Water Wairarapa Future Land Use Scenarios

September 2016

Report By:

Chris Lewis

Stefan Bryant

BakerAg

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Executive Summary

A change in land use in the Water Wairarapa area of influence is foreseen, both with or without irrigation.

With irrigation water, acceleration of land use intensification and changing land tenure will be seen, including merging of land holdings, as increasing scale will be associated with business growth.

Initially, prior to 2025, pastoral and mixed cropping farming will be the first to expand and intensify using irrigation. This is linked to current land use and the aspirations of these current farmers and land owners.

In the period from 2025 to 2040, a shift away from water on pasture to increased water on forage, arable, vegetable and fruit crops is forecast.

This will be driven by technical, economic and climatic factors. Pasture will be deemed as an inefficient user of water and nutrients, as is already demonstrated in rural Australia and parts of New Zealand such as Bay of Plenty, where water is a scarce resource.

Economically, water will, over time follow the path of highest sustainable returns which is expected to be in seed, fruit and vegetable production where Soil Class and climatic conditions (e.g. frost, rainfall and wind) permit.

Sustainable land use practises will be demanded by the community and the market place. Farmers and growers will adopt mitigation policies and processes to meet this expectation.

Resource Management Act compliance drivers including management of nutrients may influence some land owners to exit rather than alter their farm system and/or land uses.

The 2025 to 2040 period shift in land use will need to be “seeded” with skilled risk taking people, with capital, and an entrepreneurial culture.

This change in land use and culture will in turn bring opportunity for processors to move into the region, and growth in boutique value-add business associated with high value locally grown produce.

As the region shifts into value-add, greater demand for permanent and seasonal labour will result.

From the period of 2040 to 2080 the expectation is that a changing world environment, both in weather and food logistics, will see the Ruamāhanga valley increasingly exporting edible crop, vegetable and fruit to a Pacific based market. For reasons of Soil Class and urban sprawl, this period is expected to be a time of consolidation.

With vision, irrigation will bring a vibrant business and social growth to the Wairarapa community. It will be about a value-add product leaving the Ruamāhanga valley and wider districts.

The story around value-add can be enhanced with the early adoption of environmentally sustainable practises.

1.0 Approach

This view of changing land use for the area of influence of the proposed irrigation scheme within Ruamāhanga basin has been developed through a step wise process.

- Confirm current land use by enterprise and Soil Class.
- Consider the drivers for changing land use between now and year 2025.
- Re-map land use by enterprise and Soil Class.
- Then consider the drivers for land use change between 2025 and 2040.
- Re-map land use by enterprise and Soil Class.
- Then consider the drivers for land use change between 2040 and 2080.
- Re-map land use by enterprise and Soil Class.

The drivers considered for land use change are as follows.

- Environmental requirements and expectations
- Surveyed farmer response
- Revenue
- Reliability of water
- Land tenure
- Appetite for risk
- Capital
- Skills
- Supporting markets and processors
- Climate change
- Urban creep

The profile developed through this process then generates output for further analysis on nutrient flows, water use, revenue and labour. **A spreadsheet model has been designed to support the above process. This model is available for use to test alternate land use scenarios.**

The three broadly described Wairarapa Soil Class for high level reporting are as follows. More detail is in the appendices.

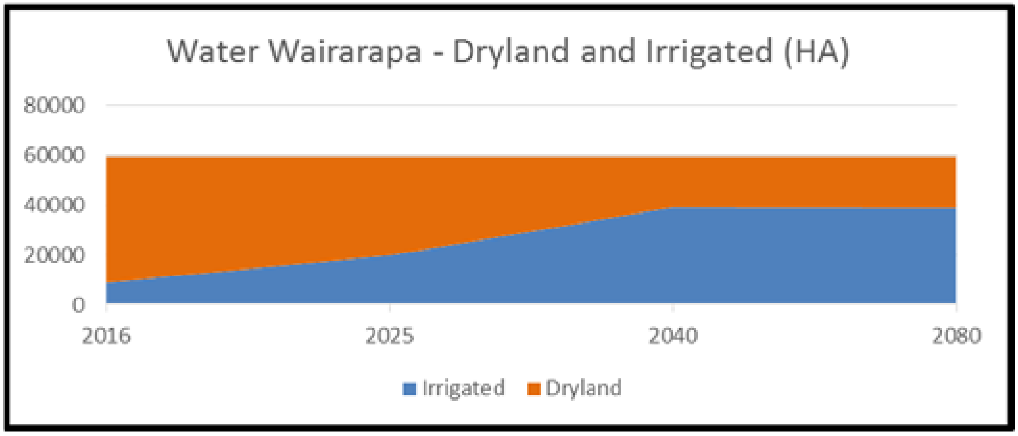
A) Ahikouka silt loam soils, good alluvial soils that are well drained such as around Greytown and also similarly productive alluvial over clay. (Similar to Pirinoa)

B) Kokotau clay loam soils. These soils are silt or loess based with a pan and some drainage limitations in their natural state.

C) Tauherenikau shallow silt loam soils. These have very good natural drainage being over gravel. In their natural state these are naturally lower fertility highly drought prone stony soils that in places can have cultivation limitations due to boulders.

2.0 Land Use Summary

The expectation within the area of influence for Water Wairarapa is for the irrigated area to change from the current 8,880 HA or 15% of the area of influence, to 38,700 HA or 65% irrigated by 2080.



Without Water Wairarapa, the irrigated area is expected to mature at 12,000 HA or 20% of the area of influence.

Traditional pastoral farming practises currently make up 92% of land use, but is forecast to reduce by 2080 to 76%, with the balance picked up by horticulture, viticulture, non-traditional pastoral (e.g. milking sheep) termed Other, and lifestyle.

The area of influence for Water Wairarapa is approximately 60,000 HA. This includes all productive lands that are associated with the irrigated area and excludes non-productive areas such as roads, rivers and clusters of lifestyle properties etc.

The following is a breakdown of current and forecasted land use.

It summarises the data appendices to this report, including detailed use by Soil Class.

