Healthy Rivers PLAN FOR CHANGE | Wai Ora HE RAUTAKI WHAKAPAIPAI

Draft for discussion purposes

Report No. HR/TLG/2015-2016/5.3

Land use conversion costs for Healthy Rivers Wai Ora Project

This report was commissioned by the Technical Leaders Group for the Healthy Rivers Wai Ora Project

The Technical Leaders Group approves the release of this report to Project Partners and the Collaborative Stakeholder Group for the Healthy Rivers Wai Ora Project.

Signed by: 

Date: 2 May 2016

PERRIN
AG CONSULTANTS

Box 596 Rotorua
1330 Ereura Street
Rotorua, New Zealand
Ph 07 349 12121, Fax 07 349 1112
consult@perrinag.net.nz
www.perrinag.net.nz

MEMORANDUM

TO: Waikato Regional Council

FROM: Lee Matheson (Director, Perrin Ag Consultants Ltd)

DATE: 7 April 2015

SUBJECT: Land use conversion costs for Healthy Rivers Wai Ora Project

1. Introduction

1.1 Perrin Ag Consultants Ltd was engaged by the Waikato Regional Council in March 2015 to provide assessments of land use conversion costs for a range of pastoral enterprises in the Waikato Region. This data was to assist with the extension of the economic model for the Upper Waikato catchment, forming part of the Healthy Rivers Wai Ora project.

2. Methodology

2.1 In order to assess the total cost of conversion associated with land use change in the Waikato catchment, conversion models for variants of three farm systems were developed. The farm systems modelled were to be typical or representative of farm systems in the region. These were to be a dairy farm model, a dairy support model and a sheep & beef model.

2.2 The AgFirst 2014 Waikato/Bay of Plenty Financial Survey provided key parameters for the assumed typical Upper Waikato dairy farm system, while the base farm parameters for the sheep & beef and dairy support farm systems were based off Beef+Lamb NZ Economic Service Sheep & Beef Farm Survey data for the Northland-Waikato-BOP sample; the sheep & beef farm system was based off the Class 4 NI hill country data, while the dairy support model utilised the Class 5 NI intensive finishing data. Unlike the Class 5 B+LNZ survey model, we have assumed this farm system comprises 100% contract grazed livestock.

2.3 In total, nine conversion processes were to be considered, labelled A through I. These were as follows:

A – Forestry to dairy

B – Dairy support to dairy

C – Sheep & beef to dairy

D – Forestry to dairy support

E – Dairy to dairy support

F – Sheep & beef to dairy support

G – Forestry to sheep & beef

H – Dairy to sheep & beef

I – Dairy support to sheep & beef

2.4 Where existing pastoral land uses existed, the new land use would occur at the same scale as the former land use – i.e. a 241ha dairy support property would convert to a 241ha dairy farm.

2.5 Where conversions from forestry to alternative pastoral land uses was to be modelled, it was assumed that conversion will result in farm properties with an effective area equivalent to the average for the respective farm types in the region. This has been considered valid for the dairy support and sheep & cattle conversions given such properties tend to operate in conjunction with pre-existing businesses, rather than necessarily be economically viable in their own right i.e. as stand-alone enterprises. However, our experience would tend to suggest that dairy conversions from forestry cut-over will potentially be larger than "average" dairy farm size in the Waikato, in an attempt to balance operational efficiency with available capital and land resource.

2.6 Forestry land available for conversion in the Waikato region has tended to be in aggregations and with contour distribution that lends itself for larger sized production units, often with effective milking areas of 240-250ha. Despite the implications of a non-consented Variation 6 allowance of only 15m3 per day of water for milk cooling, CIP and yard wash potentially limiting dairy farm size, with careful planning, installation of water minimising systems and recycling of green-water for yard wash, it is still possible to operate a rotary milking parlour with twice-daily CIP and still be within Variation Six limits. However, the 15m3 limit effectively sets an upper limit to cow numbers of about 800 cows.

2.7 While there is little accurate data available on the typical farm sizes of recent forestry-to-dairy conversions, we have assumed a dairy farm unit of 241ha effective for development out of forestry.

