



Waimakariri land and water solutions programme Options and Solutions Assessment

Economic assessment

Report Prepared for Environment Canterbury

July 2019

Prepared By:

Simon Harris

For any information regarding this report please contact:

Simon Harris

Phone: +64 3 379 6680

Email: simon@landwaterpeople.co.nz

LWP Ltd

PO Box 70

Lyttelton 8841

New Zealand

LWP Client Report Number: 2019-03

Report Date: July 2019

Table of Contents

1	Background	5
2	Assessment of changes to the flow regime	8
2.1	Method.....	8
2.2	Results.....	13
2.2.1	<i>Reliability</i>	<i>13</i>
2.2.2	<i>Financial Outcomes</i>	<i>14</i>
3	Assessment of Nitrate mitigation requirements for the Nitrate Priority Area (NPA).....	20
3.1	Method.....	20
3.1.1	<i>N Loss rates</i>	<i>20</i>
3.1.2	<i>Profitability.....</i>	<i>21</i>
3.1.3	<i>Mitigation</i>	<i>22</i>
3.1.4	<i>Regional impacts</i>	<i>23</i>
3.2	Results and Discussion.....	24
3.3	Alternate Scenario for Interzone area.....	30
4	Stock Exclusion	33
5	In-stream Biodiversity Costings.....	34
6	Proposed changes to Permitted Activity rules	36
6.1	Zone wide	36
6.2	Ashley Estuary (Te Aka Aka) and Coastal Protection Zone.....	37
7	Drinking water treatment costs	38
8	Summary.....	40
8.1	Analysis results	40
8.2	Performance of Solutions Package against Community Outcomes	43
9	Bibliography	44
Appendix A Estimates of reliability and financial outcome by catchment		45
Figure 1: Waimakariri water management zone		5
Figure 2: Nitrate Priority Area and reduction stages required		8
Figure 3: Reduction in profit for reduction in N losses, dairy operation		23
Figure 4: Change in farm and regional indicators with requirements for on farm reduction in N loss, NPA		25
Figure 5: Staged reduction requirements for Waimakariri pLWRP Nitrate Priority Area (Source: ECan)		26
Figure 6: Proportion of sheep and beef, cropping farms with different levels of debt as a proportion of total assets (Source: Beef and Lamb NZ Sheep and Beef Farm Survey).....		29

Figure 7: Operating profit, Regional GDP and Regional Household Income for Current and Dryland scenarios, Interzone area	32
Figure 8: On farm and regional employment for Current and Dryland scenarios, Interzone area	32

Table 1: Description of scenarios used in assessment of changes to flow regimes, Waimakariri zone (Source: Megaughin, pers.comm.)	9
Table 2: Irrigated land use by catchment (ha).....	10
Table 3: Farm models used for revenue, expenses and profit	12
Table 4: Classification of severity of restrictions	13
Table 5: Grading of reliability by catchment and scenario	14
Table 6: On farm and regional outcomes by catchment and scenario.....	15
Table 7: Total outcomes by scenario for surface water irrigators (includes reliability and allocation changes), Waimakariri zone	18
Table 8: Assessment of change in reliability and final reliability for surface water catchments.....	19
Table 9: Per ha N loss rates by land use and soil category NPA (Source ECan, Overseer version 6.2.2)	21
Table 10: Operating profit (\$/ha) by land use and soil type	22
Table 11: Impact of Solutions Package requirements for N mitigation in NPA	27
Table 12: Qualitative assessment of likely impacts to farm viability over 10 years (indicative only)	30
Table 13: Land use assumptions for Interzone area under Current and Interzone Dryland scenarios (ha)	31
Table 14: Outcomes for Interzone area under Current and Interzone Dryland scenarios (\$million/annum).....	33
Table 15: Cost of different fencing and buffer size options, Waimakariri zone (\$million total cost)	34
Table 16: Cost per item for Biodiversity Restoration in Northern Waimakariri Tributaries	35
Table 17: Source of costings for biodiversity	35
Table 18: PA Threshold Options.....	36
Table 19: Cost of additional consents for changes to PA rules, Waimakariri zone all scenarios.....	37
Table 20: Change in number of consents and stream length protected for Ashley Estuary (Te Aka Aka) and Coastal Protection Area	38
Table 21: Costs of additional consenting requirements for Ashley Estuary (Te Aka Aka) and Coastal Protection Area.....	38
Table 22: Number of private drinking water wells affected by nitrate MAV exceedances by scenario.....	39
Table 23: Cost of treatment for private drinking water supplies by scenario (NPV, 6%, 25 years)	39
Table 24: Changes to zone indicators associated with changes to the flow regimes, by scenario	40
Table 25: Summary impacts of Waimakariri Solutions Package relative to Current scenario	42
Table 26: Summary impacts of Waimakariri Solutions Package relative to Current Pathways scenario	42

1 Background

This technical assessment focusses on the Waimakariri Canterbury Water Management Strategy (CWMS) zone and the process managed by Environment Canterbury (ECan) to assist the Waimakariri Water Zone Committee with the Waimakariri land and water solution programme. The output from the Waimakariri land and water solution programme is recommendations for on the ground actions (e.g. riparian planting) and, recommendations for planning provisions for inclusion in the Waimakariri sub-regional chapter of the Canterbury Land and Water Regional Plan.

The CWMS Waimakariri zone is the Waimakariri district, which spans from the north bank of the Waimakariri River to just north of the Ashley River (see Figure 1). It is bounded by the Hurunui District to the north, and by Christchurch City and Selwyn District to the south. In this technical assessment, the whole Waimakariri zone is considered.

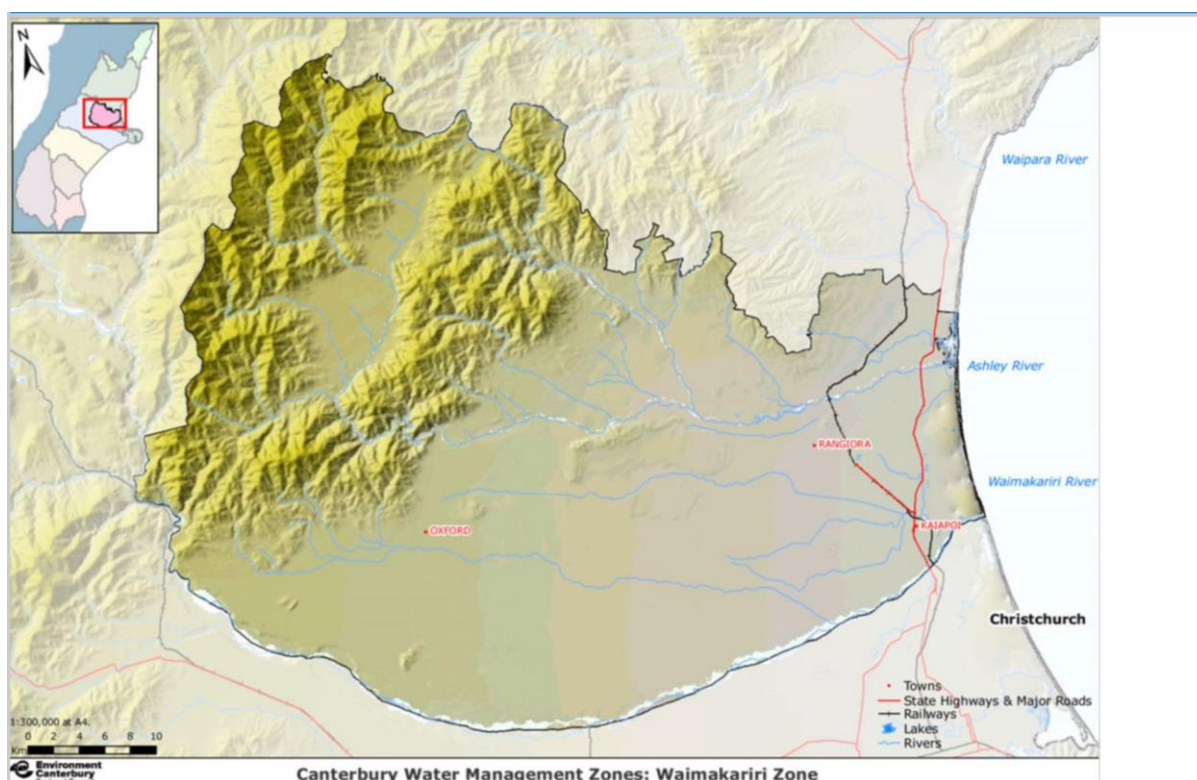


Figure 1: Waimakariri water management zone

The Waimakariri Zone has been further divided into two Freshwater Management Units (FMUs) for managing freshwater quality and quantity (see Figure 1B below). These are the Ashley River / Rakahuri FMU and the Northern Waimakariri Tributaries FMU.

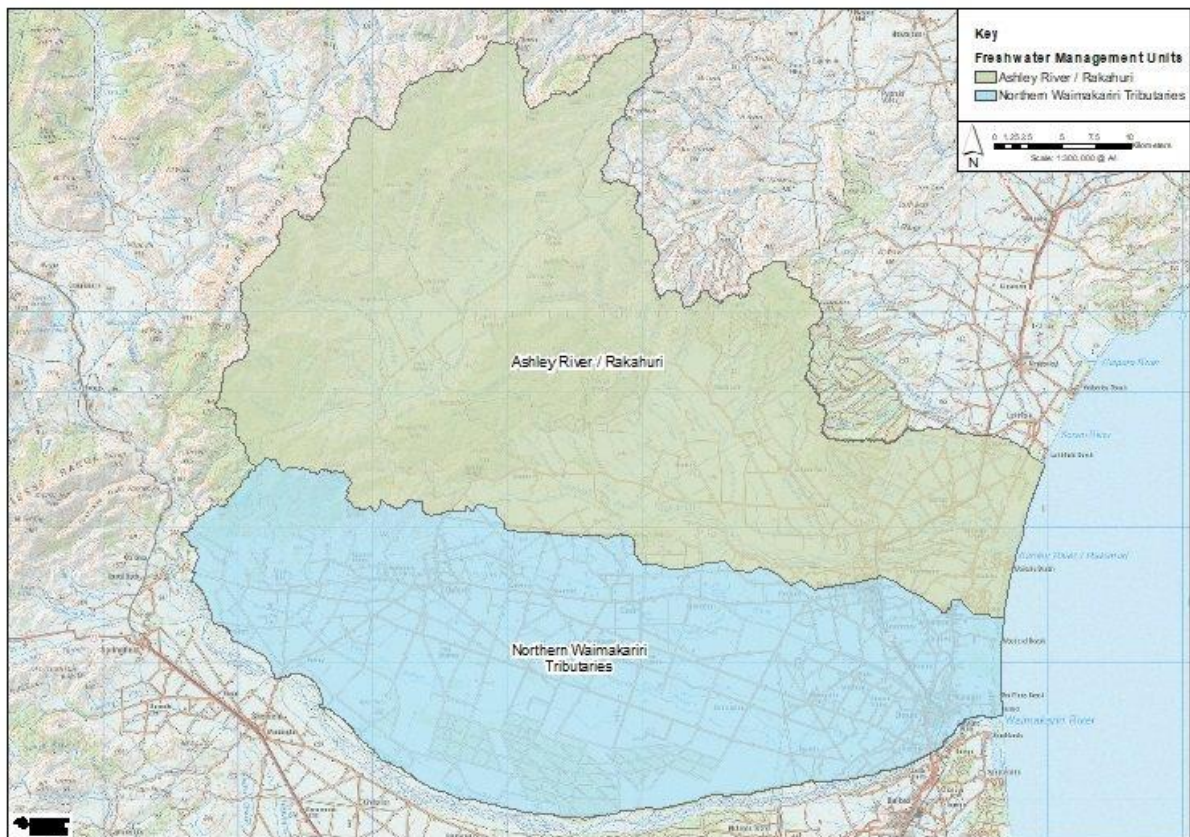


Figure 1B: Waimakariri Freshwater Management Units (FMUs)

The assessments utilise outputs from ECan's other technical assessments of land uses, nutrients, surface and ground water quality, and stream ecology. It should be noted that many bio-physical effects have economic consequences, for instance, ecological effects are important for the consequences they have for industries using water and potentially for tourist activity. Similarly, economic effects are interconnected with social ones. For instance, employment growth affects population levels which in turn affect community vitality. While relevant these chains of effects do not form part of this assessment, which relates solely to the economic effects on the market related economy.

The ZIPA contains a collection of integrated actions and proposals, referred to As Community Outcomes, which aim to give effect to the vision and principals of the CWMS for the zone.

Community Outcome 6 defines a target of 95% reliability for irrigation water in the Waimakariri Zone. The narrative provided by the WWZC for this outcome suggests that it would be achieved if:

1. irrigation water (from both surface and groundwater) reliably supplies water to meet demand when operating within flow and allocation regimes;
2. 100% of the irrigated area can be irrigated 95% of the time;
3. the effects of climate change are considered in the planning and effective long-term management of water and land; and
4. opportunities for water storage are considered.

Community Outcome 8 seeks to achieve an improved contribution to the regional economy from the zone. The WWZC narrative associated with this objective, which provides guidance on what it means to achieve it, describes thriving, and vibrant communities supported by a sustainable local economy based on diverse and productive land and water use. Integrated and sustainable management of the effects of flooding, earthquakes and climate change protects assets and amenities and builds resilience in communities and ecosystems. Community Outcome 8 therefore defines both social and economic goals for the Waimakariri zone

This report analyses includes three main scenarios:

- Current – the best estimate of the current state of the catchment.
- Current Pathways – best estimate of the state of the catchment if the current planning rules continued to be implemented. The current planning rules are generally defined by the LWRP, but in some surface water allocation zones (SWAZ) the Waimakariri River Regional Plan (WRRP) rules apply.
- Solutions Package – best estimate of the impact of the recommendations contained in the ZIPA.

The report focuses on the main areas where changes are likely to occur as a result of the ZIPA, which include

- the economic impacts of changes to the flow management regimes,
- the implications of a requirement to reduce N losses for the Nitrate Priority Area (NPA) (see Figure 2 below);
- requirements for additional stock exclusion;
- instream biodiversity enhancement works;
- the impacts of changes to the permitted activity rules of the Land and Water Regional Plan (LWRP) zone wide and for the Ashley Estuary (Te Aka Aka) and Coastal Protection Zone; and
- mitigation of the impacts of elevated nitrate levels for drinking water supplies.

It does not address the non-market benefits associated with improvements (or reduced degradation) of biodiversity and recreation values, nor of changes to social outcomes. These are discussed in a range of other reports.

We use the Current Pathway as a benchmark against which to compare the Options Assessment, and the Solutions Assessment. We have also provided details of the Current State as this gives important context to certain aspects of the Options Assessment and Solution Assessment. Current State is based on the current (2017/2018) consent conditions for water take consents, regardless of whether they align with the operative plan rules (WRRP/LWRP). These consent conditions are what define the supply reliability experienced by those taking water, they are also the driver for the environmental outcomes that are currently experienced instream.

Our assessment of the options and solution in Section 5 and 6 is only against the Current Pathway because this is the position which was agreed upon in the last plan review and

therefore any impacts of reaching this position have already been incorporated into a previous process. However, in some parts of the zone and for some changes there is a significant disparity between the Current State and Current Pathway, and it is important that the difference between Current State and Current Pathway be documented so that the cumulative impact of the last plan change (which has only been partially implemented in consents) and this proposed plan change can be fully understood. We have therefore also provided an assessment overall and for some areas of change (flow regime, PA rules, and drinking water) of the cumulative impacts of moving from Current State to Solutions Package.

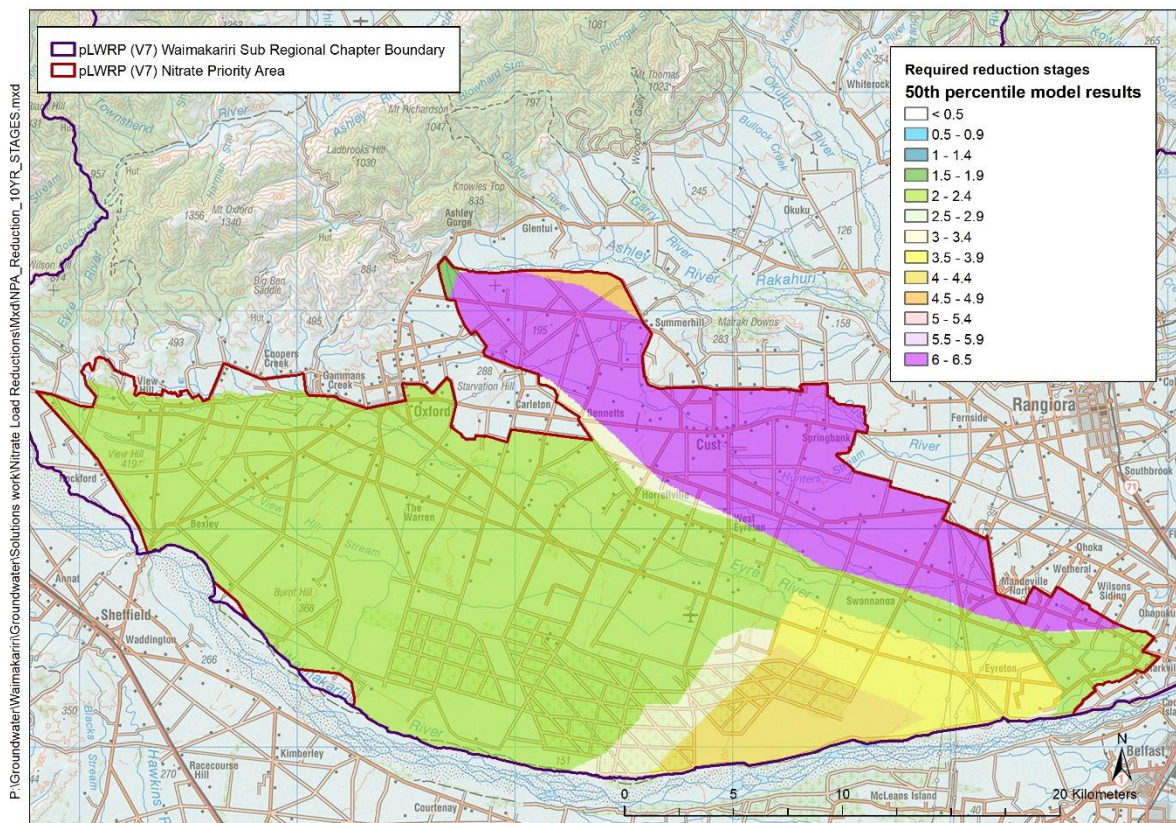


Figure 2: Nitrate Priority Area and reduction stages required

2 Assessment of changes to the flow regime

2.1 Method

Data were supplied (Megaughin, et al., 2019) on the annual and monthly restrictions for the available time periods, for which the earliest record varied between 1967 and 2010. ECan supplied three – 5 scenarios of flow regime for 18 combinations of catchments and allocation blocks. Three scenarios were assessed for all catchments and blocks: The Current State, Current Pathways¹ (Current Pathways and WRRP), and Solutions Package (ZIPA). In the

¹ For Waikuku, Taranaki and Silverstream the allocation limits have been adjusted to more accurately represent the true allocation limit than the figures in the current plan.

Solutions Package scenario for Saltwater Creek the analysis includes both the interim and the 2032 scenarios², but the aggregate results are reported on the 2032 scenario. The scenarios assessed and the associated assumptions made in their construction are shown in Table 1.

Table 1: Description of scenarios used in assessment of changes to flow regimes, Waimakariri zone (Source: Megaughin, pers.comm.)

Scenario	Operative plan	Minimum flow	Allocation limit	Partial restrictions	Allocation consented	Stream depletion methodology
Current State	WRRP	As per consents – good compliance with plan	As per plan, some over-allocation exists	As per consents – good compliance with plan	As per current consents – varies by SWAZ	30-day rule
	Current Pathways	As per consents – poor compliance with plan	As per plan, significant over-allocation exists	As per consents – poor compliance with plan	As per current consents – varies by SWAZ	Current Pathways Schedule 9 (the 150-day rule)
Current Pathway	WRRP	Full compliance with plan	As per plan, no over-allocation	Full compliance with plan	Fully allocated	30-day rule
	Current Pathways	Full compliance with plan	As per plan, no over-allocation. Errors in spring-fed trib limits fixed	Full compliance with plan	Fully allocated	Current Pathways Schedule 9 (the 150-day rule)
Solution Package (ZIPA)	Current Pathways, incorporating PC7	As per ZIPA	As per ZIPA	Pro-rata partial restrictions required	Fully allocated	Current Pathways Schedule 9 (the 150-day rule)

A model was constructed that aggregates the monthly restrictions for each irrigation season and compares this with an indicator of likely demand (whether the PET³ exceeds rainfall over the previous 14 days). Thus, the volume reliability figures reported here include measures of both supply and demand, not simply supply reliability and may differ from figures that report only supply reliability. The number of days on partial and full restriction are for supply reliability only, and therefore will not correspond exactly to the volume reliability estimates⁴.

