Land and Water Management in Ashburton District – Economic Impact Report

Executive Summary

The National Policy Statement for Freshwater Management and associated legislation has reframed the approach for land and water management in New Zealand. These are intended to address a range of issues associated with freshwater quality and land management, particularly in relation to the role that primary production plays with the environment. The regulations are significant. They are likely to change the way a number of farm systems are structured and how they operate.

This report was requested by the Ashburton District Council to assess the possible economic impact of the National Policy Statement for Freshwater Management and the associated legislation. It aims to provide an understanding of the implications of, and estimate the potential economic impact of the regulations at both farm and community level in the Ashburton District.

Existing economic and farm practice change modelling data was used as the basis for calculations. This modelling was previously undertaken to identify the impact of 'Plan Change Two' of the Canterbury Land and Water Regional Plan on the Hinds Plains Catchment, and it has been used to provide a very conservative indication of the economic impact of the new regulations. The modelling data was extrapolated across the wider Ashburton District.

The impact assessment identified a significant change in land use as farm businesses responded to regulations and the requirement to reduce nutrient losses. Typically, the businesses moved away from intensive, high input systems to less intensive, lower input farm systems. Complete system changes and land use changes are predicted to occur as the mitigation and nutrient loss requirements became more stringent.

The most stringent mitigation under Plan Change Two was used as a proxy for calculating the economic impact of the new regulations. Under these conditions, dairy farming land-use decreased from approximately one third of land area to one fifth of land area. This is replaced by a large increase in sheep and beef land-use and a slight increase in arable farming.

Coinciding with the change in land-use, all land uses also see a reduction in profitability. In the case of dairy farming, which shows the greatest impact of the regulations, profitability declines by 83%, with other farm types also showing reduced profitability. The remaining low level of profitability may pose a significant challenge for meeting principal repayment obligations in the future, and potentially call into question the economic sustainability of some farm businesses.

Under the National Policy Statement for Freshwater Management and the associated legislation, conservative estimates show that farm profitability will decline by -$57.9M or -83%, and farm expenditure will decline by -$139.9M or -23% across the district. This will flow through to affect 653 employees. These figures do not take into account the effects of Plan Change Two on farms in the Hinds Plains Catchment.

The regulations will challenge existing farming systems with a number of established farm practices needing to change, and new technology and innovation adoption will be required. This will come at a cost and will push farm businesses beyond their comfort zone. Many businesses will be faced with significant profit reductions, farm spending will reduce affecting jobs on-farm and in the Ashburton community.

These will be significant issues to navigate and this report makes two recommendations to continue moving forward:

1. The Ashburton District Council receives the report.
2. That the report be referred to the Canterbury Mayoral Forum and other relevant stakeholders (both political and industry organisations) for consideration and comment.

Land and Water Management in Ashburton District – Economic Impact

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Problem Definition

New land and water management regulations have been implemented by the New Zealand Government, however, there has been limited assessment of the economic impact of these rules. Understanding the quantum and the way these regulations may affect businesses is important for managing the negative effects.

Introduction

Land and Water are important natural resources which underpin the economic development of Ashburton District. The sustainable use of these resources is critical so that opportunities for future generations are not restricted by the activities of today. This requires a careful balancing act between current and future needs.

After a period of community consultation and submissions on the 'Essential Freshwater' reforms late last year, several pieces of legislation were passed into law in early August 2020 – the National Policy Statement for Fresh Water Management (NPS-FWM), the National Environmental Standards for Fresh Water Regulations and Stock Exclusion Regulations. These are intended to address a range of issues associated with freshwater quality and land management, particularly in relation to the role that primary production plays with the environment.

The rules will affect all types of farming with a greater impact on more intensive land uses. Ashburton District is recognised as having intensive agricultural land uses, except for high-country farming.

Economic Impact

Initial work was undertaken by primary industry levy funded bodies during the 'Essential Freshwater Policy' submission period in October 2019 (Doole, 2019; MFE, 2019; Stroombergen, 2019; SENSE Partners, 2019; Beetham & Garland, 2019). These reports identify a likely decline in farm productivity and profitability as farms change their management in response to the regulations. Five areas of likely impact are highlighted in the reports, and are summarised as:

1. Reduced productivity – Limits on Nitrogen input leading to lower stocking rates, restrictions on key farm management practices, loss of productive land through mitigation measures.
2. Increased operating costs – Additional compliance and audit costs, additional borrowing.
3. Increased capital spending – Upfront spend on mitigation actions such as fencing, stock handling facilities, infrastructure etc.
4. Reduced opportunities for diversification – Land use changes may require a consent; low producing farms have restrictions on their ability to lift productivity.
5. Reduction in capital value of land – Uncertainty and complexity of the regulation will undermine business confidence and is likely to lead to a reduction in land values.

The approach for assessing economic impact

A 'desk-top' approach was considered an appropriate and cost-effective way to determine the quantum and way in which the district may be affected. Two possible approaches were identified.

One approach was to use the modelling and case study data developed for the Essential Freshwater Policy submission phase. These reports were developed by the agricultural peak bodies and they explored the impact at a regional and national level with focus on each respective sector.

An alternative approach was to utilise the Hinds Plains Catchment modelling reports (Everest, 2013) which were initially completed in 2013 and updated in 2018. This work was commissioned by ECAN and explored the economic impact of Plan Change Two (PC2) of the Canterbury Land and Water Regional Plan on the Hinds Plains Catchment.

