Hurunui zone limit setting process: Economic assessment of the current state

Draft report prepared for Environment Canterbury

September 2017

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LWP Client Report Number:	2016-03
Report Date:	September 2017
LWP Project:	2017-03

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1 Background

This technical assessment focusses on the Hurunui-Waiau zone and the process managed by Environment Canterbury (ECAN) to assist the Hurunui-Waiau Zone Committee to manage water quality and quantity limits for the zone.

The Hurunui-Waiau zone includes the Waiau, Hurunui, Waipara, and Kowai catchments, and a number of coastal streams which are aggregated into the Northern and Southern coastal streams. The Conway river is excluded from the current zone committee process due to the need for that area to manage earthquake recovery. The zone therefore covers most, but not all, of the Hurunui district.

The report briefly outlines an overview of the economy in the Hurunui zone, focusing on the nature of business and employment. It then focuses on key water using activities, with the primary detail in the land based activities that both use water and contribute to water quality problems. The report concludes with analysis of the contribution of the key agriculture and tourism sectors to the current economy.

2 Economy, business and employment in the Hurunui zone

The economy of the Hurunui district is dominated by agriculture, which comprises 33% of the employment in the district. Accommodation and services, health care, other primary sectors (forestry, fishing and mining), and construction are all 8% - 9% of the employment in the district.

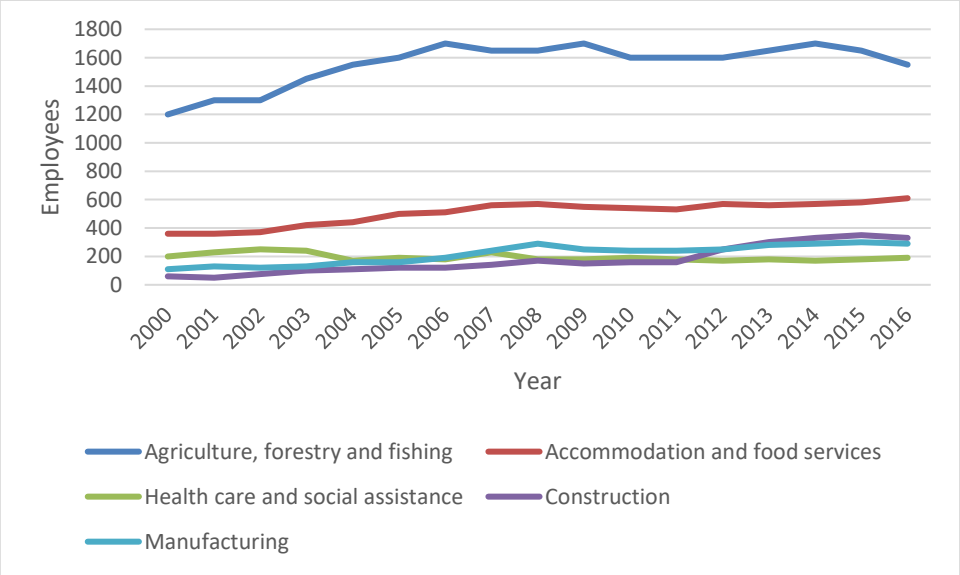
Statistics NZ business demographic data shows that relative to the Canterbury economy the Hurunui district economy is heavily weighted towards a few of the larger sectors (based on share of employment), with agriculture (33% vs 5%), retail trade (9% vs 5%), and forestry, fishing and mining (8% vs 1%) all larger parts of the employment in Hurunui than in New Zealand as a whole (see Table 1). In both Canterbury and New Zealand manufacturing and healthcare and social assistance are the largest industries, and professional, scientific and technical services are in the top five industries nationally, of which only healthcare is represented in the top five of the Hurunui district. The collective primary sector represents 40% of the employment in the district, which suggests an economy strongly focused on these sectors. When the tourism sector, which is an amalgamation of a number of sectors (accommodation, food and beverage, transport etc.), is presented as a whole it is the second largest part of the district with 974 FTEs or ~20% of the employment in the district in the 2013 data.

Table 1: Five largest industries in the Hurunui District by employee count (Statistics NZ, various)

Industry (ANZSIC06)[(1)]	Hurunui District		Canterbury	
	Employee count	Percent of total employee count	Employee count	Percent of total employee count
Agriculture	1,609	33%	13,506	5%
Accommodation and Food Services	458	9%	13,315	5%
Health Care and Social Assistance	408	8%	38,732	15%
Forestry, Fishing, and Mining	403	8%	3,773	1%
Construction	397	8%	29,265	11%

There has been significant growth the Hurunui economy between 2000 and 2016 as measured by number of businesses and employment. The number of businesses has increased from 1950 in to 2658 (36% increase), and employment has increased by 57% over that period. Figure 1 shows that this increase appears to have been led by increases in agriculture, accommodation and food services, and construction. Population has increased from 9970 to 12,700 over that period, an increase of 27%, which suggests that the economic growth is likely to be driven by a number of factors in addition to population growth.

Figure 1: Hurunui District employee count by major sector 2000 - 2016



A Hurunui district model[1] was created in order to estimate the district-wide structure of the economy as described by employment, household income and GDP[2].

[1] Because of the minimal amount of meat and milk processing in the district, no flow-on impacts of processing were calculated for this model.

[2] The employment figures are based on business demographic data and are provided in comparison with the 2012/13 Census estimates, which suggest that the business demographic data significantly underestimates employment. The GDP estimates for the Area units were made on the basis of total district GDP per sector multiplied by each Area Unit's share of district

The Hurunui district model was also subdivided on a Statistical Area Unit basis. The Area Units are not geographically identical to the catchments within Hurunui district, but they are useful because they recognise communities of interest, which are of greater significance from an overall economic perspective than physical catchments. Figure 2 provides a comparison of the Area units and catchments in the district, and the estimates of district employment are shown in Table 2 and of GDP in Table 3.

The district model shows a not unexpected pattern of a dominant agricultural sector in the rural area units, and a more mixed economy in the smaller area units based on townships in the district. Hanmer Springs is the outlier in respect of having a greater employment focus on accommodation and food services, retail trade. Healthcare and social assistance proportionately important in all the townships, but particularly in Hanmer, Cheviot and Amberley.

In terms of GDP, the rural areas are largely focused around agriculture again, but there are some differences for the townships, with for example rental, hiring and real estate being the single largest source of GDP in Hanmer Springs and Amberley, which likely reflects the nature of the industry structure. Overall the Hurunui and Amuri area units, which encompass the Hurunui and Waiau catchments, are the largest contributors to GDP.

employment in each sector. Note that because these are derived from business demographic data that is likely to underestimate employment, the GDP figures provided here are likely to underestimate GDP in some areas.

Figure 2: Location of Area Units and Catchments for Hurunui District (Source:Opus)

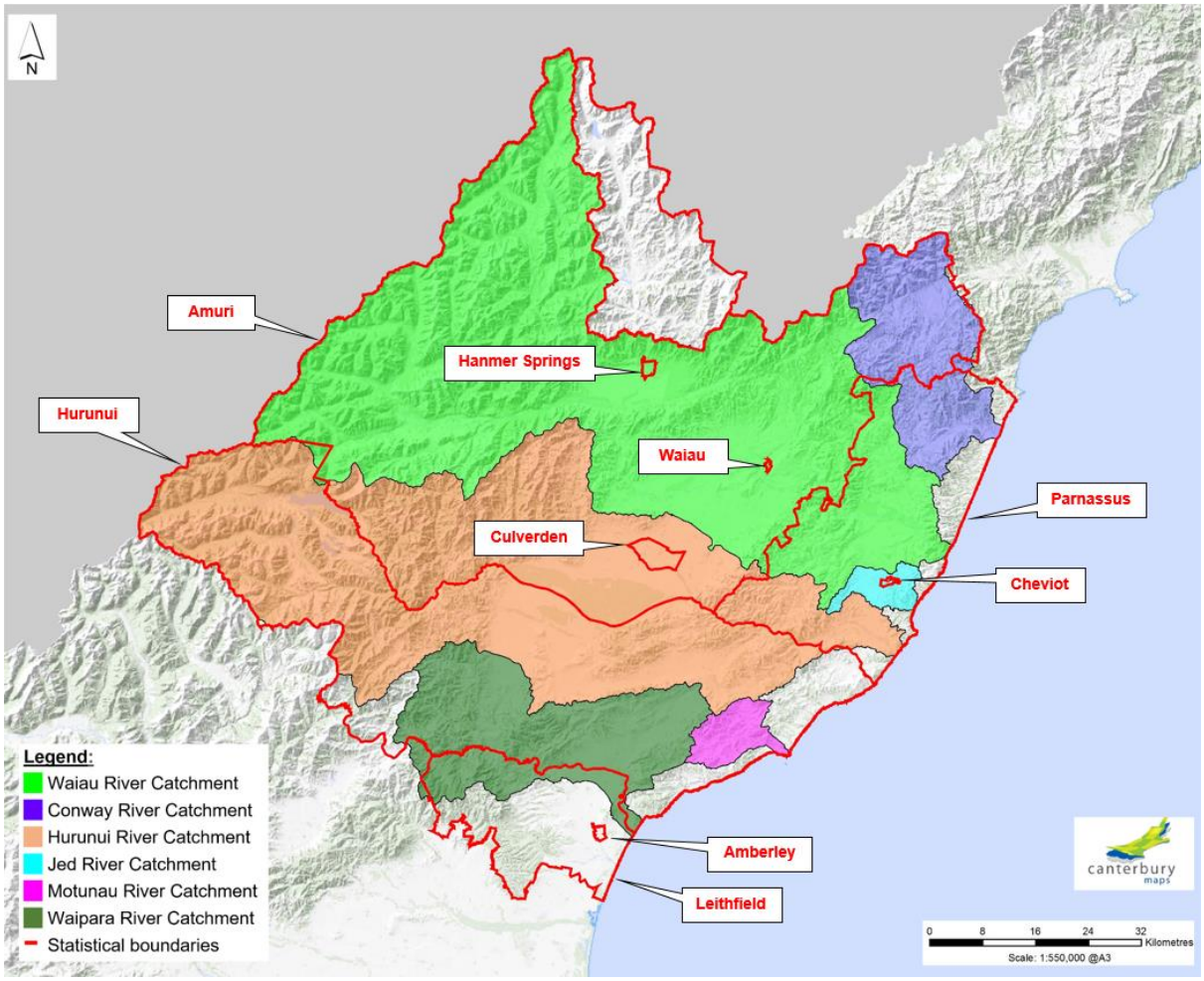


Table 2: Employee count by area unit and sector (and comparison with 2013 Census)