Where a supply shortage exists, this is assumed to translate directly into lost production (depending on the farm type) for that period, using a growth curve from reported data for Lincoln⁵. The conversion into lost production is conservative and is likely to overestimate the actual losses because losses in production are not linearly related to days of moisture deficit but have a more complex relationship to soil moisture deficit. However extensive consultation with farmers on the impacts of poor reliability suggest that the difficulties associated with negative events in farming such as irrigation restrictions, can exceed the direct pasture production losses, and these may include managing feed curves, sourcing replacement feed,

² The 2032 scenario increases the minimum flow from 100l/s to 148 l/s.

³ PET is a measure of daily Potential Evapotranspiration or plant water use)

⁴ The data was provided on a monthly basis, so it was not possible to identify the days when restrictions were occurring in conjunction with likely soil moisture deficits.

⁵ Source of data: Lincoln dairy farm 2006 - 2010 irrigated farm cited in DairyNZ SI pasture growth data <http://www.dairynz.co.nz/feed/pasture/pasture-growth-data/>. Accessed 2 March 2018

feeding out costs and transitioning difficulties, animal health, stress and cashflow difficulties⁶. It is considered therefore that the overestimate of losses is compensated for by the other difficulties that variability create for farm management that cannot be accounted for in this type of modelling.

The irrigated area for most of the surface water allocation zones (SWAZ) was provided by ECan. However, in several cases the SWAZ irrigated area and the allocation from the catchment were significantly mismatched, suggesting that irrigation water was being transferred across SWAZ boundaries. Therefore, the total area irrigated was estimated assuming a 0.6 l/s/ha application rate and any peak use statistics available for that catchment⁷, and the land use mix from the SWAZ was assumed to apply to the allocation from that water resource. For the Middle Brook, Cust Main drain, No. 7 Drain, and Greig's Drain specific land use data was not available, and the average irrigated land use mix for the Waimakariri Northern Tributaries FMU was used.

The land use mix used by scenario is shown in Table 2 below. The farm models developed for the Current State reporting in consultation with industry and farmers were applied for the five farm types – dairy, dairy support, sheep and beef, horticulture and arable. These were based on 2014/15 data supplied by DairyNZ and Beef and Lamb NZ and have been updated to December 2018 using Statistics NZ Producer Price Index (input and outputs) for the relevant industry and Canterbury region data from the latest Dairy NZ Economic Survey (2016/17). The financial assumptions used for each land use are shown in Table 3.

Table 2: Irrigated land use by catchment (ha)

Catchment	Scenario	Dairy (ha)	Arable (ha)	Sheep and Beef (ha)	Dairy support (ha)	Horticulture (ha)	Total (ha)
Northern Waimakariri Tributaries FMU							
Cam River	Current	261	0	183	0	19	463
Cam River	Current Pathways	658	0	461	0	47	1167
Cam River	Solutions Package	261	0	183	0	19	463
North Brook	Current	205	0	102	0	10	317
North Brook	Current Pathways	216	0	107	0	10	333
North Brook	Solutions Package	205	0	102	0	10	317
Middle Brook	Current	31	2	12	2	0	48
Middle Brook	Current Pathways	32	3	13	2	1	50
Middle Brook	Solutions Package	32	3	13	2	1	50
South Brook	Current	14	0	0	0	26	40
South Brook	Current Pathways	60	0	0	0	107	167
South Brook	Solutions Package	14	0	0	0	26	40
Cust River	Current	303	21	253	33	0	610
Cust River	Current Pathways	240	17	200	26	0	483
Cust River	Solutions Package	240	17	200	26	0	483

⁶ There has also been commentary from farmer stakeholders about the effect of dormancy where pasture takes a while to revive and recommence growing after a dry period.

⁷ So for example the Waikuku allocation is 1033l/s multiplied by peak use of 62% gives 640l/s. This is applied at an assumed 0.6l/s/ha giving 1067ha irrigated.

Catchment	Scenario	Dairy (ha)	Arable (ha)	Sheep and Beef (ha)	Dairy support (ha)	Horticulture (ha)	Total (ha)
Cust Main Drain	Current	864	69	340	54	13	1340
Cust Main Drain	Current Pathways	741	59	292	46	12	1150
Cust Main Drain	Solutions Package	741	59	292	46	12	1150
No. 7 Drain	Current	91	7	36	6	1	142
No. 7 Drain	Current Pathways	140	11	55	9	2	217
No. 7 Drain	Solutions Package	91	7	36	6	1	142
Ohoka Stream	Current	273	112	320	57	16	778
Ohoka Stream	Current Pathways	292	120	343	61	17	833
Ohoka Stream	Solutions Package	292	120	343	61	17	833
Silverstream	Current	686	0	31	0	3	720
Silverstream	Current Pathways	1588	0	71	0	8	1667
Silverstream	Solutions Package	686	0	31	0	3	720
Greig's Drain	Current	49	4	19	3	1	77
Greig's Drain	Current Pathways	75	6	30	5	1	117
Greig's Drain	Solutions Package	49	4	19	3	1	77
Courtenay Stream	Current	175	1	23	14	0	213
Courtenay Stream	Current Pathways	191	1	26	15	0	233
Courtenay Stream	Solutions Package	175	1	23	14	0	213
Ashley River/Rakahuri FMU							
Ashley A block	Current	550	0	1157	105	13	1825
Ashley A block	Current Pathways	352	0	740	67	8	1167
Ashley A block	Solutions Package	352	0	740	67	8	1167
Ashley B block	Current	842	0	0	0	0	842
Ashley B block	Current Pathways	833	0	0	0	0	833
Ashley B block	Solutions Package	225	0	0	0	0	225
Ashley C block	Current	138	0	291	26	3	458
Ashley C block	Current Pathways	1508	0	3170	287	36	5000
Ashley C block	Solutions Package	148	0	311	28	3	490
Little Ashley Creek	Current	52	0	18	0	0	70
Little Ashley Creek	Current Pathways	211	0	75	0	0	287
Little Ashley Creek	Solutions Package	52	0	18	0	0	70
Waikuku Stream	Current	1332	0	168	138	0	1637
Waikuku Stream	Current Pathways	624	0	78	64	0	767
Waikuku Stream	Solutions Package	1127	0	142	116	0	1385
Waikuku Stream	Current Pathways adjusted	1127	0	142	116	0	1385
Taranaki Creek	Current	345	0	67	46	0	458
Taranaki Creek	Current Pathways	77	0	15	10	0	102
Taranaki Creek	Solutions Package	187	0	36	25	0	248
Taranaki Creek	Current Pathways adjusted	187	0	36	25	0	248

Catchment	Scenario	Dairy (ha)	Arable (ha)	Sheep and Beef (ha)	Dairy support (ha)	Horticulture (ha)	Total (ha)
Saltwater Creek	Current	173	31	638	0	0	842
Saltwater Creek	Current Pathways	173	25	482	0	0	680
Saltwater Creek	Solutions Package	173	25	496	0	0	695
Saltwater Creek	Current Pathways adjusted	173	25	496	0	0	695
Saltwater Creek	Solutions Package 2032	173	25	496	0	0	695

Table 3: Farm models used for revenue, expenses and profit

Item	Dairy	Sheep and beef	Arable	Dairy support	Vineyard	Dryland sheep and beef
Revenue/unit	\$6.392/kgMS	\$0.166/kgDM consumed		0.168/kgDM grown		
Revenue/annum (ex farmers reference group)	\$8,557	\$2,364	\$3,027	\$2,652	\$16,219	\$958.7
Fixed expenses/annum	\$982	\$895	\$2,440	\$2,032	\$9,642	\$684.7
Variable expenses/unit	\$3.46/kgMS	\$59/stock unit				
Total variable expenses/annum (ex farmer reference group)	\$4598	\$951				
Operating profit/annum (ex farmer reference group)	\$2,976	\$518	\$587	\$620	\$6,577	\$274

The modelling of the water resource uses estimated flows and reliability, and allocation rates rather than actual use rates, so the results may not be entirely reflective of the situation that currently exists or will occur. This may occur for a number of reasons:

- In some catchments the minimum flow restrictions on consented water takes have not yet been imposed in accordance with current Regional Plan, so irrigators have been experiencing higher reliability than they will do when their consent conditions are brought into alignment with current rules.
- Infrequent gauging at some sites can cause higher and lower numbers of restriction events, depending on the state and timing of the gauging. It is likely to benefit consent holders as flows decline throughout the season and therefore a gauging early in the season will fix restrictions at a lower level.
- Some errors in the low flow database mean that irrigation restrictions do not reflect consent conditions.
- A single allocation band was chosen to represent all takes where there were multiple bands in a SWAZ. This was done in order to minimise the number of scenarios to consider. The chosen band will not be representative of all takes in all bands.

- Irrigators may have more water allocated than they actually use, and the additional water would provide for higher reliability during partial restriction events than is assessed here. These instances should reduce as consents are brought into line with actual use during consent review and replacement.

However the data presented here it is the best available information and in that sense is suitable for providing an assessment of the potential impact of changes. They are best used in a relative way to provide comparative information for decision making on the regimes

2.2 Results

The results are reported as levels of restriction on average over all irrigation seasons, and for the 1 in 4 and the worst year event. In addition, the reliability for a 1 in 10 year restriction event is also reported here to give an indication of a moderate but not uncommon restriction year and a bad year respectively. The financial impacts at a farm level are provided for the average, 1 in 4 and worst year, and the impacts aggregated for the catchment and region are provided for the average.

2.2.1 Reliability

The reliability of the irrigation takes are described in a number of ways including severity of restrictions, frequency of restrictions and timing of restrictions.

Severity is described by the number of days on restriction and the restriction in total volume available. The reliability based on severity is given an overall class based on its volume restriction. These classes are indicative only and the terminology has no meaning outside the definitions provided here. The classes are shown in Table 4 below.

Table 4: Classification of severity of restrictions

Reliability Class based on severity of restriction	Volume restriction	Days of restriction
S-A	0 – 5% restriction	Very few days restriction and limited number of full restriction days.
S-B	5 – 10% restriction	Very few full days restrictions and only a moderate number of partial days restrictions.
S-C	10% - 20% volume restriction	Some full day restrictions and many partial restrictions.
S-D	20% - 30% volume restriction	Numerous full and partial restrictions.
S-E	30% - 50% volume restriction.	Numerous full and partial restrictions.
Non-viable (for run of river irrigation)	>50% volume restrictions.	Numerous full and partial restrictions.

Table 5: Grading of reliability by catchment and scenario

Catchment	Reliability (based on severity of restriction)		
	Current	Current Pathways	Solutions Package
Cam	S-C	S-E	S-C
North Brook	S-C	S-C	S-D
Middle Brook	S-E	Non-viable	Non-viable
South Brook	S-B – S-C	S-C	S-A
Cust	S-A	S-E	S-E
Cust B block	S-A	S-E	S-E
Cust Main Drain	S-A	S-A	S-A
No 7 Drain	S-A	S-A	S-A
Ohoka	S-A	S-A	S-A - S-B
Silverstream	S-A	S-B	S-B
Greig's	S-A	S-A	S-A
Courtenay	S-B	S-B	S-D
Ashley A block	S-D	S-E	S-E
Ashley B block	S-E	Non-viable	S-E
Ashley C Block	S-E	Non-viable	Non-viable
Little Ashley	S-E	Non-viable	S-B
Waikuku	S-E	Non-viable	Non-viable
Taranaki	S-A	S-C	S-C
Saltwater Creek	S-A	Non-viable	Non-viable ⁸

2.2.2 Financial Outcomes

The financial outcomes are shown on a per ha basis and for the region. Because of the large number of results in the per ha category these are not discussed in detail but are shown in the appendices. It should be noted that the operating profit (revenue minus expenses including depreciation but excluding interest, rent, taxes, and returns to owners) outcomes shown in those tables exclude capital and drawings for the landowner, so the potential for a net negative outcome with significant reductions in reliability is greater than has been shown here, and even small changes can have an important impact for highly indebted landholders. There are also a number of situations where groundwater irrigators are deemed to be stream depleting under the rules adopted in the LWRP, and these irrigators will move from a very high reliability in Current scenario to, in some cases, substantially lower reliability in Current Pathways and Solutions Package scenarios. The impacts of these changes are therefore likely to be greater than is indicated here for the individuals affected in this way.

There are also some potential mitigations that may reduce the impacts calculated here. Additional on farm storage is possible, although potentially difficult in parts of the catchment, and for SWAZs with moderate reliability this may significantly reduce the impact. The plan allows for irrigators in over-allocated surface water catchments to access water from deep groundwater (>80m) in some circumstances, although this is likely to be expensive and water may not be available. In some cases alternative feed sources may be available, at a price that

⁸ Both initially and for 2032

is sufficiently low to be worth using to maintain production. In this case the impacts would be marginally lower but not removed.

The timing of the impacts for individual irrigators will depend on when their consent comes up for replacement, or when/if the consents are reviewed by ECan to bring them into line with the plan change. The ZIPA recommends consents may be reviewed for the Ashley/Rakahuri FMU in 2026 - 27, and Northern Waimakariri Tributaries FMU in 2028 – 2029.

The on farm and regional outcomes are shown in Table 6 and aggregated across all catchments in Table 7. The situations where the change in regional outcomes from Current to Solutions Pack is more than 10% have been highlighted, with the darker the colour the greater the change.

Table 6: On farm and regional outcomes by catchment and scenario

Scenario	On farm Operating profit (\$m/annum)	Contribution to Regional GDP from irrigators ⁹ (\$m/annum)	Contribution to Regional Household Income from irrigators (\$m/annum)	Contribution to Regional Employment from irrigators (FTE)	Irrigated Area (ha)
Cam Current	\$1.10	\$6.10	\$3.00	\$49.00	463
Cam Current Pathways	\$1.09	\$4.27	\$2.21	\$36.93	1167
Cam Solutions Package	\$0.60	\$2.32	\$1.21	\$18.23	463
North Brook Current	\$0.60	\$2.40	\$1.20	\$19.00	317
North Brook Current Pathways	\$0.60	\$2.22	\$1.11	\$17.23	333
North Brook Solutions Package	\$0.10	\$0.30	\$0.10	\$2.03	317
Middle Brook Current	\$0.00	\$0.30	\$0.10	\$2.00	48
Middle Brook Current Pathways	\$0.10	\$0.30	\$0.10	\$2.00	50
Middle Brook Solutions Package	\$0.23	\$0.67	\$0.39	\$7.79	50
South Brook Current	\$0.60	\$1.90	\$1.10	\$23.00	40
South Brook Current Pathways	\$0.23	\$0.67	\$0.39	\$7.79	167
South Brook Solutions Package	\$1.10	\$4.20	\$2.10	\$33.00	40
Cust Current	\$0.53	\$2.57	\$1.29	\$20.79	610
Cust Current Pathways	\$0.53	\$2.57	\$1.29	\$20.79	483
Cust Solutions Package	\$3.10	\$10.80	\$5.30	\$82.00	483
Cust Main Drain Current	\$2.45	\$9.16	\$4.54	\$70.68	1340
Cust Main Drain Current Pathways	\$2.75	\$9.56	\$4.64	\$72.68	1150
Cust Main Drain Solutions Package	\$0.32	\$1.30	\$0.65	\$10.06	1150
No 7 Drain Current	\$0.50	\$1.70	\$0.80	\$13.00	142
No 7 Drain Current Pathways	\$0.32	\$1.30	\$0.65	\$10.06	217
No 7 Drain Solutions Package	\$1.32	\$4.78	\$2.34	\$39.78	142
Ohoka Current	\$1.20	\$4.80	\$2.40	\$40.00	778
Ohoka Current Pathways	\$1.30	\$4.80	\$2.40	\$40.00	833
Ohoka Solutions Package	\$2.46	\$8.70	\$4.29	\$66.36	833
Silverstream Current	\$4.30	\$15.80	\$7.70	\$114.00	720
Silverstream Current Pathways	\$2.36	\$8.40	\$4.19	\$64.36	1667
Silverstream Solutions Package	\$0.21	\$0.65	\$0.33	\$5.56	720
Greig's Current	\$0.20	\$0.90	\$0.40	\$7.00	77
Greig's Current Pathways	\$0.21	\$0.65	\$0.33	\$5.56	117
Greig's Solutions Package	\$0.61	\$1.93	\$0.91	\$14.28	77
Courtenay Current	\$0.50	\$2.00	\$1.00	\$15.00	213
Courtenay Current Pathways	\$0.41	\$1.63	\$0.81	\$12.28	233
Courtenay Solutions Package	\$1.10	\$4.20	\$2.10	\$33.00	213

⁹ Includes dryland substituted for irrigated land where allocation changes between scenarios.

Scenario	On farm Operating profit (\$m/annum)	Contribution to Regional GDP from irrigators ⁹ (\$m/annum)	Contribution to Regional Household Income from irrigators (\$m/annum)	Contribution to Regional Employment from irrigators (FTE)	Irrigated Area (ha)
Cust B Current	\$0.53	\$2.57	\$1.29	\$20.79	610
Cust B Current Pathways	\$0.53	\$2.57	\$1.29	\$20.79	483
Cust B Solutions Package	\$1.80	\$8.40	\$4.20	\$71.00	483
Ashley A block Current	\$1.08	\$5.90	\$2.98	\$51.28	1825
Ashley A block Current Pathways	\$1.18	\$6.00	\$3.08	\$52.28	1167
Ashley A block Solutions Package	\$1.80	\$6.70	\$3.20	\$48.00	1167
Ashley B block Current	\$1.50	\$6.11	\$2.91	\$43.13	842
Ashley B block Current Pathways	\$0.67	\$2.65	\$1.35	\$21.70	833
Ashley B block Solutions Package	\$1.64	\$8.13	\$4.31	\$80.05	225
Ashley C block Current	\$0.90	\$14.10	\$7.10	\$119.00	458
Ashley C block Current Pathways	\$1.34	\$7.48	\$3.99	\$74.60	5000
Ashley C block Solutions Package	\$1.10	\$6.10	\$3.00	\$49.00	490

Scenario	On farm Operating profit (\$m/annum)	Contribution to Regional GDP from irrigators (\$m/annum)	Contribution to Regional Household Income from irrigators (\$m/annum)	Contribution to Regional Employment from irrigators (FTE)	Irrigated Area (ha)
Little Ashley Creek Current	\$0.16	\$0.80	\$0.36	\$7.06	70
Little Ashley Creek Current Pathways	\$0.30	\$1.40	\$0.70	\$11.00	287
Little Ashley Creek Solutions Package	\$0.26	\$0.90	\$0.46	\$7.06	70
Waikuku Stream Current	\$3.20	\$11.90	\$5.80	\$86.00	1637
Waikuku Stream Current Pathways adjusted	\$1.57	\$7.75	\$3.78	\$57.55	1385
Waikuku Stream Solutions Package	\$1.77	\$7.75	\$3.78	\$57.55	1385
Taranaki Creek Current	\$1.20	\$4.00	\$1.90	\$29.00	458
Taranaki Creek Current Pathways adjusted	\$0.56	\$2.19	\$1.05	\$16.96	248
Taranaki Creek Solutions Package	\$0.30	\$1.29	\$0.66	\$11.02	102
Saltwater Creek Current	\$0.90	\$4.10	\$2.10	\$36.00	842
Saltwater Creek Current Pathways adjusted	\$0.24	\$2.30	\$1.21	\$20.07	695
Saltwater Creek Solutions Package	\$0.34	\$2.40	\$1.21	\$21.07	695
Saltwater Creek Solutions Package 2032	\$0.24	\$2.10	\$1.11	\$19.07	695

The results here can be seen in two ways. The change from Current to Solutions Package shows the impact that irrigators will experience relative to that which they currently experience. However, the change from Current Pathways to Solutions Package shows how different the irrigators experience of reliability would be post replacement of their consent under the conditions of the LWRP. In some cases, their reliability under the Solutions Package will be worse than currently experienced, but better than it would have been under the Current Pathways (see Table 8).

Approximately half the catchments are in situations where the changes that have already been regulated in the LWRP (Current Pathways) will cause very significant problems for existing

surface water irrigators. These are Cam, Cust, Cust B block, Ashley A block, Ashley B block, Ashley C block, Little Ashley, Waikuku, Taranaki and Saltwater creek. Of these the Cam, Ashley B block and Little Ashley are improved by the Solutions Package, and the others remain significantly worse off. Only the North Brook and Courtenay are much worse off in the Solutions Package scenario than they would be under the Current Pathways, which suggests that the main impacts for affected catchments are not caused by the ZIPA but are the status quo in terms of the existing rules for those catchments. In most cases these are associated with the requirement in the Current Pathways for partial restrictions so that the minimum flow is not breached by irrigation draw down, which is a sensible and generally accepted policy for managing water resources. Because the severity of partial restrictions is affected primarily by the size of the allocation block relative to the river flows, it would seem that for a number of the catchments significantly affected by moving to partial restrictions that the allocations are too high relative to the available flows.

