

Talk 01_Stephen Macaulay_NZPIM: Farm Environment Planner Accreditation Scheme

1. Which platform is currently in use to develop these farm plans?
 - a. At this point there is no generic online platforms to develop farm plans. This may come over the course of time, but this would need to be agreed upon by farmers/industry/regional council/Govt. Given that farm systems and landscapes can vary, practical consideration would need to be given to whether a generic platform is appropriate.
2. How do you measure someone's understanding of farm systems?
 - a. The certification process is not intended to assess applicants expertise in farm systems, rather we are looking to assess applicants knowledge and expertise to competently complete farm environment plans that are fit for purpose, which does require a fundamental understanding of farm systems. The online assessment modules does include a range of questions and scenarios to assess applicants understanding of practices that impact on water quality. An understanding of farm systems is needed to be able to accurately answer these online quizzes. While the validation process of applicant's FWFP has yet to be finalised as part of the application process for certification, we expect this process would also check whether farm system changes proposed by applicants are realistic and practical.
3. Given the 'Certifier' is simply confirming the contents of the plan meet requirements do you think this task could become more automated (software app) in the future? Leaving RPs with more time to focus on supporting implementation of mitigation activities?
 - a. Good question. A lot will depend on whether a Certifier wants to assist farmers in developing a FWFP (assuming MfE accepts that a Certifier can also help farmers prepare FWFPs). Given the complex nature of farm systems and depending on the level of information required by regulators, I think machine learning technology is some way off. However, once we get better at identifying or codifying environmental risks on-farm and possible mitigation strategies across a broad range of different farm systems, then the approval process for certifying FWFP could be sped up and allow advisors to focus on other areas.

Alison Worth: This is interesting because while AI could help create efficiencies in processing FEPs, the risk of gaming the system is very real (and happens already!). Implementing and writing code that can prevent/reduce this would require significant expense, both from supporting technologies and dev time.
4. How can planners validate they've sent 10 FEPs to councils if none of the councils are accepting them yet because they're waiting to see what the requirements are?
 - a. This was included to recognise individuals that have been submitting FEPs to a regulatory body over the last 2 years. This is more applicable where regional councils have been requiring FEPs (or similar) as part of their resource consenting process.
5. Could a farmer become certified, and certify their own plan?
 - a. Provided a farmer meets the prerequisite and assessment requirements for the Scheme, they can become a Certifier. However, based on the professional and ethical standards

excepted of Certifiers it would be inappropriate for them to certify their own farm. I also expect this would be viewed poorly by regional councils if they were made aware of such circumstances. Regards Stephen

6. Is this separate from CNMA?
 - a. Yes this is separate from the CNMA scheme.
7. How will the assessment piece, overlap with current requirements for CNMA? Appears to be a lot of overlap with regards to ethics module, CPD, modules
 - a. In terms of the assessment modules there could be some overlap in the Nutrient Management module as you would expect. The Ethics module used by CNMA is provided under license by NZIPIM. If a Certified Adviser had completed the ethics module and CPD under CNMA Scheme, then this would - depending on the content - most likely be recognised by the FEP Certification Scheme (eg if a Certified Adviser completed 20 CPD hours under the CNMA Scheme, this could also count toward meeting FEP Certification Scheme CPD requirements).
8. Would a certifier be required to do both or one or the other?
 - a. This is dependent on what service the individuals intends to provide and what your client needs are. If an individual intends to work with farmers/growers in the development of FFWP, then they would be best to complete assessment requirements under the FEP Certification Scheme.
9. If the RP has completed the ethics module, does NZIPIM then accept some liability/provide some protection as a professional institute?
 - a. The Ethics Modules is an education and assessment tool designed to expand and test individuals knowledge of ethics and to enable them to better understand their professional obligations to their clients, regulators and the public. As a member of NZIPIM we expect that members will abide by our Code of Ethics ([link](#)). Should a complaint be raised on a member's professional conduct then our Complaints Process our By-Laws comes into effect. To reduce the risk of potential claims being made against members we recommend they take out professional liability insurance.
10. You mentioned early on in your talk that the certification process would be focused on confirming the individual's regulatory understanding. How do you see this working given the likely variation in Regional Council, meat/milk company, and customer requirements? (ie if we are going to have 'certified planners' is a 'one size fits all' approach appropriate?)
 - a. Within the assessment process we have provided the option for regional councils to choose whether, or not, applicants need to demonstrate their knowledge of local regional rules. In speaking to some regional councils they are looking to extent this further by requiring applicants to attend workshops to focus on key environmental risks in their regions/catchments. At this point the focus has been around meeting regulatory requirements under the regional and national regulations, rather than market based requirements.
11. When are the six online assessments available? And can you please remind us of the headings for the six online assessment areas?
 - a. The six core competencies (on which the online modules are based) are: These will be available when the FEP Certification Scheme is launched.
 - b. The six core competencies (on which the online modules are based) are: 1. Cross cutting principles (regulatory process), 2. Waterways, 3. Nutrient management, 4. Land and soils,

5. Irrigation management, and 6. Effluent management. These will be available when the FEP Certification Scheme is launched.
12. How would a certifier who presumably hasn't visited each farm certify that the person who delivered the plan has captured and correctly assessed all of the risks?
 - a. By certifying a FWFP, the Certifier accepts responsibility that the FWFP meets the requirements of the RMA. The Certifier has a professional obligation to their client and regional council to ensure the Certified FWFP is fit for purpose. This would be difficult to achieve remotely.
 13. And when an FEP writer submits an FEP to be verified, how does the verifier know that the FEP writer/certifier has identified all risks?
 - a. MfE are working on developing regulatory guidance to regional councils in appointment process of certifiers to complete freshwater farm plans. This should include the verification process in assessing FWFP/FEPs. While identifying all environmental risks could be challenging, there will be some common risks that an assessor/regional council will be looking at in verifying FWFP/FEPs as part of the certification process including farming system, topography, soil types, LUC, irrigation, etc.
 14. Do you think it is possible to see just one person deliver and meet the requirements for the certified farm plan you would be offering through NZIPIM or this will likely evolve into a scheme or organisation owned certification? I am asking as having one individual certified across freshwater, policy, land management, GHGs and farm systems seems like a high level of criteria which would only identify a handful of people in NZ.
 - a. Great question. It would be unrealistic for an advisor to be across all the areas described in your message. I think that we will see different business models evolve in that you might see specialists focus in one area (eg. completing nutrient budgets) or a team approach coordinated by a lead advisor or Certified Planner. Given the lack of capacity in the advisory market to develop FWFP for farmers/growers I think a certain amount of flexibility will be required, while ensuring the credibility of the certification process.
 15. We have a need for these certified people now to work through alternative pathways under essential fresh water regulations by the mid to end of this year, how many certified planners do you think we need across the country and how many do we have now? I am relying on that these certified people actually help the farmer write the plan as issues that arise from them not having a full understanding of how the farm operates would come out with some unusual requirements in a mitigation sense.
 - a. That will be a challenge. NZIPIM estimates that there are around 50-75 advisors out there currently assisting farmers in completing FEPs. More will be required and in NZIPIM's submission on the Essential Freshwater package in Oct 2019, we estimated that around 200 certifiers would be required. But in saying this a lot will depend on whether there is wider acceptance by central and local govt of market assurance programmes in meeting the freshwater requirements of the RMA. If so a lesser number will be required.

Talk 02_Andrew Wark_WRC: Engaging farmers in the development of FEPs

Answered by Mark Gasquoine

1. Will Waikato Regional Council audit some of the independent checks or will the external audit be at a compliance visit?