	Hanmer Springs	**Culver-den**	**Waiau**	**Amuri**	**Parnass-us**	**Cheviot**	**Hurunui**	**Amber-ley**	**Leith-field**	**Total Hurunui district**	*2013 census*[3]
Agriculture	6	28	6	505	115	3	330	6	208	1,207	*1,609*
Forestry, Fishing, and Mining	9	18	3	79	44	45	72	3	70	343	*403*
Manufacturing	9	6	-	6	45	-	68	27	125	286	*292*
Electricity, Gas, Water, and Waste services	-	-	-	3	-	-	35	-	27	65	*57*
Construction	18	15	12	49	9	3	28	41	157	332	*397*
Wholesale Trade	6	21	-	-	-	3	36	37	30	133	*115*
Retail Trade	67	15	12	6	25	27	15	69	12	248	*238*
Accommodation and Food Services	310	12	-	80	9	60	43	34	53	601	*458*
Transport, Postal and Warehousing	9	35	-	9	21	-	24	39	-	137	*123*
Information Media, Telecommunications and Other Services	-	3	-	6	-	-	-	12	-	21	*19*
Financial and Insurance Services	-	-	-	-	-	-	-	6	-	6	*15*
Rental, Hiring and Real Estate Services	34	-	-	-	9	-	9	15	12	79	*145*
Owner-Occupied Property Operation	-	-	-	-	-	-	-	-	-	-	
Professional, Scientific and Support Services	9	3	-	33	6	6	21	36	6	120	*199*
Administrative and Support Services	12	-	-	6	-	-	3	6	-	27	*66*
Public Administration and Safety	-	3	-	-	3	6	-	55	6	73	*78*
Education and Training	9	61	9	15	15	36	61	30	50	286	*234*
Health Care and Social Assistance	125	21	3	47	-	42	48	104	34	424	*408*
Total All Industries	623	241	45	844	301	231	793	520	790	4,388	*4,856*

[3] The 20123-13 figure is a more comprehensive figure of Full Time Equivalent (FTE) jobs. It is based on the census and other sources including household labour force survey and business demography data to get an annual average figure for the year. Business demography data is at a point in time, and is less comprehensive in its coverage. The business demography data shows employment growth from 2013 – 2016 of 50 jobs

Table 3: Estimates of GDP by Area Unit and sector ($million 2016/17)[4]

	Hanmer Springs	Culver-den	Waiau	Amuri	Parnass-us	Cheviot	Hurunui	Amber-ley	Leith-field	Total Hurunui
Agriculture	$1	$4	$1	$76	$17	$0	$50	$1	$31	$182
Forestry, Fishing, and Mining	$1	$3	$0	$13	$7	$7	$12	$0	$11	$56
Manufacturing	$2	$1	-	$1	$10	-	$15	$6	$27	$63
Electricity, Gas, Water, and Waste services	-	-	-	$1	-	-	$9	-	$7	$16
Construction	$3	$2	$2	$7	$1	0	$4	$6	$23	$49
Wholesale Trade	$1	$2	-	-	-	0	$4	$4	$3	$14
Retail Trade	$4	$1	$1	$0	$2	$2	$1	$5	$1	$16
Accommodation and Food Services	$14	$1	-	$4	$0	$3	$2	$2	$2	$28
Transport, Postal and Warehousing	$1	$3	-	$1	$2	-	$2	$3	-	$11
Information Media, Telecommunications and Other Services	-	$0	-	$1	-	-	-	$1	-	$2
Financial and Insurance Services	-	-	-	-	-	-	-	$3	-	$3
Rental, Hiring and Real Estate Services	$33	-	-	-	$9	-	$9	$14	$12	$76
Owner-Occupied Property Operation	$7	$3	$0	$9	$3	$3	$9	$6	$9	$48
Professional, Scientific and Support Services	$2	$1	-	$6	$1	$1	$4	$7	$1	$23
Administrative and Support Services	$2	-	-	$1	-	-	$0	$1	-	$4
Public Administration and Safety	-	$0	-	-	$0	$1	-	$5	$1	$6
Education and Training	$0	$3	$0	$1	$1	$2	$3	$2	$3	$15
Health Care and Social Assistance	$9	$1	$0	$3	-	$3	$3	$7	$2	$30
Total All Industries	**$80**	**$26**	**$5**	**$124**	**$54**	**$22**	**$126**	**$73**	**$133**	$642

[4] Note that because these are derived from business demographic data that is likely to underestimate employment, the GDP figures provided here are likely to underestimate GDP in some areas.

3 Water using industry

The water bodies of the Hurunui district provide a range of ecosystem services. Those that are able to be defined through takes, discharges or other quantitative means are described here. However there are a range of other services that support the economy, including waste assimilation, flood amelioration and various non-consumptive values such as recreation, tourism and other amenity values that are not represented through analysis of consented takes or discharges. While the tourism sector is represented in some detail in Section 5.4, the other services are not able to be described within the scope of this report and must be supported by information from technical experts in other disciplines.

The waterways provide two key ecosystem services in respect of provisioning services through the supply of water for a variety of uses, and assimilative services through acceptance of contaminant discharges.

Figure 3 and Figure 4 show the aggregation of surface and groundwater takes in the Hurunui and Waiau catchments. They demonstrate that irrigation and other agricultural/horticultural related consents comprise by far the largest share of water use in this catchment. Community related takes such as drinking water and stockwater are significant, but other uses are minor in comparison. Surface water is the majority of water use, and of these the Waiau catchment is a larger source of water than the Hurunui. The relatively small size of groundwater reflects that lack of major groundwater aquifer systems that are not connected to surface water catchments. There are a number of diversions associated with the irrigation schemes, roadworks and aquaculture which are not shown here. Industrial use of water appears to be a minor source of water takes in the zone.

Figure 5 shows that by number the largest category of discharge is human effluent, most of which are septic tanks. Dairy effluent, other animal effluent, and stormwater are the largest other categories, with stormwater the largest source of discharges directly to water. Most other categories have a minor number of discharges. The majority of the consents to discharge are located in the Hurunui and Waiau catchment.

