

IN THE MATTER OF the Resource Management Act
1991

AND

IN THE MATTER OF applications by Central Plains
Water Trust to:

the 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

the 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:

the Selwyn District Council for
the designation of land for works
associated with the construction
and operation of the Central
Plains Water Enhancement
Scheme.

REBUTTAL EVIDENCE OF PHILIP THOMAS DONNELLY

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1. I have read and wish to comment on the evidence of Professor Hazeldine, Messrs Copeland, Butcher (the other economists), Jansen and Ford. So as to make my rebuttal easier to follow, I have grouped my comments on the other economists by topic and Messrs Jansen's and Ford's evidence separately. The topics are as follows:

- Appropriate definition of efficiency
- CBA methodology
- Relevance of EIA
- Importance of scheme to economic well-being
- CBA farm productivity assumptions
- CBA dairy price
- Inclusion of environmental costs
- Opportunity cost of water
- Treatment of alternative irrigation schemes
- Coase Theorem
- Mr Copeland's reproduction of my CBA
- 10 percent discount rate
- Cost increases
- Take-up of scheme by farmers with existing groundwater irrigation
- Mr Jansen's evidence
- Mr Ford's evidence
- Conclusion.

2. The consequence of adopting a topic approach to my rebuttal is that I have omitted commenting on some less important points made by the other economists that I do not agree with.

Appropriate definition of efficiency

3. Both Messrs Butcher and Copeland have defended Dr Brown on my criticism of the definitions of efficiency he provided in his Section 42A report. I consider that they have misunderstood the criticism.
4. All the economists accept that economic efficiency, also known as Pareto efficient allocation of resources, has three components, namely, allocative, productive (also known as technical) and dynamic efficiency.
5. Dr Brown provided several definitions efficiency and I was critical of those definitions for two reasons. First, I considered his definition of allocative efficiency unhelpful to the Hearing Committee as I considered that the average layperson could not apply it to the CPW scheme to determine whether it was efficient. Second, all his other definitions related to technical or productive efficiency. Those definitions were provided without explaining they were defining a different concept to his first definition.¹
6. By presenting definitions of productive efficiency without explaining they were not a substitute for his first definition of allocative efficiency or indicating the relationship, I considered that he undermined the fact that the emphasis for this hearing should be on allocative efficiency not productive efficiency.
7. To explain this point it is necessary to refer to Dr Brown's definition of allocative efficiency.² This definition contained two key concepts, namely, that producers be technically efficient while at the same time producing the right mix of goods to satisfy consumer preferences. Because his subsequent definitions were of productive efficiency they all referred to the first key concept, but did not refer to producing the right mix of goods, and this is why I was critical of his subsequent definitions.
8. This point is explained by a principal text book used by Canterbury University in recent years:

“...But, as we have already pointed out, technical efficiency is not a sufficient condition for Pareto efficiency. The right mix of goods must also be produced. It does little good for an economy to be an efficient producer of yo-yos and xylophones if no-one wants these goods. In

¹ He said economic efficiency can be defined as: “the effectiveness o[f?] resource allocation in the economy as a whole such that outputs of goods and services fully reflect consumer preferences for these goods and services as well as individual goods and services being produced at minimum cost through appropriate mixes of factor inputs”.

² .² 1

*order to assure Pareto efficiency, we need some way to tie individual's preferences and production possibilities together....*³

9. The concept of efficiency that ties both productive or technical efficiency with maximizing an individual's preferences is allocative efficiency. This does not mean that productive efficiency has no relevance, as it is built into the concept of allocative efficiency. That is why allocative efficiency rather than productive efficiency is the relevant concept for the Hearing Committee to consider.
10. Regardless, I did not think that Dr Brown's definition was a helpful definition of allocative efficiency as it cannot be usefully applied to determine whether the CPW scheme is efficient. In this respect I note that his definition was not the strict economic definition,⁴ however, I said that the strict definition has little practical usefulness and needed to be modified to make it more useful.
11. In this respect I gave the strict definition of allocative or Pareto efficiency, namely a state where there is: "An allocation of resources in which no one individual can be made better off without making someone else worse off". Under the strict definition, a proposal to reallocate resources achieves an improvement towards this optimal state of efficiency where the resources are allocated without making someone worse off. Clearly no major projects would pass the Pareto efficiency test.
12. To overcome the practical limitations of using the strict definition of efficiency the Kaldor Hick's compensation test is applied which loosens up the extreme restriction that there must be no losers before a project or policy can be judged potentially efficient. The Kaldor Hick's compensation test, which underpins all CBA, states that a project can be assessed as being efficient providing there is a net benefit after taking account of the losses to people who will be adversely affected as it implies they could be compensated to a level where it is win-win situation. Thus, in CBA, a project or policy is potentially efficient if there is a net benefit to society. It is noteworthy that, when asked by the Hearing Committee what was the appropriate definition of efficiency, Mr Butcher said just that.

³ Page 555, Microeconomic Theory Basic Principles and Extensions, Walter Nicholson

⁴ Dr Brown's definition is a practical adaptation of the concept of allocative efficiency that can be applied in practice, although technically speaking it is not a correct definition. I have frequently used similar definitions myself where it is appropriate.

CBA methodology.

13. Professor Hazeldine and Messrs Copeland and Butcher discuss cost benefit analysis (CBA) methodology. Professor Hazeldine devotes a considerable amount of his evidence commenting on my conventional approach and his alternative method sparked this discussion.
14. During the presentation of his evidence, Mr Copeland indicated he supported the conventional approach and did not support Professor Hazeldine's alternative approach. Mr Butcher had some support for Professor Hazeldine's approach, but did not think it achieved its objectives. He considered, however, that Professor Hazeldine's approach was complementary to the conventional CBA.
15. I strongly disagree with Mr Butcher if he is implying that Professor Hazeldine's approach has any technical merit. I consider, for the reasons I will explain, that Professor Hazeldine's analysis is unsound theoretically and therefore is not of any help in assessing the efficiency of the proposed CPW scheme.
16. The reason given by Professor Hazeldine for his single year-up-and-running approach was that the 35-year time horizon I had adopted for my analysis period was "...well beyond the bounds of our capability to make useful quantitative predictions".⁵ He also argued that conventional CBA was not applicable to the CPW scheme as, for all practical purposes, it was irreversible. He also argued that his method had the advantage of avoiding the need to choose a discount rate.
17. It is noteworthy that Professor Hazeldine admitted in response to a question of clarification that his up-and-running cost benefit analysis was his own adaptation of conventional cost benefit analysis for the purpose of this hearing and it was not an accepted analytical tool.
18. CBA is the practical arm of welfare economics and, consequently, is based in economic theory. It has been extensively evaluated in economic literature and I consider Professor Hazeldine's reasons for dismissing CBA's relevance to the CPW scheme unconvincing as internationally it is commonly applied to projects that have very long time horizons and practically are irreversible.

⁵ Para 2.1.

