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Menu

Practices to improve water quality

Dairy farms

DairyNZ

Healthy Farms Healthy Rivers
ACTIONS FOR CHANGE

Waikato Regional Council
Te Kaunihera ā Rohe o Waikato

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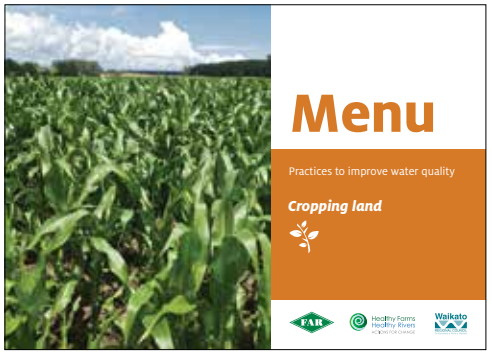

This menu has been developed by Waikato Regional Council and the Upper Waikato Primary Sector Partnership, a group of representatives from agricultural industry organisations working in the Upper Waikato catchment. The group aims to work together to help farmers improve nutrient efficiency and reduce losses.

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Headlands minimal footprint - optimal profit

FAR

beef+lamb new zealand

Thank you for technical input from:

Ross Abercrombie, Don Harford, Blair Keenan, Alan Campbell, Jackie Fitchman and Angela Davies, Waikato Regional Council with technical writing assistance from Ange Bryant

Mike Scarsbrook, Bruce Thorrold, Adrian Brocksopp and Chris Glassey, DairyNZ

Richard Allen, Fonterra

Erica van Reenen, Beef + Lamb New Zealand

Diana Mathers and Mike Parker, the Foundation for Arable Research

Aaron Stafford and Ian Power, Ballance Agri-Nutrients

James Houghton, Paul Le Miere, Chris Lewis and Chris Irons, Federated Farmers Waikato and Bryan Osbourne, Federated Farmers Rotorua-Taupo

James Allen and Kate Ody, AgFirst Waikato

Alison Dewes, Headlands

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Menu of practices to improve water quality: dairy farms

About this menu

This menu provides a range of practices for dairy farms to improve nutrient management and reduce impacts on water quality. It is designed to help identify the best options for individual circumstances. The practices listed are generally a step ahead of current regulatory expectations. They will also help farmers to better meet future sustainability challenges.

This menu should be used together with a farm management team and consultant to support current industry initiatives, such as the Upper Waikato and Waipa Sustainable Milk Projects and the Sustainable Dairying: Water Accord.

The starting point for using this menu is a nutrient budget and a farm system analysis, which looks at farm goals, management approaches and feed supply. These tools will help identify the water quality improvement practices that best fit an individual farm, taking into account flow on effects on feed budgets and other farm policies. Looking at the big picture will help ensure changes in one area do not create deficits or unbudgeted costs in another.

What's the issue?

Farmers, iwi, industry, local government and others have already done much to improve water quality, and continue to do so. However, more is needed to meet community desires for fresh water.

Water quality varies across the Waikato region from excellent to poor. This is largely due to variations in land use type and intensity, and also due to geology. In less developed parts of the region conditions are excellent and there have been few signs of deterioration. But water quality is poorer in intensively farmed areas. In some areas, urban and other non-agricultural point sources also contribute to poor water quality.

In waterways across the region, slowly but steadily rising levels of nitrogen over the last 20 years are cause for concern. Nitrogen in groundwater can take decades to emerge into surface water, and this indicator of water quality will worsen before it improves. Levels of micro-organisms are moderate to high, but stable. Sediment levels are high in places, and phosphorus levels vary.

Water quality benefits

To help determine the most effective water quality improvement practices for an individual farm, each practice's likely water quality benefits are rated. The ratings are based on latest research and indicate likely effectiveness in reducing the amount of nitrogen (N), phosphorus (P), sediment and micro-organisms entering waterways.

Topography and management regimes vary from farm to farm, as does the need for and effectiveness of each practice listed. The ratings are an indicative best estimate and assume generally accepted industry good practice is followed.

