

ACCELERATING THE ADOPTION OF GOOD ENVIRONMENTAL PRACTICE ON DAIRY FARMS IN THE UPPER WAIKATO CATCHMENT

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Abstract.

The Upper Waikato Sustainable Milk Project is the largest environmental good-practice catchment project ever undertaken by the New Zealand dairy industry. Co-funded by the Waikato River Authority and DairyNZ, the project aims to accelerate the adoption of good environmental practice on farm to ultimately improve the health of the Waikato River. Over a three-year period from June 2012, all 700 dairy farms in the Upper Waikato Catchment are being offered one-on-one advice and support via the development of a farm-specific DairyNZ Sustainable Milk Plan (SMP). The SMP process involves consultants working with farmers individually to assess the current status of their farming system and identify risks in the key areas of nutrient, effluent, waterways and land management, as well as water use efficiency. From this assessment, an action plan to improve environmental practices and meet agreed project environmental targets, sustainable dairy water accord commitments and regional compliance rules is being developed and implemented for each farm. Follow-up support is also provided by the consultant during the implementation phase.

All individual actions implemented are being documented to enable estimation of potential changes in nitrogen, phosphorus, sediment and *E. coli* losses off-farm before and after plan implementation. Catchment modelling tools will be applied to estimate the total reduction in loads from all farms at a catchment scale. Success of the project will be measured by the collective actions of 700 farmers demonstrably reducing dairy farm-sourced nutrients, sediments and faecal contaminants going to the Waikato River, and an improvement in water use efficiency on farms. The project also aims to increase the capability of farmers and their advisors, contribute information to regional policy making processes and ensure that farmers are better prepared for the future of ‘farming with limits’.

1. Introduction

The Upper Waikato Sustainable Milk Project, co-funded by the Waikato River Authority (WRA) and DairyNZ, is the largest environmental good-practice catchment project ever undertaken by the New Zealand dairy industry. The primary aim of the project is to support on-farm changes that will enhance water quality and ecosystem health in the Waikato River and demonstrate to policy-makers and the wider community the collective commitment of farmers to sustainable dairying in the catchment. The Vision and Strategy for the Waikato River (WRA 2013) has been a key influencing factor in the progress of the project. The Vision & Strategy aims to provide “...a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn are all responsible for restoring and protecting the health and wellbeing of the Waikato River...”

The UWSMP project will have succeeded if:

- All farmers in the catchment have identified the risks, options and appropriate actions for their farm in a Sustainable Milk Plan and are working to complete the voluntary actions recorded in their plan
- The collective actions of the 700 farmers result in demonstrable reductions in dairy farm-sourced sediment, nutrient and faecal contaminant loads to the upper Waikato River and improvements in water use efficiency
- The capability of Farmers and advisors in the catchment have has been increased
- Farmers, as a result of the project are better prepared for the future

2. Methods and approach

Study site

This project is focused on the Upper Waikato Catchment which covers an area of 465,871 hectares from Huka Falls to the Lake Karapiro dam (Figure 1). Pastoral farming is the dominant land use type in the catchment, represented by dairying (25% of catchment land area), drystock (24%) and dairy support (5%) (MPI unpublished data). Average annual production is 1090 kg MS/ha (LIC/DairyNZ 2013). Approximately 31% of the land area is currently in forestry of which some may be converted to agricultural use in the coming years.

The quality of water in the Waikato River is closely monitored at a range of sites across the catchment by the Waikato Regional Council (WRC). Overall water quality in the upper catchment is generally excellent or satisfactory at most of the sites monitored (Figure 2). It is, however, acknowledged that there has been a declining trend for certain water chemistry parameters measured at some locations.