Of the catchments that change significantly from the Current to Solutions Package the Cust, Cust B block, Waikuku and Saltwater Creek have a Solutions Package state that is either Very Poor (30% - 50% average restriction) or non-viable (>50% average restriction). It is likely that irrigation in these catchments will become a marginal proposition, and the ability to service the capital requirements of irrigation infrastructure and intensive farming will mean that there will be a significant decline in the regional outcomes from these catchments. Irrigators in these catchments are likely to experience significant difficulties in transitioning their businesses.

The irrigators in the North Brook change from Moderate to Poor reliability, which will have a significant impact, but the impact for those on the Courtenay which changes from Good to Poor reliability will be even greater.

In some cases, the Current allocation is less than that allowed under the Current Pathways, and typically in these cases (Cam, North Brook, South Brook, No. 7 Drain, Silverstream, Greig's, Ashley C Block, Little Ashley) reduced allocations can be achieved without clawback. If the changes in allocation are achieved through voluntary surrenders and claw back of unused water, the impacts on current irrigators will be limited, and the Solutions Package will only affect the future potential economic output achievable from the use of water. However, if there is some other mechanism adopted to reduce allocation (i.e. clawback), the impact on irrigators could be significant.

A real reduction in allocation relative to Current occurs for a number of catchments (Cust Main Drain, Cust, Cust B, Ashley A, Ashley B, Waikuku, Taranaki). In the case of the Cust the magnitude of the reduction in reliability between Current and Solutions Package (from Good to Very Poor) together with a reduced allocation is likely to cause a significant reduction in the regional contribution from irrigated agriculture in this catchment, although it is noted that at least some of the current allocation may not be utilised for irrigation.

Table 7: Total outcomes by scenario for surface water irrigators (includes reliability and allocation changes), Waimakariri zone

Scenario	Operating profit (\$m/annum)	Regional GDP (\$m/annum)	Regional Household Income (\$m/annum)	Regional Employment (FTE)	Area (ha)
Current	\$22.95	\$88.25	\$43.81	706	11,490
Current Pathways¹⁰	\$18.67	\$89.96	\$44.55	713	16,515
Solutions Package¹¹	\$16.20	\$67.12	\$33.85	554	9,105

In addition to these outcomes there is also some potential costs for water users in the Kairaki / McIntosh SWAZ. Proposed rules for that SWAZ will mean that current holders of DIRECT/HIGH/MODERATE stream-depleting groundwater consents will not be able to access water, unless they prove their connection is LOW, or they drill deeper wells. This impacts 11 consents totalling 55 L/s including a WDC supply well (5 L/s from two wells M35/4502 (33 m deep) and M35/8413 (49 m deep). Depending on the outcomes of the stream depletion tests, this could have significant impacts on those water users.

The impact across all catchments is for a significant reduction in operating profit associated with irrigated land, and a reduction in all indicators of contribution of irrigated land to regional activity under both the Current to Current Pathways scenario and the Current Pathways to Solutions Package scenario. As noted above some of this will not be a real difference, because the decreases in allocation are merely paper transactions. Furthermore, the reliability under the Current Pathways would mean that much of the additional allocation in that scenario would not occur. Nevertheless, there is likely to be a substantial reduction in the operating profit for irrigated landholders, and contribution to the regional economy, as a result of changes from the Current flow management regime.

¹⁰ Uses Current Pathways adjusted for Taranaki Creek and Saltwater Creek.

¹¹ Uses ZIP 2032 for Saltwater Creek

Table 8: Assessment of change in reliability and final reliability for surface water catchments

Catchment	Reliability (based on severity of restriction)		Final reliability	Change in allocation
	Solutions Package Change relative to Current	Solutions Package change relative to Current Pathways		
Cam	Slightly worse	Much better	Moderate	No change
North Brook	Worse	Worse	Poor	No change
Middle Brook	Slightly worse	No change	Non-viable	No change
South Brook	Better	Much better	Very good	No change
Cust	Substantially worse	Slightly worse	Very poor	Decrease
Cust B block	Substantially worse	Substantially worse	Very poor	Decrease
Cust Main Drain	No change	No change	Very good	Decrease
No 7 Drain	No change	No change	Very good	No change
Ohoka	Slightly worse	Slightly worse	Good	Increase
Silverstream	Slightly worse	Slightly worse	Good	No change
Greig's	Slightly worse	Slightly worse	Very good	No change
Courtenay	Substantially worse	Substantially worse	Poor	No change
Ashley A block	Worse	Same	Very poor	Decrease
Ashley B block	Slightly worse	Slightly better	Very poor	Decrease
Ashley C Block	Substantially worse	Same	Non-viable	Increase
Little Ashley	Substantially better	Substantially better	Good	No change
Waikuku	Substantially worse	No change	Non-viable	Decrease
Taranaki	Worse	No change	Moderate	Decrease
Saltwater Creek	Substantially worse	No effective change	Non-viable	Decrease

¹² Includes changes associated with compliance with the LWRP that are included in the Current Pathways scenario.

3 Assessment of Nitrate mitigation requirements for the Nitrate Priority Area (NPA)

The Nitrate Priority Area (NPA) is an area where the reduction in nitrate losses (N) from intensive land uses is required under the ZIPA recommendations. The reductions are 15% beyond GMP for dairy, and 5% from other land uses, and will apply to consented land uses where the required reduction in N leaching rates would be over 3kgN/ha for dairy, and 1kgN/ha for sheep and beef. The NPA applies only in the Solutions Package scenario, and in the Current Pathways scenario there will be a change that involves the implementation of a Good Management Practice (GMP) regime as defined in PC5 of the LWRP. The implications of a change to GMP have not been explored in this scenario, and in most cases there should not be any major profitability implications. There are however some properties that will experience significant cost to upgrade irrigation equipment and other changes in order to meet the required standards, and these should be kept in mind when assessing the impact of the changes.

The impact of this requirement to lower N losses will differ according to the land use, and the impacts have been estimated across all affected land uses in the NPA.

3.1 Method

3.1.1 N Loss rates

Environment Canterbury¹³ provided estimated losses from the root zone for various land uses and soil types across the NPA. Soil types were aggregated into five categories, and an average loss rate for the whole area applied to these categories as shown in Table 9¹⁴.

¹³ Source O. Moysilovic, pers.comm. February 2019

¹⁴ In order to maintain consistency therefore the loads were recalculated using the area average loss rates, which may differ slightly from the catchment specific loads.

Table 9: Per ha N loss rates by land use and soil category NPA (Source ECan, Overseer version 6.2.2)

Land use	Loss rates by Soil category (kg/ha/annum)				
	XL	L	M	H	VH
	IRRIGATED				
Dairy	65	48	52	47	27
Dairy support	35	26	19	17	23
Arable	45	35	23	19	21
Forestry	NA	NA	NA	NA	NA
Sheep and beef intensive	25	22	24	19	20
	DRYLAND				
Dairy	39	30	35	31	30
Dairy support	22	20	38	34	22
Arable	23	22	22	18	20
Forestry	1	1	1	1	1
Sheep and beef intensive	17	19	18	14	15

3.1.2 Profitability

The modelling uses operating profit as an indicator of the economic outcomes. The operating profit figures for each land use are derived as for the reliability from the work with farmer stakeholders and include depreciation. Profitability by land use and soil is shown in Table 10 below.

Table 10: Operating profit (\$/ha) by land use and soil type¹⁵

Land use	Soil category				
	XL	L	M	H	VH
IRRIGATED					
Dairy	\$3,069	\$3,069	\$3,069	\$2,762	\$2,762
Dairy support	\$620	\$620	\$620	\$620	\$620
Arable	\$616	\$616	\$616	\$616	\$616
Forestry	\$0	\$0	\$0	\$0	\$0
Sheep and beef intensive	\$518	\$518	\$518	\$518	\$518
DRYLAND					
Dairy ¹⁶				\$2,762	\$2,762
Dairy support	\$303	\$303	\$303	\$303	\$303
Arable	\$274	\$274	\$274	\$274	\$274
Forestry	\$146	\$146	\$146	\$146	\$146
Sheep and beef intensive	\$274	\$274	\$274	\$274	\$274

3.1.3 Mitigation

A curve for mitigation of N losses was derived for dairy land use based on information generated with the Farmer Reference Group as well as results from mitigation modelling undertaken by Dairy NZ. Generally, the mitigations investigated by the Farmer Reference Group fall into the category of changes that can be made to existing farm systems, without making major adjustments involving significant infrastructure. These mitigations achieved up to ~10% reduction in N losses, with a cost to profitability in the order of 0 – 10%. The DairyNZ mitigations extended on this and investigated a wider range of mitigations including options that involve infrastructure such as feedpads, generally up to ~30% reduction in N losses, although some care should be taken with these figures because the definition of the GMP 'start point' from which the reductions occur do not align exactly between the mitigation modelling approaches. The modelling assumes that beyond this point land use change is required to achieve further reductions, which is potentially a conservative assumption because other mitigations such as housing of dairy cattle may potentially reduce losses further at a lower cost¹⁷. However, the implications of housing dairy cattle on a large scale have not been investigated, and it is considered that the assumptions and data available here are sufficiently robust to provide the indicative estimates of costs required for this stage of decision making.

The data used to estimate the costs of mitigation, and the curve generated and included in the modelling are shown in Figure 3.

¹⁵ These do not exactly match the profitability in the reliability models because they are intended to reflect typical properties covering a range of reliabilities, and the heavy and light soils are separated out. The reliability models use regional averages and production for fixed expenses, and typical production for the revenue and variable expenses, averaged for soil type representation. The different approaches are used in order to match the manner in which the models operate.

¹⁶ Dryland dairy is assumed to occur only on heavier (H and VH soils) with higher soil moisture holding capacity.

¹⁷ Although it should be noted that the point of inflection in the results curve suggests that at the 30% mitigation level, under the assumptions used here, the cost of land use change is less than the cost of further mitigation.

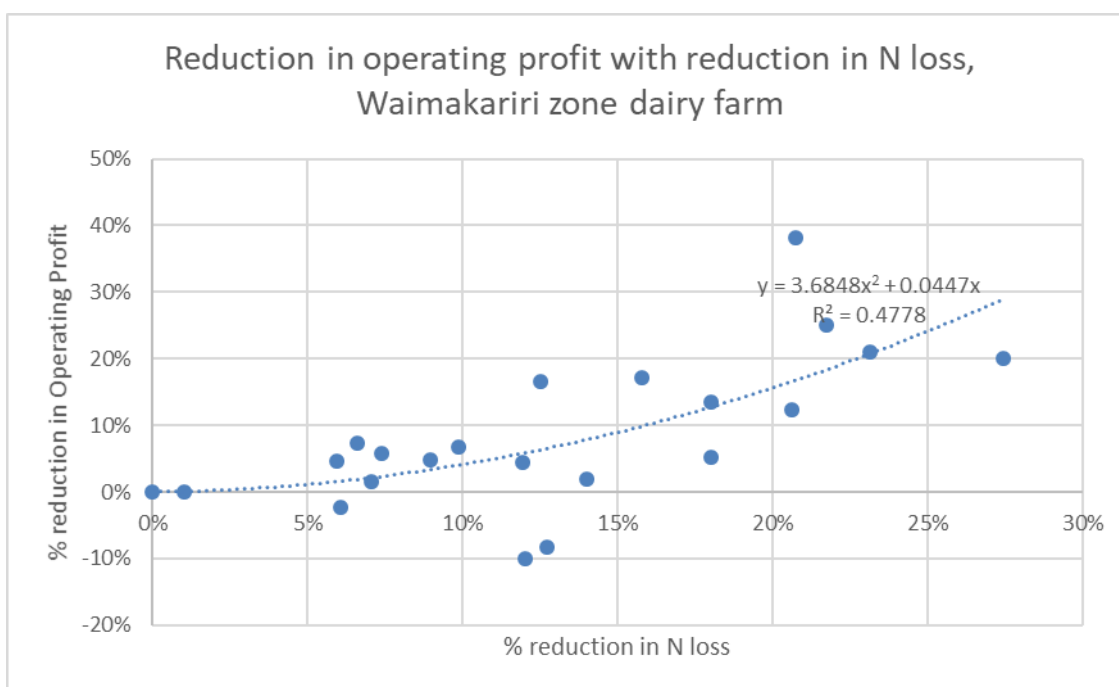


Figure 3: Reduction in profit for reduction in N losses, dairy operation

The Farmer Reference Group also investigated potential mitigations for sheep and beef and arable. No specific mitigations were found for mitigating beyond GMP for these land uses, which is generally typical of exercises of this nature and reflects the fact that:

- Sheep and beef and dairy support land uses tend to be lower intensity and have lower levels of inputs, which provides fewer opportunities for mitigation. GMP as defined in the MGM already includes the major sets of mitigations available.
- Arable run at GMP reflects a very efficient system where nutrients are captured by product, and any reduction in losses will tend to have a direct reduction in yield because they require a reduction in inputs. Because of the high levels of fixed costs, and the small margins in cropping, it is not likely to be worthwhile to take this approach.

Therefore for these land uses a portion of the area is assumed to be removed and replaced with forestry in order to achieve the required mitigation.

3.1.4 Regional impacts

There will be a change in regional flow on impacts as a result of the change in intensity and area of different land uses. The change resulting from the requirement to reduce nutrients will have different impacts for different industries. For non-dairy and non-forestry operations the impact is taken directly from the reduction in revenue, since it is assumed that the landholder is taking some land out and replacing it with forestry. For dairy operations, the mitigations up to 10% are assumed to involve increases in expenditure rather than a reduction in area or intensity, which will not have a significant negative impact on the regional indicators and may have some positive benefits¹⁸. Above 10% the change in profit modelled above is apportioned to revenue allowing for the reductions in expenditure that also occur with decreasing intensity.

¹⁸ Although without modelling a new operation type for each level of mitigation this is difficult to determine

Forestry used to substitute for higher leaching land uses will generate no effective revenue until harvest in ~30 years. In the short term an allowance has been made for the increased expenditure associated with planting and release spraying, spread evenly over the first ten years. These expenditures are treated as outputs from the Services to Agriculture and Forestry for the purposes of calculating their flow on impacts.

3.2 Results and Discussion

The results from this modelling of the costs of reducing nutrient loads should be seen as indicative. The modelling uses available information, the information on mitigation developed through the farmers stakeholder group, and information provided by DairyNZ. The profitability figures for land use can be highly variable, and the differential between land uses can vary similarly. This modelling adopts a limited range of financial returns and N losses, and this means that the modelling is reasonably simplistic in the context of the true likely complexity. However, the analysis is sufficiently robust to identify the likely scale of costs associated with the ZIPA proposals over the plan period.

Figure 4 shows the total change in farm and regional indicators with a uniform reduction in N loss across all land uses, as well as the impacts specifically on the dairy and forestry sectors. These graphs show that there is an increasing reduction in all indicators as the requirement for N mitigation increases. For dairy the operating profit is impacted initially but regional indicators are not, primarily because of the assumption that the first 10% of mitigation comes from increased expenditure rather than decreasing income. Beyond that regional indicators decline steeply.

Forestry indicators increase across all scenarios. This assumes that forestry is not required to mitigate their N losses and is the preferred alternative land use for those non-dairy operations required to reduce losses – i.e. land is transferred into forestry. In practice this will occur to a greater or lesser degree depending on the circumstances of the property, their willingness to commit land to forestry, and the alternatives available to them.

The ZIPA provides for further reductions in N losses beyond the life of the plan (Figure 5), which are subject to review based on information and monitoring. These further reductions are of the same magnitude per plan period, but extend between 2 and 5 plan periods into the future beyond this one. It is almost certain that if fully implemented these further reductions will be accompanied by significant land use change, since for dairy this would result in 45% to 90% reduction in N losses. At the lower end these may be possible particularly with improved technology and innovation, but at the upper end is highly unlikely to be achievable. Given that these will be implemented over long time periods and are subject to change they have not been assessed in this report.

Figure 4: Change in farm and regional indicators with requirements for on farm reduction in N loss, NPA

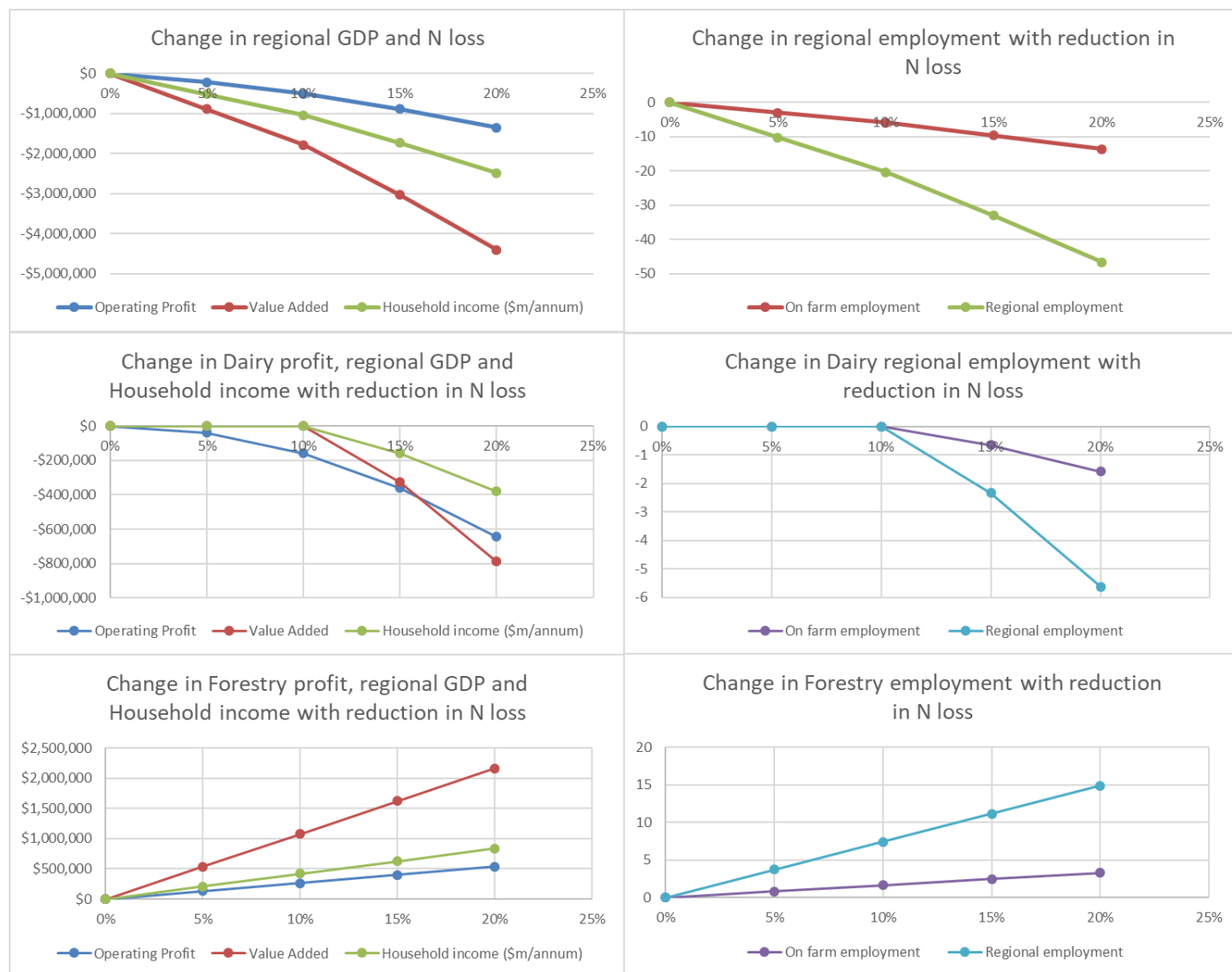
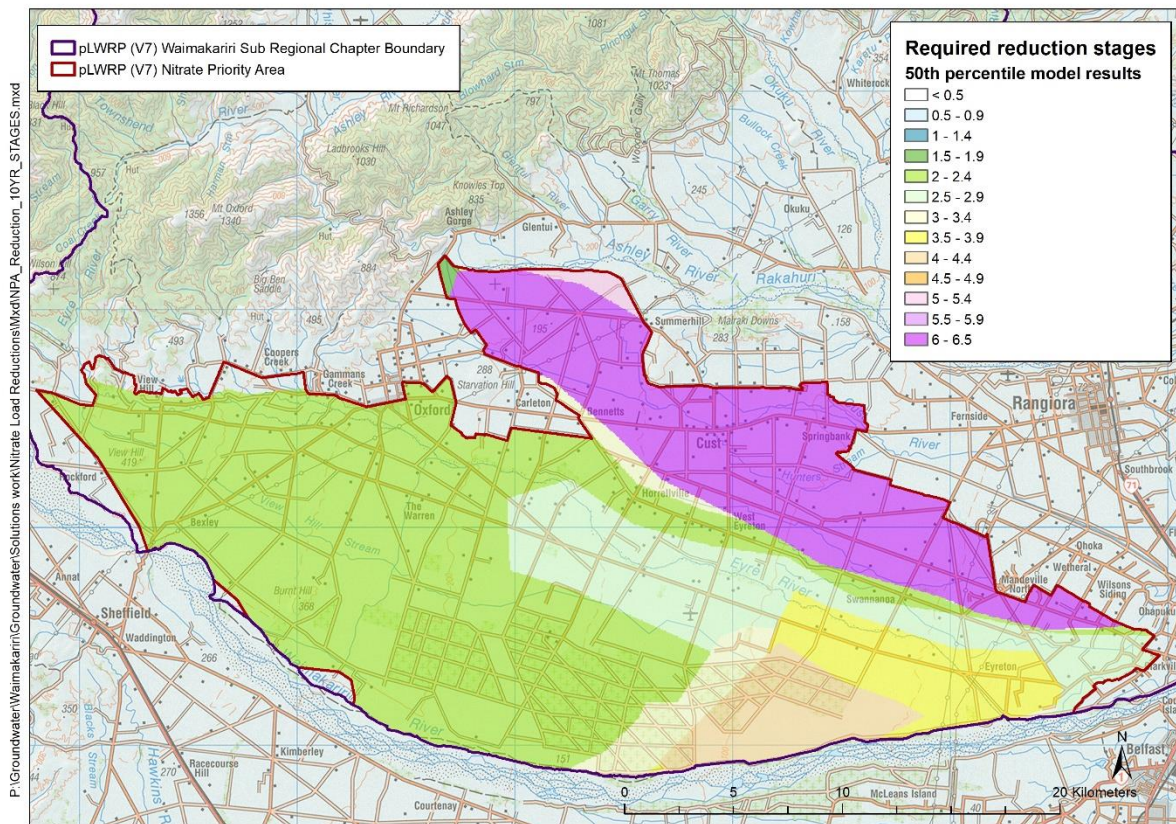


Figure 5: Staged reduction requirements for Waimakariri pLWRP Nitrate Priority Area
(Source: ECan)



Achieving major reductions in N loads beyond GMP is possible but can cause significant costs in terms of reduced profit and land use change. Even where the costs are not large in regional terms because of the size of the catchment and the relatively low returns from sheep and beef, changes such as this are disruptive and potentially problematic for the individual landholders involved. For major reductions in the non-dairy land uses it is possible that some businesses will not remain as viable economic units, and there may need to be amalgamation of farms, sale for lifestyle units, and loss of employment and people from the catchment. Furthermore, if forestry is not a viable replacement in the catchment because of its effect on water quantity concerns or the potential for windthrow, making major reductions in N losses will be more difficult and costly.