19. The irreversibility argument does not stack-up with the wide scale use of CBA for projects such as hydroelectric dams, airports and major roading projects. The perceived uncertainty and irreversibility of projects is not accepted in the literature as valid reasons for the non-use of CBA.
20. The range of CBA uses is highlighted by the European Commission's Guide to Cost-Benefit Analysis of Major Projects.⁶ CBA is a major requirement for successful application for EC Structural Funding. The guide gives some examples of the sectors supported by the ERDF, which is the Structural Fund that is most frequently involved in the part financing of suitable projects. Under the heading Water and the Environment, examples listed include aqueducts, dams and irrigation, depurators, waste treatment plants and other environmental works. Under the heading Transport, examples include railways, roads and highways, ports, underground, trans-European networks, while the heading Energy, lists energy production, energy distribution and trans-European networks.
21. I consider Professor Hazeldine's claim that a 35-year time horizon is well beyond the bounds of our capability to make useful quantitative predictions a weak argument for abandoning conventional CBA, as long time horizons have little bearing on the results. For example, at 10 percent discount rate almost 80 percent of the weight given to costs and benefits is made up of the costs and benefits that occur in the first 15 years of the project and that over 20 years this percentage increases to 88 percent. Less than three percent of the NPV weight is contributed from year 30 on.
22. Professor Hazeldine's alternative assessment method is highly problematic. It is incapable of dealing with costs and benefits occurring at different times and is incapable of testing the scheme's sensitivity to variation in capital assumptions.
23. One of the reasons advanced by Professor Hazeldine for his up-and-running method is that it avoids the need to "get into arguments about the appropriate discount rate".⁷ However, in discussing scheme construction costs he states:

"It makes things simpler if we convert the capital cost (on and off-farm) estimates for the scheme of \$682 million into an annual flow. That is, we suppose that the shareholders take out long-term loans to fund the scheme. As the base-case interest rate for this loan I use the figure for

⁶ Guide to Cost-Benefit Analysis of Major Projects, In the Context of EC Regional Policy, 1977 Edition.

*the cost of capital used by MacFarlane Rural Business, which is 7.5%.
Of course this figure is well below current interest rate levels.”⁸*

24. As a consequence of this long-term loan assumption, he inserts an annual interest cost of approximately \$51.2M into his up-and-running analysis (i.e. $\$682\text{M} \times 7.5\% = \51.2M in place of estimated construction costs. Effectively, the capital cost of the scheme, which is up front cost, is ignored in his analysis and substituted by interest payments. It is noteworthy that in undiscounted dollars, over 35-years, this equates to \$1.79 billion or about 2.6 times the estimated capital cost or about \$2.15B with his 20 percent allowance for cost overrun, i.e. about 3.2 times the actual construction cost.⁹
25. There is no means by which to avoid discounting in project analysis if costs at different points of time are to be converted to comparable (net present) dollars. Professor Hazeldine’s approach fails unequivocally in this respect, as there is no valid alternative for dealing with capital cost other than by discounting.
26. A major problem with Professor Hazeldine’s up-and-running approach is that he includes interest (as indicated above) and depreciation costs in his analysis. In respect to depreciation he states:

*“One major expense missing from Mr Donnelly’s analysis is the cost of maintaining the scheme. This assumption comes over from the Macfarlane Rural Business reports in which it is stated: ‘The irrigation cost is calculated as 100 percent capital hence no [annual] charges are calculated (e.g. para 4.6 in the Report of 24th April, 2006). But the scheme will not run itself. It will need to be managed, maintained **and depreciated**, and this must be **costed into the calculations of net benefits.**”¹⁰ (Bold emphasis added.)*

27. In response to a question of clarification asked during the presentation of his evidence, Professor Hazeldine insisted that he was correct in including both interest and depreciation in CBA and was adamant, in response to a question of clarification, that interest did not represent a transfer payment.
28. Professor Hazeldine’s view is unequivocally wrong when CBA is undertaken from society’s perspective. Interest should be excluded because it is a transfer payment while depreciation is an accrual accounting concept. To

⁷ Para 3.3

⁸ Para 3.3

⁹ Para 4.9

include depreciation in CBA cash flows is paramount to double-counting of capital expenditure. Effectively, depreciation is an accrual accounting mechanism of spreading a sunk cost over the perceived useful life of the asset rather than including all the cost in the year of occurrence.

29. The error in Professor Hazeldine's analysis is highlighted by the Australian Department of Finance and Administration CBA manual titled "*Introduction to CBA*" (January 2006) which correctly states as follows:

"CBAs are conducted on a cash accounting basis. The full cash cost of a capital item is recorded in the analysis at the time of purchase so that over the life of the project the item can be considered to be depreciated in full.

Depreciation is an accrual accounting concept. It allows an annual expense for capital items. However, it is a non-cash expense (cost) and should not be included in a CBA. To do so would be a form of double-counting because the full cost is allowed for at the time of purchase. ...

Interest payments are also excluded from the cashflow in CBA because they are implicitly reflected in the process of discounting."¹⁰

30. Similarly, Steve Harrison writes:

*"Capital outlays. Initial Outlays and not depreciation allowances should be **included** in the cashflows. That is, the cashflows of financial transactions should be recorded at the time they are made, rather than making periodic allowances for the services yielded by capital items".*

And:

*"Interest payments. As mentioned earlier the discounting procedure simulates **interest payments**. In any case, **interest payments are transfer payments** between borrowers and lenders, and so should not be **included in social cost**. [The bold emphasis is Harrison's.]¹¹*

31. In summary, because Professor Hazeldine has used a non-conventional problematic analysis that includes interest payments and depreciation, his analysis is unsound theoretically. It produces results that are of no practical

¹⁰ Para 3.4.

¹¹ 5.5 Treatment of depreciation and interest page 25.

value while the method is incapable of testing the sensitivity of the proposed CPW scheme to changes in key assumptions. In my opinion, his up-and-running analysis should be ignored as erroneous and unhelpful to assessing the efficiency of the proposed CPW scheme.

Relevance of EIA

32. Professor Hazeldine questions the relevance of the **regional** economic impact analysis (EIA) that I present in my evidence. I did not measure the effects at the national level.
33. Professor Hazeldine dismisses the EIA for the CPW scheme. Mr Copeland draws the Hearing Committee's attention to the general limitations of EIA and the weight that should be given to such impacts in terms of "**economic well-being**" and "**efficient use**" of resources.¹³ Mr Butcher, states that it is only the net impacts that are relevant and that they are likely to be somewhat smaller than the gross impacts that I describe, particularly at the national level.¹⁴
34. While Professor Hazeldine acknowledges that I correctly explain the purpose of EIA, namely, to examine how a policy or project will change the economy, assessed in terms of snapshots of different points in time, he argues:

"I consider these analyses to be generally of little use, because they pay no heed to the supply side of the story. They rarely note that economic activity or employment "boosted" in one region must be reduced by a nearly equivalent amount somewhere else. Apart from adjustment costs, there are no particular normative implications to a change in location of activity, at least at the national level relevant under the RMA."

