Waimakariri Land and Water Solutions Programme

Options and Solutions Assessment

Social Assessment

Technical Report to Environment Canterbury

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List of Abbreviations

CWMS	Canterbury Water Management Strategy
ECAN	Environment Canterbury – the promotional title of the Canterbury Regional Council
ETS	Emissions Trading Scheme
FEP	Farm Environment Plan, required by the LWRP PC5
GMP	Good Management Practice is an industry defined set of standards for farm
LWRP	Canterbury Land and Water Regional Plan
WRRP	Waimakariri River Regional Plan
MAV	Maximum Acceptable Value for drinking water as defined by the New Zealand Drinking Water Standard for nitrates of 11.3mg/l, which is based on World Health Organisation recommendations.
MEC	Modified Employment Count
WDC	Waimakariri District Council
WIL	Waimakariri Irrigation Limited
WRRP	Waimakariri River Regional Plan
WWZC	Waimakariri Water Zone Committee or “Zone Committee”
ZIPA	Zone Implementation Programme Addendum

Executive Summary

The Waimakariri Zone Implementation Programme Addendum (ZIPA) includes recommendations to amend relevant regional plans, as well as non-statutory activities, to support for improvements in water quality and quantity, biodiversity and ecosystems, thus to mahinga kai and general recreation and amenity values. This social impact assessment focuses on how these regulatory recommendations are likely to impact upon those people most directly affected, as well as on the community as a whole. It also assesses the extent of added benefits to the members of the community that could be achieved through successful implementation of the non-statutory actions recommended in the ZIPA.

This assessment identifies the Canterbury Water Management Strategy (CWMS) vision and the link between this and the outcomes sought by the Waimakariri Water Zone Committee (WWZC) for its area. There is a brief outline of the key features of the Waimakariri Zone, and an appendix which provides some of the most recent statistics for the Waimakariri District, the boundaries of which largely coincide with the boundaries of the Zone. This section and appendix builds on the socio-economic and recreation current state reports prepared in 2016.

A section outlines the approach used in this social impact assessment, which assesses the changes recommended in the ZIPA against the outcomes sought by the WWZC. It also takes into account the changes from the Waimakariri River Regional Plan (WRRP) and the Land and Water Regional Plan (LWRP) and subsequent Plan Changes that have yet to be implemented. These changes mainly relate to consented takes that have yet to be reviewed in order to incorporate new minimum flows, partial restriction regimes and/or changes to the method of calculating the stream depleting effects of groundwater takes. The ZIPA recommends dates for these reviews.

The conclusions about social impacts rely on the technical work undertaken by Environment Canterbury (ECAN) to evaluate the current state, and subsequent modelling to evaluate the effects of the current land and water management regime, particularly with respect to water quality and quantity. The outcome of this work, therefore, provides the basis for the social assessments.

Social impacts on Ngāi Tūāhuriri associated with historic land use changes and current land use activities are a key component of the overall social context as addressed in the COMAR report, which focuses on values with regard to mahinga kai as well as outcomes for Māori defined within the ZIPA Community Outcomes.

The following table summarises the social assessment results by zone social outcomes with an assessment of the likelihood of achieving them. This assessment is against the best estimates of the situation that will prevail when all the existing planning settings and complementary actions are realised. Section 3 of the report provides an overview of the main recommendations in the ZIPA, and Section 4 provide the analysis that lies behind this assessment against the outcomes sought by the WWZC in this ZIPA.

Social impacts of a process of change such as the implementation of a resource management plan will depend, at least in part, on the way the changes are managed. This process of management should aim to reduce or mitigate negative impacts and enhance the

positive ones. The report ends with a section that discusses management of the changes recommended in the ZIPA in order to maximise outcomes for social wellbeing.

Zone outcomes	Assessment criteria	Results
The Ashley River/Rakahuri is safe for contact recreation, has improved river habitat, fish passage, and customary use; and has flows that support natural coastal processes (section 4.1)	Level of recreational use of the Ashley River/Rakahuri, environs and Estuary	A minimal improvement in the longer term
The water quality and quantity of spring-fed streams maintains or improves mahinga kai gathering and diverse aquatic life (section 4.2)	Amenity values, recreational uses, food gathering and cultural values in lowland streams	A modest improvement in the longer term
The Waimakariri River as a receiving environment is a healthy habitat for freshwater and coastal species, and is protected and managed as an outstanding natural landscape and recreation resource (section 4.3)	Recreational use of the lower Waimakariri River, estuary, mouth and adjacent beaches	Very little change from the status quo.
Indigenous biodiversity in the zone is protected and improved (Section 4.4)	Enhanced amenity, recreational and cultural values from indigenous vegetation	Gradual improvement in values over time from non-statutory recommendations
The zone has safe and reliable drinking water, preferably from secure sources (Section 4.5)	The availability and cost of safe and reliable drinking water which meets the New Zealand drinking water standard.	The continuation of intensive farming, albeit with constraints on nitrate leaching, plus legacy affects will lead to further decline in quality in some areas in the shorter term
Land and freshwater management in the Waimakariri Zone will, over time, support the maintenance of the current high-quality drinking water from Christchurch's aquifers (Section 4.6)	Christchurch residents have access to high quality, untreated, cost effective drinking water in the longer term	Little change from the status quo in the short term – possible increase in legacy nitrates in medium term before improving
Highly reliable irrigation water, to a target of 95%, is available in the zone (Section 4.7)	Farmers in all areas, operating within flow and allocation regimes have reliable irrigation water, having taken advantage of water storage opportunities	Reliability will be reduced for some farms and remain variable across the zone
Optimal water and nutrient management is common practice (Section 4.8)	Farmers achieve the levels of reduction recommended in the Nitrate Priority Area, and the constraints recommended on winter grazing	A modest improvement above the LWRP
Improved contribution to the regional economy from the zone (Section 11)	Zone has thriving and vibrant communities supported by a sustainable local economy based on diverse and productive land and water use.	Some reduction in the level of output from pastoral farming but little change to the level of activity for the regional or district economy as a whole

Scale used in results column:

Much worse	A bit worse	Same or very little change	A little bit better	A lot better

1 Introduction

1.1 Objectives of the assessment

The Waimakariri Water Zone Committee (WWZC) has prepared a Zone Implementation Programme Addendum (ZIPA) for the management of water.[1] The ZIPA is designed to guide a sub-region plan change to section 8 (Waimakariri) of the LWRP, and support practical on-the-ground actions in the zone.

This social assessment considers the potential effects on people and communities of the ZIPA recommendations based on guidance from other technical assessments. The social assessment focuses both on the recommendations for regulatory measures for inclusion in section 8 (Waimakariri) of the LWRP, and on the non-regulatory measures recommended to Environment Canterbury, the Waimakariri District Council, Ngai Tahu and other agencies. Particular objectives are to:

- Report the anticipated changes at the level of the Waimakariri Zone specifically for all stakeholders and water users,
- Report on the implications of these changes in relation to social outcomes and the health and wellbeing of the Zone.
- Make an overall assessment of likely effects of the ZIPA recommendations as a whole on the health and social wellbeing of the Zone.

1.2 Social Outcomes expected from the ZIPA

The CWMS sets out a vision for water management in the region. This vision includes a number of social outcomes.

The vision statement for the CWMS is:

1. *People will feel they are being treated fairly and involved in decision-making.*
2. *Allocation decisions will be resolved in most cases without resorting to the courts*
3. *There will be a high level of audited self-management, and compliance action will be targeted on a minority of non-complying water users.*
4. *Ecosystems, habitats and landscapes will be protected and progressively restored, and indigenous biodiversity will show significant improvement.*
5. *Water quality will be protected and starting to return to within healthy limits for human health and ecosystems*
6. *Opportunities to exercise kaitiakitanga and rangatiratanga will be operative and increasing.*
7. *Opportunities for recreational activities will be returning and improving.*
8. *Water users will have access to reliable water, which will be used efficiently and productively.*
9. *Primary production and employment will be increasing, and the net value added by irrigation to the Canterbury economy and the national balance of payments will be increasing.*
10. *Efficiency in the use of energy will be improving.*

[1] Water is taken here to include lakes streams and rivers, ground water, and coastal lagoons and estuaries.

11. *Opportunities for tourism activities based on and around water will be returning and improving, and the net value to Canterbury's economy from these activities will be increasing.*
12. *Rural community viability will be improving and community cohesion will be maintained.*
13. *Understanding and empathy between rural and urban dwellers will be increasing.*
14. *Water management systems will be better able to adapt to climate change in the future.*

In its ZIPA the WWZC identified the following Community Outcomes that it is seeking for its zone. The numbers beside each of these outcomes identifies the linkages with the CWMS vision.[2] The social assessment considers how the implementation of measures recommended in relation to each of these outcomes will potentially affect the health and wellbeing of the people and communities of the Zone.

- The Ashley River/Rakahuri is safe for contact recreation, has improved river habitat, fish passage, and customary use; and has flows that support natural coastal processes *[4,7,11]*
- The Waimakariri River as a receiving environment is a healthy habitat for freshwater and coastal species, and is protected and managed as an outstanding natural landscape and recreation resource *[4,7,11]*
- The water quality and quantity of spring-fed streams maintains or improves mahinga kai gathering and diverse aquatic life *[4,6]*
- Highly reliable irrigation water, to a target of 95 %, is available in the zone *[8]*
- Indigenous biodiversity in the zone is protected and improved *[4]*
- The zone has safe and reliable drinking water, preferably from secure sources *[5]*
- Optimal water and nutrient management is common practice *[3,8]*
- Improved contribution to the regional economy from the zone *[9,11]*
- Land and freshwater management in the Waimakariri Zone will, over time, support the maintenance of the current high-quality drinking water from Christchurch's aquifers *[5]*

1.3 Approach to the assessment

The social assessment was commissioned by Environment Canterbury (ECAN). It builds on a comprehensive social and recreation profile reports on the zone commissioned previously by ECAN.[3] The profiles were completed in 2016. For the purposes of this assessment of the ZIPA, and where relevant and possible,[4] the material in these reports has been updated for the current work. The assessment also considered Zone Committee discussions and the results from community engagement activities to identify key issues and effects for different options and scenarios.