The ZIPA has set a requirement for a 15% reduction from dairy operations and 5% from all other operations (subject to the minimum reductions noted above). The impacts from that requirement are shown in Table 11 below. They show a total reduction in operating profit of \$5.80 million per annum, which is made up primarily from reductions for dairy (\$4.93 million) and sheep and beef (\$0.53 million). Contribution from agriculture in the affected area to regional GDP declines by \$5.75 million per annum, which is affected primarily by reductions in contributions from dairy and sheep and beef. Contribution to regional employment declines by 46 FTE, and on farm employment by 13 FTE. The percentage change in impacts are also shown in Table 11 below, which shows that for most land uses there is a 5-10% decline in profitability once fully implemented, and a decline in the order of 0-5% for contribution to most regional indicators.

Table 11: Impact of Solutions Package requirements for N mitigation in NPA

Indicator	Dairy	Sheep and beef	Arable	Dairy Support	Forestry	Total
Operating profit (\$/annum)	-\$4,930,000	-\$530,000	-\$130,000	-\$180,000	\$0	-\$5,770,000
NPV (6%) operating profit ¹⁹	-\$60,950,000	-\$6,540,000	-\$1,660,000	-\$2,260,000	\$0	-\$71,410,000
NPV (6%) operating profit ²⁰ over 10 years	-\$19,960,000	-\$2,140,000	-\$540,000	-\$740,000	\$0	-\$23,390,000
Regional GDP (\$/annum)	-\$3,810,000	-\$1,260,000	-\$380,000	-\$430,000	\$130,000	-\$5,750,000
Regional Household income (\$/annum)	-\$1,840,000	-\$680,000	-\$150,000	-\$200,000	\$70,000	-\$2,800,000
On farm employment (FTE)	-8	-3	-1	-1	0	-13
Regional employment (FTE)	-27	-13	-3	-4	1	-46
Land Value (\$)	-\$90,990,000	-\$31,070,000	-\$6,510,000	-\$1,840,000	\$3,610,000	-\$126,790,000
Change in indicator values						
Indicator	Dairy	Sheep and beef	Arable	Dairy Support	Forestry	Total
Operating profit	-8%	-7%	-8%	-7%	0%	-7%
Regional GDP	-2%	-3%	-4%	-5%	8%	-2%
Regional Household income (\$m/annum)	-2%	-3%	-4%	-5%	10%	0%
On farm employment (FTE)	-2%	-3%	-4%	-5%	18%	0%
Regional employment (FTE)	-2%	-3%	-4%	-5%	10%	-2%
Land Value ²¹	-8%	-8%	-8%	-2%	38%	-7%

It is likely that there will be an interaction between the reliability changes in the catchment and the N mitigation requirements. For those operations which experience major reductions in reliability, there will likely be an associated reduction in production because the opportunities to mitigate the lower reliability are limited in the short term. The lowered production is highly likely to cause a reduction in N losses, particularly if pasture continues to be managed efficiently. The interaction between these two factors has not been taken into account in this analysis.

¹⁹ This NPV is over 50 years, and assumes that no further reduction is required after year 10. If the scheduled reductions for subsequent plan periods are included the impact would be substantially greater than set out here.

²⁰ This NPV is over 50 years, and assumes that no further reduction is required after year 10. If the scheduled reductions for subsequent plan periods are included the impact would be substantially greater than set out here.

²¹ Where the land value reduction is not directly proportional to the reduction in profit, the impact will be limited by the floor, or because an alternative feasible land use value is higher.

A qualitative and therefore subjective assessment of the impacts of these changes on farm viability was provided by this author to the zone committee during their deliberations, which was based on the size of profit margins and debt burdens carried. This is shown below in Table 12 below, and using the same criteria it suggests that the size of the changes proposed are likely to be accommodated by most operations without major impacts on viability, particularly with the changes being introduced over a 10 year time frame. However it should be noted that there is a large range in the debt loadings and profitability of farming businesses, and the distribution of impacts on viability will not be uniform. For dairy operations there are a number of potential sources of information on dairy farm indebtedness and vulnerability.

- Statistics NZ (Statistics New Zealand, 2014) estimated that the total equity-to-asset ratio for the dairy industry was 30% in Canterbury.
- DairyNZ' s estimate of average assets is \$12-\$13 m for a 240-hectare farm (210 effective) with liabilities/debt around 50%²². The DairyNZ data indicates that Canterbury farms carry higher total debt on average, as a result of them being larger than the New Zealand average, but on a per kg milk solids²³ (MS) basis they are similar to national debt levels.
- DairyNZ estimate for the average of 2016/17 and 2017/18 average debt was \$23/kg MS for Marlborough/Canterbury, and a debt/asset ratio of 50%.
- Debt servicing and rent costs nationally were estimated to average \$1.36/kgMS for 2014/15 and 2015/16. For the model irrigated dairy farm on light land this amounts to \$1,864/ha or 75% of operating profit. This correlates closely with data provided by DairyNZ for that period on Marlborough/Canterbury dairy farm debt levels, which showed median and average debt servicing costs of \$1,835/ha and \$1,869/ha respectively.
- The Reserve Bank (Reserve Bank NZ, 2015) undertook stress testing of the potential impact of the low farmgate milk price through to 2018/19. Under a base scenario with the milk price recovering²⁴ to \$5.50/kgMS in 2016/17 and subsequently to \$6.50 in 2018/19, non-performing loans (where cashflow is negative and equity is less than 10%) increase to 7.8% of debt. In a scenario where the milk price is \$4/kgMS in 2015/16 and increases at 50c/kgMS annually through to 2018/19, 25% of farms and 44% of debt is in non-performing loans. This indicates that a small proportion of farms (<10%) are vulnerable to any decrease in operating profit, and a larger proportion (~25%) are vulnerable to a sustained decrease in operating profit.

Beef + Lamb New Zealand statistics on the debt to asset ratios for Marlborough/Canterbury sheep and beef farms are shown in Figure 6. They indicate that sheep and beef, and mixed cropping properties have a lower average level of debt as a proportion of assets than dairy properties.

- On average, mixed cropping and finishing farms (Farm Class 8) had a debt/asset ratio of 23% from 2012/13 - 2016/17, and debt servicing and rent costs of \$444/ha or 59%

²² Source: Matthew Newman, 2018 DairyNZ, pers.comm. Also for later information regarding debt loadings for Canterbury relative to the national figures.

²³ Milk solids is the measure by which dairy farmers are paid. The total milk solids are also adjusted for the ratio of milk solids and milk fats present in each suppliers product.

²⁴ The payout for the 2014/15 year was \$4.40/kg MS (excl dividend), and the Reserve Bank used prices of \$4 to \$4.15 in their scenarios of 2015/16 payout.

(range 48% - 81% over that period, on a quintile basis the range for 2016/17 is 37% to -380%) of operating profit for the farm class.

- Debt/asset ratio for finishing-breeding sheep and beef properties (Farm Class 6) was only 16% on average from 2012/13 to 2016/17, although this covers a mix of irrigated and dryland properties. It is likely that irrigated properties will have a higher debt ratio because of greater capital demands with irrigation. Debt servicing costs and rent averaged \$13.44/SU over the five years from 2012/13 to 2016/17, with a range from \$11.86 to \$15.20/SU (ranges from 23% to -590% for 2016/17 of operating profit on a quintile basis).

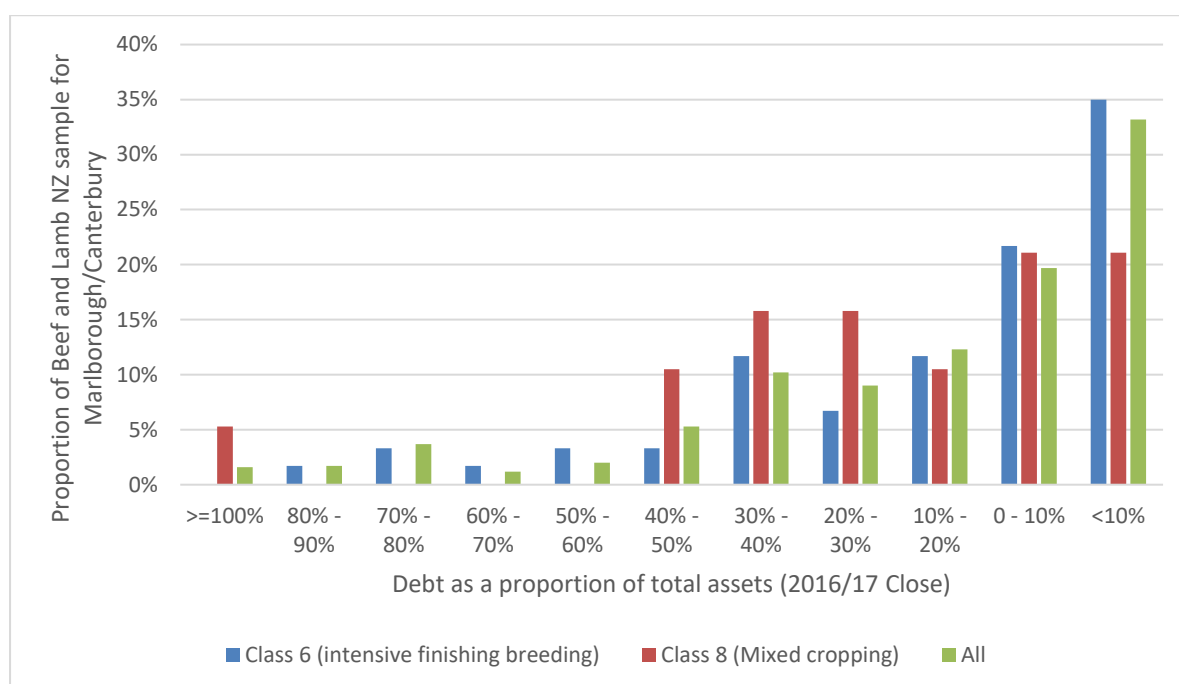


Figure 6: Proportion of sheep and beef, cropping farms with different levels of debt as a proportion of total assets (Source: Beef and Lamb NZ Sheep and Beef Farm Survey)

The ZIPA proposes a series of reductions beyond the 10 year time frame, increasing to 30% for dairy by 2040 and 10% for other land uses, and beyond this up to 90% for dairy in some areas (Figure 5). These further reductions will be subject to consideration and confirmation at future plan reviews. These further staged reductions will have impacts on operating profit and land value.

For operating profit the staging of further reductions if required is likely to significantly reduce the overall impact of the required changes. The greater the time available to reach the higher levels of reduction the better landholders will be able to adapt. The adaptation will come about through improved technology and practice, greater time to reduce debt levels to improve resilience, and running down of existing capital investments so that land use change is more practical. Therefore the impacts shown in Table 12 over a 10 year period will not be the same as the impacts over a longer time period.

After a period of 20 – 30 years the impact of the required reductions becomes very difficult to assess because the economic landscape could potentially be very different. The main impact

that can be understood as almost certain is that greater constraints on N losses will reduce land use flexibility and effectively make some land uses and/or styles of farming uneconomic.

The impact on land values will however be more immediate for a number of reasons. The uncertainty associated with the likely future impacts of mitigation will reduce the desirability of land in the affected areas, and thus sales price. It has also been true over the last 2 – 3 decades that increases in land value have been a major component of the returns experienced by landholders. Thus the mitigation pathway outlined in the ZIPA will cause an increased operating cost, reduced operating profit and reduced potential for capital gain. The combination of these factors is likely to see a more immediate reduction in land value for properties in the affected areas. Because reducing asset values will increase the debt to asset ratios will increase the potential for business insolvency, these reductions in land value have the potential to become problematic well before the decrease in operating profits occur.

Table 12: Qualitative assessment of likely impacts to farm viability over 10 years (indicative only)

Reduction in N loss	Impact of required reduction in N loss for viability of different land uses		
	Dairy	Sheep and Beef	Arable
5%	Low impact	Most farms able to cope but impacts for cashflow.	Most farms able to cope but impacts for cashflow.
10%	Low impact for most farms depending on baseline.	Significant impacts	Significant impacts
20%	Heavily indebted farms non-viable ²⁵	Farms with average performance and debt loadings threatened.	Farms with average performance and debt loadings threatened
30%	Farms with average performance and debt loadings non-viable ²⁶	Farms with average performance and debt loadings non-viable	Farms with average performance and debt loadings non-viable

3.3 Alternate Scenario for Interzone area

There is some concern regarding the impacts of intensive agriculture in the Interzone area and the potential for contamination of the drinking water supply and lowland streams of Christchurch. An alternate scenario was modelled with a loss rate from agriculture in this zone of ~8kgN/ha on average, which involved converting all irrigated agriculture to forestry (Interzone Dryland scenario).

The land use assumptions for the Interzone area under the Current and Interzone Dryland scenarios are shown in Table 13.

²⁵ Based on Reserve Bank stress testing 2014

²⁶ While interest costs could be just be serviced for most farms there would be no profit available for drawings, debt repayment or farm development. This is not sustainable over the long term.

Table 13: Land use assumptions for Interzone area under Current and Interzone Dryland scenarios (ha)

	Current Scenario									
Land Use	Irrigated soil type (ha)					Dryland soil type (ha)				
	XL	L	M	H	VH	XL	L	M	H	VH
Dairy	10280	1860	383	11	206	0	0	0	0	0
Dairy support	287	0	17	0	0	1912	676	279	0	43
Arable	127	199	10	0	0	79	87	10	0	1
Forestry	47	4	1	0	0	1209	73	306	0	27
Sheep and beef intensive	2294	1050	166	0	126	3790	2368	509	0	380
Sheep and beef extensive	256	16	6	0	8	1734	948	443	0	112
	Interzone Dryland scenario									
Land use	Irrigated- soil type (ha)					Dryland - soil type (ha)				
	XL	L	M	H	VH	XL	L	M	H	VH
Dairy										
Dairy support						1912	676	279	0	43
Arable						79	87	10	0	1
Forestry						14500	3202	889	11	367
Sheep and beef intensive						3790	2368	509	0	380
Sheep and beef extensive						1734	948	443	0	112

The implications of this scenario for the various regional indicators are shown in Figure 7 and Figure 8 below and in Table 14. They show a substantial reduction across all indicators for contribution from this area to the regional economy from the removal of irrigated land uses from that part of the zone. Current operators of irrigated properties would become non-viable as businesses unless they carried no debt at all, and there would be a significant number of jobs lost. The nature of these impacts would depend on the time scale over which any such reduction was implemented, as discussed above.

Figure 7: Operating profit, Regional GDP and Regional Household Income for Current and Dryland scenarios, Interzone area

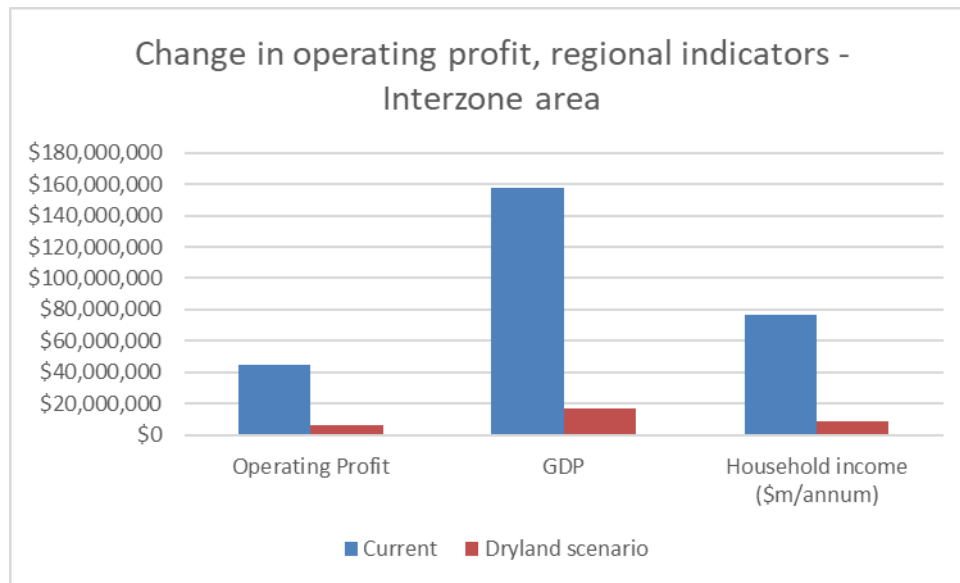


Figure 8: On farm and regional employment for Current and Dryland scenarios, Interzone area

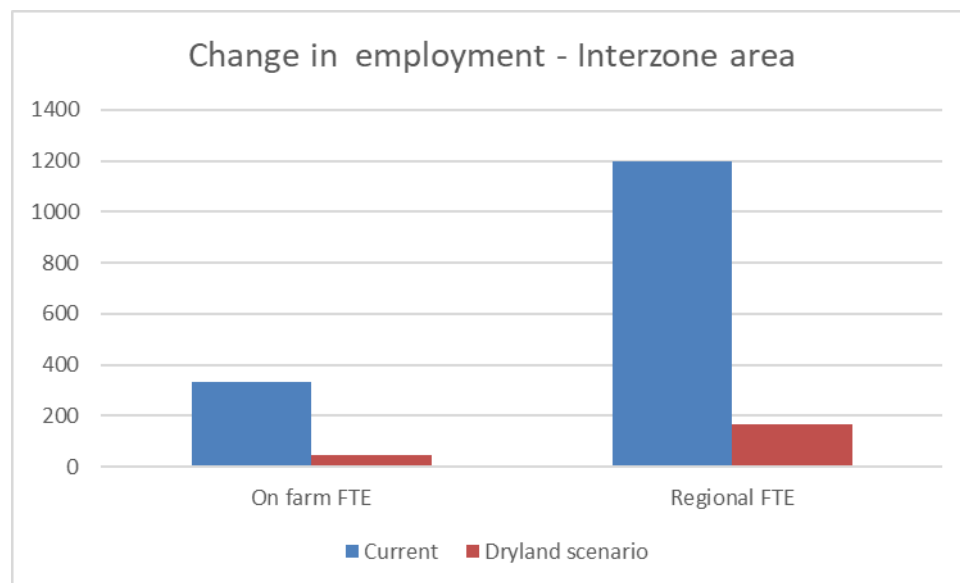


Table 14: Outcomes for Interzone area under Current and Interzone Dryland scenarios (\$million/annum)

Economic indicator	Interzone Current	Interzone Dryland scenario
Operating Profit (\$m/annum)	\$45	\$6
Contribution to GDP (\$m/annum)	\$157	\$17
Contribution to household income (\$m/annum)	\$77	\$9
On farm employment (FTE)	334	48
Contribution to regional employment (FTE)	1200	166

4 Stock Exclusion

The ZIPA proposes additional rules for stock exclusion, although the exact format of these has not been determined at time of writing. The costings use data supplied by ECan (Arthur, et al., 2019) for lengths of drains, springhead circumferences, and area in buffer zones. The costings assume that no drains are fenced currently, which is likely to result in some overestimate of the costs. However, there is no data on drain fencing with which to alter this assumption. The costings also assume that none of the areas are fenced with buffers now.