35. I agree with the other economists that it is the net impacts of EIA at the level at which it is undertaken (e.g. district, region) that are of real importance. However, I find some of the criticism in this respect somewhat ironic as I effectively said that in my evidence in chief where I said ¹⁵ that one of the key differences between EIA and CBA is that the former is (effectively) a before

¹² Page 6, Cost -Benefit Analysis in Forestry Research, In Harrison et al/ Socio-economic Research Methods in Forestry. A training Manual, Leyte State University, VISCA, Baybay, The Philippines, 4-10 February 2002. University of Queensland.

¹³ Para 28.

¹⁴ For the record, it is noteworthy, that my EIA was effectively a partial update of the initial report undertaken by Mr Butcher for the CPW scheme.

¹⁵ To be precise I said: "A fundamental distinction between the two approaches is that economic impact analysis is based on a "before" and "after" approach while cost benefit analysis is based on a "with" and "without" assessment basis. Refer para 5.3.

and after analysis, whereas the latter, is “with” and “without”. The point I was making is that we do not know what irrigation and/or non-irrigation activities, if any, may take the place of the CPW scheme if it should not proceed and, therefore, it is not really possible to claim it is “with” and “without” analysis. Thus, by default EIA falls into “before” and “after analysis”, but I was criticised for saying that by the other economists.

36. Regardless, I disagree with much of the commentary of the other economic witnesses for two reasons, namely, their excessive focus from an RMA perspective on economic wellbeing and an unfounded presumption that the resources available to the economy are finite and, therefore, allocation to the CPW scheme must inevitably deny use elsewhere in the economy. That is an extreme and, in my view, indefensible view.
37. The other economists dismiss the relevance of EIA in respect to “**economic well-being**” and “**efficient use**” of resources (in a very narrow CBA context). In my view, they have overlooked the fact that the RMA requires a much wider consideration than just efficiency (section 7(b)) and economic well-being (section 5(2)(b)), while I made it clear in my evidence that it is the wider consideration that I address in my regional EIA.¹⁶
38. In my opinion, EIA is relevant to RMA resource consent applications because section 5(2) of the enabling provisions refers to “...managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and **communities** to provide for their **social** and, economic, and cultural well-being...”. (The emphasis is added.) The regional EIA evaluates the socio-economic impacts of the scheme rather than efficiency impacts.
39. The word “communities”, in my opinion, requires resource managers to have regard to the well-being of all the relevant communities, local, district, regional and national, and not just the national community which Professor Hazeldine implies. It is noteworthy that the Ministry for the Environment, which is responsible for administering the RMA, commissioned an EIA assessment from a sub-national perspective in respect to Meridian’s cancelled Project Aqua. This study was commissioned to provide balance to the national focused CBA, which was earlier commissioned by the Ministry of Economic Development.

¹⁶ Refer para 2.6 of my evidence in chief and 12 of my rebuttal of Dr Brown’s evidence.

40. If measuring growth, which is the focus of EIA, is an irrelevant concept, why is it closely monitored at the national level by Government and why does Statistics New Zealand spend so much time and effort measuring GDP? The answer is that growth is a prerequisite to improved social and economic well-being. In addition, “dynamic” efficiency, which is one of the three components of economic efficiency, introduces growth into the latter concept and, therefore, growth cannot be dismissed as being irrelevant.
41. I consider that Professor Hazeldine’s assertion, which is supported by Messrs Copeland and Butcher, “... that economic activity or employment ‘boosted’ in one region must be reduced by a nearly equivalent amount somewhere else” an extreme and, in my opinion, erroneous and unsubstantiated opinion. Professor Hazeldine’s “fixed cake” theory implies that economic resources available to a sub-national area and/or the New Zealand economy as a whole are finite and cannot be supplemented without displacing activity elsewhere. Thus, if they are used in region X they are not available to Y, but regardless, nationally, it doesn’t matter where resources are used as in a situation of scarcity they will find employment somewhere.
42. The view implies that economic resources (land, labour, capital and entrepreneurial skill) are fixed and fully utilized. The fact is that at the national and sub-national level capital resources are virtually infinite as capital is internationally mobile. Providing projects can afford the cost of borrowing there is virtually an unlimited supply of international capital available to meet their needs. This is highlighted by the huge quantum of funds that the financial sector has borrowed offshore over the last several years, much of it to fund substantial and destructive property price inflation. There is no evidence that this has been at the expense of capital available to other activities, although undoubtedly it has affected the commercial viability of many productive activities by inflating interest rates and the exchange rate.
43. Labour is also a highly mobile resource, nationally and internationally, and it is a dubious argument to assert that the CPW scheme must of necessity deprive other regions’ employment needs. The sources by which the available supply of labour may increase, include: migration into New Zealand; reducing the rate at which New Zealand residents migrate to other countries; growth in the labour force (e.g. more young people entering the labour force than older people retiring); and increased labour force participation (e.g. from mothers, students, sickness beneficiaries re-entering the labour force).

44. The land area available in New Zealand is finite. However, its productive potential can be substantially enhanced by irrigation and the application of technology.
45. For those reasons, I disagree with the other economists' reasons for asserting that the CPW scheme or other new development projects in general add no extra benefit to the regional or New Zealand economy. However, I do consider it highly desirable that projects/policies should be evaluated in the first instance on their efficiency, i.e. how much they improve welfare rather than how much economic activity they appear to generate. Regard should only be had to the potential scale of the impacts projects/policies generate if they are efficient.¹⁷

Importance of scheme's exports to economic well-being

46. In respect to the section of my evidence titled "Importance of exports to economic well-being", Professor Hazeldine refers to my analysis as "half-baked"¹⁸ and incorrectly assumes it is related to an "unnamed" model dating back to the 1960s.¹⁹ Mr Butcher states that while the immediate effects of CPW on exports would be positive, the long-term net impacts on the balance of payments and GDP would be smaller than I suggest. They also may well be trivial because, when extra resources go to CPW from elsewhere in the economy, the entire economy adjusts to compensate for this.
47. I disagree with both economists while I consider the important points I made have been lost in the criticism. This section of my evidence made four points, namely:
- New Zealand is heavily dependent on agricultural exports while the CPW scheme is an export scheme and would produce significant new exports (around \$734M)
 - export earnings are vital to the health of the national economy and to our economic well-being

¹⁷ This is because as the costs of projects/policies rise economic impacts increase. However, all things being equal, high cost projects/policies are likely to be less efficient than low cost projects/policies as the gap between benefits and costs will be less. That is, efficiency and the scale of impacts may move in opposite directions.

¹⁸ He is referring to my comments in paragraphs 4.6 to 4.8 of my evidence in chief.

¹⁹ In fact it relates to the knowledge that I acquired in the first 24-years of my career working in applied economics in central and local government.

- there is a (complex) relationship between what the country exports in commodities and services and the total level of domestic activity as measured by GDP
- based on the observed historic relationship I observed the scheme's exports may increase GDP by between \$2.2B and \$2.9B.