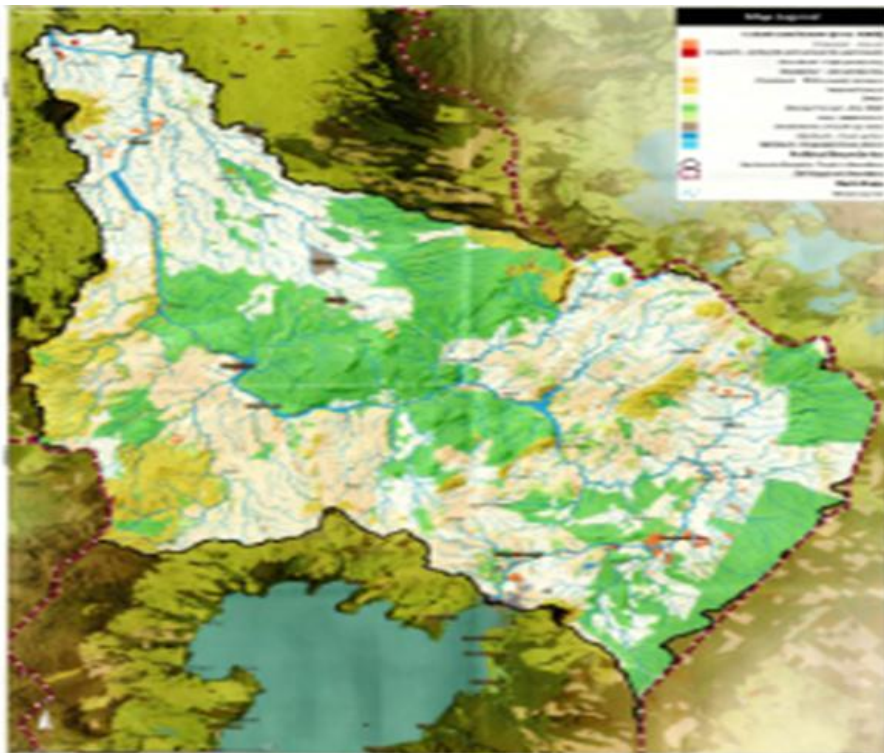


Figure 1: Overview of study catchment

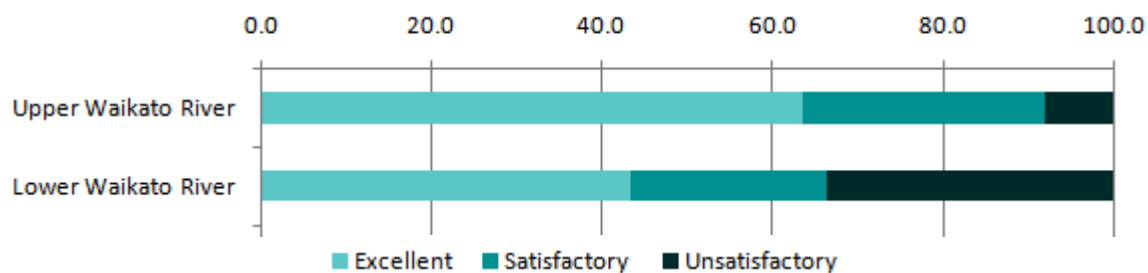


Figure 2: Summary % of samples meeting the Waikato regional Council's guidelines for river quality and ecological health (source: Waikato Regional Council)

Establishment of steering group

At the start of the project a steering group was formed to aid, develop and provide direction for the project. The Steering Group comprises of a number of key stakeholders from DairyNZ, Raukawa Charitable Trust, Te Arawa River Iwi Trust, Awhina Group, Tauhara-Moana Dairy, farmer representatives, Waikato Regional Council, Milk Supply Companies, Federated Farmers, NZIPIM and the fertiliser industry. The specific tasks that sit with the Steering Group are to:

- define and agree on catchment-scale targets
- agree communication messages and channels used in the project
- review project deliverables
- provide feedback on project to Project Team through Steering Group Chair

Sustainable Milk Plan Process

Over a three-year period from June 2012, all 700 dairy farms in the Upper Waikato Catchment are being offered one-on-one advice and support via the development of a farm-specific Sustainable Milk Plan. The SMP, designed by DairyNZ, represents a practical, farm-specific plan which outlines and agrees on steps to be taken on-farm to contribute towards catchment-scale environmental targets. The SMP enables farmers to prioritise their existing and proposed activities into one, simple document. A key characteristic of the SMP is that it contains the farmers' own agreed actions and a timeline for implementation.