[2] As we have noted.
[3] Reports prepared by Mary Sparrow on social economic features and outdoor recreation related to fresh water in 2016
[4] Updating of social-economic data is limited by the unavailability of census data from 2013. At this point, results of the 2018 census are unlikely to be published before mid-2019.

An important part of the assessment was to interpret the results of other technical modelling and assessments from a social perspective, in particular the results from water quality analysis, ecological analysis and economic analysis are relevant. This integration of technical analysis came from presentations by other technical team members, memos on their preliminary results and direct discussions with relevant experts.[5]

Nitrate modelling and narrative water quality assessments have led to the recommendations which are a major focus of this social impact assessment. These are issues relating to:

> 1) the suitability of water for contact recreation (includes swimming, wading, boating with intermittent immersion), and food gathering, including mahinga kai; and
>
> 2) the suitability of water for human consumption, across the area, via community supplies and household wells consistent with NZ and international standards for nitrates and pathogens.

The economic modelling provided the basis for assessing social effects of the measures recommended that will require farmers in some areas within the Zone to achieve higher standards than Good Management Practice (GMP) for some aspects of their operation. Results from this modelling identify effects on profitability for the affected farms, and the possible consequences for on and off-farm employment. The economic modelling also provided a picture of the impact these recommendations for changes in farm practices are likely to have on the regional economy and all district households.[6]

Ecological assessments of the solutions package provided a basis for assessing potential cultural effects, amenity effects, and consequences for outdoor recreation and visitor activity. The assessment focused on the main water bodies and recreation/access points identified in Appendix A of the Recreation Profile. The community has particular interests in shellfish in rivers and estuaries, whitebait, and trout and salmon and the probable effects of the recommended statutory and non-statutory ZIPA recommendations will be assessed in terms of their likely impact on these.

The assessment does not replicate cultural assessments associated with historic land use changes and current land use activities, as provided by Ngāi Tūāhuriri. These impacts were a key component of the overall social context for the ZIPA formation and implementation. Effects of the ZIPA on Ngāi Tūāhuriri are addressed by them in their cultural assessment, which focuses on values with regard to mahinga kai as well as the expected outcomes for Māori defined within the ZIPA Community Outcomes.

Wherever possible, the assessment considered effects consistent with the attribute tables in the NPSFM (2014 as updated 2017) indicating, in particular, likely periphyton and macrophyte conditions that could affect attractiveness for food gathering (mahinga kai), swimming, picnicking and passive uses, the presence of *E. coli.* and cyanobacteria that could affect the health of humans and pets, and the levels of nitrogen that compromise drinking water safety.

Comparative findings from other social assessments in Canterbury's water zones were also relevant in helping to frame the analysis, such as results from the Selwyn Waihora, Hinds-

[5] See reports by Kreleger and Etheridge (2019), Arthur et al. (2019) and Harris (2019).
[6] As reported by Simon Harris (2019).

Hekeao, and Waitaki zones, recognising that while there are many similarities in Canterbury catchments, there are also important physical and social differences between zones.

Finally, it was important to distinguish and comment on the projected social effects from changes that would have happened in the area anyway, such as from increased urbanisation and further population growth.

1.4 Updating of the social profile

It was possible to update the following information in the social profile:

- Business frame data on business units and employment by sector that is available on an annual basis – to understand ongoing relative importance of agriculture, and agricultural services in the district economy.
- Sub regional (District) population estimates released by Statistics NZ.
- Data on dairy farming in the District published annually.
- School roll data – a key indicator of community wellbeing in the District that is also published annually.
- School ethnicity data – an indicator of cultural change due to increasing numbers of Māori, and also of new settlers and migrant workers in the District.
- Updated information on social services, focusing in particular on support services to farmers in a period of rapid change and stress – available through key-informant interviews.

Details on these updates were provided to ECAN in a research note (Appendix 1) and footnotes are provided below to give further details on the sources.

1.5 Assessment framework

The social assessment was organised by ZIPA outcomes and an assessment of the likelihood of achieving each outcome (see summary table above). Assessment is against current pathways, which is based on continuing development within the existing planning framework provided by the Waimakariri River Regional Plan (WRRP) and the Land and Water Regional Plan (LWRP). Sections 3-11 of this report provide the analysis that lies behind this assessment, while section 2 below is a summary of key findings and updates from the social profile report.

2 The Waimakariri District

2.1 The place and its catchments

The Waimakariri District lies north of the Waimakariri River and includes catchments for the northern tributaries of the Waimakariri River and the Ashley River/Rakahuri catchment (see Figure 1).

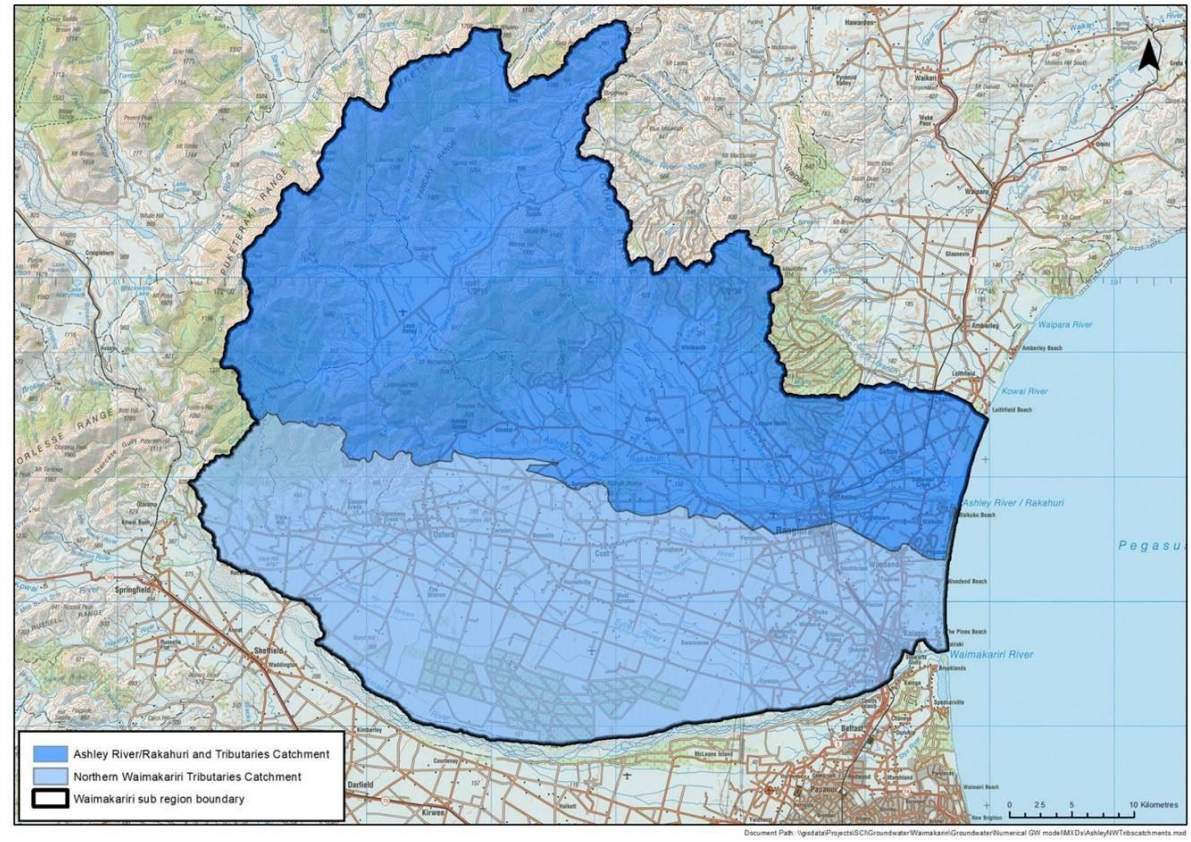

Figure 1. Map of the Waimakariri Zone major catchments

2.2 The patterns of settlement

The Waimakariri District has two main towns, Kaiapoi and Rangiora, plus the twin settlements of Woodend/Pegasus with the Ravenswood subdivision currently under development. There are also a number of smaller settlements in the east of the District. Oxford is the main settlement to the west of the District (see figure 2).

