

**Farm Environmental Management
Plan: Bog Roy Station**

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

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2. Farm Description

2.1 General farm description

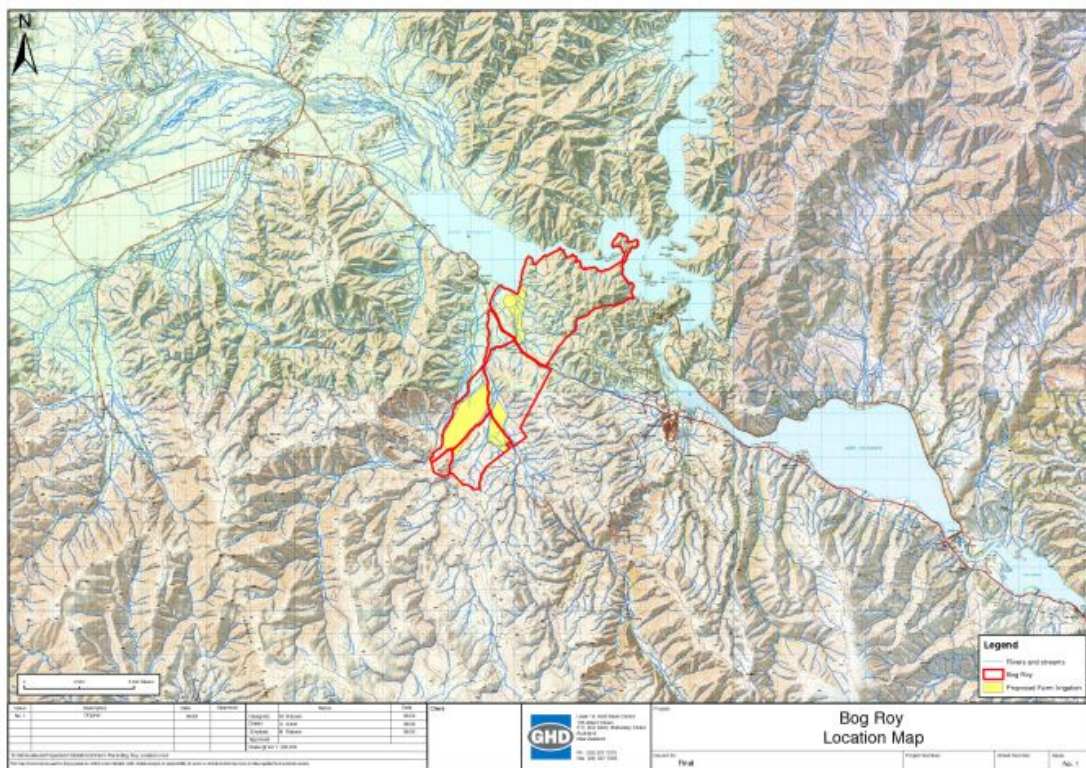
The property currently runs beef cattle and sheep.

The property is 3,000 hectares in total and consists of flatter country (closest to Lake Benmore) and gently rolling country.

30 hectares is currently irrigated with water taken from Corbies Creek, using k-line irrigation. This will be developed to enable up to 60ha to be spray irrigated.

The irrigated land is vital to the economics of the operation allowing the applicant to grow winter feed and finish all the properties young stock.

Irrigation on Bog Roy has occurred since the 1960's, and prior to this, the system was used to supply stockwater. The applicant's grandfather constructed the system and it is thought to have been put in place in the early 1950's. Therefore, it has been in existence for some time.