The first approach using Essential Freshwater submissions was dismissed as the reports were considered too broad, and significant areas of judgement were required to identify suitable datasets relevant to the Ashburton District.

The Hinds Plains Catchment modelling approach was identified as the preferred basis for assessing the economic impact of the regulations. This approach was chosen for several reasons:

1. A large proportion of the Ashburton District is evaluated in the reports. The Hinds Plains Catchment represents nearly half (47%) of all the plains area of the Ashburton District, and is one third of the entire agricultural land-use, including the high country.
2. The natural resources, geography and community infrastructure are similar for businesses in the Hinds Plains Catchment as other farms on the plains.
3. The Hinds Plains Catchment reports were commissioned by the regional regulator, assessed using a recognised farm management modelling tool, Farmax, and were updated and peer reviewed.

Rationale and limitations of using the Hinds Plains Catchment data

It is important to note that using Hinds Plains Catchment data will provide a broad indication of the economic impact rather than an exact impact figure.

There are two reasons for this. Firstly, the natural resources (soils, rainfall, topography etc) in Hinds Plains Catchment are broadly similar but not exactly the same as the rest of the district. The variation within the catchment is reasonably representative of the variation across the remaining plains area of the district. Everest (2013) highlighted that on-farm practices play a more important role in mitigation rather than the natural resources per-se. On this basis, the Hinds Plains Catchment Farmax modelled data was considered to be a valid data set which can be applied to the remaining land area of the plains of the Ashburton District.

Secondly, the requirements for the new land and water regulations are similar but different from PC2. Both aim to reduce nutrient loss and changes to farm practices through infrastructure investment and reduced farm inputs. However, they both tackle these issues slightly differently. It is considered that the new land and water regulations are more stringent than the existing PC2 requirements, with central government intervention in the day to day management of specific farm practices and a change to the priorities with the use of water (Bennett, 2020). This is evidenced by a range of attributes that must now be given effect through the regulations. Of particular significance are the

freshwater Nitrate – Nitrogen attribute levels for rivers. Under PC2, 6.9mg nitrogen per litre (mgN/L) or less was required, whereas the new regulations require the level to be 2.4mgN/L per litre or less.

When considering the validity of using the Hinds Plains Catchment modelling on a district wide basis, it is considered that both the land use, and the natural resources are similar. The environmental outcomes sought by PC2 and the new regulations are aligned, though the new regulations require a higher standard of water quality. On balance, it is considered that using the Hinds Plains Catchment modelling as a reasonable starting point for estimating a district wide economic impact.

Method

The Ashburton district-wide economic impact was determined by calculating the effects on each type of land use and by how large of an area that land use accounted for in the district. This was undertaken in six steps:

1. *Determine the area of each land use in the Ashburton district* - The 'footprint' of each land use was calculated using a land-use map created in 2012 (LandcareResearch, 2012). This map used GIS data to determine the acreage of each type of land-use in the district.
    a. The current-day area of dairy farming was updated using 2020 data (Infometrics, 2020). Judgement was applied to estimate the land-use change in the intervening period for arable, mixed system, sheep and beef, deer and horticulture in 2020.
    b. Estimates were made for irrigation use based on an interview with an irrigation company, Irrigo. This identified 220,000 hectares (79%) of the plains being under irrigation (J. Wright, personal communication, August 20, 2020).
    c. Figures show that dairy support land use accounts for 25% of the land currently used under dairy farming (Englebrecht & Everest, 2018).

2. *Determine the predicted economic impact for each land use* - The economic impact calculations for land use on the Ashburton District plains (as distinct from the high country) are detailed in the 'MAR Economic Review report – 2018'. This report identifies economic impact values for dairying, irrigated and dryland dairy support, irrigated and dryland arable, irrigated and dryland sheep, beef and deer (Englebrecht & Everest, 2018).
    a. The new regulations are more stringent than PC2, therefore the highest level of mitigation, '48 % reduction' figures are used (Englebrecht & Everest, 2018, p.17).
    b. Figure 5 from Englebrecht and Everest (2018, p. 16) is used to identify the application of the appropriate mitigation and corresponding economic impact figure.
    c. Figure 7 from Englebrecht and Everest (2018, p. 17) is used to calculate the economic impact on each respective land use.

    The horticultural economic impact calculation is based on the irrigated arable figures.
    a. Outdoor vegetable production (potatoes, onions and squash) makes the greatest GDP contribution to the horticultural land use in the Ashburton District (Infometrics, 2020). For this report, the farm management response to achieving the environmental requirements is considered to be consistent with arable land-use changes. However, it is recognised that horticulture is a more intensive land use than irrigated arable.

    The high-country economic impact was calculated based on the case study work of Beetham and Garland (2019).
    a. Several sheep and beef case studies were prepared in the report and the case study which most closely reflected a high-country operation was selected.
    b. Case study Farm B was used for the basis of the calculation from Beetham and Garland (2019, p.39-44, p.68-71)

c. B+LNZ Economic Service dataset (Beef and Lamb NZ, 2020)- Land class 1 classified as '*South Island high country – all regions'* was used to cross-reference high country farm production, stocking rates, product mix, effective area and other farm performance data.
d. Expert judgment in consultation with existing high-country farmers, was used to identify the possible implications of the regulations on farm performance and economic impact e.g. fencing, riparian planting, fertiliser use (K. Harmer, personal communication, September 28, 2020).