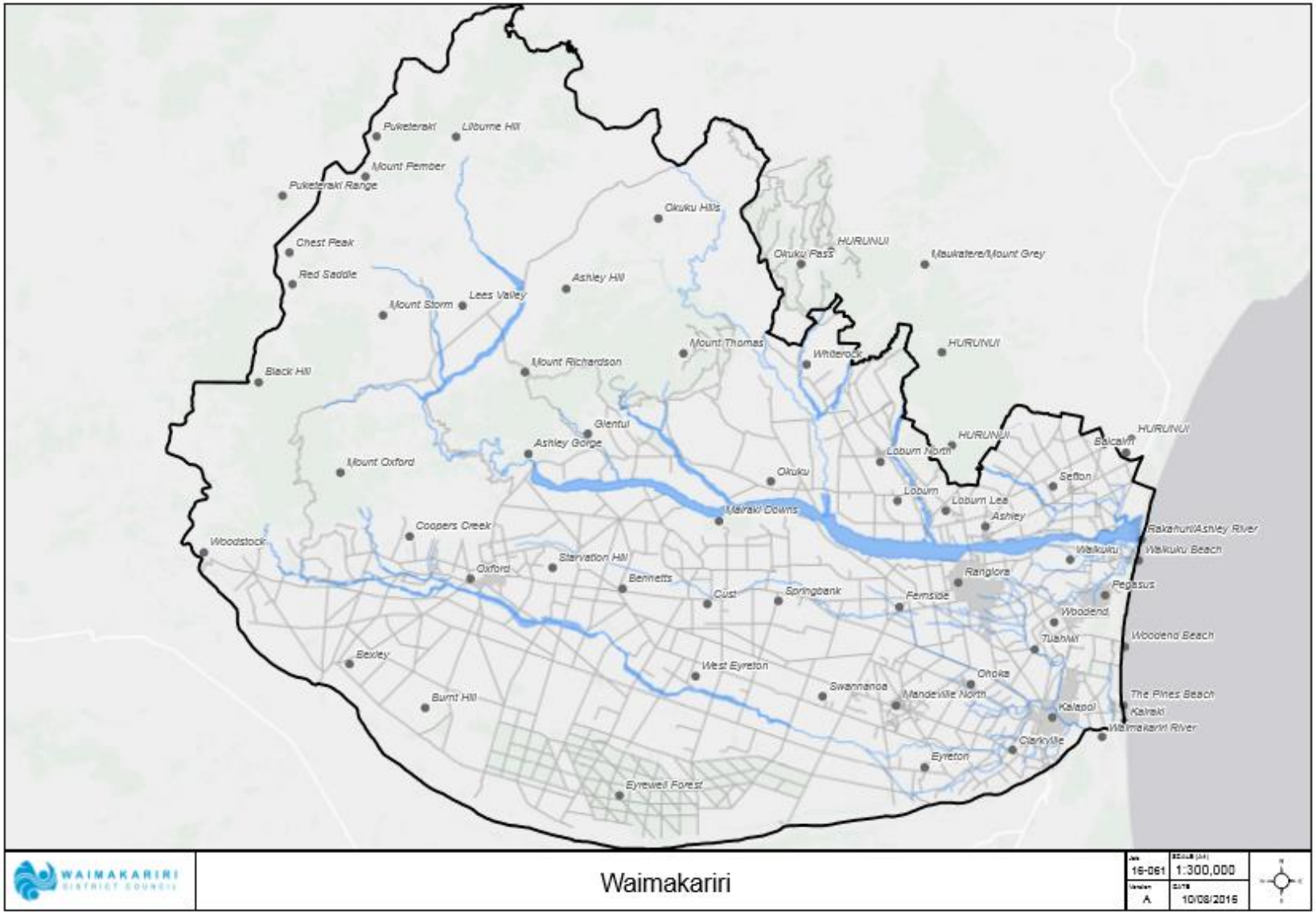

Figure 2 Map showing the main settlements of the Waimakariri District

Parts of the district (the towns of Kaiapoi, Woodend/Pegasus and Rangiora) are included in the Greater Christchurch Urban Strategy Area. Linkages to the larger urban economy affect the transport systems, labour markets (much of the District is in a reasonable commuting distance to Christchurch) and available services (central government, tertiary health and education services are largely outside the District).

The District is one of the fastest growth areas in the country. The estimated[7] resident population for the Waimakariri District as at 30 June 2018 was 60,700, and with a median age of 43.4 years. This represents an increase over the last 5 years of 8,400 (16.1%), and an increase in the median age of 0.8 years. The District's population is projected, by Statistics New Zealand based on the results of the 2013 Census to increase to 71,500 by 2028, and 79,600 by 2038

Within the Waimakariri District approximately 65% of the people live in urban areas, excluding several rural residential developments such as Fernside and Mandeville. In mid-2018 the town of Rangiora had an estimated population of just over 18,000 people, and Kaiapoi an estimated population of 11,630. The south east of the District i.e. the area to the south of the Ashley River/Rakahuri and the east of the Two Chain Road accommodates approximately 77% of the population. In addition to the people living at Woodend/Pegasus, the beach settlements, the remainder of these people live in the settlements such as Waikuku, Fernside, Ohoka and Mandeville, or on the many small rural holdings created in the last 30 years.

The areas to the north and west of the District have a significantly lower population density, with the main settlement, Oxford, currently having a population of just over 2,000 people. These rural areas are characterised by a substantial number of large farms, including ones irrigated from the Waimakariri Irrigation Limited (WIL) irrigation scheme. Some of the properties to the west of Oxford and outside of the command area for WIL are drawing water for irrigation from deep groundwater wells. To the north of the Ashley River/Rakahuri there is limited use of irrigation except in the vicinity of the Saltwater Creek and its tributaries. The few properties in Lees Valley are farming under distinctively different conditions from those on the plains and foothills of the Waimakariri District. Lees Valley has long cold winters and relatively short growing seasons, conditions that are more akin to the conditions faced on other high country properties in Canterbury.

2.3 The place of farming

While employment and business activity are growing, this does not apply to the agriculture sector. In 2018 the Waimakariri District had 6429 business units and an employee count of 15,000.[8]

[7] Sub-regional population estimates from Statistics NZ.

[8] The Statistics New Zealand Business Demographic Series provides an overview of business activity in the Waimakariri District. This data series is reported annually and is based on the PAYE (pay as you earn taxation) returns each February. A person with two jobs is included twice in the employee count. Working proprietors who do not pay their tax via the PAYE system are not counted.

M.E Consulting (October 2018) prepared a *Waimakariri District Business Land Assessment,* including a modified employment count (MEC).[9] The paper compares the situation in 2000 with 2017, and shows that in many of the industrial sectors other than agriculture there has been considerable growth over the period. In terms of the share of growth over the period: construction (30%), retail trade (13%), education and training (11%), health care and manufacturing (9%), and professional, scientific and technical services have recorded the highest growth percentages. In contrast, agriculture's share of growth has been -10%, and the annual rate of decline is assessed at -2% per year.

Another way of viewing the position of farming in the District today is to compare the number of agricultural business units and the employee count as a percentage of the total for the District. The 2018 Business Demographic Series reported 1275 agricultural business units which represented 19.8% of the total business units for the District, while the employee count of 970 for the agricultural industrial classification represented only 6.5% of the total unmodified employee count for the District as a whole. This highlights the fact that many of the farms in the District do not have employees, but have owners who do much of the farm work themselves and/or rely on contractors to do this.

Despite the diminishing share of agricultural business activity in the District, there has been substantial growth in dairy production in recent years. A good deal of this growth is the result of changes in land uses, principally from the sheep/beef and cropping group but also areas of forestry on the plains.

The first dairy farms in the District were established in the 1890s in the Sefton area, and the areas to the east of that quickly converted to dairying in the early 1900s. Much of today's dairying to the east of the District is, therefore, on land which has been used for this purpose for a century or more in the Waikuku area and north of the Ashley River/Rakahuri in the vicinity of Saltwater Creek.

The notable change is to dairying with irrigation on light soils, which is now a dominant feature of farming. A high proportion of the new dairy farms to the west of the District have been established since the commencement of the WIL irrigation scheme in 2000. In the 2017/18 season there were 104 herds recorded as having 70,700 dairy cows on 20,488 effective hectares, equating to 3.45 cows/ha on average.[10] This is an increase of 5,232 (7.4%) in the number of cows, and 451 (2.2%) in the effective hectares compared with the 2016/17 milking season.

2.4 Recreation opportunities

The Waimakariri Zone offers a wide range of water-related recreation opportunities. The land adjacent to the lower reaches of the Waimakariri River and Ashley River/Rakahuri have been established as Regional Parks, and development of these areas is on-going. Much of the land along the coast between the Waimakariri River and the Ashley River/Rakahuri is

[9] The MEC can be seen as a more accurate representation of the total employment for an area, as it takes into account the working proprietors. A significant proportion of these people are working in the agricultural sector, and also in other small/owner operated, or businesses involving a single entrepreneur such as real estate, professional services, administrative support or construction, sectors which are also well represented in the District.
[10] Statistics provided by Dairy NZ – see the appendix to this report.

controlled by the Te Kohaka o Tuhaitara Trust, and managed under a 200 year development plan seeking to restore indigenous habitat and enhance recreation opportunities.

The Ashley Estuary/Te Aka Aka stands out as an important bird habitat for many species, some of which are migratory, and is of great significance for those interested in observing birds. Both the Ashley Estuary/Te Aka Aka, and the Waimakariri Estuary provide for a wide range of recreational pursuits including fishing, whitebaiting, boating including yachting and kayaking, as well as wind sports.

The lowland streams (both the northern tributaries of the Waimakariri River and the streams that flow into the Ashley River/Rakahuri) are sources of mahinga kai, important to Ngāi Tūāhuriri both as an immediate food source and for maintaining their cultural tradition of food gathering. In addition, these streams provide opportunities for food gathering, angling and stream-side recreation including walking, cycling, picnicking, boating and fishing for the whole District.

Much of the foothills land and upland streams in the District are controlled by the Department of Conservation, which has developed many tracks and picnic areas that are valued by the community. Heavily-used places such as at Ashley Gorge and Mt Thomas are located adjacent to streams used for contact recreation such as swimming and paddling.

Outdoor recreation is an important part of the overall recreation activity for the zone's residents. The area as a whole can also be regarded as part of the play-ground for people living in Christchurch. This is consistent with the overall importance of outdoor activities for the national population and has implications for greater life satisfaction,[11] health and well-being.

[11] https://www.stats.govt.nz/reports/kiwis-participation-in-cultural-and-recreational-activities

3 ZIPA Recommendations

The ZIPA recommendations are introduced under five headings:

- Improving stream health
- Protecting and enhancing indigenous biodiversity
- Reducing nitrates
- Managing surface water quality
- Managing ground water quality

A range of inter-related statutory measures, and non-statutory initiatives are recommended under each heading which together are seen as likely to provide substantial improvement to water in the Waimakariri Zone.

Statutory recommendations

- Stricter controls on livestock in waterways on the plains than in the LWRP.
- Dairy platforms in target area (Nitrate Priority Area, see Figure 3) to reduce leaching to 15% below that allowable under GMP as required by Plan Change 5 of LWRP by 2030.
- All other farming enterprises within the Nitrate Priority Area to reduce leaching to 5% below that allowable under GMP as required by Plan Change 5 of LWRP by 2030.
- Controls on winter grazing across the whole zone.
- Increases in the minimum flows at which all the taking of water for irrigation must cease for some streams**.**
- Change in the method of calculating stream depletion for ground water takes from wells deemed hydraulically linked to streams in the WRRP to that out in the LWRP
- Over-allocations to be clawed back for Surface Water Allocation Zones and accompanied by the introduction of sharing regime as the river/stream falls below its new minimum flow plus the authorized take where these are not already in place, and a rationalizing of the allocation bands.
- For the Ashley River/Rakahuri in Blocks B and C an allocation for mahinga kai enhancement shall be available equal to 50% of the available allocation.
- Over-allocation of Groundwater Allocation Zones to be clawed back at consent reviews.
- Consent review brought forward with Ashley River/Rakahuri catchment recommended to commence in 2026/27, and the northern tributaries of the Waimakariri River recommended to commence in 2028/29.
- Add Cam River at Bramley's Road to the site list of LWRP to be monitored for recreation contact water standard.

