Farm Environmental Management Plan: Waitangi Station

1. Introduction

The Water Quality Study ('WQS') funded by Mackenzie Water Research Limited ('MWRL'), found that the additional irrigation proposed in the catchment could take place without significant adverse effects on the environment providing that nutrient reduction occurred on the farms.

The process that was advocated for ensuring this on-farm nutrient reduction was through Farm Environmental Management Planning. A clear process for building a Farm Environmental Management Plan (FEMP) was laid out in the Water Quality Study and has been followed here. An overview schematic of the process of building a FEMP is shown in Appendix A.

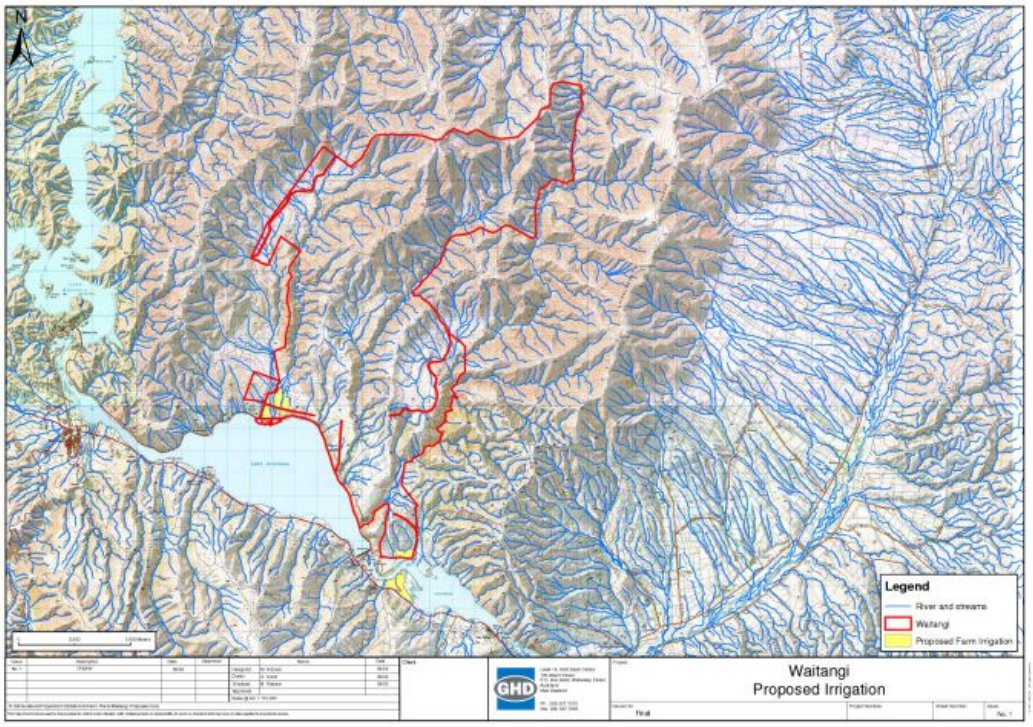
The responsibility for the implementation, monitoring and auditing of the plan lies with the **farmer**.

