CRC011361-A

Farm Environmental Management Plan: Dunstan Peaks, Clifton Downs and Twinburn Stations

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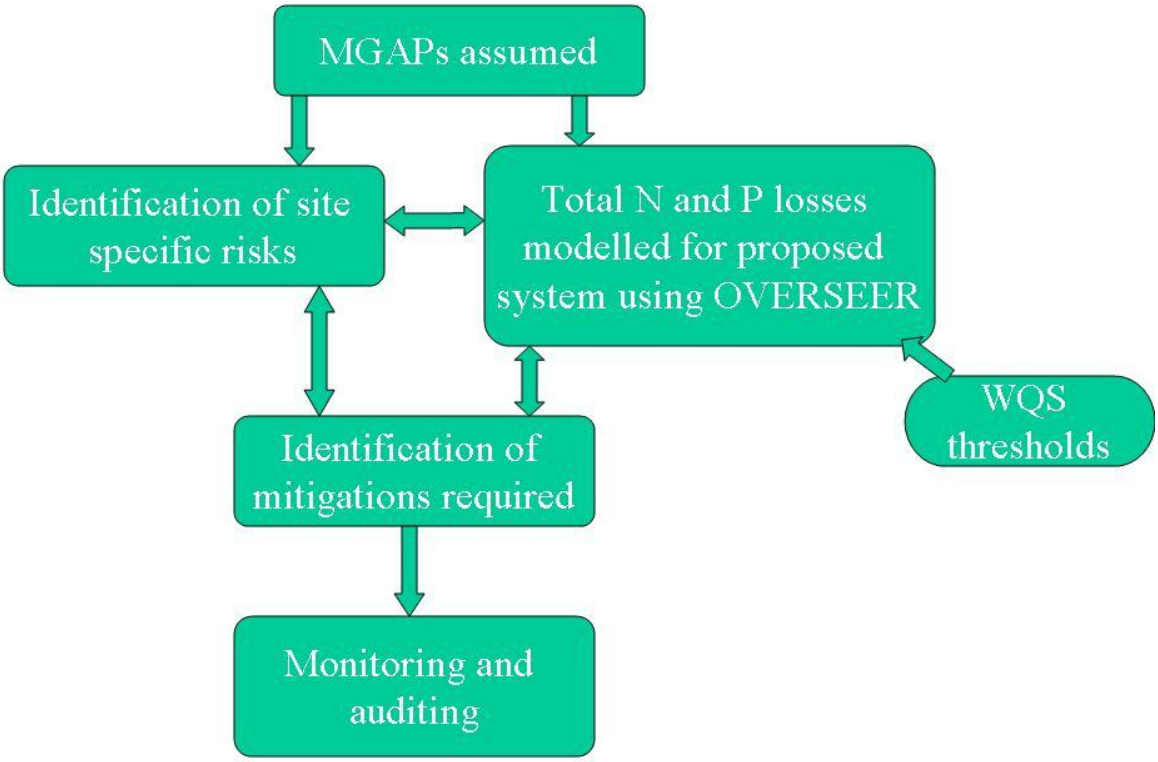
1. Introduction

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 Figure 1.

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

Figure 1: Overview schematic of the process to build a Farm Environmental Management Plan



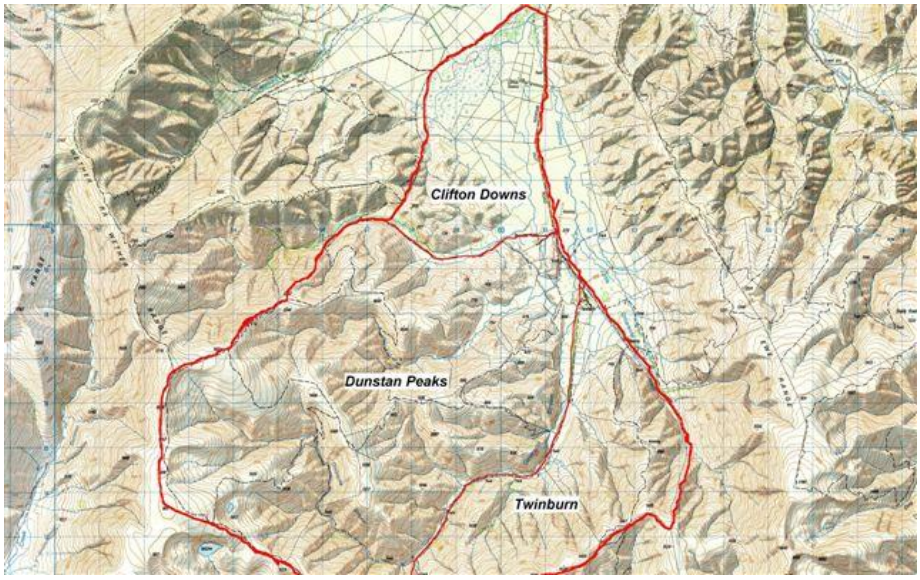
2. Farm Description

2.1 General farm description

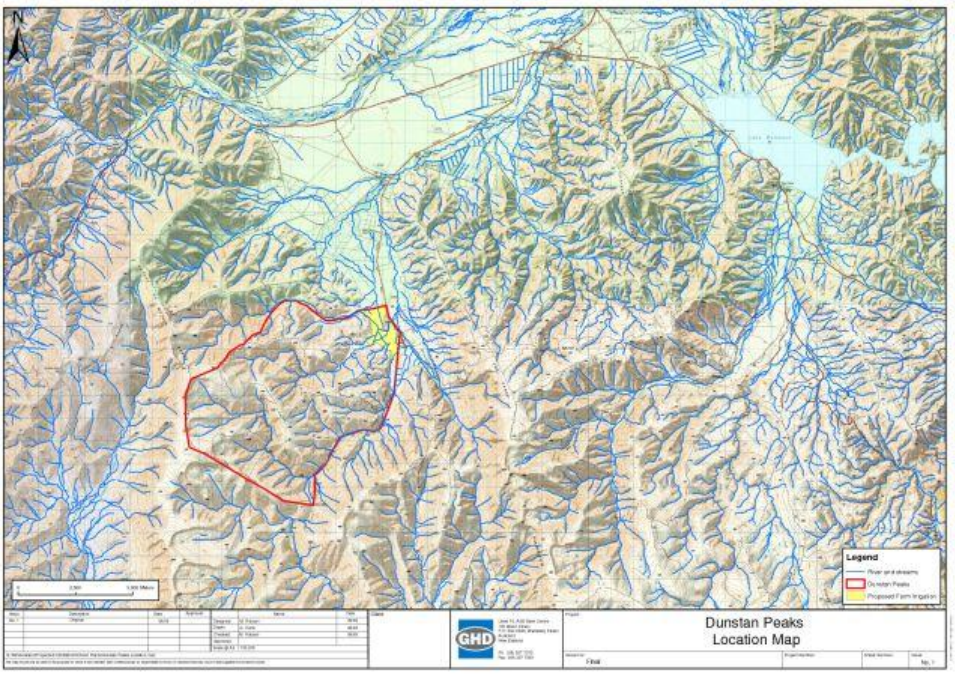
This FEMP includes 3 properties known as ‘Clifton Downs’ ‘Dunstan Peaks’ and ‘Twinburn’. All three properties are owned and farmed by a family company. Dunstan Peaks and Twinburn are typical high country properties with developed flats to extensive high altitude native country. Clifton Downs is lower altitude situated in the heart of the valley and predominantly flats.

