IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications by Central Plains Water Trust to: Canterbury Regional Council for resource consents to take and use water from the Waimakariri and Rakaia Rivers and for all associated consents required for the construction and operation of the Central Plains Water Enhancement Scheme Selwyn District Council for resource consents to construct and operate the Central Plains Water Enhancement Scheme
AND	
IN THE MATTER OF	a notice of requirement by Central Plains Water Limited to: Selwyn District Council for the designation of land for works associated with the construction and operation of the Central Plains Water Enhancement Scheme

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EVIDENCE IN REPLY OF ANDREW WEBSTER MACFARLANE

BUDDLE FINDLAY
Barristers and Solicitors
Christchurch

Solicitor Acting: **Rachel Dunningham**
Counsel: **Matt Casey Q C**
Tel 64-9-337 0400 Fax 64-9-357 0030 PO Box 317 Shortland Street Auckland

Qualifications and experience

1. My full name is Andrew Macfarlane. My qualifications, experience, and the basis on which I am providing this evidence have been outlined in my evidence in chief.

2. I am providing this further evidence to reply to evidence which has been given on farm economics generally and on my pre and post CPW budgets presented in my evidence in chief.

3. My evidence will cover the areas of:

   (a) Changes in on farm profitability since June 2007 and the implications these have for the budgetary assumptions I have used.

   (b) Further explanation of the changes in productivity I have assumed between pre and post scheme regimes.

Section I

Macro drivers to land use changes

4. This section of my evidence in reply responds to criticisms by submitters that CPW is relying solely on high dairy prices to justify the assumed economic returns from the scheme. As I will explain there are compelling reasons for being satisfied that a variety of farming and cropping activities will become more profitable in the next few decades, and the scheme will afford opportunities to take advantage of those options.

5. Farming is now undertaken in a global environment where there is a requirement to balance the primary need for higher food production, while doing this and energy production, in an environmentally sustainable manner, using fewer resources and emitting less carbon. The sudden focus on food and energy security is part of a long term trend that has only recently reached the public consciousness in the manner that climate change has.

6. World food stocks have been declining since World War II, but have only recently sunk below the 70-90 day buffer deemed desirable to manage supply in the face of adverse events.

7. Changes in world food stocks since the 1940's can be summarised as:

   Post World War II 350 – 400 days

2003	133 days
2007	57 days
2008	40 days[1]

8. Contributing factors to the change in balance on the supply side include:

   - Variable climate and water availability
   - Under utilised or degraded soil in areas where land tenure has been/is unstable.
   - Political interference in production systems.
   - Competing land use (urbanisation, biofuels)

9. Demand side drivers include:

   - Population (approximately 50% of the lift in demand). The trend in population (left column) and the farmland per person (right column) can be summarised as:

1950	2.5B	0.52ha/person
1975	4.1B	0.34ha/person
2000	6.1B	0.25ha/person
2025	8.0B	0.19ha/person
2050	9.23B	0.16ha/person[2]

   - Economic growth (approximately 50% of the lift in demand). The number of low income consumers lifted out of poverty will be the most important determinant of the future global demand for food.

10. In the past 18 months we have seen major rises in the price of sugar, milk and grain, and significant declines in meat prices. Sugar prices have reacted to increasing demand for ethanol in addition to food sugar needs. Grain prices have reacted to a combination of a steady demand increase coinciding with well publicised drought effects on the supply side, and sluggish political action to increase land utilization for grain. Examples of such sluggishness include set aside areas in the EU, abandoned farms in Zimbabwe, and

[1] UK Institute of Agriculture
[2] H Gow, Associate Profession of Agribusiness and Food Marketing, Michigan State University

unutilized land in Eastern Europe. 90% of the worlds dairy cows are in "confinement", where grain makes up a large proportion of their diet.

11. A combination of steady demand increases, politically constrained EU production (quotas), and cost side(feed) pressures preventing increased production have caused a huge lift in milk prices.