Table 1: Current Land Use

CURRENT LAND USE	**Dry – HA & %**	**Irrigated - HA & %**
Pastoral Dairy	7,780 13.1%	6,460 10.8%
Dairy Support	6,710 11.3%	340 0.6%
Sheep & Beef	20,130 33.8%	240 0.4 %
Finishing Arable	12,060 20.2%	1,150 2%
Viticulture / Horticulture	301 0.5%	520 0.7 %
Other (Appendix Definition)	2,410 4.0%	170 0.3%
Lifestyle	1,290 2%	
Total of 59,561	50,681 85.1%	8,880 14.9%

Table 2: Land Use Projected 2025

Year: 2025 Predicted Land Uses	**Dry – HA & %**	**Irrigated - HA & %**
Pastoral Dairy	4,100 6.9%	11,830 19.9%
Dairy Support	5,000 8.4%	1,800 3.0 %
Sheep & Beef	14,500 24.3%	1,200 2.0%
Finishing Arable	11,500 19.3%	3,800 6.4%
Viticulture / Horticulture	936 1.6%	841 1.4%
Other (Appendix Definition)	2,320 3.9%	333 0.6%
Lifestyle	1,400 2.4%	
Total of 59,560	39,756 66.7%	19,804* 33.3%

*The irrigated figures include land which is currently irrigated (8,880ha). It is assumed that this land will remain irrigated

In the period from 2016 to 2025 the following activities are anticipated.

- Farm land sold will tend to be purchased by neighbours who will continue with their existing land use, but expand and intensify.
- Dryland Sheep & Beef land use in its traditional form will start to shrink. This will continue over successive periods with land initially transiting to either Dairy or Finishing & Arable.
- Lifestyle based sub-divisions will be subject to district planning permission. Based on the current patterns expansion has been profiled, but primarily in Soil Class B. It is predicted that the option to farm with water on the better class soils will discourage subdivision, as might planning permission.

Table 3: Land Use Projected 2040

Year: 2040 Predicted Land Uses	**Dry – HA & %**	**Irrigated - HA & %**
Pastoral Dairy	1500 2.5%	12000 20.1%
Dairy Support	2000 3.4%	3500 5.9%
Sheep & Beef	6810 11.4%	5750 9.7%
Finishing Arable	6000 10.1%	12000 20.1%
Viticulture / Horticulture	875 1.5%	2125 3.6%
Other (Appendix Definition)	1400 2.4%	3600 6.0%
Lifestyle	2000 3.5%	
Total of 59,560	20,585 34.6%	38,975* 65.4%

* The irrigated figures include land which is currently irrigated (8,880ha). It is assumed that this land will remain irrigated

During this period, a proportionally significant move is forecast, with the Viticulture & Horticulture area doubling, particularly in Soil Class A & C.

By 2040, climate change is expected to start influencing pastoral farming systems. These will be challenged by warmer air temperatures (overnight), reduced frost and an increase in pests.

With the greater risk of droughts, Arable cropping will come under pressure with “arable” farms trending away from cereal crops and into maize, seed and vegetable. A guide to this profile is present day Hawkes Bay.

Intensive livestock finishing systems are expected to peak in land use by 2040 and then, for climatic and economic reasons start to decline heading towards 2080.

The irrigation effect will have matured by 2040 with the portion of Soil Class A & C under irrigation taking the greater portion of land area. Future technologies might enable the same water to be applied over an even greater area, but there have not been speculations too far from current known technologies.

Table 4: Land Use Projected 2080

Year: 2080 Predicted Land Uses	**Dry – HA & % of total**	**Irrigated - HA & % of total**
Pastoral Dairy	1500 2.5%	11500 19.3%
Dairy Support	2500 4.2%	2000 3.4%
Sheep & Beef	4800 8.1%	5500 9.2%
Finishing Arable	5760 9.7%	11500 19.3%
Viticulture / Horticulture	2200 3.7%	3500 5.9%
Other (Appendix Definition)	1300 2.2%	4700 7.9%
Lifestyle	2800 4.7%	
Total of 59,560	20,860 35.0%	38,700* 65.0%

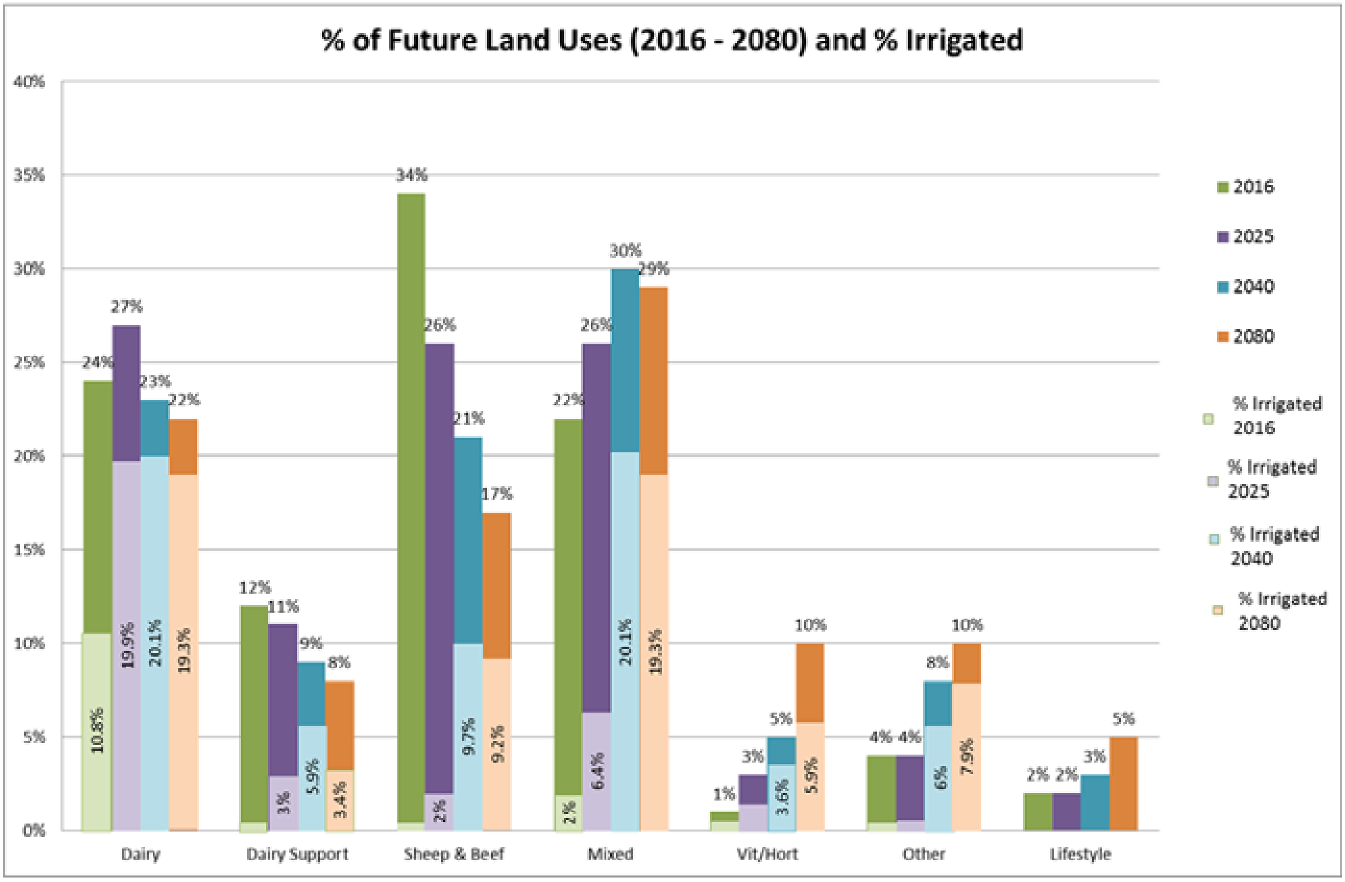
* The irrigated figures include land which is currently irrigated (8,880ha). It is assumed that this land will remain irrigated

