Waimea Dam Economic Assessment

Update of economic impact assessment of Waimea Community Dam

NZIER report to Nelson Economic Development Agency

July 2017

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NZIER was established in 1958.

Authorship

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The assistance of all those who gave their time and information to assist this analysis is gratefully acknowledged.

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Key points

We last examined the costs and benefits of the Waimea Dam in 2014

In 2014 NZIER's Waimea Dam Economic Assessment report found the dam would provide substantial net benefits for the Nelson-Tasman region, by

- Avoiding losses to primary production that would arise in the absence of supply augmentation by the dam
- Enabling existing irrigated land uses to raise their productivity through a more secure supply
- Encouraging new irrigated land uses and areas to be brought into production.

The 2014 analysis – and this update – examined a conservative assumption of water restrictions equivalent to 20% cut in allocation, and a stronger assumption of 35% allocation cuts.

We update the 2014 report in light of recent land use and margin changes in the region

This report updates that analysis to reflect recent changes in margins for primary produce, and land use changes in the Waimea district.

Other aspects of the model and assumptions remain the same as in 2014, for ease of comparison.

This updated analysis is a cost benefit analysis that compares total costs with total benefits across the affected region. It is not a financial analysis that considers viability for individual landowners or how to fund the dam.

The combined effect of these changes is to improve the dam's prospective benefits

The updated analysis suggests that under the 20% water allocation cut scenario, the estimated net benefits over 25 years would have a present value of $295 million and a benefit cost ratio of 6.0.

This is 14% larger than the 2014 result.

Under the higher 35% cuts scenario, the net benefits would be larger at $374 million, with a benefit cost ratio of 7.4.

The results are robust to different assumptions: the dam would remain net beneficial even with much lower benefits or much higher costs

The excess of benefits over costs is so large that with 20% allocation cuts, benefits could be reduced to 30% of their base estimates and the dam would still break even.

Alternatively, if benefits were halved and costs doubled, the dam would break even.

The wider regional economic impacts are also higher in this update

A combination of increased margins on some crops and adjustment to the base irrigated land area leads to substantial increase in the direct and indirect economic

impacts in the region. Compared to the 2014 report the present value of total impacts are about 13% larger under the 20% cut scenario and 24% larger under the 35% cut scenario, with most of the impacts on primary production sectors (growers).

Table 1 Economic impacts of Waimea Dam for Tasman-Nelson region

NZ$ in 2013 terms; and present values over 25 years on 2013 base.

Measure	20% allocation cut	35% allocation cut
Increase in GDP in first 2 years	$55 million	$55 million
Increase in GDP for each subsequent year	$78 million	$107 million
Present value of GDP increases at 8% over 25 years		
Total regional economy	PV$665 million	PV$923 million
Primary production sectors	*PV$465 million*	*PV$572 million*
Food processing	*PV$44 million*	*PV$72 million*
Other sectors	*PV$140 million*	*PV$242million*

Source: NZIER

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1. Introduction

This report provides an update of NZIER's Waimea Dam Economic Assessment (October 2014).

The Waimea Community Dam, proposed for the Lee Valley south of Richmond, would provide storage of about 13 million cubic metres, sufficient to meet unrestricted demand and enhanced environmental minimum flows in drought conditions in the Waimea River.

1.1. Scope of Update

The 2014 report modelled the economic benefits of the Waimea Dam in terms of:

- Avoidance of non-augmentation costs, estimated as the opportunity cost of current production that would be lost without the dam due to new water allocation and rationing restrictions
- Increased production and processing of primary produce, from improved reliability of water which enables
- Productivity improvements on existing irrigated area
- Conversion to more intensive land uses in new irrigated areas.

This framework remains unchanged for this update.

This update has been requested by the Nelson Economic Development Agency to reflect improvements in "margins" for different land uses reported in the Nelson-Waimea district.

For comparability with the 2014 report, we use the same methods and same settings as in that study except for changes reflected in margins, which are decomposed into effects on price, productivity and land use changes.

1.2. Changes in water allocation

In 2013 Tasman District (TDC) Council adopted Plan Changes 45-48 regarding Waimea Water Management and Water Augmentation, in response to a Commissioners' decision. These changes replaced the interim provisions that had been in place since droughts in the early 2000s, and provided for future rural, urban, industrial and environmental purposes, in the event of no dam being built, by:

- Reducing all allocations to irrigation from 2015 as they come up for expiry and renewal in line with each user's previous use, or standard allocations for specific soil types or specific crops
- Implementing new rationing trigger levels and allocation cuts required in the event of drought episodes of different severity
- Placing restrictions on the types of activity that can be allocated new water.