2. Farm Description

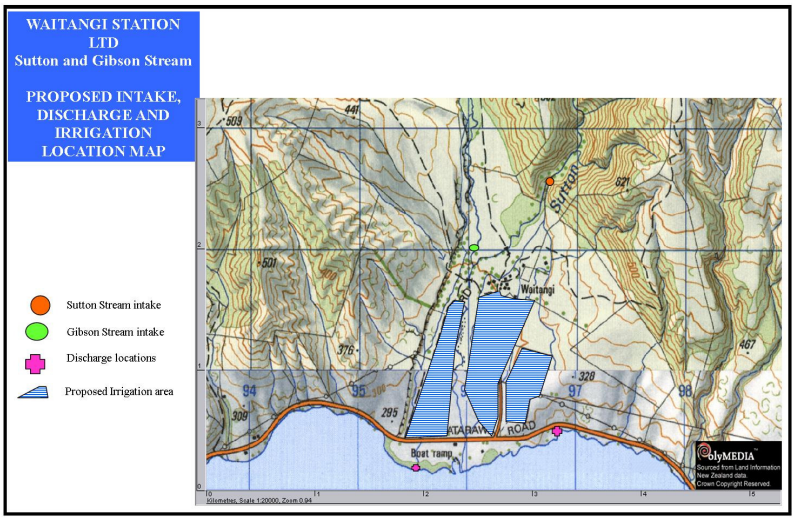
2.1 General farm description

Waitangi Station is a high country station which is predominantly hill country with a small amount of flat land, approximatley 200 ha. The station currently runs 14,000 merino sheep and 300 cattle. All stock are summered and wintered on the hill country. The hill country comprises a large area of 2500-3500ft mid altitude country of which 5000ha has been oversown and topdressed. The lower areas of rolling hill and flat area of cultivation approximately 140 ha and some oversown and topdressed approximately 400ha.

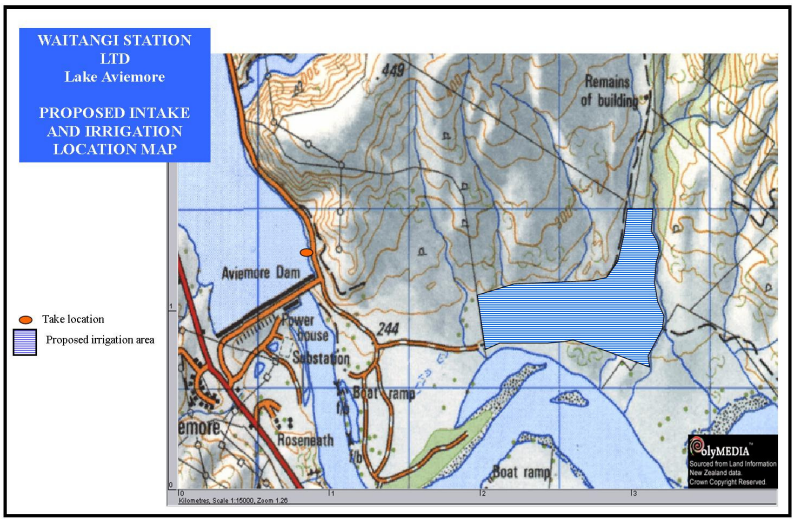
Three catchments form the property giving the property a North-South aspect. Ground cover ranges from grasses (lower alttitude) fescue tussock (mid altitude) snow tussock (high altitude) matagouri and other native scrub is spread throughout.



Map A: Location map



Map B: Proposed Irrigation Location map for Gibson/Sutton area



Map C: Proposed Irrigation Location map for Lake Aviemore area

Table 1. Cover utilisation by season and stock class for current system

	Cover utilisation by season and stock class - CURRENT			
Class of stock	**Spring**	**Summer**	**Autumn**	**Winter**
Ewes	Oversown Hill	Oversown Hill	Oversown Hill	Oversown Hill/Native

Hoggets	Grass flats and oversown hill	Oversown Hill	Oversown Hill	Oversown Hill
Breeding cows	Oversown Hill	Oversown Hill	Oversown Hill	Oversown Hill
Wethers	Oversown Hill/Native	Native	Native	Native

Photo A: Area of land to be irrigated using Sutton Stream Water, shows existing land cover (photo courtesy of Susannah Vesey)

Photo B: Area of land to be irrigated using Sutton Stream Water, shows existing land cover (photo courtesy of Susannah Vesey)

Photo C: Area to be irrigated using Lake Aviemore water. Proposed irrigation area runs along base of hills on left and across to fence line on right. Willows and tussocks along lake create a 'buffer zone'. Photo taken from main highway (photo courtesy of Susannah Vesey)

2.2 Proposed farming system

The proposed irrigation development is at two separate sites; Sutton/Gibson and at Lake Aviemore. 78 hectares is proposed to be developed at the Sutton/Gibson location and 50 hectares at Lake Aviemore.

Irrigation will ensure winter feed supplies as well as cull merino lambs will be fattened in Sept-Oct as opposed to selling store. Cattle will be used strategically on irrigation to be fattened i.e. run on hill till 12-20 months old then finished on irrigation. Strategic saving of autumn grass to feed to twin bearing and 2 tooth ewes before lambing.