3. *Establish the projected land-use change for the Ashburton district* – Using the current area of land in each land-use as identified in Step one of the methods approach of this report, the predicted changes in the land-use is calculated using figures presented in Englebrecht and Everest (2018). Englebrecht and Everest (2018) also discuss that the changes in land use and associated economic impact will create significant opportunity costs. These are accounted for as follows:
    a. Using Figure 6 (from Englebrecht & Everest, 2018, p. 17), the current land use areas are recalculated using the percentage change of the Hinds Plains Catchment from '2018 Estimate' to 'land use change for 48%'. The percentage change is applied to the current land use areas calculated in Step one.
4. *Calculate the economic impact on agriculture in the Ashburton District* - The different types of land-uses across the district for both dryland and irrigated are multiplied by the economic impact as identified in Step two.
    a. Impact = (dairy hectares x Net Profit After Tax (NPAT[1])) + (irrigated dairy support hectares x (NPAT) + (irrigated arable hectares x (NPAT) etc…
    b. All the land uses calculations are added together to get a district wide economic impact assessment for agriculture.

5. *Account for changes in farm expenditure and their flow on affect into the district* – The changes in farm expenditure are detailed in the 'MAR Economic Review report – 2018'. This report identifies changes to expenditure for dairying, irrigated and dryland dairy support, irrigated and dryland arable, irrigated and dryland sheep, beef and deer (Englebrecht & Everest, 2018).
    a. Using Figure 6 (from Englebrecht & Everest, 2018, p.17), the expense figures relating to each farm type for Good Management Practice (GMP) and '48% reduction' figures are used,
    b. The difference between these figures for each land use are calculated and multiplied by the respective land use area.
    c. The Infometrics Regional multiplier model is applied to the change in farm expenditure to establish the effect of reduced farm expenditure on employment.
6. *Peer review* – Infometrics was engaged to review the methodology applied in this report for calculating the on-farm impact, farm expenditure changes and the effect on employment. The approaches undertaken in developing this report were considered reasonable.

Results

Total agricultural land in the Ashburton District equates to 395,658 hectares, with 114,153 hectares located in the high country and 281,505 hectares on the plains. The Hinds Plains Catchment covers 131,411 hectares of land on the plains of Ashburton District.

[1] NPAT – is 'Net Profit after Tax', which excludes principal payment and capital expenditure

To draw a comparison between the well documented Hinds Plains Catchment, with the wider Ashburton District, table one is created. Table one establishes the projected land-use change for the Ashburton District if it is subjected to the restrictions proposed under Englebrecht and Everest's '48 % reduction and change land use'. The results show a significant change in many types of land-use.

Currently, land used for dairy farming equates to 25.5% of the district with a further 6.4% devoted to dairy support giving a total dairy footprint of 31.9% of the district's agricultural land. Arable farming covers 20.6% of land, with sheep, beef and deer using a further 45.6%. This includes high country farming which makes up two thirds of that area. Under the conditions of '48% reduction and land-use change', the dairy farming footprint declines to 20.7% of land area. The figures project a significant increase in sheep and beef farming to 55% of total land use with that increase occurring on the plains, mostly as irrigated sheep and beef farming. Arable shows a five percent increase in land use.

Table 1: Land-use from current to 48% reduction in nutrient loss and land use change in Ashburton District

	Hinds Plains Catchment '48 % reduction and change land use' (%)	**Current Ashburton District land use (ha)	Estimated irrigation/ dryland land use spilt (ha)	Ashburton District - '48 % reduction and change land use' (ha)
Dairy 3	-33%	101,278	101,278	**68,292**
Dairy Support –irrigated	-33%	25,335	20,403	**13,671**
Dairy Support - dryland	-33%		4,932	**3,304**
Arable – irrigated (ave 1,2,&3)	+38%	81,760	73,648	**74,440**
Arable (4) - dryland	0%		8,111	**11,082**
Horticulture and other	0%	6,936	6,936	**6,936**
Sheep, Beef & Deer - irrigated	+52%	66197	36,242	**72,213**
Sheep, Beef & Deer- dryland	+0%		29,955	**31,567**
High country - sheep and beef	0	114,153	114,153	**114,153**
TOTAL		395,659	395,658	**395,658**
	Derived from (Englebrecht & Everest, 2018)	Extrapolated from Landcare land use map	(based on 79% land being irrigated)	

The results of table one show that land-use change will occur to meet the environmental standards. Significantly, the land-use will shift from more intensive to less intensive practices i.e. from dairy farming to sheep and beef. These findings are consistent with other research undertaken (Doole, 2019; Higgins & Lefroy, 2020).

The assessment in table two shows an economic impact at a district level of -$113,017,097. This is largely driven by the negative impact on dairy farming performance which accounts for 62% of the district's reduction. This decline grows to 68% when changes to dairy support land-use is included.

Most farm types demonstrate a reduced level of profitability once the mitigation measures are put in place. Dairy farming is forecast to change from an NPAT of $783 per hectare, under GMP to an NPAT of $131 per hectare, after the recommended mitigations have been implemented. This change equates to a decline in profit by 83%.

After the appropriate mitigations, dryland dairy support is forecast to make an operating loss, and irrigated dairy support, while still making a surplus, is forecast to decline in profit by 91%. Irrigated arable is forecast to decline by 71% in profitability ($404/ha under GMP to $118/ha after mitigation). Lower input land uses show a variable response. Dryland arable will produce a net loss, as does dryland sheep, beef and deer, while irrigated sheep, beef, and deer show a modest improvement in overall farm profitability through changed farm practices.