The SMP process is focused on five main management target areas; nutrient, effluent, and waterways management, and water use efficiency. The five management areas broadly reflect the following individual action types:

- Nutrients:** Actions related to all aspects of nutrient management except effluent, including nutrient budgeting, fertiliser application, stocking rates and feed management.
- Effluent:** Actions relating to the collection, containment and application of dairy effluent including planning, infrastructure, operation, monitoring and training.
- Waterways:** Actions related directly to the management of runoff to waterways including stock exclusion, riparian planting and wetlands.
- Land:** Practices related to land management practices including cropping, pasture, erosion control and critical source areas (tracks, laneways, crossings).

Water use: Actions related to water use efficiency including consents, monitoring, and practices or the implementation of new infrastructure to reduce water consumption.

A suite of narrative objectives for each management area were developed through the steering group and wider stakeholder discussions as a benchmark by which to measure the overall success of the project (Table 1). These objectives have been captured as targets within the SMP template and form a critical element of the initial discussions between farmers and their project consultant. One of the greatest challenges we faced in finalising the targets was the current uncertainty in the catchment over future policy directions. The final targets agreed to by the Steering Group provide direction and help for farmers to focus on actions which will be most effective in contributing to reductions in contaminant loads to the River or directly improving resource use efficiency.

The SMP process has been structured around the following three main phases which are carried out over a 6-8 month period following initial contact with the farmer (Figs 3 & 4):

1. Completion of a baseline assessment of the catchment - “Where are we at present?”
2. Acknowledgement of achievements to date - “What have we already completed?”
3. Further actions to model potential outcomes of accelerated farmer action - “What is the potential to influence the quality of the river?”

The process commences with a ½ day structured visit to the farm by a consultant. A questionnaire and farm walk is used to guide initial discussions and identify potential farmer actions. The questionnaire also links into a discussion around farmer goals in terms of economic, environmental and long term sustainability. All three sections of the plan are populated as an outcome of this initial visit, with the farmer agreeing on actions that they will commit to achieving over an agreed period.

Following the initial assessment, the consultant provides the farmer with on-going support to complete the actions over the next 6-8 months. Examples of support may include:

- Specific technical information / tools and resources
- One on one advice
- Brokering to technical specialists
- Regional supporting activities

In the final phase, a follow-up assessment is carried out to evaluate, record and, where possible, to quantify the effect of the environmental improvements on the farm. The purpose of this is to:

- Identify how key environmental sustainability indicators have changed throughout the Sustainable Milk Plan process and proposed changes by June 2015.
- Revise the SMP actions and propose new actions up to the end of June 2015.
- Provide feedback on the Sustainable Milk Plan: reasons for completing actions and barriers to change now and in the future.

Table 1: Description of key actions and narrative objectives for each management target area.