12. The worlds farmers have reacted to the high grain price by:

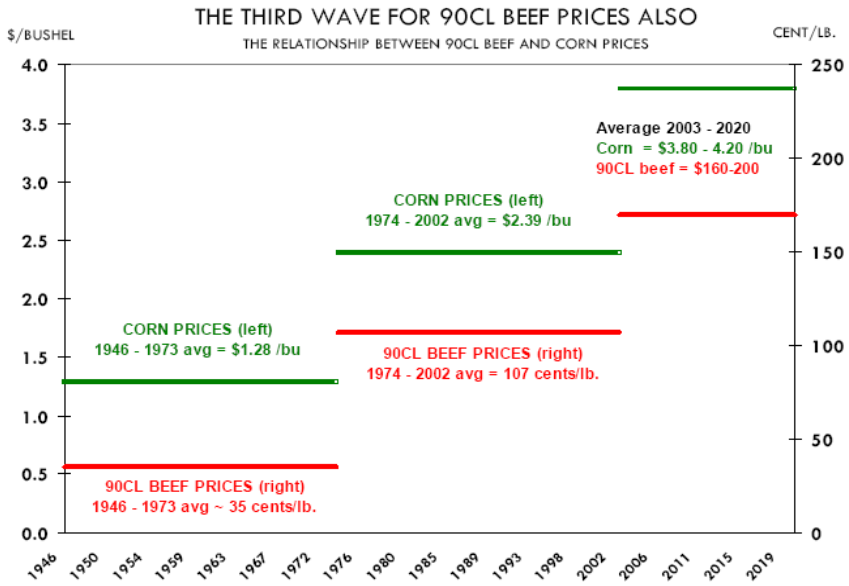
    (a) Sowing more grain, which increases demand for inputs like glyphosate, fertilizer, tractors, harvesters, fuel etc. As a result, input prices are up, and availability is squeezed;

    (b) Transferring grazing land to grain and sugar production.

13. As a result of the above factors, meat prices have been falling globally until very recently. The recent changes have arisen because:

    - Most meat producers feed grain
    - Land is being taken out of meat production to grow grain.
    - The cost of production is increasing globally.
    - Capital livestock numbers are falling (sheep, beef, pigs, deer)
    - The reduction in capital stock is keeping supply up.
    - Consumers (via retailers) are slow to adjust to higher pricing structure – the shortfall in product has not happened yet but venison volumes have bottomed out first, followed now by beef, with sheep meat next.
    - Underlying demand is increasing. As a consequence, Venison prices have already lifted 100%, and world beef prices are rising rapidly at present, and sheep meat has just started to lift.

14. Figure 1 demonstrates a long term price relationship between beef and corn.



I am therefore very confident that meat prices will rise considerably over the next 2 years. Already, beef prices are approaching US180c/pound..

15. The conclusions which can to be drawn in relation to the Central Plains catchment are as follows:

    (a) volatility in product prices is more likely due to low world stocks which are less capable of buffering production changes.

    (b) grain price rises are very significant to the Central Plains area, where the better soils (typically east of Dunsandel/Hororata) are capable of any arable/horticultural land use.

    (c) milk protein has lead the increase in world protein markets, and, while potentially more volatile, will maintain a higher value into the foreseeable future, and a good future for the light soil types between Rakaia and Dunsandel, which are predominantly in dairy land use now.

    (d) milk prices have lead the overall increase in soft commodities in New Zealand, and have therefore had an undue amount of publicity and attention. It is noticeable that the level of attention and query from other witnesses in relation to dairy economics is out of proportion to the significance of the sector to the long term future of the Central Plains scheme.

16. While I have great confidence that dairy product prices, along with other food prices, are on a different plain to two years ago, it is just as apparent that the gap between dairy prices and other commodities will narrow as all food markets realign their balance. We cannot, as a community, afford to only focus on dairy at the expense of other land uses.

Such realignment will be apparent in Section II, where I describe changes in farm profitability over the past year.

17. As I stated in my earlier evidence to the hearing, I see the longer term trend in the Central Plains' catchment (outside Te Pirita/Bankside) being towards production of fresh produce and vegetable seed, where the criteria is:

    - Good soils
    - Reliable water
    - Proximity to transport (air/sea/road)
    - Proximity to labour (Christchurch)
    - Proximity to infrastructure (packing, processing etc)

18. The Central Plains area meets all those criteria, especially as existing fresh produce production in Pukekohe, Gisborne, Hawkes Bay and Marlborough is threatened by urbanisation and wine making. As evidence of the trend, the largest Gisborne fresh vegetable producer (Leaderbrand) now has a presence in Mid Canterbury, and several Pukekohe fresh vegetable producing families have invested in Mid Canterbury spray irrigated farmland over the past two years, with a further major purchase in the past four weeks. The key driver to their investment in Mid Canterbury, rather than Central Canterbury, is the supply of reliable water and more user friendly infrastructure development.