Non-Statutory recommendations

- The development of catchment management plans.
- Education for landowner and small block owners with respect to biodiversity, the value of wetland protection, riparian management and the planting of appropriate indigenous plants, including a free biodiversity advisory service.
- Extensive monitoring and research, the promotion of "citizen science", and including an improved understanding of the impact of climate change and sea level rise on indigenous biodiversity.

- Attention to removing fish barriers, improving flood gates and ensuring best practice with respect to drain cleaning.
- Recognition for the importance of natural, amenity and landscape values of estuaries and braided rivers, and including the removal of woody weeds from the Ashley River/Rakahuri above the confluence with the Okuku River.
- Support for projects that benefit instream health, Ngai Tuahuriri values and recreational amenity.
- Support for community groups working to address indigenous biodiversity protection and enhancement.

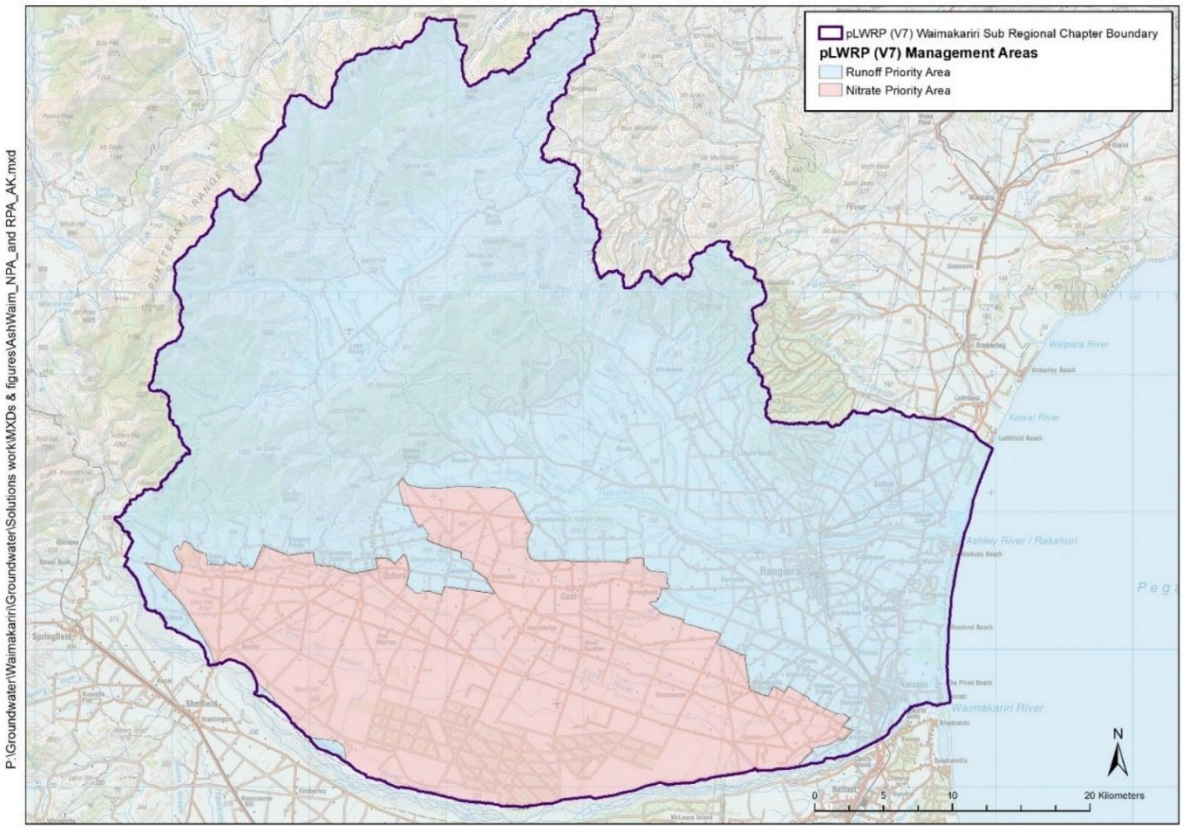

Figure 3: Proposed Nitrate Priority Area and Runoff Priority Area

4 Impact assessment

4.1 Recreational use of the Ashley River/Rakahuri

Outcome: The Ashley River/Rakahuri is safe for contact recreation, has improved river habitat, fish passage, and customary use; and has flows that support natural coastal processes [4,7,11]

The main issues identified for the Ashley River/Rakahuri and its catchment were:

- Low flows, and intermittent loss of surface flows during the summer months.
- Intermittent toxic algal blooms posing risks to people and animals swimming in the river.
- *E. coli* levels in the river and estuary posing risks to outdoor recreation.
- Degradation of the Ashley Estuary/Te Aka Aka from nitrate run-off.

Recovering surface water over-allocation is proposed in the ZIPA. This will contribute towards supporting improved low flows in the lower reach of the river and the estuary, as will the requirement for partial restrictions on all takes. Such measures are unlikely to significantly change the occurrence of dry reaches on the Ashley River/Rakahuri, this being a natural process.

To a certain extent the recovery of over-allocation involves the recovery of paper allocations which will not impact on the farming community. In some instances it may reduce the amount of water available for irrigation, which could have the potential to curtail agricultural production for the affected farms, if not accompanied by an increase in the efficiency of use of available water. This change will, nevertheless, mean that the granting of new consents to take water from the main stem of the Ashley River/Rakahuri, its tributaries or wells hydraulically linked with these in the future is less likely.

The ZIPA proposes two management priority zones: a Nitrate Priority Area and a Runoff Priority Area (See Figure 3). The Ashley River/Rakahuri catchment is in the proposed Runoff Priority Area. This means that close attention will be paid there to minimising surface run-off of sediment, phosphorus and *E. coli* in particular from farmland into waterways. In addition, increased controls on intensive winter stocking are proposed to curtail any increase in this activity as there is concern about the potential for increasing nitrate discharges to adversely impact on the Ashley Estuary/Te Aka Aka. It is proposed that, the minimum area for winter grazing as a permitted activity should reduce from 10 hectares to 5 hectares, to target the potential for increased use of smaller properties for this activity. This change is considered likely to mean that only a small number of existing farms will need to seek consents for winter grazing. The need to obtain a consent may, however, serve as a disincentive to any increase in winter grazing on smaller properties.

Controls on land uses in Lees Valley are aimed at maintaining the status quo, and these will limit the likelihood of water quality degrading below contact recreation standard under flows likely to attract swimmers.

The water quality and ecology current state report concluded that:

Faecal contamination has only occasionally been recorded as being so high as to pose a risk to contact recreation in the Ashley River, the Glentui River and the Grey River in the

past five years. Toxic cyanobacteria have not been recorded as posing a significant or consistent health risk in most hill-fed rivers. The only exceptions are the main-stem of the Ashley River, between Rangiora/Loburn Road and SH1, where significant Phormidium growths were recorded during the summer months. These may pose a significant health risk to recreational users and detract from river uses.[12]

The report also explains:

Benthic cyanobacteria such as Phormidium (Figure 1-2) can have a range of deleterious impacts on recreational values. It produces toxins that cause detrimental health effects including nausea, skin rashes and abdominal pain, cramps and diarrhoea. Dogs are particularly susceptible to the toxins produced, with death occurring in as little as 30 minutes in some cases (Wood et al., 2007). Cyanobacteria can also produce musty or earthy odorous compounds (i.e. Geosmin) that can be objectionable to people, contaminate bodies, clothing and equipment, and taint fish flesh, making it unpalatable. These attributes can particularly affect mahinga kai uses[13]*.*

Implementation of the ZIPA recommendations should reduce levels of sediment and nutrients in the river system, improving the habitat for indigenous and other species, with benefits for mahinga kai, amenity values and recreational uses. The ZIPA recommendations may also mitigate the development of toxic algal blooms in summer months to a limited extent, but these blooms are still likely to occur reasonably regularly in the longer term with accompanying risks to people and animals detracting from the recreational experience offered in the lower reaches of the Ashley River/Rakahuri. The highly valued Ashley Gorge area will remain an important recreational location for the District as will the riparian recreational areas that have developed alongside the lower river and estuary in recent years. These areas already have significant enhancement work by community groups such as the Ashley-Rakahuri Rivercare Group[14] and from visitor infrastructure provided by the Waimakariri District Council (WDC).

Outcome summary: Recreational use of the Ashley River/Rakahuri, environs and estuary are likely to increase with increased demand from a growing population, and from further enhancement of the riparian environment with the development of river parks and tracks, predator control and increased biodiversity (actions largely outside the ZIPA). The ZIPA recommendations will contribute a minor improvement in the longer-term to river ecology, habitat and amenity values, and enhance recreational use, offset by possible costs to farmers and farm production.

[12] Greer, M. and Meredith, A., 2017. Waimakariri Zone water quality and ecology: State and trend. Environment Canterbury Report No. R17/18
[13] Ibid p. 5
[14] The Ashley-Rakahuri Rivercare Group is a community group formed in 1999 to assist with management of the lower reaches of the Ashley River/Rakahuri https://www.visitwaimakariri.co.nz/things-to-do/thewaimakaririword/rivercare/

4.2 Amenity values, recreational and cultural uses of lowland streams

Outcome: The water quality and quantity of spring-fed streams maintains or improves mahinga kai gathering and diverse aquatic life [4,6]

The main issue identified for the spring-fed streams in the water quality and ecology current state report indicated poor ecological community health resulting from high levels of bed silt and relatively high nitrate levels, which are projected to increase significantly.[15]

The lowland streams fall into two groups, those that feed into the Ashley Estuary/Te Aka Aka including Taranaki Stream, and the Waimakariri River's northern tributaries including the Cam River. While this outcome specifically refers to the spring-fed streams, the Cust Main Drain should also be included. Although the Cust River rises in the foothills close to Oxford, the lower reaches of this waterway, identified as the Cust Main Drain, can be grouped with the spring-fed Waimakariri tributaries because this section is fed by drains that carry water from springs to the north and south of the river as well as from farming areas.

