

Farm Environmental Management Plan: West Edge Ltd – Birchwood Run

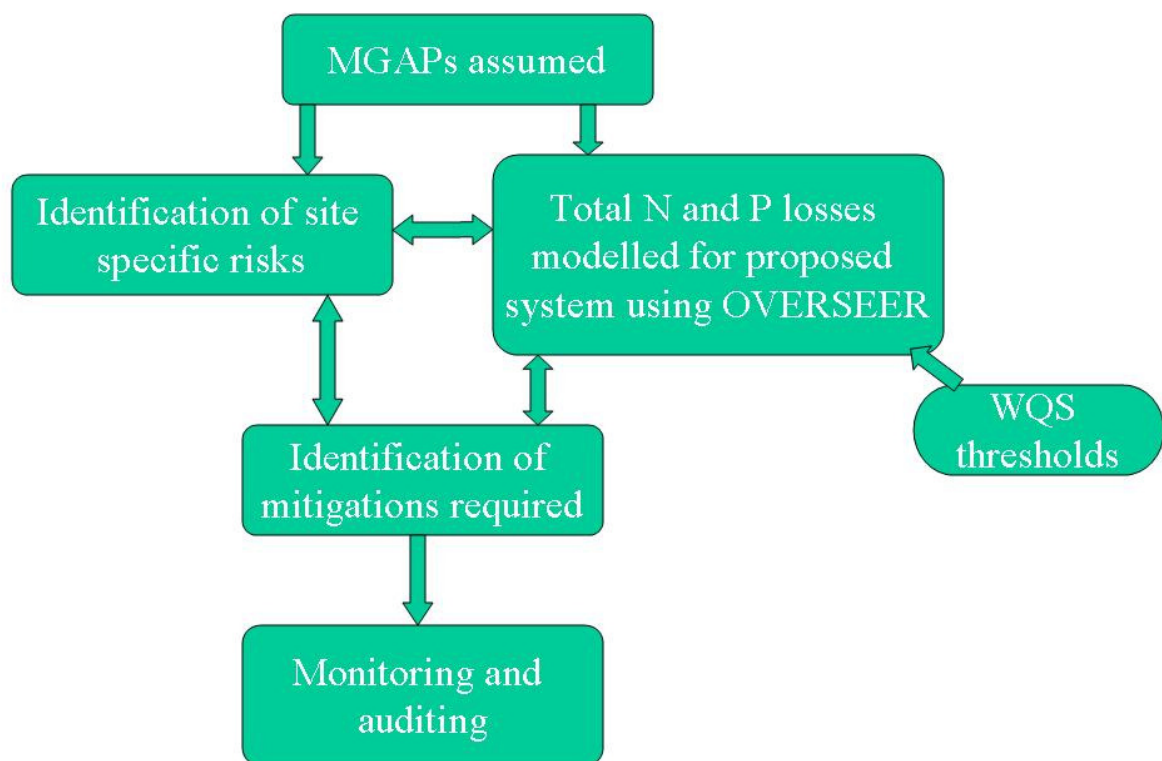
1. Introduction

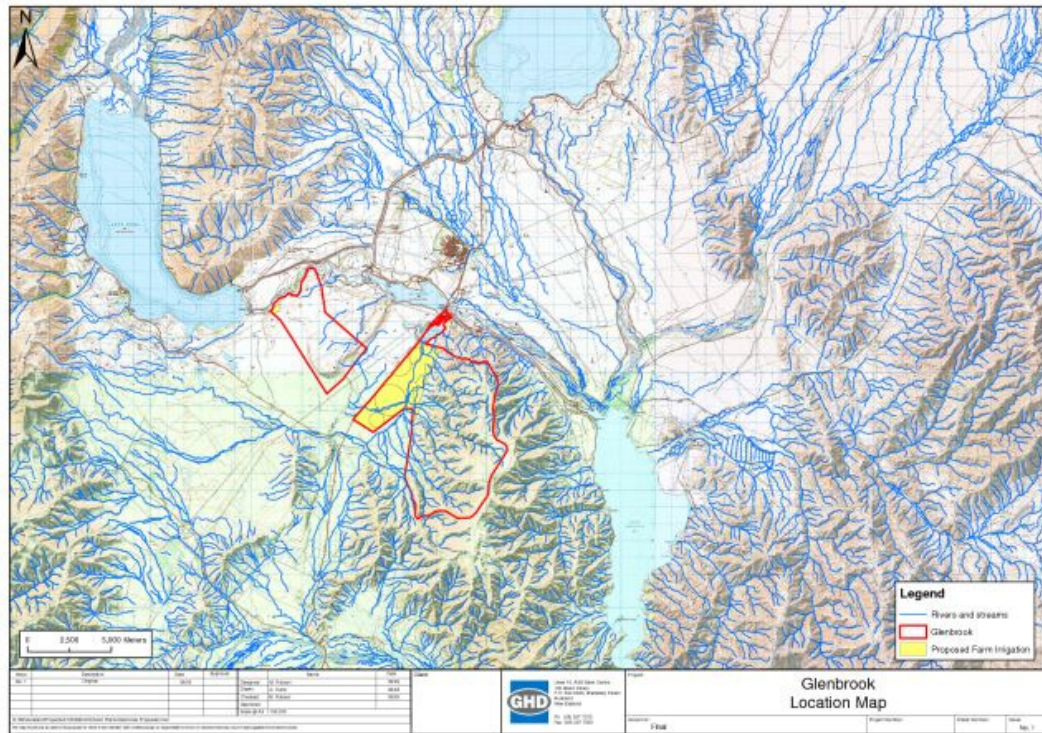
The Water Quality Study ('WQS') funded by Mackenzie Water Research Limited ('MWRL'), found that the additional irrigation proposed in the catchment could take place without significant adverse effects on the environment providing that nutrient reduction occurred on the farms.