These changes to plan provisions form a key part of the context in which our updated analysis will be conducted. Potential allocation cuts create the non-augmentation

losses, which the dam would alleviate as well as enabling higher productivity for existing irrigators and potential new irrigation.

1.3. Background

The Waimea Community Dam in the Lee Valley has been designed with a capacity to meet foreseeable demands without rationing cuts up to a one in 60 year drought, and could, with management, provide security against even more severe droughts.

It has sufficient storage capacity to eliminate rationing cuts in all but the most severe and infrequent droughts; to provide for demands for water from growth in irrigated agricultural and horticultural activity and in the urban and industrial activity in both Tasman District and Nelson City; and also to enable the minimum environmental flow in the Waimea River system (including the Lee and Waimea rivers) to be raised from 800 l/s to 1100 l/s at Appleby Bridge in the lower Waimea River.

A critical question is how, given their likely frequency and duration, cuts of 20% or 35% magnitudes in the absence of the dam would affect the productivity of existing irrigated areas, prospects for new irrigated area, and the mix of enterprises across the Waimea catchment.

This is primarily an issue for agronomists and farm managers to assess the impact of water shortages on different crops at different times, on a property by property basis. It is beyond the scope of this updated report to explore these issues in detail. But we use comments from growers about their use of water to adjust the assessments in the previous reports that were informed by farm consultants.

The effect of the changes in water availability is that in the absence of the dam, rural water users can expect to face 20% rationing cuts for some days in all years, and 50% rationing cuts for some days in most years.

This means non-augmentation will result in costs, risks and lost production compared to the current situation, and that the status quo will not continue unchanged in the absence of the dam.

1.4. Recent changes in land use

In the relatively short period since 2014 there are unlikely to have been major shifts in margins that would significantly change land use and production. This appears to be the case. National level prospects for the land uses identified for expansion in the Waimea Dam model are summarised below (with the potential new irrigated hectares enabled if the dam is built in parentheses):

- Pastoral (400 new irrigated hectares in Waimea): the switch from dry-stock to dairying has suffered from decline in milk prices, slowing rather than reversing the momentum of dairy conversion
- Apples (960 new hectares in Waimea): nationally these are benefiting from improved prices; MPI's Pipfruit monitoring model for Nelson has earnings before interest and tax per hectare increasing by 28% per annum on average between 2014 and 2016
- Kiwifruit (90 new hectares in Waimea): nationally these are also on a recovery phase after reductions caused by the PSA virus. Recovery is

accompanied by replacement of green kiwifruit with more resistant gold variety, and trays produced per hectare increased by 9% between 2014 and 2015. In Waimea they are a relatively small component, and the area planted has not changed from 2014

- Wine grapes (200 new hectares in Waimea): nationally vineyards are expanding in some areas, including nearby Marlborough; but in Nelson-Tasman there is limited scope for conversion to vineyards.
- Berryfruit (150 new hectares in Waimea): nationally these are relatively static and the area planted in Tasman-Nelson district has not changed between 2014 and 2015
- Vegetables have a sizeable presence with 400 hectares in the existing irrigated area affected by Waimea, but are not expected to expand in area with the presence of the dam.

Table 2 shows that after some adjustment in land uses in the 2007-2011 period, there has been very little change in areas planted of the main volume crops in the combined Nelson-Tasman region. The main changes have been a reduction in kiwifruit area in face of the PSA infection, a decline in berryfruit due to low returns, and substantial increase in area of vegetables. The fastest growth in area occurred for summerfruit, but from a very low base.

Table 2 Areas planted in fruit and vegetable growing

Tasman-Nelson	2007	2011	2012	Annual average percent change 2007-2012
Apples	2,438	2,496	2,496	1%
Wine grapes	805	821	821	0.5%
Kiwifruit	614	497	497	-5%
Berryfruit	925	688	688	-7%
Summerfruit	10	22	22	22%
Avocados	9	7	7	-6%
Citrus	1	1	1	0%
Other subtropical	296	284	284	-1%
Total fruit	5,281	5,051	5,051	-1%
Vegetables	486	804	804	13%

Source: Freshfacts 2016

For the area potentially affected by the Waimea Dam, since the 2014 report changes in land use noted by the Tasman District Council include around 100 hectares taken out of irrigated pasture and a further 20 hectares taken out of berryfruit, with increase in apples of about 20 hectares and in grapes and vegetables of about 50 hectares each.

Our 2014 report based its assessment of the impact of new water restrictions on the same approach as used in the 2011 report by John Cook and Northington and

Partners, with some adjustment to account for 400 hectares of vegetables and floriculture use (mostly outdoor, but including some glasshouses) not modelled in the 2011 report. Assuming the capacity of the dam to service hectare equivalents remained the same, the 400 hectares was accommodated into the 3,800 hectares of current irrigated land by removing a pro rata share from other land uses.