Table 2. Cover utilisation by season and stock class for proposed system

	Cover utilisation by season and stock class - PROPOSED			
Class of stock	**Spring**	**Summer**	**Autumn**	**Winter**
Ewes	Some ewes grass flats and oversown hill	Oversown hill	Oversown hill	Oversown hill
Hoggets	Grass flats and oversown hill	Oversown hill	Oversown hill	Oversown hill
Breeding cows	Oversown hill	Oversown hill	Oversown hill	Oversown hill
Wethers	Oversown hill/native	Oversown hill/native	Oversown hill/native	Oversown hill/native

Pasture and crop rotation is unknown at this stage but will be as required e.g. cereal-lucerne, or short term crops e.g. Italian ryegrass-permanent pasture

2.3 Soils

Soils range from stony flood plain around the Homestead area, to good soils over clay on the downs around the Homestead. Good soils with rocky outcrops in mid altitude country very rocky steep gorges. Steep high altitude country stony soils rising to shingle tops.

The soils in the proposed irrigation development areas are as below:

Sutton/Gibson – Eweburn, Tasman and Becks with PAW of between 40-100mm

Lake Aviemore – Grampians, Dalgety and Eweburn with PAW of between 45-90mm

2.4 Topography

Waitangi topography is formed by 3 catchments, Deep Stream, Stony Creek and Sutton Stream. Gorges formed by these streams are very steep right down to Lake Aviemore except for Sutton Stream which opens out onto a flood plain approximately 1.5km from Lake Aviemore. Altitudes range from approximately 260m (Lake Waitaki) to 1880m (Mt Sutton). Approximately ½ the property is mid altitude rolling hill with the back ½ of the property steep hill.

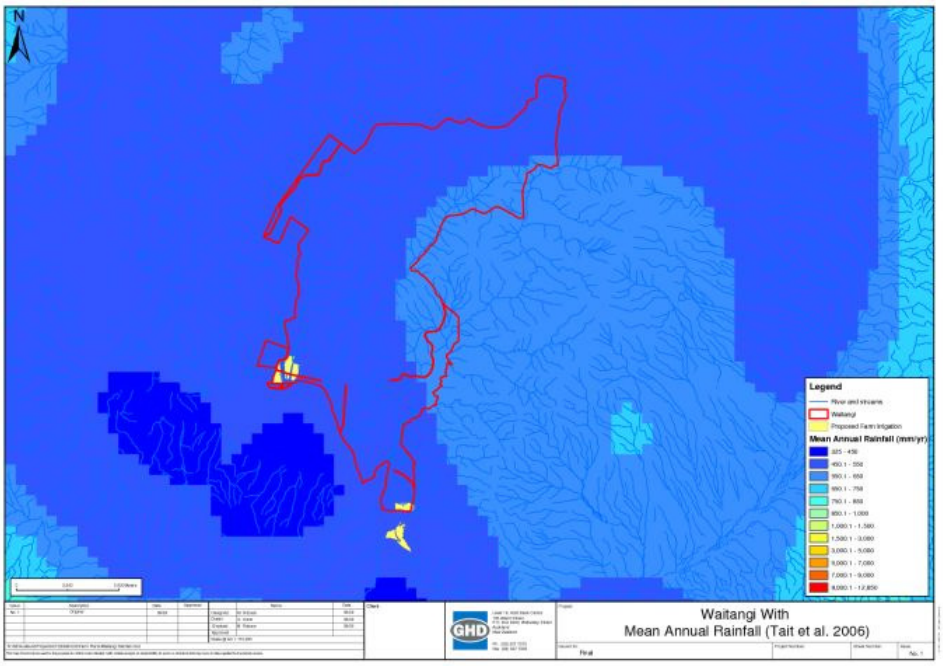
2.5 Climate

Rainfall records have been taken at the Waitangi Homestead for approximately 50 years; these put the variation from the last 50 years of between 225mm at the driest to 650mm at the wettest.

Snow: most winters 3000-3500ft snowline, most winters there is snow cover to the lowest point on the farm but shifts reasonably quickly in approximately 1-7 days. Heavy snow every 3-5 years over whole property.