For the period 2040 to 2080 a consolidation of the total area irrigated is expected.

Movement into Viticulture and Horticulture is anticipated with land shifting out of pastoral use. This will primarily occur in Soil Class A & C, but the better parts of Soil Class B will come under demand.

The forecast in this period is based around an expectation of a farming climate featuring 100 drought days and virtually no frosts.

Incursion by Lifestyle will continue, but controlled and directed to Soil Class B.



The changes in land use and irrigated area, as explained in chapter 2.0, are illustrated in the above graph.

2.1 Without Water Wairarapa

A future land use profile has been generated without the irrigation scheme. This provides for uptake of two thirds of the remaining surface and shallow aquifer water, and some on-farm storage which will generate land use change.

In a mature state, the irrigable profile with Water Wairarapa is 38,700 HA compared with a profile without water storage at 12,000 HA. Some of the trends with water storage will continue such as land merger and extension and intensification of existing practices. However, with restraints to available water, the next “phase” that would give greater fruit, vegetable and seed production will be muted.

The analysis suggests the following profile of land use with and without storage.

Table 5: Land Use Profile With and Without Water Wairarapa

Hectares	With Water-Wairarapa					Without Water-Wairarapa			
	Current	2025	2040	2080		Current	2025	2040	2080
HA Irrigated	8880	19804	38975	38700		8880	12639	12005	12005
Dairy Dry	7780	4100	1500	1500		7780	7596	5850	5450
Dairy Irrigated	6460	11830	12000	11500		6460	8334	7850	7850
Dairy Support Dry	6710	5000	2000	2500		6710	6250	5050	4550
Dairy Support Irrigated	340	1800	3500	2000		340	450	450	450
Sheep & Beef Dry	20130	14500	6810	4800		20130	15606	12345	11285
Sheep & Beef Irrigated	240	1200	5750	5500		240	315	315	315
Finishing Arable Dry	12060	11500	6000	5760		12060	13000	15850	15110
Finishing Arable Irrigated	1150	3800	12000	11500		1150	2300	2150	2150
Vit / Hort Dry	301	936	875	2200		301	637	1460	2360
Vit / Hort Irrigated	520	841	2125	3500		520	840	840	840
Other Dry	2410	2320	1400	1300		2410	2253	4600	5600
Other Irrigated	170	333	3600	4700		170	400	400	400
Lifestyle	1290	1400	2000	2800		1290	1579	2400	3200

2.2 Changes as a Consequence of Water Storage

In summary, at a high level the area in Dairy and Dairy related operation is expected to initially grow, as it will be a fast adopter of irrigation, but will ultimately shrink in land area utilised.

Sheep and Beef will decline with land diverted into Livestock Finishing and Arable (related skill sets and infrastructure), then collectively this area will decline with land taken up in Viticulture, Other and Lifestyle.

With Water Wairarapa Dairy & Dairy support (currently at 36%) will mature at 29% of the area of influence. Currently 56% of the area of influence is used for Sheep & Beef, Finishing and Arable, but will reduce to 46%. The remaining land use types are currently 8% but will with storage and market development increase to 24% of the area of influence.

The physical and financial effect of water storage beyond the area of influence is outside the scope of this report. However, a displacement effect is anticipated where supporting land use moves onto land proximate to the area of influence. As an example, medium to intensive store sheep units and dairy runoffs will establish to support operations of higher intensity within the area of influence.

3.0 Ruamāhanga Valley Vision

A warming climate and reliable water provided by Water Wairarapa will bring change for the Wairarapa.

How it chooses to harness this change will rest on its community, both for rural and urban dwellers.

Farmers of the Ruamāhanga valley could pursue conservative business models focussed on the modest provision of low-end commodities, leaving the region with minimal value-add.

Alternatively, it could seek to design and implement its own unique value-add vision.

The Ruamāhanga valley and its surrounds are rich with potential; the soils, the water and climate can combine over the next century to make this region a diverse, productive and sustainable provider of vegetable, fruit, meat and milk products.

Unlike most other irrigated regions of New Zealand, the Ruamāhanga valley has relatively small land holdings. There will be aggregation of land over time but the instigators of land use change will not be using scale to leverage value.

The new farming community will use quality of produce, high-end use processing and the experience associated with visiting the region to generate premium returns.

To make this a robust, culturally sensitive and achievable vision, the natural resources need to be coupled with people that can harness the potential. Skilled farmers and growers, smart value-add business and a community that embraces the concept with labour and complimentary enterprises.

4.0 The Key Drivers to Land Use Change

This report provides for distinct changes in the elements that drive land use change. Existing land tenure and traditional markets will initially drive the change. However, as climate, expectations, technology, skills and market opportunities develop land use will divert, particularly in the lighter, free draining soils

Short Term Drivers for the period 2016 - 2025

I. Existing tenure is characterised as risk averse. Farm sales to neighbours will influence 2025 land use, where land use is dictated by the existing status of purchaser.