Location Plan



Aerial Photograph of Bog Roy Station

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
Hoggets	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland
Breeding cows	Native	Native	Native	Native
R1 Steers & Heifers	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland

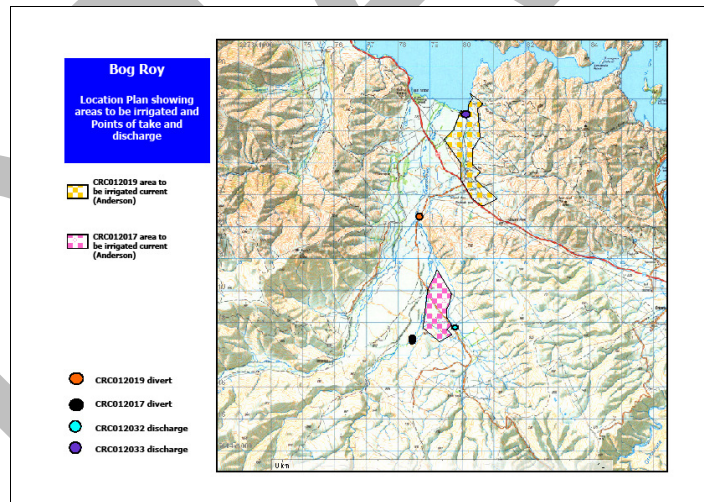
2.2 Proposed farming system

The mode of irrigation application will change over the next 5 years (from date of renewal) from a current flood (100ha) and k-line (28ha) system, to entirely spray. However, the actual farming system (stock classes and numbers) will to a large degree remain the same.

Complete table describing proposed system.

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	Oversown hill	Oversown hill
Hoggets	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland
Breeding cows	Native	Native	Native	Native
R1 Steers & Heifers	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland	Irrigation/Improved Dryland



Irrigation Area

2.3 Soils

- Eweburn 45mm

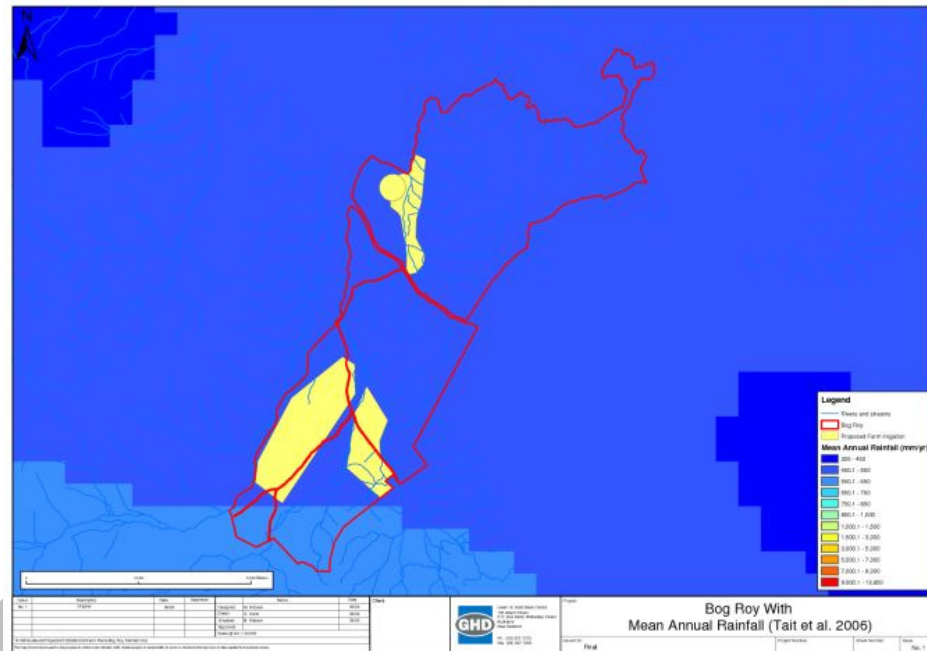
- Grampians 90mm
- Streamlands 90mm and 100mm

2.4 Topography

Bog Roy comprises of approximately one third flats, one third improved rolling hill and one third native steeper hill.