Temperature to -15oC in winter, frost average -5oC and -10oC

Summer temperatures can rise up to 38oC.



Map D: Mean annual rainfall

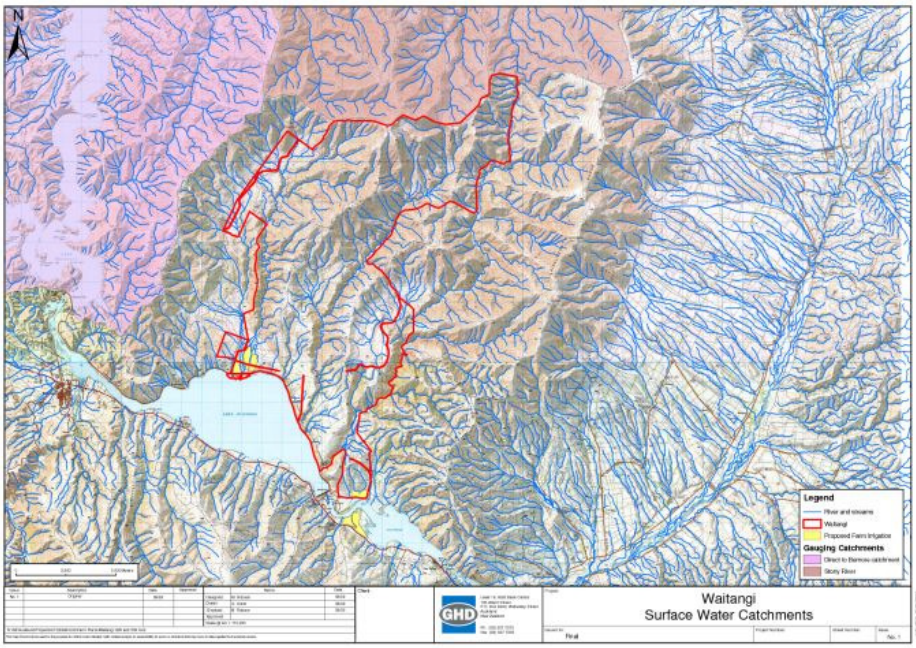
3. Environmental Context

The environmental context of the farm is a reference both to local and wider receiving environments.

3.1 Water Quality Study receiving environments and mitigation requirements

Waitangi Station, according to the WQS, lies in the Lake Aviemore surface water catchments for the Gibson/Sutton area of proposed irrigation and Lake Waitaki for the Lake Aviemore area of irrigation, as can be seen from the below map.

As can be seen below in Table 3, Waitangi has no specific mitigation requirements from the WQS.



Map E: Surface water receiving environment

3.2 Local receiving environments

Lake Aviemore and Lake Waitangi are the local receiving environments for Waitangi Station proposed irrigation. Both are artificial lakes, with 95% open water, with steep shorelines. Both provide habitat for waterfowl.

Table 3. Water Quality Study mitigation requirements for Waitangi Station

	Stream mitigation required for periphyton kg/ha irrigated land	Secondary Stream mitigation required for periphyton kg/ha irrigated land	Stream mitigation required for ANZECC kg/ha irrigated land	Secondary Stream mitigation required for ANZECC kg/ha irrigated land	GWR mitigation required kg/ha irrigated land	Lake Mitigation required kg/ha irrigated land
Waitangi	N/A	N/A	N/A	N/A	N/A	N/A

4. Farm Environmental Management Plan development

4.1 Stage 1 – Mandatory good agricultural practices

The table below shows the mandatory good agricultural practices that will be adopted. These include the base assumptions of OVERSEER and therefore help validate the use of the model on the farm.