2.8 The forestry conversion process is based off Perrin Ag Consultants Ltd's experience in this field. Additional information on such a process can be found in Forestry to Farming (Forest to Farming Group, 2007). This, along with other key conversion assumptions, are presented in Appendices 1 & 2 below.

2.9 Pricing for all conversion costs were based off current recommended retail pricing provided by representative merchants and suppliers in the region. These included:

- PGG Wrightson
- Ballance Agri-nutrients
- Farmquip
- DRP Contractors Ltd
- Reporoa Engineering 1982 Ltd
- JLN Builders Ltd

2.10 While the actual cost of conversion inputs will invariably be lower than recommended retail, as a result of bulk purchasing and/or the use of competitive tenders for key elements, the necessity to provision for contingent expenditure in any conversion project (which isn't provided for in this analysis) makes the use of retail pricing appropriate. All costs are presented as GST exclusive, except for housing for which GST cannot be claimed back.

2.11 Farm configuration data (used to generate paddock size, lengths of races and tracks, water systems etc) was based off real farm properties that have been mapped by Perrin Ag and subsequently analysed for these parameters.

2.12 Livestock values were sourced from the respective 2013/14 surveys from AgFirst and B+LNZ, as were the capital investment required in operating plant and machinery. We have assumed any new dairy conversions will supply Fonterra, with shares equivalent to 85% of the expected status quo milk production purchased up-front. A share price of $6.51 per share has been used – this is the average value of the share since TAF ("Trading amongst Farmers") was launched on 30 November 2012.

2.13 The cost of land itself was excluded, as was the potential for any impact on land values resulting from the change in land use.

2.14 Where the land use change is occurring from an existing pastoral land use to another, the net cost of conversion has been assumed. This accounts for any potential additional investment in infrastructure to effect the conversion, as well as the impact of realising the value of liquid assets (livestock, Fonterra shares and machinery/vehicles where appropriate). Sunk investment in surplus fixed assets (such as buildings) is deemed to be unrecoverable in the event that the new land use doesn't require them (i.e. a milking parlour after a sheep & cattle conversion).

3. Results

3.1 The results of the land use conversion analysis are presented in **Error! Reference source not found.** elow. As can be seen, the cost of converting forestry land to dairying has the greatest capital cost, at $37,500/ha. This sits in contract to the impact of converting to a dairy support operation from a dairy farm, which is expected to generate a net release of capital equivalent to $13,000/ha, largely associated with the sale of livestock and Fonterra co-operative shares and the fact that very little investment is required to effect conversion. The results are more or less consistent with the premise that conversion from a less intensive land use to a more intensive land use is accompanied by relative capital investment.

PERRIN AG CONSULTANTS LTD

References

AgFirst 2014. Financial Survey 2014: Waikato/Bay of Plenty Dairy. http://www.agfirst.co.nz/images/uploads/Waikato_BoP_dairy_report_2014.pdf;

Beef + Lamb NZ Economic Service 2014. http://www.beeflambnz.com/information/on-farm-data-and-industry-production/sheep-beef-farm-survey/nni/;

Forest to Farming Group 2007. Forestry to Farming: Your guide to land conversion using environmental best management practices. Sustainable Farming Fund. 51p;