II. Risk averse land owners will rely upon their existing skill set.

III. Technology – slow adopters, capital introduced with care.

IV. Markets and value-add processors are distanced from producers so there will be limited opportunities for entrepreneurial type land use change outside of traditional farm, vineyard and orchard systems.

V. On establishment, farmers with access to irrigation via storage will re-think family objectives. This will trigger a rapid and relatively significant change of tenure and farm management.

VI. Wairarapa is also characterised by a lack of irrigation expertise and support networks compared with other parts of the country.

Medium Term Drivers for the period 2025 - 2040

I. Change in tenure will be a strong driver in this period, introducing land owners with a higher risk appetite.

II. Markets will change and land use will alter to match.

III. Capital and technology required to link “I” and “II” above will be adopted.

IV. Climate starting to impact – Hawkes Bay-like overnight temperature, with increasing drought frequency & intensity.

V. Day time and summer temperatures increase more than night time and winter temperatures.

VI. Temperature range increases.

Long Term Drivers to 2080.

I. Reduced change in tenure – consolidation and maturity phase.

II. Markets become more refined and localised value-add business develops further.

III. Technology – continued fine tuning.

IV. Better agricultural support services

V. Climate – “Poverty Bay to Hawkes Bay” – mild winters with minimal frost highly probable with drought conditions.

4.1 Period Description; the Impact of Land Use Drivers

As irrigation water becomes available, the drivers for land use change will be phased. Initially, land tenure will alter land use, followed by a phase where tenure and appetite for risk will combine to shift water away from pastoral to higher profit fruit, vegetable and seed production. Then a phase of consolidation the climate will alter productivity and suitability of plant type and cultivars.

Period: Current to 2025

During this period some change in land ownership is expected, predominantly as existing operators acquire neighbouring land. Expanding their boundaries and developing the newly acquired land to align with their existing land use.

Existing land holders will typically resist change in land use but seek to improve productivity within the existing business. There will be a reluctance to increase capital within the business except where it applies to use of irrigation water.

Processors and markets will initially be slow to move into the Wairarapa although some niche operators will explore smaller scaled opportunities.

As the Water Wairarapa storage scheme is commissioned, a re-thinking of family objectives is expected to be triggered. Tenure, succession and management change will be accelerated on some properties. This will drive some immediate changes.

Those farmers that choose to continue “business as usual” will tend to be risk averse with no rapid change in skill set. This group of “slow adopters” might acquire any neighbouring land that comes available, take up an irrigation opportunity with stored water, but simply expand on existing land use.

Period: 2025 to 2040

Over this period, changing land tenure and acquisition of land by stakeholders with a higher risk appetite will drive land use change.

Land and water will be moved more clearly into highest return use.

Processors and the market will arrive and bring realistic and sustainable returns for those invested into higher capital and high value return land use.

The shift away from pastoral land use into intensive fruit, vegetable and arable will be significant.

There will be a demand for skills associated with vegetable and fruit production.

There will be some automation adopted but more people will be required to “farm” the region.

The climate in this period will become more like Hawkes Bay, with higher air temperatures, notably more so during the day and in autumn and summer, which will be less favourable to continental pasture plants, but conducive to “ripening” of produce.

Winters will be milder with the result that frost events will reduce by 30%-50%. This then exposes the region to pests and diseases that are less tolerant to cold conditions. It also may limit fruit species that require cooling for buds to form.

Summer rainfall is less reliable and drought-like conditions are expected for 75 days and to occur 5 years out of 6.

Urban creep could impact this period, especially if the transport corridor to Wellington is opened up. The expansion of lifestyle properties could be more of an issue during this period in terms of the loss of productive agricultural land.

Period: 2040 – 2080

Climatically, the region is expected to be on average 2 degrees warmer than it is now, but could be as high as 4 degrees warmer, so control of water and using warmer temperatures to productive advantage will be a bigger driver of land use change.

Higher average air temperatures will mean less ruminant based farming and more plant based food production.

100 “drought days” are expected every year by 2080, and winters will be virtually frost free. This will alter pastoral land use, as pasture composition will change with reduced ryegrass and increased dry, summer tolerant species, for example fescues. There will be greater reliance on herbage crops for ruminant supplement and farm systems will adapt. Non-irrigated pastoral will shift away from reliance on late spring and summer growth.

The lack of frosts will extend the growing season and enable crops to be grown that are currently not seen in the lower North Island.

In this period, Soil Class C will be divided over intensive horticulture and urban development.

Soil Class A will predominantly support high-end arable, some vegetable and intensive dairy.

Soil Class B will remain dominated by pastoral farming, a mix of dairy, pockets of arable and lamb finishing units.

Land tenure on the farmed land is expected to stabilise in this period, but added value business and processors will continue to develop.

5.0 Land Use Details

5.1 Land Use Change Associated With Water Wairarapa Storage & Predicted Climate Change.

The interpretation of the climate change report from MfE "Climate Change Projections for New Zealand" (summarised in the appendices), is reduced suitability for pastoral land use and a shift into plants and crops more typically seen in coastal regions north of the Wairarapa. With this will come plant and animal pests and diseases that are currently of minor economic impact or not experienced.

The Wairarapa has an advantage in pastoral farming terms with a climate which is more aligned to Canterbury than with the rest of the North Island, but which is highly variable from year to year.

The cold winters, and significant diurnal temperature range gives the region a good ryegrass growing environment – a pasture type with persistence and relatively high energy values.

The same weather conditions limit or prevent plant and animal pest/disease challenges like Black beetle, facial eczema and theileria.

Over time, the current climatic advantage will be lost. While this will not prevent pastoral farming with ruminants, it will create challenges that the farming community will work to overcome.

The likelihood of increased dry summer events will be a catalyst towards the adoption of irrigation in pastoral farming.

It is anticipated that some pastoral land will transfer into alternate land uses because farmers fail to adapt to the technology changes, compliance requirements (see later) or the opportunities for Soil Classes A & C to increase economic returns via alternate land use deem it worthy of exiting pasture based systems.

The efficiency by which plants use soil water differs across species. Pasture is deemed to be a relatively inefficient converter of soil moisture to herbage, primarily as it is shallow rooting.