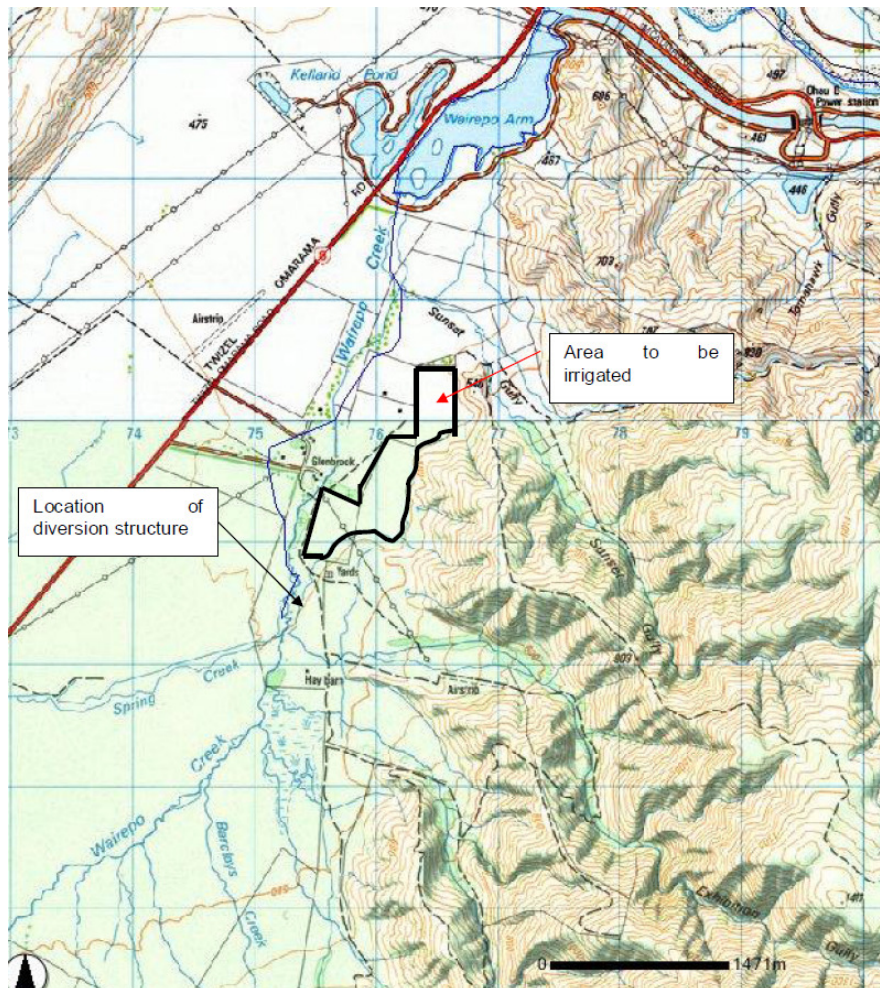
The process that was advocated for ensuring this on-farm nutrient reduction was through Farm Environmental Management Planing. A clear process for building a Farm Environmental Management Plan (FEMP) was laid out in the Water Quality Study and has been followed here. An overview schematic of the process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







Map B: Area of irrigation currently in hearings for renewal

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 | Irrigated grass flats | Irrigated grass flats | Irrigated grass flats | Irrigated grass flats |
| 18 month Steers | Grass flats | Irrigated grass flats | Irrigated grass flats | Irrigated grass flats |

2.2 Proposed farming system

It is not proposed to change the farming system, as this is a renewal of an existing irrigation system with a farming system already in place.