48. The first point is purely factual.²⁰ Professor Hazeldine disputes points 2 to 4 while Mr Butcher seems to dismiss the idea of any long-term relationship between exports and GDP. Consequently, I will explain why I disagree with both those witnesses.
49. Export earnings to the nation effectively serve the same purpose as the income of a household. Therefore, if I explain the importance of household income, the second point bullet point will become more intuitively obvious and explain why I consider Professor Hazeldine's criticism unfounded.
50. Household income is used to buy the commodities and services that the household cannot or does not have a comparative advantage in producing. The level of household income determines the occupants' standard of living, i.e. the level of their economic well-being. Thus, the household's standard of living is a function of its income.
51. In the short to medium-term borrowings can be used to prop up household spend and, therefore, its standard of living. However, if the borrowings are not used productively, the increased spend will be short-term and at the expense of future consumption and eventually the household will be forced to reduce its consumption and live within its sustainable income.
52. Some household occupants may be involved in unpaid economic activity such as education, childcare or voluntary work. Consequently, the total level of economic activity generated by the household may be a multiple of the income of the household. As household income increases, more members can be sustained in unpaid work. Thus, the total level of sustainable household activity is also a function of household income.
53. The example parallels the situation for the New Zealand economy. The export sector is effectively the income earner while the non-tradable sector of the economy is the equivalent of the unpaid economic activity undertaken by

²⁰ The precise level of CPW scheme exports will depend on the product prices actually realised and the prevailing exchange rate.

the household. While borrowings from the rest of the world can enhance New Zealand's standard of living by supporting a larger non-tradable sector, ultimately the economic well-being of the country and the total level of activity that can be supported is a function of exports. Consequently, without export earnings and/or an adequate growth in export earnings, New Zealand would become impoverished just as a household would become impoverished without income.

54. It is nonsense for the other economists to suggest otherwise, although some economists promoted the idea that the free floating of the dollar and the deregulation of the New Zealand economy in the 1980s meant that the Government no longer had to promote export growth.²¹
55. New Zealand can only raise its standard of living and grow if we export. We cannot do it by being inwardly focused. The argument for increasing exports is concisely put by Tim Harcourt, Chief Economist, Australian Trade Commission. He said:

“Why does South Australia need to export? For the same reasons as it is important for Australia to export. There are both macroeconomic reasons and microeconomic reasons. In macroeconomic terms, increased exports help us pay for our imports as our economy grows. Exports are also growth prospects for the state and for the nation and creating export industries helps assist the workers by providing high quality jobs with good career prospects. Australia is a small country with a limited domestic market, so exporting is the only way in which we can grow and take advantage of economies of scale. And this is especially important for a state like South Australia that has a relatively low population.”

56. Professor Hazeldine implies that I consider that there should be some premium attached to foreign exchange earnings. I do not. Rather, what I am saying is that it is not easy to develop and/or increase exports and that the

²¹ The theory was that if New Zealand was short of foreign exchange earnings the exchange would adjust and more resources would flow into the export sector and vice versa if we had an excessively favourable balance-of-payments position. This has not worked as predicted because of the enormous non-trade dealings in New Zealand currency and due to the time taken to develop new export opportunities. The large non-trade dealings in the New Zealand dollar have suppressed price signals to exporters. This has been compounded by the Reserve Bank's use of interest rates to control inflation. At times when more foreign exchange earnings are needed the exchange rate has been rising and exporters have been retrenching and or relocating offshore.

export tap cannot be turned on and off at will. It takes a great deal of time to develop our export markets, while New Zealand has struggled in this area for decades. As a consequence, New Zealand's standard of living has languished at the bottom end of OECD countries. If the CPW scheme does not proceed it cannot be assumed that some other 'equivalent' level export activity will take its place. For those reasons I also refute Mr Butcher's assertion that exports are not special.²²

57. Professor Hazeldine challenges my assertion that the decline in the ratio of New Zealand's exports to GDP is responsible for an unsustainable increase in the balance-of-payments deficit. He asserts (while referring to the support of unnamed economists and policymakers) that we do not have an export shortage problem, but rather a low national savings rate. I presume he is saying that if we saved more we would not need to borrow as much from the rest of the world and that our balance-of-payments deficit would rectify itself.
58. While less spending on imports (e.g. cars, TVs) and travelling overseas should help reduce the balance-of-payments deficit (it will also reduce our standard of living), I do not agree this is the only or best solution. The simple fact is that New Zealand relies on a Third World level of exports to prop up a First World standard of living and it does not work.
59. Mr Butcher states that the impact on the balance of payments and GDP will be far less than I suggest. However, I made no prediction about the effect on the balance of payments. I simply said we have an unsustainable balance-of-payments deficit and as a country more exports are needed. The CPW scheme provides a means of increasing our exports. As to my indication of how much additional GDP might be sustained by the scheme's exports. I said the relationship between exports and GDP is very complex, but it is possible to make an estimate on observed historic and current relationships.
60. It is noteworthy that the Government does not buy into Professor Hazeldine's thesis (or Mr Butcher's views) that we do not have an export shortage as it has placed considerable importance on promoting free trade agreements with other countries and has also recently signed an agreement with China. For the same reason, the Government promotes the removal of trade barriers in agriculture (e.g. through World Trade Organisation discussions). If exports were irrelevant to New Zealand's well-being, why would it bother to pursue free trade agreements and promote free trade in agriculture?

²² Refer slide 3,

61. For those reasons, in considering the impact of the scheme on enabling economic well-being, the Hearing Committee should in my opinion give considerable weight to the scheme's very large annual exports.

CBA farm productivity assumptions

62. The other economists question the post-scheme dairy productivity assumption with Mr Butcher stating that it is clear from the analysis that the productivity assumptions in respect to new dairying drives the CBA's NPV gain.
63. Mr Macfarlane has responded to this criticism in his rebuttal evidence, but in summary it is justified because, as he explains, there are a large group of farms, including dairy units, which are significantly underperforming relative to their potential, due to lack of water reliability²³. Based on data extracted from the CPWES survey, Mr Macfarlane concludes that it could reasonably be expected to have enhanced production from about 38,000 hectares of land classified as irrigated from groundwater if they shifted to CPW water as there are a large group of farms, including dairy units, which are significantly underperforming relative to potential, due to lack of water reliability.²⁴.
64. Regardless, for the Hearing Committee's information, I have determined the impact of assuming that there is no difference in dairy productivity pre and post-scheme. Equating productivity pre and post-scheme results in the NPV falling from \$375M to \$102M or by \$273M with a fall in the IRR from 14.4 percent to 11.3 percent at 10 percent discount rate. Thus, the efficiency of the proposed scheme is not dependent on the dairy productivity assumption.