- a. The check that occurs after a farmer has been through the 3 steps will be an approval type of set-up where a certified person says whether they feel the FW-FP is reflective of the farm and associated system. This person will then certify or approve the farm plan as being ready for a consent application with councils. The council won't play a role in this approval process as it may get in the way of the consent process that will come soon after.
2. Wondering about the reference to 'freshwater farm plans'. Does this imply only FW is covered in FEPPs delivered in the Waikato?
 - a. At this stage WRC is focussing only on freshwater farm plans as this is where we have the clearest role and mandate. We are aware that farm plans will have broader content to them, but a regional councils role isn't clear, particularly in the GHG space. We are working with some industry groups to include these other aspects into the process that is outlined, but this would be for industry to drive.
3. Great that you start with identifying the underlying environmental risks, but are you confident that you can identify all risks? how accurate is the risk identification process?
 - a. It is definitely an area that we need to work on building consistency around. We are fairly confident that we identify most risks, but we also know that a risk may appear differently day-to-day. This is why audits and ongoing reviews for a farmer are important.
4. How does Waikato sit relative to other councils - are you a head of the curve with relation to farm planning?
 - a. WRC has had the benefit of learning from other councils, particularly when it comes to 'what to avoid etc'. We are taking a slightly different approach to other councils, but have a similar end-goal in mind. We are seeing more and more councils wanting to work together though which is hugely beneficial.
5. Who is producing the templates?
 - a. WRC has produced a couple of templates which are fit for the process outlined. That doesn't mean we can't and don't use other templates though. We know a number of different groups have put a lot of time and effort into building systems to support their farmers and growers. Our template helps to identify WRC's needs.
6. Keen to know how the farming groups are being identified?
 - a. We go where energy already exists at the moment. This can be through a community getting in contact with us, or industry body driving some engagement. It's a case-by-case basis.
7. What are the keys to getting a whole catchment engaged? Even in the priority catchments are you still seeing people reluctant to engage?
 - a. In all honesty, we don't know that. "How do you engage the dis-engaged?" We are big proponents of farmers defining their own community needs and driving the change they want to see. This is far more engaging than council. But the regs are still there are bottom-line reminders for those who don't want to be part of the community or refuse to do anything.
8. What is your plan for quantifying the impact of mitigation options and monitoring progress?
 - a. **Andrew Walk:** This is an important point that we need to make sure that the mitigations are resulting in improvement to water quality. Monitoring the attributes to measure water quality is an ongoing process for WRC and we will be looking at the mitigations that have

been conducted in catchments to assess changes in water quality. It should also be noted that some mitigations will take time before improvements will be seen.

9. If it becomes a certification scheme later as you suggested, will it be localised to Waikato or be a national scheme? Who will pay for the third-party verification? farmers and growers? If so, do you think this will be an obstacle to farmer buy-in to the process?
 - a. Andrew Walk: At this time there is no clarity on the structure of the certification process at either national or regional levels so it is hard to answer this now, however we need to be thinking how it might fit with in this process. It is perceived that in this process the farmer will pay for the certification stage however we hope that by taking the farmer through the workshop steps there will be significant savings to developing the farm plan, especially if we can obtain funding from a national level to support this approach.

Talk 03_Dave Harrison_He-Waka-Eka-Noa: Update from a nationwide perspective

1. What is being published on pricing options?
 - a. We are testing and refining the policy with farmers and growers from industry environment reference groups. We will also be engaging more broadly with stakeholders on options later in 2021.

[Sign up for updates here](#) or mail us on yourfeedback@hewakaekenoa.nz

2. Any restrictions around size of "farms" for reporting requirements? All landowners?
 - a. For meeting the first milestones of knowing numbers and reporting, farms have been agreed as:

Farming enterprises larger than 80 hectares, as well as:

- a. All dairy herds with a milk supply number
- b. Feedlots as identified in the Freshwater Legislation (where cattle are kept for at least 80 days in any 6-month period; and are fed exclusively by hand or machine).

This covers 97% of greenhouse gas emissions and roughly 25,000 farms.

3. How many farms are He Waka Eke Noa targeting? Over 12,000 farms, which are already setup in OverseerFM can easily already see their GHG number.
 - a. As above, He Waka Eke Noa is targeting 25,000 farms, which capture 97% of agricultural greenhousegas emissions.
4. What solutions/mechanisms are being provided to farmers to be able to do their GHG FPs and accounting?
 - a. Two sources of information from *He Waka Eke Noa: The Primary Sector Climate Action Partnership* can help industry bodies and farmers understand their agricultural greenhouse gasemissions, mitigation, and sequestration options.
 1. [Greenhouse Gases: Farm Planning Guidance](#)
 2. [Current tools and calculators that meet requirements for calculating greenhouse gases.](#)

Each partner is working to integrate a GHG module into their farm environment plans.

More tools will be assessed over coming months.

5. Where are GHG guidance docs for FEPs available?
 - a. There is a document on the He Waka Eke Noa website in the resources section <https://hewakaekenoa.nz/resources/>
6. How is the ghg guidance for plans going with a scheduled completion of Jan 2021?
 - a. This is completed – see above.
7. Will GHG emission mitigation's be required as part of a farm plan by 2025 as well?
 - a. A He Waka Eke Noa Milestone is that by 2025, 100% of farms include the measurement and management of GHG gases in their farm plans.

Some industry assurance farm plans already include greenhouse gas mitigation. Others are currently integrating the GHG guidance into their programmes and plans.

8. What kind of guidance for GHG in farm plan for the farmers?
 - a. Greenhouse Gases: Farm Planning Guidance

Following the four principles:

1. Know your farm's greenhouse gas emissions
2. Identify opportunities to reduce your farm's greenhouse gas emissions and capture carbon
3. Choose your actions
4. Keep records, monitor and review

The guidance sets out the opportunities to reduce greenhouse gas emissions and increase sequestration for a wide a range of farm systems.

9. It's a very important initiative and we want to support you. How widely are you going to disseminate the draft guidance for farm plans for input? Who should we contact for a copy?
 - a. You can take a copy from online or contact us for hard copies. Greenhouse Gases: Farm Planning Guidance.

Industry partners are currently integrating the farm plan guidance into existing programmes. Any feedback is welcome at yourfeedback@hewakaekenoa.nz.

10. Will farmers who are more efficient be penalised?
 - a. An objective of the programme is to recognise and support farmers and growers that are already adopting farm emission reductions.
11. As an alternative pathway to the Essential Fresh water regulations farmers require by next year basically certified farm plans asap. How many can be ready?
 - a. Specific progress or activities by sector to achieve the farm planning milestones include:
 - From May, Beef + Lamb New Zealand will roll out their farm planning system that will
 - support sheep and beef producers to develop active farm plans including a climate module.

About 25 percent of dairy farmers already have plans to manage their emissions.

12. Have you any ideas as of yet on how to measure on farm sequestration at an individual level?
 - a. Work is underway to look at ways to recognise on farm sequestration that currently doesn't meet the definition in the Emissions Trading Scheme. This includes ways to

estimate, account for, and verify sequestration on farm.

13. How will emissions be measured? What tools/calculators will be able to be used and how will consistency of outputs be achieved to ensure we're comparing apples with apples for benchmarking etc.?

- a. AgFirst assessed publicly available tools to ensure that they used methodologies and definitions that are appropriate for He Waka Eke Noa.

Assessed so far are HortNZ, MfE, Alltech, E2M, Fonterra/AIM, Farmax and Overseer.

More tools will be assessed over the next three months, including Beef + Lamb New Zealand's GHG calculator, and tools from Toitū, Foundation for Arable Research (FAR), and New Zealand Pork.

Differences between models can occur due to more complex, detailed approaches that can capture farm-scale information (e.g. feed types and N contents, dry matter intake, metabolisable energy, animal liveweights, replacement rates), which influences the dry matter intake and N intake. These drive CH₄ and N₂O emissions.

While simpler models are relatively quick to complete, they rely on national/ international default values. This typically results in a less accurate farm-scale GHG footprint but is useful for generating an estimate of a farm footprint.

Differences also occur in GHG numbers due to different interpretations by users in the supplied input data. In some cases the variability is driven by the quality of the data that was entered.

Our first priority is for farmers to know their greenhouse gas numbers, and understand where emissions are coming from on their particular farming operations. At this stage this variability in

GHG results is acceptable. Currently there is no detailed model covering all land use types for the evaluation, so several models are required to support farmers to 'know their numbers'.

It is likely that there will be some changes in the definitions and methods that will be used to base the pricing mechanism. This is needed to make sure the pricing system is fair and consistent between different farmers and growers, and this work is underway as part of developing recommendations on an alternative pricing mechanism.