Fencing costs are based on data from a MPI study on the costs of stock exclusion (The Agribusiness Group, 2016), using the Canterbury specific data and updated to 2018 using the producer price index data from Statistics NZ. Costs of \$3.55/m for a two wire electric fence are used for dairy properties, \$16.2/m for deer fencing and \$11.6 for fencing on sheep and beef properties. Land costs of \$10,000/m are allowed for properties on the plains, and \$5,000/ha for hill country. These are relatively low land values, but not all the land adjacent to streams and drains would be fully utilised.

The results show that swimming site exclusion costs are relatively small, at \$10k as there is only a relatively small length of fencing required. Costs for including all drains and springs are \$1.5 million, while extending this to all cattle would increase the cost to \$4.4 million.

When hillfed streams are included, and when buffer zones around the drains and streams are included, the costs increase significantly to ~\$20 million for hillfed stream fencing, and \$300 million to \$3.8 billion for the inclusion of buffers. Even spread over 10 years these are significant costs for the rural economy.

Table 15: Cost of different fencing and buffer size options, Waimakariri zone (\$million total cost)

Scenario	No buffer (\$m)	1m buffer (\$m)	3m buffer (\$m)
Swimming site exclusion	\$0.01		
Drains and springs	\$1.50	\$300	\$900
Drains and springs extended to all cattle	\$4.40	\$600	\$1,700
Hillfed streams included in fencing requirements	\$19.70	\$1,300	\$3,800
Including Lees Valley	\$21.60	\$1,300	\$3,800

5 In-stream Biodiversity Costings

In addition to stock exclusion, the ZIPA recommends a number of further actions to improve instream biodiversity. While these will be the basis of further study and the development of catchment management plans, some indicative costings of further interventions that could be undertaken to improve instream biodiversity. 6 options for interventions are:

- Fencing
- Planting
- Rebattering of collapsed banks
- Rebattering of steep banks
- Sediment removal
- Sediment traps

Removal of fish passage barriers have not been costed at this stage.

Detailed assumptions are contained in Table 16 below based on extrapolation from case studies where stream walk data has been collected on the biodiversity restoration work required²⁷. Drains have not been included in these costings, as they form the basis of the costings in the Stock Exclusion section.

The costings show that the total cost of undertaking all these items across all streams could be in the order of \$60 million in total, or NPV \$44 million when spread over 10 years. This includes all the spring-fed streams, including the Ashley tributaries as well as the Waimakariri tributaries. The largest part of the costs is for planting, rebattering of steep slopes, fencing of unfenced stream banks, and sediment traps.

It is likely that not all these costs will be required so there is some overestimation built into these costings. However, the costs do not include ongoing operating costs so there is also some underestimation. For some of these the operating costs would be considered within the normal purview of farm operation – for example fencing maintenance. However retired areas and plantings may require weed control in the future depending on how well they have been

²⁷ J. Arthur, ECan, pers.comm. 2018.

done, and wetlands may require removal of material. Sediment traps also require regular clearance of material to be effective in ongoing operation.

It is important to note that the ZIPA does not recommend that these costs should be borne by the farming community alone: ZIPA recommendation 3.25 proposes that a targeted rating district should be explored together with industry and government funding to provide the finance required for the improvements in stream health and biodiversity required.

Table 16: Cost per item for Biodiversity Restoration in Northern Waimakariri Tributaries

Item	Units	Quantity	Per unit cost	Total cost	NPV when spread over 10 years
Fencing cost	m	760,000	\$11.6	\$8,760,000	\$6,440,000
Planting	m ²	2,300,000	\$11.0	\$25,600,000	\$18,840,000
Land cost	ha	230	\$10,000	\$2,330,000	\$1,710,000
Sediment trap	per trap	1,360	\$2,250	\$3,060,000	\$2,260,000
Rebattering cost for collapsed	m	3,110	\$65	\$200,000	\$150,000
Rebattering cost for steep	m	281,840	\$65	\$18,320,000	\$13,480,000
Sediment removal	m of stream	87,430	\$20	\$750,000	\$550,000
Management	per ha	110,000	\$5.9	\$640,000	\$470,000
Total				\$59,700,000	\$43,900,000

Table 17: Source of costings for biodiversity

Item	Source of units	Source of cost
Fencing cost	Case study streamwalk data	From MPI Stock Exclusion Costs report (2016) updated to 2018 using PPI index
Planting	Case study streamwalk data	From MPI Stock Exclusion Costs report (2016) updated to 2018 using PPI index
Land cost	Case study streamwalk data extrapolated, allowing 3m setback distance, 30m ² for wetland.	Indicative
Sediment trap	(Hudson, 2017) - number of traps/km	From WDC costings
Rebattering cost for collapsed	Case study streamwalk data	WDC costing data
Rebattering cost for steep	Case study streamwalk data	WDC costing data
Sediment removal	Length of REC stream order 1, 43% of streamwalk streams have streambed with >20% fine sediment	\$20/linear m from WDC costings
Management	Area of contributing catchment	From ECan SFF application for working on with lifestyle blocks, converted to per ha.

6 Proposed changes to Permitted Activity rules

6.1 Zone wide

The ZIPA approximately halves the Permitted Activity thresholds for the area of winter grazing of cattle at which a consent is required from that in PC5, which will impose costs on those properties which exceed the thresholds and are required to obtain consents (assuming that properties decide to continue with winter grazing in the event that consent is required to do so). Etheridge et al. (2019) analysed four options for different PA thresholds. These area shown in Table 18 below. Their analysis indicates that there are an additional 50 properties which will require consents under the Solutions Package relative to Current Pathways. These properties will be required to complete a Farm Environment Plan (FEP), apply for a consent and undertake regular audits of the FEP. In addition, they will have to reduce their N losses by 5% if they are located within the NPA (which is likely to be a small proportion of the estimated 50 additional properties).

Table 18: PA Threshold Options

Option	Winter grazing allowances based on property size (ha)				
	< 5	<10	10 – 100	100 – 1,000	>1,000
Draft ZIPA	No consent	5%	5%	5%	50 ha
Current Pathways (PC5)	No consent	No consent	10 ha	10%	100 ha
Scenario 4	No consent	No consent	7.5 ha	7.5%	75 ha
Solutions Package	No consent	5 ha	5 ha	5%	50 ha

There is a wide range of costs for obtaining consents depending on the complexity of the operation. Since in this catchment it is likely that primarily sheep and beef operations will be those which move from PA to consent requirements with the lower threshold for dairy grazing, the analysis allows \$2750 per Farm Environment Plan (FEP) and Nutrient Budget, \$1500 per consent for consultant time, \$2350 per consent for council processing costs (\$2350), and \$1000 per consent for auditing²⁸.

Repeat costs for consenting was allowed based on a consent renewal period of 10 years to match with the plan period. It is assumed that consents require replacement every 10 years. The majority of properties are obtaining B grades on audit, with limited A and C grades, so an allowance was made for audits every 2 years at a cost of \$1000 per audit.

²⁸ Based on discussions with the two major consultancies undertaking farm plan and nutrient budgeting work (The Agribusiness Group, David Lucock; Nicole Phillips, Irricon. Pers comm. March 2019). Costs for auditing within irrigation schemes may be lower, but those properties will not be affected by the changes to PA rules.

Table 19: Cost of additional consents for changes to PA rules, Waimakariri zone all scenarios

Scenario	Additional PA threshold consents relative to Current	Additional cost relative to Current	NPV additional to Current cost incurred over 10 years	Additional PA threshold consents relative to Current Pathways	Additional cost relative to Current Pathways	NPV additional to Current Pathways cost incurred over 10 years
Current Pathways	250	\$3,870,000	\$2,850,000			
Scenario 4	280	\$4,340,000	\$3,190,000	30	\$460,000	\$3,420,000
Draft ZIPA	400	\$6,200,000	\$3,190,000	150	\$2,320,000	\$340,000
Solutions Package	300	\$4,650,000	\$4,560,000	50	\$770,000	\$1,710,000

The estimated costs are shown in Table 19, which shows that the Solutions Package relative to Current pathways will incur an additional \$770,000 in total costs, and an NPV over 25 years of \$1.7 million including auditing and replacement consents. In addition, there will be costs for those properties of complying with reduced nitrate losses. It is likely that many of these properties will adjust their farming systems so that winter grazing no longer breaches the revised PA threshold, so neither the consenting nor nutrient mitigation costs are incurred. However if this were to occur there is likely to be a cost associated with reducing the amount of winter grazing available, either directly, in terms of management flexibility and complexity, or for alternate feed supplies and impacts for farmers purchasing winter feed, but these costs have not been calculated.

6.2 Ashley Estuary (Te Aka Aka) and Coastal Protection Zone

A Coastal Protection Area is proposed for the Waimakariri Zone in recognition of the important natural resources and values found here. The area encapsulates the main spring-fed streams and coastal lagoons and wetlands near the Waimakariri coast. ECan (Etheridge, et al., 2019) have assessed the stream lengths that would benefit from the improved protection and management associated with a requirement to obtain a Resource Consent and produce audited Farm Environment Plan (FEP) for several different consenting threshold options. These three options for thresholds of requiring a FEP and consent are:

- CPA 1: Properties with areas >5 ha with > 0.5 ha of winter grazing or >0.5 ha of irrigation to produce an audited FEP.
- CPA 2: Properties with area >5ha
- CPA 3: Properties with area > 20ha.

The additional number of consents and stream length protected are shown in Table 20 below. This table shows that the Solutions Package PA rules would cause an additional 7 properties in the affected area to require consents, which would rise to 65 additional properties under CPA 1, 282 under CPA 2, and 98 under CPA 3.

Table 20: Change in number of consents and stream length protected for Ashley Estuary (Te Aka Aka) and Coastal Protection Area

Option	Description	Approximate No. of consents	Stream length (km)
Current Pathways (PC5)	LWRP WG & IRR rules	15	56
Solutions Package	ZIPA WF PA rules	22	-
CPA 1	>5 ha property, > 0.5 ha WG or >0.5 ha IRR	65	152
CPA 2	>5 ha property	282	204
CPA 3	>20 ha property	98	184

Because the additional consenting requirements for the Solutions Package have already been calculated in Section 6, the costings here account for the additional consenting requirements for each option relative to the Solutions Package. The costs of the additional consents is calculated using the same assumed per consent costs as the cost of changes to the PA rules described in Section 6 above, but excluding the costs of nutrient budgets. The results show that CPA 1 would require an additional 610,000 in additional costs, or \$450,000 over 10 years, \$3.7 million for CPA 2, and \$1.1 million for CPA 3.

Table 21: Costs of additional consenting requirements for Ashley Estuary (Te Aka Aka) and Coastal Protection Area

Scenario	Number of consents required	Additional consents relative to Solutions Package	Additional cost relative to Solutions Package	Additional cost incurred over 10 years
Solutions Package	22			
CPA Option 1	65	43	\$610,000	\$450,000
CPA Option 2	282	260	\$3,660,000	\$2,690,000
CPA Option 3	98	76	\$1,070,000	\$790,000

7 Drinking water treatment costs

Nitrates in drinking water supplies will be higher than current measured concentrations under both the Current Pathways scenario and in the short to medium term under Solutions Package as a result of recent increases in land use intensity and lag time in the appearance of nitrates in groundwater due to transportation underground. The increased nitrates are not expected to cause any of the public water supplies to exceed the MAV, so no allowance has been made for the costs of treating or replacing water supplies in either Christchurch city or the public water supplies of the Waimakariri district²⁹.

There will however be private drinking water supplies which exceed the MAV. ECan (Kreleger, et al., 2019) has estimated (Table 22) there are approximately 160 wells which exceed MAV for nitrate currently, which will rise to 265 if no action is taken, but to 245 under the Solutions Package.

²⁹ It is noted however that an indicative costing of replacing the supply for Christchurch was estimated by CCC (Mick Bourke, pers.comm. November 2018) at \$450million for a treatment plant for Waimakariri river water, and a further \$100million for linking this into the current distribution system.

There are no alternate sources of low nitrate water immediately available to these households, so treatment of drinking water or rainwater storage is likely to be the only solution where public water supplies are not available. Costings for under bench treatment were obtained from two suppliers, with Reverse Osmosis treatment units considered by those suppliers as most appropriate. Costs range from \$650 - \$1500 per unit, with a cost of \$1000 allowed plus installation costs of \$500. Maintenance costs of \$150 for filters annually and \$150 every three years for membrane replacement have also been allowed.

The costs were applied over 25 years and converted into an NPV, with the total cost by scenario shown in Table 23. The costs for the Current scenario are approximately \$610,000 which rises to \$1 million if no action is taken, but rises to slightly less at \$930,000 under the Solutions Package. There are further reductions in the requirements for treatment under the Solutions Package, but the costings for the Solutions Package in 10 years already cover treatment for those wells with reduced loads, so these out-years are not included. It is possible that households will remove treatment once nitrates decrease, but it appears unlikely given that there are a number of other contaminants (particularly bacteriological) to which these wells will be subject.

Table 22: Number of private drinking water wells affected by nitrate MAV exceedances by scenario

Scenario	Weighted median N (mg/L) for all PWSAs combined	% samples > 11.3 mg/L	% samples > 5.65 mg/L	#wells > 11.3 mg/L
Current	3.1	6%	25%	160 (6.1%)
Current Pathways	5.6	12%	47%	265 (10.1%)
ZIPA Solution 10yr	5.1	10%	43%	245 (9.3%)
ZIPA Solution 20yr	4.8	9%	40%	230 (8.7%)
ZIPA Solution 50yr	4.1	7%	34%	205 (7.8%)

Table 23: Cost of treatment for private drinking water supplies by scenario (NPV, 6%, 25 years)

Scenario	Number of wells	Cost	Additional cost relative to Current	Additional cost spread over 10 years (NPV)
Current	160	\$610,000		
Current Pathways	265	\$1,000,000	\$400,000	\$290,000
Solutions Package (ZIPA Solution 10yr)	245	\$930,000	\$320,000	\$240,000
ZIPA Solution 20yr	230	\$870,000	\$260,000	\$190,000
ZIPA Solution 50yr	205	\$780,000	\$170,000	\$130,000

8 Summary

8.1 Analysis results

The Solutions Package will incur costs across a range of areas. The largest of these are in the changes to minimum flows, where operating profit reduces from \$18.7 million per annum in Current Pathways scenario to \$16.2 million per annum in the Solutions Package (Table 24). The implementation of existing Plan rules will reduce operating profit from \$23 million per annum under the Current scenario, to \$18.7 million per annum in Current Pathways scenario. Some of these impacts are illusory because they are associated with changes in irrigated area that will not occur. For example, the Current Pathways has a potential of 16,515 ha irrigated, which is 5000 ha more than the current scenario. However, under the Current Pathways scenario profit reduces because the impact of higher allocation on reliability causes the overall profit to reduce, which suggests that the additional irrigated area will never be taken up. Similarly, the Solutions Package has a lower irrigated area by 2,400 ha, but again at least some of this reduced area will occur through realigning consents with their actual use, so no real costs would be incurred.

However, it is not currently known how much of the reduction in allocation can be achieved without impacting on irrigators use of water, and in addition there are some situations where a move to a partial restriction regime under the Current Pathways, and where minimum flows are changed in the Solutions Package, where there will be real impacts on irrigators. There is therefore potential for actual reduction in economic activity associated with changes to the flows.

Table 24: Changes to zone indicators associated with changes to the flow regimes, by scenario

Scenario	On farm Operating profit (\$m/annum)	Contribution to Regional GDP from irrigators ³⁰ (\$m/annum)	Contribution to Regional Household Income from irrigators (\$m/annum)	Contribution to Regional Employment from irrigators (FTE)	Area (ha)
Current	\$22.95	\$88.25	\$43.81	\$706.12	11,490
Current Pathways ³¹	\$18.67	\$89.96	\$44.55	\$713.26	16,515
Solutions Package	\$16.20	\$67.12	\$33.85	\$553.76	9,105

The impacts associated with changes to the nutrient management regime are next most important, since these will impact across a range of land uses including dryland. The total reduction from Current Pathways to the Solutions Package will be approximately \$5.8 million per annum in operating profit, \$5.7 million per annum in regional GDP, \$2.8 million per annum in regional household income, and 46 full time equivalent jobs. The majority of these impacts are associated with the dairy sector (\$4.9 million out of the \$5.8 million in operating profit reduction), which forms a large part of the land that experiences nutrient losses that exceed

³⁰ Includes dryland substituted for irrigated land where allocation changes between scenarios.

³¹ Under the Current Pathways increases in allocation cause an increase in irrigated area, which increases total returns and the model converts this into additional regional activity. However, in reality much of this additional allocation will not be utilised because the reliability is too low.

the threshold at which mitigation is required. These impacts have been calculated using a set of reasonably conservative mitigation assumptions for non-dairy landholders, that may prove to be overestimates if there are other mitigation options available. However, there are also risks that the costs may be higher than has been stated here because some of the larger dairy mitigations were calculated relative to the Environment Canterbury portal GMP estimates, which may not represent the actual GMP figure for a property. If a landholder has already undertaken some of the mitigations used to calculate the curve, the costs of reaching the mitigation target will be higher.

There is likely to be an interaction between the reduction in reliability and N losses, because farms that experience lower reliability or reduced allocation are also likely to have reduced production and reduced N losses. It is unclear how important these interactions will be, but it should be noted that at least part of the costs of flow management changes and N mitigation requirements may not additive.

The Solutions Package costs for stock exclusion were calculated as a capital cost, while the costs for a lower PA threshold and drinking water were calculated as NPV based on the costs over time. For the Solutions Package relative to the Current Pathways scenario, these costs are \$4.4 million for stock exclusion including non-intensively farmed cattle but with no buffers in riparian zones, \$0.77 million for additional compliance costs for the lower zone wide PA threshold, \$0.6 million for the additional compliance costs for CPA1 option for managing the Ashley Estuary (Te Aka Aka) and Coastal Protection Area, and a saving of \$0.08 million for drinking water compliance. If the costs are incurred evenly over the period of the plan (10 years), then converted to an equivalent annual value over 25 years, the equivalent costs are \$0.25 million per annum for stock exclusion, \$0.13 million per annum for compliance costs with the lower PA threshold, \$0.27 million for the additional compliance costs for CPA1 option for managing the Ashley Estuary (Te Aka Aka) and Coastal Protection Area, and a saving of \$0.004 million per annum for drinking water treatment. These annual costs are shown in Table 25.

The equivalent annual costs are shown relative for the Solutions Package relative to Current in Table 25 and the Solutions Package relative to the Current Pathways scenario in Table 26. The Solutions Package relative to the Current Pathways scenario is the most relevant in showing the impact of the proposed Plan Change, because the Current Pathways includes all the impacts of the current Plan, some of which have not been implemented yet. The change from Current scenario is shown to allow the cumulative impacts of all changes experienced by the community from their current state to be understood. The results show that approximately a third of the total costs that will be experienced are associated with the change from Current to Current Pathways, as the cost of the Solutions Package is \$13.44 million in annual terms relative to Current, but \$8.92 million per annum relative to the Current Pathways scenario. Most of the difference is in the changes to the flow management regime, where the LWRP and WRRP will impose most of the additional cost, of which a large portion is associated with the move to partial restrictions.

Table 25: Summary impacts of Waimakariri Solutions Package relative to Current scenario

Item	Change in Operating profit (\$m/annum)	Change in contribution to Regional GDP (\$m/annum)	Change in contribution to Regional Household Income (\$m/annum)	Change in contribution to Regional Employment (FTE)
Flow management regime	-\$6.75	-\$21.13	-\$9.96	-152
Nutrient mitigation impact on operating profit	-\$5.80	-\$5.75	-\$2.80	-46
Stock exclusion (Swimming sites, drains extended to all cattle)	-\$0.25			
Change to PA rule thresholds zone wide	-\$0.36			
Ashley Estuary (Te Aka Aka) and Coastal Protection Area	-\$0.27			
Drinking water	-\$0.02			
Total Solutions Package relative to Current	-\$13.44	-\$26.88	-\$12.76	-198

Table 26: Summary impacts of Waimakariri Solutions Package relative to Current Pathways scenario

Item	Change in Operating profit (\$m/annum)	Change in contribution to Regional GDP (\$m/annum)	Change in contribution to Regional Household Income (\$m/annum)	Change in contribution to Regional Employment (FTE)
Flow management regime	-\$2.47	-\$22.84	-\$10.70	-160
Nutrient mitigation impact on operating profit	-\$5.80	-\$5.75	-\$2.80	-46
Stock exclusion (Swimming sites, drains extended to all cattle)	-\$0.25			
Change to PA rule thresholds zone wide	-\$0.18			
Ashley Estuary (Te Aka Aka) and Coastal Protection Area	-\$0.35			
Drinking water	\$0.00			
Total Solutions Package relative to Current Pathways	-\$8.92	-\$28.59	-\$13.50	-205

These costs are significant for the landholders affected, particularly those who are affected by multiple measures (for example a reduction in reliability and a requirement to exclude stock from streams). In the context of the contribution to the regional economy by water using industries, and to the regional economy overall, the ~\$30 million per annum GDP impact is 6.4% of the \$474 million contribution to GDP from the water using industries in the Waimakariri zone, and 2.0% of the \$1.57 billion district GDP³². These impacts will accrue over a 10-year period, and while they may be noticeable in the rural economy, are unlikely to have a major impact in the context of the regional economy.