Table 2: Summary of the estimated on-farm economic impact of '48 % reduction in nutrient loss plus land use change' in the Ashburton District

Land use type	*2020 Land use area (ha)*	GMP* NPAT* ($/ha)	Total profit with Good Management Practices ($)	*Land use change (ha)*	AM2** NPAT ($/ha)	AM3** NPAT ($/ha)	Total profit with 48% reduction + land use change ($)
Dairy 3	*101,278*	783	79,300,674	*68,292*	640	**131**	8,946,252
Dairy Support – irrigated	*20,403*	336	6,855,408	*13,671*	113	**30**	410,130
Dairy Support - dryland	*4,932*	500	2,466,000	*3,304*	326	**-45**	-148,680
Arable irrigated (average 1,2,&3)	*73,648*	404	29,753,792	*74,440*	219	**118**	8,784,156
Horticulture and other	*6,936*	404	2,802,144	*6,936*	219	**118**	818,448
Arable (4) - dryland	*8,111*	170	1,378,870	*11,082*	**-4**	32	-44,328
Sheep, Beef & Deer - irrigated	36,242	19	688,598	*72,213*	78	**20**	1,444,260
Sheep, Beef & Deer- dryland	29,955	171	5,122,305	*31,567*	**76**	39	2,399,092
High country - sheep & beef	*114,153*		9,931,311	*114,153*			2,672,675
TOTAL Profit For Ashburton District	395,658		138,299,102	395,658			25,282,005
Change in TOTAL Profit							**-$113,017,097**
	Refer Table 1	(Englebrecht & Everest, 2018)		Refer Table 1	(from Figure 7 Englebrecht & Everest, 2018, p.17)		

*GMP – Good Management Practice; NPAT – Net Profit After Tax;
**AM2/3 - Advanced Mitigation 2/3
+ shaded box denotes the NPAT figure used in the profit calculation

The change in expenditure on farm is demonstrated in table three where current land use under GMP is recalculated for '48% reduction and change of land use'. The on-farm expenditure figures are reported by Englebrecht & Everest, (2018, p.17) and extrapolated across the Ashburton District. The results for the Ashburton District show farm expenditure is projected to decrease by -$263,427,980 or -22%.

	Good Management Practice (GMP)			48% reduction and changed land use			
	Current Land Use (ha)	Expenses ($/ha)	Total Expenses ($)	Changed Land Use (ha)	Expenses ($/ha)	Total expenses ($)	Total expense change ($)
Dairy	101,278	7,131	722,213,418	68,292	5,760	393,360,134	-328,853,284
Dairy suppt - Irrig	20,403	2,187	44,622,105	13,671	2,293	31,346,566	-13,275,538
Dairy suppt - Dry	4,932	2,074	10,228,263	3,304	2,054	6,786,790	-3,441,473
Arable – Irrig	73,648	3,731	274,779,793	74,442	3,763	280,123,365	5,343,572
Arable – Dry	8,111	1,724	13,983,778	11,082	1,887	20,912,401	6,928,623
Sheep, Beef & Deer - irrigated	36,242	1,417	51,354,914	72,213	1,558	112,507,854	61,152,940
Sheep, Beef & Deer-dryland	29,955	1,119	33,519,645	31,567	1,331	42,015,677	8,496,032
Hortic & other	6,936	3,731	25,878,216	6,936	3,763	26,100,168	221,952
SnB H Country	114,153	123	14,040,819	114,153	123	14,040,819	0
			1,190,620,951			**927,192,898**	**-263,427,176**
Hinds Plains Catchment is 47% of land area. The remaining district covers 53% of the land area				(0.53 x -$263,427,176) = -**$139,616,404** is the effect of the NPS-FWM on farm expenditure			

Table 3. Changes in on-farm expenditure from GMP to '48% reduction plus changed in land use'.

Table 3 shows that farm expenditure will decline by 22% through farm practice and land use change with -$263M less being spent by farm businesses with their suppliers and service providers. Dairy farming shows the biggest change with a projected 50% decrease from GMP levels. This is partially offset by substitution of land use to sheep, beef and deer, as well as arable land uses who show increases in spending. These farm systems operate with a lower cost structure with less inputs, and as a result do not fully replace the decline in expenditure from dairy farming but contribute toward achieving the required reduction in nutrient loss.

To estimate the employment effect of a change in farm expenditure, the Infometrics Regional multiplier model has been used. The multiplier model is based on inter-industry relationships within an economy, understanding how shocks in one industry flow onto other industries and ultimately households. The employment effect of a change in farm expenditure includes indirect affects (changes relating to farm suppliers) and induced effects (changes in household expenditure).

The change in farm expenditure and its potential impact on the Ashburton District can be represented by their effect on employment. Table four shows that 1,233 less people will be employed because of the decreases in farm expenditure. Employment associated with the dairy industry will undergo greater change (1,624 people decrease) which is offset with an increase in employment associated with other land uses. The nett effect is that 1,233 fewer roles will result from the changes in on-farm expenditure.