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 | Irrigated grass flats | Irrigated grass flats | Irrigated grass flats | Irrigated grass flats |
| 18 month Steers | Grass flats | Irrigated grass flats | Irrigated grass flats | Irrigated grass flats |

2.3 Soils

Light to medium dept topsoils on hill, some stone with a mixture of soil types on both undeveloped and developed flat land.

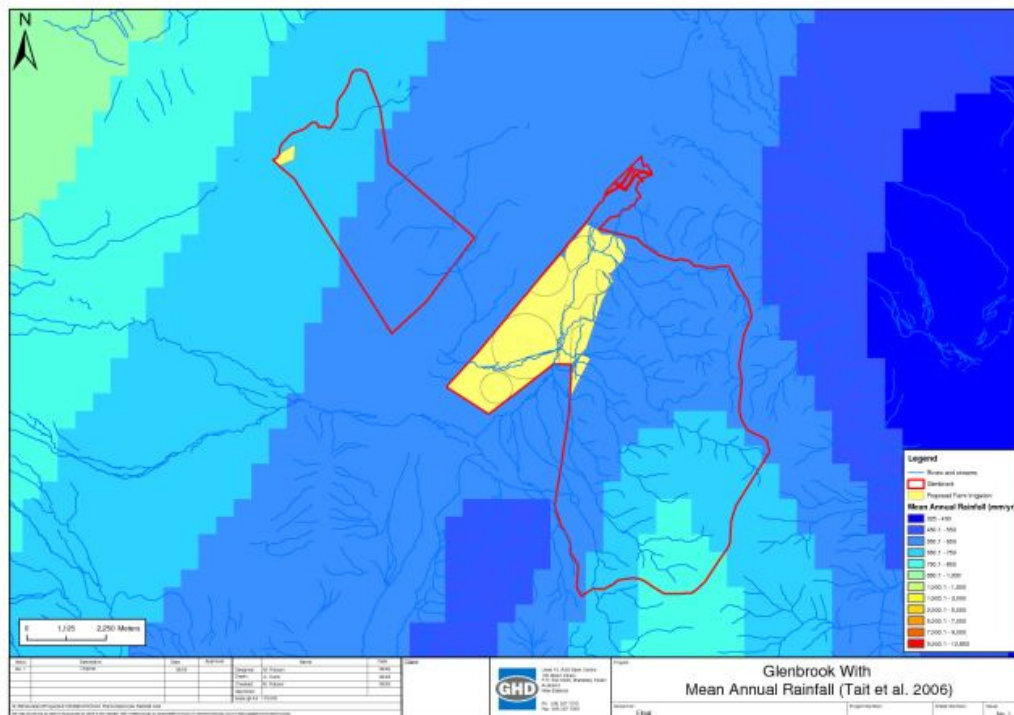
2.4 Topography

Birchwood Run is a mixture of rolling flats and very steep hills country. The Wairepo Arm of Lake Ruataniwha is located at the northern end of the property.

2.5 Climate

Winter cold (heavy snow falls common) and summer dry with high evaporation levels. North-westerly weather aspect with unreliable rainfall, especially from October to March.