Table 3 shows further adjustment to the base to account for recent changes in irrigated land use since 2014 in response to changes in margins. This would see 100 hectares removed from pasture and 20 hectares removed from berries, but apples would gain 20 hectares and grapes and vegetables each gain 50 hectares. The areas in the base case without the dam are shown in the left hand column for the 2014 report and the right hand column for this report updated to 2016.

Table 3 Revision of water allocation scenarios

Adjustment of irrigated areas (hectares) and crops in light of recent margin changes

	Base area 2014	Base change in 2016	Updated base in 2016	New without dam	New with dam
Pasture	1,300	-100	1,200	241	400
Apples	1,480	20	1,500	275	960
Kiwifruit	70	0	70	13	90
Grapes	490	50	540	91	200
Berries	60	-20	40	11	150
Vegetables and flowers	400	50	450	74	0
Total	**3,800**	**0**	**3,800**	**705**	**1,800**

Source: NZIER

As in the previous reports, we assume at the extreme a 70% cut in water availability results in an 80% reduction in irrigated land area to 705 hectares, which we distribute across the land uses on a pro rata basis.

For new potential irrigation with the dam, we assume none for vegetables (because margins are so low), and reduced area of potential growth in grapes from 400 in the 2011 report to 200, with the difference spread across irrigated pasture and apples to maintain the 1800 hectares of new irrigated production.

2. Cost benefit update

We have compared the different costs and benefits over a 25-year period in which:

- Dam building costs are spread equally over years 1 and 2, allowing for dam filling in year 3 and full operation in year 4
- Hydro generation installation costs are spread over years 3 and 4 and operation in year 4
- Non-augmentation and current user benefits begin in year 4
- New irrigated use benefits occur from year 4 for pasture, year 5 for berries, year 6 for apples and year 8 for kiwifruit and grapes, to allow for structural adjustments and delay in reaching full operational maturity
- Results are estimated for two levels of water restriction – a modest 20% across the board cut and a more severe 35% cut.

2.1. Main results

The results of the basic analysis for 20% cuts with 8% discount rate are presented in Table 4.

With only 20% cuts in water availability, new irrigation at 80% uptake is the largest component of benefit, but avoidance of non-augmentation costs alone would be sufficient to outweigh the costs of the dam.

The benefits from hydro operation are very small by comparison.

Overall the updated gross benefits exceed costs, with benefit cost ratios of 6 before accounting for tax, or 4.3 after deducting tax.

Table 4 Basic results for 20% cuts at 8% discount rate

Assuming 20% reduction in allocations			Pre-tax		Exc tax
Discounted over 25 years at	8.0%		*PV$m*		*PV$m*
Avoided non-augmentation cost			104.8		75.5
Benefits for existing irrigation	80%	82.7		59.5	
Benefits of new irrigation uptake	80%	165.4		119.1	
Combined irrigation benefits			248.0		178.6
Full hydro option at 8c/kWh			1.3		0.9
Combined benefits			354.1		255.0
Cost of water supply dam			-58.8		-58.8
Direct net benefits of dam over period			**295.3**		**196.1**
BCR			**6.0**		**4.3**

Source: NZIER

These net benefits of PV$295 million are about 14% higher than they were in the 2014 report, which had a pre-tax net benefit of PV$258 million and a benefit cost ratio of 5.4.

The updated analysis performed with a 6% discount rate would result in a net benefit of PV$402 million with a benefit cost ratio of 7.1. Lower discount rates produce higher net benefits, but we report 8% below to be conservative and more consistent with the 2014 report.

The results of the basic analysis for 35% cuts in water allocation are presented in Table 5. With deeper cuts in water availability, the non-augmentation costs become more significant although still not larger than the new irrigation at 80% uptake. The benefits from hydro operation are unchanged.

Overall the gross benefit cost ratios are larger than with 20% cuts, at 7.4 before accounting for tax, and 5.3 after deducting tax. They are also larger than in the 2014 report, which had benefit cost ratios of 6.4 and 4.6 respectively.

Table 5 Basic results for 35% cuts at 8% discount rate

Assuming 35% reduction in allocations			Pre-tax		Exc tax
Discounted over 25 years at	8.0%		*PV$m*		*PV$m*
Avoided non-augmentation cost			183.4		132.1
Benefits for existing irrigation	80%	82.7		59.5	
Benefits of new irrigation uptake	80%	165.4		119.1	
Combined irrigation benefits			248.0		178.6
Full hydro option at 8c/kWh			1.3		0.9
Combined benefits			432.7		311.6
Cost of water supply dam			-58.8		-58.8
Direct net benefits of dam over period			**373.9**		**252.7**
BCR			**7.4**		**5.3**

Source: NZIER

2.2. Key findings from update

These results indicate that at face value **the dam ought to provide substantial net benefits and estimates would need to be badly awry to obtain a different result**.