2.5 Rainfall

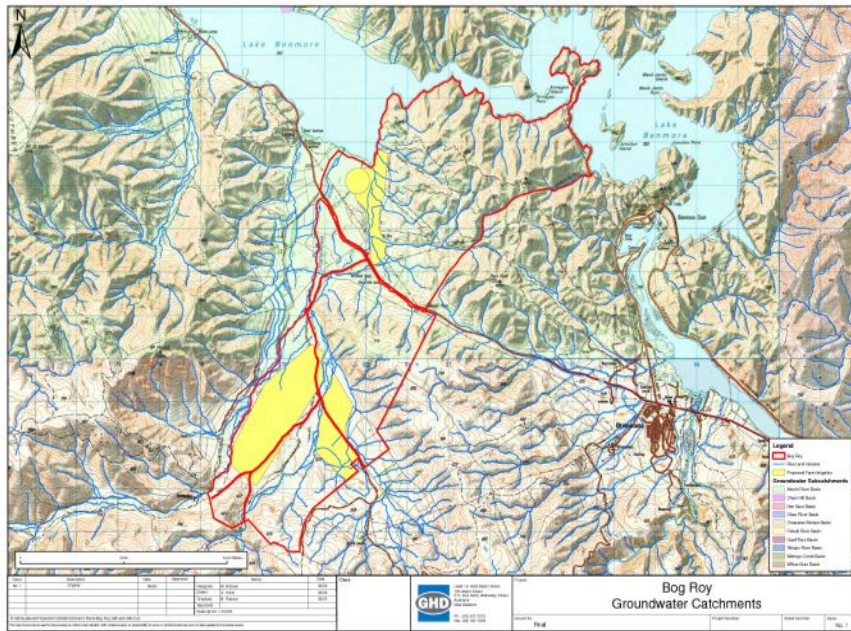
The average annual rainfall measured at the Bog Roy Homestead is 400mm. The WQS indicates that the average annual rainfall for the irrigation area is in the order of 500mm to 600mm.



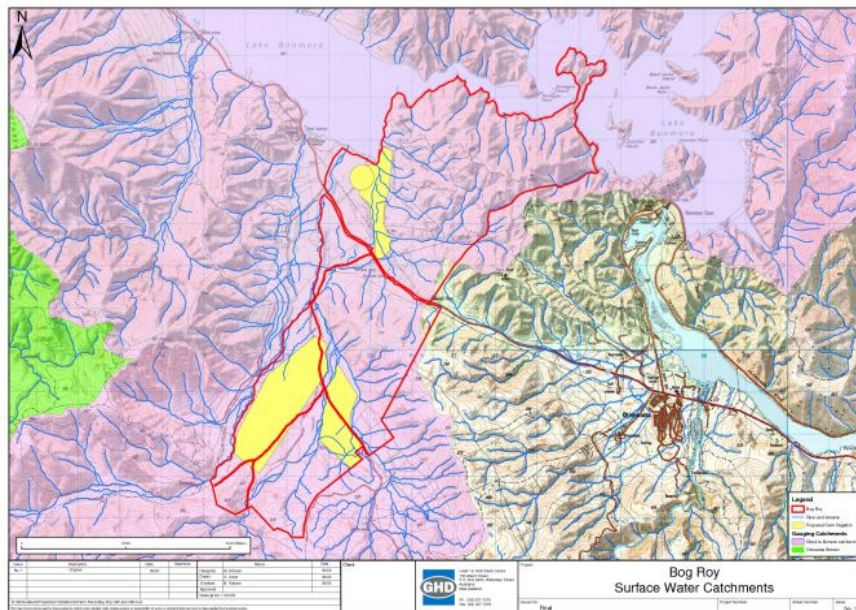
Rainfall Map

3. Environmental Context

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



Groundwater Receiving Environment



Surface Water Receiving Environment

3.1 Water Quality Study receiving environments and mitigation requirements

Bog Roy Station, according to the WQS, has no groundwater catchment, but lies in the “Ahuriri Arm” surface water catchment.

The following table shows the calculated nutrient mitigation requirement of the receiving environments determined in the WQS and the resulting thresholds for N and P for Bog Roy Station.

Ahuriri Arm Mitigation required kg/ha irrigated land
N -10.70
P -1.10

For this farm, the Ahuriri Arm mitigation requirements are the most stringent. These mitigation requirements cap Bog Roy Station’s nutrient discharges at 8,834 kg N per annum and 227 kg P per annum.