This compares with crops like chicory, maize and fodder beet which are known to extract water (and nitrogen) from deeper levels and more efficiently turn this into herbage. In the current to 2040 period, pastoral farmers will adapt their farm systems on both dry and irrigated ground to utilise this productive and efficiency difference.

As the climate becomes warmer, and droughts increase, the shift into more water efficient herbage and alternate farm systems will become necessary.

For horticultural land use, climate change in the Wairarapa becomes relatively exciting, opening up the potential for fruit, vegetable and seed that require more growing days and conditions suitable for ripening. It also closes off horticultural species that rely on winter chilling.

Having sufficient water, good soils and growing days will in time make the Wairarapa a very suitable place for domestic food crop production. Subject to world markets, processors and value add investment; this growth in food crops could be leveraged to include exportable high value products such as berries.

5.2 Land Use by Soil Class over Time.

With irrigation water the Wairarapa might initially see small changes in the mix of land use, but this will accelerate in the period of 2025 to 2040. Irrigated pastoral land use will peak soon after 2025 but then decline by 2040.

Land use has been classified according to seven enterprise types, then according to soil class (see appendices) and whether the land area is dry or irrigated. The profile is then replicated for current year, 2025, 2040 and 2080.

Table 6: Current Land Use (HA)

Year		Current								
Soil type		Soil Class A			Soil Class B			Soil Class C		
Irrigation Status		Total	Dry	Irrigated	Total	Dry	Irrigated	Total	Dry	Irrigated
Land Use	Pastoral Dairy	4735	2468	2267	2802	1271	1531	6703	4041	2662
	Dairy support	1595	1525	70	1755	1646	109	3700	3539	161
	Sheep & Beef	5406	5341	65	8901	8876	25	6063	5913	150
	Finishing & Arable Mixed	5014	4690	324	3595	3300	295	4601	4070	531
	Viticulture / Horticulture	56	33	23	328	137	191	436	131	306
	Other	74	74	0	1146	1105	41	1360	1231	129
	Lifestyle / Urban	206	206		225	225		859	859	
	Total		14337	2749		16560	2192		19784	3939
	Total for Soil class		17086			18752			23722	
	Total Irr Area		8880							
	Total for Region		59560							

Table 7: Land Use Projected 2025

Year		2025								
Soil type		Soil Class A			Soil Class B			Soil Class C		
Irrigation Status		Total	Dry	Irrigated	Total	Dry	Irrigated	Total	Dry	Irrigated
Land Use	Pastoral Dairy	5098	1063	4035	3157	532	2625	7675	2505	5170
	Dairy support	1578	1368	210	1670	1174	496	3552	2458	1094
	Sheep & Beef	3255	2865	390	7192	6944	248	5253	4691	562
	Finishing & Arable Mixed	6819	5807	1012	4515	3353	1162	3966	2340	1626
	Viticulture / Horticulture	60	4	56	743	436	307	974	496	478
	Other	74	74		1146	1092	54	1433	1154	279
	Lifestyle / Urban	202	202		329	329		869	869	
	Total		11383	5703		13860	4892		14513	9209
	Total for Soil class		17086			18752			23722	
	Total Irr Area		19804							
	Total for Region		59560							

This presents the first stage of irrigation from water storage in the Wairarapa, overlaid with land use change within the various soil classes.

Pastoral farming in Soil Class A & C will see the biggest uptake in irrigation.

Soil Class B and C double in area for viticulture and horticulture, but this is a change from 2% of the total area of influence to 4%. Apple production is anticipated to be the larger part of this land shift. In this period relatively small changes are forecast in the Other and Lifestyle categories.

It is anticipated that lifestyle will be directed to the less productive Soil Class B soil.

Table 8: Land Use Projected 2040

Year		2040								
Soil type		Soil Class A			Soil Class B			Soil Class C		
Irrigation Status		Total	Dry	Irrigated	Total	Dry	Irrigated	Total	Dry	Irrigated
Land Use	Pastoral Dairy	4000	500	3500	3500	500	3000	6000	500	5500
	Dairy support	1000	500	500	1500	500	1000	3000	1000	2000
	Sheep & Beef	3248	1748	1500	5752	3752	2000	3560	1310	2250
	Finishing & Arable Mixed	7800	3800	4000	4700	1200	3500	5500	1000	4500
	Viticulture / Horticulture	135	10	125	1000	500	500	1865	365	1500
	Other	400	300	100	1800	800	1000	2800	300	2500
	Lifestyle / Urban	500	500		500	500		1000	1000	
	Total		7358	9725		7752	11000		5475	18250
	Total for Soil class		17083			18752			23725	
	Total Irr Area		38975							
	Total for Region		59560							

By 2040, the shift away from pastoral farming becomes apparent with a reduction from 53,730 HA to 49,560 HA. Most notably in Soil Class A & C.

Less area is used for Dairy, Dairy Support and Sheep & Beef in Soil Class A & C.

Soil Class A peaks for Livestock Finishing and Arable Cropping in this period.

Viticulture/Horticulture and Other are the significant shifters in this period with Soil Class C being in strongest demand.

Table 9: Land Use Projected 2080

Year		2080								
Soil type		Soil Class A			Soil Class B			Soil Class C		
Irrigation Status		Total	Dry	Irrigated	Total	Dry	Irrigated	Total	Dry	Irrigated
Land Use	Pastoral Dairy	4000	500	3500	3500	500	3000	5500	500	5000
	Dairy support	700	200	500	1500	1500		2300	800	1500
	Sheep & Beef	3000	1500	1500	5000	2500	2500	2300	800	1500
	Finishing & Arable Mixed	7383	3383	4000	5052	1552	3500	4825	825	4000
	Viticulture / Horticulture	700	200	500	1000	500	500	4000	1500	2500
	Other	500	300	200	2000	500	1500	3500	500	3000
	Lifestyle / Urban	800	800		700	700		1300	1300	
	Total		6883	10200		7752	11000		6225	17500
	Total for Soil class	17083	17083			18752			23725	
	Total Irr Area		38700							
	Total for Region		59560							

In this period, the irrigable footprint has matured.

Land use with Sheep & Beef and Finishing & Arable are replaced by Viticulture & Horticulture.

Soil Class A & C remain in demand as this best suits intensive fruit and vegetable production.