In the meantime, details on tools can be found here <https://hewakaekenoa.nz/tools/>

14. What sort of records should be kept, where, how and will they be reviewed and certified like FP-FW plans?

- a. Record keeping is essential to inform future decision-making and allow easy verification of farm emissions, which will likely be a future requirement.

Minimum information to record for the calculation of farm emissions includes:

- Livestock numbers by stock type, either using monthly values or, for simple tools, a weighted annual average
- Amount of synthetic N fertiliser applied annually.

Additional information that can support a more detailed understanding of farm emissions and reduction opportunities includes:

- Farm total and effective area, farm topography (slope)
 - Livestock class, age, number, and movements
 - N fertiliser or lime applications including product type, rate, and timing
 - Crop residues
- Production data such as milk solids, liveweight or crop yield
Woody vegetation planting records.

15. Does the Paris Agreement include food producing activities?
- a. [Paris Agreement: Sustainable Development Knowledge Platform \(un.org\)](https://un.org)

Article 2 recognises the importance of food production:

“(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.”

16. Will a copy of this preso be available afterwards please?
- a. This has been forwarded.
17. Is HWEN working to ensure that the GHG measurements and mitigations are included in the FP-FW plans, to ensure that pollution swapping (which we are already seeing) is avoided?
- a. The Partnership will line up information, tools and support for on-farm climate action with other on-farm environmental actions, such as protecting and restoring freshwater health and biodiversity.
18. How does the release to public of the guidance doc affect the Jan 2021 deadline?
- a. The milestone for releasing the guidance was met at the end of December 2020.
19. What tools are being considered? given the state of science it seems challenging to have robust tools by Feb...
- a. Right now, a variety of tools and calculators are available so farms can start getting a handle on their greenhouse gas numbers.

AgFirst assessed publicly available tools to ensure that they used methodologies and definitions that are appropriate for He Waka Eke Noa. More tools will be assessed over the next three months, including Beef + Lamb New Zealand’s GHG calculator, and tools from Toitū, Foundation for Arable Research (FAR), and New Zealand Pork.

Assessed so far are HortNZ, MfE, Alltech, E2M, Fonterra/AIM, Farmax and Overseer.

It is likely that there will be some changes in the definitions and methods that will be used to base the pricing mechanism. This is needed to make sure the pricing system is fair and consistent between different farmers and growers, and this work is underway as part of developing recommendations on an alternative pricing mechanism.

20. Do you think there will be any adjustment to the timeline you have just proposed based on the news that has just come out that the government is going to replace the RMA?
- a. The He Waka Eke Noa milestones are on track. There are no plans to revise the timeframes.

21. HWEN has published high-level timeframes for different targets - but within all those targets, specific tools, guidance, training etc will likely be required in order to deliver on those targets. Do you have more granular timeframes for when you are targeting the release of supporting materials and tools throughout the next 4 years?
 - a. He Waka Eke Noa Partners are currently developing detailed plans to support delivery of the targets/milestones within their respective sectors.

Talk 04_Alastair Rutherford_EC: ECAN FEP audit programme

1. Really good that FEPs are based on GMPs... who is responsible for updating these based on changing expectations, science etc... and how often? What does this then mean for an existing FEP (eg: what is requirement to review/update FEP)?
 - a. Good question. ECan was involved in a project called the *Matrix of Good Management (MGM)*. This was a joint industry group chaired by Tom Lambie an ECan Commissioner. The concept was, if we were to estimate the footprint of N and P loss for a range of farm systems in Canterbury assuming they are operating at good management practice (GMP) then we needed to be clear what constitutes GMP on farms. The MGM project eventually produced and published the *Industry-agreed GMP relating to water quality, September 2015*, (attached). While the MGM project recognised that: “*As the knowledge and technology advance over time, updates to these GMPs, and associated implementation guidance, is likely to be necessary.*” It did not give any recommendation on how this should be done. I doubt there is any enthusiasm to re-convene the MGM project, but there is a growing need to review these standards – particularly with regards the use of N fertilisers particularly since the Government's Essential Freshwater Package and the introduction of an N cap on nitrogen fertiliser and better understanding on efficiency of N use on farms. In my view, as these standards are industry owned and effectively set a baseline standard, they would be best reviewed by the relevant industry body, such as the Fertiliser association of NZ should be the body who owns and is responsible for those GMP standards relating to fertilisers. There may be scope for a joint industry secretariat to manage and commission reviews as required. Any volunteers?
2. Where are the Ecan GMPs available?
 - a. See Appendix 1 & 2. Note the GMPs for Mahinga kai were not developed via the MGM project
3. Is there any scheme from government to pay for the new irrigation systems installed by the farmers?
 - a. No – there is no scheme to fund farmers for irrigation, but some irrigation schemes and projects receive government support in various ways, Irrigation New Zealand are best placed to answer this question.
4. Can a certified auditor audit FEPs written by other staff in same organisation?
 - a. This is a very hot question. With the Government requiring ‘Certified’ and ‘audited’ Freshwater Farm Plans (FW-FPs) for all farms over 20ha and horticultural enterprises over 10ha, the question as to who can undertake these functions is currently being considered by MfE and MPI. It is likely a national scheme will be adopted, possibly based on the NZPIM model, but Regional Councils will be given some authority over approval at the regional level, this recognises that the farming systems and risks and priorities for Regional Plans for freshwater quality, vary considerably region to region. A key point that needs to be kept in mind here is that FW-FPs are very focused on environmental risks and ecosystem health,

so any certification programme must recognise that these competencies are going to be essential if FW-FPs are to achieve their outcomes. We can expect to see draft regulations on FW-FP, including certification requirements, later in the year.

5. presumably there is some discussion happening at national level as to what component or other of Ecan scheme are nationally applicable/could be modified to make nationally applicable? How does the current process fit with NZPIM scheme (Ecan scheme seems to provide relevance for certifier/auditor component at minimum ...at least some GMPs should be relevant?
 - a. This is a very hot question. With the Government requiring 'Certified' and 'audited' Freshwater Farm Plans (FW-FPs) for all farms over 20ha and horticultural enterprises over 10ha, the question as to who can undertake these functions is currently been considered by MfE and MPI. It is likely a national scheme will be adopted, possibly based on the NZPIM model, but Regional Councils will be given some authority over approval at the regional level, this recognises that the farming systems and risks and priorities for Regional Plans for freshwater quality, vary considerably region to region. A key point that needs to be kept in mind here is that FW-FPs are very focused on environmental risks and ecosystem health, so any certification programme must recognise that these competencies are going to be essential if FW-FPs are to achieve their outcomes. We can expect to see draft regulations on FW-FP, including certification requirements, later in the year.
6. You made the point that ECan approach focusses more on FEP audit and actually once a farm has an FEP, the document itself is not very important in the process and compared to Waikato RC where there is a lot of focus on the document itself, do you think that the Waikato approach improves on the ECan approach in this regard?
 - a. That is a difficult question. I don't think it is possible to say that one approach is better than another, there are valuable lessons to be learned from each approach and in general the various Regional Council staff involved in their particular programmes are well connected and share experience and have been closely involved with MfE and MPI in the design of the new FW-FP package. A particular regional Farm Plan Programme will reflect the characteristics of farming and the particular environmental issues prevalent within that region. This highlights the importance of building some regional flexibility into the new FW-FP regulations within a consistent national and overarching framework.

Talk 05_William Morrison_Morrison farming, Rangitikei: How we use our Farm Plan

1. How much has funding through regional council/industry helped with the fencing and erosion control planting?
2. Is it possible to get a summary of your FEP key elements? I appreciate it may not be easy to distil it down.