3.2 Local receiving environments

The Otamatapaio River and Lake Benmore are the two local receiving environments.

The Otamatapaio River drains the Hawkdun and St Cuthbert Range, directly into the southern side of the Ahuriri Arm of Lake Benmore at Sailors Cutting. The Otamatapaio River has a catchment area above SH83 of 185km². Corbies Creek also contributes to the Otamatapaio catchment.

The catchment altitude ranges from 360m up to 1850m, and the upper catchment has snow on the shady faces for much of the winter months and therefore low flows in the catchment are usually experienced in winter.

There are significant flow losses down the system below the Foot Bridge; however the losses are the greatest approximately 200 metres downstream of the Corbies Creek confluence where often in the summer months the river bed is completely dry.

The Otamatapaio supports fisheries common to high country rivers. These include common and upland bullies, common river galaxies, rainbow and more predominantly brown trout.

Lake Benmore is a hydro lake, and part of Bog Roy Station was inundated with the creation of the lake in the 1950's. Therefore, part of the station now borders the lake.

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 5. 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	<p>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</p> <p>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.</p>
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	<p>Maintaining good crop input records is important for:</p> <ul style="list-style-type: none"> • 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

	<p>determine crop requirements;</p> <ul style="list-style-type: none"> • 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 Bog Roy Station, using the most stringent nutrient mitigation requirement, are 8,834kg N/year and 237 kg P/year. Table 5 below shows the output from OVERSEER for the modelled proposed farming system at Bog Roy 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 attached.

Table 4: Total N and P losses modelled by OVERSEER for the proposed farming system on Bog Roy Station and WQS thresholds

	Nitrogen Threshold (kg/farm)	Phosphorous Threshold (kg/farm)
MWRL Water Quality Study Property Thresholds	8,834	237
OVERSEER® outputs	8,511	96

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

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) Evidence of erosion
- b) Runoff from winter feed crops
- c) Laybacks from waterways from fertiliser application
- d) Timing of P fertiliser on border dykes
- e) Track runoff - check
- f) The Otamatapaio River
- g) Tailgate water from border-dykes until conversion to spray is completed
- h) Fencing off water races

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

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5. Farm Environmental Management Plan for Bog Roy Station

5.1 Mitigation measures and management options adopted on Bog Roy Station

The table below shows the all the mitigation and management tools that are proposed to be undertaken on Bog Roy 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 7 indicates in brief how the measures are to be monitored and audited.

Table 7. Table of mitigation options, monitoring and auditing for Bog Roy 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	e.g. 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

FEMP stage	Measure	Monitoring	Auditing
3	e.g. Fencing stock out of waterways through riparian fencing and planting where appropriate	Surface water testing of race/waterway as it enters and exits the property	Annual auditing visit.
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 Bog Roy Station.

Table 8. Baseline monitoring on Station Bog Roy Station

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	All blocks in rotation	1 in 2 years	Standard suite of soil nutrients, pH C, N and organic matter
Pasture	Ground cover and species	All blocks	As needed	% Ground cover, species

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 Bog Roy Station and Table 9 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 9. Example monitoring plan for Bog Roy 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 blocks in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients, pH C, N and organic matter		

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
Soil	Soil compaction testing	All blocks in rotation	Annually for soil compaction testing.	Soil compaction		
Runoff	Wet weather survey	All blocks	Annually	Runoff		
Water	Surface water quality	Entry and exit of stream X on property boundaries.	XX times per year for first couple of years to establish patterns.	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, E Coli and suspended solids.		
Water	Groundwater quality	Groundwater bore location XX	Annually for groundwater	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, and dissolved reactive phosphorus,		
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
Weed and pest pressures	Weed and pest populations	Relevant blocks	Annually	% or magnitude of infestation		

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 10 below shows an example of an annual audit report for Bog Roy Station.

Table 10. Table showing proposed contents of an annual audit report for Bog Roy 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	Spreaders and irrigators not performing should be

Audit measures	Action in the case of non-compliance
years by independent auditor	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
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.

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