CBA dairy price

65. Professor Hazeldine and Mr Butcher discuss the milk solids price assumed for the purposes of my CBA, namely, \$5.50/kg of milk fat. In his Section 42A report Mr Butcher criticises this price as being too high and asserts that lower figures should be used. Professor Hazeldine disagrees with Mr Butcher, as he considers New Zealand and the world have entered a new regime of higher food prices.²⁵ He argues, however, that current high prices (that are well above \$5.50) are unlikely to be sustained.²⁶ Subsequently, it is noteworthy that Mr Ford's evidence supports a price of \$5.50/kg of milk fat.

²³ Para 28

²⁴ Para 28

²⁵ Para 3.27.

²⁶ Para 3.28.

66. The points to note about the milk solids price is that it compares to Fonterra's latest forecast payout of \$7.90/kg, i.e. about 44 percent higher. Further, since that announcement, the New Zealand dollar has declined from a peak exchange rate of \$1NZ=\$US0.80 to closer to \$1NZ=\$US0.70 or a devaluation of more than 10 percent. While further fluctuations can be expected most economists consider that the New Zealand dollar is overvalued and further devaluation of the New Zealand dollar can be expected. More importantly, the upward movement in the international price of milk solids appears to be related to factors in addition to those that drive cyclical swings.
67. If food prices move upwards across a wide range of products, the point made by Professor Hazeldine is less likely to apply, namely, high prices induce increased supply as there is less incentive to change to dairy production to capture the associated increased profits.²⁷ His other point, namely, high prices cause a reduction in demand, thus reducing the extent of upward movement, should be apparent with existing prices as there is unlikely to be any lagged consumption effect. That is, consumers immediately respond to high prices by cutting consumption.
68. While the other economists appear reluctant to consider the possibility, much higher prices than I have assumed in my CBA are possible, especially given the high probability that the exchange rate will decline. It is noteworthy that for each upward movement of 50cents in the milk solids price adds \$50M to the CBA NPV at 10 percent discount rate.

Inclusion of environmental costs

69. Professor Hazeldine criticises my analysis on several other grounds, namely, failing to quantify CO₂ emissions, the cost of surface water pollution caused by dairying and not applying an opportunity cost to water. I will discuss each of these points in turn.

CO₂ emissions

70. Professor Hazeldine asserts that I make no allowance for the environmental damage caused by the increased dairy area and includes a carbon price of \$30/tonne in his up-and-running project assessment.²⁸ Mr Butcher states that he has reservations about the inclusion of carbon costs. He states that "if

²⁷ Para 3.28.

²⁸ Para 3.8.

CO₂ taxes become part of the world trading system, they may have significant impacts on output prices as well as costs...” and that Professor Hazeldine has not considered the effect on the latter.

71. Regardless of his reservations, Mr Butcher implies that it is appropriate to use a tax as an indicator of environmental damage. I have serious problems with that presumption even if the tax is set by a trading scheme, as the price that will eventuate is totally unrelated to the marginal damage caused by CO₂ emissions.
72. The cost of any damage caused by increased CO₂ emissions is indeterminable as not enough is known about the relationship between changes in greenhouse gas emissions, changes in temperature and the resulting environmental damage.
73. Regardless, some farm interests claim that there is no basis for claiming that farm animals add to carbon emissions. This is because both farms and forests extract carbon from the air and store it in organic life forms until that organic matter is burnt or decays in the open air, thus returning their borrowed carbon to the atmospheric storehouse. The renowned environmentalist, Dr David Bellamy, supports this view. He states:

“Cows and sheep are Mother Nature’s own brand of internal combustion engine. They get their energy by ‘burning’ cellulose, the same stuff wood is made of... Each one is a solar powered, self building, repairing and regenerating mobile mini supermarket. The solid waste from which it recycles, returning organic compost to the soil...”

“Exhaust from these internal combustion engines both large and small contain carbon dioxide and methane... The molecules of carbon that make up their flesh, wool hide, burps and farts is not fossil carbon.

“It was sequestered from their pasture rarely longer than a year and most within a few days before their release back into the atmosphere.

“Although somewhat modified by human influence they are part of the 97 percent of the main cycle of carbon dioxide that makes the living world go round. Not the three percent that the global warmers say are tipping the world, towards an omnivore-driven Armageddon.”²⁹

²⁹ <http://homepaddock.wordpress.com/2008/06/03/bellamy-belching-farting-ok/>

74. Opponents of this theory argue that cows emit methane, which is more potent than the borrowed CO₂. Owen McShane responds to this argument as follows:

“My argument is not that cows are carbon neutral or not. My argument is that we actually have no idea of the different exchanges, which take place between the different elements of the biosphere – something which Freeman Dyson has been saying for years...”

“So if we are going to tax farmers (inorganic or organic) for their emissions how do we calculate the tax when we have no idea of the basic chemistry.”³⁰

75. Thus, I have no idea, nor in my opinion does anyone else, of the “incremental damage” that will be done by increased dairy cow greenhouse gas as a consequence of the CPW scheme coming to fruition. Regardless, even if Professor Hazeldine’s guestimate was subsequently shown to be correct, there are two other considerations that should also be taken into account.
76. First, the incremental damage done by additional dairy cows would have to be offset by the CO₂ storage gains from increased arable farming. Professor Hazeldine has ignored this potential benefit. Second, should the CPW not go ahead, it is necessary to consider whether this would make any difference to the net growth in dairy cows. It may simply transfer the perceived greenhouse gas problem elsewhere as the world is demanding more dairy products. Declining the CPW scheme because of the impact of CO₂ emissions may simply result in shifting jobs offshore and losing export income for no net international environmental effect.
77. I consider it is appropriate to leave the contentious issue of CO₂ emissions to the judgment of the Hearing Committee. This is because it is not possible at this stage of scientific knowledge to meaningfully include a net damage value in the CPW scheme’s CBA. Regardless, in my opinion, the incremental value of any additional damage is almost certainly likely to be infinitesimal as my understanding is that New Zealand contributes between 0.2 and 0.3 percent of total global emissions.

³⁰ <http://blog.greens.org.nz/2008/7/2/carbon-neutral-cows/>

Waterway pollution

78. Professor Hazeldine applies a cost of \$5M/year which he states is about \$200/ha/year for the additional 24,000ha converted into dairying, as a consequence of the scheme, in respect to the cost of mitigating pollution of waterways and aquifers and/or as representing the cost to society of unmitigated damage. The rationale for this cost is that he can find no sign of any provision for mitigation costs in the budgets.
79. I agree with Mr Butcher that the estimate is quite arbitrary. More importantly, Professor Hazeldine's estimate implies that avoidance of waterway and aquifer pollution has a significant cost, which I consider is unfounded. My understanding is that good farm management practice can avoid surface and groundwater pollution at minimal cost. I am advised that a Sustainability Protocol is proposed for the CPW scheme which irrigators will be obliged to comply with.
80. It is noteworthy that the Waimakariri irrigation scheme, which has been operating for ten years, recently received a clean bill of health in respect to avoiding adverse effects on the environment (Waimakariri District Council report July 2008). I also understand that the proposed Sustainability Protocol will impose more stringent controls on CPW irrigators than that required by the Waimakariri irrigation scheme. Given the few streams through the CPW area and the flat land that would be irrigated, the Sustainability Protocol should result in virtually no direct discharges to waterways.