Map C: Mean annual rainfall

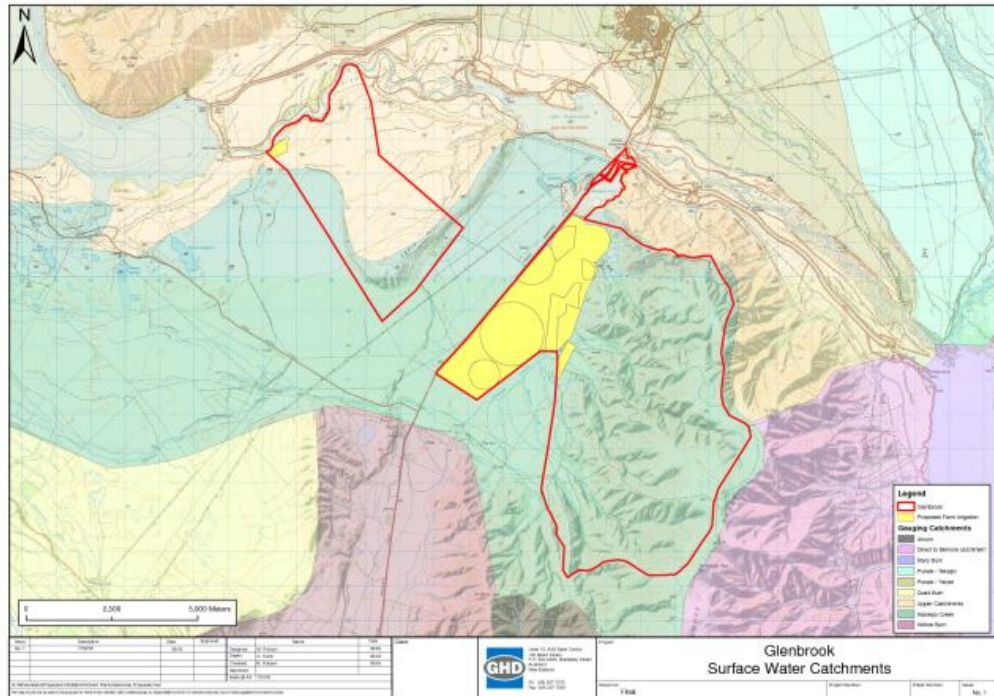


3. Environmental Context

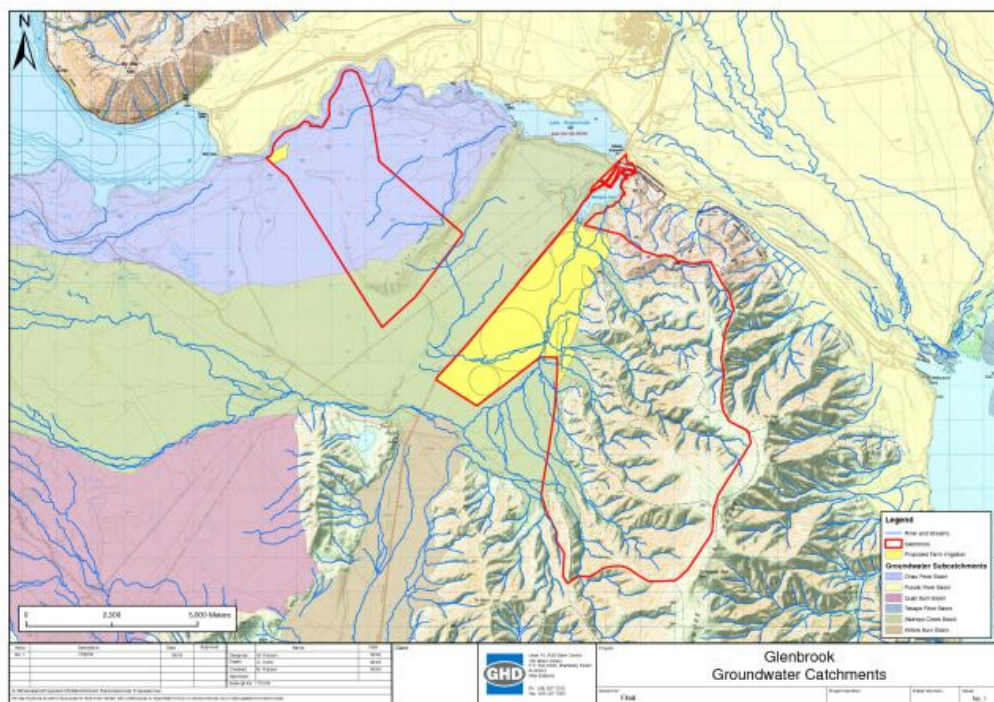
The environmental context of the farm is a reference both to local and wider receiving environments.

Below are maps that show the receiving environments of West Edge Ltd.

Map D: Surface water receiving environment



Map E: Groundwater receiving environment



3.1 Water Quality Study receiving environments and mitigation requirements

The property, according to the WQS, lies in the Ohau River and Wairepo Creek groundwater catchments, and Wairepo Creek surface water 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 Glenbrook Station.

For this farm, the groundwater mitigation requirements are the most stringent. These mitigation requirements cap the properties nutrient discharges at 24,031 kg N per annum and 795 kg P per annum.

3.2 Local receiving environments

The area irrigated receiving environment is the Wairepo/Spring Creek which flows to the west of the area irrigated.

Table 3. Water Quality Study mitigation requirements for Glenbrook 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 |
| 0 | 0 | 0 | 0 | 1.90 | 1.00 | 0 | 0 | 16.40 | 00.70 | 0 | 0 |

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 | <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 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 WQS thresholds set for Glenbrook Station, using the most stringent nutrient mitigation requirement, are 24,031kg N/year and 795 kg P/year. The table below shows the output from OVERSEER for the modelled proposed farming system at the property. 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 the property and WQS thresholds

| | OVERSEER modelling outputs kg/year | WQS threshold kg/year |
|-------------------------|---|------------------------------|
| Total N leaching/runoff | 6,945 | 24,031 |
| Total P leaching/runoff | 219 | 795 |

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 Glenbrook and has highlighted potential soil, stock 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 Stock risks

The risks associated with stock are that at present stock are not fully excluded from watercourse within the irrigation area.