Likely water quality benefits: estimated reduction (at whole farm scale) in contaminant reaching waterways

	Nitrogen (N)	Phosphorus (P)	Sediment	Micro-organisms
Low L	Less than 10%	Less than 20%		
Medium M	From 10 to 25%	From 20 to 50%		
High H	More than 25%	More than 50%		

Farm business impacts

Each practice's potential cost and economic benefit to the farm business are also rated. Individual farm circumstances will influence costs and benefits. However, the menu can help you identify a short list of practices for the farm management team and consultant to consider in more detail. Many of the practices' cost ratings are different to their benefit ratings. For example, a low cost practice may provide a high farm benefit. Also, some of the benefits may take some time to be realised.

Potential impact on farm business

	Cost	Benefit
Low **$**	Limited input of farmer time and expenditure. Limited practice change required.	Little change to farm profit as a result of this practice, or may require small changes to farm infrastructure.
Medium **$$**	Moderate input of farmer time and expenditure. Some practice change required.	Practice likely to result in a moderate increase in profitability or improved management.
High **$$$**	Significant input of farmer time and significant expenditure. Significant practice change required.	Very profitable practice or results in improved management e.g. large reduction in farm operational costs.

To copy mitigations into your farm environment plan go to **www.farmmenus.org.nz**.

Tell us what you think and register for updates

This menu reflects current knowledge and future editions will be produced as knowledge develops. We value your feedback, so if you have any concerns or suggestions, please contact a Waikato Regional Council Agricultural Advisor on freephone 0800 800 401 or info@waikatoregion.govt.nz.
To automatically receive future editions of this menu, please register at www.waikatoregion.govt.nz/menus.

Dairy farms

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Whole farm planning	Whole farm business and systems analysis	Whole farm analysis will identify water quality risks. Likely water quality benefits depend on farm contour, management challenges and practices used to manage risks on farm.				$	$$$	Involves assessment of farm resources, stocking policies and farm business risks. A good starting point that will help clarify the most useful practices to consider in this menu.
	Whole farm soil test and fertiliser policies optimised as result	L	M	-	-	$	$$$	Test all soil nutrients including total nitrogen. Benefits will occur if variability in the range. This might help redefine management units for further fertiliser applications.
	Stock policy	Depend on farm system				$	$$$	Involves assessment of optimising comparative stock rate, replacement rates, and milk production.
Nutrient management	Do a whole farm nutrient budget	Likely water quality benefits will depend on the range of practices used to manage nutrients as a result of nutrient budget recommendations.				$	$$	Farm consultant/advisor should use OVERSEER®[1] (most recent version) to create a nutrient budget for the whole farm, with recommendations to be included in a nutrient management plan.
	Apply N fertiliser in accordance with feed budget, climatic conditions and soil temperatures greater than 7°	-	-	-	-	$	$$$	Refer to the Fertiliser Association's *Code of Practice for Nutrient Management* www.fertiliser.org.nz.
	Keep Olsen P at agronomic optimum using soil testing	-	M	-	-	$	$$$	Avoiding unnecessary application of P will reduce costs. To minimise run off, apply P fertiliser when soil moisture is good and no large rainfall events are forecasted. Consider use of lower solubility P fertiliser if soil conditions allow.

[1] The OVERSEER® nutrient budgeting programme assumes many 'low' rated practices, such as following effluent management guidelines, are already in place. If these practices haven't yet been implemented, OVERSEER® is likely to underestimate nutrient losses. Making these changes over time may result in little change to your OVERSEER® nutrient budget even though you are achieving positive change on the ground.

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Nutrient management *(cont.)*	Diet substitution to reduce overall N input (use low protein supplement e.g. maize instead of high protein/ high N pasture)	M	-	-	-	$$	$	Requires good quality maize silage and careful feed monitoring and budgeting. Addition of a feed pad will reduce feed wastage, but increases costs. Can improve overall nutrient budget compared to N boosted pasture in spring because low protein supplement is more N use efficient. The benefit of substitution will be lost if the farmer continues to offer the same quantity of high protein feed as well as the new low protein feed to their herd.
Riparian management	Fence stock out of waterways	L	M	H	H	$	$$	Lower stock losses in waterways are a key benefit. Fencing can sometimes be used to improve subdivision and pasture utilisation.
	Put in culverts or bridges at regular stock crossings	L	M	H	H	$ - $$$	$$	Cost will depend on whether culvert or bridge is required. Bridges also require resource consent. Improved crossings reduce lameness and reduce stock and vehicle travel time.
	Fence stock out of wetlands and maintain water levels (i.e. avoid drainage)	M on flat land L on steeper land	L	H	M	$ - $$	$$	N removal effectiveness depends on wetland type, paddock slope, how long water stays in the wetland (the longer the better), and stock management (no pugging or erosion). Fenced wetlands reduce stock losses and improve habitat for wildlife and fish. Appropriate planting and weed/pest management can further increase benefits.
	Constructed wetlands	M	M	M	M	$$$	$	High cost option to improve water quality of run off before it enters a stream or river e.g. from tile drainage. Not effective if little or no surface run off. Factors to consider include optimal wetland size for catchment area, ability to harvest vegetation occasionally and weed and pest control. Can provide habitat for wildlife and fish.