Target area	Project targets
Nutrient management	<ul style="list-style-type: none"> • Catchment farmers have an up-to-date nutrient budget (Overseer v. 6) and are implementing appropriate actions to improve nitrogen use efficiency within their current system. • Catchment farmers understand current N-loss in the context of their farm system and the potential options for reducing losses if required in future. In recognition of potential business risk associated with “High” levels of N-loss (i.e., > 43 kg N/ha/yr), farms in this category are implementing appropriate actions to reduce N-loss. • The following values represent current estimates of Low, Medium and High N- losses from milking platforms in the catchment: <ul style="list-style-type: none"> ○ 30 kg N/ha/yr (25% of catchment farmers currently leach less than this value) ○ 36 kg N/ha/yr (50% of catchment farmers currently leach less than this value) ○ 43 kg N/ha/yr (75% of catchment farmers currently leach less than this value) • Catchment farmers have identified current P-loss risk (e.g. Overseer; Critical Source Areas) and are implementing appropriate actions to minimise this risk for their farm
Effluent management	<ul style="list-style-type: none"> • Catchment farmers achieve 100% compliance with regional council effluent management rules and/or resource consent conditions
Waterway management	<ul style="list-style-type: none"> • Catchment farmers have identified stream, lake and wetland areas on their properties and are implementing appropriate actions to improve biodiversity and water quality outcomes
Land management	<ul style="list-style-type: none"> • Catchment farmers have identified areas of soil loss risk on their properties and are implementing appropriate actions to reduce erosion and sediment & faecal run-off to waterways
Water use	<ul style="list-style-type: none"> • Catchment farmers understand their obligations and associated business risks under the Variation 6 (Water Allocation) rules of Waikato Regional Council’s Regional Plan and have applied for required consents before December 2014 • Catchment farmers have identified opportunities for improving water use efficiency and are implementing appropriate actions to provide flexibility during times of water shortage (i.e., when water takes become restricted)
Additional targets around industry expectations for minimum standards	<ul style="list-style-type: none"> • 100% of dairy farms exclude dairy cattle from significant waterways irrespective of whether regional council rules apply • 100% compliance with regional council nutrient management rules and or resource consent conditions • 100% compliance with regional council effluent management rules and/or resource consent conditions. • 100% of dairy farms will comply with water take and use rules and/or resource consent conditions



Figure 3. Diagram of the Sustainable Milk Plan Process

A

DairyNZ Sustainable Milk Plan

Farm details		Name: Farmer X	Date: 01.03.2013	Assessor: A Brocksopp
Farm & Supply Number	xxxxx	Physical Address	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
Catchment	Upper Waikato	Business Type	Other	Email address: xxxxxxxxxxxxxxxx
Farm area	Total ha: 203	Peak cow numbers milked	480	Stocking rate (cows/ha): 2.6
	Effective ha: 187	Production 11/12 in MS total	177,500 in kg MS/ha: 949	in kgMS / cow: 370
Effluent Application area (ha)	24	Production 10/11 in MS total	165,000 in kg MS/ha: 882	in kgMS / cow: 344
Support / Runoff block (s) ha	49	Operating Profit (\$/ha)		Pasture eaten (t DM/ha): 12
What's run on support block	half winter grazing, 50 sales	DairyNZ Farm System: 1-5	3	Cow Live weight: 430
KgN/ha/yr applied (whole farm ave)	130	Farm Working expenses (\$/kg MS)		Cow Live weight (kgLWT/ha): 1104
Farm contour (% Flat/Rolling/Steep)	100% Rolling	Cow efficiency (kg MS/kg LWT)	0.85998062	Cows/Full Time Equivalent: 2.5
Milking platform soils	Pumice	Effluent storage volume (cubic metres)	24	6 week in calf rate (%): 74%
Support block/runoff soils	Pumice	Water use around shed (L/cow/day)	?	Empty rate (%): 6%
Wintering (Cows on or off farm; numbers and duration)	200 cows off for 6 weeks June 1 to mid July			
Imported supplement Type and amount: (t DM)	360t Palm Kernel and 15ha Silage from the run-off			

Nutrient management indicators: Upper Waikato (N data from 69 farms; 2011/12; Overseer v.6)

Number of farms vs N conversion efficiency (% N in product/Total N inputs). Median = 34.

Number of farms vs N-loss (kg N/ha/yr). Median = 36.

% of farms vs P loss (kg P/ha/yr). Median = 1.5.