19. I consider therefore, that the Central Plains Scheme should not be viewed as being solely about dairy development, but should be seen as part of a long term strategy for integrated food production systems of which dairy will have an important, but not necessarily dominant role, and which will likely be confined predominantly to the lower water holding capacity soils.

Section II

Farm profitability assumptions

20. Most agricultural commodities have been in a strong price upswing over the past 12 months. That increase applies to both costs and returns.

21. I have elected not to formally alter the budgeted returns and capital cost in my farm budgets for pre and post CPW farms, as to do so only generates higher returns than those already stated in June 07 which are robust.

Secondly I am reluctant to get into a continuous review process for these budgets as they will inevitably be superseded every few months so, unless they become unduly optimistic, there is little to be gained from such an exercise.

22. Given the sensitivity of the economic projections, I have reviewed the budgets to 2008/09 projections in order to determine the relative movements in profitability over the past 12 months. The budgets assume identical productivity levels.

They also assume long term product prices for key products of:

Milk	$6.25/kgMS
Feed wheat	$450/t
Milling wheat	$520/t
Potatoes	$186/t
Grass seed	$2.30/kg
Winter lamb price	$5.00/kg
Summer lamb price	$4.50/kg
Lamb trading margin	$38/head(winter)
	$22.30/head (summer/autumn)
Beef Price	$4.40/kg
Beef Trading Margin	$506/head

23. The lift in EBIT/ha (profitability) between June 07 and August 08, using those assumptions, is:

Dairy	1%
Arable	21%
Intensive finishing	100%

These changes demonstrate

(a) The folly of focusing solely on dairy

(b) The need for mixed land use (which will occur)

(c) The need to look strategically at global issues when assessing the economics of projects such as Central Plains Water, rather than assume that what has happened in the past will repeat.

24. The described change in structural profitability can be broken down further into income and expenditure.

	Dairy	Arable	Livestock finishing
Change in gross income	+13%	+25.4%	+55%
Change in farm working expenses	+27.5%	+28.7%	+26.2%
Change in EBIT	+1%	+21%	+100%
Change in off farm irrigation capital cost	13%		

25. On that basis, return on capital has improved for the scheme as a whole, but dairying is less competitive relative to the other land uses.

26. Obviously dairy is very sensitive to payout price. Hence the high current payout is having an outsized influence on short run conversion activity. The increase in profitability at various assumed dairy payouts can be summarised as follows:

Payout ($/kgMS)	Increase in profit from June 07 Budgets
$6.25	1%
$6.50	9%
$7.00	25%
$7.50	41%
$7.90 (07/08, of which 25ckgMS retained)	54%

27. I believe all commentators agree that to budget on long run payout prices in excess of $7/kgMS would be a high risk strategy. My assumption of $6.25 is in line with MAF forward predictions for 4 years, which I believe will prove conservative, but probably less volatile than the actual payouts.

28. I contend therefore, that my June 07 figures are conservative. The minor variations in the dairy budgets noted by others resulted from my business partner updating some items while I was in Ireland at the World Farm Management Congress. While I was able to check the summary pages, and stand by the end results, I was unable to check detailed comparisons around

such details as hourly rates times hours worked per year. As all those figures are now conservative, I have not thought it necessary to make minor alterations.

29. However, I have had the opportunity to further review Mr Ford's table 3 (p10) in detail subsequent to him asking for a comment from my partner, Mr Eaton, who transferred budget detail for me while I was in Ireland.