Table 4. Mandatory good agricultural practices

Mandatory good agricultural practices	What these practices mean on farm
Fertilisers applied according to code of practice for fertiliser use	The fertiliser users' code of practice aims to ensure that where fertilisers are used that they are used safely, responsibly and effectively and in a way that avoids, remedies or mitigates any adverse environmental effects. The code of practice includes guidance on fertiliser use, application, storage, transport, handling and disposal.
Use a fertiliser recommendation system (nutrient budget) and account for all sources of nutrients including applied effluents and soil reservoirs accounted for	Planning fertiliser applications to all crops, determining crop requirement and accounting for soil nutrients and organic nutrient supplies, all reduce the risks of applying excessive fertiliser above the crop requirement. This maximises the economic return from the use of fertilisers and reduces the risk of causing nutrient pollution of the environment Accounting for all sources of nutrients including imported sources and soil reservoirs is an important management measure in all farming systems and become especially important on farms where manure is produced and applied to the land. The re-application of organic manures to land is often thought of as a disposal of a waste product, and the available nutrients within the organic manures are not accounted for. The use of an integrated nutrient budgeting tool such as OVERSEER automatically accounts for nutrients supplied in organic manures.
Fertiliser application applied evenly	The even application of fertiliser is an assumption of the OVERSEER model as included in the fertiliser code of practice. Fertiliser spreaders should be tested and calibrated in-house at least annually and every 5 years by an independent auditor.
Irrigation and effluent applied evenly	The even application of water and or effluent is an assumption of the OVERSEER model. Irrigators should be tested and calibrated in-house at least annually and then every 5 years in accordance with the code of practice for irrigation evaluation by a qualified irrigation auditor.
Crop, cultivation, nutrient inputs and yield records kept per farm management unit	Maintaining good crop input records is important for: • The calculation of cumulative annual organic fertiliser applications and also their contribution to long term nutrient supply; • The prediction of realistic crop yields that are used to determine crop requirements; • Providing accurate inputs to the OVERSEER nutrient budgeting model that is being used here as a proxy for

	measuring diffuse nutrient losses.
Good design of irrigation systems	Design will match soil properties and low application amounts on shallower soil to prevent summer drainage.
Robust irrigation scheduling	Good irrigation scheduling to prevent summer drainage.
Supplement and feeding out management	To be addressed in the Farm Environmental Risk Assessment.
Winter grazing management	To be addressed in the Farm Environmental Risk Assessment.

4.2 Stage 2 – OVERSEER and meeting WQS mitigation requirements

The WQS thresholds set for Waitangi Station, using the most stringent nutrient mitigation requirement, are 56286 kg N/year and 2390 kg P/year. The table below shows the output from OVERSEER for the modelled proposed farming system at Waitangi Station. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds. If the proposed modelled farming system was to be changed then another OVERSEER report would need to be generated to ensure that the proposed farming system changes are within the WQS threshold. Management or mitigation strategies that have been used to meet this threshold are detailed in Section 5.

A list of OVERSEER model inputs and outputs are given in Appendices B and C.

Table 5. Total N and P losses modelled by OVERSEER for the proposed farming system on Waitangi Station and WQS thresholds

	OVERSEER modelling proposed outputs kg/year	**WQS threshold kg/year**
Total N leaching/runoff	46599	56286
Total P leaching/runoff	675	2390

4.3 Stage 3 – Identification and mitigation of site specific environmental risks

Due to insufficient time before, a full Farm Environmental Risk Assessment (FERA) will be conducted on the farm within 12 months of the consent being granted or before irrigation commences by an independent and suitably qualified professional in conjunction with the farmer. The FERA will assess risks associated with soil, fertiliser, effluent, cropping, stock, water, irrigation, runoff, tracks, pest and weeds, waste disposal and biodiversity.

All environmental risks identified will be addressed and have an appropriate monitoring and auditing strategy. All management strategies chosen to mitigate the site specific environmental risks identified in the FERA will be included in Section 5.

In a workshop held on 17-19th August the following potential issues were highlighted.

a) Buffers required from any permanent streams or rivers/lake – for fertiliser application and irrigation development

b) Bridges/culverts across streams

c) Track runoff – check

d) Location of water troughs

e) Timing of fertiliser applications

f) Soil reinstating post winter feed crop

The FERA will need to address these issues specifically when carried out.