The Cam River/Ruataniwha, although a northern tributary feeding into the Kaiapoi River, is essentially fed by streams carrying groundwater arising from the Ashley River/Rakahuri augmented by stormwater from the Rangiora urban area. The Cam therefore does not carry the elevated level of nitrates which characterise the other northern tributaries, but nitrate levels do increase in the lower reaches because of surface recharge. It also has intermittent increases in flow during the summer as the result of stormwater run-off from Rangiora, while variations in summer flow occur to a much lesser extent in the Ohoka Stream and Silverstream.

The proposed actions to improve the health of spring-fed streams include:

- Increases in minimum flows at some sites, indicating the point at which all surface water takes must have ceased, and those from wells deemed hydraulically linked must either cease or reduce the amount of water taken depending on the proximity to the stream.
- The strengthening of existing plan provisions with prohibition of access to all waterways (including surface drains) on the plains for all cattle, deer, and pigs irrespective of whether these are being intensively farmed under irrigation or not.
- The establishment of a Runoff Priority Area, where particular attention will be paid to the exclusion these animals and riparian protection of waterways will be an important requirement of Farm Environment Plans. For this area the ZIPA calls for careful runoff management to address the contamination of waterways resulting from sediment, phosphorus and *E.coli.*
- The establishment of a Nitrate Priority Area, which covers the area of lighter land to the south and west of the Waimakariri/Ashley plain where a requirement for dairy platforms to reduce nitrate leaching by 15% below PC5 Baseline Good Management Practice by 2030 is proposed, together with a reduction of 5% below this level for all other consented land use activities.
- For the WRRP area stream depletion effects of irrigation takes from groundwater wells are to be estimated using the method provided in the LWRP. In general this will increase the number of wells considered to be stream depleting and therefore increases the number of takes controlled by a minimum flow. Adopting this methodology may also increase the calculated stream depletion rate for exiting takes.

[15] Ibid.

These controls together with the increased minimum flows will not come into effect until existing consents are reviewed, for the Ashley River/Rakahuri catchment the Zone Committee has recommended 2026/27 and the northern tributaries of the Waimakariri River 2028/29.

- The "claw-back" of surface water over-allocation where the current allocation exceeds the limit defined in the plan. A range of measures to achieve recovery of the over-allocated amount are proposed in the ZIPA.

In the short term the suite of statutory and non-statutory recommendations can be expected to maintain water quality in the lowland streams, whereas this was projected as continuing to decline under the "current pathways" scenario. Any improvements in the quality and quantity of water in the lowland streams resulting from the recommended measures could take more than a decade to become apparent.

The extent to which the improvements are realised for each stream could well depend in part on the undertaking of enhancement projects consistent with the non-statutory recommendations in the ZIPA. The statutory changes together with these recommended actions could, for example, see improvements such as in the *E Coli.* counts in the Kaiapoi River at Kaiapoi, and the Cam River at Bramleys Road so that the water at these locations will comply with contact recreation standards. Improvements in water quality would also see improvements in cultural values, especially the availability of an increasing range of mahinga kai in streams as well as in the Ashley Estuary/Te Aka Aka.

The improved quality of the water, with fewer instances of algal blooms and less weed growth requiring mechanical removal, will improve cultural and amenity values, and make stream-side recreation more attractive along the streams, particularly in places such as the new Silverstream subdivision and the Silverstream recreation reserve. There are plans for further biodiversity planting and the development of walking and cycle paths in these areas, and redevelopment of the Kaiapoi Town Centre through earthquake recovery plans emphasise a stronger orientation of the town to the river. Also from a recreation perspective any recovery of the lowland trout and salmon fishery will be a major gain, as this fishery has seen a severe decline in the last 20 – 30 years, considered to be largely attributable to increased nitrate levels and also to sedimentation in the spring-fed streams.[16]

Outcome summary: There is potential for small gains to the environment of the lowland streams in the short term, with increasing gains over the longer term. A large number of people in the District will benefit due to proximity of the streams to urban areas. On the other hand, a small number of farmers are likely to be affected negatively and some will require support to adapt to these changes and cope with the process of transition (see section 4.8 and section 5 below).

[16] A Meredith, pers comm.

4.3 Recreational use of the Waimakariri River

Outcome: The Waimakariri River as a receiving environment is a healthy habitat for freshwater and coastal species, and is protected and managed as an outstanding natural landscape and recreation resource [4,7,11]

The main issues identified for the Waimakariri River as a receiving environment for the northern tributaries concern the quality of water discharged from the Kaiapoi River, which is the cumulative effect of the nutrients and pathogens collected from the contributing steams, the Cam River/Ruataniwha, the Cust Main Drain, the Ohoka Stream and Silverstream (the name given by the community to the reach of the Kaiapoi River before the confluence with the Ohoka Stream) and Cust Main Drain.

The area is an iconic recreational site and has a wide variety of recreational uses including boating, wind sports, kayaking, fishing (for sport and food gathering), whitebaiting in the estuary, and surfing and swimming in the adjacent Pines/Kairaki beach areas. There is a campground at Kairaki which has been re-established by the Waimakariri District Council since the 2010/11 earthquakes.

As discussed above in relation to the lowland streams that flow into the Waimakariri, the ZIPA will assist with improvements to the quality of the lower Waimakariri and the cultural and recreational uses of this area. Ecological improvements in the northern tributaries may bring limited gains to the numbers of salmon and sea-run trout coming into the river, and contribute to whitebait spawning runs in the estuary as well as further up-stream.

Important aspects of the management of the Waimakariri River to achieve the Waimakariri ZIPA outcome are the responsibility of Ecan and managed under the sub-regional plan, yet to be developed, for the Canterbury high country and alpine rivers.

Other important aspects are the clean-up of wastewater effluent discharges – with improvements gained from linking the Kaiapoi oxidation ponds to the Eastern Waimakariri ocean outfall and Belfast to the Christchurch ocean outfall. The removal of the Belfast discharges was supported by the WWZC shortly after its establishment, and the decision to do so was seen as important gain for the committee at that stage. These changes have already brought considerable gains to water quality and recreational uses of the area.

Outcome summary: There are likely to be ongoing increases in the social (recreational) and cultural uses of the lower Waimakariri River, its estuary, mouth and the adjacent beaches. In terms of improving the water quality, however, this will be influenced by a number of factors including the management of the southern streams and the measures included in the proposed sub-regional plan for the Waimakariri River.

4.4 Improvements in indigenous biodiversity

Outcome: Indigenous biodiversity in the zone is protected and improved [4]

There has been a considerable reduction in indigenous biodiversity on the Waimakariri/Ashley plain and on the plains to the north of the Ashley River/Rakahuri. These areas were progressively cleared in the years since the arrival of the European settlers. The main areas of indigenous biodiversity in the Zone are on the foothills to the south of the

Ashley River/Rakahuri and in Lees Valley, including woodland/forest and wetland species and grasses. The Department of Conservation controls approximately 32,000 hectares of land in this area. The coastal land from the Waimakariri estuary to the Ashley Estuary/Te Aka Aka is mainly controlled by the Te Kohaka o Tuhaitara Trust, which is undertaking extensive restoration work with the assistance of many groups of volunteers.

The ZIPA and expert commentary on it[17] recommend actions to protect and improve indigenous biodiversity using statutory (ECAN and WDC) and non-statutory methods, including the funding of plants, fencing and predator controls. It also recommends to ECAN and the WDC that the use of indigenous species be promoted for riparian protection, and that expert advice be made available to land owner wishing to use indigenous species when establishing riparian protection for waterways.

The Farm Environment Plans required under PC5 will address the issue of the adequacy of riparian protection on farms. These will take into account the presence of remnant biodiversity and the use of indigenous species when planting riparian areas. Riparian protection will be a major focus of the Runoff Priority Area, and farmers will have to meet the cost of fencing and planting and ongoing maintenance. There may, however, be some public money available to assist with this work.

There are indications that members of the wider community are becoming increasingly interested in including indigenous plants on their properties and seeing them used in public spaces. The increase in the planting of indigenous plants can, therefore, be seen as further enhancing habitats and amenity values, i.e. the pleasantness of the environment, as well as the indigenous plant and animal species in the District.

Outcome summary: An increase in indigenous biodiversity will most likely follow from increased indigenous planting and enhancement in riparian margins, spring heads and wetlands of the zone. The success of the proposed ZIPA recommendations will depend on both planning instruments and targeted investment by ECAN, WDC and other agencies, and the efforts of individual farmers, other property owners and community groups involved with riparian planting and restoration activities. Increased indigenous biodiversity should in turn enhance amenity values and thus, recreational and cultural values.

4.5 Safe and reliable drinking water

Outcome: The zone has safe and reliable drinking water, preferably from secure sources [5]

The Waimakariri District Council operates 15 Community water supplies. These provide an estimated 18,000 properties or approximately 79% of the District's population, excluding those in the north of the Ashley River/Rakahuri. Of the 15 schemes, eight are "restricted", which means that properties have an allocation per day that is in most instances $2m^3$, but in some instances property owners can purchase an additional allocation. The supplies to the main urban areas are "unlimited", and these supplies are not metered.

Properties to the north of the Ashley River/Rakahuri in the Loburn, Ashley and Sefton areas are connected to a water supply managed by the Hurunui District Council, a legacy of the local government boundaries prior to the creation of the Waimakariri District in 1989. It is

[17] Grove, 2019.

estimated that approximately 2,380 properties in the Zone to the north of the Ashley River/Rakahuri are connected to this supply. This reliability of this supply in summer is poor as its restriction bands are connected to the Ashley River/Rakahuri minimum flow.