Avoiding non-augmentation costs alone, or achieving benefits of new irrigation uptake alone, would be sufficient to outweigh the costs of providing the dam. But how sensitive are the results to the assumptions used in the analysis?

2.3. Sensitivity analysis

2.3.1. Changing the discount rate

Table 6 shows the results analysis at the lower discount rate of 6% real of both the 20% and the 35% allocation cuts scenarios.

For the 20% cuts, all the present values are larger than those in Table 4 above as the discounting is less severe. The net benefits and benefit cost ratios are also larger, at 7.5 before tax and 5.4 after tax. Similarly those for the 35% cuts are larger than those in Table 5, with pre-tax NPV of nearly $500 million and benefit cost ratio of 9.1.

These results are also higher than those in the 2014 report at 6% discount rate, which for the 20% cuts had a net benefit of PV$257 million before tax and PV$244 million after tax, and benefit cost ratios of 6.4 and 4.6 respectively. For 35% cuts the net benefits were PV$438.9 million before tax and PV$298.8 million after tax, and benefit cost ratios were 8.1 and 5.8 respectively.

Table 6 Basic results for 20% cuts at 6% discount rate

Assuming 20% reduction in allocations			Pre-tax		Exc tax
Discounted over 25 years at	6.0%		*PV$m*		*PV$m*
Avoided non-augmentation cost			130.9		94.2
Benefits for existing irrigation	80%	103.2		74.3	
Benefits of new irrigation uptake	80%	227.2		163.6	
Combined irrigation benefits			330.4		237.9
Full hydro option at 8c/kWh			1.9		1.4
Combined benefits			463.2		333.5
Cost of water supply dam			-61.6		-61.6
Direct net benefits of dam over period			**401.6**		**271.9**
BCR			**7.5**		**5.4**

Assuming 35% reduction in allocations			Pre-tax		Exc tax
Discounted over 25 years at	6.0%		*PV$m*		*PV$m*
Avoided non-augmentation cost			229.0		164.9
Benefits for existing irrigation	80%	103.2		74.3	
Benefits of new irrigation uptake	80%	227.2		163.6	
Combined irrigation benefits			330.4		237.9
Full hydro option at 8c/kWh			1.9		1.4
Combined benefits			561.4		404.2
Cost of water supply dam			-61.6		-61.6
Direct net benefits of dam over period			**499.8**		**342.6**
BCR			**9.1**		**6.6**

Source: NZIER

2.3.2. Break-even analysis

Table 7 shows the break-even point, where benefits just equal costs, under the 20% cuts scenario. This occurs when all benefits are reduced to 30% of their level in the base assumptions reported above.

This indicates that **the dam would still be net beneficial with much more conservative benefit assumptions than those used in our central analysis**.

Table 7 Break-even results for 20% cuts at 8% discount rate

Assuming 20% reduction in allocations			Pre-tax		Exc tax
Discounted over 25 years at	8.0%		*PV$m*		*PV$m*
Avoided non-augmentation cost			33.5		24.1
Benefits for existing irrigation	80%	26.5		19.0	
Benefits of new irrigation uptake	80%	52.9		38.1	
Combined irrigation benefits			25.4		18.3
Full hydro option at 8c/kWh			1.3		0.9
Combined benefits			60.2		43.4
Cost of water supply dam			-58.8		-58.8
Direct net benefits of dam over period			**1.4**		**-15.5**
BCR			**1.0**		**0.7**

Source: NZIER

2.3.3. Changing uptake assumptions

The new irrigation estimates are affected by uncertainty about the opportunity cost of land converted to new irrigation.

Table 8 shows the results at an 8% discount rate of only 50% uptake of the new area available for irrigation. The new irrigation benefits would be much reduced, but still above the present value of costs of the dam project.

Combined with benefits from non-augmentation and existing irrigation, they still far outweigh the project costs.

Table 8 50% reduction in uptake of new irrigation

Summary Present Value analysis			Pre-tax		Exc tax
Discounted over 25 years at	6.0%		*PV$m*		*PV$m*
Avoided non-augmentation cost			130.9		94.2
Benefits for existing irrigation	80%	103.2		74.3	
Benefits of new irrigation uptake	50%	113.2		81.5	
Combined irrigation benefits			216.4		155.8
Full hydro option at 8c/kWh			1.9		1.4
Combined benefits			349.2		251.4
Cost of water supply dam			-58.8		-58.8
Direct net benefits of dam over period			**290.4**		**192.6**
BCR			**5.9**		**4.3**

Source: NZIER

3. Economic impact update

NZIER's 2014 Waimea Dam Economic Assessment Report, and this update, are based on NZIER's TERM-NZ model, which is a bottom-up regional computable general equilibrium (CGE) model of the Nelson-Tasman and New Zealand economies.