Table 4. The impact of changes to on-farm expenditure on employment

	District wide employment effect
Dairy	-1,624
Dairy support - Irrig	-66
Dairy support - Dry	-17
Arable - Irrig	30
Arable - Dry	55
S,B & D - Irrig	341
S, B & D - Dry	47
Hortic & other	1
SnB High Country	0
TOTAL	**-1,233**
Hinds Plains Catchment is 47% of land area. The remaining district covers 53% of the land area	(0.53 x --1,233) = -**653** employees is the effect of the NPS-FWM on employment

Discussion

In order to achieve a 48% reduction in nutrient loss, all farm businesses will need to significantly change their production systems. This will involve reducing inputs, investment into new infrastructure, changes away from the current use of land and generally operating a lower input farm system.

The Hinds Plains Catchment is a reasonable representation of the wider Ashburton District with similar types of farming, biophysical resources, and community infrastructure. Several reports which were drafted for Plan Change 2 provide an in-depth study of that area and a Farmax model that identifies likely on-farm management responses and investments in technology required to achieve the regulations (Everest, 2013; Daigneault, Samarasinghe, & Lilburne, 2013; Englebrecht & Everest, 2018). These reports provide a useful starting point for calculating the district wide impact of implementing environmental practices.

On-farm economic impact

The modelling for the Hinds catchment, extrapolated across the Ashburton District details the economic impact of meeting the conditions of PC2. The PC2 goals are a reasonable representation of what is currently required district wide. Assessed, the economic impact of meeting the PC2

regulations is estimated at -$113,017,097 in district-wide farm profit for implementing a '48% reduction in nutrient loss plus changed land use' to a lower intensity of farming. These rules aim to reduce nutrient loss to 6.9mg N/L.

When considering the impact of the NPS-FWM, it is important to account for the impact of existing regulations which farmers are already working towards. Farm businesses within the Hinds Plains Catchment are already on their way to achieve PC2 and so the impact of those regulations should be considered separately since they have been in place since 2018. This report is considering the marginal cost of implementing the NPS-FWM, without the existing cost of achieving PC2.

The effect of the PC2 regulations on the Hinds Plains Catchment was previously calculated at a cost of -$55,134,128 NPAT (Englebrecht & Everest, 2018, p. 20). In table two, the district wide impact is calculated at -$113,017,097 NPAT. Therefore, the effect of the NPS-FWM is the difference between these figures which is -$57,882,973 NPAT per annum.

Dairy farming is currently the most profitable and highest input land use assessed by Englebrecht & Everest, (2018) for the Ashburton District. The figures demonstrate that the greatest effect occurs in dairy farming with a reduction in profitability by 83%, and a reduction in acreage by 33%. Changes to dairy farming profitability and turn over will have the greatest impact on the Ashburton District. Once again, the NPS-FWN and associated legislation contains new regulations such as a nitrogen cap and winter grazing conditions that are not included within PC2 regulations. These are not accounted for in the calculations.

High country sheep and beef farming has few land-change options so no change in land use has been forecast. However, profitability of high-country farming is impacted with the profit reducing by 73%. Under the NPS-FWM and the associated regulations, the profit impact primarily occurs through the low slope and stock exclusion rules. These rules introduce a high capital cost for fencing with negligible economic benefit, while nutrient loss and water quality requirements are a lesser issue.

While PC2 estimates a significant economic impact, it is important to note that the NPS-FWM require a fresh water nitrogen level of 2.4mg N/L or less; this is approximately one third lower than the level targeted in PC2 (6.9mg N/L). This means that an economic assessment based on PC2 requirements will be very conservative compared to on-farm actions and land use change which will be necessary to achieve NPS-FWM. It is difficult to assess the cost of achieving a soluble nitrate level of 2.4 mg/L as there is very limited information or impact modelling on which to derive an assessment.

Given the likelihood that the easily implemented practice change and the logical land use changes are modelled in the PC2 calculations (Everest, 2013; Englebrecht & Everest, 2018), working towards the lower freshwater nitrate level will become increasingly more costly, relative to nutrient reductions achieved. The concept of diminishing returns is supported by the modelling work of Englebrecht & Everest, (2018) where they showed that the cost of mitigation becomes increasingly more expensive as lower soluble nitrogen freshwater levels are achieved.

Farm value

The NPAT figures in table 2 include all business expenditure other than principal repayments and capital expenditure. A sustainable business should generate sufficient profit to reduce debt over time and to replace plant and equipment. The profits shown in the assessment are low and without the ability to cover these costs, the sustainability of the business is questionable.

Furthermore, the reduced levels of profitability may also have an impact on the capital values of land. Englebrecht & Everest, (2018) proposed that land values may reduce by $11,800 per hectare. This equates to an approximate 25% decline in value. If this decrease in value materialises, it will expose

some businesses to debt and equity issues. Doole, (2019) discussed this risk in relation to the dairy industry and calculated that nationwide, the number of insolvent dairy farms is likely to rise from the current level of 2% to 11% under the 'Essential Freshwater' package.

Farm expenditure and employment

The decline in farm profitability results from a decline in expenditure. The reduction in profit is caused by lower inputs such as Nitrogen and reduced stocking rates, which generally increase profit. This is projected to result in a reduction of on-farm expenditure of $263M per annum.

Applying the same approach previously used with the NPAT calculation which takes into account the existing PC2 impact, the Hinds Plains Catchment accounts for 47% of the farm expenditure reduction. This means that 53% of the expense reduction is associated with the NPS-FWM. Table three shows the effect of the NPS-FWM to be -$139,616,404. This figure corresponds to an effect on employment of -653 employees either on-farm, or in the service and supply companies in the Ashburton District.