N Conversion efficiency (%)	27	N Leached (kg N/ha/yr)	43	P loss (kg P/ha/yr)	2.4
Date of Nutrient Budget	1/11/2010	Version of Overseer used	5.4	P loss risk	High

B		Achievements to date	Date completed:
Nutrient Management:	Completed DairyNZ audited Nutrient Management Project NB and NMP in place and advice followed from the fertiliser representative Using a fert mark certified spreader	2010 On-going On-going	
Farm Dairy Effluent:	Area is used for cropping and silage cuts where possible	On-going	
Waterway Management:	All water ways are fenced off		
Land Management:			
Water Takes and consents:			
Environmental Hotspots:			
Achievements will include meeting any Regional Council or industry expectations			

C		Agreed action(s):	Who	By when?
Nutrient Management: <i>(Industry expectation: Compliance with nutrient management rules)</i>	Update nutrient budget to Overseer 6 once the soil tests have been completed	A Brocksopp A Brocksopp	June 2013 June 2013	
	Investigate the effects of a little and often approach to N application			
Effluent Management <i>(Industry expectation: Compliance with effluent management rules)</i>	Supply Farmer x with a effluent sampling kit from the labs	A Brocksopp A Brocksopp	March 2013 March 2013	
	Supply Farmer x with details of AgITO training options	A Brocksopp	April 2013	
	Arrange meeting with DairyNZ consultant to discuss future developments on farm	Farmer x A Brocksopp	April 2013 April 2013	
	Investigate opportunity for water diversion	Farmer x	April 2013	
	Formulate a risk map for effluent application.	A Brocksopp	April 2013	
Waterway Management : <i>(Industry expectation: Cattle exclusion from waterways)</i>	Fence wet area in paddock C19	Farmer x	June 2013	
	Fence wet area in paddock C30	Farmer x	June 2013	
	Provide information on Riparian Management	A Brocksopp	March 2013	
Land Management:	No actions			
Water Use: (Industry expectation: Compliance with water take and use rules)	Attend Smart Water use field day	Farmer x	March 2013	
	Install a water meter	Farmer x	April 2013	

Figure 4: Key components of the SMP process for individual farms; (A) Initial questionnaire, (B) recording of achievements to date and (C) Farmer-agreed action plan and timelines.

3. Results and trends to date

To date over 587 farmers have already agreed to take part in the SMP process. 333 SMPs have been completed and analysed to provide an initial indication of results and trends. A total of 3055 individual on-farm actions were recorded for these farms, reflecting an average of 9.2 actions per farm distributed across the five management target areas (effluent, waterways, nutrients, land and water use). The majority of all actions are focused on nutrient management (31%) followed by effluent management (25%) and water use management (22%) (Fig. 5). Waterways and land management represent 11% of all recorded actions each, with 56% of all farms recorded some form of action around waterways.

To provide a more comprehensive analysis of specific activities within each management area, all individual actions were further classified into 40 categories and 143 sub-categories. Categories were chosen to broadly reflect various stages of planning and development, infrastructure investment, implementation, operational management and training and education. The top five individual actions within each management area expressed as a

percentage of the total number of farms are listed in Table 2. The audit process has shown that 67% of actions have been completed with the timeframes of the project, with the remainder being deferred due to timing (seasonal) or the lack of time available to complete.

Further analysis including the use of catchment modelling tools will be undertaken from here to demonstrate the collective success of on-farm mitigation measures, evaluate beneficial impacts this has on Waikato River water quality and ecological health and provide valuable information to underpin future policy development.

In addition to the individual on-farm actions committed to as part of the SMP, activities already completed prior to the plan development have also been recorded. The top five achievements completed between 2007 and 2013 for the 333 farms analysed to date are:

1. Improvement of effluent application and performance (31% of farms)
2. Reducing N application (30%)
3. Increasing effluent area (28%)
4. Improving and/or updating soil nutrient and health monitoring (24%)
5. Upgrading of effluent infrastructure (24%)