I summarise Mr Ford's table, and the financial impact as:

Category	**Pre scheme**	**Post scheme**	**Comment**	**$ impact**
Total wages	240,000	228,000	Valid	$ 21,000
Animal health ($/cow)	80	75	Valid	$ 7,500
Maize silage	300	400	Partly valid	$ 8,750
Straw (no's)	220	220	Correct (more cows)	-
Grass silage ($/ton)	150	120	Valid	$ 18,300
Feed conservation bales (no's)	500	600	Correct (more cows)	-
Sulphur super ($/t)	265	280	Valid	-$ 3,300
Nitrogen	750	675	Valid	$ 13,500
Seeds	265	250	Valid	$ 600
Combined impact				$ 48,850
Impact per ha				$ 122
Impact over scheme				$5.673M

30. While that difference of $122 per hectare is well over ridden by the impacts described earlier in this section, for the sake of consistency, the change of $5.673M should be accounted for in Mr Donnelly's economic data.

Contention around dairy production levels pre and post scheme.

31. I note the considerable debate around my assumptions on dairy productivity post CPW, relative to current levels. I wish to once again clarify the reasons for the assumptions used in my evidence, as the evidence can otherwise be readily misinterpreted.

32. One of the main reasons for the assumed change in productivity is because there is a group of farms which will achieve higher productivity after the scheme has proceeded due to higher reliability of water. That is, their current supply is marginal. Those farmers can be classified into 2 groups:

    (a) Those who have well water of marginal reliability. Some areas within the scheme have always been marginal in that respect, others have increased in their degree of unreliability, as the ground water resource has come under pressure.

(b) Those who have surface water consents. Those farms are typically in the upper Te Pirita area. These consents typically utlilize band 3 or 4 Rakaia water, and as such would need to either supplement with CPW water, fold into the scheme, or install large scale storage themselves, in order to improve reliability.

33. The other group of farms are those with existing reliable well water takes. Some of these properties do not have sufficient water duty to optimise production, but probably the majority do.

34. Dr Mark Mabin (URS) has extracted the data from the CPWES survey. Relying on that data, the areas in each category could be quantified as follows:

(a)	Well takes with reliability issues (of which 16,000ha may be seriously affected)	27,400ha
(b)	Surface water consents (almost all of which have marginal reliability)	6,020ha
(c)	Reliable well takes but with insufficient water duty (anecdotal evidence suggests at least 5000 ha)	unknown

35. On that basis, it could reasonably be expected to achieve enhanced production from about 38,000 hectares of land classified as having existing irrigation if they shifted to a CPW water supply. This includes both CPWES shareholders and non-shareholders. The balance of existing irrigators would only benefit from the lower energy and maintenance costs of a surface water scheme compared to deep well pumps.

36. As previously stated, conversion of well water to scheme water does not instantly increase production, assuming reliability is the same from both sources. But we do have though, a large group of farms, including dairy units, which are significantly underperforming relative to potential, due to lack of water reliability. I will give some specific comparisons shortly.

37. That impact of increased water reliability is only one of several impacts that occur when a reliable community irrigation scheme is installed. Other impacts include the economic impact of higher fixed cost structures but lower variable costs and the social impacts of change.

38. In every other irrigation scheme I have been involved with, the change in ownership and personnel and as a consequence, on land productivity has been dramatic, and always greater than originally estimated.

39. A good example would be the Totara Valley sub scheme of Opuha where only five of the original land owners remain. Productivity on irrigated non dairy units is typically around three times (300%) greater than pre irrigation, and the productivity of many dryland blocks associated with irrigated land has increased by 150-200%.

40. I do not expect, and have not budgeted on such dramatic impacts in the Central Plains Water area, as there is already a significant amount of water available.

41. The increase in productivity is not all a direct result of extra water applied. Instead, the availability of reliable water has been the trigger for a range of changes. It has a psychological impact because it provides predictability of productivity and therefore income, which drives business confidence. This leads to innovation, enhanced use of science and technology and brings in outside investment. The net result is a huge increase in productivity, for a multitude of reasons. Despite my intimate knowledge of those drivers, I still find I underestimate the long term impacts.

42. My role in this analysis is to predict likely productivity and economics for the scheme, post development, relative to its position pre development, as it is these figures that drive subsequent economic activity, as measured by Mr Donnelly.