The WDC's 2017/18 Annual Report states that all its supplies are microbiological compliant, and that all except the Waikuku Beach, Garrymere, Poyntzs Road and Oxford Rural No. 1 are protozoal compliant, and that these wells will be compliant by 2020. Recently there has been a move to link the Fernside and Mandeville supplies, with the relatively shallow Fernside well retained only in the case of an emergency.

This leaves some 2,750 properties across the zone reliant on private wells or other sources of water, and at 2.6 people per household means that just over 7,000 people (12% of the total population) are not receiving water from a community water supply. This is the group of the community at higher risk of not having safe and reliable drinking water, because these people are responsible for the testing of their own supply.

Monitoring of groundwater over time has shown areas with elevated levels of nitrate across the Waimakariri-Ashley Plain. Across this area there are many relatively shallow wells, and some in high nitrate areas will have water that exceeds half of the Maximum Acceptable Value (MAV), which is 5.65mg/L and a few could have supplies that spike at or above the MAV of 11.3 mg/L of nitrate-nitrogen.[18] The households that rely on these wells for their water supply are at risk, particularly if there are pregnant women or babies present. It is not advisable for pregnant women or young babies to drink water with a high nitrate content. The New Zealand Drinking Water Standard 2005 revised 2008 notes that the MAV for nitrates is "*Now short term only".* This change has been introduced to protect against methaemoglobinaemia in bottle-fed infants.

The ZIPA indicates that nitrate levels are projected to increase in the short term with patch results by area, in part because of a lag effect before the proposed controls on leaching from agriculture take effect over the longer term. This means the number of households reliant on private groundwater supplies with nitrate readings in excess of the recommended level could be about 270 wells. These households may need to address the nitrate issue by sinking deeper wells to obtain water with lower nitrate concentrations. For others where wells are at risk this should prompt more frequent monitoring of wells to ascertain nitrate levels. The purchasing of bottled water may be seen as an acceptable response when/if a baby is present in the household.

In addition, better well-head protection is recommended for these house wells, to provide against *E coli.* contamination from surface runoff. This will assist these household with maintaining their water quality. Households that have to take action to achieve supplies with nitrate levels acceptable in terms of the New Zealand Drinking Water Standard, however, may find that they have to incur considerable costs.

Additional monitoring, more accurate data, better calibration of models and improved community knowledge of the nutrient priority areas will result in greater overall awareness of nutrient issues in the Zone amongst stakeholders and the public. Better knowledge about water quality could also lead to adjustment of the priority areas and/or controls, with greater acceptance from stakeholders.

[18] The current state of groundwater quality in the Waimakariri CWMS zone: L Scott, R Wong, and S Koh. Environment Canterbury Report No. R16/48.

Outcome summary: The increased presence of nitrates in potable water, in the short to medium term, with be accompanied by increased risks to human health. There are likely to be definite benefits to the District population from reduced nitrates in drinking water over the longer term. Negative effects on farm profitability and employment resulting from controls on nitrate leaching from farming are small in terms of the District economy as a whole, as discussed below.

4.6 Christchurch drinking water

Outcome: Land and freshwater management in the Waimakariri Zone will, over time, support the maintenance of the current high-quality drinking water from Christchurch's aquifers [5]

High quality, untreated drinking water is an essential part of the sense of place for Christchurch residents and their sense of wellbeing.[19] Until recently there had been little concern about the possibility that water with elevated nitrate levels in groundwater to the north of the Waimakariri River could be travelling under the river and affecting groundwater under Christchurch City.

Research undertaken during the development of the ZIPA has indicated water from north of the Waimakariri is highly likely to be moving under the river and into the lower aquifers under Christchurch. The area from which this water is moving is within the Nitrate Priority Management Area, and modelling indicates that if nitrate levels are not constrained there is a long term risk of nitrate contamination of the aquifers to the south of the river. The controls recommended in by the WWZC area likely to reduce the risk of increased nitrate concentration in the Christchurch aquifers attributable to from north of the river.

Outcome summary: Better understanding of groundwater sources and movements. An improvement in groundwater quality over time because of the measures recommended in the ZIPA will have direct benefits to the health and well-being of the people of Christchurch and to the environmental image of the city. .

4.7 Irrigation reliability

Outcome: Highly reliable irrigation water, to a target of 95%, is available in the zone [8]

The WIL scheme is a run-of-river scheme, which means that its takes are subject to the minimum flow requirements of the Waimakariri River. The availability of water from the Waimakariri River during the first part of the irrigation season is generally reliable, but the amount of water available in the second half of the season is more variable. Overall the WIL scheme is about 75% reliable. [20] The reliability of groundwater takes is variable, depending on the location within the District. While some takes down gradient from the WIL command area report greater reliability since the commencement of the scheme, projections are that the amount of water likely to be available in future could decline as irrigation within the WIL scheme achieves high levels of efficiency required by GMP.

[19] As evidenced by recent negative reactions to temporary chlorination while city well-heads were being secured.
[20] WIL website February 2019

Farmers with irrigation takes from the spring-fed streams where increased in the minimum flows are recommended will experience reduced water availability. However, the effect is mainly localised and only a few irrigators will experience a notable decline in reliability. Most impact in terms of change from the status quo is caused by the controls introduced through the LWRP rather than from the likely impacts of the introduction of the ZIPA recommendations.[21]

Those with wells assessed as hydraulically linked under the LWRP method of calculating this relationship, which were previously assessed under the WRRP, are likely to have less reliable irrigation water than currently because of the alternative criteria involved. When this occurs in combination with an increase in the minimum flow in the stream concerned, the reduction in reliability will be greater. In some instances, these farmers may be able to obtain a better supply of water from groundwater, but wells will have to be of a sufficient depth to avoid hydraulic linkage to the stream for which a higher minimum flow has been set. For those farmers seeking deep ground water there will be the associated cost of well drilling in the hope of finding water and, if successful, the additional cost of pumping from depth.

If farmers are not able find deep water, the reduced reliability from the increase in minimum flows coupled with the change in the stream depletion calculations, could have a serious impact on their farming operation. There will be limits to their ability to adapt farming systems to cope with the reduced reliability of irrigation water. For these farmer, however, there is the option of ceasing farming in favour of subdivision of their land into lifestyle blocks, which will present as an attractive financial option.

Outcome summary: Farming with irrigation is an important component of the District's agricultural economy, so a reliable supply of water from either WIL, groundwater or surface water within the Zone is desirable. Irrigation has allowed the conversion of dry-land farms to dairying and supports rural populations and communities.[22] The most obvious alternative for some rural land holders is to subdivide into lifestyle blocks. Additional controls on water takes from spring-fed streams and stream depleting wells will have an adverse effect a relatively few farmers. On the positive side, enhancements to the lowland streams will bring benefits to amenity values, cultural and recreational uses as discussed above.

4.8 Optimal water and nutrient management

Optimal water and nutrient management is common practice [3, 8]

Plan Change 5 of the LWRP already sets rules to guide optimum water and nutrient management. The ZIPA aims to achieve reductions in nitrate leaching in the Nitrate Priority Area and reduce phosphorous and pathogens reaching rivers and streams across the Zone, with special attention being paid in the Run-off Priority Area. The LWRP requires that farms be audited to assess compliance with industry standards of good management practice. A system has been developed which places pressure on poorly operated farms to improve by setting closer intervals for audit inspections. The following table sets out the grading system

[21] See Waimakariri Land and Water Solutions Programme Options and Solutions Assessment - Economic Assessment: Simon Harris LWP Ltd. May 2019 Table 5.
[22] Waimakariri District Council (2008). Waimakariri Irrigation Scheme: Monitoring report on the impacts on the District of the introduction on the upper Waimakariri-Ashley Plain in 1999/2000.

and the frequency with which audits are required to be conducted depending the overall grade expressed in terms of “compliance against resource consent”.

Overall Grade	A	B	C	D
Compliance against your resource consent	Compliant	Compliant	Non-compliant	Non-compliant
	Frequency of Audit			
Individual consented farm and farming enterprises	3yr	2yr	1yr	6 months
Farms connected to an Environment Canterbury Approved ISO Accredited Audit Programmes (Industry Programme)	Dependent on Approved ISO Accredited Audit Programme timeframe	2yr	1yr	6 months
Farms connected to an Irrigation Scheme, Principal Water Supplier, or Huruni Waiau Collective	Dependent on Approved ISO Accredited Audit Programme timeframe	2yr	1yr	6 months
Change in management or significant change in farm systems	1yr	1yr	Within the year	6 months

FEP Audits: Canterbury Water website – 17/11/18.

The outcome sought is for most farms in the zone to be getting A grades, and WIL has an environment officer who is working with its shareholders to achieve this standard. Farms within the WIL scheme will also come under the umbrella of the irrigation company’s consent for nitrate loss. Individual farmers with consents to take surface or ground water will be audited individually, and will have to meet the nitrate loss assessed for their property individually. These farmers, without the support of an irrigation company will have to work with separate advisors, and this may present a significant challenge for some depending on their type of operation, their competency, and the characteristics of their property.

The requirements to reduce nitrate leaching below GMP by 15% for dairy platforms and 5% for all other farm types within the Nitrate Priority Area fit with the WWZC target of “challenging but achievable”, but will put considerable pressure on farm managers and farm staff. Some of the techniques that are likely to have to be used to reduce nitrate leaching on dairy platforms will present challenges in terms of maintaining animal health. Also, Dairy NZ research suggests that for some farms it may be necessary to use the techniques modelled to achieve reductions of up to 15% on dairy platforms without significant loss of production or profitability, to achieve the standard required for GMP.

The social impact of the requirement in the Nitrate Priority Area for farms other than dairy milking platforms to reduce nitrate leaching to 5% below GMP is more difficult to estimate. These farms include a wide variety of enterprises in terms of scale and complexity. Some will base their operations on providing winter grazing, others will be running a mix of sheep

and/or cattle, and there may also be some cash cropping. Those that base their operations mainly on the provision of winter grazing may also be constrained by the ZIPA recommendations with respect to this land use. There are probably opportunities, however, for most of these farms to vary management to achieve the required improvements without encountering significant hardship.