There have been a number of changes to the consents lodged for Dunstan Peak, and this FEMP reflects those changes. The irrigation system at present is a mixture of wild flood and border dyke irrigation. There is a proposal to convert the current systems into a variety of spray irrigation systems with a relocation of some of the water from upstream sites to downstream sites within the next 5-10 years. This FEMP has been written to ensure that mitigation measures for both of the existing and proposed irrigation systems have been included.

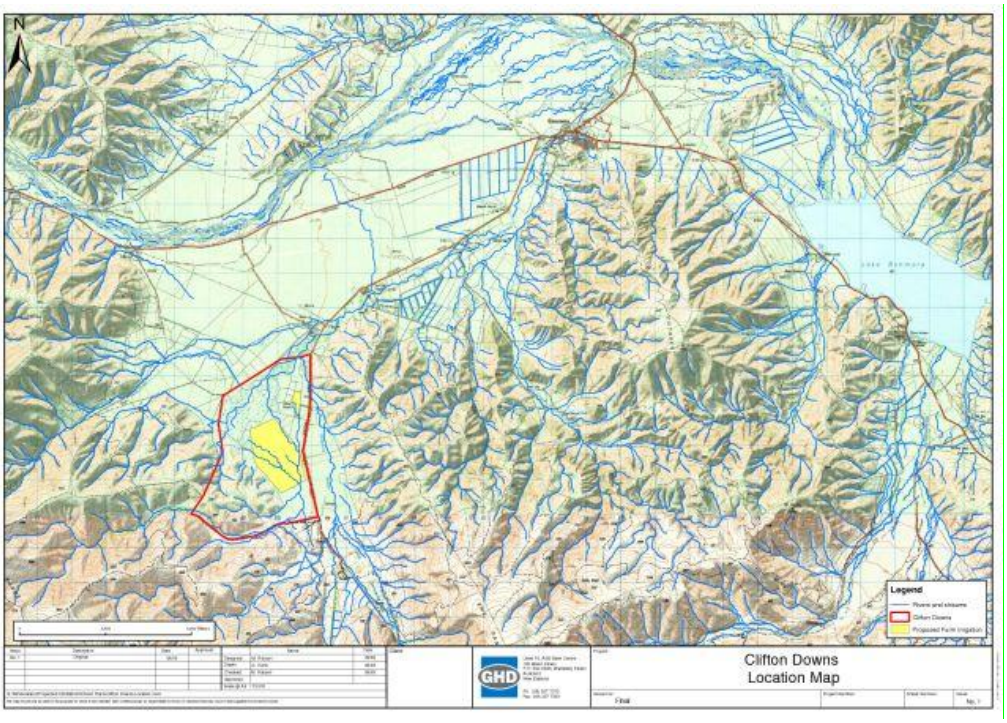
Map A: Location Map for Dunstan Peaks, Clifton Downs and Twinburn stations



Map B: Location Map for Dunstan Peaks



Map C: Location Map for Clifton Downs



Map D: Location Map for Twinburn

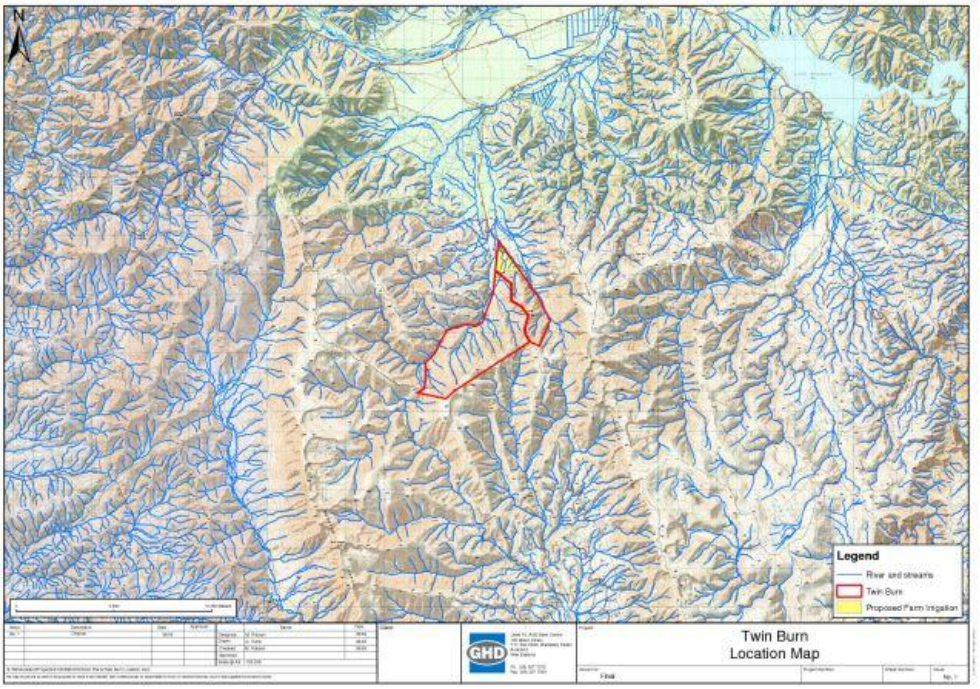

N
Legend
River and streams
Twin Burn
Proposed Farm Irrigation
GHD
Twin Burn
Location Map

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	Grass flats	Oversown hill	Native	Oversown hill
Hoggets	Grass flats	Grass flats	Oversown hill	Oversown hill
Beef Breeding Cows	Grass flats	Oversown Hill	Native	Oversown Hill
R1 Heifers	Grass flats	Grass flats	Grass flats	Oversown Hill
Deer	Grass flats	Grass flats	Grass flats	Grass flats

Photo A: Existing Border dyke system

2.2 Proposed farming system

These properties have had irrigation for some time (at least since the 1970's). Having this irrigation has formed the basis of the way in which the properties are operated. Therefore, the current method of farming outlined above, reflects the way in which the properties are operated.

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	Grass flats	Oversown hill	Native	Oversown hill
Hoggets	Grass flats	Grass flats	Oversown hill	Oversown hill
Beef Breeding	Grass flats	Oversown Hill	Native	Oversown Hill

cows				
R1 Heifers	Grass flats	Grass flats	Grass flats	Oversown Hill
R1 Steers	Grass flats	Grass flats	Grass flats	Grass flats
Deer	Grass flats	Grass flats	Grass flats	Grass flats

To renew a paddock each season for continued grass production/improvement.