Opportunity cost of water

81. Professor Hazeldine and Mr Butcher raise the issue of including an opportunity cost of water with the former going so far as to suggest an opportunity cost of \$10M per year. This is despite there being no supporting rationale other than a erroneous reference to the price paid by Christchurch City residents for water (i.e. \$1/m³).³¹ It is noteworthy, that neither Dr Brown nor Mr Butcher have suggested how CPW scheme water could be costed, notwithstanding their past involvement in irrigation scheme evaluations.
82. Indirectly, Mr Copeland also raises the issue of the opportunity cost of water as he asserts that my CBA significantly overstates the impacts/efficiencies benefits of the CPW scheme. This is because I do not have regard to

³¹ Christchurch City water supplied to households is funded by rates with each household being allocated a quota of water that can be used without charge. Excess water charges are payable at the rate of 45 cents/m³.

competing irrigation schemes able to use the water from the Waimakariri and Rakaia rivers.³² This is the alternative approach to valuing water.

83. Mr Copeland accepts the quantitative difficulties in taking alternative schemes into account due to the absence of data on revenues and costs.³³ Further, he also acknowledges that I state in my evidence in chief that I have not tested the CPW scheme against any competing projects and that I cannot say definitely that the proposed scheme is the best use.³⁴
84. Mr Butcher states: "We cannot say what the true cost of water is, because we do not know what anybody else would be willing to pay."³⁵ Nevertheless, I am expected to include a cost. He also asserts that I continue to claim that the opportunity cost of water is zero.
85. This is not what I said at all. I said water is indisputably a free good although at times in specific locations it will have scarcity value because of the cost of transporting it from locations of abundance and/or capturing it when it is abundant as in recent storms. I also said that this is a reflection of the opportunity cost of capital rather than water being a scarce environmental commodity per se.
86. I understand that there is a total of 326 trillion gallons of water which is in a constant cycle, i.e. it evaporates from the ocean, travels through the air, rains down on the land and then flows back to the ocean. About 70 percent of the planet is covered in ocean, two percent of water is fresh and 1.6 percent is locked up in the polar ice cap and glaciers. Only about 0.036 percent of the planet's total water supply is found in lakes and rivers, but that is still thousands of trillions of gallons.³⁶ On the basis of that information, if water is not a free good then nothing is. That is why I assert that it is the scarcity of capital rather than water that is the problem.
87. Regardless, I said that in specific time and locations water can have a scarcity value and, therefore, there can be an opportunity cost to its use. However, a substantial amount of CPW scheme water will be harvested when there is little or no competing demand other than in-stream use. Therefore, most of the water will have little or any scarcity value.

³² Page 5.

³³ Para 19.

³⁴ Para 20.

³⁵ Page 8, Supplementary Report.

³⁶ Web – HowStuffWorks "How much water is there on Earth?"

88. This fact is supported by figures supplied to me by URS in respect to the Waimakariri water takes in respect to the "CPW base case" which maximises the take at the lower level of river flows. This is the time when competition for the water is likely to be at its peak and, therefore, generate its highest opportunity cost. All the figures relate to average annual volumes taken from the river.
89. It is reasonable to argue that above 100 cumecs there are no in-stream competitors as that is consistent with Mr de Joux proposal on behalf of Fish and Game and that the opportunity cost of water taken above this level is zero. The total take above 100 cumecs is 180 MCM or 63 percent of the total. Competition is arguable between 80 cumecs and 100 cumecs while the main competing uses are probably recreational activities such as fishing and kayaking. There are no potentially competing commercial extractive uses at this point in time, such as taking the water for irrigation storage and/or hydro electricity generation. Thus the opportunity cost of taking the water in the 80-100 cumecs band appears to be close to zero. Twenty-three percent of the total take falls into this bracket.
90. It has been argued at this hearing that there is more competition below 80 cumecs, i.e. there will be an opportunity cost to taking the water below 80 cumecs. But only 14 percent of the CPW base case take falls into this bracket. Other water take scenarios require less to be taken in this category of flow. Thus only a small percentage of the CPW scheme take from the Waimakariri River is likely to compete with other uses and incur a true opportunity cost of water.
91. The Rakaia is subject to the Rakaia Water Conservation Order. This ensures that in-stream uses are well catered for before any water is allocated for irrigation. Therefore, it is reasonable to conclude that there is no opportunity cost to in-stream users in respect to irrigation water taken from the Rakaia River.
92. I understand that the irrigation water from the Rakaia River will be fully allocated if CPW's water take application is approved. This take will comprise about one-third (i.e. 126MCM) of the total CPW scheme water or 44 percent of the amount taken from the Waimakariri River. However, with the Rakaia all the water will be extracted during the irrigation season when there is potential competition from other irrigators. Normally this would imply a potential high opportunity cost.

93. However, my understanding is that there are no other potential competitors for the water while it has the lowest priority allocation of all the Rakaia River irrigation takes and, therefore, it has very low reliability. The water is only likely to be useful to irrigators that have backup water sources to offset the unreliability factor. Thus at this point in time, and probably for the foreseeable future, there is zero opportunity cost to the CPW schemes use of this water.
94. Regardless, I question the end purpose for including an opportunity cost of water where alternative use is from other potential irrigation schemes. As I will explain in the next section, including an opportunity for water used by the CPW scheme raises the issue of what precisely is the CBA trying to measure, namely, the welfare gain from allocating the water to irrigation or the net gain to society from the CPW scheme compared to potential competing alternative schemes. In my opinion, the RMA's first-in first-served approach to water allocation implies the latter is the principal CBA focus.
95. While I question the relevance of including an opportunity cost of water, and I reject Professor Hazeldine's suggestion of \$10M/annum as baseless, I have used that figure to show its effect on my NPV calculation, namely, it would reduce it by \$79M.

Treatment of alternative irrigation schemes

96. As previously stated, Mr Copeland argues that my CBA significantly overstates the benefits of the CPW scheme, as I do not have regard to alternative irrigation schemes that could use the water from the Waimakariri and Rakaia rivers if the CPW scheme does not go ahead. I take his statement to mean that the amount of benefit that could be generated by other schemes should be discounted from my NPV estimates with the residual element being the only real gain to society.
97. I have some problems with this proposition as it depends on the perspective from which the scheme is evaluated. This point advanced by Mr Copeland is best explained by a hypothetical example. A community needs a supermarket which can be located at site A or B. However, if the supermarket is located at A there is no benefit to the community as it could have been located at B. Alternatively, if the supermarket is located at B there is also no benefit to the community as it could have been located at A. Thus, the conclusion is that the community will derive no benefit from a new supermarket, even though its residents will all go hungry without it, which is nonsense. There is a benefit to society, but it is just not site specific.