Talk 06_Ranvir Singh_Massey University: Nitrate Attenuation

1. Is this a result from Controlled drainage only or also use of a bioreactor on the drainage water caught?
 - a. We are running controlled drainage and woodchip bioreactor as two separate treatments at this stage, so separate results presented today.
2. How long does the sawdust last in the bio reactor?
 - a. Woodchips could last 10+ years depending on the flow rates/concentrations and local climatic conditions

3. Is there potential to modify this to treat superficial runoff as well?
 - a. Typically surface runoff will have relatively low nitrate concentrations and large pulsed flow events, difficult to manage as it would require large size bioreactor. However, harvesting and reuse could be a good option in this case in undulating areas.
4. What is the impact of these drainage systems on nitrous oxide emissions?
 - a. We have not yet measured effects of drainage management or treatment on nitrous oxide emissions. However, existing studies elsewhere suggests not significant N₂O emissions, dominantly denitrification to N₂.

Talk 07_Andrew Manderson_Landcare Eesearch: Update on Smap and land/soil data

1. Is the Smap sibling finder available for anyone to use now?
 - a. Yes, link is available on the S-map online front page (under maps&tools menu at top) - link is here <https://smap.landcareresearch.co.nz/maps-and-tools/sibling-finder/filter/location>
2. Is the digital LUC survey using S Map? and will it generate a soil map that will talk to Overseer?
 - a. Yes, this is an area currently being researched (also using LIDAR etc as well). The method could also be downscaled as well - if you have farm scale data. Apart from data availability the main challenge is clarifying some of the LUC rules to allow for quantitative modelling - also currently being researched (in consultation with the LUC mapping industry)
3. How reliable will the spectral measurement be for PAW?
 - a. A paper published on this for NZ soils is available (with research ongoing across a number of soil attributes): Blaschek M, Roudier P, Poggio M, Hedley CB 2019. Prediction of soil available water-holding capacity from visible near-infrared reflectance spectra. Nature Scientific Reports 9: 12833. <https://doi.org/10.1038/s41598-019-49226-6>

Talk 08_Adam Duker_DairyNZ: Plantain/forage research

1. Does plantain silage have the same benefits to reducing N leaching as fresh?
 - a. My understanding is there is further research required to assess the N leaching reduction effect from plantain silage - it is not currently available in OverseerFM
2. Is more research ongoing on the GHG mitigation (reduced methane and NO₂) afforded by plantain in the sward?
 - a. There is a research ongoing on GHG reductions. Nitrous oxide reduction is very much correlated to the dilution of urine concentration, and is resulting in a modest reduction (I understand in ballpark of 5-10% N₂O reduction possible). Methane reduction research I understand is providing varied results.
3. What depth do you recommend sowing? We have a 15% at 4kg/ha year 1.
 - a. I don't know sowing depth sorry, though is a fine seed requiring shallow sowing. We have found plantain % is less when ryegrass sown at greater than 20kg/ha (it shadows out the plantain).
4. Overseer includes a statement that only plantain varieties that have a diuretic effect and partition nitrogen away from urine can be modelled. Is there a list of these?

- a. Currently no list that I know of. Your question raises more specific guidance is required, and is timely with the current development of the visual assessment guide. This is a question I need to follow up on, thank you!

Talk 09_Sinead Leahy_NZAGRC: Latest GHG mitigation research

1. Is it possible to get a Codex ok'ed for nitrification inhibitors? Or is the idea completely out of the question these days?
 - a. as I understand it, the Government has gone back to the Codex Alimentarius to try and get compounds like DCD and their appropriate levels registered, in addition I think the lesson has been learnt and any new inhibitors will be registered appropriately. Any compound can be registered as long as they have the right documentation and research data to support. So idea not out of the question.
2. Is there research on animal emissions when fed the normal NZ ryegrass white clover pasture grown with GMP fertiliser (NPK) cf diverse pasture mixes grown with no soluble fertilisers. (No answer)
3. Is this article of interest: <https://blog.csiro.au/feeding-seaweed-to-cows-our-livestock-methane-research-lights-up/>
 - a. Thanks, did not have time to talk through seaweed. But yes have seen this, bit of research to be done to confirm safety, health, production etc., but work in progress internationally and also in NZ.
4. Do you imagine that the govt will fund some of the science solutions to make them much more affordable/accessible to farmers, for example a vaccine?
 - a. Reading the Climate Change Commissions recent report, they do recommend that farmers will need support to implement. But not clear what that actually means. So yet to be seen what will happen in this space. Still a bit of uncertainty around how this will all play out. Plans being put forward by HWEN will also play a role in what that Government/Industry/Maori partnership will do. Watch this space

Talk 10_Phil Journeaux_Agfirst: On-farm GHG mitigations which can be used in FEPs

1. I assume 10% reduction is about 1 tonne CO₂ equiv. So the price of carbon needs to be very high before mitigation needs to be addressed?
 - a. Presume this relates to the zero-carbon act which has a 2030 target of a 10% reduction in methane. This is actually a national target, not necessarily an individual farm target. But assuming it is an individual farm target, then:
 - (i) The average dairy farm emits 9.6 tonnes CO₂e/ha/year, which is (on average) 78% methane/22% nitrous oxide. So a 10% reduction in methane would equate to a 0.75 tonne CO₂e/ha reduction.
 - (ii) The average sheep & beef farm emits 3.6 tonnes CO₂e/ha, so again on the same assumptions as above, a 10% reduction would equate to a 0.3 tonnes CO₂e/ha reduction.

The price of carbon is a moot point – it needs to be high enough to incentivise change, but not so high it cripples the farm operation.

2. Great point about any stocking rate adjustments taking time to implement. Any resources you'd point to that flesh that out some more?
 - a. Nothing directly – the comment was based on my experience in extension and understanding of farmers skills and expertise, and the need to improve this to handle a lower-stocked/higher individual animal performance enterprise

Would be good to discuss sometime.

- a. Happy to.

Also, do you have a link to that report with Scion on the farms meeting zero carbon targets that was on your slide?

- a. <https://www.agfirst.co.nz/wp-content/uploads/2020/09/Achieving-Zero-Carbon-Act-Reduction-Targets-on-Farm-AGF.pdf>

3. This needs to be overlaid with economic models?
 - a. Absolutely. In our modelling we use Farmax which can model changes in farm systems and directly relate this to changes in profitability. We then transfer the data into Overseer to get the GHG and N-leaching figures.

Talk 11_Seth Laurenson_Agresearch: Values-driven landuse change

1. Is this available for farmers and/or consultants to use now?
 - a. No not yet. It will remain in a dev environment for 12 months and be used by a limited set of endusers for validation purposes
2. Who can supply data for incorporation into the model?
 - a. I think what we are promoting here is a community of interest where owners of data can contribute (while this is most likely research groups/cris etc, there is also scope for farmers to upload their own data (for their own viewing- obviously there will be some formatting requirement.
3. Is your venn diagram just illustrative or based on specific work done that includes market size, NZ's competitive edge relative to other growers (i.e. targeting export market) and returns in terms of profit?
 - a. The structure is built and relies on Land use suitability as well as minimum size for viable operation. Does not include market analysis. We are working with NZTE on these types models as well as better understanding what level of information is required by users for this initial step in the decision making.
4. NZTE should be able to help. For NZ Inc to create value by land use change (rather than destroying value), we need to ensure market potential -including size, access etc. and consumer trends are considered as an integral part of options. Would be good to learn more about the work you are doing (and support you by providing input). What is the best way of keeping in touch?
 - a. it was slightly tricky trying to convey the various aspects of the tool in a short timeframe.
5. Does the finance circle incorporate risks, such as hail, employment issues?
 - a. No, as you will know hail is very hard to predict. A user can input insurance costs into the financial model as a line item. However, we do estimate labour requirements. This is another really good example of where those with good information could join together

6. This needs to be overlaid with economic models.
 - a. It is. In fact that was one of the key work efforts with Ngai Tahu. We are also working with NZTE on this front. This might be a specialty of yours, if so, let's have a chat?
7. The financial models need to be able to dynamically model physical changes
 - a. Not sure what you mean Simon, happy to discuss further. We've spent a great deal of time trying to understand what level of detail/precision is required for the decisions being made, so would be interested to hear your views regarding.

Talk 12_Charlotte Glass_Agrimagic: FEP challenges for the future

Talk 13_Panel Discussion_Delivery of FEPs - A New Frontier

Appendix 1

Environment Canterbury: FEP Audits: GMP Objectives and Targets by Management Area

Waterbodies

Objective: *Wetlands, riparian areas and the margins of surface waterbodies are managed to avoid damage to the bed and margins of the water body, and to avoid the direct input of nutrients, sediment, and microbial pathogens.*

T1. Stock is excluded from waterbodies in accordance with regional council rules or any granted resource consent.