2.3 Soils

Clifton Downs is a combination of rich peat soils and silt loom. Dunstan Peaks and Twinburn are silt loam composition.

Photo B: Pasture cover on Dunstan Peaks

Photo C: Pasture Cover on Twinburn

2.4 Topography

Clifton Downs: 500-700m predominantly flat with warm hill block

Dunstan Peaks: 560-1800m Balanced property with a combination of sunny and dark facing hills

Twinburn: 630-1800m Warm NW facing property

Photo D: Dunstan Peaks

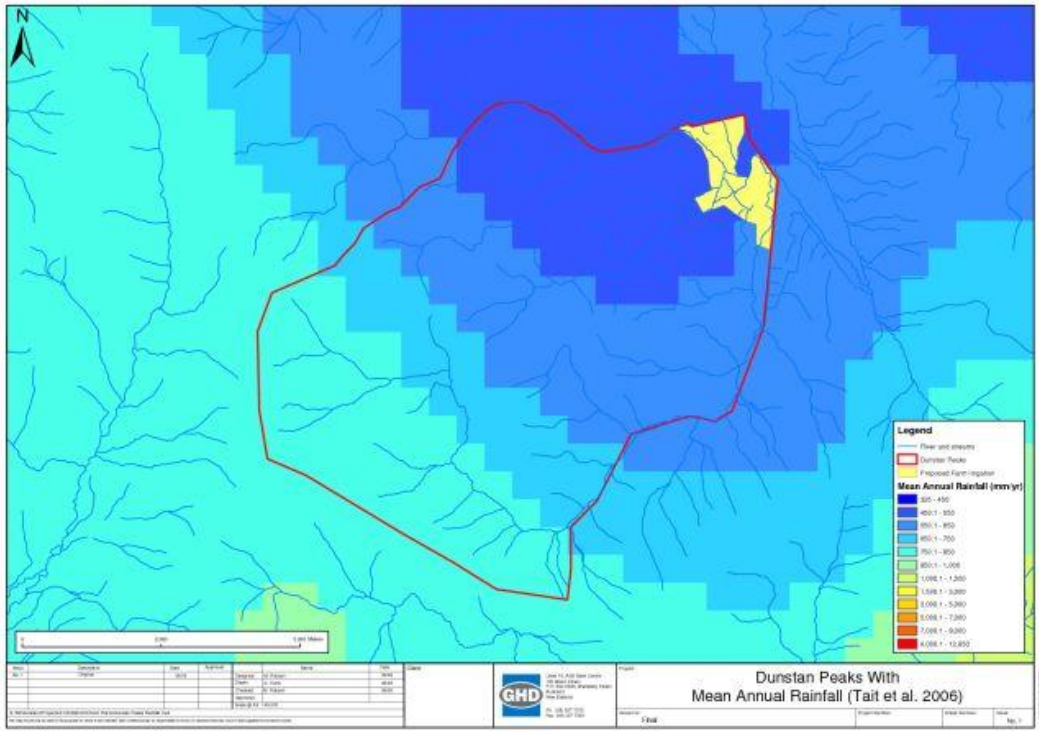
Photo E: General Topography. Looking back towards Dunstan peaks (to the left) and Twinburn's homestead (on the right)

Photo F: Topography of Twinburn. Area irrigated in the foreground.

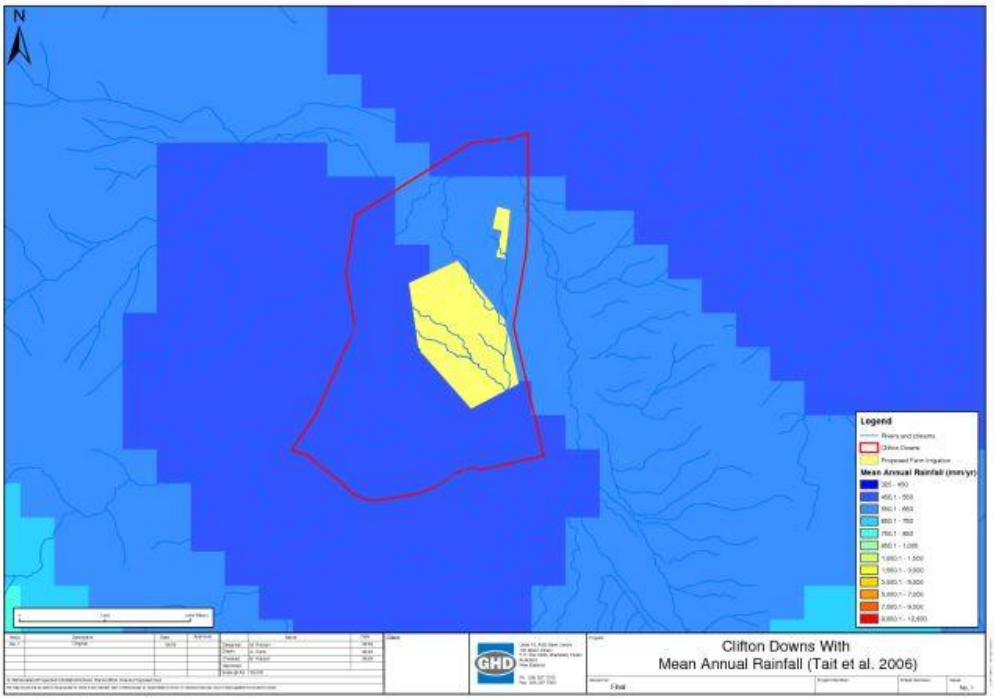
2.5 Climate

All temperature and rainfall is accurately reflected by the met station site on neighbouring property Tara Hills. You can expect a snowfall at less 3-4 times each winter to low altitude. The depth and duration it stays on ground depends on the soil temperature and weather conditions following the snow fall. Snow typically disappears quickly in the spring with the arrival of warm North West winds. It is difficult to rely on summer/autumn rain hence the valuable contribution irrigated grass flats gives us to a farming operation in this catchment.