Figure 3: Primary use for water abstraction from Hurunui catchment

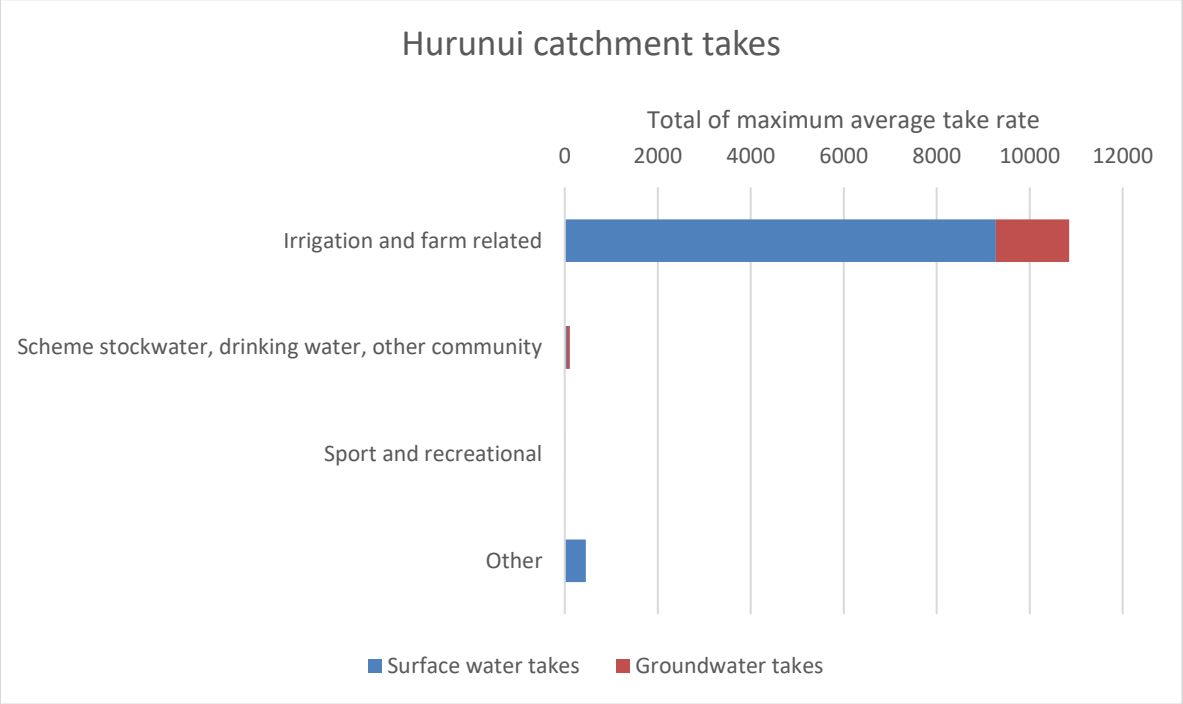


Figure 4: Primary use for water abstraction from Waiau catchment

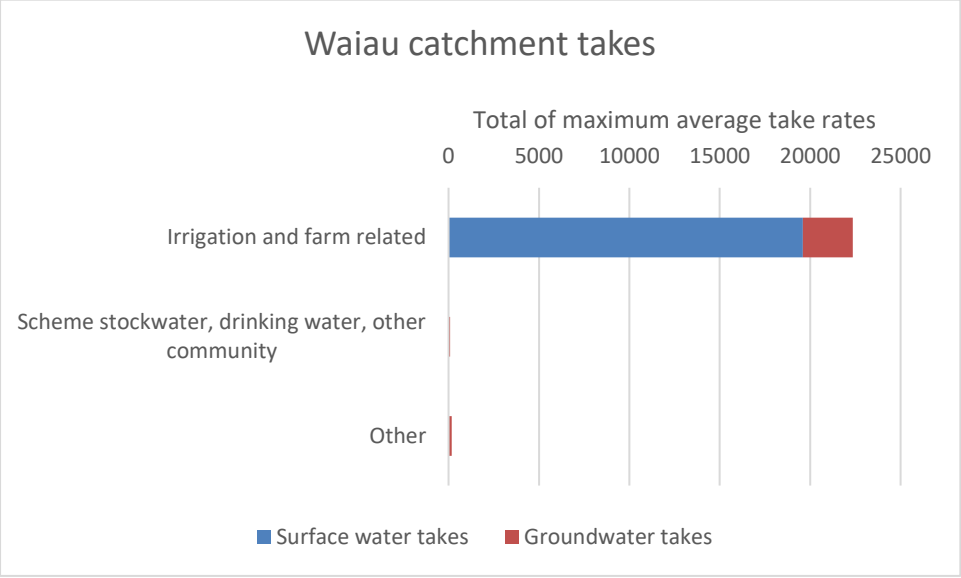
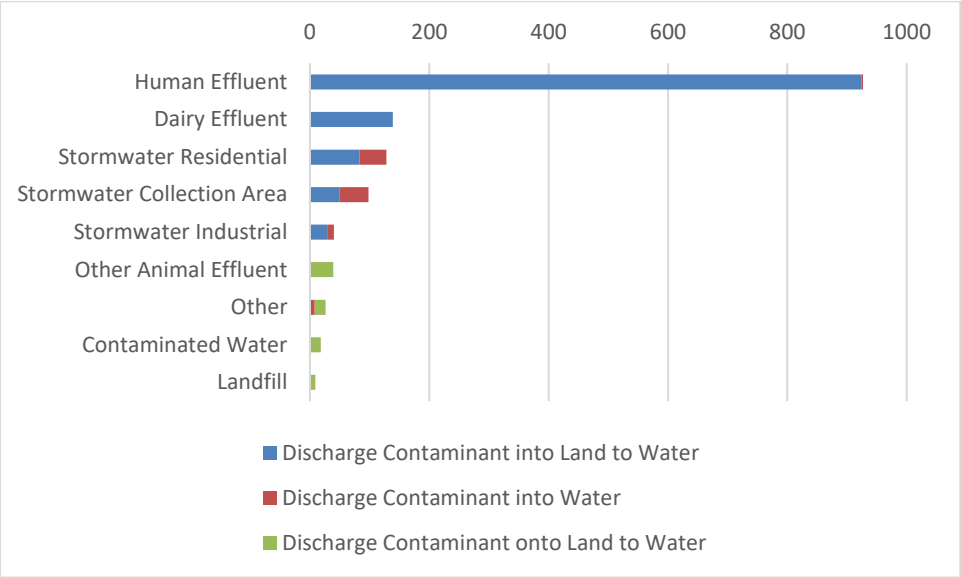


Figure 5: Discharge consents by activity type (number of consents)



4 Land use

The land using activities are generally the largest users of water in Canterbury, through stock water takes and irrigation takes. Because of the open nature of agricultural systems, they also tend to lose nutrients to the environment, which end up in water bodies. The nature and patterns of land use are therefore of considerable importance in determining the outcomes for water.

4.1 Historical land use patterns

At the time Pakeha settlement began in the mid-19th century, the plains of the Hurunui District, together with the Hanmer Basin, were described as being rich tussock grassland. The coastal hill country between the Waiau and Waipara Rivers were also covered in tussock grassland, although with small areas of forest in gullies near the coast (Gardner, 1983: 20-22, & Fig. 9). In the west of the district (roughly beyond a line between Hanmer and Waikari), the predominant type of vegetation was indigenous forest (Department of Survey & Land Information, 1995). The areas under tussock grassland began being subdivided into pastoral runs in the 1850s (Gardner, 1983: 68 & 70), and by 1900 there more than 560,000 sheep being grazed in the counties of Amuri and Cheviot, which at the time was more than 250 sheep per resident (Dadelszen, 1900: 92 & 341). Small farm settlement was boosted by the breakup of the pastoral runs in the period from the early 1890s through to the early 1910s (Gardner, 1983: 331-350), but even so, within the combined counties of Amuri, Cheviot and Waipara, there were only about 90,000 hectares under sown grass by 1916, and another 30,000 hectares under crop. Within the area occupied by farms, there were 490,000 hectares of indigenous grasslands, and 60,000 hectares of indigenous forest (Government Statistician's Office, 1916: 46 & 49)

By 1946, the number of sheep had risen to 985,000, while the sown grass area had increased only to 106,000 hectares, and the cropped area was the same as it had in 1916 (Department of Statistics, 1947: 40 & 53). Exotic forestry had nevertheless been significant in the local economy during the interwar period with the establishment of the 9800 hectare Balmoral forest

(on the north side of the Hurunui River) during the 1920s; a further 3100 hectares had also been planted at Hanmer since 1901 (Gardner, 1983: 409).

The pace of environmental transformation accelerated in the decades after the Second World War. As of 1976, the area under sown grass in the three counties was 171,000 hectares, while sheep numbers stood at 1.79 million. The sown grass area in each county had increased by about half since 1946, but at the same time the cropped area in each had shrunk, with the combined area in 1976 being 10,500 hectares. There was little in the way of dairying in the district, with the three counties having a combined dairy cow population in 1976 of just 755, whereas the combined beef cattle population was just over 118,000 (Department of Statistics, 1978: 20, 36, 42 & 55)

The advent of irrigation in the future Hurunui District from 1976 onwards (although construction of the large Waiau scheme began in 1977) was a catalyst for further change, especially with respect to dairying. Construction of the large Waiau scheme began in 1977, and once completed in 1983, it enabled the irrigation of 17,000 hectares (Lovell-Smith, 2000: 74). At the time of the 2002 agricultural census, almost 21,400 hectares within the Hurunui District had an irrigation system, while by 2012 this area had increased to 39,250 hectares, 32,661 hectares of which were irrigated via spray methods (Department of Statistics, 2002 & 2013a).

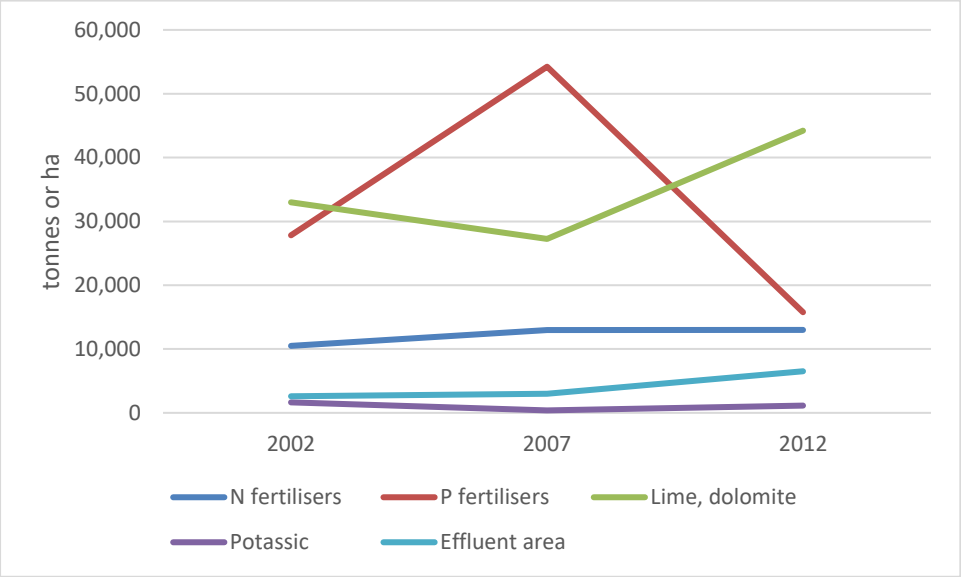
This rise in the irrigated area been associated with an increase in the effective pasture area used by dairy farms, which was around 8400 hectares in 1998/99, and stood at 22,199 hectares in 2015/16 (LIC & DairyNZ, 2016: 17). Dairy cow numbers have risen more than 100-fold in the 40 years since 1976; in 1991, the first year when figures were reported for Hurunui District, the dairy cattle population was 7,568 and in 2016 numbers stood at 79,005 (LIC & DairyNZ, 2016: 17). In comparison, there were 2.18 million sheep in 1991, and this had fallen to 1.28 million by 2012; beef cattle numbers, meanwhile, have been more stable, being around 94,000 in 1991 and 98,000 in 2012 (Department of Statistics, 1992: 19 & 21; Department of Statistics, 2013c)

The spatial scope of land use changes within the Hurunui District since 1996 can be observed by examining changes in the Land Cover Database layers for the district. Anastasiadis and Kerr (2013: 24-25) mapped differences in the 1996 and 2008 land cover layers for the whole country, while details of the individual changes between 2001 and 2012 can be investigated using the LCDB v3.3 Change and LCDB v4.0 Change layers available via Landcare Research's LRIS portal. The Anastasiadis and Kerr maps covering temporal changes from 1996 to 2008 show numerous small areas of land west of Culverden as having changed from scrub to forestry, while on the Amuri Plains between Culverden and the Waiau River, there is large scale conversion from sheep and beef farming to dairy farming (based on modelling associated with the Agribase). More detailed mapping of land use in the Hurunui River catchment (Lilburne, 2011: 1-3) shows much of the pasture immediately north of the Balmoral Forest was being utilised for the dairy industry.

Over the period 2002 – 2012 fertiliser usage has no discernible pattern, with an increase in N fertiliser between 2002 – 2007, an increase then decrease in P fertilisers, a decrease then increase in lime and dolomite, a decrease overall in K fertilisers, and an increase in effluent area. It may be that some of these differences reflect specific years in which the agricultural census was taken, although it is notable that despite the significant increase in dairy activity in the catchment (reflected in the increased effluent application) there has not been a concomitant increase in overall fertiliser usage and that N application did not change between 2007 - 2012. It should be noted that P and lime fertiliser application tends to be highly sensitive

to returns from hill country sheep and beef, and given the predominance of this land use in the catchment some variability can be expected at a catchment level.

Figure 6: Change in fertiliser application in the Hurunui district (2002 - 2007)(Source: Statistics NZ)



Among the other major landscape changes in the Hurunui District which are evident are the conversion of forestry land to pasture and vice versa. Around 1500 hectares of pasture land west of Hawarden were planted out in forest between 2001 and 2008, while between 2001 and 2012 around 2000 hectares of Balmoral Forest on the north side of the Hurunui River were harvested and replaced by pastoral farm land.

These changes are in keeping with the reduced area in production forestry across the district as a whole in recent years; in 2001, the planted production forest area was 41,555 hectares (Cross et. al., 2003: 50), while in 2016 it was 36,954 hectares (Ministry for Primary Industries, 2016: 31). On a lesser scale, in terms of the areas involved, but still importantly economically has been the growing extent of vineyards around Waipara converted from either pasture land or other horticultural/orchard land. The first of the prize-winning Waipara vineyards was established in the 1980s, and by 2002 grapes were being grown on 248 hectares in the Waipara valley (Lovell-Smith, 2000: 78; Sluys, 2006: 17); by 2013, the area in vineyards at Waipara had risen to about 1200 hectares (Dana et. al., 2013: 43).