Implementation timeframe

The PC2 regulations require farms to be mitigating their nutrient losses (48% reduction) by 2035. While challenging, there is commitment from the Hinds Plains Catchment farming community to achieve the targets with support from the Mayfield, Hinds Valetta Irrigation Company, which is working closely with farmers to help them achieve the targeted outcomes. The agreed timeframe will enable farm businesses to refine their farm systems to accommodate the changes required to minimise the potential negative economic impact where possible.

As yet, the new regulations provide little clarity regarding timeframes. Several parts of the new regulations have timeframes identified where they relate to specific on-farm practices, such as sowing dates, fencing and winter grazing. However, achieving freshwater nitrogen levels of 2.4mgN/L, which is considered one of the most challenging aspects of the new regulations, does not currently have a timeframe for implementation specified by central government.

A transition with a short timeframe will exacerbate the risks and enforce a step-change in farm practices. A step-change will limit farmers' ability to de-risk new approaches and adoption of alternative systems. A measured approach, as evidenced by the community approach of the Hinds Plains Catchment, introduced ambitious levels of practice change which are generally acknowledged as achievable though challenging. That timeframe of implementation is enabling farmers to evolve their systems to meet the requirements while learning and evolving their systems to the regulations, and integration of new and emerging technologies.

Conclusion

The impact of the land and water reforms will be significant for the environment, rural communities and farm businesses. Transitioning agriculture to be both environmentally and economically sustainable is critical, and will require a carefully considered approach by all stakeholders. Achieving the land and water outcomes while managing the negative impacts on business will be important for the economic and social wellbeing of the Ashburton District.

The impact of the NPS-FWM will be significant. The decline in profitability of farms in the Ashburton District is conservatively estimated at $57.9M. This level of profit may impact on the financial sustainability of a number of farm businesses, and is likely to accompany a decline in the capital value of farm land across the district. The decline in profit is a result of reduced spending on the drivers of farm productivity such as Nitrogen fertiliser and stocking rates. Farm expenditure is forecast to reduce

by $139M leading to the loss of -653 employee from farms, service and support businesses in the Ashburton District.

Achieving the NPS-FWM outcomes will provide a number of challenges for farmers and for the Ashburton District. In moving forward, further energy should be invested to continue to make progress. By building on well-proven approaches for practice change and filling in gaps in knowledge, the prospects of meeting the requirements of the NPS-FWM will improve, and farm businesses will achieve the balance of environmental and economic sustainability.

Recommendations

There are two recommendations from this report:

1. This report was requested by the Ashburton District Council to understand the potential impact of the NPS-FWM at a farm level and the flow on effects to the Ashburton District. It shows the projected impact on farm profitability, farm expenditure and the effects on employment. This report will help inform the Council of changes to the district associated with the NPS-FWM.

   Recommendation: That the Ashburton District Council receive the report.

2. The report highlights a number of challenges that will arise from the Essential Freshwater reforms. The reach and impact of these reforms will be significant and will change the way businesses will operate, it will change the people who own and work within these businesses, and it will change the communities that support them. These challenges are not unique to Ashburton District. The findings of this report, in principle, can be applied to other territorial authorities to help them understand the emerging challenges and potential opportunities of the NPS-FWM.

   Co-ordinating with other territorial authorities will enable more effective engagement with central government to achieve better outcomes both environmentally and economically. This will be achieved through an aligned voice, a deeper and more consistent understanding of the issues and opportunities, alignment of resources, and greater reach and influence for positive change.

   Recommendation: That the report be referred to the Canterbury Mayoral Forum and other relevant stakeholders (both political and industry organisations) for consideration and comment.

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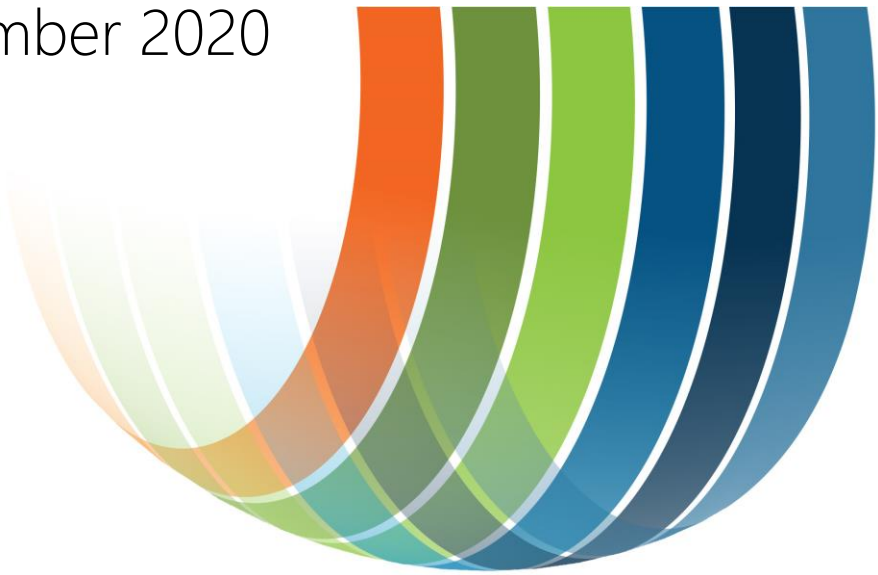
Review of land and water management economic impact modelling

For Ashburton District Council

November 2020



Infometrics

Economics put simply

Reviewing ADC's economic analysis

Ashburton District Council (ADC) modelled the economic impact of new land and water management regulations (*Essential Freshwater*) on the district's economy in the report *Land and Water Management in Ashburton District – Economic Impact*. Ashburton District is expected to be relatively sensitive to these regulations as the economy is heavily reliant on intensive agriculture, both directly through farming activities, and indirectly through support services for the agricultural sector. The purpose of ADC's modelling is to understand the quantum of potential negative effects from Essential Freshwater regulations. ADC asked Infometrics to review their report to provide confidence in using the conclusions from the report publicly.