Farms in the Runoff Priority Area will be required to provide appropriate riparian protection (e.g. planting and setbacks), which will involve additional expenditure for installation and maintenance, and for some of the smaller farms the surrender of valuable productive land. Some of these are also properties with irrigation takes that may be subject to higher minimum flows, increasing the number of days on partial or full restriction. The properties most likely to be adversely affected by these changes are the ones where there have been significant increases in the minimum flow, along the Ohoka Stream and Silverstream in particular.

The economic analysis indicates that some farmers could experience effects on profitability and capital value, and some may not be able to survive the effects of these and other ZIPA measures with current land uses[23] The ZIPA carries a recommendation that the sub-regional plan should include an extenuating circumstances provision to allow these cases to be addressed. For a few farmers this provision may allay some of fears expressed during the consultations on the proposed recommendations.

Support for farmers includes Fonterra's support for its suppliers through its Tia Ki programme, which gives farmers assistance with the preparation of a Farm Environment Plan, the preparation of consent applications and the organisation of riparian planting. This service is free to Fonterra suppliers, and it is suggest that if this service was obtained from a farm consultant it would cost around $3,500.00. Synlait suppliers indicate that this dairy company has approachable people who are able to provide support when called upon. Those not involved in the dairy industry have the opportunity to engage farm advisors to assist them.

Outcome summary: The majority of farms will probably be able to comply with the additional constraints from the ZIPA. Some farmers, however, are likely to face difficulties complying and may need technical assistance and other advice to adapt, and if unable to do so a small number may leave the industry.

4.9 Regional economy

Improved contribution to the regional economy from the zone [9,11]

The CWMS vision included the objective that primary production and employment would increase and the net value added by irrigation to the Canterbury economy and the national balance of payments would also be increasing. The Zone outcome sought to improve the area's contribution to the regional economy. The narrative for this Waimakariri Zone outcome indicates that it seeks the area to have *"thriving and vibrant communities supported by a sustainable local economy based on diverse and productive land and water use, integrated and sustainable management of the effects of flooding, earthquakes and climate*

[23] See Harris (2019).

change protects assets and amenities and builds resilience in communities and ecosystems."

The primary sector does not have a prominent position in the Waimakariri Zone in terms of employment, and a more limited role in terms of overall economic activity generated by the agricultural sector than other rural zones in the Canterbury Region. Much of the District's economy revolves around secondary and service sector, with the wealth brought into the District by the people travelling into Christchurch to work each day making major contribution. With around 60,000 people living in the District, the health and education sectors are important as is retailing/wholesaling.

Since the commencement of the WIL scheme in 2000 there has been a significant increase in dairying in the area with many of smaller farms on the lower plains replaced with large scale operations on the upper plain. This additional activity contributes to the urban areas to the west of the zone and provides additional support for rural services such as local primary schools, although in some instances it is difficult to separate the increases attributable to dairying from those associated with additional small-holding development in the same area.

M E Consulting's modified employment count (MEC) which takes into account working proprietors as well as employees indicates that between 2000 and 2017 the number of people working in agriculture, fishing and forestry in the Waimakariri District. During this period it declined from 2790 to 2070, and in 2017 those working in agriculture, fishing and forestry represented 11.4% of the 18,140 identified as the District's EMC for 2017. Between 2000 and 2017 the business count for agriculture, fishing and forestry also fell by 300 or 15.9%. Despite this trend, agriculture, fishing and forestry businesses represented approximately 20% of the District's total businesses in 2017.

The regional economic analysis points to a relatively small decrease in the total District economy and a more significant effect of the ZIPA on the farming economy. Any effect of lowering farm incomes from new controls will flow from individual farms to farm services and general expenditure, affecting rural and urban communities, in much the same way as these are impacted at times when product prices are depressed, in an extended period of dry weather, or in severe snow storms which result in stock losses. However, the proposed ZIPA changes will be in addition to the challenges that farmers are already accustomed to facing, and some will find that they have to face the combined effect of a number of these measures.

It is acknowledged that forestry has been used in the modelling of the economic impact of the requirement to reduce nitrate leaching, and that it is suggested that there could be a significant move to forestry on sheep and beef farms.[24] If farmers turn to forestry, the adverse consequences of this change in land use may be limited by the returns that will become available from the Emissions Trading Scheme (ETS). For much of the irrigated land there will be a wider range of horticultural and high value cropping options, which means that the social impact of the constraints proposed in the ZIPA will not necessarily be severe on the farmers who choose these alternatives.

The pending inclusion of the agricultural sector in the ETS is only one of a number of changes that farmers in the Zone may have to adapt to in the near future, as well as the changes driven by the ZIPA recommendations. These will include changes in market

[24] Section 3.2 Harris (2019).

relativities and climate change. In a broader context, however, it is necessary to recognise that adaptation has been a feature of New Zealand agricultural production over the years. The challenge faced by farmers in the Waimakariri Zone, as well as across the rest of New Zealand, is that in the future they will probably be under greater pressure to adapt to change than they have been in the past.

The rural economy and communities in Waimakariri commonly experience and adapt to a number of sources of uncertainty and stress so the ZIPA introduces another source of uncertainty for the rural economy to deal with. Unlike many rural areas, this economy has other opportunities for sources of employment and income that will enable farm households and those immediately affected in rural communities such as Oxford, Cust, and West Eyreton to adjust to change. These include opportunities for "off-farm" employment in Kaiapoi, Rangiora or Christchurch, developing agricultural contracting or advisory services, or other home based consultative business.

Outcome summary: Despite the prominence accorded to dairying, the rural economy of Waimakariri has a relatively diversified base, with many households in the rural areas having multiple and varying sources of income. The District has demonstrated an ability to adjust to change over the years, and is likely to do so in the future. Some individual farm operators and employees, potentially, could struggle with the implementation of changes recommended in the ZIPA and will need assistance through a process of change management.

5 Management of change

The satisfactory adjustment of rural people and communities to the recommended policy changes and associated actions will depend on a number of factors that the implementation of the ZIPA can influence. Timing of changes is the most important factor. Clearly any forced, rapid changes in land use will have the greatest potential for social disruption.

Time is seen by farmers as an asset in terms of adaptation to the changes proposed. The ZIPA sets the date of 2026/27 for the review of irrigation consents for the Ashley River/Rakahuri catchment, which will involve imposing the LWRP provisions (as modified by the upcoming plan change) with respect to the management of minimum flow regimes and the assessment of stream depletion effects on groundwater wells. The date for the review of consents for water take consents in the Waimakariri Catchment is 2028/29. This will give farmers and farm managers at least eight years to assess the implications of any changes to their current consent conditions, and to adapt their management to accommodate these.

Behavioural change towards improved environmental management will result from a mix of plan provisions, non-statutory measures and community leadership. These changes will, in turn, lead to the emergence of informal social control – along with the ready exchange of technical information, and encouragement to better performance through farmer and industry leadership, informal networks, and more formal organisations such as farm discussion groups.

An adaptive approach will assist farmers. Adaptive management is facilitated through phasing of change and good information. There are provisions proposed for better environmental monitoring in the Zone and improved management of data, as discussed above. The wide ranging dissemination of monitoring results and the analysis of these alongside the modelled projections will be important. It will give those interested in the implementation of the ZIPA objectives an indication of the progress being made with respect to the ZIPA's stated goals. Detailed monitoring, if showing the anticipated positive results, will provide reassurance that their efforts are worthwhile. If the results are not those anticipated then then the reasons for any actions can be taken to adjust the measures concerned will be apparent.

The adaptive approach is assisted by provisions such as consent review mechanisms and additional plan changes as required, although the intention in the ZIPA is for the duration of consents to be shortened. It could include redefinition of nutrient priority areas, especially at the point of scheduled plan-change reviews scheduled to commence ten years after the Plan Change, due to be notified in mid-2019, becomes operative.

The extent to which farmers and farm families will experience some increase in financial and personal stress will depend on how the recommended suite of additional controls will impact on them given their personal circumstances, irrespective of the type of farming with which they are involved. A few may need some assistance to cope. Recognition of the potential for New Zealand farmers to face mental health issues has increased in recent years. This is an issue that needs to be keep under review when considering measures likely to place additional pressures on those managing farms. A recent literature search undertaken by the

New Zealand Accident Compensation Corporation[25] found that farmers were more likely to commit suicide than other occupational groups in Australia, Great Britain and some northern European countries, jurisdictions similar to New Zealand.[26]

The Rural Support Trust has the ability to provide emotional support to farmers who are finding it difficult to cope with the pressures that they face. Fonterra advises that if their staff providing the Ti Aki service identify suppliers requiring support over and above that provided by this service, the Rural Support Trust will be advised of the need for their assistance.

The Oxford Community Trust has the capacity to provide assistance, and is already working alongside migrant communities. At its multi-cultural dinner held in July 2018, people from 17 countries were represented. This trust maintains an "open door" for all those living in its area who seek assistance, and maintain a commitment to suicide prevention.

The Community Wellbeing North Canterbury Trust together with the Oxford Community Trust, have a combination of paid staff, voluntary activity and obtain funding from a number of sources. Together these organisations provide a strong basis for assisting individuals and local communities adjust to the constraints imposed by the ZIPA.

Another important factor in the management of change is the provision of timely and helpful information. For best results in mitigating, or enhancing, ZIPA effects, there will need to be ongoing and effective communication to inform all these organisations and sources of help about the nature and timing of key changes. This communication can build on the collaborative efforts of the Zone Committee with leadership and coordination by ECAN and WDC.

Finally, it is important to emphasise that social impacts at the end of a process of change such as the implementation of the ZIPA recommendations will depend on the way they are managed. Such implementation should aim to reduce or mitigate negative impacts and enhance the positive ones. Also, it should not be viewed in isolation from other pressures for change which are being addressed by those most affected. Overall, therefore, the management of change must look to maximise outcomes for social wellbeing across the population and communities of the District and for all water users.