4.3.3 Water risks

The risks associated with water are that although no bank erosion was evident on Wairepo/Spring Creek, the banks are dirt and have a steep gradient in some areas and will need to be monitored for erosion (see Photo B).

4.3.4 Site specific management measures and mitigation measures in place

1. Bridges have been installed where the existing pivot crosses Wairepo/Spring Creek and also where stock and vehicles cross the creek. The west side of the creek has been fenced within the irrigation area and the east side fencing is yet to be completed. It must be noted that the water consented for irrigating this area is through the Benmore Irrigation Company.

Photo A: Bridges where the pivot crosses the creek



Photo B: Vehicle/Stock Bridge where the pivot crosses Wairepo/Spring Creek. Once finished the bridge will have a gate installed and a fence either side.



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. A contractor or approved handler if required is used to apply chemicals at West Edge farm.
4. 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.

5. Compaction

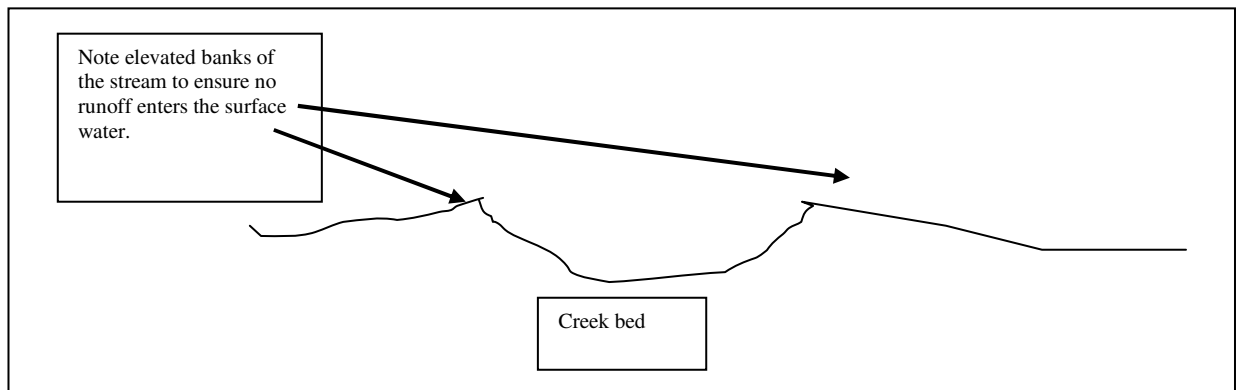
Soil around water troughs is not compacted nor does pugging occur at present. If compaction does occur then this will be assessed during the annual soil compaction survey and remedial action taken if required.

6. 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.

Cultivation on either side of the Wairepo/Spring creek has ensured that the creek bank is raised to ensure that no run off can enter the creek.

Figure 2: not to scale drawing of the raised stream banks



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

5.1 Mitigation measures and management options adopted on the property

The table below shows the all the mitigation and management tools that are proposed to be undertaken. 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.**