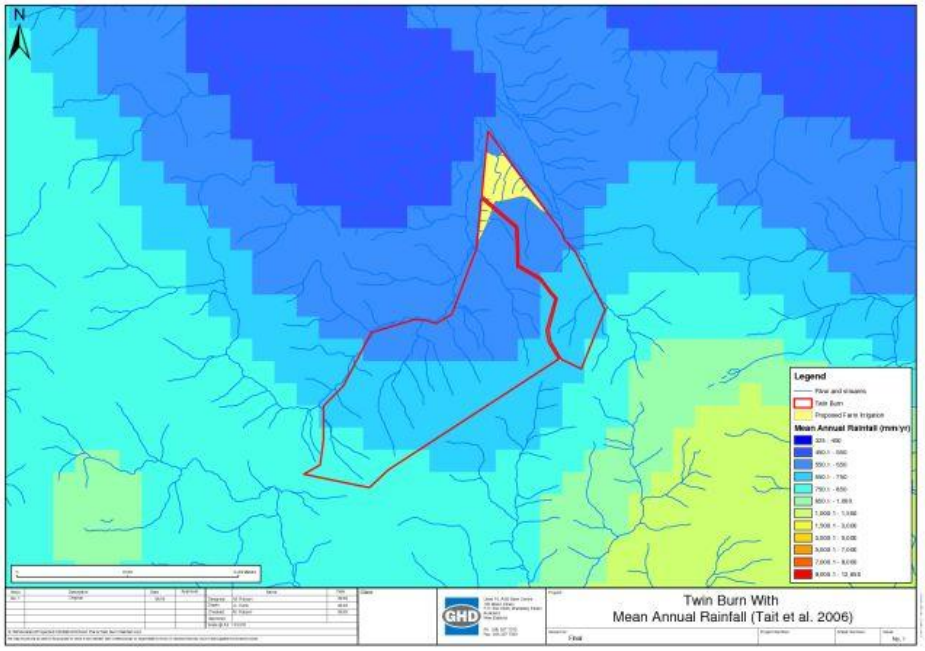
Photo G: Winter snow



Map G: Mean annual rainfall – Dunstan Peaks

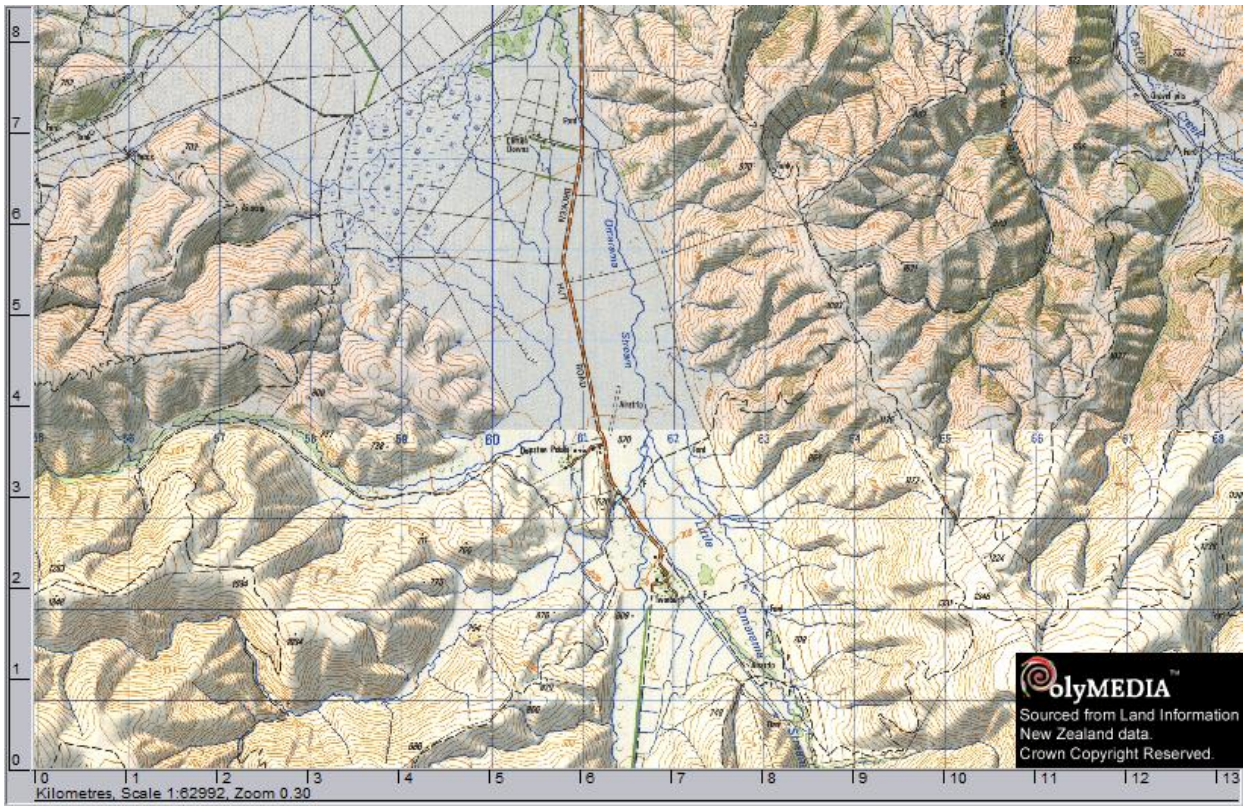


Map H: Mean annual rainfall – Clifton Downs



Map I: Mean annual rainfall – Twinburn

3. Environmental Context



3.1 Water Quality Study receiving environments and mitigation requirements

Dunstan Peaks, Clifton Downs and Twinburn Stations, according to the WQS, lies in the Omarama Stream surface water catchment and Omarama Stream and Ahuriri River groundwater catchments. These maps are shown above.

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 Dunstan Peaks, Clifton Downs and Twinburn Stations.

For this farm, the Lake Benmore mitigation requirements are the most stringent. These mitigation requirements cap Dunstan Peaks, Twinburn and Clifton Downs Station's nutrient discharges at 19,146 kg N per annum and 617 kg P per annum based on needs + buffer.

3.2 Local receiving environments

The areas irrigated receiving environments are the upper reaches of the Omarama Stream, Middle Gully, Twaddles Creek and the Clifton Downs Swamp. The lower reaches of the Omarama Stream are included with the area identified as having outstanding wildlife values and important freshwater fish habitat. So much so that in these area are protected by a National Water Conservation (Ahuriri River) Order 1990.

Table 3 Water Quality Study mitigation requirements for Clifton Downs/ Dunstan Peaks / Twinburn

	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	0	0	0	0	0	10.7
P	0	0.90	0	0.10	0	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.

Mandatory good agricultural practices	What these practices mean on farm
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 table below shows the output from OVERSEER for the modelled proposed farming system at Dunstan Peaks, Clifton Downs and Twinburn Stations. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds set out by the WQS. Management or mitigation strategies that have been used to meet this threshold are detailed in Section 5.

Table 5 Total N and P losses modelled by OVERSEER for the proposed farming system on Dunstan Peaks, Clifton Downs and Twinburn Stations and WQS thresholds

	OVERSEER modelling outputs kg/year	WQS threshold kg/year
Total N leaching/runoff	19146	20964
Total P leaching/runoff	617	675

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

The Farm Environmental Risk Assessment FERA has been undertaken on the existing farming system at all three properties and has highlighted potential soil and water risks. These risks are described below. The full FERA is attached as Appendix A.

The FERA focused on the irrigation areas; existing or proposed and any intensively farmed areas in the farming system.