Model	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Land use	*Dairy*	*Dairy*	*Dairy*	*Dairy support*	*Dairy support*	*Dairy support*	*Sheep & beef*	*Sheep & beef*	*Sheep & beef*
Base parameters	(converted from forestry)	(converted from dairy support)	(converted from sheep & beef)	(converted from forestry to B+LNZ Wai/BOP class 5 model)	(converted from dairy)	(converted from sheep & beef)	(converted to forestry from B+LNZ Wai/BOP class 4 model)	(converted from dairy)	(converted from dairy support)
Area (ha)	241	241	320	241	120	320	320	120	241
Stocking rate									
Cows/ha	2.9	2.9	2.5	-	-	-	-	-	-
SU/ha	-	-	-	9.7	9.7	9.7	9.2	9.2	9.2
Milk production (kg MS)	237,385	237,385	267,875						
per ha	985	985	837						
per cow wintered	335	335	335						
Cowshed	50R	50R	50R	-	-	-			
Woolshed	-	-	-	-	-	-	3 stand	3 stand	3 stand
Average paddock size	3.2	3.2	3.7	4.5	2.4	7.3	7.3	2.4	4.5
Number of paddocks	75.0	75.0	88.0	53.6	50	44	44	50	54
Land use conversion costs ($/ha)									
Carbon liability	4,800	-	-	4,800	-	-	4,800	-	-
Pasture development costs	5,959	801	801	5,959	-	153	5,959	-	-
Fencing, water and electricity	2,506	1,406	1,522	2,072	92	157	1,860	487	708
Buildings and earthworks	11,272	9,761	7,610	2,024	375	-	2,199	1,708	664
Professional services	197	120	99	101	5	3	100	22	14
Livestock	6,156	6,156	4,780	-	(6,154)	(1,371)	1,371	(1,371)	1,371
Plant and machinery	1,206	854	1,050	352	(854)	196	156	196	(196)
Supplier shares (assume full shares)	5,450	5,450	4,632	-	(6,412)	-	-	(6,412)	-
Total capital cost (proceeds)	9,048,861	5,916,005	6,558,149	3,689,076	(1,553,890)	(276,081)	5,262,358	(644,453)	617,159
Total costs (proceeds) per hectare	37,547	24,548	20,494	15,307	(12,949)	(863)	16,445	(5,370)	2,561

Appendix 1: Key assumptions for forestry conversion

1. Base forestry conversion model

1.1 The conversion process to pasture from either reverting wilding pines, recently replanted pine trees or cut-over immediately post-harvest is broadly similar, with the major variance in cost associated with removal of the pre-existing vegetation. We have assumed conversion from cut-over as the primary type of forestry land available in the region.

1.2 In all instances, the site needs to be cleared of its existing forest cover including any stumps and root mass. We have assumed that any recoverable merchantable timber will have been recovered prior to the conversion process, with only stumps, roots, naturally reseeded young trees and ground cover remaining.

1.3 Heavy machinery will be engaged to clear low vegetation and physically lift stumps and root mass from the ground – a technique commonly known as "root-raking". Such debris will be piled into heaps and/or windrows as appropriate for drying and subsequent burning, with all ash then incorporated into the soil in the following cultivation process. While this more-or-less immediate burning of heaps is moderately expensive, requiring a 12t or greater digger on site for 1 day for every 1-2ha of land cleared, it increase the effective area of pasture by as much as 15% compared to leaving windrows to naturally degrade over a period of 8-10 years and only then be reincorporated into the soil as a property's pasture renewal program permits. We have assumed heap burning to be the preferred option.

1.4 The cost of root-raking will vary depending on the age and density of the vegetation. We would expect plantation cutover to cost as much as $2,400/ha to root-rake, compared with $1,450-$1,650 to rake lower density wilding pines on similar contour. Heap burning is estimated at $1,000/ha of land cleared.

1.5 The cost of settling any pre-1990 deforestation liability would be additional to these figures. Based on the net sequestered carbon of a pre-1990 forest at 800t CO_2/ha and the current May 2015 bid price for carbon of $6/t, the deforestation liability associated with such permanent land use change is estimated at as much as $4,800/ha for any plantation forest land

1.6 After tree removal, seed bed preparation is required. Our experience of clearing root-raked land in the Central Plateau would suggest allowing a provision for heavy discing (to break up large particles and slash), a heavy harrow to contour the land, a light harrow and roller to prepare the seed bed and then a roll-seed-roll pass to sow pasture and ensure adequate soil to seed contact. Exact cultivation techniques will vary from site to site depending on exact soil type, contour and the condition of the land post-root-rake, but a cost in the vicinity of $570/ha would be realistic based on a minimum of 3-4 passes.