³² District level estimates of economy are 2016.

The alternate Dryland scenario for the Interzone source area where all irrigated land converted to forestry in order to achieve an average 8kgN/ha loss rate from land would have significant impacts on landholders and would result in many farm operations being no longer viable. In the short-term substitution with other land uses would not compensate for the loss of contribution to the regional economy and employment.

These costs do not include the indicative \$60 million estimated capital costs for the stream health and biodiversity rehabilitation because the ZIPA recommends that this option should be explored rather than being implemented, and the source of funding has not been determined.

8.2 Performance of Solutions Package against Community Outcomes

There are two key Community Outcomes that are relevant to the economic analysis. The Community Outcome 6 defines a target of 95% reliability for irrigation water in the Waimakariri Zone. The narrative provided by the WWZC for this outcome suggests that it would be achieved if:

1. irrigation water (from both surface and groundwater) reliably supplies water to meet demand when operating within flow and allocation regimes;
2. 100% of the irrigated area can be irrigated 95% of the time;
3. the effects of climate change are considered in the planning and effective long-term management of water and land; and
4. opportunities for water storage are considered.

This Community Outcome is not met across the whole zone under any of the scenarios. The reliability of 95% is achieved in 3 out of 19 under the Current Pathways scenario and 3 – 4 SWAZs in the Solutions Package scenario. The Solutions Package therefore maintains, or slightly improves reliability relative to the Current Pathway scenario. The groundwater reliability meets the outcome under all scenarios. While climate change has been considered in water management, it has been from the perspective of aiming to protect environmental outcomes rather than reliability for water users, and further large-scale storage in the catchment which might address climate change reliability impacts has not been considered in the ZIPA.

Community Outcome 8 seeks to achieve an improved contribution to the regional economy from the zone, with an emphasis on the economic contribution from sustainable and productive land and water use. The assessment undertaken here indicates that there will be a reduction in the economic contribution from the land and water-based industries under both Current Pathways and Solutions Package scenarios. There may be some improvements for industries that rely on high quality water, including the salmon hatchery on Silverstream³³ and recreational and tourism industries. However overall this Community Outcomes is not likely to be met under either of the future scenarios considered here.

³³ The hatchery is affected by both high N levels and low flows. N levels are not currently a major problem, but may be if they rise consistently above 10mg/l at which level they would have effects on small fish growth. Low flows are a major problem for the hatchery, and significant losses were experienced in the last prolonged low flow event. While these may be improved somewhat by the Solutions package, it is not clear that this will be sufficient without artificial enhancement of the stream flows.

9 Bibliography

- Arthur, J, Bolton-Ritchie, L and Meredith, A. 2019.** *Waimakariri Land and Water Solutions Programme, Options and Solutions Assessment, Aquatic Ecology and Biodiversity.* Christchurch : Environment Canterbury, 2019.
- Clark, A.J., et al. 2012.** Impacts of Climate Change on Land-based Sectors and Adaptation Options. *Impacts of Climate Change on Land-based Sectors and Adaptation Options.* Wellington : Ministry for Primary Industry. mpi.govt.nz/document-vault/4061, 2012, p. 76.
- Etheridge and Arthur, J. 2019.** *Assessment of Ashley Estuary (Te Aka Aka) and Coastal Protection Zone Area.* Christchurch : ECan Memorandum, 2019.
- Etheridge, Z. 2016.** *Waimakariri Current Pathways Scenario – Groundwater Assessment Results.* Christchurch : ECan internal memorandum, 2016.
- Hudson, H R. 2017.** *Scoping strategy for the Three Brooks and channel enhancements in the middle Cam River and Tuahiwi Drain.* Rangiora : Environmental Management Associates Report 2017-04 for Waimakariri District Council, 2017.
- Kreleger, A. and Etheridge, Z. 2019.** *Waimakariri Land and Water Solutions Programme, Options and Solutions Assessment, Nitrate Management.* Christchurch : Environment Canterbury, 2019.
- Megaughin, M and Lintott, C. 2019.** *Waimakariri Land and Water Solutions Programme, Options and Solutions Assessment, Water Quantity.* Christchurch : Environment Canterbury, 2019.
- Reserve Bank NZ. 2015.** *Financial Stability Report for November 2015: Box A.* Wellington : Reserve Bank NZ, 2015.
- The Agribusiness Group. 2016.** *Ministry for Primary Industries Stock Exclusion Costs Report .* Wellington : MPI Technical Report 2017/11, 2016.

Appendix A Estimates of reliability and financial outcome by catchment

A1 Cam river

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Cam Current	Average	66	2	12%
	1 in 4 year event	101	1	19%
	1 in 10 year event	121	4	31%
	Worst year	146	17	40%
Cam Current Pathways	Average	193	2	45%
	1 in 4 year event	203	1	52%
	1 in 10 year event	206	4	62%
	Worst year	210	17	72%
Cam Solutions Package	Average	80	2	14%
	1 in 4 year event	116	1	22%
	1 in 10 year event	129	4	33%
	Worst year	161	17	43%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cam Current	Revenue	\$8,500	\$2,700	\$2,100	\$0	\$14,700	\$6,200
	Expenses	\$5,600	\$2,300	\$1,800	\$0	\$9,600	\$4,200
	Operating Profit	\$2,900	\$400	\$400	\$0	\$5,000	\$2,000
Cam Current Pathways	Revenue	\$6,100	\$2,000	\$1,500	\$0	\$10,500	\$4,400
	Expenses	\$4,400	\$1,900	\$1,500	\$0	\$9,600	\$3,500
	Operating Profit	\$1,600	\$100	\$0	\$0	\$800	\$1,000
Cam Solutions Package	Revenue	\$8,400	\$2,700	\$2,100	\$0	\$14,500	\$6,200
	Expenses	\$5,500	\$2,300	\$1,700	\$0	\$9,600	\$4,200
	Operating Profit	\$2,900	\$400	\$400	\$0	\$4,800	\$2,000

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cam Current	Revenue	\$7,800	\$2,500	\$1,900	\$0	\$13,200	\$5,700
	Expenses	\$5,600	\$2,300	\$1,800	\$0	\$9,600	\$4,200
	Operating Profit	\$2,200	\$200	\$200	\$0	\$3,600	\$1,400
Cam Current Pathways	Revenue	\$5,600	\$1,800	\$1,400	\$0	\$9,500	\$4,100
	Expenses	\$4,400	\$1,900	\$1,500	\$0	\$9,600	\$3,500
	Operating Profit	\$1,200	-\$100	-\$100	\$0	-\$100	\$600

Cam Solutions Package	Revenue	\$7,900	\$2,500	\$2,000	\$0	\$13,500	\$5,800
	Expenses	\$5,500	\$2,300	\$1,700	\$0	\$9,600	\$4,200
	Operating Profit	\$2,400	\$200	\$200	\$0	\$3,800	\$1,600

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cam Current	Revenue	\$6,700	\$2,100	\$1,600	\$0	\$11,100	\$4,900
	Expenses	\$5,600	\$2,300	\$1,800	\$0	\$9,600	\$4,200
	Operating Profit	\$1,100	-\$200	-\$100	\$0	\$1,500	\$600
Cam Current Pathways	Revenue	\$4,400	\$1,300	\$1,000	\$0	\$7,100	\$3,200
	Expenses	\$4,400	\$1,900	\$1,500	\$0	\$9,600	\$3,500
	Operating Profit	\$0	-\$600	-\$500	\$0	-\$2,600	-\$300
Cam Solutions Package	Revenue	\$6,500	\$2,000	\$1,600	\$0	\$10,800	\$4,700
	Expenses	\$5,500	\$2,300	\$1,700	\$0	\$9,600	\$4,200
	Operating Profit	\$1,000	-\$300	-\$200	\$0	\$1,100	\$500

A2 North Brook

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
North Brook Current	Average	133	0	18%
	1 in 4 year event	154	0	24%
	1 in 10 year event	163	1	28%
	Worst year	186	1	43%
North Brook Current Pathways	Average	133	0	18%
	1 in 4 year event	154	0	24%
	1 in 10 year event	163	1	28%
	Worst year	184	1	42%
North Brook Solutions Package	Average	150	1	26%
	1 in 4 year event	168	0	33%
	1 in 10 year event	183	1	38%
	Worst year	195	6	54%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
North Brook Current	Revenue	\$8,100	\$0	\$2,000	\$0	\$13,900	\$6,300
	Expenses	\$5,400	\$0	\$1,700	\$0	\$9,600	\$4,300
	Operating Profit	\$2,700	\$0	\$300	\$0	\$4,300	\$2,000
North Brook Current Pathways	Revenue	\$7,700	\$0	\$2,000	\$0	\$13,900	\$6,100
	Expenses	\$5,400	\$0	\$1,700	\$0	\$9,600	\$4,300
	Operating Profit	\$2,400	\$0	\$300	\$0	\$4,300	\$1,800
North Brook Solutions Package	Revenue	\$7,600	\$0	\$1,900	\$0	\$13,000	\$5,900
	Expenses	\$5,100	\$0	\$1,700	\$0	\$9,600	\$4,100
	Operating Profit	\$2,500	\$0	\$200	\$0	\$3,300	\$1,800

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
North Brook Current	Revenue	\$7,600	\$0	\$1,900	\$0	\$12,900	\$5,900
	Expenses	\$5,400	\$0	\$1,700	\$0	\$9,600	\$4,300
	Operating Profit	\$2,200	\$0	\$200	\$0	\$3,300	\$1,600
North Brook Current Pathways	Revenue	\$7,400	\$0	\$1,900	\$0	\$13,200	\$5,800
	Expenses	\$5,400	\$0	\$1,700	\$0	\$9,600	\$4,300
	Operating Profit	\$2,000	\$0	\$200	\$0	\$3,600	\$1,500
North Brook Solutions Package	Revenue	\$7,200	\$0	\$1,800	\$0	\$12,000	\$5,600

	Expenses	\$5,100	\$0	\$1,700	\$0	\$9,600	\$4,100
	Operating Profit	\$2,000	\$0	\$100	\$0	\$2,400	\$1,400

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
North Brook Current	Revenue	\$6,600	\$0	\$1,600	\$0	\$10,900	\$5,100
	Expenses	\$5,400	\$0	\$1,700	\$0	\$9,600	\$4,300
	Operating Profit	\$1,200	\$0	-\$100	\$0	\$1,200	\$800
North Brook Current Pathways	Revenue	\$6,300	\$0	\$1,600	\$0	\$10,900	\$4,900
	Expenses	\$5,400	\$0	\$1,700	\$0	\$9,600	\$4,300
	Operating Profit	\$900	\$0	-\$100	\$0	\$1,300	\$600
North Brook Solutions Package	Revenue	\$5,800	\$0	\$1,400	\$0	\$9,500	\$4,500
	Expenses	\$5,100	\$0	\$1,700	\$0	\$9,600	\$4,100
	Operating Profit	\$700	\$0	-\$300	\$0	-\$200	\$400

A3 Middle Brook

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Middle Brook Current	Average	38	83	45%
	1 in 4 year event	48	115	57%
	1 in 10 year event	51	120	61%
	Worst year	58	139	69%
Middle Brook Current Pathways	Average	41	93	51%
	1 in 4 year event	55	134	66%
	1 in 10 year event	59	140	71%
	Worst year	61	142	72%
Middle Brook Solutions Package	Average	41	93	51%
	1 in 4 year event	55	134	66%
	1 in 10 year event	59	140	71%
	Worst year	61	142	72%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Middle Brook Current	Revenue	\$6,300	\$1,900	\$1,500	\$1,700	\$10,400	\$4,700
	Expenses	\$4,400	\$1,900	\$1,500	\$1,400	\$9,600	\$3,500
	Operating Profit	\$1,900	\$100	\$0	\$300	\$800	\$1,300
Middle Brook Current Pathways	Revenue	\$5,700	\$1,800	\$1,400	\$1,600	\$9,700	\$4,300
	Expenses	\$4,200	\$1,800	\$1,500	\$1,300	\$9,600	\$3,300
	Operating Profit	\$1,500	\$0	\$0	\$300	\$100	\$1,000
Middle Brook Solutions Package	Revenue	\$6,000	\$1,800	\$1,400	\$1,600	\$9,700	\$4,500
	Expenses	\$4,200	\$1,800	\$1,500	\$1,300	\$9,600	\$3,300
	Operating Profit	\$1,800	\$0	\$0	\$300	\$100	\$1,100

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Middle Brook Current	Revenue	\$5,500	\$1,600	\$1,300	\$1,400	\$8,800	\$4,100
	Expenses	\$4,400	\$1,900	\$1,500	\$1,400	\$9,600	\$3,500
	Operating Profit	\$1,100	-\$300	-\$200	\$0	-\$900	\$600
Middle Brook Current Pathways	Revenue	\$4,800	\$1,500	\$1,100	\$1,300	\$7,800	\$3,600
	Expenses	\$4,200	\$1,800	\$1,500	\$1,300	\$9,600	\$3,300
	Operating Profit	\$500	-\$400	-\$300	\$0	-\$1,800	\$200
Middle Brook Solutions Package	Revenue	\$5,000	\$1,500	\$1,100	\$1,300	\$7,800	\$3,700
	Expenses	\$4,200	\$1,800	\$1,500	\$1,300	\$9,600	\$3,300

	Operating Profit	\$800	-\$400	-\$300	\$0	-\$1,800	\$400
--	------------------	-------	--------	--------	-----	----------	-------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Middle Brook Current	Revenue	\$4,800	\$1,400	\$1,100	\$1,200	\$7,400	\$3,600
	Expenses	\$4,400	\$1,900	\$1,500	\$1,400	\$9,600	\$3,500
	Operating Profit	\$400	-\$500	-\$400	-\$200	-\$2,200	\$100
Middle Brook Current Pathways	Revenue	\$4,400	\$1,300	\$1,000	\$1,200	\$7,100	\$3,300
	Expenses	\$4,200	\$1,800	\$1,500	\$1,300	\$9,600	\$3,300
	Operating Profit	\$200	-\$500	-\$400	-\$200	-\$2,500	\$0
Middle Brook Solutions Package	Revenue	\$4,600	\$1,300	\$1,000	\$1,200	\$7,100	\$3,400
	Expenses	\$4,200	\$1,800	\$1,500	\$1,300	\$9,600	\$3,300
	Operating Profit	\$400	-\$500	-\$400	-\$200	-\$2,500	\$100

A4 South Brook

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
South Brook Current	Average	97	0	10%
	1 in 4 year event	109	0	13%
	1 in 10 year event	135	0	19%
	Worst year	158	0	24%
South Brook Current Pathways	Average	108	0	15%
	1 in 4 year event	133	0	21%
	1 in 10 year event	154	1	32%
	Worst year	179	1	36%
South Brook Solutions Package	Average	13	0	2%
	1 in 4 year event	16	0	2%
	1 in 10 year event	47	1	10%
	Worst year	75	4	13%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
South Brook Current	Revenue	\$8,600	\$0	\$2,200	\$0	\$14,900	\$12,700
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$8,200
	Operating Profit	\$3,000	\$0	\$400	\$0	\$5,300	\$4,500
South Brook Current Pathways	Revenue	\$7,900	\$0	\$2,100	\$0	\$14,300	\$12,000
	Expenses	\$5,500	\$0	\$1,700	\$0	\$9,600	\$8,200
	Operating Profit	\$2,500	\$0	\$300	\$0	\$4,600	\$3,900
South Brook Solutions Package	Revenue	\$9,100	\$0	\$2,300	\$0	\$15,900	\$13,500
	Expenses	\$5,900	\$0	\$1,800	\$0	\$9,600	\$8,300
	Operating Profit	\$3,200	\$0	\$500	\$0	\$6,300	\$5,200

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
South Brook Current	Revenue	\$8,300	\$0	\$2,100	\$0	\$14,200	\$12,100
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$8,200
	Operating Profit	\$2,600	\$0	\$300	\$0	\$4,600	\$3,900
South Brook Current Pathways	Revenue	\$7,600	\$0	\$2,000	\$0	\$13,600	\$11,400
	Expenses	\$5,500	\$0	\$1,700	\$0	\$9,600	\$8,200
	Operating Profit	\$2,100	\$0	\$200	\$0	\$3,900	\$3,300
South Brook Solutions Package	Revenue	\$9,200	\$0	\$2,300	\$0	\$16,000	\$13,500
	Expenses	\$5,900	\$0	\$1,800	\$0	\$9,600	\$8,300

	Operating Profit	\$3,200	\$0	\$500	\$0	\$6,300	\$5,200
--	------------------	---------	-----	-------	-----	---------	---------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
South Brook Current	Revenue	\$7,700	\$0	\$1,900	\$0	\$13,200	\$11,200
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$8,200
	Operating Profit	\$2,100	\$0	\$100	\$0	\$3,500	\$3,000
South Brook Current Pathways	Revenue	\$6,600	\$0	\$1,700	\$0	\$11,600	\$9,800
	Expenses	\$5,500	\$0	\$1,700	\$0	\$9,600	\$8,200
	Operating Profit	\$1,100	\$0	\$0	\$0	\$1,900	\$1,700
South Brook Solutions Package	Revenue	\$8,500	\$0	\$2,100	\$0	\$14,600	\$12,400
	Expenses	\$5,900	\$0	\$1,800	\$0	\$9,600	\$8,300
	Operating Profit	\$2,500	\$0	\$300	\$0	\$4,900	\$4,100

A5 Cust

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Cust Current	Average	0	16	1%
	1 in 4 year event	0	35	2%
	1 in 10 year event	0	37	3%
	Worst year	0	39	3%
Cust Current Pathways	Average	110	11	35%
	1 in 4 year event	141	18	59%
	1 in 10 year event	152	38	70%
	Worst year	163	43	71%
Cust Solutions Package	Average	83	47	40%
	1 in 4 year event	102	94	66%
	1 in 10 year event	112	137	75%
	Worst year	115	140	76%
Cust Unrestricted	Average	#N/A	#N/A	0%
	1 in 4 year event	#N/A	#N/A	0%
	1 in 10 year event	#N/A	#N/A	0%
	Worst year	#N/A	#N/A	0%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust Current	Revenue	\$9,200	\$3,000	\$2,300	\$2,600	\$16,100	\$5,800
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,400	\$1,900
Cust Current Pathways	Revenue	\$6,700	\$2,200	\$1,700	\$1,900	\$11,800	\$4,200
	Expenses	\$4,800	\$2,000	\$1,600	\$1,500	\$9,600	\$3,200
	Operating Profit	\$1,900	\$200	\$100	\$400	\$2,100	\$1,000
Cust Solutions Package	Revenue	\$6,700	\$2,100	\$1,600	\$1,800	\$11,100	\$4,200
	Expenses	\$4,600	\$2,000	\$1,500	\$1,500	\$9,600	\$3,100
	Operating Profit	\$2,100	\$100	\$100	\$300	\$1,400	\$1,100
Cust Unrestricted	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$5,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$1,900

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust Current	Revenue	\$9,100	\$3,000	\$2,300	\$2,600	\$15,900	\$5,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,200	\$500	\$500	\$600	\$6,300	\$1,800
Cust Current Pathways	Revenue	\$5,200	\$1,600	\$1,300	\$1,400	\$8,700	\$3,200

	Expenses	\$4,800	\$2,000	\$1,600	\$1,500	\$9,600	\$3,200
	Operating Profit	\$400	-\$400	-\$300	-\$100	-\$1,000	\$0
Cust Solutions Package	Revenue	\$5,000	\$1,500	\$1,100	\$1,300	\$7,800	\$3,100
	Expenses	\$4,600	\$2,000	\$1,500	\$1,500	\$9,600	\$3,100
	Operating Profit	\$400	-\$500	-\$400	-\$200	-\$1,900	\$0
Cust Unrestricted	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$5,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$1,900

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust Current	Revenue	\$9,100	\$3,000	\$2,300	\$2,600	\$15,900	\$5,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,100	\$500	\$500	\$600	\$6,200	\$1,800
Cust Current Pathways	Revenue	\$4,400	\$1,300	\$1,000	\$1,200	\$7,100	\$2,700
	Expenses	\$4,800	\$2,000	\$1,600	\$1,500	\$9,600	\$3,200
	Operating Profit	-\$400	-\$700	-\$600	-\$400	-\$2,500	-\$500
Cust Solutions Package	Revenue	\$4,300	\$1,200	\$1,000	\$1,100	\$6,500	\$2,700
	Expenses	\$4,600	\$2,000	\$1,500	\$1,500	\$9,600	\$3,100
	Operating Profit	-\$200	-\$700	-\$600	-\$400	-\$3,100	-\$400
Cust Unrestricted	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$5,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$1,900