98. The same confusion is implicit in Mr Copeland's proposition as he implies there is no benefit to society from any water that could be allocated elsewhere. I do not agree with that. What Mr Copeland should be asserting is that my estimate of the net impact/gain to society is not showing the net gain to society from allocating water to the CPW scheme that is over and above what may be generated by alternative allocations. I agree with that proposition, as I do not have sufficient information to make that estimate, and as noted by Mr Copeland and in my evidence in chief.³⁷ However, this is not a relevant issue in the RMA process.

Coase Theorem

99. In response to a question from Commissioner Milne in respect to alternative uses of water in other schemes, I referred to the Coase Theorem. Professor Hazeldine asserts that I stated that this theorem makes comparisons unnecessary. His response was that the Coase Theorem is not relevant as it only applies to situations when decisions are freely reversible. Mr Butcher supports this position.

100. The requirement for the Coase Theorem to be applicable is that bargaining be costless (or in a practical situation to be very low) not freely reversible. However, I agree with Mr Butcher that once a large irrigation scheme investment is made it makes it more difficult for new uses to compete because much of the investment is sunk cost and, therefore, the ongoing marginal cost of continuing to supply an existing scheme is low. But that situation applies in varying degrees to most economic activity (e.g. the Waitaki hydro schemes) and it is not unique. Nevertheless, the presence of large sunk costs does not in any way interfere ex post with the ability of parties to bargain at low cost.

101. The important point that I was making, and which was overlooked by Professor Hazeldine and Mr Butcher, was that the RMA has effectively taken on the Coase thesis in respect to water allocation. This is by adopting a first-in first-served approach to processing resource consent applications, not requiring regulators to establish the most efficient use of water and providing for transferability of water consents within the same catchment. In my opinion, it is pointless for them to argue whether the Coase Theorem is relevant or not, as effectively the underlying economic principles have been incorporated into the RMA.

³⁷ Para 9.33.

102. Regardless, the RMA's provision for transferability of water consents is a vastly superior approach to promoting water efficiency than requiring regulators to make such judgments as part of the resource consent application. This is because there is generally insufficient information available to make those assessments while the situation will change significantly over time as market conditions for competing uses change.³⁸

Mr Copeland's reproduction of my CBA

103. Mr Copeland is critical of the lack of information attached to my evidence in chief and recreates my analysis from the information contained in my evidence, with limited success as he resorts to plugging in the information gaps. Unfortunately, he was unaware that I had supplied Dr Brown, Mr Butcher and Professor Hazeldine with "active" spreadsheets providing the detailed assumptions and workings. Those spreadsheets enabled the recipients to easily check my assumptions and calculations and undertake their own sensitivity analysis.

104. The differences between my CBA and Mr Copeland's are generally explained by his incorrect assumptions and his rejection of the dairy productivity assumptions post scheme. In particular, he assumes that the three components of capital cost – off-farm capital costs, on-farm capital costs and associated capital costs – are spread linearly which is not the case for the latter two. He also assumes that growth in benefits occur linearly from year 3 to 8 which was not the case. I assumed non-linear increases from years 3 to 6, although I did extend my analysis to years 3 to 8 to determine the impact of delaying the time taken to reach maximum benefits. All those assumptions were made at the advice of Macfarlane Rural Business as being realistic in practice. By implication that implies Mr Copeland's linear assumptions in respect to on-farm capital costs and associated capital costs and growth in benefits are not realistic in practice.

105. Other differences include Mr Copeland's discounting from the start of the year whereas I discount at the end of the year.

10 percent discount rate

106. As I stated in my evidence the choice of the discount rate is problematic. For this reason I adopted the rate used by the New Zealand Treasury for the last

³⁸ The lack of information available to regulators is highlighted by this hearing with other economists insisting that I include an opportunity cost of capital or to compare to potentially competing uses when no-one can actually provide that information to the Commissioners.

several decades, namely 10 percent. I indicated that this rate is high while the debate in economic and CBA literature is for a much lower rate.

107. Mr Copeland adopts 10 percent discount rate in his CBA, but does not test the implications of adopting different rates. Surprisingly the other economists do not discuss the appropriate discount rate. Effectively, they accept³⁹ the high rate used by the New Zealand Treasury without question.
108. The New Zealand Treasury has recently reviewed its real discount rate to be used in CBA. The new rate applicable to water and energy infrastructure projects is now eight percent.⁴⁰ The impact of applying this discount rate to the CPW scheme is to increase the base NPV from \$375M to \$681M or by \$306M.

Cost increases

109. Mr Butcher discusses changes to costs. He states there have been queries as to whether the capital costs include land costs and costs of mitigation. For off-farm costs I used an estimate of \$409M supplied by URS for the 240 MCM base case “gravity supply only to reservoir” scenario. that included an allowance for land purchase costs of \$20M.
110. I should have excluded some of the land cost from the capital cost of the scheme as this amount represented a transfer payment rather than a true cost to society. The opportunity cost of land used by the CPW scheme is accounted for by deducting the pre-scheme net production (i.e. farm gate output less expenses) from the post-scheme net production. To include a land cost on top of this is to double count.
111. However, some of the land cost represents purchase of land to accommodate canals and the storage dam and, therefore, the land cost should be included in the construction cost of the scheme. There is also a case for including the compensation element of the land purchase price in the construction costs as this represents the cost of social disruption.
112. The latest August 2008 cost assumptions in respect to land purchase are as follows.⁴¹

³⁹ Para 6.2, evidence in chief.

⁴⁰ New Zealand Treasury Website.

⁴¹ Mr Lewthwaite recently revised his estimates for the 240 MCM base case “gravity supply only to reservoir” scenario to about \$464M inclusive of land cost. This includes an additional allowance of \$39M for land purchase cost (i.e. \$59M in total

- Reservoir - 1200ha under water, plus a further 1000ha purchased and re-sold at a loss of \$3.75M. the loss figure is a transfer payment
- Headrace - 440ha purchased for \$11.66M of which about 50% is in the inner canal, and 50% in the outer embankments which can be grazed for dryland farming, Thus the transfer payment could be up to half (i.e. about \$6M) depending on uses to which the land might be put
- Distribution races - 700ha purchased at \$20.95M, split 50/50 within the canal and in outer embankments with the latter being used for dryland grazing. Hence the transfer payment is up to half the total purchase price (i.e. about \$5.5M).