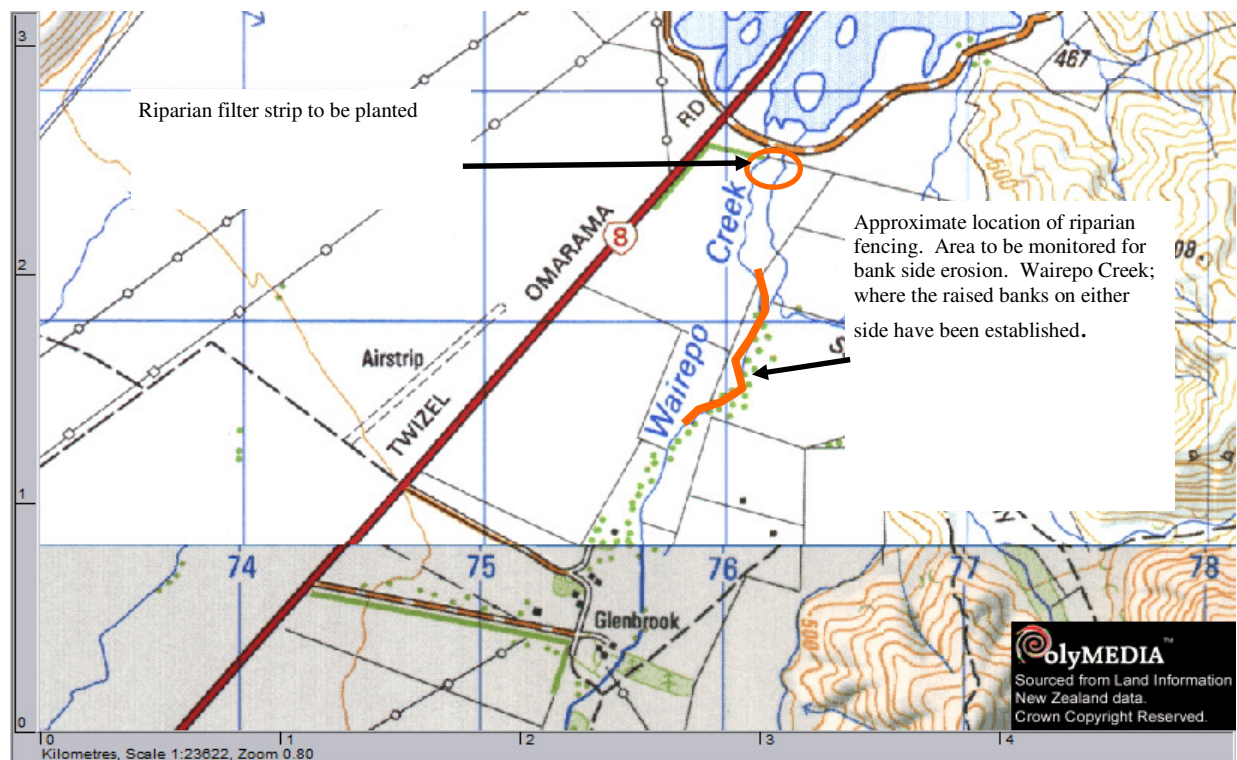
Table 6 indicates in brief how the measures are to be monitored and audited.

Table 6. Table of mitigation options, monitoring and auditing

| 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 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 (every 3 years) | Submission of soil tests |
| 3 | Finish fencing stock out of Wairepo/Spring creek through riparian fencing within the irrigation area | Surface water testing of race/waterway as it enters and exits the property | Annual auditing visit. |
| 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 | Plant a riparian filter strip/settling pond on the Wairepo/Spring Creek as it exits the | Photos | Audit report on the completion of planting |

| FEMP stage | Measure | Monitoring | Auditing |
|------------|---|---------------------------------------|--|
| | property before discharging into Wairepo Ponds | | |
| 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 |

Map F: Mitigation measures and approximate locations



5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

Baseline monitoring is already underway. Monitoring of water quality is undertaken by ECAN at the Wairepo Creek arm outlet.

Table 7. Baseline monitoring on Glenbrook Station

| | | Location | Frequency | Measured parameters to include |
|-------|-----------------------|------------------------------------|------------------|--|
| | | Irrigated pasture | 2-3 years | |
| Soil | Soil nutrient testing | Hill and dry land | 5 yearly | Standard suite of soil nutrients, pH C, N and organic matter |
| Water | Surface water quality | At specific points marked on Map G | Every two months | Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids, Ph, Conductivity, Turbidity, dissolved organic carbon, e.Coli. |

| | | Location | Frequency | Measured parameters to include |
|-----------------|--------------------------|------------|-----------|---------------------------------------|
| Pasture | Ground cover and species | All blocks | | % Ground cover, species |
| Weeds and Pests | | Whole Farm | Annually | Done as part of an annual Ecan survey |

