

The type of occupations held by residents of a particular area reveals the diversity of jobs that are available to them and provides information about the access they have to quality jobs with high status and better than average incomes. Longitudinal data about occupations can indicate whether residents of an area have improved their economic welfare through holding higher status occupations.

Measure – Percentage of residents with higher status occupations.

- ***Percentage of residents with blue collar occupations.***

Employment Status

The employment status of residents provides information about the numbers of residents of a particular area who are wage and salary earners, employers, self-employed, and unpaid family workers. This information can be used to assess changes in the scale of local enterprises, and to ascertain if more jobs are being generated in the area whether they are on farm or in agricultural support industries.

Measure – Paid employees as a percentage of residents.

- ***Employers as a percentage of residents.***
- ***Self employed as a percentage of residents.***

Labour Force Status

The labour force status of residents of a particular area allows the quality of jobs in a particular area to be appraised. The classification of jobs into full-time and part-time provides a relatively unsophisticated measure of the quality of employment. A shift into part-time employment by residents with a concurrent loss of full-time jobs would indicate a decline in job quality; particularly in the current climate where part-time employment has become associated with unskilled and low paid work.

Measure – employed full time as a percentage of Labour force.

Income Status

Household Incomes

The median of household incomes provides a benchmark to compare levels of economic welfare between different areas at a particular time. Unless it is adjusted for inflation, however, it is a less reliable indicator of changes in economic welfare within a particular area over the long term.

Measure – Median household income.

Distribution of Incomes

This section complements the analysis of median household incomes by examining the distribution of household incomes in particular areas. The manner in which incomes are distributed between households provides another benchmark with which to compare the economic welfare of particular areas. Like median household incomes it is not a reliable

indicator of long term changes within a particular area unless an adjustment is made for inflation.

Measure – Percentage of households with incomes under $30,000.

- Percentage of households with incomes over $50,000.

Qualitative

Schools

The rolls of schools, and qualitative data about schools, provide important indicators of demographic and social change in rural communities. Not only do schools provide educational services to children, but they often provide an important focus for community activities. Those activities which may be directly associated with the school itself, or use the school's facilities, create and maintain social networks that sustain the vitality of a community.

Measure – School rolls.

- number of schools.

- Spread of age groups in school.

- School facilities.

Community Organisations

The variety and number of community organisations provide information about the vitality of community life in a particular area. When the lives of these organisations can be examined over a period of at least ten years, they often reflect the social change that has occurred in a rural community.

Measure – Variety, number and range of community organisations.