CGE modelling is widely regarded as providing a more robust analysis than multiplier methodologies.[1] This is because CGE models are not only driven by prices but also account for resource constraints and flow-on effects.

This means that CGE models produce more conservative, but more credible, economic impacts compared to multiplier methodologies. TERM-NZ treats the Nelson-Tasman region as a separate economy but linked to the rest of New Zealand through inter-regional trade in goods and factors. The model outputs include contribution to regional gross domestic product (RGDP) and its components which are: expenditures on consumption, investment, government services, exports and imports; and income measures of employee compensation (wages and salaries), operating surplus (earnings before deducting depreciation) and indirect taxes.

We use TERM-NZ to estimate the potential economic costs of non-augmentation and the likely long term economic benefits of dam installation and expansion of irrigated areas in the Waimea plains. In particular, we analyse the impacts of:

- 20% water cuts
- 35% water cuts
- augmentation (dam installation and expansion in irrigated areas)

The model and many of its settings remain the same for this update, to ease comparison with the 2014 report. The cost of the dam remains the same, and all values are expressed in 2013 dollar terms.[2]

We estimate the annual economic impacts of non-augmentation and of augmentation, then consider the present value of these impacts over 25 years for three scenarios:

- immediate dam build with benefits flowing two years after start of construction, with immediate relief of non-augmentation costs and increased production from augmentation phased in over 8 years, following an S-shaped diffusion curve[3]
- delayed dam build with benefits lagged four years from the present
- further delayed dam build with benefits beginning eight years from the present.

These estimates are not forecasts or predictions, as prices and volumes produced may change for reasons as yet unknown. But they do illustrate the scale of benefits and the economic consequences of deferring the dam's costs and benefits into the future.

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1 On Input-Output tables: Uses and abuses of http://www.pc.gov.au/__data/assets/pdf_file/0008/128294/input-output-tables.pdf

2 From last quarter 2013 to first quarter 2017 general prices have increased by 3.2% according to RBNZ's inflation calculator.

3 Diffusion of new ideas and market uptake is commonly observed to follow an S-shaped curve, with few early adopters, rapid growth as ideas take hold and spread, then growth tailing off as saturation is approached.

3.1. Economic impacts of non-augmentation

3.1.1. Macroeconomic impacts

Table 9 presents the economic impacts (in million $NZ per year) on the region.

The Nelson-Tasman economy would be smaller each year on average by $20.3 million and $49.3 million with water allocations cuts of 20% and 35% respectively.

All components of Nelson-Tasman RGDP would also contract. Under a 20% water allocation cut, investment and exports would be smaller by $1.1 million and $18.2 million, respectively. Exports fall as insecurity of water supply and land use changes reduce the productive capacity of key agriculture sectors in the Waimea plains.

In turn, reduced profitability (gross margins), production and exports pull down investments – i.e., lower returns reduce incentives to invest.

With a 35% water allocation cut, investment and exports would be smaller by $4.2 million and $47.7 million respectively.

Table 9 Regional gross domestic product (RGDP) impacts from non-augmentation

Water cuts of 20% and 30%, in constant 2013 $NZ million per year

	20% cut	35% cut
Consumption	-5.5	-18.3
Investment	-1.1	-4.2
Government	-0.3	-1.1
Exports	-18.2	-47.7
Imports	4.8	22.0
RGDP (expenditure-side)	-20.3	-49.3
Employee compensation	-4.0	-13.7
Operating Surplus (returns to land and capital)	-14.8	-30.9
Production taxes[4]	-0.5	-1.5
Commodity taxes	-1.0	-3.3
RGDP (income-side)	-20.3	-49.3
RGDP 25-Year PV (at 8% discount rate), benefits 2 years after build starts **PV$m**	**180.6**	**438.7**
RGDP 25-Year PV (at 8% discount rate) lagged 4 year **PV$m** s	147.6	363.2
RGDP 25 year PV (at 8% discount rate) lagged 8 years **PV$m**	111.1	269.8

Source: NZIER

[4] Calculation of GDP includes indirect taxes that are embedded in market prices and difficult to remove (like excise duties). Production taxes are those paid by business sectors, commodity taxes are those paid on consumption.

Our measure of economic well-being (household consumption – labelled 'Consumption' in the tables that follow), indicates that Nelson-Tasman residents would be 'worse off' by between $5.5 million and 18.3 million annually. This arises as incomes from wages, and operating surplus (returns to land and capital) in the region would fall by $4.0 million and $14.8 million respectively under a 20% water cut; and by $13.7 million and $30.9 million under a 35% water cut.