T2. Vegetated riparian margins of sufficient width are maintained to minimise nutrient, sediment and microbial pathogen losses to waterbodies.

T3. Farm tracks, gateways, water troughs, self-feeding areas, stock camps wallows and other farming activities that are potential sources of sediment, nutrient and microbial loss are located so as to minimise the risks to surface water quality.

T4. Mahinga kai values are protected as a result of measures taken to protect and enhance water quality and stream health

Water-use (Non-Irrigation)

Objective: *To use water efficiently ensuring that actual use of water is monitored and efficient.*

T1. Actual water use is efficient for the end use.

Point Source Water Pollution Risk

Objective: *The number and location of pits are managed to minimise risks to health and water quality.*

T1. All on-farm silage, offal pit and rubbish dump discharges are managed to avoid direct discharges of contaminants to groundwater or surface water.

Nutrients (Objective 1)

Objective: *Nutrient losses do not exceed permitted or consented nitrogen limits*

T1. Nitrogen losses from farming activities are at or below the farms' nitrogen discharge allowance.

T1a. Additional nitrogen loss mitigation measures (excl. those associated with irrigation, fertiliser or effluent) are implemented.

Nutrients (Objective 2)

Objective: *To use nutrients efficiently and minimise nutrient losses to water.*

T1. Phosphorus and sediment losses from farming activities are minimised.

T2. Manage the amount, timing and application of fertiliser inputs to match the predicted plant requirements and minimise nutrient losses.

T3. Store and load fertiliser to minimise the risk of spillage, leaching and loss into waterbodies.

Mahinga Kai (Waitaki)

Objective: *Mahinga kai values of surface waterbodies on the property are recognised by achieving other objectives and targets in the Farm Environment Plan.*

T1. Mahinga kai values of surface waterbodies on the property are recognised by identifying opportunities to undertake additional plantings of indigenous vegetation, and carrying out and managing any additional plantings in accordance with regional council guidelines for riparian planting

T2. Mahinga kai values of surface waterbodies on the property are recognised by managing pest plants in accordance with regional council rules

Mahinga Kai (Selwyn)

Objective: *To protect mahinga kai and manage waterways and drains recognising their cultural and ecological sensitivity to discharges of contaminants within the Cultural Landscape Values Management Area*

T1. Mahinga kai values are protected by implementing all other Farm Environment Plan Objectives and Targets taking mahinga kai values into account

T2. Mahinga kai species and habitats are protected when drain management and vegetation clearance occurs.

T3. Mahinga kai habitats and species are sustained through the management of remnant native vegetation and wetlands

T4. Properties within Selwyn District Council Drainage Scheme comply with any District Council Discharge of Land Drainage Water resource consent

Irrigation

Objective: *The amount and timing of irrigation is managed to meet plant demands, minimise risk of leaching and runoff and ensure efficient water use.*

T1. New irrigation systems are designed and installed in accordance with industry codes of practice and standards.

T2. The performance of irrigation systems is assessed annually and irrigation systems are maintained and operated to apply irrigation water at optimal efficiency.

T3. The timing and depth of irrigation water applied takes account of crop requirements & is justified through soil moisture monitoring or soil water budgets & climatic information.

T4. Staff are trained in the operation, maintenance and use of irrigation systems.

Cultivation and Soil Structure

Objective: *The physical and biological condition of soils is maintained or improved in order to minimise the movement of sediment, phosphorus and other contaminants to waterways.*

T1. Farming activities are managed so as to not exacerbate erosion.

T2. Farming practices are implemented that optimise infiltration of water into the soil profile and minimise run-off of water, sediment loss and erosion.

Biodiversity (Waitaki)

Objective: *To protect and enhance instream biodiversity values.*

T1. The location of any spring heads, wetlands and spring-fed streams on the property or within the farming enterprise are identified.

T2. Prioritise achievement of the targets for Management Area: Waterbody Management for any spring heads, wetlands and spring-fed streams so as to protect and enhance the instream biodiversity values.

Animal Effluent & Solid Waste

Objective: *Animal effluent and solid animal waste is managed to minimise nutrient leaching and run-off*

T1. Effluent systems meet industry Codes of Practice or an equivalent standard.

T2. The timing and rate of application of effluent and solid animal waste to land is managed so as to minimise the risk of contamination of groundwater or surface water bodies.

T3. Sufficient and suitable storage is available to enable animal effluent and washdown water to be stored when soil conditions are unsuitable for application.

T4. Staff are trained in the operation, maintenance and use of effluent storage and application systems.

Appendix 2



These industry-agreed good management practices relating to water quality were developed from the Canterbury Matrix of Good Management project and were first published in April 2015. While intended for use in Canterbury, they were developed to be applicable across all regions in New Zealand.

Foreword

The Matrix of Good Management (MGM) project aims to estimate the 'footprint' of nitrogen and phosphorus loss for the range of farm systems in Canterbury today, assuming that they are operating at good management practice (GMP). This means we need to be clear about what constitutes good management on farms.

Our approach to this been to ask the industry partners in the project - DairyNZ, Deer Industry New Zealand, NZPork, Beef + Lamb New Zealand, Horticulture NZ and the Foundation for Arable Research – to consult widely within their sectors to define GMP. Over the past 18 months, a great deal of hard work by a large number of farmers and growers has culminated in the definitions of GMP set out here.

It would not have been possible to achieve this milestone of industry-agreed, pan-sector GMP descriptions without the thoughtful contributions, willingness to listen, and sheer determination of many people from both the Canterbury and national farming community.

This sort of hands-on participation by all the project partners, and many of the farmers that they represent, typifies the 'co-production' of this important project.

As chair of the MGM project Governance Group, and on behalf of the Environment Canterbury Commissioners, I would like to thank all those involved in producing this milestone document.



Tom Lambie

Chair, MGM Governance Group

Version 2, 18 September 2015

Previous version: Version 1, 9 April 2015

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BACKGROUND

The Matrix of Good Management (MGM) project is a collaborative initiative between Environment Canterbury, Crown Research Institutes (AgResearch, Plant & Food Research and Landcare Research), primary sector organisations (DairyNZ, Deer Industry New Zealand, NZPork, Beef + Lamb New Zealand, Horticulture NZ and the Foundation for Arable Research) and is overseen by a cross-sectoral governance stakeholder group. The project aims to quantify the typical nutrient losses that are expected to occur from the range of farming systems, soils and climates across Canterbury when managed to good management practice (GMP). This information is important for two key reasons: to provide more reliable nutrient loss estimates that can be used for catchment modelling, and for regulatory purposes to indicate that all farmers are operating at GMP.

Although there is widespread support for the implementation of good management practices across primary industries, until now there have been no commonly agreed definitions of GMP, nor a good understanding of the nutrient losses that occur on farms operating at GMP. For any particular GMP there will be a range of estimated nutrient losses and these losses will vary with differing land uses and different soil types and climate zones.

The GMPs described here have been prepared following workshops with groups of farmers, rural professionals and industry representatives covering the six sectors involved in the MGM project. The resulting lists of GMPs were compared across industries, and a single set of cross-sector GMPs has been developed along with implementation guidance for these GMPs. Most of the guidance is also cross-sector but some is specific to particular industries.

These GMPs will be applicable to all farms in Canterbury by June 2017. They do not overrule any requirements of council consents, regional plans or land management agreements. As knowledge and technology advance over time, updates to these GMPs, and the associated implementation guidance, is likely to be necessary.