5. Farm Environmental Management Plan for Waitangi Station

5.1 Mitigation measures and management options adopted on Waitangi Station

The table below shows the all the mitigation and management tools that are proposed to be undertaken on Waitangi Station. Measures indicated as **FEMP stage 1 are those identified as Mandatory Good Agricultural Practice**, **measures identified as FEMP stage 2 are those changes that have been modelled in OVERSEER to meet the WQS mitigation requirement (if required)**, and those indicated as **FEMP stage 3 are mitigation measures chosen to ameliorate site specific environmental risks on the farm.** Where the full FERA has not been carried out, the final part of the table will be completed once the assessment has been made.

Table 6 indicates in brief how the measures are to be monitored and audited.

Table 6. Table of mitigation options, monitoring and auditing for Waitangi Station

FEMP stage	Measure	Monitoring	Auditing
1	Fertilisers applied according to code of practice for fertiliser use		Self certification
1	Accounting for all sources of nutrients including applied effluents and soil reservoirs	Soil and effluent testing and cumulative effluent inputs per management unit	Reconciliation of fertiliser, effluent and soil records with nutrient budget for example blocks. Submission of examples soil and effluent tests
1	Even fertiliser application	Calibrate and optimise fertiliser spreaders annually and every 5 years by an external auditor	Submission of testing and calibration
1	Even irrigation and effluent application	Calibrate and optimise irrigators annually in house and every 5 years by an external auditor	Submission of testing and calibration
1	Record crop, cultivation, nutrient inputs and yields per farm management unit	Upkeep of records	Submission of example block records
1	Good design of irrigation systems	Design of irrigation system by a certified professional	Irrigation system audited by a certified auditor every 5 years
1	Robust irrigation scheduling	Calculation of annual % effective water use	Submission of annual % effective water use
2	No winter application of fertiliser on irrigation land. Application of fertiliser on the hill country is often in autumn or late winter and is approximately 60kg/ha	Field records	Signed field records
2	N fertiliser applications split to under 50 kg N/application	Field records	Signed field records
2	No P fertiliser within three weeks of irrigation	Field records	Signed field records
2	Olsen P of below 30 maintained; only applicable to those areas where the natural P level of the soil is below 30	Regular soil testing (every 3 years)	Submission of soil tests
3	Fencing stock out of permanent flowing waterways within the irrigation area	Photos and location map	Annual Audit and updates by photos if additional fencing is undertaken

FEMP stage	Measure	Monitoring	Auditing
3	Buffer zone created between the irrigation area and Lake Waitaki (see Photo C)	Photo and location map	First annual audit and then bi-annual photo
	To be filled in once the FERA is completed		

5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

Baseline monitoring is already underway on Waitangi Station.

Baseline monitoring of the Sutton Stream was undertaken by the Upper Waitaki Water Quality Trust in April, June and October 2007 and January 2008.

Table 7. Baseline monitoring on Waitangi Station

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	Applicable hill and paddocks	1 in 3 years	Standard suite of soil nutrients, pH C, N and organic matter
Water	Surface water quality	Sutton Stream exit from property	April, June October 2007 and January 2008	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids.
Pasture	Ground cover and species	All blocks	Annually	% Ground cover, species
Pest		Whole Farm	Annually	Done as part of an annual survey from ECan Hot spot locations of pest infestation
Weed		Whole farm	Annually	Self monitored for weed infestation

5.2.2 On-going monitoring

On going monitoring and auditing of FEMP are as important as the plan itself.

Table 7 above shows the monitoring suggested for the mitigation and management options chosen for Waitangi Station and Table 8 below shows the frequency and parameters for the monitoring. The triggers and contingency plans will be finalised in consultation with farm consultants once the FERA has been completed and all the mitigation measures identified.