Table 9 also shows significant long term RGDP impacts. Over 25 years, non-augmentation would cause Nelson-Tasman's GDP (in $PV terms, discounted at 8%) to be smaller by $216.5 million and $526.7 million with water allocation cuts of 20% and 35% respectively.

The Waimea Dam could avoid most, but not all, of these costs. Table 9 shows avoiding non-augmentation losses with 20% or 35% cuts would have present value of $180.6 million or $438.7 million respectively, assuming the benefits of avoiding non-augmentation only occur after the dam is commissioned, 2 years after commencement of construction.

The 2014 report assumed building would occur in the following two years (2015 and 2016), but if the dam is not built until two years later, the benefits of augmentation would not begin until 4 years from the start of analysis. In this case, the present value of non-augmentation costs in RGDP that would be avoided with the dam range from $147.6 million to $363.2 million with allocation cuts of 20% and 35% respectively. If commencement of the dam is delayed by 5 years, so that construction and filling occurs 6 and 7 years hence and benefits start flowing in year 8, the present value of non-augmentation costs in RGDP would be between $111.1 million and $269.8 million with allocation cuts of 20% and 35% respectively.

3.1.2. Industry impacts

We now trace the impacts on **directly-affected industries**. Table 10 shows that direct non-augmentation losses would be in the order of $12.7 and $24.8 million per year.

Under a 20% water allocation cut, the apple industry would incur $12.2 million in value added losses.[5] This effect is driven by the affected industry occupying roughly 43% of total land area in the Waimea plains.

The other directly-affected industries (kiwifruit, grapes, berries, vegetables & floriculture, and dairying) show value added losses ranging between $0.1 and $0.4 million per year. Partly offsetting the negative impacts is the $0.6 million expansion in dryland sheep and beef pasture.

[5] Value-added is the industry equivalent of regional Gross Domestic Product.

Table 10 Industry impacts of non-augmentation

Impacts on value-added; Water cuts of 20% and 35%, in constant 2013 $NZ million per year

	20% cut	35% cut
Apples	-12.2	-23.9
Kiwifruit	-0.4	-0.6
Grapes	-0.2	-0.4
Berries	-0.1	-0.2
Vegetables & Floriculture	-0.1	-0.1
Dairy	-0.3	-0.5
Sheep and beef (shift)	0.6	1.0
Total direct impacts	**-12.7**	**-24.8**
Other primary sectors	0.5	1.0
Food processing	-1.5	-4.7
Other manufacturing	0.1	0.4
Wholesale	-1.6	-4.7
Retail	-2.5	-7.2
Other industries	-1.7	-6.0
Total indirect impacts	**-6.6**	**-21.3**
Total value added (direct + indirect) impacts	-19.3	-46.1
Add: Commodity taxes	-1.0	-3.3
RGDP	**-20.3**	**-49.3**
25-Year PV (8% discount rate) – benefits 2 years after build starts	**180.6**	**438.7**
RGDP 25-Year PV (at 8% discount rate) lagged 4 years	147.6	363.2
RGDP 25 year PV (at 8% discount rate) lagged 8 years **PV$m**	111.1	269.8

Source: NZIER

Table 10 also shows the **indirect 'flow-on' impacts to other industries** in the region.

The negative impacts are partially offset by higher value added contributions from other primary industries (fishing and forestry, $0.5 million) and other manufacturing industries ($0.1 million). These industries expand as they benefit from additional and cheaper capital and labour resources no longer in use by directly-affected agriculture industries.

The value added contribution of the food processing industry would fall by $1.5 million due to scale effects — i.e., due to lower volumes of primary produce being available for further processing. The value added contributions of the wholesale and retail industries would also be smaller by $1.6 and $2.5 million, respectively. These are industries that households spend money on and are indirectly affected by lower household incomes.

3.2. Economic impacts of augmentation

Table 11 shows the economic impacts (in million $NZ per year) of dam installation and the consequent benefits from water augmentation in the Waimea plains. These are unchanged from the 2014 report.

On the first year, the construction of the dam would generate an additional $59 million in investment.[6] This will result in Nelson-Tasman's RGDP increasing by $55.1 million and would lift household consumption (our measure of 'well-being') by $27.4 million due to higher incomes. RGDP increases by less than the amount of dam investment because the materials used to construct the dam are mostly imported from outside the region.