Further information

There are many useful, generic and sector-specific publications that expand on the GMP implementation guidance. Use of these documents is recommended. These include:

Generic

- The Fertiliser Association of New Zealand's Code of Practice for Nutrient Management
- Irrigation New Zealand's Irrigation Design and Installation Codes of Practice and Standards
- Irrigation New Zealand's Performance Test Guidelines

Dairy

- Sustainable Dairying: Water Accord
- DairyNZ FDE Guide to managing FDE and Guides to operating effluent irrigation system
- FDE Design Code of Practice

Sheep and Beef

- Beef + Lamb New Zealand website
- Land and Environment Plan (LEP)

Deer

- The New Zealand Deer Farmers Landcare Manual 2012
- 1999 Deer Industry Guidelines for the Winter Enclosure of Deer
- Deer Industry New Zealand endorses the use of Beef + Lamb New Zealand's Land and Environment Plan (LEP)

Horticulture

- Nutrient Management Code of Practice
- Erosion and Sediment Control Guidelines

Arable

- FAR Focus 6 (2012): Nutrient Management Plans

Outdoor Pigs

- EnviroPork (2005) Pork Industry Guide to Managing Environmental Effects

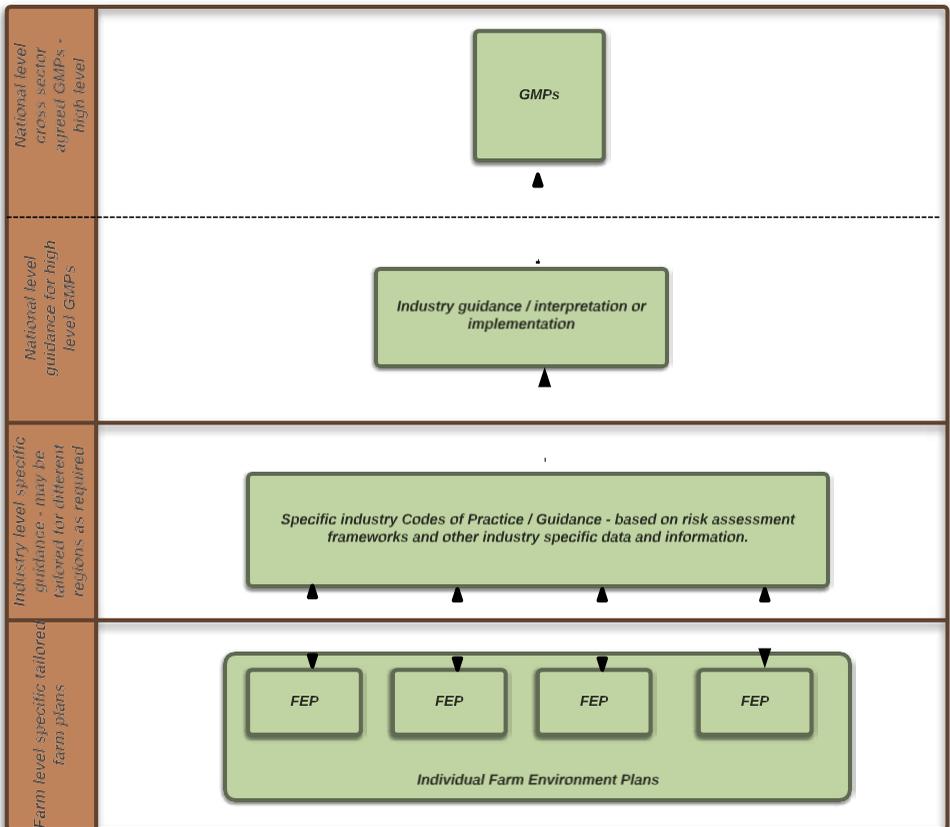
Underpinning concepts

- Understand the nutrient loss pathways on your property;
- Assess risks to water quality;
- Manage appropriately;
- Record actions;
- Review regularly.

Caveats

- This document includes some background information to provide context for the GMPs but it is not intended as a comprehensive report on the steps taken to develop these GMPs. Neither is it intended as a guide for farmers and growers.
- The Implementation Guidance set out here is not a requirement of GMPs, recognising that practices and actions relevant to a particular farm will be determined by risk assessment and intervention with the most appropriate action.
- These GMPs focus on water quality (notably nitrogen, phosphorus, sediment, and faecal contaminants) and may not fully take into account GMPs for other aspects of farm management (e.g. greenhouse gas reduction, health and safety, biosecurity, biodiversity and conservation of natural and cultural heritage).

The context of the Good Management Practices



Glossary of terms

These may be subject to further refinement as the Environment Canterbury Land and Water Regional Plan develops.

Buffer strips Vegetated buffer strips are land strips adjoining waterways of critical source areas that are managed to maintain their vegetated state permanently; they are not cultivated and are grazed only to manage the vegetation. Width may vary according to level of mitigation required and topography.

Critical Source Area Areas of enriched contaminant sources and hydrological activity that occur in small parts of a catchment or farm such as a gully, swale or depression, but that contribute a disproportionately large amount of contaminants to the environment.

Cultivation The preparation of land for growing pasture or a crop and the planting, tending and harvesting of that pasture or crop, but excludes:

- Direct drilling of seed;
- No-tillage practices;
- Re-contouring of land;
- Forestry.

Intensive grazing Intensive grazing is the grazing of stock on fodder crops or pasture, to the extent that the grazing results in significant de-vegetation. This is usually associated with break feeding behind temporary electric fencing.

Waterways, significant waterways, wetlands and significant wetlands

As defined by the relevant Regional Council or Unitary Authority.

SUMMARY LIST OF GOOD MANAGEMENT PRACTICES

WHOLE FARM

Farm planning and records

GMP: Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately.

GMP: Maintain accurate and auditable records of annual farm inputs, outputs and management practices.

LAND

Cultivation and Soil Structure

GMP: Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate.

Ground cover

GMP: Manage periods of exposed soil between crops/pasture to reduce risk of erosion, overland flow and leaching.

GMP: Retire all Land Use Capability Class 8 and either retire, or actively manage, all Class 7e to ensure intensive soil conservation measures and practices are in place.

Sediment, phosphorus and faecal bacteria

GMP: Identify risk of overland flow of sediment and faecal bacteria on the property and implement measures to minimise transport of these to water bodies.

GMP: Locate and manage farm tracks, gateways, water troughs, self-feeding areas, stock camps, wallows and other sources of run-off to minimise risks to water quality.

GMP: To the extent that is compatible with land form, stock class and intensity, exclude stock from waterways.

GMP: Monitor soil phosphorus levels and maintain them at or below the agronomic optimum for the farm system.

PLANTS

Nutrient management

GMP: Manage the amount and timing of fertiliser inputs, taking account of all sources of nutrients, to match plant requirements and minimise risk of losses.

GMP: Store and load fertiliser to minimise risk of spillage, leaching and loss into water bodies.

GMP: Ensure equipment for spreading fertilisers is well maintained and calibrated.

Irrigation and water use

GMP: Manage the amount and timing of irrigation inputs to meet plant demands and minimise risk of leaching and runoff.

GMP: Design, calibrate and operate irrigation systems to minimise the amount of water needed to meet production objectives.

ANIMALS

Feed

GMP: Store, transport and distribute feed to minimise wastage, leachate and soil damage.

Farm effluent and wastewater management

GMP: Ensure the effluent system meets industry specific Code of Practice or equivalent standard.

GMP: Have sufficient, suitable storage available to enable farm effluent and wastewater to be stored when soil conditions are unsuitable for application.

GMP: Ensure equipment for spreading effluent and other organic manures is well maintained and calibrated.

GMP: Apply effluent to pasture and crops at depths, rates and times to match plant requirements and minimise risk to water bodies.

Intensive grazing

GMP: Select appropriate paddocks for intensive grazing, recognising and mitigating possible nutrient and sediment loss from critical source areas.

GMP: Manage grazing to minimise losses from critical source areas.

GOOD MANAGEMENT PRACTICES AND INDUSTRY IMPLEMENTATION GUIDANCE

WHOLE FARM

Farm planning and records

Our intent: Ensure that significant environmental risks to water quality have been assessed, addressed and documented to demonstrate adherence to GMP.

GMP: Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately.

Implementation guidance:

Consider:

- Biophysical characteristics such as soil types, topography, and climate.
- Physical characteristics such as waterways, artificial drainage networks, irrigation.
- Risk factors such as soil loss, nutrient loss and damage to soil structure.
- Management or practices that are required by third parties to be recorded e.g. offal pits, feed storage, effluent storage and application area and irrigation area.
- **Outdoor pigs:** Farm in low rainfall area and on flat land to minimise runoff.