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Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Riparian management *(cont.)*	Riparian planting	L	M	H	H	$$$	$	Effectiveness improves with a grass margin to help filter run off, especially on steeper slopes. Effectiveness depends on species planted. Ongoing weed and pest management is an added cost but reduces with time. Can improve bank stability, provide habitat for wildlife and instream shade for fish and insects.
	Sediment trap (an engineered structure to slow water flows, reduce energy, filter sediment and allow grass growth e.g. decanting dam, detainment bunds)	L	M	M	L	$$$	$	Most useful where steady flow of run off to waterways during wet periods and sediment/P is an issue. Detainment bunds designed to allow ponding for no more than three days to maintain pasture. Require water storage of around 120m³/ha of contributing catchment. Can be costly where not using existing structures. Requires sound engineering design and ongoing maintenance.
Effluent management[2]	Increase land application area	L	L	L	M	$	$$	Can be beneficial where effluent K loads are above pasture requirements with potential to affect animal health. Maximum nutrient gains can be achieved by using a whole farm nutrient budget. Will depend whether further suitable land (topography and soil type) is available. Is likely to require changes to irrigation system design. Can allow better fit with grazing rotation.
	Move to land application system from two pond discharge to water system	M	H	L	H	$$ - $$$	$$$	Very effective for reducing nutrients to waterways but increases farm labour requirements. Can be a more cost effective alternative to upgrading old pond systems and allows for reuse of nutrients in the farm system, potentially reducing fertiliser requirements over time. Maximum nutrient gains can be achieved by using a whole farm nutrient budget. Less feasible in steep areas or areas with poor soils. For more information, check the soil map at www.waikatoregion.govt.nz/soilsmapinfo for effluent areas.

[2] Any changes to effluent storage systems must be undertaken in accordance with Industry Practice Note 21. Land application of effluent must be undertaken in accordance with best practice. See www.dairynz.co.nz/effluentcode for more information on effluent management best practice.

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Effluent management ***(cont.)***	Minimise effluent volumes at source (by reducing wash water volumes and rainwater in the system)	L	L	L	L	$	$$	Reduces pumping cost and need for storage. Improves water efficiency on farm.
	Grow maize on the effluent block	L	L	-	-	$	$$	Effective for N and K removal and allows lower cost maize growth on farm with less fertiliser. Requires good maize management to minimise leaching, including direct drilling, avoiding mid-winter cultivation and timing any N applications to match peak plant uptake using split applications or slow release N. Use of additional N fertiliser will reduce benefit of N loss, so should be done in accordance with soil tests. Affects stock rotations in summer if effluent block not available for grazing.
	Export effluent solids to run off or cropping areas	M	L	L	M	$	$$	Most useful in Dairy System 5 and assumes solid separation already occurs. See www.dairynz.co.nz/systems. Water quality benefits only realised if fertiliser use remains unchanged. Suits low rate effluent application systems (<6mm application depth). Higher cost and labour for solids separation and transport but option to lower N and K for high input system in sensitive catchment. Receiving farm will ideally have a nutrient budget to manage effect of imported nutrients.
	Monitor soil moisture deficit for effluent irrigation and use information to improve timing of effluent applications	L	L	-	M	$$	$	Ensures shed and feed pad effluent is applied without direct discharge to water or draining to groundwater. May mean increasing effluent storage capacity during wet periods. Use pond calculator to estimate pond storage required.