This land use change aligns with a changing climate where the conditions will support the establishment and ripening of crops with more growing days, less frosts and the availability of water in these Soil Class areas.

Land Adjacent to area of influence

When land is irrigated, it has a direct effect on the land being irrigated and a domino effect on immediate neighbouring land, and tends to have a regional effect, in this case beyond the area of influence as less profitable land use pushes out onto relatively marginal land, and supporting land use develops in the region; e.g. Lamb and Beef supply chains and Dairy Support.

5.3 Future Management of Nutrients

Protection of the natural assets; land water and environment must be foundational to any future plans for the Ruamāhanga Valley.

Whether farmers and growers are developing their business or keeping the status quo, they will need to actively manage their land in a manner that at least meets the local and national compliance requirements.

There are five categories for mitigation activities that farmers and growers may implement to ensure their environmental footprint is minimal and at least compliant.

I. Currently used and increasing engagement.

II. Known, proven but still to be adopted.

III. Developed, unproven and still to be adopted.

IV. Experimental phase.

V. Concept and unknown.

The terms of reference for this report does not provide for a listing of all possible, known mitigation activities. It is not possible to predict the full width or detail of future mitigation strategies.

It is expected that there will be a sinking lid on the nutrient loss from commercially farmed properties in the Ruamāhanga valley and adjoining land areas.

Table 10: Examples of mitigation activities

Soil	Minimum tillage, precision agricultural technology
	Riparian strips
	Wetlands
Effluent	Design and operational
Water	Fencing off waterways
	Use deficit irrigation scheduling techniques to minimise drainage events.
Plant & Herbage	Use of deeper rooting plants to increase the zone of nutrient adsorption.
Monitoring	Soil moisture recorded, drainage water tested.
Management	Periodic off-farm grazing to limit urine N loss.
Nutrient Modelling	Building future farm systems based around Overseer modelling.

Drivers of nutrient loss

The “first” nutrients of concern are phosphate and nitrogen. These two nutrients are most likely to precipitate changes in water quality.

Phosphate loss into the water is predominantly from lateral movement of soil and waste into waterways. Restricting this movement by fencing off waterways and limiting the proximity of farming to waterways will be a prerequisite to good practise.

Nitrogen can be lost into waterways through vertical and lateral movement of water, soil and waste. The loading of nitrogen in excess of the farm system’s ability to absorb and export as product, followed by water movement as drainage is the predominant driver.

Fencing off waterways, riparian strip planting, minimising activities proximate to waterways and adopting a range of strategies to minimise nitrogen in drainage water will become an accepted requirement for all farming systems.

DairyNZ, Horizons, Massey University and Landcare Research have implemented a program on the Rangitikei river which could provide a template for monitoring and management within the Ruamāhanga catchment.

1. Land Use Information – similar to that prepared in this report.
2. Loss rate estimate from each land use.
3. Point source loads – bore dipping.
4. Desktop outcome (Overseer).
5. Attenuation – Lag times and estimates.
6. In river load calculator.
7. Comparison and variations in loads.
8. Sensitivity analysis.
9. State and Trends assessment.
10. Dashboard development.

Research

New Zealand is currently undertaking numerous nutrient management research initiatives which are expected to support pastoral and non-pastoral based farming.

Example: Pastoral 21 Next Generation Dairy Systems was a collaborative[1] five-year farm programme that aimed to provide proven, profitable, simple, adoption-ready systems that lifted production and reduced nutrient loss.

The Pastoral 21 programme was set up in four regions to address issues relevant to that area.

[1]*DairyNZ, Fonterra, Dairy Companies Association of New Zealand, Beef + Lamb New Zealand and the Ministry of Business, Innovation and employment, and managed by AgResearch

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Waikato

DairyNZ's Scott Farm, Hamilton

Project goal: To show that an average Waikato farm could increase annual milk production by up to 200kg/ha with increased profit per hectare, while reducing nitrogen leaching from 35-50+ kg/ha per year down to 20-

30kg/ha per year.

Manawatu

Massey University's No. 4 Dairy Farm Palmerston North

Project goal: To develop a practical housing system for the lower North Island region, that combines high production and profit with lower nitrate and phosphorous leaching.

Canterbury

Lincoln University Research Dairy Farm and Lincoln University's Ashley Dene Farm

Project goal: To develop practical dairy farming systems that combine high production and profit with lower nitrate leaching.

South Otago

Telford Farms Dairy Unit, Telford Farm Training Institute, near Balclutha

Project goal

To investigate ways dairy farmers in the region can manage soils, animals and forage crops during the challenging shoulder and winter seasons, so they optimise their business and reduce environmental footprint.

Summary

Environmental targets set for the project were achieved. Averaged across the 3-year monitoring period, estimated whole-system N and P losses were reduced by≥24%, while sediment losses were reduced even further. Operating profits were not increased, however, and milk solids production from the treatment farmlets was 2-3% less than for the control.

Case Study Farms

There are demonstrations of good practise farming with high performance and relatively small environmental footprint. For example, this has been a focus at Lincoln University Dairy Farm where it has lowered its stocking rate but held productivity, increased profitability and reduced nitrate losses.

	2015 – 2016	2012 - 2013
Cows milked	560	632
Imported supplement kg / cow	126	434
Nitrogen fertiliser kg N/HA/yr	179	351
Milk Production kg MS/HA	1,812	1,878
Farm Working Expenses $/kgMS	3.45	3.84
N Loss kg N/HA/yr	28	45

5.4 Modelling Future Technologies

A future should be modelled, where water is used efficiently and there is a sinking lid on nutrient loss.

To model future land use in the Wairarapa, there needs to be awareness of numerous drivers that will change how natural resources are used. Where irrigation is concerned we know this will come with cost and rules. These drive efficiency and business behaviour.