GMP: Maintain accurate and auditable records of annual farm inputs, outputs and management practices.

Implementation guidance:

Maintain accurate and auditable records that:

- set out objectives to be met;
- identify all relevant farming activities and practices, including those that demonstrate that relevant GMPs are being applied;
- demonstrate the assessment of all risks to water quality;
- identify how and when actions to mitigate risks will be undertaken;
- allow the generation of an annual actual OVERSEER® nutrient budget.

Utilise industry templates for recording key information – such as water use, fertiliser inputs, and spray diaries, planting dates, paddock rotation, feed inputs and composition, stock numbers and production outputs or yield.

Review the planned actions annually (e.g. carry out a self-audit).

- Farm Environment Plans (FEPs) may be used to assist with this GMP; FEPs include the industries' specific planning tools such as NZ Pork Farm Environment Plan, SustainableMilk Plans, NZ GAP or Global GAP, Land and Environment Plans, ProductionWise.
- Some regional councils may have approved consistent templates to assist in preparing FEPs.
- Mixed systems may need to combine or adapt existing FEPs.

LAND

Cultivation and soil structure

Our intent: To minimise direct and indirect losses of sediment and nutrients to water without being prescriptive about cultivation or soil management techniques used, as there are many agronomic considerations to take into account on a paddock-by-paddock and season-by-season basis.

GMP: Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate.

Implementation guidance:

Consider:

- Distance from surface waterways, effectiveness of buffers
- Slope of land (degree and length) in relation to waterway
- Soil type and texture, quality (e.g. pugging, or compaction susceptibility)
- Climatic and weather conditions to determine timing of cultivation
- Cultivation methods (pre-, during, and post-cultivation; contour, no- or low-tillage)
- Measures to prevent sediment and nutrients entering waterways (e.g. sediment traps or interception drains, headlands or diversion bunds, grazing techniques)
- Measures to prevent soil loss through erosion, overland flow and wind blow (e.g. space planted trees, windbreaks, cover crops)
- Measures to prevent or remedy soil damage
- Previous use of land, and future use of land
- Using sub-soiling or ripping to remedy compaction of soils

Leave grassed areas around rocks, gullies and riparian margins. If spraying out pasture, first identify areas that won't be worked or re-sown e.g. gullies, runners, riparian margins and rocky areas.

In heavy soils, cultivate soil when conditions are dry enough to reduce compaction and

pugging and improve drainage and soil structure.

Ground cover

Our intent: Reduce risk of erosion, overland flow and leaching associated with exposed soil.

GMP: Manage periods of exposed soil between crops/pasture to reduce risk of erosion, overland flow and leaching.

Implementation guidance:

- Consider soil conditions and crop rotation.
- Areas that are harvested, grazed or stock damaged (resulting in bare soil) are re-sown as soon as practical to minimise periods of exposed soil.
- Rest and re-sow erosion damaged areas.
- Use cover crops (green feed, oats, mustard, other biological activates) to reduce losses and nutrient use; this also increases organic matter.
- When developing paddocks, retain native vegetation such as tussock and shrub habitat in gullies, steep and higher country as this will regulate run off of water, help retain water quality, reduce soil movement and provide filter areas prior to water entering streams (a significant co-benefit is that it also provides cover for newborn stock).
- **Outdoor pigs:** Maintain groundcover in accordance with the following.
 - For dedicated outdoor units or those in a pastoral rotation the minimum ground cover is:
 - For dry sows: at least 40% cover on 75% of the land (less than 40% cover permissible on 25% of the land);
 - Each paddock to have on average more than 10% cover;
 - For lactating sows: at least 70% cover.
 - For outdoor units as part of an arable operation the minimum ground cover is:
 - For dry sows: 25% cover (100-0% over 2 years);
 - For lactating sows: at least 70%;
 - Reduce fallow during and immediately after the pig phase of the rotation e.g. by planting a catch crop.

GMP: Retire all Land Use Capability Class 8 and either retire, or actively manage, all Class 7e to ensure intensive soil conservation measures and practices are in place.

Sediment, phosphorus and faecal bacteria

Our intent: Minimise transport of sediment, phosphorous and faecal bacteria to water bodies.

GMP: Identify risk of overland flow of sediment and faecal bacteria on the property and implement measures to minimise transport of these to waterbodies.

Implementation guidance:

- Identify, record and manage risk to and from critical source areas such as wallows, bank erosion, pugging, trampling or slips on steep hillsides to minimise or eliminate sediment entering waterways.
- Where appropriate use methods to minimise or eliminate sediment entering waterways such as:
 - vegetated buffer strips/riparian planting adjusted in width for slope, hydrology, bank stability, land use and proximity to critical source areas;
 - sediment traps;
 - paddock contouring;
 - earth bunds;
 - raised headlands.
- **Deer** - Fence pacing considerations:
 - Maintain appropriate feeding levels to reduce stress and fence pacing.
 - Identify the best stock class to fit the soil types to minimise the risk of soil erosion, as identified in the Deer Farmers Landcare Manual.
 - Maintain pasture length in winter or wet periods, to prevent soil being washed off in heavy rain. In particularly vulnerable areas retain tussock cover or native vegetation to regulate water runoff and to reduce risk of soil loss particularly in gullies or along riparian margins.
 - If fence pacing is bad, fill in area and re-sow or plant with trees and if damage is extreme, re-fence to remove the problem area. If fence pacing continues, review fence placement as this can be a contributing factor.

GMP: Locate and manage farm tracks, gateways, water troughs, self-feeding areas, stock camps, wallows and other sources of run-off to minimise risks to water quality.

Implementation guidance:

- Locate and design laneways so that run-off is filtered by a vegetated strip. Design and manage laneways to minimise water ponding, excessive effluent build-up and erosion.
- In areas exposed to wind erosion, establish shelter belts with trees that will filter the wind and provide added shade and shelter.
- On tracks, allow for cut-offs and slumps that will take the run off away from streams.
- **Deer** - wallow considerations:
 - Identify natural springs and wallows prior to cultivating paddocks and pipe or drain into retired areas;
 - Provide a suitable area away from waterways for safe wallowing.

GMP: To the extent that is compatible with land form, stock class and intensity, exclude stock from waterways.

Implementation guidance:

- Plan and prioritise waterway areas (including wetlands) to fence, based on the vulnerability of the land, significance of the waterway and potential to impact on water quality off-farm.
- Exclusion of extensively farmed stock from waterways in hill and high country areas may not be practical but rather a mix of mitigations and practices can be used to minimise sediment and faecal bacteria losses from farms.
- Actively manage stock, stock density and stock classes adjacent to waterways to reduce risks to water where fencing is not practical.
- Exclude stock from significant waterways, drains and significant wetlands.
- Locate and manage crossing of waterways so it will not result in degradation of those waterways.
- Provide alternative stock-water sources away from waterways where possible.
- Provide shade and shelter away from waterways where appropriate.
- Place salt blocks and supplementary feed away from riparian margins.
- Leave an appropriate buffer depending on slope, to filter runoff, even if only temporarily during vulnerable periods.
- During high risk periods for erosion e.g. winter grazing, fawn weaning, actively manage stock to prevent slumping, pugging or erosion.

GMP: Monitor soil phosphorus levels and maintain them at or below the agronomic

optimum for the farm system.

Implementation guidance:

- To determine the level of phosphorus fertiliser needed, conduct regular, on-going soil testing (Olsen P or an equivalent, recognised soil test) at the block scale to monitor trends, patterns and the impacts of nutrient management decisions.
- Leave an unfertilised strip as a buffer zone beside creeks, drains and storm water flood zones. Allow more distance as slopes become steeper.

PLANTS

Nutrient management

Our intent: Balancing the application of nutrients to match plant requirements and minimise risk of losses.

GMP: Manage the amount and timing of fertiliser inputs, taking account of all sources of nutrients, to match plant requirements and minimise risk of losses.