4.3.1 Soil Risk

The risks associated with soil are that although wind erosion wasn't evident there is a potential vulnerability to wind erosion. The continuation of irrigation will ensure that ground cover levels are upheld and will reduce the risks associated with bare ground and wind erosion

4.3.2 Water risks

The risk associated with water is that stock are not restricted from entering all of the head races of the border dykes. Dunstan Peaks has a proposed conversion plan to convert to spray irrigation whereby the water flow in the headraces will cease.

4.3.3 Runoff Risks

Currently the borderdykes at Twinburn are all manually controlled. There is occasionally an issue with significant runoff due to this manual operation.

4.3.4 Site specific management measures and mitigation measures in place

1. Culverts are evident on streams within the irrigated area as are stock bridges.

Photo H: Stock and Vehicle Bridge crossing the upper reaches of the Omarama Stream

2. Fodder crops are grown as part of the pasture renewal process, ensuring that organic matter levels are not depleted in only a few paddocks. Regrassing after winter grazed fodder crops will be at the earliest opportunity.
3. Cultivation and Trafficking

Direct drilling is the primary method for renewing pasture. Inversion tillage is used if required to break in (cultivate for the first time) any new pastures and occasionally soil can be left bare over winter. Inversion tillage is used at the most appropriate time to reduce the potential effects of wind erosion

Stock are grazed over winter and trafficking of soils when wet does occur. Annual monitoring and identification of soil compaction and documented remedial actions taken will ensure any soil compaction due to stock grazing over winter is identified.

4. Compaction

Soil around water troughs is not compacted nor does pugging occur at present. If compaction does occur then this will be assessed during the annual soil compaction survey and remedial action taken if required.

5. Runoff

There is no evidence of track runoff entering a watercourse. This will be monitored as part of the annual track survey. Annual monitoring and identification of track runoff and documented remedial actions taken will ensure any track runoff entering a watercourse is identified.

There is the potential for runoff from the borderdykes at Twinburn entering the Omarama Stream via the discharge point. Water quality testing is also being undertaken at the Twinburn bridge, this being below the discharge location and prior to the Omarama Stream going underground.

6. Erosion

There is no evidence of stock induced bank side erosion in the Omarama River or Twaddles Stream. This will be monitored as part of an annual survey, as outlined in Table 8.

4.3.5 General issues on extensive high country farming systems

In extensive high country farming systems there are a number of issues that on more intensive farming systems would be assessed as being a risk to water quality but on extensive high country farming systems they have not been defined as a risk due to the extensive nature of the farming systems and the lower stocking rate per hectare. Some of these general issues have been identified below:

1. There will be areas within the farming system where tracks will cross waterways; these are tracks that are used irregularly, in extensive areas of the farm.
2. There are also areas within a high country farming system where stock will have unrestricted access to streams for crossings and stock water. This is essential access for stock movement and stock water. On most farms there are a number of small creeks/streams that flow within the hill country and it would be logistically impossible to place stock crossings on all of these. There is also the need for stock to move across streams/creeks within a block (paddock) for grazing access. A reticulated water system would be unsustainable in the hill country as troughs would freeze solid in the winter months, preventing access to fresh drinking water.
3. Swamps/heavy grounds are an integral area in a high country farming system; they provide a water source and good grazing for stock in dry years. In undertaking the FERA it has been identified that all swamps/heavy ground need to be monitored to ensure that bank erosion, compaction and pugging does not occur.
4. Wind erosion is a significant issue in the upper Waitaki Catchment. The sparse vegetation on large areas of land in the Mackenzie Basin gives little protection to the shallow, friable soils which continue to be eroded by frost heave and westerly winds. A mean soil loss of 0.22 mm/year or 2.2 tonnes of soil lost per hectare across a number of sites within the Mackenzie Basin has been reported. While it cannot be assumed from this information that erosion rates will continue at this level in the future, the results do confirm a strong relationship between the percentage of vegetation cover and erosion risk. The problem of bare ground and exposure to wind erosion has been compounded since the early 1990s by the rapid spread of hieracium particularly on the poorest soils. One of the most significant impacts of further irrigation in this area would be a reduction in the amount of bare ground and corresponding reduction in wind erosion risk. (*Environmental, Economic and social impacts of irrigation in the Mackenzie Basin. Ministry for the Environment, February 2005.)*
5. Monitoring and identification of any problems arising for the above issues has been included in Table 8.

5. Farm Environmental Management Plan for Dunstan Peaks, Clifton Downs and Twinburn Stations

5.1 Mitigation measures and management options adopted on Dunstan Peaks, Clifton Downs and Twinburn Stations

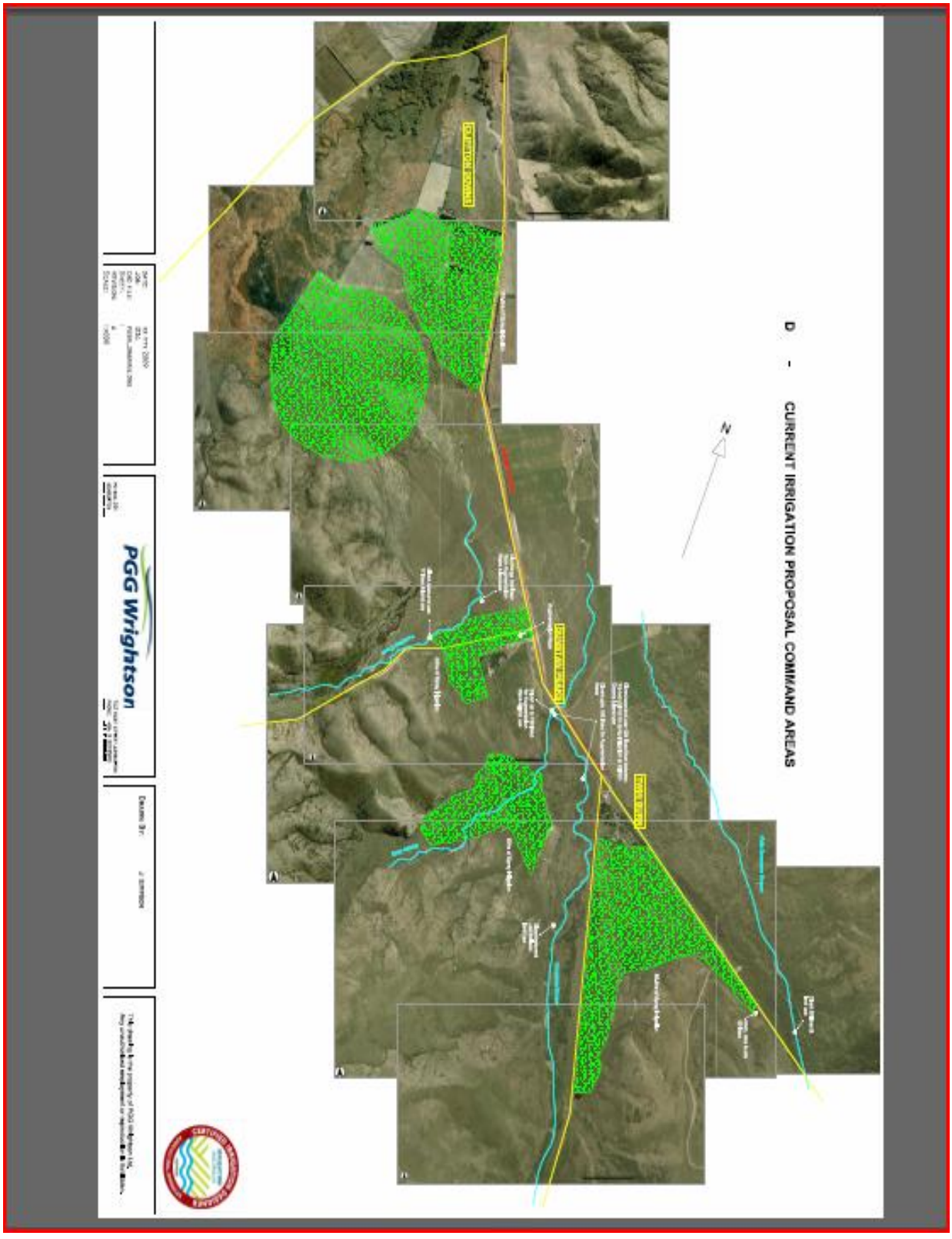
The table below shows the all the mitigation and management tools that are proposed to be undertaken on Dunstan Peaks, Clifton Downs and Twinburn Stations. Measures indicated as **FEMP stage 1 are those identified as Mandatory Good Agricultural Practice**, **measures identified as FEMP stage 2 are those 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**. **FEMP stage 4 mitigation measures are chosen for when the conversion to spray is undertaken.**