Table 11 Key regional economic indicators

Dam installation, in 2013 $NZ million (nominal terms)

	Dam installation
Regional GDP	**55.1**
Investment	59.2
Imports	-57.7[7]
Consumption	27.4

Source: NZIER

The economic impacts of augmentation stem from the dam's improvement in water supply enabling investment in higher productivity land uses. In our modelling, we assume that the full production benefits from expansion in irrigated areas would only occur 8 years after the dam has been constructed, building up to that level in years 3-8 following the S-shaped diffusion profile.Table 12 shows the economic benefits associated with water augmentation and expansion in irrigated areas in the Waimea plains.

On the 8th year after the dam has been built, the Nelson-Tasman RGDP would expand by $60.6 million per year. Much of this increase would be driven by higher export revenue associated with increased agricultural production in the Waimea plains. Higher production and profitability would encourage additional investment.

All Nelson-Tasman residents would be better off. Household consumption would increase by $13.9 million per year due to higher incomes (wages and profits) linked to increased production.

6 The dam would be constructed over two years and this is reflected in the cost benefit analyses in section 3, but in this static model the full capital injection needs to be accounted for in a single year.

7 Note, this does not imply that imports into the region decline, but rather that they detract from calculation of the Regional GDP. They comprise about $18 million imports into New Zealand and 39 million imports from other regions in New Zealand.

Table 12 Regional gross domestic product (RGDP) impacts from augmentation

In constant 2013 $NZ million per year

	Augmentation
Consumption	13.9
Investment	3.5
Government	0.8
Exports	52.4
Imports	-9.9
RGDP (expenditure-side)	**60.6**
Compensation of employees	10.0
Operating Surplus (returns to land and capital)	46.7
Production taxes	1.5
Commodity taxes	2.5
RGDP (income-side)	**60.6**
RGDP 25-Year PV (at 8% discount rate), benefits phased in 2 years after dam build starts, fully realised year 8	**435.5**
RGDP 25-Year PV (at 8% discount rate) lagged 4 years	358.1
RGDP 25-Year PV (8% discount rate), benefits from year 8	323.2

Source: NZIER

Over 25 years, Nelson-Tasman's GDP (in NPV, discounted at 8%) would be higher by $435.5 million, from the viewpoint of the start of the dam construction. On the assumption the dam is built two years later and benefits deferred until after 4 years from now, the present value of impacts on RGDP would be $358.1 million. If the dam were deferred further so that benefits did not start to flow until 8 years from now, the present value of RGDP impacts would be $323.2 million.

Table 13 shows the direct and indirect value added impacts once the full augmentation benefits are realised 8 years after the dam has been constructed. The highest value added gains would accrue to the apple industry. The value added gain of the berry industry ($5.3 million) is $2.7 million smaller than in the 2014 report, as it would lose some land area for conversion to other crops.

The indirect 'flow-on' impacts to other industries in the Nelson-Tasman region from augmentation are generally positive except for value added losses in 'other primary industries' and 'other manufacturing' industries which are affected by resource reallocation effects.

The value added contribution of food processing industry would increase from having more agricultural inputs available for further processing.

Table 13 Industry impacts of augmentation

Industry value added; constant 2013 $NZ million per year

	Augmentation
Apples	32.8
Kiwifruit	2.1
Grapes	0.1
Berries	5.3
Vegetables & Floriculture	0.0
Dairy	0.5
Sheep and beef (shift)	0.5
Total direct impacts	**41.1**
Other primary sectors	-1.7
Food processing	4.1
Other manufacturing	-0.3
Wholesale	4.4
Retail	6.7
Other industries	3.8
Total indirect impacts	**17.0**
Total value added (direct + indirect) impacts	58.1
Add: Commodity taxes	-1.0
RGDP	**57.1**
RGDP 25-Year PV (at 8% discount rate), benefits phased in 2 years after dam build starts, fully realised year 8	**435.5**
RGDP 25-Year PV (at 8% discount rate) lagged 4 years	358.1
RGDP 25-Year PV (8% discount rate), benefits from year 8	323.2

Source: NZIER

Finally, household-dependent industries such as wholesale and retail industry would realise value added gains owing to increased household incomes and business activity in the Nelson-Tasman region.

Assembling these impact results, Table 14 combines results from Table 10 on non-augmentation costs and Table 12 on augmentation benefits to show the GDP impacts of the dam in alleviating a 20% cut in water availability, distinguishing the direct impacts on primary production and flow on impacts on food processing and other industries. We assume the costs of non-augmentation avoided by the Waimea Dam can be counted as benefits. Benefits start 2 years after dam building commences and

are fully realised by the 8th year. The construction figure[8] is counted in the summation as a production boost and market stimulant, not as a cost.

