Farm Environmental Management Plan: Twin Peaks 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**.

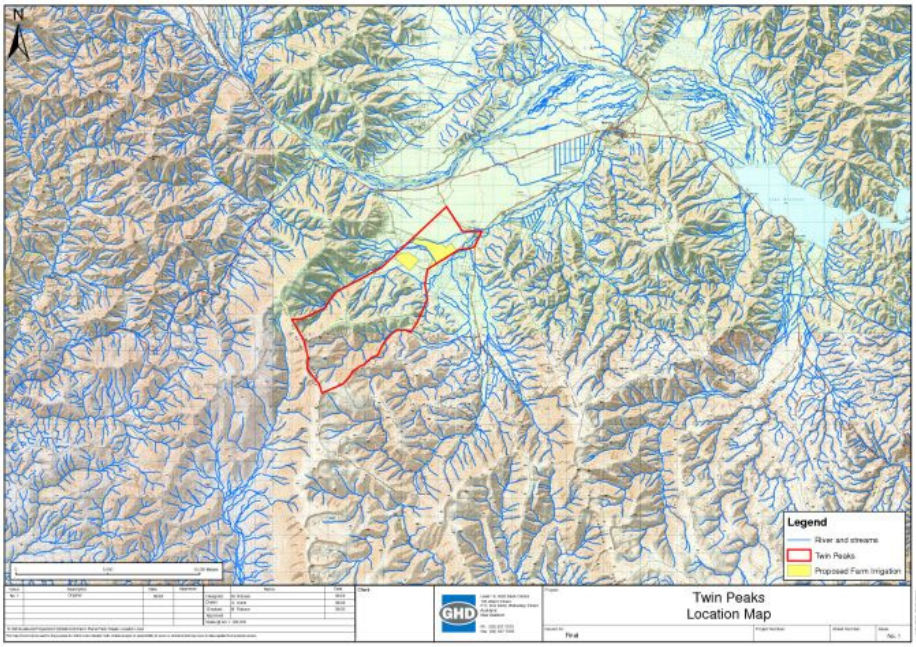
2. Farm Description

2.1 General farm description

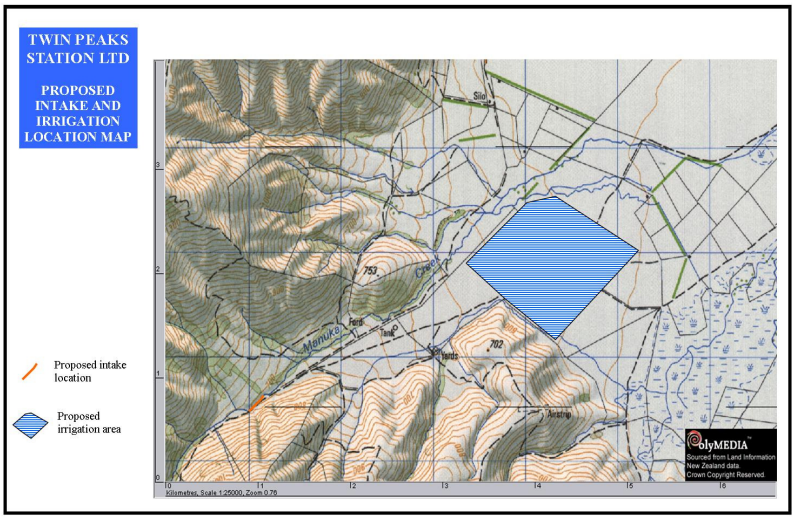
Twin Peaks Station is a 3500 ha leasehold high country station comprised of 600ha of flats and the balance 2900ha of hill; country located between Broken Hutt Road and the Lindis Pass.

The applicant currently holds consent CRC960044.2 which allows them to take and use up to 27L/s from the Clifton Downs Swamp Drain. The water taken pursuant to this consent is used to irrigate approximately 130 hectares of land via spray irrigation.

The station currently runs 6000 stock units with approximately 90% of these being merino sheep and 10% cattle. The ewes are put out onto the hill country in September and come back down onto the flats in August. The lambs are brought down on to the flats at weaning and stay down. At particular times of the year (i.e. for weaning and shearing) the stock in the hill country are brought down to the flats.



Map A: Existing irrigation and proposed irrigation development locations. The existing irrigation is the larger area of yellow on the right.