5.2.2 On-going monitoring

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

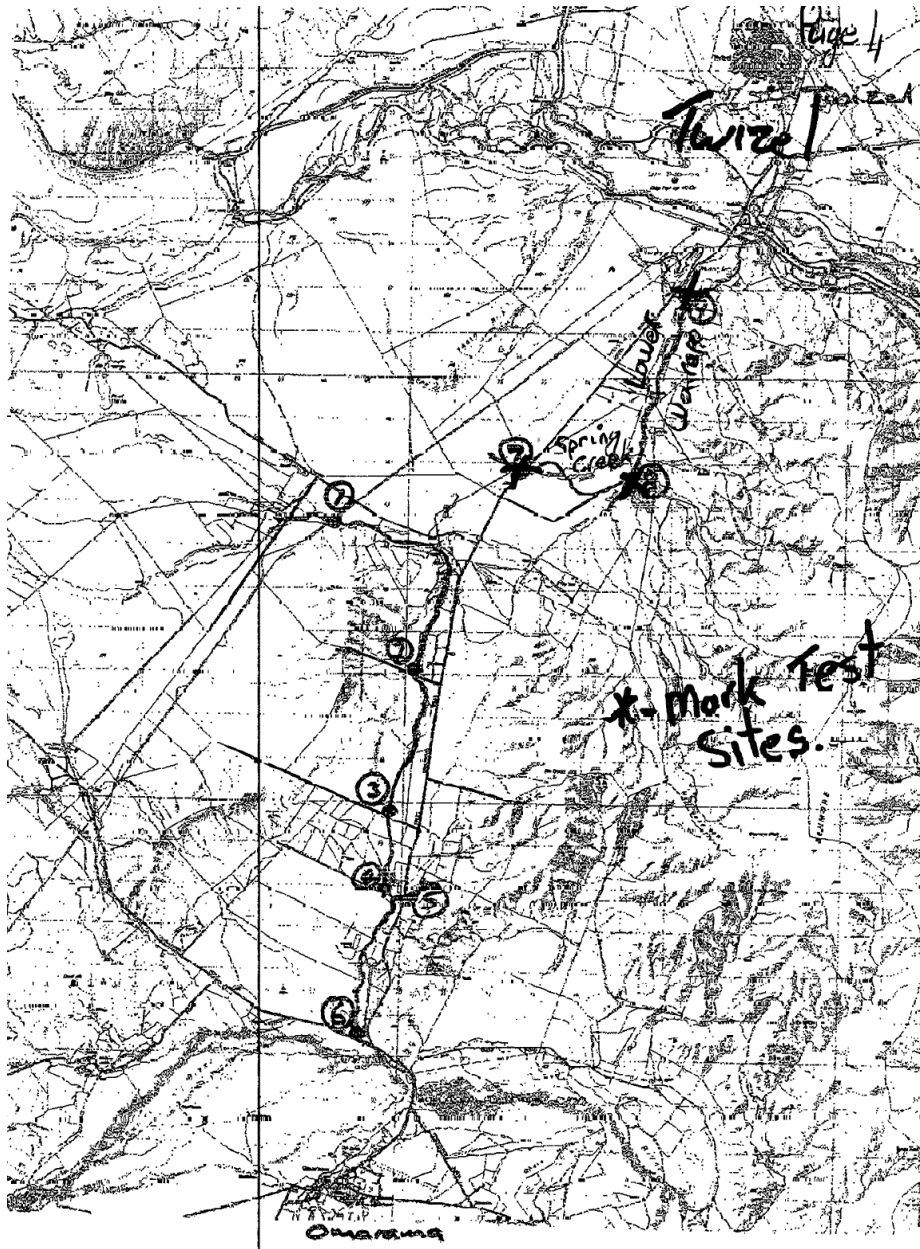
Table 7 above shows the current monitoring undertaken for Glenbrook Station and Table 8 below shows the proposed monitoring plan, frequency, location for the monitoring along with the triggers and contingency plans if triggers are exceeded.

Table 8. Example monitoring plan for Glenbrook 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 | Olsen P>30 | Reduce or stop the application of P fertiliser to the area and monitor |
| Soil | Soil compaction testing | All blocks in rotation | Annually for soil compaction testing. | Soil compaction | Compaction, surface capping | Remove compaction with the appropriate tool |
| Runoff | Wet weather survey | All blocks | Annually | Runoff | Runoff occurring | Introduce runoff removal infrastructure where appropriate. |
| Water | Surface water quality | As per consent conditions | As per consent conditions | As per consent conditions | No significant decrease 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 |
| 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 |

| | | Location | Frequency | Measured parameters to include | Triggers | Contingency plan if triggers are exceeded |
|-------------------------|---------------------------|-----------------|-----------|--------------------------------|---|---|
| Weed and pest pressures | Weed and pest populations | Relevant blocks | Annually | % or magnitude of infestation | ECAN monitor and communicate if there triggers have been exceeded | Legislative compliance with notice of direction issued by ECAN. |

Map G: showing location of water quality monitoring points on Glenbrook station



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 arise 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 your 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.

Table 10 below shows an example of an annual audit report for Glenbrook Station.