4.2 Current land use

There are approximately 580 sheep and beef farms in the Hurunui district, with an additional 15 undertaking some cash cropping[5]. Beef and Lamb NZ data for the northern part of Canterbury[6] shows that for the period 2000/01 to 2013/14 there has been a decrease in area per farm for the both hill country and intensive finishing breeding categories. Intensive properties have seen a decrease in stocking rate both per farm and per ha, while hill country

[5] Statistics NZ, 2012 Agricultural production census.
[6] Hurunui, Selwyn and Waimakariri districts.

properties have seen an increase in both. Fertiliser usage per ha over that period has also decreased by 8% on intensive properties, and increased by 2% on hill country properties.

Table 4: Key statistics for Beef and Lamb Class 6 Finishing Breeding farms[7] (Source: Beef and Lamb NZ data for Hurunui, Waimakariri and Selwyn)

	2000/01	2013/14	% change
Farm Class 6: Intensive finishing breeding			
Stocking rate** (SU/farm)	4,035	3,311	-18%
Effective area** (ha/farm)	496	423	-15%
Stocking rate** (SU/ha)	8.1	7.8	-4%
Fertiliser usage*** (kg/ha)	181	166	-8%
Farm Class 2: Hill country			
Stocking rate (SU/farm)	5,434	6,201	14%
Effective area (ha/farm)	1,154	1,114	-3%
Stocking rate (SU/ha)	4.7	5.6	18%
Fertiliser usage (kg/effective ha)	67	69	2%

North Canterbury has on average the highest dairy herd production in the country, reflecting a combination of larger herd sizes, high stocking rate and high production per cow. Hurunui district in 2015/16 has 850 cows/herd, compared with the national average of 624, and production in Hurunui district was 1,496 kgMS/ha with an average of 420 kgMS/cow (DairyNZ & LIC, 2015). Dairy support is estimated to cover ~17,000 ha in the zone, with the majority of that on dryland.

Arable and horticulture land uses are relatively small in terms of area in the district (Figure 9). Arable crops cover approximately 1000 ha, of which the majority is likely to be grain production. There are a relatively limited number of purely arable farms in the district (3), although as noted above the 2012 Agricultural census indicated a further 15 sheep and beef farms with some cash cropping. Specialist seed and vegetable production do not appear to be significant features of the district.

Horticulture is predominantly viticulture, with small areas (<100ha total) in olives and various nut crops. As noted above most of the viticulture occurs in the Waipara catchment.

There are a number of small holdings spread through the Hurunui district, with ECan estimating that there are 3600 ha in smaller blocks. Approximately 1/3 of the small block holdings are in the Kowai catchment, likely driven by proximity to Christchurch and associated peri-urban areas.

The current land use is shown in Figure 7[8] and is dominated by sheep and beef, which comprises over half of the total land use in the catchment. Non-productive land, including

[7] Class 6 is considered by Beef and Lamb NZ to represent 95% of sheep and beef farms in the Hurunui district.

[8] There are three dominant land uses in the Hurunui zone, with different approaches to measurement yielding different figures for each. The land use figures developed by ECan are considered definitive for the purposes of this analysis.

native forest, scrub, water, and urban areas, is 34% of the total land, and dairy, dairy support, forestry and lifestyle are 1% - 4% of the catchment area.

Irrigated land use (Figure 8) is primarily in dairy with 64% of the total area, followed by sheep and beef with 27% of the total irrigated area. Much of the irrigated sheep and beef is likely to be run in conjunction with dryland blocks. Dairy support, arable and horticulture are less important irrigated land uses.

Figure 7: Estimated land use in catchment (Source: ECan)

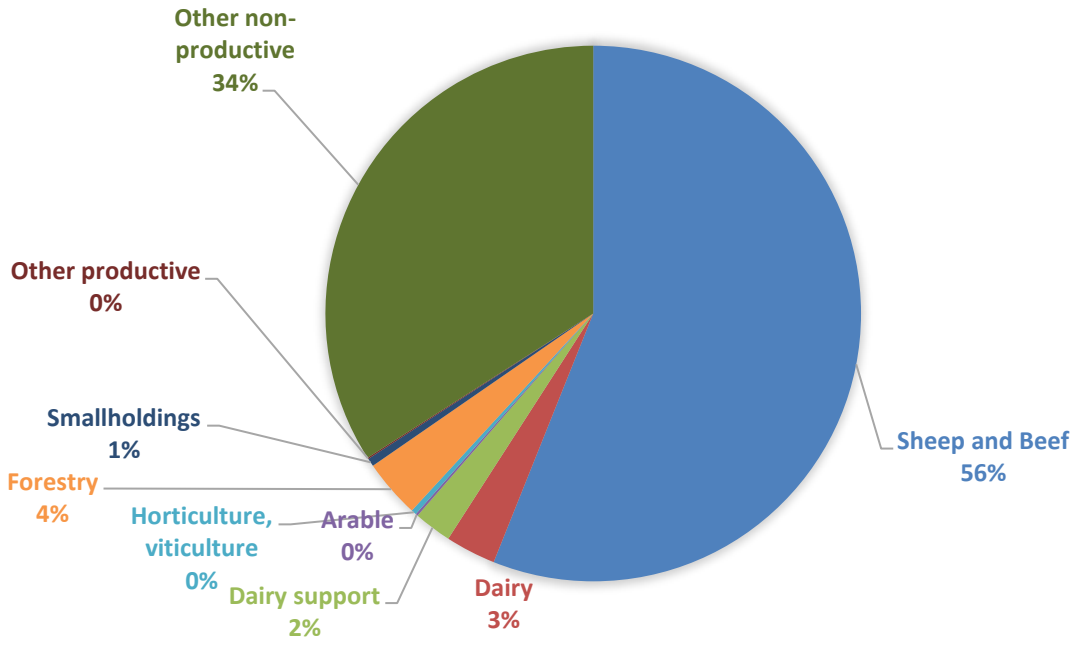


Figure 8: Estimated irrigated land use in catchment (Source: ECan)

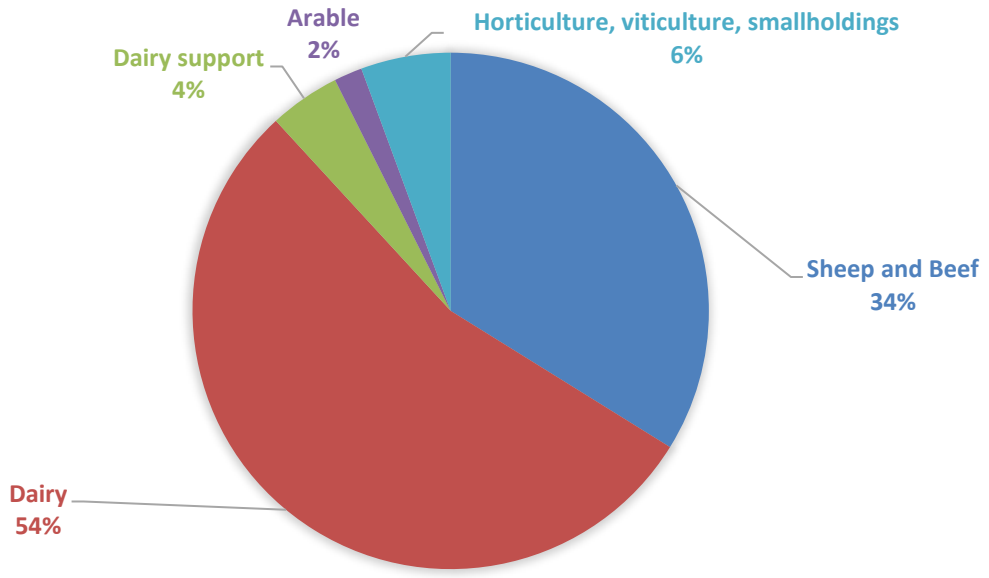
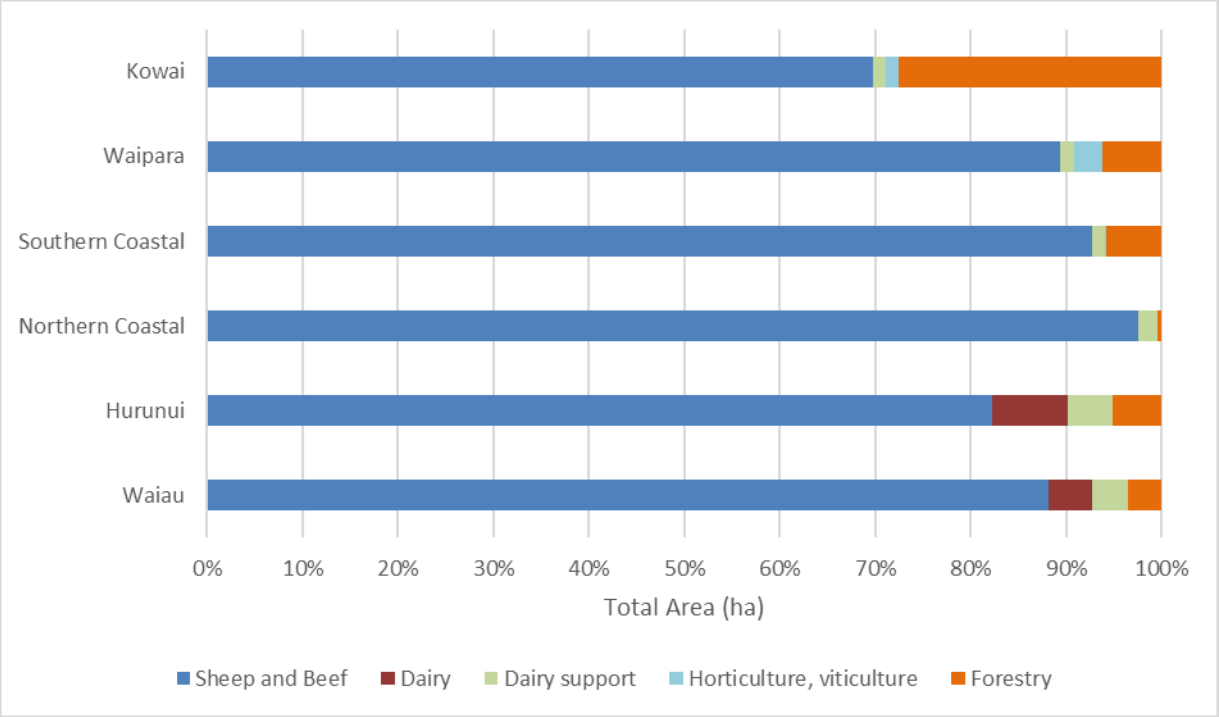


Figure 9: Share of catchment land use



A comparison of the breakdown in land use for the 6 component catchments of the Hurunui-Waiau zone shows that while sheep and beef are dominant in all catchments, the minor land uses occur in different proportions across the catchments. Dairy and dairy support are significant features of the Hurunui and Waiau catchments, while horticulture is more significant in the Waipara catchment based largely on viticulture, and forestry is a significant part of the Kowai catchment. Sheep and beef is most dominant in the Northern and Southern coastal catchments.