43. The most difficult task in such analysis is to predict the "blue sky" changes that occur from changes in land use. A good example would be viticulture in Marlborough, which would have been significantly underestimated in Marlborough 30 years ago. In a similar manner, while my instinct is that this area will have a large scale fresh produce industry in 30 years, which would obviously improve the economics of development, it would be difficult to budget on, and defend such a vision. The only alternative is to ensure that we are not unduly conservative in our estimates from conventional out put.

44. As previously stated, my "post development" production is in the top 20% of existing production. The reasons for the difference between 1330kg/ha (pre scheme) and 1616kg/ha (post scheme) are very subtle, and can be readily justified on actual data. The impact of the various reasons for the differences can be summarised in the form:

	Pre scheme	Post scheme
Production (kg/ha)	1330	1616
Multiplied by conversion efficiency (kgDM/kgMS)	11	10.2
= kgDM consumed per ha	14630kgDM/ha	16483kgDM/ha
Less supplement used 3.75 cows/ha x 640kg/cow 3.5 cows/ha x 646kg/cow	2261kg/ha	2400kg/ha
= kg pasture grown and utilised	12369kgDM/ha	14083kgDM/ha
Difference in growth utilised		1714kgDM/ha

45. If we assume 60% of the difference in growth utilized is a consequence of management changes resulting from water predictability, and 40% is simply from water availability, then we can calculate:

40% of 1714kg/ha	=	686kg/ha
@ 10kgDM/mm water	=	68.6 mm water (686 m3/ha)
Over 180 days irrigation season	=	0.381 mm/day (.044l/sec/ha)

46. That difference in water availability is within the variance in evapotranspiration I see from pasture with shelter relative to pasture without shelter, and is therefore reasonably indicative of the impact water reliability can have.

47. To further illustrate my point, my dairy specialist partner, Jeremy Savage has summarised a range of data from the monthly "DSM" (Dairy System Monitoring) data base, which is used to monitor over 40 farms.

48. DSM uses a range of calculated and monitored variables including milk production supplementary feed inputs, changes in pasture cover, and feed quality, to backwards calculate benchmarks including pasture growth, response to supplements, and feed conversion efficiency. The feed and nutrition program "UDDER" is the base driver to the DSM program. I have selected from his data base of DSM monitored farms, several properties that can demonstrate my point.

49. Table 1 summarises a range of properties in the system. They include the top and bottom system quartiles, two reliable irrigation farms, one in the Central Plain Water catchment, 2 unreliable irrigated farms, both in the Central Plains Water catchment (upper Te Pirita) the Lincoln dairy unit, which has excellent reliability and volume, and, Pencarrow, my home property which has RDR water topped up with well water, with reliability in the early 90's, currently being upgraded to high 90's.

Table 1 2007/08 DSM Summary

	Bot. 25 %	Average	Top 25 %	LUDF	Pencarrow	Marginal A	Marginal B	Reliable A	Reliable B
Gross Margin / Ha	$4,524	$6,579	$8,349	$9,464	$ 8,249	$5,704	$5,565	$8,381	$7,957
Feed Harvested (TDM/HA)	9.7	11.5	13.0	16.1	12.8	11.2	10.5	14	14.1
Stocking Rate	2.87	3.32	3.65	4.22	3.63	3.53	3.64	3.97	3.69
Per Cow Production (kgMS)	337	383	427	410	404	347	338	416	408
Pasture Harvested kgDM/cow	3,385	3,456	3,562	3,818	3,529	3,169	2,882	3,528	3,819
Supplements Used kgDM/cow	548	680	734	470	546	606	608	943	697
Feed Intake Per Cow (kgDM)	3,691	4,074	4,244	4,288	4,075	3,775	3,490	4,471	4,516
KGDM per KgMS	11	10.8	10.5	10.5	10.1	10.9	10.3	10.8	11.1
Digestibility	77%	80%	82%	82%	82%	78%	79%	80%	83%
Days In Milk Per Cow	252	260	265	256	260	236	246	260	267

Data average of 44 Farms in DSM (Dairy Systems Monitoring) database.

50. The dairy farm simulation model UDDER is used to simulate the farm system. The input information is milk production from fencepost, and monthly data from the farm, including, areas, stock numbers, supplements and crops, nitrogen etc. The model is then calibrated to simulate the farms production, revised and validated monthly. 2007/08 season prices are used for income and expenditure.