Implementation guidance:

- Manage nutrients supplied from all sources including the soil, brought in feed, previous grazing and crops and any organic sources applied.
- Regularly soil test to identify nutrient needs, particularly paddocks that are going into crop.
- Expert guidelines, for example using crop calculators, expert agronomic advice or codes of practice should be used where appropriate.
- Nitrogen and phosphorus fertiliser is applied strategically to meet agronomic requirements, and to avoid adverse environmental impacts (e.g. strategic use around Critical Source Areas). Detailed guidelines are provided in The Fertiliser Association of New Zealand's Code of Practice for Nutrient Management (with emphasis on fertiliser use).
- Nutrient budgets as a tool to manage nutrient loss can be helpful.
- Practices such as use of side dressings and split applications may be helpful to reduce the risk of leaching and ensure greater utilisation of nutrients by plants.
- **Dairy:** All farmers have and use a predictive nutrient budget (OVERSEER®) as the basis for managing nutrients on their farm (milking platform, and any support land).

Predictive nutrient budgets and nutrient management plans are developed by Certified Nutrient Management Advisors, and updated when the farm system changes. The OVERSEER® data input standards are used to create OVERSEER® nutrient budgets.

The Dairy Industry's Audited Nitrogen Management System contains recording and reporting requirements for N fertiliser on dairy farms (including milking platform, and any contiguous support land).

- **Outdoor pigs:** No NPK fertilisers are to be applied to the outdoor pig unit.

GMP: Store and load fertiliser to minimise risk of spillage, leaching and loss into waterbodies.

Implementation guidance:

- Follow fertiliser industry code of practice for fertiliser handling, storage and use.
- Locate storage sites away from waterways.

GMP: Ensure equipment for spreading fertilisers is well maintained and calibrated.

Implementation guidance:

- Any contractors used for fertiliser spreading should be accredited. The current industry standard is Spreadmark.
- Ensure your spreading equipment is calibrated according to its design specifications specific to the product being spread.
- Information on fertiliser applications is kept (or sought from contractors), including product, rate, date, location.

Irrigation and water use

Our intent: To apply irrigation water efficiently to meet plant demands and minimise risk of leaching and runoff.

GMP: Manage the amount and timing of irrigation inputs to meet plant demands and minimise risk of leaching and runoff.

Implementation guidance:

There is a demonstrable reason why irrigation is to be applied, for example:

- to replace soil moisture deficit
- for the purpose of herbicide activation
- to prepare soil for cultivation
- frost protection
- for fertigation

GMP: Design, calibrate and operate irrigation systems to minimise the amount of water needed to meet production objectives.

Implementation guidance:

- Any new development, upgrade or redevelopment is consistent with irrigation industry codes of practice.
- The irrigation system is evaluated annually to demonstrate optimal performance using irrigation industry guidance.
- **Dairy:** Actual irrigation water take is measured with a water meter. Soil moisture levels are tracked throughout the season to justify irrigation events, e.g. using soil moisture balance calculations or soil moisture probes or tapes.
- **Dairy:** Actual annual irrigation use is evaluated for consistency with estimated agronomic needs for the season based on climatic data and pasture/crop requirements.
- **Dairy:** Dairy sheds will use no more water for dairy shed washdown and milk cooling than is necessary to produce hygienic and safe milk (Sustainable Dairying: Water Accord). Actual water use in the dairy shed is measured with a water meter.
- **Horticulture and Arable:** Water is applied to maintain soil between stress point and field capacity - knowledge of evapotranspiration, field capacity and use of soil probes can assist in achieving this.
- **Horticulture and Arable:** Volumes applied are informed by all relevant factors e.g. crop type, plant growth stage, soil type and field capacity.

ANIMALS

Feed

Our intent: Minimise risk of contamination of waterbodies from stored feed.

GMP: Store, transport and distribute feed to minimise wastage, leachate and soil damage.

Implementation guidance:

- Design feed storage facilities to minimise wastage and soil damage, i.e. sealed or compacted surface.
- Minimise leachate generation (e.g. make silage at optimum moisture content) and prevent leachate from entering surface waterbodies, groundwater or stockwater.
- Site silage stacks so that overland flow of water from heavy rain cannot enter the stack.
- Site feed areas away from waterways.
- Distribute feed so as to minimise soil damage (from farm equipment and animals) and potential surface run-off to waterways, i.e. avoid Critical Source Areas.
- **Deer:** Make sure silage is made at the optimum moisture content to reduce possible leaching, recommended at 30% dry matter or more.
- **Outdoor pigs:** Feed diets and feed levels appropriate for the physiologic state of the animal i.e. separate gestating and lactating sow diet.

Farm effluent and wastewater management

Our intent: Minimise risk of contamination of waterbodies from stored and applied effluent.

GMP: Ensure the effluent system meets industry specific Code of Practice or equivalent standard.

Implementation guidance:

- **Dairy:** All new effluent systems are designed to Farm Dairy Effluent (FDE) Design Code of Practice. The main objectives of the system are: to capture all FDE; to spread the FDE at a time that allows uptake by plants; to uniformly spread the FDE to the desired depth, and at the desired intensity; to control FDE application to within the boundaries of the application area; to ensure that FDE systems can be operated safely; and to comply with all regulatory requirements, including consent conditions.

GMP: Have sufficient, suitable storage available to enable farm effluent and wastewater to be stored when soil conditions are unsuitable for application.

Implementation guidance:

- **Dairy:** Suitable storage is calculated using the Dairy Effluent Storage Calculator. This enables FDE to be stored when soil and management conditions are unsuitable for FDE land application. All areas that FDE is collected from are sealed (this includes feed pads). All new effluent systems are designed to FDE Design Code of Practice standard. Storage facilities are sealed and maintained to ensure containment of effluent. Storage is actively managed to ensure storage is available when required.
- **Deer:** Enclosure systems should be located and managed to minimise environmental impact of effluent. In particular:
 - Store effluent for later dispersal to land where appropriate;
 - Effluent and run-off water should not enter natural waterways untreated;
 - Solid waste should be kept away from waterways;
 - Faecal/urine surface material should be cleared annually;
 - Paddock enclosure systems should not result in significant or irreparable soil loss or erosion.

GMP: Ensure equipment for spreading effluent and other organic manures is well maintained and calibrated.

Implementation guidance:

- **Dairy:** Spreading equipment is calibrated according to its design specifications specific to the product being spread. The effluent system can apply effluent efficiently. Information on effluent applications is kept (or sought from contractors), including product, rate, date, location. The effluent system is self-evaluated annually to demonstrate optimal performance, e.g. through an application efficiency test (bucket test); see DairyNZ FDE Guide to managing FDE and Guides to operating effluent irrigation system.

GMP: Apply effluent to pasture and crops at depths, rates and times to match plant requirements and minimise risk to waterbodies.

Implementation guidance:

- **Dairy:** FDE is applied to pasture and crops at depth, rates and times to best prevent loss and to increase utilisation; area complies with consent (use OVERSEER® to calculate). Take account of nutrients supplied by effluent or manure when calculating

fertiliser requirements, e.g. use the DairyNZ FDE calculator app to determine the amount of nutrients applied. See FDE Design Code of Practice.

- **Outdoor pigs:** No effluent to be spread on the outdoor unit.

Intensive grazing

Our intent: Minimise risk of contaminant loss to waterbodies, and maintain soil structure and quality.

GMP: Select appropriate paddocks for intensive grazing, recognising and mitigating possible nutrient and sediment loss from critical source areas.

Implementation guidance:

- Where possible, select paddocks for winter grazing that are not vulnerable to pugging and compaction, do not have significant artificial drainage such as mole and tile drains, waterways, temporary streams or natural drainage channels (running in times of high rain). Choose wintering paddocks away from waterways if possible.

GMP: Manage grazing to minimise losses from critical source areas.

Implementation guidance:

- Sow crops for grazing across slopes if possible rather than up and down hills, to reduce runoff.
- Graze lower lying areas and areas closest to waterways last.
- **Deer:** Where possible, shift deer to dry, sheltered areas before wet weather arrives.
- **Deer:** Monitor animals regularly on self-feed silage pits to make sure all animals retain the required body condition score.