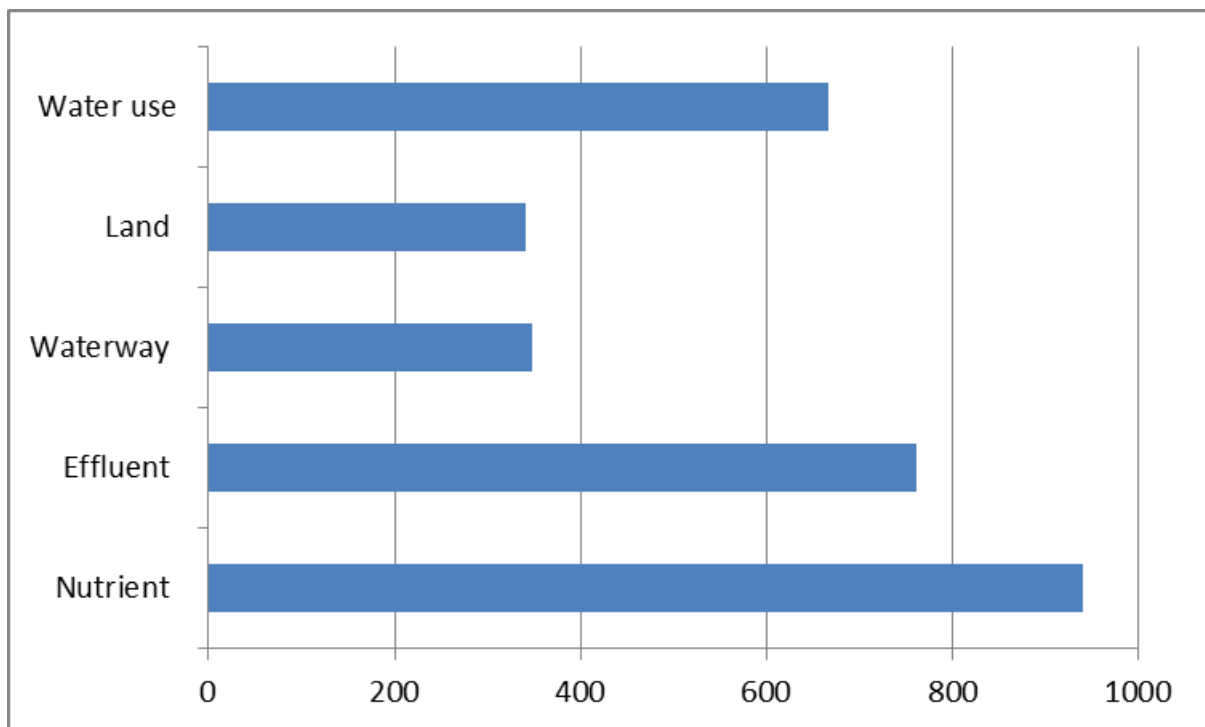


Figure 5: Total number of on-farm actions within each management area for the 333 farms with completed SMPs to date.

Table 2: Summary of the five most common individual on-farm actions agreed to within each management area for the first 333 farms which have completed the SMP.

Management area	Agreed actions	% of farms
Nutrients	Utilise nutrient budget and scenarios to understand nutrient loss drivers, optimal nutrient requirements, efficiency rates and strategies to manage nutrient losses	70%
	Update whole-farm nutrient budget to Overseer V6	53%
	Review optimal effluent block size, location and/or application rate	26%
	Increase effluent area	17%
	Manage/target/ P application around optimal Olsen P levels, (apply P only for maintenance)	17%
Effluent	Assess current and/or future effluent storage requirements (Dairy Effluent Storage calculator)	31%
	Monitor application depth	18%
	Monitor nutrient concentration	17%
	Upgrade effluent infrastructure (additional travellers, increase sprinklers, irrigator line, hydrants, pipeline leaks, filtration systems, solids separator, underground network, increased pump capacity, K-Line pods on slopes).	14%
	Monitor application rates	13%
Waterways	Carry out/re-establish Riparian planting	21%
	Fence off waterways according to accord	20%
	Education (weed control, riparian species and management, waste and chemical disposal, chemical spraying around waterways, economical source of plants)	14%
	Develop riparian planting plan	10%
	Fence off waterways additional to accord (seeps, springs, ponds, wet areas, drains)	9%
Land	Retire and/or plant pasture for erosion control (steep sideling's and gullies, bluffs and slips)	17%
	Manage runoff from tracks and races (divert or contain runoff, maintain track condition, improve drainage, fence races)	14%
	Improve crop cultivation practices (use minimum tillage forage crops, immediately re-sow crop paddocks to pasture after harvesting, spray and direct drill re-grassing procedures to minimise soil disturbance, chicory on winter crop paddocks, reduce crops near waterways, lengthen crop rotation, reduce crop area, thicken swards), cultivate along contours)	13%
	Improve waste management (remove rubbish, re-access farm waste disposal sites relative to groundwater table, chemical handling practices, recycle, pesticide collection)	8%
	Investigate wintering strategies (stand-off, infrastructure, economic feasibility)	6%
	Manage stock on steep areas/ sideling's (permanent/winter exclusion, young stock)	6%
Water use	Investigate efficiency options (Smart water use booklet, leak detector, reduce wash-down water, water savings)	44%
	Complete/ Apply/ Submit/ consent	36%
	Install water meter	31%
	Monitor water use (establish baseline flow, meters, leak detection devices, measuring water used in tank, establish water requirements)	29%
	Investigate variation 6 consent requirements and options	19%