Map B: Proposed irrigation development location

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	Native	Oversown hill/ryecorn
Hoggets	Grass flats/irrigation	Grass flats	Grass flats/irrigation	Ryecorn
Breeding cows	Grass flats/oversown hill	Oversown hill	Native	Native
R1 and R2 cattle	Grass flats	Grass flats/irrigation	Grass flats/irrigation/oversown hill	Oversown hill

Photo A: Existing landuse and groundcover at the proposed irrigation development location

2.2 Proposed farming system

Twin Peaks is proposing to irrigate a further 72 hectares of land.

Farm practices are not predicted to change. Twin Peaks will carry more hoggets through the winter. The new irrigation development is proposing to support the existing farm practices

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	Oversown hill	Oversown hill	Native	Oversown hill/ryecorn
Hoggets	Grass flats/irrigation	Grass flats	Grass flats/irrigation	Ryecorn
Breeding cows	Grass flats/oversown hill	Oversown hill	Native	Native
R1 and R2 cattle	Grass flats	Grass flats/irrigation	Grass flats/irrigation/oversown hill	Oversown hill

2.3 Soils

Soils on Twin Peaks are; steep lands 50% yellow brown earths also yellow grey earths. Hill soils 18% above 900m upland yellow brown earths, below 900m yellow grey earths. The rolling and fan country 18% yellow grey earths stony and shallow. Flood plain and terrace soils are a mixture of wetland soils.

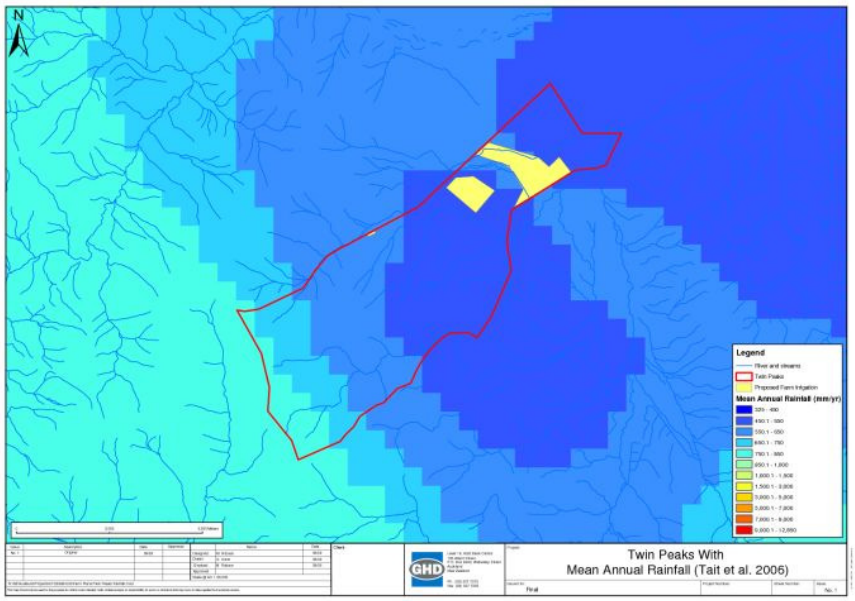
The land proposed for irrigation is a combination of Edwards moderately deep soils and Sawdon and Glenrock stony soils with an average PAW of 90mm.

2.4 Topography

Twin Peaks starts at an elevation of 500m rising up to 1800m. Twin Peaks consists of 600ha of flats, 1200ha of rolling to medium hill and 1700ha of steep hill. Most of the hill country is north facing.

2.5 Climate

Twin Peaks has quite a harsh climate with hot dry summers and cold winters. In the summer temperatures can rise into the mid 30's. In the winter it can drop as low as -18oC. Rainfall on the flats is 500mm a year increasing as you increase in elevation. Snow falls at least once a year which lies around the house.



Map C: Mean Annual rainfall

3. Environmental Context

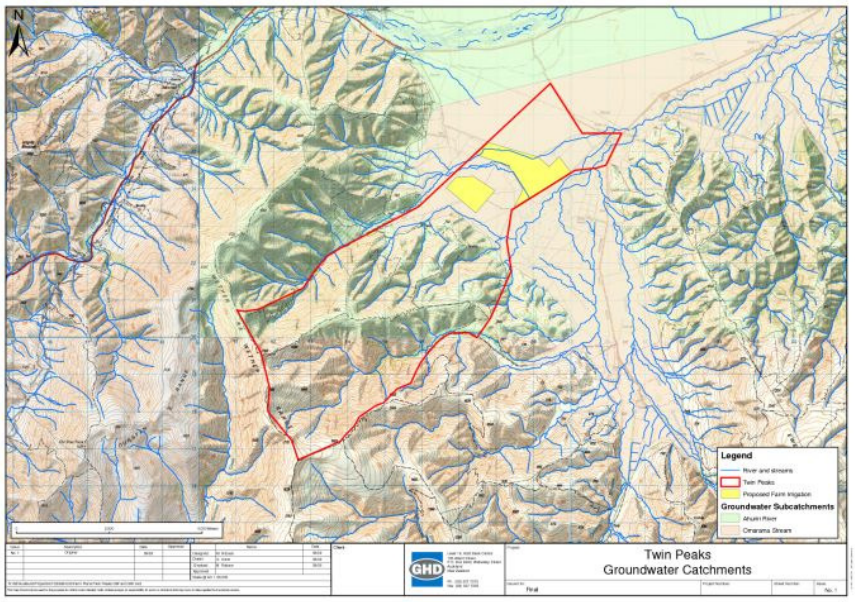
The environmental context of the farm is a reference both to local and wider receiving environments.