113. Based on the latest land purchase cost estimates the transfer payment component is about \$20M, and the true economic cost about \$39M. However, at the time I undertook my CBA, the budget for land purchase was only \$20M. Thus, on a pro rata basis about \$6.8M was transfer payment and, therefore, I should have used an off-farm capital cost of about \$402M instead of \$409M. That cost has now increased to about \$444M net of transfer payments or \$35M more than I included in my CBA
114. However, CBA should be undertaken in real prices and, therefore, usually the analysis should only be updated to reflect errors in estimates and/or abnormal unforeseen price changes that is likely to change real price estimates.
115. In this respect, I draw the Hearing Committee's attention to the sensitivity analysis included in my evidence in chief.⁴² This showed that my analysis is not dependent on the selected discount rate, that the scheme's capital and operating cost could be much higher than estimated while still producing a strongly positive welfare gain to society, while the analysis is far more sensitive to variations in revenue than cost assumptions.
116. It is noteworthy that at a 10 percent discount rate, off-farm capital cost can almost double before NPV becomes negative, i.e. after correcting for costing errors in farm operating and off-farm capital costs of \$38M NPV. Alternatively, all on-farm capital and operating costs, excluding Fonterra shares, can increase by 47 percent. Revenue can fall by 13 percent before

the NPV becomes negative. If the new 8 percent Treasury discount rate is used instead of the old 10 percent rate, the CBA becomes even less sensitive to cost variations.

117. Thus, there can be a huge variation in the cost assumptions before the CBA's NPV becomes negative. The analysis can also withstand changes to the dairy productivity assumptions, include (unsubstantiated) environmental damage costs and water charges. Therefore, the CBA is robust and shows that the scheme is almost certainly efficient, i.e. providing net non-market costs are not greater than the positive NPV.
118. I am advised by Mr Mcfarlane that a \$5.75M per annum error has been identified in the farm budgets that I based my CBA calculations on. For the Hearing Committees' information I have reworked my estimates to determine the impact on my net national gain estimate of \$375M NPV. Adjusting my estimates for that error at 10 percent discount rate reduces my estimate by \$45M. However, I incorrectly included a transfer payment in respect to land purchase of about \$7M. Thus the effect is to reduce the CBA NPV from \$375M to \$337M.

Take-up of scheme by farmers with existing groundwater irrigation

119. The other economists challenge the assumptions relating to the switch from groundwater to scheme water and release of existing water rights. Mr Macfarlane addresses this issue.
120. However, Mr Butcher states that although I tested a slower rate of uptake in my sensitivity analysis, I only assumed a delay of two years. While that statement is correct, my analysis assumed that while revenue was deferred, the costs were incurred at the same rate as for the base case, which is unrealistic. This assumption had the effect of reducing the base case NPV by \$144M to \$231M. This showed that a substantial deferral is possible, especially if some of the on-farm costs are lagged as well, which will be the case in practice if the scheme up-take is slower than predicted.

Mr Jansen's evidence

121. Much of Mr Jansen's evidence is non-economic evidence and, therefore, outside my area of expertise to comment on. However, he does discuss

⁴² Refer paragraphs 9.23 to 9.32.

economic efficiency in several paragraphs of his evidence and I wish to comment on that.

122. In this respect he states that if Canterbury attempted to maximise economic efficiency then Canterbury needs a plan that addresses all interests in scarce water and soil resources and all possible uses. Maximising efficiency would then involve selecting the combination of projects within Canterbury that could be undertaken with the available water and soil resources to maximise the net present value of the outcome having regard for risk. He states that the end result would likely be water allocated sparingly across all irrigable soils to maximise marginal and overall returns and to minimise environmental cost. He asserts market efficiency would result in the uptake of available resources, as opposed to re-allocation of resources.⁴³ I presume this means, for example, not transferring from groundwater to surface water.
123. He proceeds to argue that maximising economic efficiency from a public resource is only valid if the wealth gained and opportunity costs incurred are then redistributed across the community reliant on those resources.⁴⁴ To this end he redefines the three components of economic efficiency to include his view of equity.⁴⁵
124. I have three points that I wish to make. First, Mr Jansen's revised definitions of efficiency have no economic validity. Efficiency and equity are different concepts and it is not always possible to reconcile the two as he has tried to do. Second, regulators will never have all the information required to maximise economic efficiency and, therefore, the proposition that a plan should be developed to this achieve this end is fanciful. Third, his view that water should be allocated sparingly across all irrigable soils to maximise marginal and overall returns is contrary to the rebuttal evidence of Mr Macfarlane on this matter. Therefore, this approach to water allocation will sub-optimize rather than maximise the net benefit that can be derived from allocating water for productive purposes.

Mr Ford's evidence

125. Mr Ford asserts that Mr Macfarlane's farm financial analysis is based on a "before and after basis" and that it is more appropriately done on a "with' and "without" basis.⁴⁶ Because of this he claims that the analysis presented does

⁴³ Par 4.9

⁴⁴ Para 4.11

⁴⁵ Para 4.12

⁴⁶ Para 18.

not consider the potential for dryland farming (or existing groundwater irrigation) and irrigated farming systems to improve or reduce profitability over time as a result of dynamic systems adjusting to new technology, innovation, input inflation, market and environmental pressures and so forth. He also claims that the analysis as a consequence does not consider the potential for irrigation in the command area to occur through a range of alternative means including individual provision or community scheme provision in different forms or scales than that proposed.⁴⁷

126. I disagree with Mr Ford's assertion that Mr Macfarlane's approach is based on "with" and "without" not "before and after". I agree with Mr Ford that the farm models did not consider matters such as technological change, innovation and so forth. However, such changes are likely to affect the proposed scheme as much as existing farming operations. That is, both existing farming and the CPW scheme scenarios are likely to be higher than estimated overtime because of technology driven increased output. Thus this type of change is unlikely to cause an overstatement of CBA results as it will apply to both scenarios. In fact the converse is more likely as Mr Mcfarlane's rebuttal evidence highlights the importance of water reliability in driving both production increases, innovation and application of managerial skills.
127. His second assertion, namely, that alternatives in the command area were not considered in the farm modelling is correct, but that is irrelevant to whether Mr Mcfarlane's approach is "with" and "without".

CONCLUSION

128. My analysis shows that the CPW scheme produces a significant net national benefit before inclusion of non-market costs and benefits, at a very high 10 percent discount rate, and thus is almost certainly efficient. That is, the net non-quantified costs and benefits would have to have a negative value of more than \$337M NPV for this proposition to be invalid.
129. My sensitivity analysis shows that the scheme's key assumptions such as dairy productivity, capital and operating costs, and revenue can all be substantially altered without producing a negative NPV at 10 percent discount rate. The results become even more robust below 10 percent.
130. I do not agree that it is appropriate and/or necessary to include an opportunity cost of water for the reasons that I have explained. Nor do I

⁴⁷ Para 19.

consider it appropriate to include a cost for CO2 emissions. However, a substantial value could be inserted for both items without changing the conclusion that the scheme is potentially efficient.

131. I consider that the EIA is relevant to RMA considerations and that with the exception of rival commercial uses of the subject water, the scheme will not deny economic resources to other activities in the region or elsewhere in the economy.
132. The scheme will produce substantial new exports and, thereby, help promote New Zealand's economic well-being and expand GDP compared to the without CPW scenario. It cannot be assumed that some other 'equivalent' level export activity will take its place if the scheme does not proceed. The Hearing Committee should in my opinion give considerable weight to the scheme's very large annual exports.
133. Providing adverse effects can be adequately avoided, remedied or mitigated it is my view that the scheme can be supported from an economic perspective.