Table 10. Table showing proposed contents of an annual audit report for Glenbrook Station

| Mitigation Measure | Audit Measures | Action in case of non compliance |
|--|---|---|
| | 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. |
| | Submission and brief interpretation of water quality analysis | 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 and brief of annual wet weather survey | Any remedial actions proposed after the annual survey should be undertaken. |
| | Submission and brief of annual tracks that cross waterways survey | Any remedial actions proposed after the annual survey should be undertaken |
| | Submission and brief of annual compaction survey of the irrigation area | Any remedial actions proposed after the annual survey should be undertaken |
| | Annual pest and weed survey undertaken by Ecan should be submitted | Legislative compliance |
| Fertilisers applied according to code of practice for fertiliser use | Self certification | Any issues should be rectified and identified in next audit |

| | | |
|--|--|---|
| Accounting for all sources of nutrients including applied effluents and soil reservoirs | Reconciliation of fertiliser and soil records with nutrient budget. | Where reconciliation is not verified then this should be rectified at next audit |
| Even fertiliser application | Calibrate and optimise fertiliser spreaders annually and every 5 years by an external auditor. Signed records for verification | Spreaders not performing shall be recalibrated |
| Even irrigation application | Calibrate and optimise irrigators annually in house and every 5 years by an external auditor | Submission of testing and calibration |
| Record crop, cultivation, nutrient inputs and yields per farm management unit | Verification of records | If records have not been produced then this should be rectified for next audit |
| Good design of irrigation systems by a certified professional and audited every 5 years | Irrigation system audited by a certified auditor every 5 years and any changes recommended should be implemented | If changes recommended not implemented then this should be rectified by next audit |
| Robust irrigation scheduling | Verification of records | If records not received then this should be rectified by next audit |
| No June/July application of fertiliser on the irrigated area | Field records | If records not received this should be rectified for next audit. |
| N fertiliser applications split to under 50 kg N/application | Field records | If records not received this should be rectified for next audit |
| No P fertiliser within three weeks of irrigation | Field records | If records not received this should be rectified for next audit |
| Olsen P of below 30 maintained | Submission and brief interpretation of soil test results | 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. |
| Finish fencing stock out of Wairepo/Spring creek through riparian fencing within the irrigation area | Check fenced area is present. Photos | Areas of fencing damage should be repaired. |
| 20 metre layback from any water way when applying fertiliser by land based application e.g. bulk spreader | Field records and maps | If maps not received with annual audit this should be rectified by the next audit. |
| Plant a riparian filter strip/settling pond on the Wairepo/Spring Creek as it exits the property before discharging into Wairepo Ponds | Check settling pond is present. Photos | Settling ponds should be constructed and in use before next audit |

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.

Webb, T. H. (1992). Soils of the Upper Waitaki Basin, South Island, New Zealand, DSIR.

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? | Not in the irrigation area. 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 | No |
| 3 | Stock crossings? | Within irrigation area bridges are installed. 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 |
| 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, Wairepo/Spring Creek is partially fenced at present but will be fully fenced within the pivot irrigation area where the steers are grazed. No if you consider the water race divert from spring creek. |
| 3 | Do you graze stock in paddocks that have a hydraulic connection to a watercourse in winter months? | Potentially if groundwater is located within this area |

| | | |
|--|---|---|
| 4 | Yards - do you use water? If yes, details (e.g is it collected, discharged, what is it used for...?) | Yes for dipping on an irregular basis contained within an old swim dip bunker |
| Some guideline questions for biodiversity | | |
| 1 | Are there any special areas or species of interest or conservation on the farm? | NO |
| 2 | Are there any water or wetland features on the farm? | NO |
| 3 | Are these features actively protected? | N/A |
| | | |
| Some guideline questions for chemical usage | | |
| | <i>Chemical storage and handling is dealt with under the Hazardous Substances and New Organisms Act</i> | |
| 1 | Are those handling chemicals of 'approved handler status'? | Yes, contractors are used for spraying |
| Some guideline questions for water | | |
| 1 | Do you use border dyke irrigation? | Yes |
| 2 | Do you collect wipeoff losses? | No |
| 3 | Are these wipeoff losses discharged to a watercourse | No |
| 4 | Is there evidence of bankside erosion in any permanent flowing watercourses? | No - shallow, stony creeks. Wairepo/Spring Creek will be funnly fenced within the irrigation area and regeneration of vegetation will ensure potential erosion is mitigated |
| Some example questions on cropping | | |
| 1 | Is inversion tillage used? Describe | Yes, discing 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 arable land? | Kale |
| 4 | Are remedial measures in place after winter grazed crops? | Yes, very early spring into permanent pasture to utilise the nutrients deposited in the winter |
| 5 | Is there a possibility of run off from winter grazed areas reaching a water course? | Yes slim possibility, potential reduced with the fencing off of the stream and the upward sloping land at the stream edge |
| 6 | Other cropping issues or incidences? Please describe | No |
| Some example questions on soil health | | |
| 1 | Are there compacted, consolidated or capped soils? | None evident, checked |
| | | |
| Some example questions on pest and weed management | | |
| 1 | Do you undertake any current pest or weed control? E.g rabbits, gorse | Yes, night shooting rabbits |