1.7 In the absence of soil test data for proposed conversion areas, it would be realistic to assume the soil has high phosphate and sulphur requirements. We have budgeted on 1t/ha of a potassic super phosphate (or similar solid fertiliser product) to correct the worse macro nutrient deficiencies prior to pasture establishment. An estimated 5t/ha of agricultural lime is also typically required to lift the pH of the acid soils normally found under pine trees to a level more conducive to pasture growth ≈ >pH 5.6. Additional fertiliser will usually be applied at sowing (normally a product high in both P and N, such as DAP) and again after pasture establishment.

1.8 Our model assumes 10% of any converted area will be sown into a winter brassica crop in any given year, 20% of the area into a short-rotation pasture mix (the areas going into crop over the subsequent two years,) and the balance (70%) into a permanent pasture mix. A desiccant

spray prior to sowing would be normal practice to try and reduce competition from weeds prior to establishment and post-emergent weed control would also be normal practice. A similar approach to establishment is suggested for the brassica crop area. Pasture establishment (fertiliser, seed, chemicals) is estimated to cost $2,200/ha.

1.9 Electricity will be required for the operation of either milking or shearing facilities, as well as for power and lighting to implement sheds and any domestic dwellings. We have assumed an average of 870m of power lines, plus appropriate transformers and installation for a standard forestry to dairy conversion, and half this distance for a non-dairy conversion, on the basis that location of housing and woolshed, if applicable, needn't be as centrally located as the milking parlour.

1.10 Establishment of effective subdivision (fencing), water reticulation and stock access is also critical to effect successful pastoral conversion. To this point, the conversion process will be broadly similar, if not identical, irrespective of the actual pastoral land use. Major differences in conversion costs would arise from this point of the conversion process.

2. Sheep & cattle infrastructure

2.1 Based on the proposed 320ha farm unit for the areas to be converted, we would estimate in the vicinity of 11,500m of boundary fencing will be required, as well as 24,500m of five-wire to effect paddocks of approximately 7.3ha in size and ensure any natural water course and wetlands are adequately fenced off from stock. These quantities are based off paddock scale mapping of forestry conversions of this size for this purpose. It is important to realise that until a detailed paddock layout of the areas is completed it is difficult to provide greater accuracy in total length of fencing required.

2.2 Our cost estimates assume five wire fencing (with two electric wires) and intermediate post spacing (5 metres) for all non-riparian subdivision on the basis of providing the potential for multi-stock class grazing (lambs as well as young cattle). Riparian fencing is assumed to be completed to a higher standard of stock exclusion (being the same as a boundary fence). The total cost of fencing is estimated at $1,077/ha.

2.3 Provision of water supply is assumed to come from a pumped deep water bore, with reticulation in the paddock (two 1000L troughs with 32mm delivery line) and storage to allow for effective gravity delivery to these areas costing an estimated at $622/ha.

2.4 The necessity to create a centralised race and track system (grass only) to allow for effective stock movements within the areas has been assume, so provision has been made for limited earthmoving to effect this at $254/ha, plus 0.6km of metalled driveway for stock transport and access to dwellings and buildings.

2.5 A requirement for a single set of cattle yards (200 head capacity) and sheep yards (1,000 head capacity) has been assumed, along with a raised three-stand woolshed. A six-bay implement shed with one lockable bay has also been assumed.

2.6 Based on the expected farm size, provision for the construction of a single four-bedroomed dwelling with garaging has been made, with on-site reticulation of sewerage.

3. Dairy support infrastructure

3.1 The 241ha dairy support conversion assumes 8.6km of boundary fencing and 29.9km of internal 3 wire electric fencing to subdivided the property into c. fifty-four 4.5ha paddocks.

Provision of water supply is again assumed to come from a pumped deep water bore, with reticulation in the paddock (two 1000L troughs with 32mm delivery line) and storage to allow for effective gravity delivery to these areas costing an estimated at $775/ha.

3.2 Races totalling 6.1km have been assumed, with metalled roadway through to the 4-bedroom farm dwelling, the 200 head capacity cattle yards and implement shed.