Table 14 Direct and indirect impacts on GDP from 20% water cut

Present value impacts on regional GDP, calculated over 25 years at 8% discount rate

PV$m	Direct impact	Food Processing	Other industry	Total	Indirect Tax	Total
Construction	49.1			**49.1**		**49.1**
Avoided cost of non-augmentation	112.9	13.7	45.1	**171.7**	8.9	**180.6**
Augmentation production benefit	303.0	30.5	94.8	**428.2**	7.4	**435.5**
Total	**465.0**[9]	**44.2**	**139.8**	**649.0**	**16.3**	**665.3**

Source: NZIER

Table 15 does the same for the effect in alleviating 35% cuts in water allocation. In both cases the production boost for primary industries and food processing is the same, but the avoided cost of non-augmentation is the main driver of differential impact, and its effects spill over into differential impacts on other industries as well.

Table 15 Direct and indirect impacts on GDP from 35% water cut

Present value impacts on regional GDP, calculated over 25 years at 8% discount rate

PV$m	Direct impact	Food Processing	Other industry	Total	Indirect Tax	Total
Construction	49.1			**49.1**		**49.1**
Avoided cost of non-augmentation	220.3	42.1	147.4	**409.7**	29.0	**438.7**
Augmentation production benefit	303.0	30.5	94.8	**428.2**	7.4	**435.5**
Total	**572.3**	**72.6**	**242.1**	**887.0**	**36.3**	**923.3**

Source: NZIER

These results are larger than those in the 2014 report, which had a central estimate with present value over 25 years of $591 million under 20% cuts and $742 million under 35% cuts. The updates are about 13% larger under the 20% cuts and 24% larger under the 35% cuts, a function of the changes in initial land use, higher margins in some production, and the annual benefits recurring over a long period.

[8] Derived as the total capital cost of $59 million divided by two and shared equally between the first two years of construction, then discounted to present value.

[9] Note the total PV of GDP exceeds the CBA results in Table 4 and Table 5, because these analyses use different measurement bases, and GDP includes items not included in CBA, including labour incomes and indirect taxes

4. Conclusions

This report has revised and updated estimates from the 2014 Waimea Dam Economic Assessment report in light of changes in returns in the Nelson-Tasman region since that report was completed.

There have been improved returns for apples and grapes in particular, and also changes in land use in the region which will drive future benefits flowing from the building of the dam.

The basic model, and many of its inputs, remain the same as in the 2014 report to improve the comparison between the two sets of results. In particular, the dam cost remains the same, although this is so small relative to estimated benefits that its costs could substantially increase without overturning the result.

We also predominantly report the results using a discount rate of 8%, although the Treasury's default rate for general purpose public appraisals changed to 6% in 2016. A lower rate would make the long term benefits appear larger, so retaining a higher rate means the net benefits are conservative estimates.

The combined effect of these changes is to improve the dam's prospective benefits

The updated analysis suggests the net benefits would be larger than in the 2014 report.

Under the 20% water allocation cut scenario, the estimated net benefits over 25 years would have a present value of $295 million and a benefit cost ratio of 6.0. This is 14% larger than the 2014 result.

If the higher 35% cuts prevailed the net benefits would be larger at $374 million, with a benefit cost ratio of 7.4.

The excess of benefits over costs is so large that benefits could be reduced to 30% of their base estimates and the dam would still break even. Conversely the cost of the dam could be substantially higher and still provide a net benefit. Under the 20% cuts scenario, if benefits were halved and costs doubled the dam would just break even.

The wider regional economic impacts will also be increased

The first two years of dam construction would increase Nelson-Tasman's regional GDP by $55 million, and raise household incomes and consumption by $27 million.

With a conservative assumption of water restrictions equivalent to 20% allocation cuts, the value of dam construction, avoidance of non-augmentation costs and achievement of production gains from water augmentation would have an impact on regional GDP with a present value (discounted at 8%) over 25 years of $465 million directly for the primary production sectors, and further flow on effects from food processing ($44 million) and other sectors ($140 million) totalling $665 million.

With a stronger assumption of water restrictions equivalent to 35% allocation cuts, the corresponding impacts on regional GDP in present values (discounted at 8% over 25 years) would be $572 million direct impact, $72 million on food processing and $242 million on other sectors, totalling $923 million.

Limitations and caveats

This report has simply updated the 2014 model for changes in margins and land uses and does not represent a full update of the analysis. In particular, Statistics New Zealand updated its input output tables on which NZIER's economic model is based, but this has not been incorporated into the model. Unless there has been a significant structural change in the region, this should not have a material impact on the economy-wide results, and certainly not large enough to overturn the benefit-cost results and the positive economic impacts estimated here.

The monetary calculations are conducted in 2013 dollar terms for comparability with the 2014 report. General inflation has increased values by 3.2% in the intervening period, and updating numbers would not materially change the results of the analysis. Similarly, the present value analyses, although calculated as if from a base year in 2013 without a dam, would not materially change if conducted from a base year of 2016 or 2017.