[25] Farmers' mental health: A review of the literature – Report prepared for the Farmers' Mental Wellbeing Stakeholder Group by the Accident Compensation Corporation: Alison Goffin, ACC Policy Team, 2014.

[26] The situation in New Zealand cannot be clearly ascertained from Coronial data because farming is combined with other trades for the occupations of people who suicide that are examined by Coroners in this country.

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Appendix 1 – Note on social profile updates

The Waimakariri District's estimated resident population

Statistics New Zealand estimates the resident population for territorial authority areas as at 30 June each year. This estimated population takes into account the number of people from an area who are overseas on short-duration visits as well as the people resident in the area at that date.

As at June 2018 Statistic New Zealand gave the estimated resident population for the Waimakariri District as 60,700 people. Of these people 38,870 (64.1%) lived in the district's main urban areas:

Rangiora	18,340
Kaiapoi (including Pines/Kairaki)	12,190
Woodend/Pegasus	5,140
Oxford	2,170
Waikuku Beach	1,030
Total	38,870

The remaining people live in the rural areas, smaller settlements or Residential 4 (rural residential) zones, with many on smaller rural holdings to the east of the District:

North of the Ashley River/Rakahuri	5,200
East of the District	1,850
South east of District	5,940
Central area, west of Rangiora	3,130
South west of District	4,950
Total	21,070

Schools in the Waimakariri District

The Waimakariri District has 26 schools:

2 Secondary (Rangiora and Kaiapoi High Schools)
2 Composite (Oxford Area School and Rangiora New Life School)
1 Teen-parent unit (Karanga Mai)
21 Primary schools (19 state schools and 2 Catholic schools)

In July 2018 there were a total of 8905 pupils attending schools in the Waimakariri District. Of these, 2927 (32.9%) were secondary school aged with 2540 at the District's two secondary schools and 387 at its composite schools. There were 5978 (67.1%) pupils at the District's primary schools. The average number of students per year for the five years of secondary schooling in 2018 was 585, while the average for the eight years of primary schooling was 747. It should be noted that a significant number of the District's secondary school aged children attend schools in Christchurch. Also the number of students at secondary school declines during the year as people leave while the number of children at primary schools increases during the year as children begin school.

Of the state primary schools 7 are located in Rangiora (3), Kaiapoi (2), Woodend (1) and Pegasus (1). Rangiora and Kaiapoi each have one Catholic primary school. In 2018 the largest of the urban primary schools were the Rangiora Borough School (560), Kaiapoi North School (531), Ashgrove School in Rangiora (517), and the Pegasus School (413). The remaining 10 primary schools are located across the rural area, with the largest of these in 2018 being Swanannoa with a roll of 301, and the smallest View Hill with a roll of 63.

Overall 1787 (20.2%) of the pupils at the District's schools were non-pakaha/European in 2018. Of the non-pakaha:

1207	(13.6%)	Māori
228	(2.6%)	Asian
183	(2.1%)	Pacific Islands
130	(1.5%)	MELAA
39	(0.4%)	Other

The percentage of the rolls at each school who are non-pakaha varied widely. Māori at the Tuahiwi School was 82.0%. The two Kaiapoi primary schools together had 269 (30.7%) non-pakaha and 124 (46.1%) of these children were Māori. For the high and composite schools the number and percentage of the rolls of each non-pakaha were:

192	(22.9%)	Kaiapoi High School
88	(18.6%)	Rangiora New Life School
280	(16.5%)	Rangiora High School
80	(15.7%)	Oxford Area School

These numbers include 60 international fee paying secondary school students, 42 of whom were attending the Rangiora High School.

Business demographic series

The Statistics New Zealand business demographic series provides annual statistics for business units and employee counts for each industrial sector. These statistics are based on the Pay As You Earn (PAYE) returns for February each year, and this means that the employee count only takes into account the people paying their tax via PAYE and not those paying by the alternative instalment method. As a result working proprietors are not included in the employee count.

Between 2000 and 2018 the number of geographic units (businesses in the Waimakariri District increased from 4131 to 6429 (55.6%), and the employee count from 7500 to 15000 (100.0%), indicating a strong increase in local employment.

Between 2000 and 2018 the number of geographic units in the agriculture industrial group declined from 1689 to 1275 (24.5%). The employee count for agriculture had increased from 930 in 2000 to 970 in 2018 (4.3%), although 2004 and 2005 the employee count for the agricultural sector fell below 800.

Market Economics Ltd. has provided a modified employee count (MECs) for the Waimakariri District for 2000 and 2017, which takes into account working proprietors including farmers as opposed to farm employees. Based on this approach to the calculation of the district's workforce, the total MEC has increased from 10,930 in 2000 to 18,140 in 2017. The

agricultural sector MEC has fallen from 2,790 to 2,070, and its share of the overall growth in the district's workforce has been -10%. All other sectors have recorded increases, with the construction, retail trade, and education and training recording the greatest increases in terms of the modified employee count.

For the 1275 business units reported for agriculture in 2018 the distribution for farm type was:

969	(75.8%)	Sheep/beef/cropping + other cropping + deer + other livestock
150	(11.8%)	Dairy cattle farming
129	(10.2%)	Nursery/horticulture + mushroom/vegetable + fruit/nut trees
27	(2.2%)	Poultry

For the 965 employee count reported for agriculture in 2018 the distribution for farm type, excluding working proprietors, was

420	(43.7%)	Dairy cattle farming
267	(27.7%)	Sheep/beef/cropping + other cropping + deer + other livestock
218	(22.6%)	Nursery/horticulture + mushroom/vegetable + fruit/nut trees
60	(6.2%)	Poultry

In addition there were 129 business units and an employee count of 230 for agriculture and fishing support services in 2018.

Waimakariri District – Dairy statistics

Season	Total herds	Total cows	Total effective hectares	Average kg milk solids per herd	MS/cow	MS/ha	Average herd size	Average effective hectares	Average cows per hectare
2008-09	**82**	**44,761**	**13,607**	**190,159**	**348**	**1,146**	**546**	**166**	**3.29**
2009-10	**84**	**44,960**	**13,648**	**204,332**	**382**	**1,258**	**535**	**162**	**3.29**
2010-11	**90**	**48,880**	**15,349**	**199,936**	**368**	**1,172**	**543**	**171**	**3.18**
2011-12	**91**	**52,812**	**15,349**	**222,155**	**383**	**1,317**	**580**	**169**	**3.44**
2012-13	**99**	**58,820**	**16,933**	**225,733**	**380**	**1,320**	**594**	**171**	**3.47**
2013-14	**103**	**62,561**	**18,161**	**240,229**	**396**	**1,362**	**607**	**176**	**3.44**
2014-15	**105**	**65,213**	**19,119**	**260,637**	**420**	**1,431**	**621**	**182**	**3.41**
2015-16	**106**	**68,883**	**19,839**	**269,337**	**414**	**1,439**	**650**	**187**	**3.47**
2016-17	**106**	**65,468**	**20,037**	**270,360**	**438**	**1,430**	**618**	**189**	**3.27**
2017-18	**104**	**70,700**	**20,488**	**273,284**	**402**	**1,387**	**680**	**197**	**3.45**

Dairy NZ - correspondence

It should be noted that the number of business units identified as dairy cattle farming for the District in February 2018 was 150, while the dairy statistics for the 2017/18 season are

shown as 104 herds. The additional business units were probably operating as dairy support enterprises separate from operations which combine a milking platform with dairy support land.

Similar production data is not available at district level for other types of agricultural and pastoral farming.

Social support organisations

The Waimakariri District has a number of organisations providing social support. These include:

Rural Support Trust – provides for the psychological wellbeing of farmers. This organisation has the capacity to provide support for individual farmers and to organise group activities for farmers in communities facing particular challenges, whether economic, weather or natural disaster related. This is the point of referral for the Fonterra's Ti Aki team when they find supplier farmers psychologically stressed when trying to comply with environmental regulations.

Oxford Community Trust – based at Oxford is the contact point for information, budget services, income support, counselling, free legal advice, you workers, family services, elderly transport, youth driving, food-bank, OSCA holiday programmes and after-school care. This organisation receives funding from a range of charitable organisations and from government funding agencies such as COGS, but does not bid for social service contracts.

Wellbeing North Canterbury Community Trust – based in Rangiora and provides a range of services including family counselling, youth drug and alcohol services, school attendance, restorative justice. Most of its services are provided on contract to the Ministry of Social Development, the District Health Board, Ministry of Justice and other agencies. Its range of services vary as the range of government contracts change. The Trust also has the capacity to accept limited duration contracts in response to emergencies such as the Waiau earthquake, which saw it become involved with the navigation service assisting with the repair of homes, and social worker support.

Kaiapoi Community Support – a branch of the Wellbeing North Canterbury Trust based in Kaiapoi provides a point of contact for information, and support services including the Kaiapoi Community Pantry, and volunteer drivers.

Victim Support North Canterbury – Support to people bereaved by suicide. Support can be provided to families/whanau/ discoverers/ those affected by bereavement. Psycho-social support and referrals to appropriate support agencies. Referrals are made through Police, self-referrals and referrals from concerned family or friends.

Religious based organisations provide counselling services including:

Hope Community Trust - Wrap-around service, counselling, community drop in centre, food-bank and chaplaincy service provided by the Rangiora Baptist Church.

Presbyterian Support Family Works – Counselling service, social work in schools, safety programme (violence protection order information), and parenting through separation.

Salvation Army – Budgeting advice and food-bank. Oasis Centre for free consultations and rehabilitation for problem gamblers and their families.

St John of God Hauora Trust – Child and adolescent mental health and addiction services, primary/community and secondary/specialist service. Work to support improvements in mental health and addiction services delivery by the Canterbury District Health Board and NGOs.

Social Services Waimakariri – a collaborative organisation involving most of the main social/welfare agencies and NGOs, and is able to bring these organisations together to discuss key issues for the community as these emerge.