5 Economic indicators associated with water using industry

The indicators for agricultural activities are based on the business level budgets and areas of each land use. The business level budgets are based on five years of historic data and are used in conjunction with a model of the flow on economic impacts from activity in the zone to the region.

The impacts from lifestyle blocks are estimated based on the returns from dryland sheep and beef. The impacts of horticulture are estimated separately, which will be the most significant specific water related returns from small block holdings land use.

Salmon farming occurs in the Waiau catchment because of a hatchery based there, and the economic impacts of this activity are estimated separately but included in the 'other productive activities' category. There are a range of other water uses which are not represented in these estimates, but apart from public water supplies these are both individually and collectively a minor part of both surface and groundwater abstraction and discharges.

Economic activity in tourism was estimated from information collected in Annual Visitor surveys and reported by Statistics NZ at a District level. Additionally, a web search was undertaken to identify all tourism businesses in the district, and an interview survey of major players in "Visitor Activities" was undertaken to ascertain their employment and expenditure patterns. The results were used to estimate the wider impact for this part of the tourism sector. The accommodation sector was not surveyed because previous experience[9] has shown that the estimates of flow on economic activity generated by the base regional modelling process are consistent with multipliers based on detailed surveys of accommodation operators in the region. The economic impacts associated with tourism could not be reliably divided into sub catchments at this stage, although the location of activities is discussed qualitatively.

5.1 Economic indicators associated with agriculture and aquaculture

The direct business level indicators for the agricultural and aquaculture sector are shown in Figure 10 below. They show that sheep and beef is the largest sector in terms of revenue and expenditure, while dairying generates larger operating surpluses (before capital costs) despite being a significant smaller land use than sheep and beef. The majority of dairy is on irrigated land, and these outcomes partly reflect the significantly higher intensity associated with irrigation.

In terms of employment (Figure 14) sheep and beef is the largest source of employment on farm, (including the owner operator) by a significant margin, which extends to the regional scale when processing is included. Dairy operations are the next most important source of employment, with horticulture significant on both a catchment and regional scale which reflects the labour intensive nature of the industry in both on and off farm activities. These increases in employment occur not only in the agricultural industry, but also in associated servicing sectors both as a result of direct and indirect demand for goods and services from the water using sectors, but also because the increased population increases demands for associated services such as health, recreation and education. Thus the water using sectors affect capability in the district for those skills directly required, but also result in an increased capability throughout the economy.

Contribution to GDP is a measure of the value added by an activity in the economy, that is calculated by the value of outputs less the value of inputs excluding labour (Figure 13). In this catchment sheep and beef and dairy are very similar in terms of their contribution to direct and regional GDP, with sheep and beef slightly more important at the local scale while dairy is more important at the regional scale. The greater employment in the sheep and beef sector is reflected in the higher contribution to household income, particularly at the local (direct) scale.

The analysis by catchment suggests that the Hurunui and Waiau catchments are dominant in economic terms, with the Hurunui slightly larger. These reflect the much larger sizes of these two catchments relative to the other catchments in the zone, and the higher proportion of irrigated and dairy activities in them. The Waipara is the next most significant catchment in terms of primary sector contribution to economic activity, which is also likely to be determined by a combination of size and the presence of most of the viticulture activities in the zone.

[9] Work with Lincoln University in Westland, Kaikoura, Christchurch and Rotorua.

Figure 10: Agriculture and aquaculture business revenue, expenses and operating surplus by subcatchment

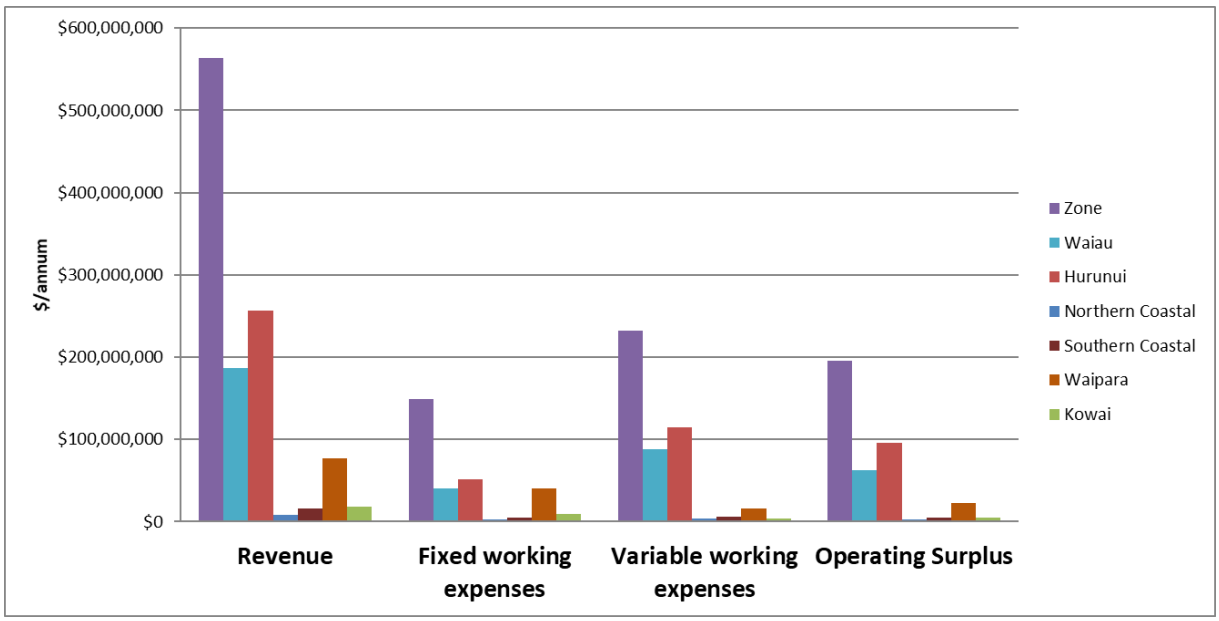


Figure 11: Agriculture and aquaculture business level indicators by sector for Hurunui-Waiau zone

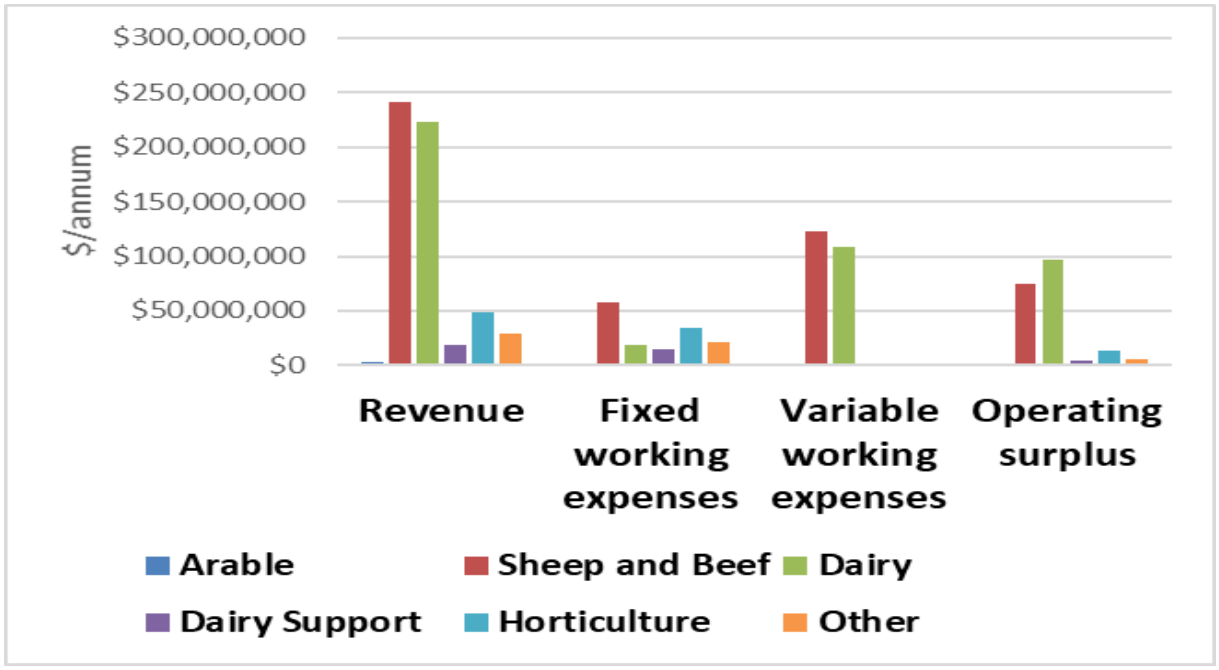


Figure 12: Agriculture and aquaculture GDP and Household Income (HHI) contribution by subcatchment for Hurunui-Waiau zone