Table 8. Example monitoring plan for Waitangi Station showing location, frequency and parameters for monitoring

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
Soil	To include: Soil nutrient testing	All applicable blocks in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients, pH C, N and organic matter	Olsen P of 30 in those areas where the Olsen P is naturally less than 30	Reduce or stop the application of P fertiliser to the area and monitor
Soil	Soil compaction testing	All irrigation blocks in rotation	Annually for soil compaction testing.	Soil compaction	Compaction, surface capping	Remove compaction with the appropriate tool
Runoff	Wet weather survey	All irrigation blocks	Annually	Runoff	Runoff occurring	Immediately review current runoff mitigation options for tracks. Introduce further runoff removal infrastructure where appropriate.
Water	Surface water quality	Locations yet to be determined	4 times per year (spring/summer/ autumn/winter) for the first couple of years	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, E Coli and suspended solids.	No significant decrease in water quality	If comparative surface water analysis indicates a decrease in surface water quality then the degraded determinant should be identified while a full root cause analysis is undertaken
Water	Irrigation application		Annually in house and 1 in 5 years by an independent	Application uniformity	>80 %	Optimisation of the irrigator performance will be performed at the time of testing
Fertiliser	Fertiliser application		Annually in house and 1 in 5 years by an independent	Application uniformity	>80 %	Optimisation of the spreader performance will be performed at the time of testing
Pasture	Ground cover and species	All blocks	2 x per year	% Ground cover and species	<80 %	Soil nutrient and compaction testing should be performed to identify possible causes of poor groundcover
Pest pressures	pest populations	Relevant blocks	Annually	% or magnitude of infestation	>80%	Undertaken annually via ECan
Weed	Weed populations	Relevant blocks	Annually	% or magnitude of infestation	>80%	Undertaken annually by self monitoring

Where triggers are exceeded, the immediate contingency plans in Table 9 should be implemented while a 'root cause' analysis is carried out. Any further mitigation measures to be adopted as a result of monitoring should be added to Tables 7, 8 and 9

1) Is the current mitigation option implemented correctly?

No – Implement and monitor

Yes – to 2)

2) Has anything changed in the farm system?

Yes – remodel and monitor

No – to 3)

3) Have there been abnormal conditions at the time of trigger breach?

Yes – continue monitoring to see if trigger breach continues

No – Seek advice if suitably qualified person to investigate root cause and suggest appropriate mitigation.

If emergency conditions occur that risk a pollution event, such as a catastrophic failure of the irrigation system that is resulting in overland flow to a watercourse, seek immediate guidance from you regional council:

Environment Canterbury 0800 76 55 88

5.2.3 Auditing

The auditing process allows both the farm operator to illustrate, and other interested parties to have confidence that the management practices and mitigations planned for the farm are being implemented. In addition, the audit shows that there is a mechanism for the adaptive management of the property should the chosen mitigation or management not perform to expectations.

An annual audit is proposed, and requires both external and in-house input. The annual audit should be completed and submitted to ECan by end of July each year.

The audit measures and actions in case of non-compliance will be finalised once the FERA is completed. Those pertaining to FEMP stages 1 and 2 are included here.

Table 9 below shows an example of an annual audit report for Waitangi Station.

Table 9. Table showing proposed contents of an annual audit report for Waitangi Station

Audit measures	Action in the case of non-compliance
Additional auditing that must be done externally	
Annual audit of OVERSEER nutrient budget and report based on previous 3 years. Submission of compliance with thresholds	Should the OVERSEER report show losses exceeding the threshold, further mitigations should be adopted to effect a reduction in nutrient loss to below thresholds.
Check riparian planting and fencing is present where it should be and that it is intact, plus photographs	Any failure in the integrity of the fencing should be repaired immediately or a barrier placed around gap to prevent stock access until repair is made
Check fertiliser storage and filling area.	There should be no possibility of loss of fertiliser to drains or direct discharge to ground. Any drains should be covered, or the filling area moved to where no discharges will occur.
Fertiliser spreader and irrigation testing and calibration 1 in 5 years by independent auditor	Spreaders and irrigators not performing should be recalibrated
Additional auditing that can be done either externally or internally	
Reconciliation of fertiliser and soil records with nutrient budget and fertiliser recommendations	Where reconciliation is not possible and an over application has occurred, this should be rectified in the following year