3.1 Water Quality Study receiving environments and mitigation requirements

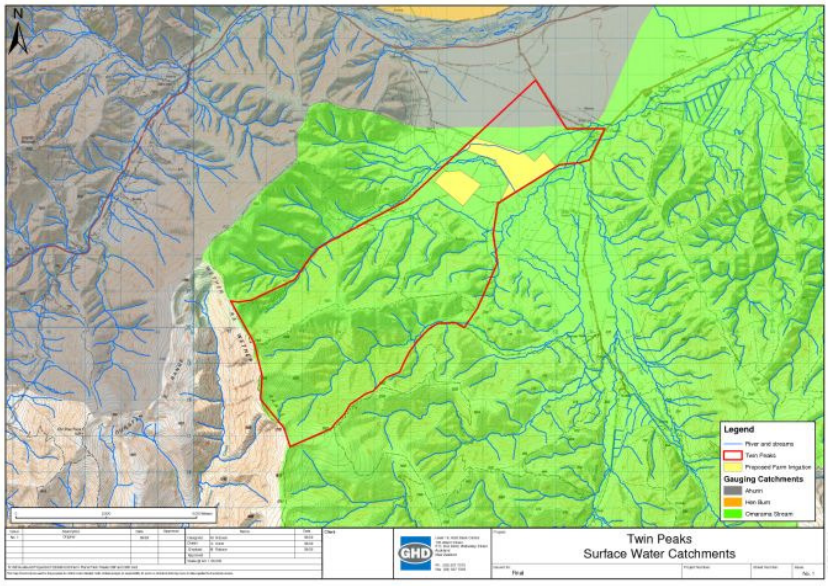
Twin Peaks Station, according to the WQS, lies in the Omarama groundwater and predominantly Omarama Stream surface water catchments with a small area of Ahuriri River catchment.

Table 3 shows the calculated nutrient mitigation requirement of the receiving environments determined in the WQS and the resulting thresholds for N and P for Twin Peaks Station.

For this farm, the Lake Benmore mitigation requirements are the most stringent. These mitigation requirements cap Twin Peaks Station's nutrient discharges at 10937 kg N per annum and 200 kg P per annum.



Map D: Groundwater receiving environment



Map E: Surface water receiving environment

3.2 Local receiving environments

The local receiving environment for Twin Peaks is Manuka Creek. Manuka Creek has been described as being in excellent condition with very good water quality. Manuka Creek is generally ephemeral out on the gentle flat farmland.

Photo B: Showing the ephemeral nature of the lower reaches of the Manuka Creek

Table 3. Water Quality Study mitigation requirements for Twin Peaks 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	
	N	P	N	P	N	P	N	P	N	P	N	P
Twin Peaks			-0.90		-0.10						-10.70	-1.1

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 Twin Peaks Station, using the most stringent nutrient mitigation requirement, are 10937 kg N/year and 200 kg P/year. The table below shows the output from OVERSEER for the modelled proposed farming system at Twin Peaks Station. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds. 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 Twin Peaks and WQS thresholds

	OVERSEER modelling outputs kg/year	**WQS threshold kg/year**
Total N leaching/runoff	9479	10937
Total P leaching/runoff	194	200

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) Soil erosion potentially an issue

b) Timing of fertiliser application

c) Track runoff

d) Location of water troughs

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

5. Farm Environmental Management Plan for Twin Peaks Station

5.1 Mitigation measures and management options adopted on Twin Peaks

The table below shows the all the mitigation and management tools that are proposed to be undertaken on Twin Peaks 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 Twin Peaks 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	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	Regular soil testing (every 3 years)	Submission of soil tests
3	Stock access to Manuka Creek will be prevented within the irrigation area, where the stream flows regularly.	Photo and location plan	Annual auditing report

FEMP stage	Measure	Monitoring	Auditing
3	An irrigation buffer from the Manuka Creek will be established	Photos and Location Map	First annual audit report
	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 Twin Peaks Station.