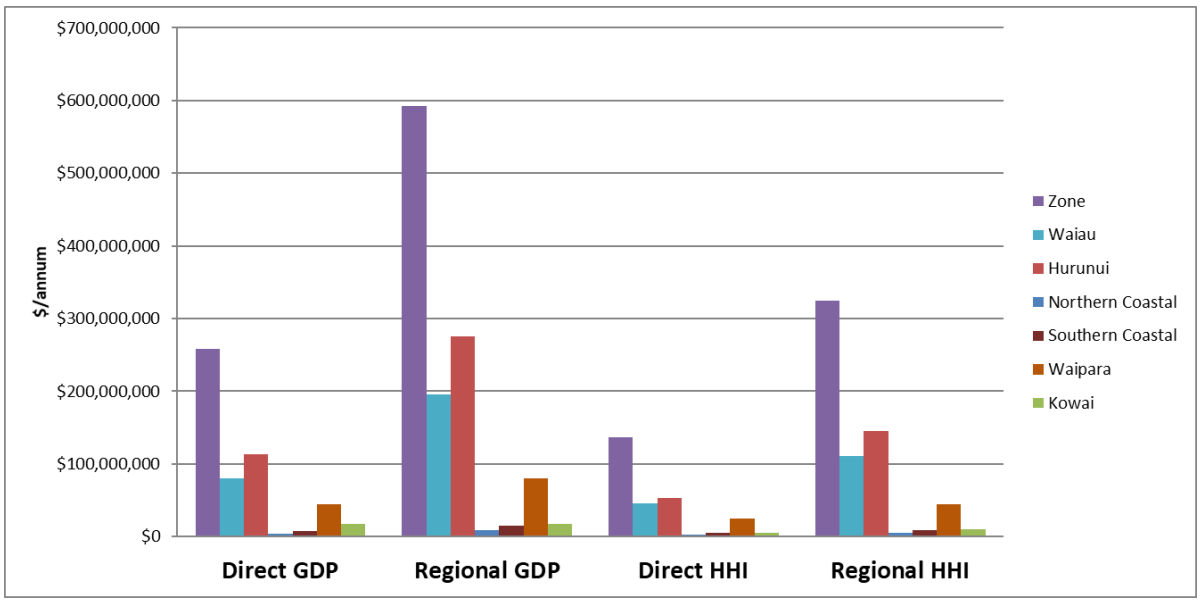


Figure 13: Agriculture and aquaculture GDP and Household income by sector for Hurunui-Waiau zone

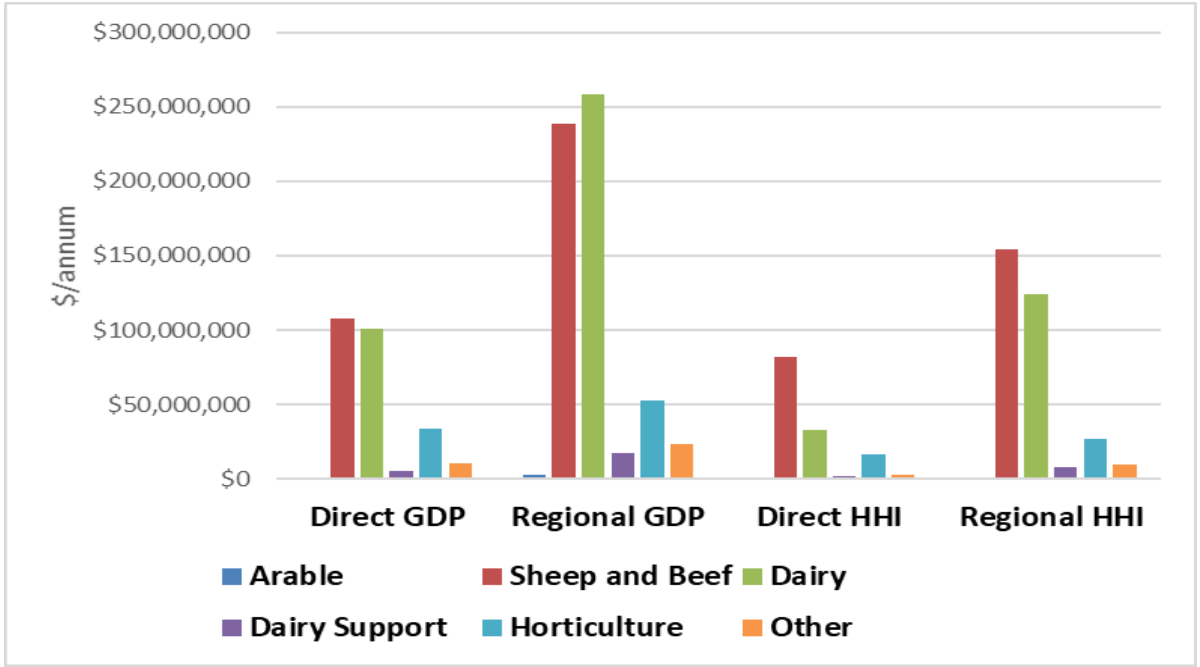


Figure 14: Agriculture and Aquaculture direct and regional employment by subcatchment

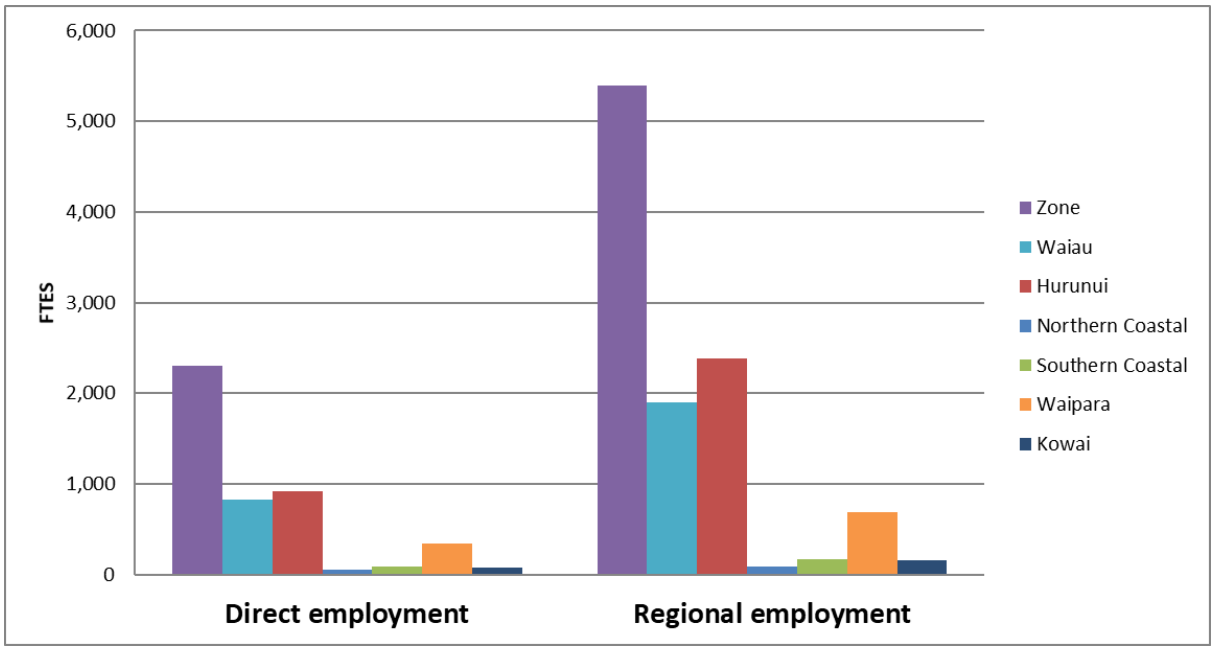
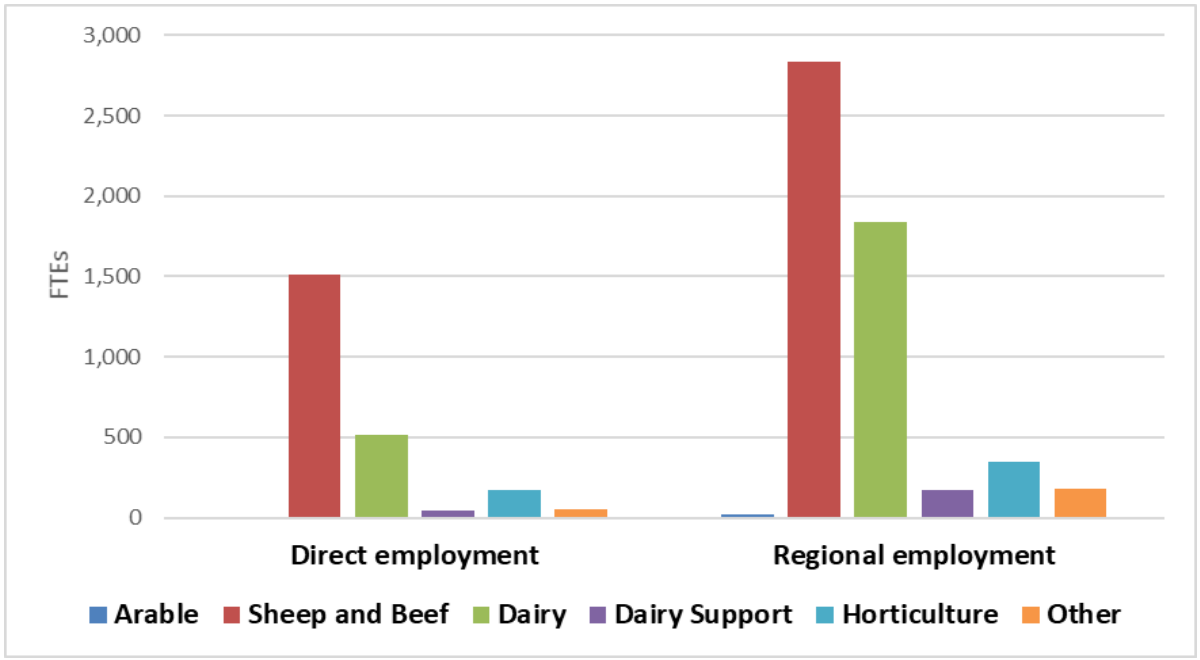


Figure 15: Agriculture and Aquaculture direct and regional employment by sector (FTEs)



5.2 Impact of debt and variability

Average sheep, beef and arable debt levels are available through Beef and Lamb NZ and for Dairy from DairyNZ. These are shown in Table 5 and suggest that average fixed term debt levels relative to the capital value of farm assets are reasonably conservative for sheep and beef, and higher for dairy operations. However when converted to debt servicing costs in

proportion to revenue, the range of interest and rent costs as a proportion of gross farm income are very similar across industry sectors.

Table 5: Debt levels and debt servicing costs (5 year averages)

Data source	Model	Fixed debt/ Farm capital	(Debt servicing +Rent)/GFI
Beef and Lamb NZ class (average debt 2011 – 2016)	Class 8 Mixed Finishing (Arable)	23%	15%
	Class 1 SI High Country	12%	14%
	Class 2 SI Hill Country	9%	11%
	Class 6 Intensive finishing breeding	10%	12%
DairyNZ (median debt, 2010 – 2015 Waimakariri, Selwyn and Hurunui districts)	Dairy	64%	15%

The economic model was further developed to enable assessment of the impact of variability in product prices on the outcomes. The approach uses Monte Carlo simulation of variability in product prices involving multiple (1000) simulations of the outcomes with a random selection of product price change. The random selections are drawn from a distribution based on the variability in product prices in each of the major sectors over the period 1994 – 2016, with an assumption that the distribution is normally based. The mean and standard deviation of outcomes from the Monte Carlo analysis is provided in Table 6, together with the proportion of time the result is positive after capital charges (interest and rent).