Audit measures	Action in the case of non-compliance
Submission and brief interpretation of soil, water quality, supplement and machinery calibration tests	Where triggers have been exceeded, immediate contingency plans should have been carried out and a root cause analysis conducted. The results of which should be presented here.
Submission of example irrigation schedules and calculated water use efficiency	Where calculated water use efficiency is such that the trigger is exceeded, remedial action of how the system is to be optimised should be submitted, and followed up in the next audit
Annual soil compaction survey, submission broad findings and remedials	Where poor soil structure is found and cause assessed, the remedials should be implemented and followed up in the next audit
Annual wet weather survey, submission broad findings and remedials	Where runoff is found and cause assessed, the remedials should be implemented and followed up in the next audit
Annual fertiliser spreader and irrigation testing and calibration	Spreaders and irrigators not performing should be recalibrated
Auditing that must be done internally	
Self certification for application of fertiliser according to code of practice	Any failures in observing the code of practice for applying fertiliser should be rectified and followed up in the next audit
Submission of proof of 'approved handler' status	Inappropriate handling of chemicals should cease until an approved handler is in place

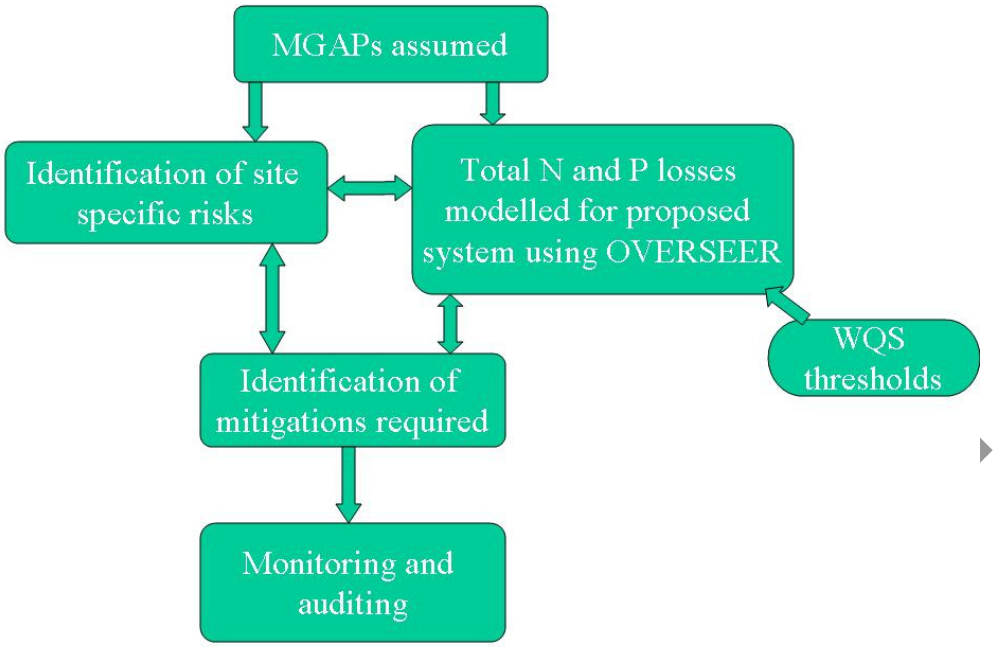
6. Summary

This FEMP has been written to serve two purposes, to ensure the proposed farm system can meet the nutrient mitigation requirements set out by the Water Quality Study, and to lay out the process for identification of farm specific environmental risks that arise from the inherent characteristics of the farm or from the proposed farm system and its management and mitigate other. A commitment to complete the full on-farm risk assessment within a pre-determined timeframe has been undertaken as well as the commitment to address the risks identified. These farm specific risks include uncontrolled discharges that are not identified in farm nutrient budget modelling but that may still have an environmental effect.

The mitigation and management measures detailed in Table 6 will lay out the techniques that have been adopted to fulfil these two objectives once the FERA has been completed. The WQS thresholds and modelling outputs from OVERSEER detailed in Section 4 illustrate that the proposed farming system meets the WQS thresholds, and the risk assessment process laid out in Section 4.3 illustrates how site specific environmental issues, including uncontrolled discharges, will be identified and mitigated.

The monitoring and auditing of this plan, addressed in Section 5 allow the performance of the measures chosen to be monitored and where they are performing sub-optimally, these can be addressed through the root cause analysis process.

Appendix A: Overview schematic of the process to build a Farm Environmental Management Plan



MGAP – Mandatory good agricultural practice