Table 7 indicates in brief how the measures are to be monitored and audited.

Table 6. Table of mitigation options, monitoring and auditing for Dunstan Peaks, Clifton Downs and Twinburn Stations

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 the irrigation area	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	Reduce annual volumes of water on border dyke systems to 600 mm/year	Water metering	Submission of water meter readings
2	Olsen P of below 30 maintained	Regular soil testing	Submission of soil tests

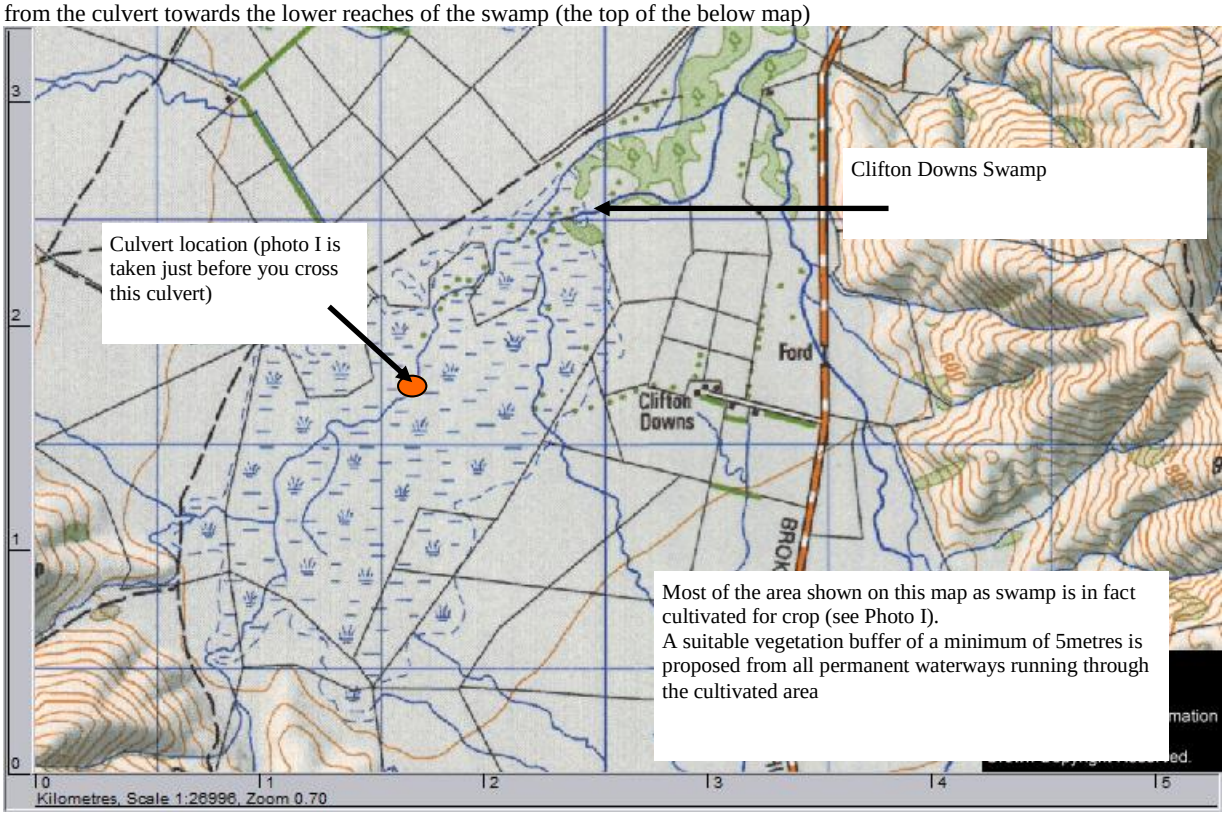
FEMP stage	Measure	Monitoring	Auditing
		(every 3 years)	
3	Establish a minimum of 5m vegetation buffer between the Clifton Downs swamp, Twaddles Creek and all other permanently flowing waterways and the cultivated/cropped land at Clifton Downs	Surface water testing of Twaddles Creek prior to the cropped land. (Tara Hills monitors downstream on Omarama Stream and Twin Peaks Station will monitor Clifton Drain)	Annual auditing visit.
3	Proposed conversion plan to spray irrigation	Photos and location map	Annual audit report until conversion completed
3	20 metre layback from any water way when applying fertiliser by land based application e.g. bulk spreader	Field records	Annual Audit report
3	Monitor and manage stock access, stock type and stock number from all permanently flowing waterways within other non irrigated intensively farmed areas	Location Plan of waterways and photos	Location plan and photos in first audit report
3	Plant and maintain a filter strip/settling area prior to the discharge into the Omarama Stream from the Twinburn borderdykes. *This will need to be completed only if the conversion plans for Twinburn borderdykes is not going to be completed within 2 years e.g. spray system within 2 years of granting of consent.*	Location plan and photos	Site inspection
3	Twaddles Creek irrigation area – a minimum setback of 5m between the irrigation area and Twaddles Creek will be established. This needs to be fenced to allow for regeneration of the vegetation to act as a filter.	Location and photos	Site inspection
4	When any new spray irrigation area is established– all permanently flowing waterways within the irrigation area are to be fenced within a minimum of 5m setback from the waterway edge.	Location and photos	Site Inspection
4	When any new spray irrigation area is established– all irrigation areas will have a setback of a minimum of 5m form any permanently flowing waterway	Location and photos	Site Inspection
4	Any permanently flowing waterways that stock or vehicles will need to regularly cross around the new irrigation areas will be culverted and fenced to restrict stock access	Location and photos	Site inspection
4	A 25m irrigation setback from the Omarama Stream will be established when the Twinburn conversion is undertaken	Location and photos	Site inspection
4	Runoff from any sloped spray irrigation area will be monitored and reported	Location and photos	Annual audit report



Proposed current spray conversion plan

Photo I: Clifton Downs swamp cultivated land for cropping. This practice has been ongoing for at least the past 15 years.