The results for average debt levels show that the after capital costs is positive most of the time (>90%), which is expected because the diversification among several sectors provides for greater resilience at the district level. Individual sectors are also almost always positive after debt servicing and rent costs, with only dairy support positive less than 90% of the time.

Table 6: Sensitivity of outcomes to changes in product prices

	Profit after interest and rent but before Wages of Management and drawings					
	Zone total	**Sheep, beef and deer**	**Dairy**	**Dairy support**	**Arable**	**Horticulture**
Mean outcome ($ m)	$118,753,548	$43,942,031	$63,716,704	$2,144,040	$186,043	$8,331,553
Standard deviation ($m)	$55,370,144	$31,154,922	$40,676,083	$3,523,944	$128,809	$3,365,473
Proportion of results positive	98%	92%	94%	73%	93%	99%

However it is worth noting that these are mid point or average figures that do not take into account wages of management and the need to repay principal. For those with high debt levels or for prolonged low product prices the impacts will be more extreme. Statistics NZ (Statistics New Zealand, 2014) estimated that the total equity-to-asset ratio for the dairy industry was 30% in Canterbury, but DairyNZ estimate is the average value is $12-$13 m for a 240 hectare

farm (210 effective) with liabilities/debt around 50%[10]. The DairyNZ data indicates that Canterbury farms carry higher total absolute debt based on size, but on a per kg MS basis they are similar to national debt levels.

The Reserve Bank (Reserve Bank NZ, 2015) undertook stress testing of the potential impact of the 2014/15 low milk price through to 2018/19. Under a base scenario with the milk price recovering 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 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.

The impact of any sustained low milk price on dairy operations is therefore likely to be severe, and the potential exists for a significant proportion of existing farms to require recapitalisation either through sale or introduction of equity. This is exacerbated by falling land prices with prolonged low product returns.

5.3 Exports

Exports were estimated based on national ratios of outputs/exports, and as such are approximations of the contribution of the district to exports. Furthermore data were included only from sheep, beef, deer, dairy, horticulture, forestry, because of lack of certainty for other sectors. The approach includes those products exported directly from the district, and those that are processed elsewhere then subsequently exported as sheep, beef, deer, dairy horticulture or forestry products. Products that were further transformed in manufactured goods were not included.

This approach yielded an estimate of $560 million in exports dependent on Hurunui produced primary product. The large majority of these exports are processed outside the district and then exported, with only small proportion exported directly. 40% of the exports are from the sheep and beef sector, and 50% from dairy.

5.4 Economic indicators associated with tourism

Tourism is often a significant non-consumptive user of water through recreation and amenity use of water bodies. Tourism in Hurunui is a significant activity, and parts of this activity, particularly those oriented around the Waiau river in the Hanmer area, are potentially affected by changes in water quantity or quality.

Visitor spend on tourism in Hurunui was $131 million in year to March 2015. Given growth since then, it is estimated to be of the order of $150 million per year for 2016/17. The visitor expenditure figure was used as a basis for estimating business activity in tourism and this modelling was used to estimated GDP and employment. The modelling indicates the tourism contributes about $49 million direct and $68 million in total per year to Hurunui GDP, and $110 million in total to regional GDP. Tourism also generates approximately 960 jobs directly, 1,100 jobs in total in the district, and 1,400 jobs in total in Canterbury region. It should be noted that this is likely to overestimate the impact of tourism somewhat because some of the sectors used to synthesise a 'tourism' sector will not be completely devoted to visitor tourism, with some local activity in food and beverage, passenger transport, and retail sales likely.

Both the economic data associated with employment in accommodation and food services, and interviewing of major tourism businesses, suggests that Hanmer Springs is the major

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

generator of tourism related activity in the district. Anecdotal evidence from farmers suggests that this area also draws employees from the surrounding rural areas and townships. The most significant attraction employer is the Hanmer Springs thermal resort, but there are other water related attractions that are important to the area including the jetboating and bungee jumping operations. Winery related tourism is important in the Waipara district, and those townships along major state highways (Amberly, Cheviot, Waikari and Culverden) are likely to benefit from through traffic activity associated with refuelling, food and beverage purchase, and to a limited extent accommodation.

Table 7: Tourism spend in Hurunui and associated economic impacts

Sum of Spend ($millions)	Years ended March			Impacts – 2017					
				Jobs (FTE)			GDP ($m / yr)		
Product	2014	2015	2017 Est	Direct	Total Hurunui	Total Canty	Direct	Total Hurunui	Total Canty
Food and beverage serving services	28	27	31	305	344	419	13	18	26
Other passenger transport	0	1	1	5	6	9	0	1	1
Other tourism products	11	15	17	142	164	207	7	10	15
Retail sales - other	6	6	7	21	24	37	1	2	5
Accommodation services	30	30	35	231	268	348	15	21	29
Cultural, recreation, and gambling services	14	13	15	115	139	180	6	9	13
Retail sales - alcohol, food, and beverages	11	17	20	88	97	127	3	5	14
Retail sales - fuel and other automotive products	20	21	24	51	54	64	2	3	3
Grand Total	**120**	**131**	**150**	**957**	**1,097**	**1,390**	**49**	**68**	**107**

Table 8: Tourism spend in Canterbury and associated economic impacts

Sum of Spend ($millions)	Year Ending March					
Product	2010	2011	2012	2013	2014	2015
Food and beverage serving services	388	347	269	297	327	378
Other passenger transport	447	431	394	415	404	451
Other tourism products	200	252	213	231	222	252
Retail sales - other	636	571	462	494	525	614
Accommodation services	320	302	269	278	297	317
Cultural, recreation, and gambling services	97	88	83	75	91	111
Retail sales - alcohol, food, and beverages	187	188	195	209	226	264
Retail sales - fuel and other automotive products	240	248	248	262	287	336
Grand Total	**2,514**	**2,429**	**2,133**	**2,261**	**2,379**	**2,722**

6 Summary

The information and results discussed here should be used carefully.

- The information is collated from a variety of sources, not all of which are consistent.
- The results represent a high-level view, and the details of specific businesses and industries cannot be fully represented at this level.
- The modelling undertaken uses representative models of businesses, and these are unlikely to be the actual average of each land use or business for a variety of reasons.
- The regional modelling is also high level and based on the latest (2013) inter-industry information available, however there are a number of averaging assumptions that have to be made when modelling at this level.
- The method used to estimate the flow on impacts has an inherent bias that leads to consistent overestimation of the impacts.

These caveats should be noted and allowed for in the decision making, and the information should be considered indicative of trends and is not definitive. The information, while reasonably accurate in an absolute sense, is likely to be more accurate for comparative purposes between sectors and between catchments.

Agriculture is the dominant activity in the zone. The Hurunui and Waiau catchments provide the largest share of the agricultural activity geographically, and sheep and beef and dairy the largest sectors. Tourism is also a major activity in the zone, with slightly under half the employment and GDP when compared with agriculture. The largest focus of tourism is in the Waiau catchment associated with the Hanmer Springs township, although there are activities spread throughout the zone.

There are other water based activities are present in the catchment, such as the aquaculture operation in the Waiau catchment, and various other water takes and discharges largely associated with urban activities. Ecosystem services from non-consumptive uses such as cultural, recreation, amenity and existence values associated with the water resources have not been assessed in this analysis.

7 Bibliography

Dadelszen, EJ von, 1901: *New Zealand Official Yearbook for 1900*, Wellington: Government Printer

DairyNZ, & LIC. (2015). *New Zealand Dairy Statistics.* Hamilton: DairyNZ.

Department of Statistics, 1947: *Statistical Report on the Agricultural and Pastoral Production of the Dominion of New Zealand for the Seasons 1944–45 and 1945–46*, Wellington: Government Printer.

Department of Statistics, 1978: *Agricultural Statistics 1975-1976 (incorporating 1973-74 & 1974-75)*, Wellington: Government Printer.

Department of Statistics, 1992: *Agriculture 1991*, Wellington: Department of Statistics.

Department of Statistics, 2003: **2002 Agricultural Census tables**

Department of Statistics, 2013a: **2012 Agricultural Census tables**

Department of Statistics, 2013b: **2012 Agricultural Census tables**

Department of Statistics, 2013c: **2012 Agricultural Census tables**

Department of Survey & Land Information, 1995: *Te Wai Pounamu: the land and its people* (map)

Government Statistician's Office, 1916: *Statistics of the Dominion of New Zealand for the year 1915,* Wellington: Government Printer.

Hurunui District Council, 2010: ''Annual Report for 2009-2010'.

Hurunui District Council, 2012: 'Hurunui Community Long Term Plan 2012-2022'.

Hurunui District Council, 2013: 'Annual Report for 2012-2013'

L Lilburne, 2011: 'Hurunui Catchment-scale Land Use and Water Quality Modelling Report', Environment Canterbury report R11/15.

LIC & DairyNZ, 2016: *New Zealand Dairy Statistics 2015-2016*, Hamilton: Livestock Improvement Corporation and DairyNZ Ltd.

L-P Dana, J Granata, F Lasch, & A Carnaby, 2013: 'The evolution of co-opetition in the Waipara wine cluster of New Zealand', *Wine Economics and Policy* 2(1), 42-49.

M Lovell-Smith, 2000: *Hurunui Heritage: the development of a district, 1950-2000*, Amberley: Hurunui District Council, 2000.

Ministry for Primary Industries, 2016: *National Exotic Forest Description*, 33rd ed., Wellington: MPI, 2016

S Anastasiadis & S Kerr, 2013: 'Land Use and Farming Intensity: For 1996, 2008 and 2020', report for the Parliamentary Commissioner for the Environment, 2013.

WJ Gardner, 1983: *The Amuri: a county history,* 2nd ed., Culverden: Amuri County Council.

New Zealand King Salmon, 2013. NZ King Salmon Report. Report prepared for EPA hearing on the private plan change to the Marlborough Sounds Resource Management Plan.

SL Sluys, 2006: ‘Climatic Influences on the Grapevine: a study of viticulture in the Waipara Basin’, MSc thesis, University of Canterbury.

A1 Appendices

A1.1 Estimation of on farm indicators

A set of revenue, expense and cash farm surplus estimates were derived from information put together by Gary Walton of Walton farm consulting. These are summarised in Table 9 and Table 10, and the detailed budgets are able to be supplied on request.