A6 Cust Main Drain

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Cust Main Drain Current	Average	24	0	2%
	1 in 4 year event	28	0	1%
	1 in 10 year event	52	0	5%
	Worst year	76	0	12%
Cust Main Drain Current Pathways	Average	24	0	2%
	1 in 4 year event	28	0	1%
	1 in 10 year event	52	0	5%
	Worst year	76	0	12%
Cust Main Drain Solutions Package	Average	24	0	2%
	1 in 4 year event	28	0	1%
	1 in 10 year event	52	0	5%
	Worst year	76	0	12%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust Main Drain Current	Revenue	\$9,200	\$3,000	\$2,300	\$2,600	\$16,000	\$6,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,200	\$600	\$500	\$600	\$6,300	\$2,300
Cust Main Drain Current Pathways	Revenue	\$8,800	\$3,000	\$2,300	\$2,600	\$16,000	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,800	\$600	\$500	\$600	\$6,300	\$2,100
Cust Main Drain Solutions Package	Revenue	\$9,200	\$3,000	\$2,300	\$2,600	\$16,000	\$6,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,200	\$600	\$500	\$600	\$6,300	\$2,300

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust Main Drain Current	Revenue	\$9,200	\$3,000	\$2,300	\$2,600	\$16,000	\$6,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,200	\$600	\$500	\$600	\$6,400	\$2,300
Cust Main Drain Current Pathways	Revenue	\$8,800	\$3,000	\$2,300	\$2,600	\$16,000	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,800	\$600	\$500	\$600	\$6,400	\$2,100
Cust Main Drain Solutions Package	Revenue	\$9,200	\$3,000	\$2,300	\$2,600	\$16,000	\$6,900
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,400	\$2,300

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust Main Drain Current	Revenue	\$8,500	\$2,700	\$2,100	\$2,400	\$14,700	\$6,400
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,600	\$300	\$300	\$400	\$5,100	\$1,800
Cust Main Drain Current Pathways	Revenue	\$8,100	\$2,700	\$2,100	\$2,400	\$14,700	\$6,200
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,200	\$300	\$300	\$400	\$5,100	\$1,600
Cust Main Drain Solutions Package	Revenue	\$8,500	\$2,700	\$2,100	\$2,400	\$14,700	\$6,400
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,600	\$300	\$300	\$400	\$5,100	\$1,800

A7 No 7 Drain

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
No 7 Drain Current	Average	0	0	0%
	1 in 4 year event	0	0	0%
	1 in 10 year event	0	0	0%
	Worst year	0	0	0%
No 7 Drain Current Pathways	Average	2	0	0%
	1 in 4 year event	3	0	0%
	1 in 10 year event	6	0	0%
	Worst year	9	0	1%
No 7 Drain Solutions Package	Average	0	0	0%
	1 in 4 year event	0	0	0%
	1 in 10 year event	0	0	0%
	Worst year	0	0	0%
No 7 Drain Unrestricted	Average	0	0	0%
	1 in 4 year event	0	0	0%
	1 in 10 year event	0	0	0%
	Worst year	0	0	0%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
No 7 Drain Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
No 7 Drain Current Pathways	Revenue	\$8,900	\$3,000	\$2,400	\$2,700	\$16,200	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,900	\$600	\$500	\$600	\$6,600	\$2,100
No 7 Drain Solutions Package	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
No 7 Drain Unrestricted	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
No 7 Drain Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400

No 7 Drain Current Pathways	Revenue	\$8,900	\$3,000	\$2,400	\$2,700	\$16,200	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,900	\$600	\$500	\$600	\$6,600	\$2,100
No 7 Drain Solutions Package	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
No 7 Drain Unrestricted	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
No 7 Drain Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
No 7 Drain Current Pathways	Revenue	\$8,800	\$3,000	\$2,400	\$2,600	\$16,100	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,800	\$600	\$500	\$600	\$6,500	\$2,100
No 7 Drain Solutions Package	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
No 7 Drain Unrestricted	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400

A8 Ohoka

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Ohoka Current	Average	4	0	0%
	1 in 4 year event	7	0	0%
	1 in 10 year event	12	0	0%
	Worst year	14	0	0%
Ohoka Current Pathways	Average	36	0	2%
	1 in 4 year event	42	0	4%
	1 in 10 year event	66	0	6%
	Worst year	87	0	7%
Ohoka Solutions Package	Average	53	0	5%
	1 in 4 year event	57	0	8%
	1 in 10 year event	89	0	12%
	Worst year	118	0	15%

Per ha outcomes by

scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ohoka Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$5,200
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$1,600
Ohoka Current Pathways	Revenue	\$8,700	\$3,000	\$2,300	\$2,600	\$15,900	\$5,000
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$9,600	\$3,500
	Operating Profit	\$2,800	\$600	\$500	\$600	\$6,300	\$1,400
Ohoka Solutions Package	Revenue	\$9,000	\$2,900	\$2,300	\$2,600	\$15,600	\$5,000
	Expenses	\$5,800	\$2,400	\$1,800	\$2,000	\$9,600	\$3,500
	Operating Profit	\$3,100	\$500	\$500	\$600	\$6,000	\$1,500

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ohoka Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$5,200
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$1,600
Ohoka Current Pathways	Revenue	\$8,700	\$2,900	\$2,300	\$2,600	\$15,800	\$4,900
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$9,600	\$3,500
	Operating Profit	\$2,700	\$500	\$500	\$600	\$6,100	\$1,400
Ohoka Solutions Package	Revenue	\$8,800	\$2,900	\$2,200	\$2,500	\$15,300	\$4,900
	Expenses	\$5,800	\$2,400	\$1,800	\$2,000	\$9,600	\$3,500
	Operating Profit	\$3,000	\$500	\$400	\$500	\$5,700	\$1,400

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
--------	--	-------	--------	----------------	---------------	-------------	------------------

Ohoka Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,600	\$16,200	\$5,200
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$1,600
Ohoka Current Pathways	Revenue	\$8,400	\$2,900	\$2,200	\$2,500	\$15,300	\$4,800
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$9,600	\$3,500
	Operating Profit	\$2,500	\$400	\$400	\$500	\$5,700	\$1,300
Ohoka Solutions Package	Revenue	\$8,400	\$2,700	\$2,100	\$2,400	\$14,400	\$4,700
	Expenses	\$5,800	\$2,400	\$1,800	\$2,000	\$9,600	\$3,500
	Operating Profit	\$2,500	\$300	\$300	\$400	\$4,800	\$1,200

A9 Silverstream

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Silverstream Current	Average	49	0	4%
	1 in 4 year event	64	0	1%
	1 in 10 year event	185	0	19%
	Worst year	195	0	19%
Silverstream Current Pathways	Average	49	0	7%
	1 in 4 year event	64	0	2%
	1 in 10 year event	185	0	39%
	Worst year	195	0	40%
Silverstream Solutions Package	Average	25	3	8%
	1 in 4 year event	0	0	0%
	1 in 10 year event	126	0	41%
	Worst year	151	35	43%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Silverstream Current	Revenue	\$9,100	\$0	\$2,300	\$0	\$15,800	\$8,800
	Expenses	\$5,900	\$0	\$1,800	\$0	\$9,600	\$5,700
	Operating Profit	\$3,200	\$0	\$500	\$0	\$6,100	\$3,100
Silverstream Current Pathways	Revenue	\$8,400	\$0	\$2,200	\$0	\$15,300	\$8,200
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$5,600
	Operating Profit	\$2,700	\$0	\$400	\$0	\$5,600	\$2,600
Silverstream Solutions Package	Revenue	\$8,800	\$0	\$2,200	\$0	\$15,200	\$8,500
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$5,600
	Operating Profit	\$3,100	\$0	\$400	\$0	\$5,600	\$3,000

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Silverstream Current	Revenue	\$9,200	\$0	\$2,300	\$0	\$16,100	\$9,000
	Expenses	\$5,900	\$0	\$1,800	\$0	\$9,600	\$5,700
	Operating Profit	\$3,300	\$0	\$500	\$0	\$6,400	\$3,200
Silverstream Current Pathways	Revenue	\$8,800	\$0	\$2,300	\$0	\$16,000	\$8,500
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$5,600
	Operating Profit	\$3,000	\$0	\$500	\$0	\$6,400	\$2,900
Silverstream Solutions Package	Revenue	\$9,300	\$0	\$2,400	\$0	\$16,200	\$9,000
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$5,600
	Operating Profit	\$3,600	\$0	\$600	\$0	\$6,600	\$3,400

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Silverstream Current	Revenue	\$8,000	\$0	\$2,000	\$0	\$13,800	\$7,800
	Expenses	\$5,900	\$0	\$1,800	\$0	\$9,600	\$5,700
	Operating Profit	\$2,200	\$0	\$200	\$0	\$4,100	\$2,100
Silverstream Current Pathways	Revenue	\$6,400	\$0	\$1,600	\$0	\$11,100	\$6,200
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$5,600
	Operating Profit	\$600	\$0	-\$200	\$0	\$1,500	\$600
Silverstream Solutions Package	Revenue	\$6,400	\$0	\$1,500	\$0	\$10,600	\$6,200
	Expenses	\$5,700	\$0	\$1,800	\$0	\$9,600	\$5,600
	Operating Profit	\$700	\$0	-\$200	\$0	\$1,000	\$700

A10 Greig's

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Greig's Current	Average	0	0	0%
	1 in 4 year event	0	0	0%
	1 in 10 year event	0	0	0%
	Worst year	1	0	0%
Greig's Current Pathways	Average	0	0	0%
	1 in 4 year event	0	0	0%
	1 in 10 year event	0	0	0%
	Worst year	1	0	0%
Greig's Solutions Package	Average	25	0	3%
	1 in 4 year event	45	0	4%
	1 in 10 year event	50	1	6%
	Worst year	59	1	11%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Greig's Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
Greig's Current Pathways	Revenue	\$8,900	\$3,000	\$2,400	\$2,700	\$16,200	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,900	\$600	\$500	\$600	\$6,600	\$2,100
Greig's Solutions Package	Revenue	\$9,100	\$3,000	\$2,300	\$2,600	\$15,900	\$6,900
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,200	\$600	\$500	\$600	\$6,200	\$2,300

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Greig's Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
Greig's Current Pathways	Revenue	\$8,900	\$3,000	\$2,400	\$2,700	\$16,200	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,900	\$600	\$500	\$600	\$6,600	\$2,100
Greig's Solutions Package	Revenue	\$9,100	\$2,900	\$2,300	\$2,600	\$15,800	\$6,800
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,200	\$500	\$500	\$600	\$6,100	\$2,300

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Greig's Current	Revenue	\$9,300	\$3,000	\$2,400	\$2,700	\$16,200	\$7,000
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$3,300	\$600	\$500	\$600	\$6,600	\$2,400
Greig's Current Pathways	Revenue	\$8,900	\$3,000	\$2,400	\$2,600	\$16,200	\$6,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,900	\$600	\$500	\$600	\$6,600	\$2,100
Greig's Solutions Package	Revenue	\$8,600	\$2,800	\$2,200	\$2,400	\$14,900	\$6,500
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$9,600	\$4,600
	Operating Profit	\$2,700	\$400	\$300	\$400	\$5,200	\$1,900

A11 Courtenay

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Courtenay Current	Average	77	0	7%
	1 in 4 year event	89	0	10%
	1 in 10 year event	105	0	12%
	Worst year	138	0	14%
Courtenay Current Pathways	Average	77	0	7%
	1 in 4 year event	85	0	10%
	1 in 10 year event	111	0	12%
	Worst year	139	0	13%
Courtenay Solutions Package	Average	145	1	29%
	1 in 4 year event	156	1	34%
	1 in 10 year event	168	2	42%
	Worst year	186	8	47%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Courtenay Current	Revenue	\$8,900	\$2,900	\$2,200	\$2,500	\$15,400	\$7,700
	Expenses	\$5,800	\$2,400	\$1,800	\$1,900	\$9,600	\$5,100
	Operating Profit	\$3,100	\$500	\$400	\$600	\$5,700	\$2,600
Courtenay Current Pathways	Revenue	\$8,500	\$2,900	\$2,200	\$2,500	\$15,400	\$7,400
	Expenses	\$5,800	\$2,400	\$1,800	\$1,900	\$9,600	\$5,100
	Operating Profit	\$2,700	\$500	\$400	\$600	\$5,700	\$2,300
Courtenay Solutions Package	Revenue	\$7,500	\$2,400	\$1,800	\$2,100	\$12,700	\$6,500
	Expenses	\$5,000	\$2,100	\$1,600	\$1,600	\$9,600	\$4,400
	Operating Profit	\$2,400	\$300	\$200	\$400	\$3,000	\$2,100

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Courtenay Current	Revenue	\$8,700	\$2,800	\$2,200	\$2,500	\$15,000	\$7,500
	Expenses	\$5,800	\$2,400	\$1,800	\$1,900	\$9,600	\$5,100
	Operating Profit	\$2,900	\$400	\$400	\$500	\$5,400	\$2,500
Courtenay Current Pathways	Revenue	\$8,300	\$2,800	\$2,200	\$2,500	\$15,000	\$7,200
	Expenses	\$5,800	\$2,400	\$1,800	\$1,900	\$9,600	\$5,100
	Operating Profit	\$2,500	\$400	\$400	\$500	\$5,400	\$2,200
Courtenay Solutions Package	Revenue	\$7,100	\$2,200	\$1,700	\$2,000	\$11,900	\$6,200
	Expenses	\$5,000	\$2,100	\$1,600	\$1,600	\$9,600	\$4,400

	Operating Profit	\$2,100	\$100	\$100	\$300	\$2,300	\$1,700
--	------------------	---------	-------	-------	-------	---------	---------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Courtenay Current	Revenue	\$8,400	\$2,700	\$2,100	\$2,400	\$14,500	\$7,300
	Expenses	\$5,800	\$2,400	\$1,800	\$1,900	\$9,600	\$5,100
	Operating Profit	\$2,700	\$400	\$300	\$400	\$4,900	\$2,200
Courtenay Current Pathways	Revenue	\$8,100	\$2,700	\$2,100	\$2,400	\$14,600	\$7,000
	Expenses	\$5,800	\$2,400	\$1,800	\$1,900	\$9,600	\$5,100
	Operating Profit	\$2,300	\$400	\$300	\$500	\$5,000	\$2,000
Courtenay Solutions Package	Revenue	\$6,300	\$1,900	\$1,500	\$1,700	\$10,400	\$5,500
	Expenses	\$5,000	\$2,100	\$1,600	\$1,600	\$9,600	\$4,400
	Operating Profit	\$1,300	-\$200	-\$100	\$100	\$800	\$1,000

A12 Cust B block

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Cust B Current	Average	21	0	2%
	1 in 4 year event	44	0	4%
	1 in 10 year event	49	0	4%
	Worst year	56	0	4%
Cust B Current Pathways	Average	0	0	35%
	1 in 4 year event	0	0	59%
	1 in 10 year event	0	0	70%
	Worst year	0	0	71%
Cust B Solutions Package	Average	0	0	40%
	1 in 4 year event	0	0	66%
	1 in 10 year event	0	0	75%
	Worst year	0	0	76%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust B Current	Revenue	\$9,200	\$3,000	\$2,300	\$2,600	\$16,000	\$5,800
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,200	\$600	\$500	\$600	\$6,400	\$1,900
Cust B Current Pathways	Revenue	\$6,700	\$2,200	\$1,700	\$1,900	\$11,800	\$4,200
	Expenses	\$4,800	\$2,000	\$1,600	\$1,500	\$9,600	\$3,200
	Operating Profit	\$1,900	\$200	\$100	\$400	\$2,100	\$1,000
Cust B Solutions Package	Revenue	\$6,700	\$2,100	\$1,600	\$1,800	\$11,100	\$4,200
	Expenses	\$4,600	\$2,000	\$1,500	\$1,500	\$9,600	\$3,100
	Operating Profit	\$2,100	\$100	\$100	\$300	\$1,400	\$1,100

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust B Current	Revenue	\$9,000	\$2,900	\$2,300	\$2,600	\$15,700	\$5,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,100	\$500	\$500	\$600	\$6,100	\$1,800
Cust B Current Pathways	Revenue	\$5,200	\$1,600	\$1,300	\$1,400	\$8,700	\$3,200
	Expenses	\$4,800	\$2,000	\$1,600	\$1,500	\$9,600	\$3,200
	Operating Profit	\$400	-\$400	-\$300	-\$100	-\$1,000	\$0
Cust B Solutions Package	Revenue	\$5,000	\$1,500	\$1,100	\$1,300	\$7,800	\$3,100
	Expenses	\$4,600	\$2,000	\$1,500	\$1,500	\$9,600	\$3,100
	Operating Profit	\$400	-\$500	-\$400	-\$200	-\$1,900	\$0

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Cust B Current	Revenue	\$9,000	\$2,900	\$2,300	\$2,600	\$15,700	\$5,700
	Expenses	\$6,000	\$2,400	\$1,800	\$2,000	\$9,600	\$3,900
	Operating Profit	\$3,100	\$500	\$500	\$600	\$6,100	\$1,800
Cust B Current Pathways	Revenue	\$4,400	\$1,300	\$1,000	\$1,200	\$7,100	\$2,700
	Expenses	\$4,800	\$2,000	\$1,600	\$1,500	\$9,600	\$3,200
	Operating Profit	-\$400	-\$700	-\$600	-\$400	-\$2,500	-\$500
Cust B Solutions Package	Revenue	\$4,300	\$1,200	\$1,000	\$1,100	\$6,500	\$2,700
	Expenses	\$4,600	\$2,000	\$1,500	\$1,500	\$9,600	\$3,100
	Operating Profit	-\$200	-\$700	-\$600	-\$400	-\$3,100	-\$400

A13 Ashley A block

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Ashley A block Current	Average	40	35	25%
	1 in 4 year event	49	43	30%
	1 in 10 year event	52	74	47%
	Worst year	59	103	58%
Ashley A block Current Pathways	Average	30	55	31%
	1 in 4 year event	35	68	41%
	1 in 10 year event	36	95	50%
	Worst year	42	112	59%
Ashley A block Solutions Package	Average	30	55	31%
	1 in 4 year event	35	68	41%
	1 in 10 year event	36	95	50%
	Worst year	42	112	59%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley A block Current	Revenue	\$7,700	\$2,400	\$1,900	\$2,100	\$13,100	\$3,700
	Expenses	\$5,100	\$2,100	\$1,700	\$1,700	\$9,600	\$2,800
	Operating Profit	\$2,500	\$300	\$200	\$400	\$3,400	\$1,000
Ashley A block Current Pathways	Revenue	\$7,000	\$2,300	\$1,800	\$2,000	\$12,300	\$3,400
	Expenses	\$4,900	\$2,100	\$1,600	\$1,600	\$9,600	\$2,700
	Operating Profit	\$2,000	\$200	\$200	\$400	\$2,600	\$800
Ashley A block Solutions Package	Revenue	\$7,300	\$2,300	\$1,800	\$2,000	\$12,300	\$3,500
	Expenses	\$4,900	\$2,100	\$1,600	\$1,600	\$9,600	\$2,700
	Operating Profit	\$2,400	\$200	\$200	\$400	\$2,600	\$900

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley A block Current	Revenue	\$6,300	\$1,900	\$1,500	\$1,700	\$10,400	\$3,000
	Expenses	\$5,100	\$2,100	\$1,700	\$1,700	\$9,600	\$2,800
	Operating Profit	\$1,200	-\$200	-\$100	\$0	\$800	\$300
Ashley A block Current Pathways	Revenue	\$6,300	\$2,100	\$1,600	\$1,800	\$11,000	\$3,100
	Expenses	\$4,900	\$2,100	\$1,600	\$1,600	\$9,600	\$2,700
	Operating Profit	\$1,400	\$0	\$0	\$200	\$1,400	\$400
Ashley A block Solutions Package	Revenue	\$6,600	\$2,100	\$1,600	\$1,800	\$11,000	\$3,200
	Expenses	\$4,900	\$2,100	\$1,600	\$1,600	\$9,600	\$2,700

	Operating Profit	\$1,700	\$0	\$0	\$200	\$1,400	\$500
--	------------------	---------	-----	-----	-------	---------	-------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley A block Current	Revenue	\$5,500	\$1,700	\$1,300	\$1,500	\$8,900	\$2,600
	Expenses	\$5,100	\$2,100	\$1,700	\$1,700	\$9,600	\$2,800
	Operating Profit	\$400	-\$500	-\$400	-\$200	-\$800	-\$100
Ashley A block Current Pathways	Revenue	\$5,300	\$1,600	\$1,300	\$1,400	\$8,800	\$2,500
	Expenses	\$4,900	\$2,100	\$1,600	\$1,600	\$9,600	\$2,700
	Operating Profit	\$300	-\$400	-\$300	-\$200	-\$800	-\$100
Ashley A block Solutions Package	Revenue	\$5,500	\$1,600	\$1,300	\$1,400	\$8,800	\$2,600
	Expenses	\$4,900	\$2,100	\$1,600	\$1,600	\$9,600	\$2,700
	Operating Profit	\$600	-\$400	-\$300	-\$200	-\$800	\$0