Review approach

Essentially, this review is asking "does the economic impact report reflect the reasonable and likely impact of new land and water management regulation?"

Infometrics has assessed ADC's overall modelling method, including consideration of the sensitivity of its conclusions to the assumptions made. We have examined ADC's key assumptions and modelling decisions, and assessed if we consider them to be reasonable. We have verified that the conclusions have come from ADC's model, and have checked some parts of the model, but have not audited the model in its entirety.

Methodology

Establishing footprint of each land use

Establishing the existing footprint of each agricultural land use is an important step as it defines the sensitivity of the District to the Essential Freshwater regulation. ADC used detailed mapping from 2012 as a basis for this, updated with more recent information on the prevalence of irrigation and the extent of dairy farming (based on Dairy NZ herd information via Infometrics). Given a general lack of up-to-date and high-resolution land-use mapping, this approach is a reasonable one. Should the extent of higher-intensity land uses such as arable and dairying be overestimated, it would lead to an overestimate of the effect of Essential Freshwater regulations on the District.

Using Hinds Plains Catchment modelling as basis for modelling

ADC considered two approaches to modelling the effects of Essential Freshwater – application of national modelling of Essential Freshwater with subjective adjustments for local conditions, or an extrapolation of previous modelling of similar environmental regulation on the Hinds catchment in Ashburton District. ADC found the results of both approaches to be comparable. ADC chose to base its work on the extrapolation of the Hinds catchment modelling, as it was considered more robust due to the lack of subjective adjustments. This approach provides a greater level of accuracy around the agricultural practices and environmental conditions in the District, but less accuracy around the specifics of the Essential Freshwater regulation. Overall, we agree with this approach.

The Hinds catchment differs from the rest of the District in that it only covers plains, not hill country, and could have different proportions of land use types to other plains areas in the District. ADC have attempted to account for this by using national modelling on

the effect of Essential Freshwater on hill country farming, and land use data to adjust for the relative prevalence of different land uses. Given data limitations, we think this approach is a reasonable one.

The outputs from this approach are somewhat sensitive to the process of adjusting land uses for the prevalence of different land uses between Hinds and other plains in the District.

Land use changes

ADC has modelled land use changes based on the assumption that Good Management Practice (GMP) is currently in use, and that land use will change to meet the most strict requirements of Plan Change 2 (PC2) modelled for the Hinds catchment. The limits for dissolved nitrogen are substantially tighter under Essential Freshwater than PC2, meaning that the economic impact assessment is likely to understate the economic impact of Essential Freshwater.

The approach of applying nationally modelled effects for extensive (or hill country) sheep and beef farming is less specific and is therefore likely to be less accurate than other land uses. However, extensive sheep and beef farming makes a relatively small economic contribution to the District and is therefore a very small component of the overall economic impact of Essential Freshwater.

In modelling how agricultural activities will change in response to Essential Freshwater, ADC has assumed both a reduction in production levels and a change in farm systems. There is an implicit assumption that for each farm, the current land use represents the highest return for that farm, and therefore any change in land use will be to a land use with a lesser return. This assumption is broadly reasonable, although it should be noted the large-scale land use change prompted by these regulations may enable new land uses to be developed with sufficient scale.

Impact on farm profitability

Essential Freshwater will have an economic effect on the district through two mechanisms.

- Changes in land use towards lower intensity and lower profitability land uses
- A reduction in the intensity of farming activity within intensive land uses, leading to lower profitability

Infometrics advised ADC that it would be time-consuming to develop and apply multipliers to account for the flow-on effect of a change in profit, so ADC has reported a decrease in profit (net profit after tax – NPAT) of $113m without multiplier analysis. ADC removed the effect of changes (both land use and intensity) being made to meet existing regional regulations (PC2), indicating that the Essential Freshwater package would have the effect of reducing Ashburton farm profitability by $57.9m. Overall, this is a reasonable and conservative approach.

Flow-on effect of change in farm expenditure

ADC used the change in farm expenditure for each farm type, and the change in area of land under each farm type, to estimate how farm expenditure would change as a result of essential freshwater. Englebrecht and Everest (2018) indicate that the mix of farm inputs was unlikely to substantially change, and that where it did so, the use of standard economic multipliers, which assume a steady mix of inputs, was appropriate. Infometrics provided a basic multiplier analysis (including indirect and induced effects), which

indicated that the $139.9m decrease in farm expenditure would translate to a net loss of 653 jobs in the district. This reduction amounts to approximately 3% of the District's filled jobs, which seems reasonable given the importance of agriculture to the District's economy – the agriculture industry directly accounts for 24% of employment in Ashburton, with further jobs indirectly supported by the industry.

Due to conservatism in the previous calculation steps, this figure of 653 jobs is likely to be an underestimate. Furthermore, the large impact on farm profitability is also likely to lead to further job losses, although this effect was not quantified.