- Water will be deemed too expensive to waste. In response, farmers will look to the design of systems that incorporate technologies which minimise drainage events and maximise productivity per unit of water.
- If drainage is minimised, then nutrient loss is minimised.
- Where "cheaper" surface water is currently taken it tends to be inefficiently used. For example when river flows are reducing, farmers will tend to apply water to the point of a drainage event with a view that soil water should be filled to capacity before the onset of "dry" conditions.
- Soil moisture monitoring might be expected as a pre-requisite for scheme water uptake.
- Reliable water enables farmers to utilise management tools like "deficit irrigation" where the soil moisture holding capacity is optimised. This is a much more efficient process.
- In an environment where water is not metered, farmers will irrigate to waste, working on the perception that too much irrigation is less damaging to the business performance than under-Irrigation. Design will be aligned to greater efficiency and modern technologies. We should expect to see more systems with variable rate irrigation and linked soil moisture monitoring devices.
- In the future, water will be applied to match the crops demand.
- Crop rotations will be planned around best use of water and a crops ability to mine nutrients.
- Tools like Farmax (physical and financial modelling) will be linked with Overseer (environmental modelling) and IrriCalc (irrigation water demand modelling) so that farmers target outcomes that are truly optimal.

Nutrient Loss

Where water is derived from an irrigation scheme, farmers and growers will appreciate a need for a sinking lid approach on nutrient loss. In the points above, if drainage can be limited it will be an immediate driver to reduced leaching.

There will be an expectation for farm systems design to match compliance requirements.

Dryland farmers/growers within the area of influence will need to abide by the same compliance rules as they will also be contributing to the pool of nutrient loss.

If a catchment based approach is taken to nutrient loss, then an acceptable maximum for nutrient loss would be derived.

The sum of individual farms / land user's nutrient loss (nitrogen) should not exceed the accepted catchment loading.

In turn, a catchment model might best operate with an allocation tool. Tradable rights for nitrogen loss is an example where farmers can elect their choice of land use, providing they have sufficient nitrogen loss credits. This might work in a manner similar to the Lake Taupo catchment, "grand parenting", would enable existing land users to be fairly transitioned into such a scheme.

Farmers/Growers will want to know what a Nitrogen Tradeable Rights scheme would look like, and how it would operate.

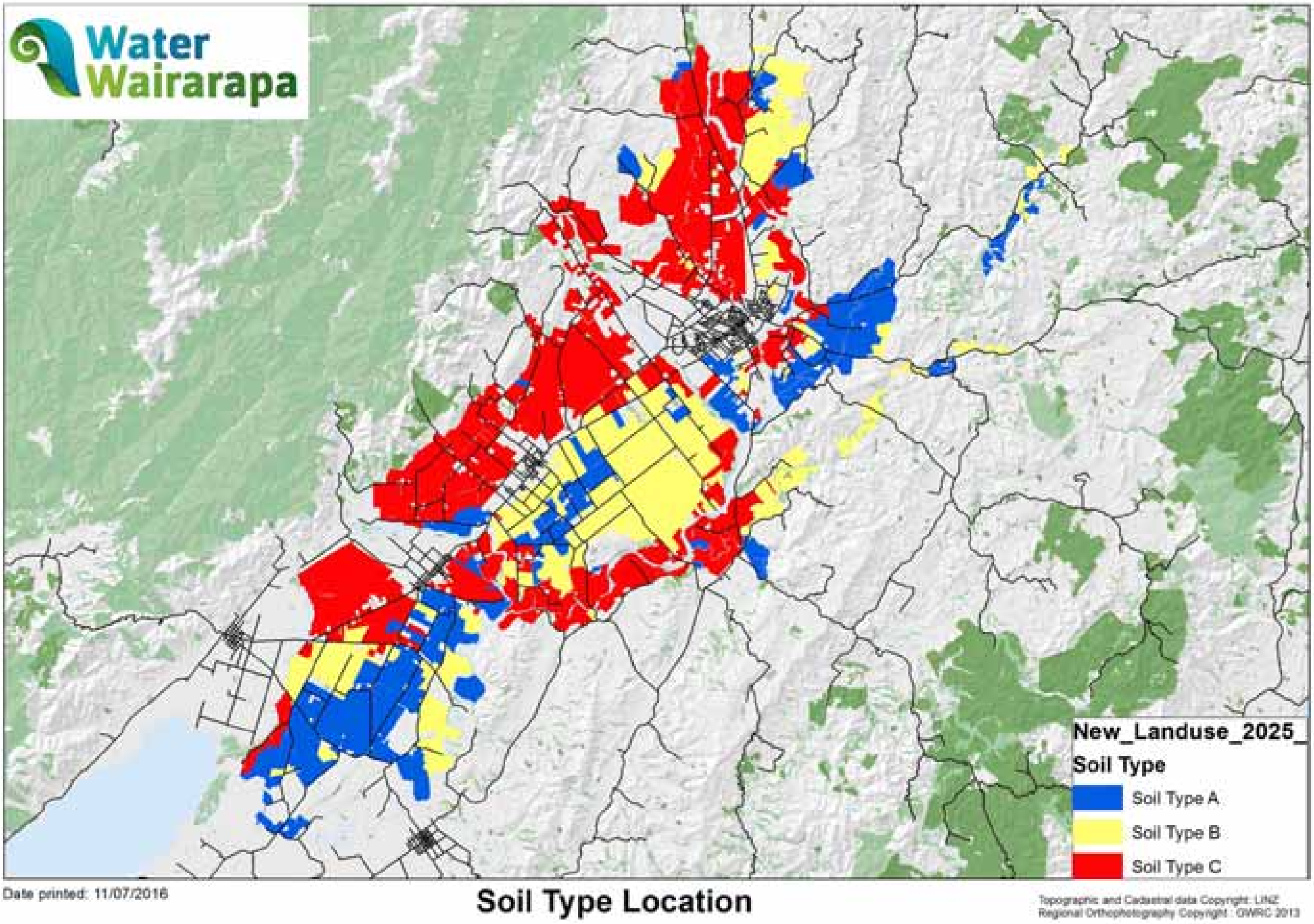
Climate Change

As mentioned in chapter 1, the predictions for climate change tell us that the area of influence will, in the future, have an environment that suits a greater range of crops, provided they have access to reliable water. In essence these are crops currently grown to the north of Wairarapa, that could be more successfully grown in the future (2040 to 2080).

Modelling work needs to make space for these crops appearing in the area of influence.