Table 7. Baseline monitoring on Twin Peaks Station

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	All blocks in rotation	1 in 3 years	Standard suite of soil nutrients, pH C, N and organic matter
Pasture	Ground cover and species	All blocks		% Ground cover, species
Pest and Weed		Whole Farm	Annually	Done as part of an annual survey from Ecan

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 Twin Peaks 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.

Additional monitoring will be carried out on a sub-catchment basis on the Omarama Stream and also in the Ahuriri Arm of Lake Benmore. Baseline monitoring has been undertaken by the Upper Waitaki Water Quality Trust (UWWQT) on the Omarama Stream at Twin Burn and SH8. The Ahuriri River has also been monitored in a number of locations by the UWWQT.

Table 8. Example monitoring plan for Twin Peaks 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 irrigation blocks in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients, pH C, N and organic matter	Olsen P >30	Reduce or stop the application of P fertiliser to the area and monitor
Soil	Soil compaction testing	All irrigation blocks in	Annually for soil compaction	Soil compaction	Compaction, surface capping	Remove compaction with the appropriate tool

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
		rotation	testing.			
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	Irrigation application	Irrigation area	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
Fertiliser	Fertiliser application	Whole Farm	Annually in house and 1 in 5 years by an independent	Application uniformity		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
Weed and pest pressures	Weed and pest populations	Relevant blocks	Annually	% or magnitude of infestation		This is currently undertaken via a survey from Ecan
Complete table with other monitoring planned to include the monitoring of FEMP stage 2 measures						

See Map B for the proposed irrigation area map, where a number of these monitoring locations refer to. Map A shows the whole farm area.

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, 9 and 10.

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 Twin Peaks Station.

Table 9. Table showing proposed contents of an annual audit report for Twin Peaks 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
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

Audit measures	Action in the case of non-compliance
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

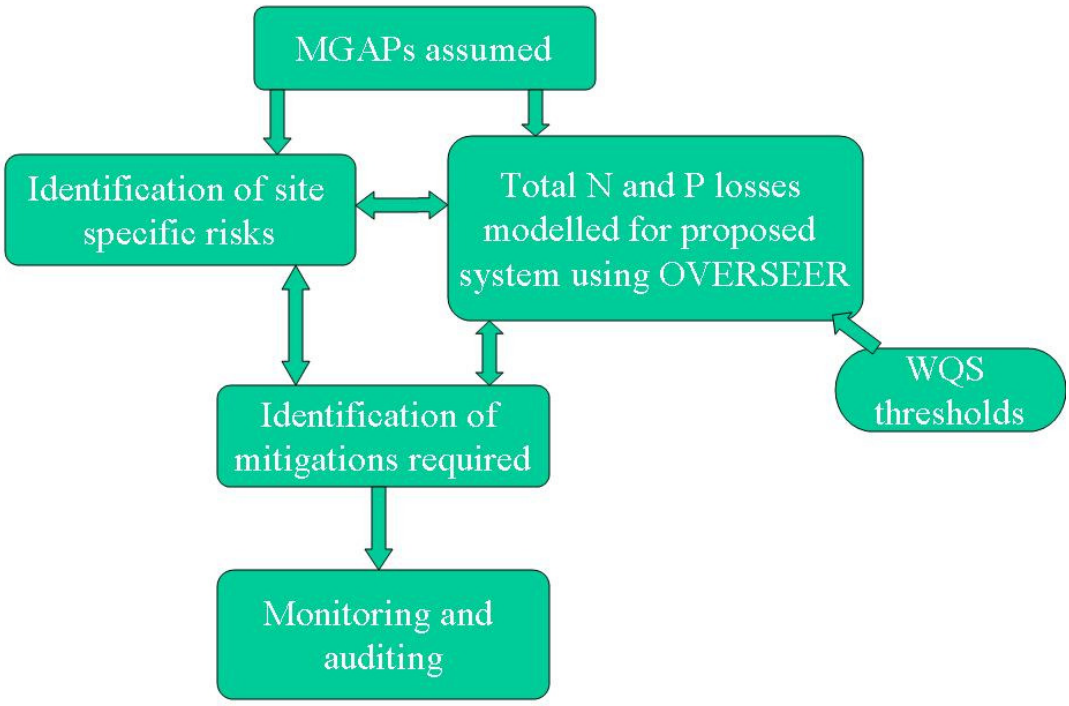
6. Summary

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 7 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 practices