51. The properties described as Marginal Properties are subject to river flows of the Rakaia River. They are in Band 4. The properties are located in the Upper Te Pirita area. Reliable A is in the Darfield area. This is a centre pivot farm with good management. Reliable B is in Seafield, mid Mid Canterbury,. Rotorainer irrigated with average management.

52. Key points to note from the table of 07/08 production include :

- Feed harvested per hectare improves within a range 10.5t/ha to 16.1t/ha
- Feed conversion efficiency improves with a range of 10.1 to 11.

53. Those two figures reflect in:

- Higher stocking rate with water.
- Higher pasture harvested per cow
- More days in milk
- More output per cow (338kg to 427kg/ha)

54. The figures above demonstrate, I believe, the increases in productivity that result from the combination of water availability and reliability, management skill, entrepreneurial skills, and the risk management ability that is typically associated with the farmers who borrow large sums of money to join a scheme like Central Plains Water.

55. While I appreciate the points other witnesses make about the apparent aggressiveness of my post CPW production, I am satisfied, that the income differences between pre and post scheme development will prove robust. I base this statement, not only on the points I have made above, but on my own personal experience of developing and enhancing water supply and use on three dairy farms, under a self imposed stiff environmental criteria. This was covered in my previous brief of evidence on water reliability and how this impacts on productivity.

56. Finally I wish to specifically comment on some of Prof. Hazeldine's statements as they relate to my evidence. For ease of reference I use his numbering at the start of each paragraph.

57. Para 2.1. Prof. Hazeldine criticises the use of a 35 year time horizon. However, farmers typically invest with a 30-40 year timeframe in mind, as proved by the return on capital they accept. Even so, discount analysis places a relatively small emphasis on returns in year 35, so Prof Hazeldine's point is not critical to the analysis.

58. Para 2.3. I agree that we cannot readily predict future land use. While I have given my view, without budgeting on that view, it does underline that need not to be conservative and rely on current land uses. History has shown we inevitably get changes in land use and technology that generate higher long term returns than originally estimated.

59. Para 2.9. This point (that we need to make a judgment on the direction of likely long run trends) is valid, and covered in section I of my evidence. I consider those trends are very positive for the Scheme.

60. Para 3.4. Prof. Hazeldine assumes the cost of maintaining the Scheme is missing from the budgets. However running costs of the Scheme are covered under "standing charges" in the budget.

61. Paras 3.8 and 3.9. My budgets include full environmental planning and mitigation. For example an outlay of $43,500 on each dairy farm for nitrate inhibitors is budgeted. I have not assessed carbon, which on current estimates could cost a tax of 53ckgMS, $1.20/kg lamb and 55c/kg beef. However, the dynamics of how carbon taxes will eventuate, how emissions will be mitigated, and whether tax can be recovered in the market place are yet to be decided. It is inappropriate to distort the economics of the investment with variables that are unconfirmed, and unclear in relative impact. On first principles, the economics of using surface water, potentially pressurized, must have significant carbon gains relative to pumping high energy cost deep water.

62. In the same manner, I would agree that water is not "free". The capital cost, of running costs of extraction are high, and increasing. Stating that water is "free" ignores all that cost. It would be fair to say that as the "cost" of water has increased exponentially, farmers have become very sensitive about

using it wisely. Hence the proliferation of new, more water efficient developments.

63. Para 3.24. Using national average dairy farm productivity as a benchmark for the Central Plains Scheme is dangerous, as this area has larger and more productive farms than the national average, even without CPW. Mr Ford's evidence of LIC data for Selwyn at 1,207kgMS/ha, including the smaller, older farms outside CPW is indicative that a pre CPW productivity of 1,330kg/ha is appropriate, even given some of the water unreliability issues described.

64. As stated in my evidence in chief, there is no debating that a capital intensive scheme such as Central Plains Water is a major challenge for individual farmers to fund. There is also no doubt that cost side challenges ranging from input cost increases to carbon taxes will have to be encountered.

65. Conversely the events of the past year have shown that real increases in food costs are a reality, and that the productivity gains and innovations that have kept farmers viable over the past 40 years are not diminishing. The material I have presented gives some indication of the reason for my confidence that the budgets I have provided are conservative.

A W Macfarlane