Map P: Mitigation measures at Clifton Downs. The swamp as it exists today is not as extensive as indicated on the below topo map. The land from the culvert location back towards the hill is all dry and currently cropped. The above photo is taken looking from the culvert towards the lower reaches of the swamp (the top of the below map)



5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

Baseline monitoring is already underway on Dunstan Peaks, Clifton Downs and Twinburn Stations. *Water quality monitoring on the Omarama Stream at Twinburn Bridge has been undertaken by ECAN in 2007 and 2008.*

Table 7 Baseline monitoring on Dunstan Peaks, Clifton Downs and Twinburn Stations

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	Irrigated pastures	Every 2 years	Standard suite of soil nutrients
Pasture	Ground cover and species	Irrigated pasture	Annually	Visual Appraisal
Weed and pest		Whole farm	Annually	Done as part of annual survey from ECan

5.2.2 On-going monitoring

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

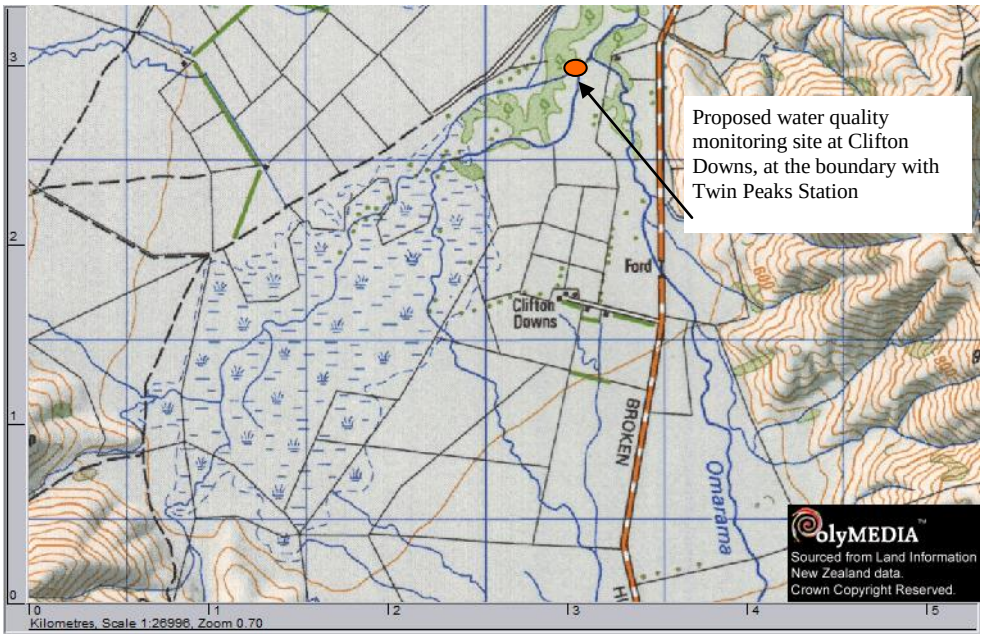
Table 7 above shows the current monitoring undertaken on Dunstan Peaks, Clifton Downs and Twinburn Stations and Table 8 below shows the proposed monitoring plan, frequency location for the monitoring along with the triggers and contingency plans if the triggers are exceeded.

Table 8. Example monitoring plan for Dunstan Peaks, Clifton Downs and Twinburn Stations showing location, frequency and parameters for monitoring

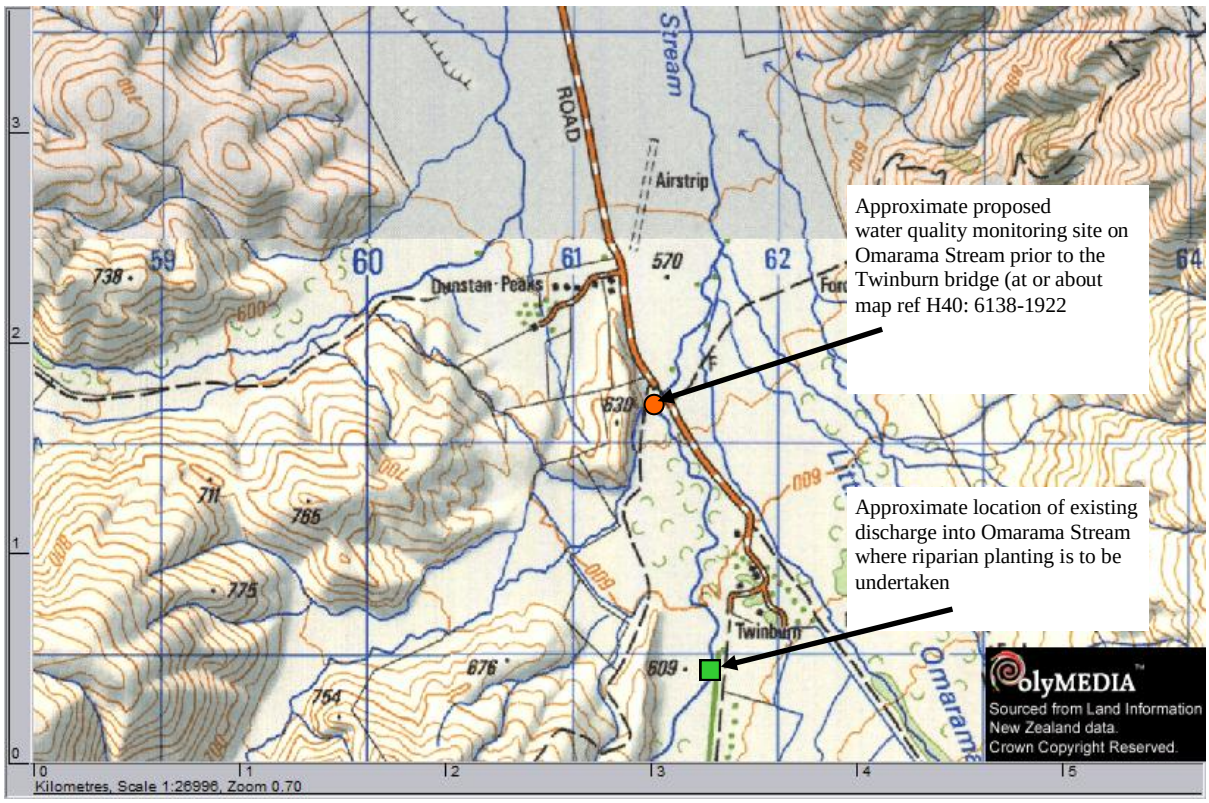
		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
Soil	To include: Soil nutrient testing	All irrigation paddocks and intensive areas in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients	Olsen P >30	Reduce or stop the application of P fertiliser to the area and monitor
Soil	Soil compaction testing	All irrigation and intensive areas in rotation	Annually for soil compaction testing.	Soil compaction	Compaction, surface capping	Remove compaction with the appropriate tool
Soil	Visually monitor swamps/heavy ground	Clifton Downs swamp (see Map P)	Annually	Visual compaction, pugging or stock induced bank erosion	Any visual sign of compaction, pugging or stock induced bank erosion	Remove stock from the area and rectify
Runoff	Wet weather survey	All blocks	Annually	Runoff	Runoff observed	Introduce runoff removal infrastructure where appropriate.
Water	Surface water quality	As per consent conditions	As per consent conditions	As per consent conditions	No significant deterioration in water quality	If comparative surface water analysis indicates a decrease in surface water quality then the particular contaminant should be identified while a full root cause analysis is undertaken