4. Dairy infrastructure

4.1 The modelled dairy conversion of 241ha assumes a 50-bale rotary milking parlour would be the preferred option for the cow-shed. Daily wash water, which will fully recycle plate cooling water, is estimated at 5m3 per wash cycle (two per day), and with a further 5m3 of clean water introduced into the effluent system for pit and platform hosing, such a shed would be compliant with Variation 6.

4.2 An effluent system capable of holding 30 days of dairy effluent has been assumed, as well as a passive weeping wall system to remove sufficient solid material to allow green-water to be recycled for all yard wash.

4.3 Races, fencing water reticulation requirements are based off the assumption of 3.2ha paddocks, 2 troughs per paddock and typical farm layout. We estimate 55m of boundary fence per hectare (8.6km total) and 164m of internal (a mixture of 2 and 3 wire) fences per hectare (39km total). Main race lengths (7-8m wide) are estimated at 17m per hectare and secondary races (5-6m wide) at 12m per hectare (7km total race lengths).

4.4 A farm of this size would require between 3 and 4 full time equivalent labour units. We have assumed the necessity to construct four dwellings; one four-bedroomed, two three-bedroomed and a single two-bedroomed unit.

4.5 A six bay implement shed for equipment storage is assumed (one fully-enclosed) with additional calf-rearing facilities

Appendix 2: Key assumptions for conversion from existing land use

1. Sheep & beef to dairy

- 500kg/ha of capital fertiliser
- 2.5t/ha of capital lime
- Regrassing 50% of effective area – 40% grass-to-grass, 10% via a winter crop
- Subdivision of existing paddocks with two-wire electric fencing to double the number of paddocks
- New power lines from road to new milking parlour site
- New deep water bore drilled and complete replacement of water system
- All new races
- New calf-rearing facilities
- Three additional dwellings
- Additional plant & machinery purchases
- Dairy livestock and Fonterra share purchases, sale of existing livestock

2. Sheep & beef to dairy support

- 250kg/ha of capital fertiliser
- No additional regrassing
- Retention of existing subdivision
- New power lines from road to new milking parlour site
- Installation of one additional trough over half the farm area (to cater for greater cattle numbers) and in-line mineral dispenser
- Small additional plant & machinery purchases
- Sale of existing livestock and replacement with contract grazers

3. Dairy support to dairy

- 500kg/ha of capital fertiliser
- 2.5t/ha of capital lime
- Regrassing 50% of effective area – 40% grass-to-grass, 10% via a winter crop
- Subdivision of existing paddocks with two-wire electric fencing to increase the number of paddocks by 38%.
- New power lines from road to new milking parlour site
- New deep water bore drilled and complete replacement of water system
- All new races
- New calf-rearing facilities
- Three additional dwellings
- Additional plant & machinery purchases
- Dairy livestock and Fonterra share purchases

4. Dairy support to sheep & beef

- No additional regrassing
- Conversion of assumed 3-wire electric fences to 5-wire electric, same paddock size
- New power lines from road to new milking parlour site
- Replacement of one larger trough with one smaller per paddock (to cater for sheep to drink)
- Construction of 3 stand woolshed and sheep yards (capacity 1,000 head)
- Slight increase in required plant and machinery
- Purchase of required livestock

5. Dairy to dairy support

- No additional regrassing
- Conversion of assumed 2-wire electric fences to 3-wire electric over all of the fences.
- Construction of cattle yards (200 head capacity)
- Likely decrease in required plant and machinery
- Sale of existing dairy livestock and Fonterra shares, replacement with contract grazers

6. Dairy to sheep & beef

- No additional regrassing
- Conversion of assumed 2-wire electric fences to 5-wire electric over half the area (to create sheep proof “paddocks” double the original size
- Replacement of one larger trough with one smaller per paddock (to cater for sheep to drink)
- Construction of 3 stand woolshed, sheep yards (capacity 1,000 head) and cattle yards (100 head capacity)
- Likely decrease in required plant and machinery
- Sale of existing dairy livestock and Fonterra share, purchase of required livestock