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Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Effluent management ***(cont.)***	Optimise the volume of shed, yard and cleaning water	L	L	L	L	$	$	Maximises storage capacity available, allow effluent to be applied to land in optimum conditions. Flood wash with water from the effluent pond (refer to conditions of use from your milk processor).
	Optimise the volume of feed pad cleaning water	L	L	L	L	$	$	Recycle green water for feed pad cleaning.
	Prior to spreading, locate sand trap heaps on sealed pads and away from watercourses and drains	L	L	-	L	$	-	Ensure drainage is back to the pond so contaminated rainwater can be captured and contained.
	Low rate effluent irrigation	L	M	L	M	$$ - $$$	$$	Requires some solid separation. Allows more 'safe' irrigation days per year and lowers overall effluent storage need. Allows application to steeper land but can be challenging to keep application rates consistent. Cost dependent on system choice.
	Increase storage volume and using deferred irrigation	L	M	M	H	$$$	$$	Can be high cost as most existing pond systems are not able to be used for storage. Can be challenges with mechanical desludging. Lowers risk of effluent run off during wet and/or busy periods.

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Off pasture options	Use controlled grazing regimes (within paddocks, on-off grazing or opening up more feed ahead of storms) to reduce risk of N leaching, run off, soil loss and compaction	L	M	M	M	$ - $$$	$$$	On-off grazing requires a stand-off pad and effluent storage, but feed wastage and soil compaction are reduced. Low cost if existing stand-off facilities on farm. Benefit is greatest on farms with high risk soils.
	Use of off pasture facility (e.g. shelters or loafing pads) suitable for removing stock from pasture during prolonged wet or dry periods (using bought in feed)	H	H	H	H	$$ - $$$	$$	Requires feeding and effluent capture facilities with adequate storage and land application area. Also requires a revised nutrient budget to take into account the value of supplementary feed. Requires different set of management skills from pasture-based farming systems. Benefits depend on soil type and climate.
	Cut and carry pasture management with feeding facilities	H	H	H	H	$$$	$	Requires a feed pad and appropriate effluent capture facilities. Management skills required are very different to those developed in traditional NZ farm systems.
	Graze cows off farm in winter	M	M	M	M	$$	$$	Water quality benefit for catchment but exports the issue elsewhere. Farmer loses some control of stock health and condition when stock off farm.
Protecting soil health with good grazing management	Avoid grazing heavy stock on steeper or more vulnerable soils especially when wet	L	M	M	M	$	$ - $$$	Keeping stock off saturated soils may be as easy as shifting stock to a different soil type on farm through to stand-off facilities. Cost-benefit depends on options chosen to take stock off pasture. Highest benefit on high risk soils.

Dairy farms

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Managing critical source areas - hotspots (high sediment, phosphorus or faecal loads coming from small areas of high run off)	Reduce run off from tracks and races (using cut-offs and shaping)	L	M	M	M	$	$$	Cost and effectiveness depends on contour of farm (higher risk of soil loss on steeper land but will also require more work). Requires regular maintenance but can reduce lameness, water damage and long term maintenance costs.
	Move water troughs and gateways away from water flow paths	L	M	M	M	$	$	These areas of concentrated stock use have high nutrient loads and reduced vegetative cover so are higher risk for run off. Cost and effectiveness depends on contour of farm (higher risk of soil loss on steeper land but greater benefit).
	Fence and plant springs and permanent wet and boggy areas	L	L	L	L	$$	$$	Benefits will be proportional to the number of sites and total area retired. Effects for nitrogen will also be proportional to the groundwater catchment and therefore the benefits may be more than just the wetland area.
	Fence and plant out unproductive steeper slopes	-	H	H	L	$$$	$$	Planted steeper slopes will slow water movement from this area and reduce the potential for erosion Will reduce weed control costs and lower fertiliser expenditure.
	Replace summer and winter sacrifice paddocks with sealed loafing pads	H	H	H	H	$$	$$	Allows pasture to recover quicker after prolonged wet or dry periods. Collected effluent will be stored in effluent pond for late spring application. Requires effluent capture and storage for land application.
	Use low N crops	L	L	-	-	$	$	Fodder beet and fodder radish have low N content and lower N urinary deposition. The benefit depends on how you use the crop in your farming system.