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
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
Tracks that cross waterways	Visual assessment of bank/track erosion	All tracks that cross creek/stream within extensively farmed areas	Annually	Visual assessment of bank/stream erosion caused by vehicle crossing or stock	Any sign of extensive visual erosion	Restrict vehicle and stock access until an assessment of the damage and cause can be made
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
Weed and pest pressures	Weed and pest populations	Relevant blocks	Annually	% or magnitude of infestation	ECAN monitor and communicate if their triggers have been exceeded	Legislative compliance with notice of direction issued by ECAN

Map Q: Location of proposed water quality monitoring point on Clifton Downs



Map R: Proposed water quality monitoring and mitigation locations on Twin burn



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. The annual audit should be completed and submitted to ECan by end of July each year.

6. Summary

This FEMP has been written to serve two purposes; to ensure the existing farm system can meet the nutrient mitigation requirements set out by the MWRL Water Quality Study, and to set out the process for identification of farm specific environmental risks that arise from the inherent characteristics of the farm and from the existing farm system and its management.

The WQS thresholds and modelled outputs from OVERSEER detailed in Section 4.2 illustrate that this proposed system meets the WQS thresholds identified.

A full on-farm risk assessment was completed in December 2009 with a commitment to address the risks identified. Section 4.3 sets out the risks identified for this property and those issues common to all high country farming systems, along with existing mitigation measures.

The mitigation and management measures detailed in Table 6 set out the measures that have been adopted to mitigate and manage the risks that were identified in the risk assessment along with mandatory good agricultural practices and those measures that have been modelled in OVERSEER.

Baseline monitoring and any additional monitoring proposed for this property are identified and set out in Section 5.2, Tables 7 and 8 allows 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.

The auditing of this plan, addressed in Section 5.2.3, Table 9 ensures that the relevant mitigation measures outlined in Table 6 are audited annually either internally or externally and communicated to ECAN by the end of July each year.

7. References

Ministry for the Environment. 2005. Environmental, Economic and social impacts of irrigation in the Mackenzie Basin.

GHD (2009a). Cumulative Water Quality Effects of Nutrients from Agricultural Intensification in the Upper Waitaki Basin – Mitigation Toolkit.

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APPENDIX A: Farm Environmental Risk Assessment

GUIDELINES QUESTIONS FOR THE
COMPLETION OF A FERA November/December 2009

The plan is to focus on those existing/proposed irrigation areas along with any intensive areas surrounding. We also need to keep in mind that this is a whole farm environmental risk assessment and hence other areas of the farm may also be applicable at times. Take notes on wetland areas, swamps, major streams/rivers, location of the yards in relation to watercourses

Some guideline questions for track management and runoff		**Notes/description**
1	Do any regularly used tracks run through streams?	NO. In extensive high country properties there are areas within the farm where tracks will cross streams, these will be tracks that are used irregularly
2	Do any tracks directly runoff to a water course	None directly
3	Stock crossings?	Predominantly bridges or culverts are installed within intensively farmed areas. In extensive high country properties there are areas within the farm where stock will cross streams and use streams for stock water.
4	Any evidence of previous runoff, soil wash or erosion?	No but a potential vulnerability to wind erosion
6	Do you have a silage pit located near a permanent watercourse?	No, pits located at Clifton Downs
Some guideline questions for stock management		
1	Are measures taken to control dietary intakes of N and P? (Intensive beef and dairy)	N/A
2	Are stock restricted from entering watercourses in intensively farmed areas?	Yes, other than the head races of the border dykes
3	Do you graze stock in paddocks that have a hydraulic connection to a watercourse in winter months?	No

4	Yards - do you use water? If yes, details (e.g. is it collected, discharged, what is it used for…?)	Yes, no runoff can enter a watercourse
Some guideline questions for biodiversity		
1	Are there any special areas or species of interest or conservation on the farm?	Twin Burn have gone through Tenure Review so DOC has an easement to a conservation area.
2	Are there any water or wetland features on the farm?	Clifton Swamp - has had drains installed at some stage in the past, which has reduced the size of the swamp considerably
3	Are these features actively protected?	No
Some guideline questions for chemical usage	*Chemical storage and handling is dealt with under the Hazardous Substances and New Organisms Act*	
1	Are those handling chemicals of 'approved handler status'?	Yes, contractor for spraying lucerne, helicopter for pasture spray
Some guideline questions for water		
1	Do you use border dyke irrigation?	Yes
2	Do you collect wipeoff losses?	Yes three times over the borders at Twin Burn
3	Are these wipeoff losses discharged to a watercourse	Yes, into Omarama Stream
4	Is there evidence of bankside erosion in any permanent flowing watercourses?	No monitor Twaddles Creek, soil/dirt banks, all other streams stony, shallow streams
Some example questions on cropping		
1	Is inversion tillage used? Describe	Yes if required discing is used otherwise direct drill
2	Are soils left bare over winter?	No
3	If arable or fodder crops are grown, are measures taken to conserve or build soil organic matter on	No

	arable land?	
4	Are remedial measures in place after winter grazed crops?	N/A
5	Is there a possibility of run off from winter grazed areas reaching a water course?	No
6	Other cropping issues or incidences? Please describe	Historic cropping around the Clifton Swamp for at least 15yrs, not fenced nor adequate riparian strips.
Some example questions on soil health		
1	Are there compacted, consolidated or capped soils?	None evident, only small mobs of deer and no obvious fence walking
Some example questions on pest and weed management		
1	Do you undertake any current pest or weed control? E.g rabbits, gorse	Helicopter shooting rabbits when mustering