4. Summary

The protection and restoration of the Waikato River is an inter-generational undertaking (WRA 2013), but every landowner in the catchment has the potential to reduce sediment, nutrient and faecal loads to the river right now. The extent to which these loads need to be reduced to meet freshwater objectives is currently unknown. However, achieving good practice on farm, or in town, does not need to wait for regulation. With some guidance on what good practice looks like and support to implement appropriate changes, there is potential for significant gains to be made in river water quality.

To date the project has delivered Sustainable Milk Plans to 431 catchment farms (out of 700) with an additional 169 farms agreeing to take part in the process to date. There are a number of very positive signals coming from our preliminary analysis of actions. Farmers are committing to increased understanding of the environmental effects of their farming activities, at the same time as setting out specific actions for improving performance. This indicates the project is on-track to achieving its stated measures of success. On average, farmers who have already completed the plan have made commitments to 9.2 actions per plan across the five key target areas (nutrient management, effluent management, waterway management, land management and water use).

Overall, effluent management, nutrient management and water use are clearly the three top topics on farmer's minds, whereas land and waterway management have generated far fewer actions, although not all farms have waterways within their boundaries. Ultimately all actions recorded in these target areas should lead to reductions in contaminant losses to surface waters or groundwater. In addition, water use remains a very hot topic for farmers in the Upper Waikato catchment, which is expected given the requirements for water take consents confirmed through Variation 6 (Water Allocation) to the Regional Plan (www.waikatoregion.govt.nz/Council/Policy-and-plans/Rules-and-regulation/Water-allocation-variation/).

The project has also shown that there is an increased awareness and appetite to commit to actions around waterway and land management in many cases over and above the Clean Streams Accord, for example by fencing of small, ephemeral streams or protecting and restoring wetland areas. Some of these actions are covered by requirements under the new Sustainable Dairying: Water Accord, but these farmers will be ahead of any increased requirements.

The project is not just about the process and the content; it is also about people. We have found that being actively engaged in the project, both farmers and consultants are demonstrating an increase in knowledge and capability. This has been aided by the voluntary, farmer agreed process to change being employed that has encouraged the farmer to take ownership of the process.

However we need to be aware that there are influencing factors to ensuring engagement and continual improvement. Firstly communication is key for all parties to maintain engagement pre, during and post the project time frames, achieving this will keep the number of non-participants as low as possible (currently below 10%). The farming calendar has had a big influence on the timing rate of change.

References:

LIC/DairyNZ (2013). New Zealand Dairy Statistics 2012/13. Published by Livestock Improvement Corporation and DairyNZ, Hamilton. 50p.

WRA (2013). Vision and Strategy for the Waikato River: Restoring and protecting the health and wellbeing of the Waikato River. Published by Waikato River Authority, Hamilton. 12p.