A14 Ashley B block

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Ashley B block Current	Average	0	84	38%
	1 in 4 year event	0	105	48%
	1 in 10 year event	0	127	58%
	Worst year	0	140	65%
Ashley B block Current Pathways	Average	18	85	42%
	1 in 4 year event	20	108	54%
	1 in 10 year event	23	125	60%
	Worst year	34	140	69%
Ashley B block Solutions Package	Average	5	85	39%
	1 in 4 year event	5	108	51%
	1 in 10 year event	6	125	58%
	Worst year	8	140	66%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley B block Current	Revenue	\$6,900	\$0	\$0	\$0	\$0	\$6,900
	Expenses	\$4,700	\$0	\$0	\$0	\$0	\$4,700
	Operating Profit	\$2,200	\$0	\$0	\$0	\$0	\$2,200
Ashley B block Current Pathways	Revenue	\$6,300	\$0	\$0	\$0	\$0	\$6,300
	Expenses	\$4,500	\$0	\$0	\$0	\$0	\$4,500
	Operating Profit	\$1,700	\$0	\$0	\$0	\$0	\$1,700
Ashley B block Solutions Package	Revenue	\$6,800	\$0	\$0	\$0	\$0	\$6,800
	Expenses	\$4,700	\$0	\$0	\$0	\$0	\$4,700
	Operating Profit	\$2,100	\$0	\$0	\$0	\$0	\$2,100

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley B block Current	Revenue	\$6,100	\$0	\$0	\$0	\$0	\$6,100
	Expenses	\$4,700	\$0	\$0	\$0	\$0	\$4,700
	Operating Profit	\$1,400	\$0	\$0	\$0	\$0	\$1,400
Ashley B block Current Pathways	Revenue	\$5,500	\$0	\$0	\$0	\$0	\$5,500
	Expenses	\$4,500	\$0	\$0	\$0	\$0	\$4,500
	Operating Profit	\$1,000	\$0	\$0	\$0	\$0	\$1,000
Ashley B block Solutions Package	Revenue	\$6,000	\$0	\$0	\$0	\$0	\$6,000
	Expenses	\$4,700	\$0	\$0	\$0	\$0	\$4,700

	Operating Profit	\$1,400	\$0	\$0	\$0	\$0	\$1,400
--	------------------	---------	-----	-----	-----	-----	---------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley B block Current	Revenue	\$5,100	\$0	\$0	\$0	\$0	\$5,100
	Expenses	\$4,700	\$0	\$0	\$0	\$0	\$4,700
	Operating Profit	\$400	\$0	\$0	\$0	\$0	\$400
Ashley B block Current Pathways	Revenue	\$4,600	\$0	\$0	\$0	\$0	\$4,600
	Expenses	\$4,500	\$0	\$0	\$0	\$0	\$4,500
	Operating Profit	\$0	\$0	\$0	\$0	\$0	\$0
Ashley B block Solutions Package	Revenue	\$5,000	\$0	\$0	\$0	\$0	\$5,000
	Expenses	\$4,700	\$0	\$0	\$0	\$0	\$4,700
	Operating Profit	\$400	\$0	\$0	\$0	\$0	\$400

A15 Ashley C block

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Ashley C block Current	Average	138	0	36%
	1 in 4 year event	157	0	44%
	1 in 10 year event	168	0	45%
	Worst year	187	0	52%
Ashley C block Current Pathways	Average	25	139	66%
	1 in 4 year event	33	159	76%
	1 in 10 year event	38	170	80%
	Worst year	47	187	91%
Ashley C block Solutions Package	Average	2	87	70%
	1 in 4 year event	3	147	83%
	1 in 10 year event	7	164	86%
	Worst year	8	187	92%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley C block Current	Revenue	\$6,900	\$2,200	\$1,700	\$1,900	\$11,600	\$3,400
	Expenses	\$4,700	\$2,000	\$1,600	\$1,500	\$9,600	\$2,600
	Operating Profit	\$2,200	\$200	\$100	\$400	\$2,000	\$800
Ashley C block Current Pathways	Revenue	\$4,800	\$1,500	\$1,100	\$1,300	\$7,800	\$2,300
	Expenses	\$3,700	\$1,600	\$1,400	\$1,100	\$9,600	\$2,100
	Operating Profit	\$1,100	-\$200	-\$200	\$200	-\$1,800	\$200
Ashley C block Solutions Package	Revenue	\$4,800	\$1,400	\$1,100	\$1,200	\$7,400	\$2,200
	Expenses	\$3,600	\$1,600	\$1,300	\$1,100	\$9,600	\$2,000
	Operating Profit	\$1,200	-\$200	-\$300	\$100	-\$2,300	\$200

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley C block Current	Revenue	\$6,400	\$2,000	\$1,500	\$1,700	\$10,600	\$3,100
	Expenses	\$4,700	\$2,000	\$1,600	\$1,500	\$9,600	\$2,600
	Operating Profit	\$1,700	\$0	\$0	\$200	\$900	\$500
Ashley C block Current Pathways	Revenue	\$4,200	\$1,200	\$1,000	\$1,100	\$6,600	\$2,000
	Expenses	\$3,700	\$1,600	\$1,400	\$1,100	\$9,600	\$2,100
	Operating Profit	\$500	-\$400	-\$400	\$0	-\$3,100	-\$100
Ashley C block Solutions Package	Revenue	\$3,900	\$1,100	\$800	\$900	\$5,700	\$1,800
	Expenses	\$3,600	\$1,600	\$1,300	\$1,100	\$9,600	\$2,000

	Operating Profit	\$300	-\$500	-\$500	-\$100	-\$3,900	-\$200
--	------------------	-------	--------	--------	--------	----------	--------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Ashley C block Current	Revenue	\$5,900	\$1,800	\$1,400	\$1,600	\$9,600	\$2,800
	Expenses	\$4,700	\$2,000	\$1,600	\$1,500	\$9,600	\$2,600
	Operating Profit	\$1,200	-\$200	-\$200	\$0	\$0	\$300
Ashley C block Current Pathways	Revenue	\$3,200	\$900	\$700	\$800	\$4,600	\$1,500
	Expenses	\$3,700	\$1,600	\$1,400	\$1,100	\$9,600	\$2,100
	Operating Profit	-\$500	-\$800	-\$700	-\$400	-\$5,000	-\$600
Ashley C block Solutions Package	Revenue	\$3,300	\$800	\$600	\$700	\$4,500	\$1,500
	Expenses	\$3,600	\$1,600	\$1,300	\$1,100	\$9,600	\$2,000
	Operating Profit	-\$300	-\$800	-\$700	-\$300	-\$5,200	-\$600

A16 Little Ashley

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Little Ashley Creek Current	Average	183	0	32%
	1 in 4 year event	195	0	38%
	1 in 10 year event	207	0	41%
	Worst year	209	1	53%
Little Ashley Creek Current Pathways	Average	209	0	57%
	1 in 4 year event	212	0	63%
	1 in 10 year event	212	0	66%
	Worst year	213	1	77%
Little Ashley Creek Solutions Package	Average	66	0	9%
	1 in 4 year event	93	0	11%
	1 in 10 year event	106	0	16%
	Worst year	139	1	33%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Little Ashley Creek Current	Revenue	\$7,200	\$0	\$1,800	\$0	\$0	\$5,800
	Expenses	\$4,900	\$0	\$1,600	\$0	\$0	\$4,000
	Operating Profit	\$2,300	\$0	\$200	\$0	\$0	\$1,800
Little Ashley Creek Current Pathways	Revenue	\$5,300	\$0	\$1,300	\$0	\$0	\$4,300
	Expenses	\$4,000	\$0	\$1,400	\$0	\$0	\$3,300
	Operating Profit	\$1,300	\$0	-\$100	\$0	\$0	\$900
Little Ashley Creek Solutions Package	Revenue	\$8,700	\$0	\$2,200	\$0	\$0	\$7,000
	Expenses	\$5,700	\$0	\$1,800	\$0	\$0	\$4,700
	Operating Profit	\$3,000	\$0	\$400	\$0	\$0	\$2,300

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Little Ashley Creek Current	Revenue	\$6,800	\$0	\$1,600	\$0	\$0	\$5,400
	Expenses	\$4,900	\$0	\$1,600	\$0	\$0	\$4,000
	Operating Profit	\$1,900	\$0	\$0	\$0	\$0	\$1,400
Little Ashley Creek Current Pathways	Revenue	\$4,900	\$0	\$1,200	\$0	\$0	\$4,000
	Expenses	\$4,000	\$0	\$1,400	\$0	\$0	\$3,300
	Operating Profit	\$900	\$0	-\$200	\$0	\$0	\$600
Little Ashley Creek Solutions Package	Revenue	\$8,600	\$0	\$2,200	\$0	\$0	\$6,900
	Expenses	\$5,700	\$0	\$1,800	\$0	\$0	\$4,700

	Operating Profit	\$2,800	\$0	\$400	\$0	\$0	\$2,200
--	------------------	---------	-----	-------	-----	-----	---------

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Little Ashley Creek Current	Revenue	\$5,900	\$0	\$1,400	\$0	\$0	\$4,700
	Expenses	\$4,900	\$0	\$1,600	\$0	\$0	\$4,000
	Operating Profit	\$1,000	\$0	-\$200	\$0	\$0	\$700
Little Ashley Creek Current Pathways	Revenue	\$4,100	\$0	\$900	\$0	\$0	\$3,300
	Expenses	\$4,000	\$0	\$1,400	\$0	\$0	\$3,300
	Operating Profit	\$100	\$0	-\$500	\$0	\$0	-\$100
Little Ashley Creek Solutions Package	Revenue	\$7,200	\$0	\$1,800	\$0	\$0	\$5,800
	Expenses	\$5,700	\$0	\$1,800	\$0	\$0	\$4,700
	Operating Profit	\$1,500	\$0	\$0	\$0	\$0	\$1,100

A17 Waikuku

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Waikuku Stream Current	Average	155	0	31%
	1 in 4 year event	169	0	40%
	1 in 10 year event	180	0	44%
	Worst year	191	1	47%
Waikuku Stream Current Pathways adjusted	Average	200	0	56%
	1 in 4 year event	207	0	63%
	1 in 10 year event	210	0	65%
	Worst year	211	1	70%
Waikuku Stream Solutions Package	Average	202	0	60%
	1 in 4 year event	207	0	66%
	1 in 10 year event	210	0	69%
	Worst year	211	1	74%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Waikuku Stream Current	Revenue	\$7,300	\$0	\$1,800	\$2,000	\$0	\$6,200
	Expenses	\$4,900	\$0	\$1,600	\$1,600	\$0	\$4,300
	Operating Profit	\$2,300	\$0	\$200	\$400	\$0	\$2,000
Waikuku Stream Current Pathways adjusted	Revenue	\$5,400	\$0	\$1,300	\$1,500	\$0	\$4,600
	Expenses	\$4,000	\$0	\$1,400	\$1,200	\$0	\$3,500
	Operating Profit	\$1,300	\$0	-\$100	\$200	\$0	\$1,100
Waikuku Stream Solutions Package	Revenue	\$5,400	\$0	\$1,200	\$1,400	\$0	\$4,600
	Expenses	\$3,900	\$0	\$1,400	\$1,200	\$0	\$3,400
	Operating Profit	\$1,500	\$0	-\$100	\$200	\$0	\$1,200

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Waikuku Stream Current	Revenue	\$6,600	\$0	\$1,600	\$1,800	\$0	\$5,700
	Expenses	\$4,900	\$0	\$1,600	\$1,600	\$0	\$4,300
	Operating Profit	\$1,700	\$0	\$0	\$200	\$0	\$1,400
Waikuku Stream Current Pathways adjusted	Revenue	\$4,900	\$0	\$1,200	\$1,300	\$0	\$4,300
	Expenses	\$4,000	\$0	\$1,400	\$1,200	\$0	\$3,500
	Operating Profit	\$900	\$0	-\$200	\$100	\$0	\$700
Waikuku Stream Solutions Package	Revenue	\$4,900	\$0	\$1,100	\$1,300	\$0	\$4,200
	Expenses	\$3,900	\$0	\$1,400	\$1,200	\$0	\$3,400
	Operating Profit	\$1,000	\$0	-\$300	\$100	\$0	\$800

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Waikuku Stream Current	Revenue	\$6,200	\$0	\$1,500	\$1,700	\$0	\$5,400
	Expenses	\$4,900	\$0	\$1,600	\$1,600	\$0	\$4,300
	Operating Profit	\$1,300	\$0	-\$100	\$100	\$0	\$1,100
Waikuku Stream Current Pathways adjusted	Revenue	\$4,500	\$0	\$1,100	\$1,200	\$0	\$3,900
	Expenses	\$4,000	\$0	\$1,400	\$1,200	\$0	\$3,500
	Operating Profit	\$500	\$0	-\$400	-\$100	\$0	\$300
Waikuku Stream Solutions Package	Revenue	\$4,400	\$0	\$1,000	\$1,100	\$0	\$3,800
	Expenses	\$3,900	\$0	\$1,400	\$1,200	\$0	\$3,400
	Operating Profit	\$500	\$0	-\$400	-\$100	\$0	\$400

A18 Taranaki Creek

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Taranaki Creek Current	Average	50	0	4%
	1 in 4 year event	72	0	7%
	1 in 10 year event	80	0	7%
	Worst year	96	0	7%
Taranaki Creek Current Pathways adjusted	Average	142	0	17%
	1 in 4 year event	153	0	23%
	1 in 10 year event	160	0	24%
	Worst year	168	1	25%
Taranaki Creek Solutions Package	Average	142	0	17%
	1 in 4 year event	153	0	23%
	1 in 10 year event	160	0	24%
	Worst year	168	1	25%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Taranaki Creek Current	Revenue	\$9,000	\$2,900	\$2,300	\$2,600	\$0	\$7,400
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$0	\$4,900
	Operating Profit	\$3,200	\$500	\$500	\$600	\$0	\$2,500
Taranaki Creek Current Pathways adjusted	Revenue	\$7,800	\$2,600	\$2,100	\$2,300	\$0	\$6,400
	Expenses	\$5,400	\$2,200	\$1,700	\$1,800	\$0	\$4,500
	Operating Profit	\$2,400	\$400	\$300	\$500	\$0	\$1,900
Taranaki Creek Solutions Package	Revenue	\$8,200	\$2,600	\$2,100	\$2,300	\$0	\$6,700
	Expenses	\$5,400	\$2,200	\$1,700	\$1,800	\$0	\$4,500
	Operating Profit	\$2,800	\$400	\$300	\$500	\$0	\$2,200

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Taranaki Creek Current	Revenue	\$8,900	\$2,900	\$2,200	\$2,500	\$0	\$7,200
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$0	\$4,900
	Operating Profit	\$3,000	\$500	\$400	\$500	\$0	\$2,400
Taranaki Creek Current Pathways adjusted	Revenue	\$7,500	\$2,500	\$1,900	\$2,200	\$0	\$6,100
	Expenses	\$5,400	\$2,200	\$1,700	\$1,800	\$0	\$4,500
	Operating Profit	\$2,000	\$200	\$200	\$400	\$0	\$1,600
Taranaki Creek Solutions Package	Revenue	\$7,800	\$2,500	\$1,900	\$2,200	\$0	\$6,400
	Expenses	\$5,400	\$2,200	\$1,700	\$1,800	\$0	\$4,500
	Operating Profit	\$2,400	\$200	\$200	\$400	\$0	\$1,900

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Taranaki Creek Current	Revenue	\$8,800	\$2,900	\$2,200	\$2,500	\$0	\$7,200
	Expenses	\$5,900	\$2,400	\$1,800	\$2,000	\$0	\$4,900
	Operating Profit	\$3,000	\$500	\$400	\$500	\$0	\$2,300
Taranaki Creek Current Pathways adjusted	Revenue	\$7,400	\$2,400	\$1,900	\$2,100	\$0	\$6,000
	Expenses	\$5,400	\$2,200	\$1,700	\$1,800	\$0	\$4,500
	Operating Profit	\$1,900	\$200	\$200	\$300	\$0	\$1,500
Taranaki Creek Solutions Package	Revenue	\$7,700	\$2,400	\$1,900	\$2,100	\$0	\$6,300
	Expenses	\$5,400	\$2,200	\$1,700	\$1,800	\$0	\$4,500
	Operating Profit	\$2,300	\$200	\$200	\$300	\$0	\$1,800

A19 Saltwater Creek

Severity of restrictions

		Days of partial restriction	Days of full restriction (100% restriction)	Volume restriction
Saltwater Creek Current	Average	0	0	0%
	1 in 4 year event	0	0	0%
	1 in 10 year event	1	0	0%
	Worst year	4	0	0%
Saltwater Creek Current Pathways adjusted	Average	208	0	52%
	1 in 4 year event	212	0	59%
	1 in 10 year event	212	0	64%
	Worst year	212	0	69%
Saltwater Creek Solutions Package	Average	208	0	52%
	1 in 4 year event	212	0	59%
	1 in 10 year event	212	0	64%
	Worst year	212	0	69%
Saltwater Creek Solutions Package 2032	Average	209	0	62%
	1 in 4 year event	212	0	69%
	1 in 10 year event	212	1	75%
	Worst year	213	3	80%

Per ha outcomes by scenario

Average year

Per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Saltwater Creek Current	Revenue	\$9,300	\$3,000	\$2,400	\$0	\$0	\$3,800
	Expenses	\$6,000	\$2,400	\$1,800	\$0	\$0	\$2,700
	Operating Profit	\$3,300	\$600	\$500	\$0	\$0	\$1,100
Saltwater Creek Current Pathways adjusted	Revenue	\$5,600	\$1,800	\$1,400	\$0	\$0	\$2,500
	Expenses	\$4,200	\$1,800	\$1,500	\$0	\$0	\$2,100
	Operating Profit	\$1,400	\$0	-\$100	\$0	\$0	\$300
Saltwater Creek Solutions Package	Revenue	\$5,900	\$1,800	\$1,400	\$0	\$0	\$2,500
	Expenses	\$4,200	\$1,800	\$1,500	\$0	\$0	\$2,100
	Operating Profit	\$1,700	\$0	-\$100	\$0	\$0	\$400
Saltwater Creek Solutions Package 2032	Revenue	\$5,200	\$1,500	\$1,200	\$0	\$0	\$2,200
	Expenses	\$3,800	\$1,700	\$1,400	\$0	\$0	\$2,000
	Operating Profit	\$1,400	-\$100	-\$200	\$0	\$0	\$200

1 in 4 year event

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Saltwater Creek Current	Revenue	\$9,300	\$3,000	\$2,400	\$0	\$0	\$3,800
	Expenses	\$6,000	\$2,400	\$1,800	\$0	\$0	\$2,700
	Operating Profit	\$3,300	\$600	\$500	\$0	\$0	\$1,100
Saltwater Creek Current Pathways adjusted	Revenue	\$5,200	\$1,600	\$1,300	\$0	\$0	\$2,300
	Expenses	\$4,200	\$1,800	\$1,500	\$0	\$0	\$2,100
	Operating Profit	\$1,000	-\$200	-\$200	\$0	\$0	\$100
Saltwater Creek Solutions Package	Revenue	\$5,400	\$1,600	\$1,300	\$0	\$0	\$2,300

	Expenses	\$4,200	\$1,800	\$1,500	\$0	\$0	\$2,100
	Operating Profit	\$1,300	-\$200	-\$200	\$0	\$0	\$200
Saltwater Creek Solutions Package 2032	Revenue	\$4,800	\$1,400	\$1,100	\$0	\$0	\$2,000
	Expenses	\$3,800	\$1,700	\$1,400	\$0	\$0	\$2,000
	Operating Profit	\$900	-\$300	-\$300	\$0	\$0	\$0

Worst year

per ha		Dairy	Arable	Sheep and Beef	Dairy Support	Viticulture	Weighted Average
Saltwater Creek Current	Revenue	\$9,300	\$3,000	\$2,400	\$0	\$0	\$3,800
	Expenses	\$6,000	\$2,400	\$1,800	\$0	\$0	\$2,700
	Operating Profit	\$3,300	\$600	\$500	\$0	\$0	\$1,100
Saltwater Creek Current Pathways adjusted	Revenue	\$4,600	\$1,400	\$1,100	\$0	\$0	\$2,000
	Expenses	\$4,200	\$1,800	\$1,500	\$0	\$0	\$2,100
	Operating Profit	\$400	-\$400	-\$400	\$0	\$0	-\$200
Saltwater Creek Solutions Package	Revenue	\$4,800	\$1,400	\$1,100	\$0	\$0	\$2,000
	Expenses	\$4,200	\$1,800	\$1,500	\$0	\$0	\$2,100
	Operating Profit	\$600	-\$400	-\$400	\$0	\$0	-\$100
Saltwater Creek Solutions Package 2032	Revenue	\$4,100	\$1,100	\$900	\$0	\$0	\$1,700
	Expenses	\$3,800	\$1,700	\$1,400	\$0	\$0	\$2,000
	Operating Profit	\$300	-\$600	-\$500	\$0	\$0	-\$300