Comparison with other modelling

Although there is no comparable modelling available on the effect of Essential Freshwater on Ashburton, we can look at national and regional modelling as a form of cross-check. ADC's work will differ to national work because:

- ADC used Englebrecht and Everest's (2018) agronomic modelling, which was based on a detailed understanding of the Hinds catchment in the District. Other work is based on more generalised regional and national modelling.
- Englebrecht and Everest (2018) is designed to model Plan Change 2, not Essential Freshwater. The comparison work is specifically designed to model Essential Freshwater.
- NZIER uses a Computable General Equilibrium (CGE) modelling approach, which accounts for the response of the entire economy to the "shock" of Essential Freshwater. ADC's approach only accounts for the initial economic effect of a reorganisation of the agriculture industry and the reduction in production. The CGE-based approach takes the analysis one step further, by including the positive effect of resources (such as workers) being reallocated from the agricultural industry to enable growth in other industries. The CGE-based approach is likely to be a better indicator of the long-term net effect of the regulations.

Sense Partners[1] estimated that dairy cattle farming employment would fall by 17% nationally. Given that 24% of Ashburton's employment is in the dairy cattle farming industry, this result would suggest an overall drop in the District's employment of 4% due to the fall in dairy farming employment alone. This result does not account for flow-on effects on employment in other industries, nor the slight increase in employment associated with other land uses as a result of Essential Freshwater. This comparison suggests that ADC's estimate of a 3% decline in employment is conservative.

Dairy NZ[1] estimated that Essential Freshwater would lead to a 50% decrease in dairy farm profit across Canterbury Region, compared to a 41% reduction suggested in ADC's work. Sapere[2] estimated that Canterbury would struggle to meet the nitrogen limits in freshwater, even using all available mitigations through farm practices. Implementing the available mitigations would lead to a decrease in farm profit of 38.4%, without meeting nitrogen reduction targets.

[1] https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/2183C%20Dairy%20NZ.pdf

[2] https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/essential-freshwater-regulations-industry-impact-analysis.pdf

NZIER[3] estimates starkly different economic effects to the other consulting reports, due to different agronomic modelling and a CGE modelling approach. Its agronomic approach differs from ADC and Englebrecht and Everest (2018) – assuming an increase in arable land use (away from dairying) and no increase in sheep and beef. This assumption means that NZIER estimates a smaller decrease in farm profit of only $88m across Canterbury. The CGE approach, which accounts for long-term adjustments across the economy, suggests an overall decrease in employment of 0.7% in Canterbury.

Discussion

The conservative modelling approach employed by ADC means that the economic effect stated is unlikely to be an overestimate, but is instead quite likely to be an underestimate of the actual effect of Essential Freshwater on the District. The land use change assumptions used in ADC's modelling achieve a far less stringent dissolved nitrogen level than required under Essential Freshwater. In our view, the effect on farm profit is likely to be greater than stated. The effect on employment is also likely an underestimate in several respects – as it neither accounts for the effect on employment resulting from a decrease in profitability, nor the negative effect of achieving a further reduction in dissolved nitrogen beyond PC2 requirements.

We agree that the loss of farm profitability will flow through to farm land values, while also reducing the ability of existing farm operators to make capital repayments on farm borrowings. This outcome raises significant concerns about the viability of many of the district's farms. From a purely economic point of view, the sale of farms at a loss to new operators provides an opportunity for farms to adjust their intensity to meet the Essential Freshwater requirements, but this process is a deeply disruptive process to individuals, businesses, and the broader economy.

There results are sensitive to several assumptions. However, given the overall conservatism taken in the modelling, we consider it very unlikely that the modelling has overestimated the effect of Essential Freshwater regulation. The results are broadly consistent with national modelling by Sense Partners, DairyNZ, and Sapere.

In interpreting the results of this modelling, it is important to consider timeframes and the ability of economies to adapt. The effect of these changes will vary over time – there could be a positive economic effect at first, as investment in farms is made to meet the regulations. This outcome could be followed by a negative effect, as farms reduce output and, therefore, employment and expenditure. Over time, the District's economy will adjust in response to changes in relative prices (for example, land values and wage rates) and other existing industries will grow, or new industries develop. NZIER's national modelling, using a CGE approach that suggests a 0.7% decrease in employment across Canterbury, should be considered as indicative of the long-term effect of the regulation. Furthermore, the District will benefit from improvements in water quality – for example, through amenity value.

The District currently has a significant dairy cattle farming industry with an established supply chain. The disruption to this industry and supply chain expected under Essential Freshwater may be an opportunity for dairy industry resources to shift en masse to some

[3] https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/economic-effects-of-water-quality-proposals-modelling-scenarios.pdf

other industry, enabling it to achieve a scale that wouldn't have been possible otherwise – for example, growing and processing particular crops.

Conclusion

There is considerable uncertainty in understanding how Essential Freshwater will affect national and regional economies. The stated purpose of ADC's modelling is to assess the quantum of the impacts from Essential Freshwater regulations on the District. We have assessed ADC's report and modelling, and believe that it meets the stated purpose. We believe that the modelling follows a reasonable approach and produces reasonable outputs which represent the likely quantum of impacts resulting from Essential Freshwater.

We have only been asked to review the economics of ADC's report and modelling, so do not express an opinion on ADC's policy recommendations based on the modelling.