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Cropping management	Reduce soil cultivation by adopting strip tillage or direct drilling	L	H	H	-	$	$$	Effective for reducing run off and soil loss, and improving soil quality and infiltration. Soils that have been grazed over the winter may be compacted or pugged, requiring more cultivation or resulting in rough paddocks. Requires modified planter machinery to deliver good seed placement for even plant establishment. Additional expenditure might be required for insect pest control. FAR trials show a benefit of $200/ha to direct drilling if crop establishment costs and yields are similar.
	Maintain buffer strips on sloping cropping paddocks	-	H	H	M	$	$	Reduces risk of soil loss from heavy rain events. Benefit will be proportional to area cultivated
	Establish autumn pastures early	L	L	L	-	$	$$	Suggested planting date for perennial pasture is before 31 March, regardless of soil moisture. Consider earlier maturing varieties as previous crop's harvest date is a factor. Nitrate benefit will be proportional to the area cultivated.
	Use winter active crops	L	-	-	-	$	$	Winter active crops (oats, rape, Italian rye) may reduce N leached.
	Cultivate along contours (rather than up and down the slope) where slopes greater than 3°	L	H	H	-	$	$$	Slows down run off and reduces erosion. Row orientation should follow contour.
	Time N application to meet crop demand using split applications or slow release N	H	-	-	-	$	$$	By targeting crop demand better uptake of nutrients by crops and lower losses occur. Split applications are more costly and management intensive.

Dairy farms

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Cropping management *(cont.)*	Actively manage grazing of winter forage crop areas to reduce risk of N leaching, run off, soil loss and compaction	L	M	M	M	$$	$$	Graze from top to bottom of paddock contour. Avoid leaving stock on during wet periods, for long periods, or concentrated on small sections of the crop.
	Graze crops and pasture towards waterways, rather than away from them	L	H	H	M	$	$	Applies to grazed paddocks in wet weather with overland flow that converges to form small channels of running water. Will capture run off from grazed areas. Benefit will be proportional to area grazed.
	Use placement tools e.g. GPS guidance, crop sensing, where possible	H	H	-	-	$$$	$$$	Delivers more precise nutrient inputs for expected crop yield. Likely to become more widely used as tractors are upgraded over time.
	Include grass buffer strips (2m or more) for cultivated land next to waterways	L	M	L	-	$$	$	Effective for filtering run off and reducing the risk of fertiliser loss during spreading. More benefit on greater slope but wider buffer required. Grazing of buffers only appropriate for ephemeral waterways during summer dry. May require weed management but can provide habitat for beneficial predatory insects, reducing need for pest control.
Irrigate to avoid increased drainage and run off	Measure and record soil moisture and rainfall to develop a water budget	-	-	-	-	$	$	There is value in collecting farm data to inform management decisions. Note that one will need local evapotranspiration data to complete the water budget
	Use water budget to schedule irrigation	Depend on irrigation type and farm system				$$	$$	Water scheduling increases water efficiency. Benefits will depend on current practice, soil type and farm system. Seek professional advice on water scheduling and irrigation type (e.g. low pressure v flood v high pressure).

Management area	On farm practice	Likely water quality benefit				Potential impact on farm business		Factors to consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Irrigate to avoid increased drainage and run off *(cont.)*	Do not exceed soil water infiltration rate	Depend on irrigation type and farm system				$	$$	Benefits will be dependent on current practice, soil type and farm system. Seek professional advice to avoid drainage.
	Maintain irrigation equipment	Depend on irrigation type				$$	$$	Check pipes are not leaking and nozzles are working well.
Emerging technologies currently in development	Precision fertiliser applications	L	M	-	-	$	$	GPS application of fertiliser is currently used to improve accuracy of application and can result in improved N conversion efficiency and reduced fertiliser use. Maximum benefits achieved where waterways or critical source areas (high sediment, P or faecal loads) are avoided.
	Use of gibberellic acid to boost pasture growth	L	-	-	-	$	$	Only provides water quality benefit if used as an N substitute to reduce overall N inputs. Plant hormones should be used with care.
	Consider deeper rooted species in pasture composition	L	L	L	-	$	$	Mixed swards (e.g. chicory, lucerne) recover more soil N between January to May than does barley or pasture.
Farm training	Embed environmental management into farm practices through training and incentivising staff	M	M	M	M	$	$	The level will depend on the staff members experience in environmental practice and ability to influence on farm practice change.
	Ensure staff responsible for effluent management are adequately trained	L	L	L	M	$	$	AgITO courses available.

Please note: This document assumes generally accepted industry good practice is followed in all aspects of farm management.
See www.dairynz.co.nz/environment/in-your-region/sustainable-dairying-water-accord/ for more information and advice on overall environmental good practice for dairy farms.

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