6.0 Appendices

Command Area Map by Soil Class



6.1 Summary of Climate projections for Wairarapa: Ministry for the Environment, Climate Change Projections for New Zealand, 2016

- **Drought** (over 300mm soil moisture deficit) intensity and frequency is predicted to be one of the most severe future challenges for primary production. This is a direct combination of changes to wind, rainfall, solar radiation and temperature.
- **The report states that "***The change in PED is considerable, especially in the drought prone northern & eastern coasts of the North and South Island***"**
- On average, it's predicted that the Wairarapa will experience in the order of:
  - 65 **drought days** per year, in about 85% (5 out of 6) years by 2025
  - 75 drought days per year, in about 85% (5 out of 6) years by 2040
  - 100 drought days per year, every year by 2080
- The probability of **back-to-back droughts** rapidly increases as does their severity, as the century progresses. In the Wairarapa, droughts currently occur, on average, about 1 every 3 years.
- **Storms** are not predicted to increase in frequency but rather increase in intensity (rain & wind strength) i.e. they will be more damaging
- **Frosts** are predicted to decrease by:
  - 30-50% by 2040
  - 30-90% by 2090
- The number of 'cold nights' (nights under 1.0^0C) will decrease by about 25 to 5 days per year; virtually frost-free by 2090
- **Average air temperatures** are predicted to increase by approximately:
  - 1.° C by 2040
  - 3. °C by 2090
- The number of '**hot days'** (days over 25.0^0C) will increase from about 35 to 85 days per year by 2090
- Although not stated in the MfE report, the number of **Growing Degree Days** will increase commensurate with the increase in the average daily temperature.

6.2 Definitions

Area of influence - The effective area of farms that could be influenced by the scheme. This includes the parts of farms directly within the command area, plus the parts of farms currently assumed to be outside the command area (for example, hills) but that are still affected because the farms are operated as whole units (approx. 60,000 ha)

Command area: The gross area that could be supplied with water from a scheme (approx. 44,200ha)

Net Supplied area: The portion of the command area that can potentially be irrigated/supplied, after accounting for buildings, tracks, hedges and less than 100% uptake (approx. 30,000 ha)

Effective farm area: Total actual farmed area of a farm; excludes all non-productive areas

Irrigable area: The area of a farm that is suitable for irrigation on a farm (whether it is currently irrigated or not)

Currently irrigated area: The current irrigated area on a farm (as informed by farmer)

Farms: Single or multiple properties owned and/or managed and operated by a farmer as a farm unit; for clarity a farm can include leased land and land operated as part of that farm

Irrigated farm: Farm with a current consent to take water whether they irrigate or not

Dryland farm: Farm that doesn't have a consent to take water (for irrigation)

Irrigable area: The area of a farm that is suitable for irrigation on a farm (whether it is currently irrigated or not)

Irrigated area: The actual current irrigated area as informed by stakeholders

Stakeholder: Any party interested or affected by the project; includes communities, individuals, and groups who are either indirectly or direct affected

"Other" Land Use: Deer, equine, stud, commercial, recreation, research, etc.

6.3 Soil Class

This report classes the area of influence various Soil Classes into three broadly described Wairarapa soil groups (classes) for high level reporting purposes.

A) Ahikouka silt loam soils, good alluvial soils that are well drained such as around Greytown and also similarly productive alluvial over clay. (Similar to Pirinoa)

B) Kokotau clay loam soils. These soils are silt or loess based with a pan and some drainage limitations in their natural state.

C) Tauherenikau shallow silt loam soils. These have very good natural drainage being over gravel. In their natural state these are naturally lower fertility highly drought prone stony soils that in places can have cultivation limitations due to boulders.

Table 11: A detailed description of Soil Classes

Soil A	Soil B	Soil C
Argillic Orthic Gley Soils	Mottled Immature Pallic Soils	Pallic Firm Brown Soils
Peaty Orthic Gley Soils	Mottled-pedal Immature Pallic Soils	Typic Firm Brown Soils
Typic Orthic Gley Soils	Typic Immature Pallic Soils	Acidic Allophanic Brown Soils
Typic Recent Gley Soils	Mottled Argillic Pallic Soils	Pedal Allophanic Brown Soils
Mellow Humic Organic Soils	Typic Argillic Pallic Soils	Typic Allophanic Brown Soils
	Argillic Perch-gley Pallic Soils	Acidic Orthic Brown Soils
	Argillic-fragic Perch-gley Pallic Soils	Mottled Orthic Brown Soils
	Typic Perch-gley Pallic Soils	Typic Orthic Brown Soils
	Mottled Fragic Pallic Soils	Typic Sandy Brown Soils
	Fragic Perch-gley Pallic Soils	Mottled Fluvial Recent Soils
	Mottled-argillic Fragic Pallic Soils	Mottled Weathered Fluvial Recent Soils
		Typic Fluvial Recent Soils
		Weathered Fluvial Recent Soils
		Weathered Orthic Recent Soils
		Typic Sandy Recent Soils
		Fluvial Raw Soils
		Typic Gley Raw Soils
		Sandy Raw Soils

Hydric Raw Soils

6.4 Water Wairarapa Survey Summary, 2025 land use

What is the irrigated land use in the WW catchment zone going to look like five years after the WW is operational?

We envisage that 10 000 hectares of additional irrigation will be taking place. There will not be a big change in land use due to a majority of the first up-takers of WW water being existing irrigators expanding their irrigated area. These land owners know the benefits of water and have existing infrastructure.

Three groups of first up-takers have been identified

1. The just want it's [just do it?] – The dry land farmers that want the opportunity and the options that reliable water offers.
2. Existing irrigators that want to irrigate more area but are restricted by their existing consents.
3. Existing irrigators that will buy their neighbours and expand their current land use and irrigated area.

Just Do It

From the surveys of dry land farmers we can identify those that just want water. As long as the finances stack up they will irrigate. Some land use change is expected. We have modelled the change of 45% of the dry land properties that indicated they would irrigate in the first 5 years of the scheme being operational

Existing Irrigators – Expand

From the surveys of existing irrigators we can identify those that said they would expand their irrigated area if they had access to more water. We have modelled the increased area of 70 % of those properties. It is not expected that the land use will change.

Existing Irrigators – Buy Neighbours

From the surveys, we can identify those irrigators that want to increase their operation and those dry land farmers that wish to sell. We have identified 26 instances where this is likely to occur.

7.0 Acknowledgements

MfE – Summary of Climate projections for Wairarapa: Ministry for the Environment, Climate Change Projections for New Zealand, 2016

Water Wairarapa – Greg Ordish, Farmer Survey Summaries, Land Title and Current Land Use

Greater Wellington Regional Council

Wetlands reference: Dairy Exporter, February 2016, pg. 68