- Additional sources of information include:
- Extensive sheep and beef is derived from Beef and Lamb NZ Farm Class 1 which is a high country operation. The use of this model enabled the estimates of district employment and GDP to be more closely calibrated to known estimates than those generated using the Walton figures. This is likely to be because of the large areas of very extensive sheep and beef country in the upper parts of the Hurunui and Waiau catchments.
- The information for Aquaculture is derived from work undertaken in the Waimakariri zone and the upper Waitaki, using confidential account information supplied by operations in those areas.
- Sources of information on tourism operations were sourced from direct interview or regional estimates of business structure.

Other Explanatory notes

Revenue

- All revenue is net of stock purchases.
- Prices are based on current returns which reflect a degree of variance experienced in the preceding years, especially dairying.
- All prices are quoted exclusive of GST.

Expenses

- The wages cover all casual and permanent staff including various levels of stock managers. The Managerial Salary covers the provision of the situation where the owner is either absent or does not have any input into the daily decision making on farm. For the purpose of analysis and comparison, the managerial salary is added back onto from the farm profit before tax and then a wage of management (which includes an assessed managerial reward) would then be deducted to reflect a true situation.
- The Total Labour metric includes the Owners input as well as the labour input from paid staff.
- Animal health is the direct animal related expenses and includes items such as ear tags, mineral supplements and anthelmintics.
- Weed and pest control covers the chemical and the application costs.
- The Dairy Industry has some specific categories such as Breeding and Improvement and the Farm Dairy items. Lime has been added to the Fertiliser category to save space. Grazing bills have been split between heifer grazing and cow gazing through the winter.
- The sheep and beef industry commonly separates out the shearing expense and in most cases the cash crop expenses.
- Irrigation expenses include the electricity of fuel associated with pumping water. All other electricity is covered in the power category.

- Administration covers items such as professional fees of accountancy, legal and advisory. It also includes communication items of stationery, phone and internet. Travelling expense (work related) can also be included here along with bank fees and computer expenses.
- Insurance and ACC levies have been combined as a space saving mechanism on the summary sheets.
- All other items are deemed self-explanatory.
- There a number of metric KPI's on the summary page mostly in italics. These are used to compare different farms with one another and in some cases are critical in assessing business performance.
- The phrase FTE stands for full time equivalent.
- Grazing stock units have been included in some instances where stock are only on the farm for a short period and as such are included as an equivalent number of stock units for a full year.

Table 9: Revenue and expenses for land uses where stocking rate is not taken into account

Land use	Revenue/ha	Expenses/ha
Arable Irrigated	3,351	2,635
Arable Dry	1,442	1,134
Dairy support irrigated	1,693	1,636
Dairy support dry	1,009	733
Exotic Forest	928	727
Other (Pig, horse, etc)	1,693	1,636
Horticulture	20,446	14,657

Table 10: Revenue and expenses for land uses where stocking rate is taken into account

Land use	Stocking rate (Cows/ha or su/ha)	Revenue/us	Fixed expenses/ha	Variable expenses/su
Dairy Irrigated	3.5	$2,804	$790	$1,361
Sheep and Beef dry intensive	7.7	$126	$208	$59
Sheep and Beef irrigated	17.9	$150	$876	$101
Lifestyle dryland	5.0	$126	$208	$59
Lifestyle irrigated	11.6	$150	$876	$101
Sheep and beef extensive	1.3	$88	$34	$47
Salmon hatchery	per unit	$1.08	$0.24	$0.78

The EBIT or operating profit was estimated as shown in the equations below.

- For dairy, the revenue and variable expense data was adjusted linearly for differences in stocking rate. This results in profitability increasing with increasing stocking rate. For dairy this can be problematic since there are situations where operators with low stocking rates have similar or better profitability than those with high stocking rate, and management skill is probably a better predictor of profitability than stocking rate.

Therefore, the relationships outlined here may not hold in all situations and across all time periods. (Equation 1)

- For arable, horticulture and forestry properties a fixed budget was used (Equation 2). The figures used are shown in Table 9, and the aggregate for each land use in the catchment was estimated by the area of each land use times the EBIT for that land use.
- For sheep and beef and deer the revenue, fixed and variable expenses were calculated per stock unit. (Equation 1)

Equation 1: EBIT calculation for dairy and sheep and beef land use

$$EBIT_{(lu)} := \left(R_{lu} \times SU_{(lu)}\right) - FWE_{(lu)} - \left(VWE_{(lu)} \times SU_{(lu)}\right)$$

Where:

$EBIT_{(lu)} =$ Earnings before Interest, tax, depreciation and other capital charges ($/ha/annum)

$R_{(lu)} =$ Revenue per cow (dairy) or per stock unit (sheep, beef and deer) ($/ha/annum)

$SU_{(lu)} =$ Number of cows or stock unit (sheep, beef and deer) per ha

$FWE_{(lu)} =$ Fixed Working Expenses per ha. This includes all items that do not typically vary at the margins with changes in intensity ($/ha/annum)

$VWE_{(lu)} =$ Variable working expenses per ha. These expenses are expected to change as stocking rate changes ($/ha/annum)

Equation 2: EBIT calculation for arable, horticulture and forestry

$$EBIT_{(lu)} = R_{lu} - FWE_{(lu)}$$

Where:

$EBIT_{(lu)} =$ Earnings before Interest, tax, depreciation and other capital charges per ha ($/ha/annum)

$R_{(lu)} =$ Revenue per ha for arable, horticulture and forestry ($/ha/annum) or per tonne

$FWE_{(lu)} =$ All Working Expenses per ha. ($/ha/annum)

Equation 3: EBIT calculation for catchment

$$EBIT_{(C,lu)} = \sum_{lu} EBIT_{(lu)} \times area_{(lu)}$$

Where

$EBIT_{(C,lu)} = EBIT\ for\ each\ land\ use\ in\ the\ catchment$ ($/annum)

$Area_{(lu)} = Area\ of\ each\ land\ use\ in\ the\ catchment\ (ha)$

For aquaculture the revenue and expenditure estimates were broken down on a per smolt unit basis, then multiplied by the estimated number of smolt produced. The smolt produced were derived from a 2013 EPA report on King Country Salmon which discussed the production at the Waiau hatchery.

The approach adopted here is reasonably simple in that it uses high level data aggregated across the catchment to estimate the on-farm outcomes. While the data used is robust and has been subject to comparison with other data, its specific applicability to all farms in the area cannot be guaranteed. In particular it should be noted that farm systems and

economics of land uses by the coast are significantly different from those in the upper catchment, and it is not possible to model all land uses across the highly heterogenous catchment. For this reason there is considerable potential for variation between the results estimated and the answer you would get if you surveyed all farms across the catchment. However it should be noted that there are significant uncertainties across all areas of the technical modelling in this catchment, and the level of accuracy of the economic modelling is intended to be reflective of a high level, catchment scale modelling rather than farm scale modelling. In the context of comparing between scenarios at a broad scale across several highly heterogenous zones, to estimate the direction and approximate magnitude of the impact of changes, it is appropriate scale at which to model.

Estimates of regional outcomes from changes in agricultural land use were derived from a regional model developed by Butcher Partners Ltd but updated for this project. This input/output (IO) model was developed using standard methodologies for developing IO tables (e.g. see Jensen 1990[11]), and the sectors included in the model customised to include detailed sectors covering arable, dairy, dairy support, sheep and beef and horticulture. Regional IO modelling involves a description of the input (expenditure) and output (revenue) structures of sectors in the economy of the area being described. These are collated into a table that describes the interrelationships between all the sectors – because the inputs from one sector is an output from another sector in the economy. The table is used to estimate the degree to which a change in output from one sector will result in further changes in other sectors of the economy. The magnitude of these relationships is estimated as a ratio between the direct output and total output, household income, and employment changes (including various flow on impacts) - effectively a set of "multipliers" for each sector and each indicator, which describe the relationship between output of a sector and the flow on impacts in the rest of the economy. Regional IO modelling tends to overestimate the total impact of land use change because it does not include feedback effects[12], but is the most appropriate model type suitable for use at this scale.

[11] Jensen, R.C. 1990 Construction and Use of Regional Input-Output Models: Progress and Prospects. International Regional Science Review, Vol. 13, No 1&2, pp 9-25, 1990

[12] For example where a change increases demand for labour in an area, which results in higher wages, which in turn impacts on demand for labour across a range of sectors.

A2 Tables of results

A2.1.1 Current Scenario

Table 11: Land use (ha) for Current Scenario

Land Use	Irrigated	Dryland	Total
Sheep and Beef	14,300	408,571	**422,871**
Dairy	22,949	0	**22,949**
Dairy support	1,878	15,361	**17,239**
Arable	747	302	**1,049**
Horticulture, viticulture	2,377	0	**2,377**
Forestry		26,657	**26,657**
Lifestyle	180	3,501	**3,681**
Other productive		628	**628**
Other non-productive		256,825	**256,825**
Total	**42,430**	**711,846**	**754,276**

Table 12: On farm indicators for Current Scenario ($m/annum)

Land Use	Revenue ($m)	Farm Working expenses ($m)	Variable Expenses ($m)	Operating profit before capital items ($m)
Sheep and Beef	$240	$60	$120	$70
Dairy	$220	$20	$110	$100
Dairy support	$20	$10	$0	$0
Arable	$0	$0	$0	$0
Horticulture, viticulture	$50	$30	$0	$10
Forestry	$20	$20	$0	$10
Lifestyle	$0	$0	$0	$0
Other productive	$0	$0	$0	$0
Other non-productive	$0	$0	$0	$0
Total	**$560**	**$150**	**$230**	**$200**

Table 13: Regional indicators for Current Scenario ($m/annum, FTE)

Land Use	Direct GDP ($m)	Regional GDP ($m)	Direct HHI ($m)	Regional HHI ($m)	Direct employment (FTE)	Regional employment (FTE)
Sheep and Beef	$110	$240	$80	$150	1,510	2,840
Dairy	$100	$260	$30	$120	520	1,840
Dairy support	$10	$20	$0	$10	40	170
Arable	$0	$0	$0	$0	10	20
Horticulture, viticulture	$30	$50	$20	$30	170	350
Forestry	$10	$20	$0	$10	30	130
Lifestyle	$0	$0	$0	$0	20	30
Other productive	$0	$0	$0	$0	10	10
Other non-productive	$0	$0	$0	$0	-	-
Total	**$260**	**$590**	**$140**	**$320**	**2,300**	**5,390**