



PHOSPHORUS MITIGATION PLAN



ABOUT YOUR PLAN

This Phosphorus Mitigation Plan document is the result of a tailored farm environment planning service provided to you through Tiaki Sustainable Dairying. It's part of the advantage you get through Farm Source as a member of the Fonterra Co-Operative. The purpose of this plan is to describe the environmental conditions present on your farm and the management of these conditions. From this, mitigations to potential impacts to water quality are documented and additional mitigations maybe planned, with sensible timeframes. Underpinning this plan, are the agreed national Good Farming Practices that are supported by the agricultural and horticultural sectors. Industry bodies along with Regional Councils and Central Government have developed the Good Farming Practice: Action Plan for Water Quality 2018 in a commitment to swimmable rivers and improving the ecological health of our waterways. The Dairy Industry Strategy (Dairy Tomorrow), as well as the Good Farming Practice: Action Plan for Water Quality 2018, both align with the goal for all dairy farms to have a Farm Environment Plan by 2025. Now that this plan has been created it's the plan owner's responsibility to ensure it is put into action and kept up to date as actions are completed or conditions on farm change. Tiaki Sustainable Dairying is here to help with that implementation and ongoing management through our team of Sustainable Dairying Advisors who can be contacted via the details below.

PHONE: 0800 65 65 68

EMAIL: sustainable.dairying@fonterra.com

CONTENTS:

FARM DETAILS	3
FARM OVERVIEW MAPS.....	4
MERRIBURN SUMMARY OF OPEN ACTIONS.....	7
MERRIVALE SUMMARY OF OPEN ACTIONS.....	8
PHOSPHORUS OVERVIEW	8
MERRIBURN RISK RATING.....	10
MERRIBURN LAND MANAGEMENT.....	11
MERRIBURN WATERWAYS MANAGEMENT.....	17
MERRIVALE RISK RATING.....	30
MERRIVALE LAND MANAGEMENT.....	31

FARM DETAILS

FARM NAME

Woldwide Runoff

SUPPLIER NUMBER

Merrivale & Merriburn

PLAN OWNER

Albert De Wolde

+64 27 2272537
dewolde@farmside.co.nz

FARM ADDRESS

**20 Gill Road & 1711 Otautau-
Tuatapere Road**

LOCATION



REGIONAL COUNCIL

Southland

PLAN LAST EDITED DATE

02 August 2019

POINTS OF NOTE

MERRIBURN FARM OVERVIEW MAP

The map below presents the land on which the farming operations covered in this document occur and identifies some key points of interest. More detailed maps looking at specific environmental management topics are contained throughout the document.

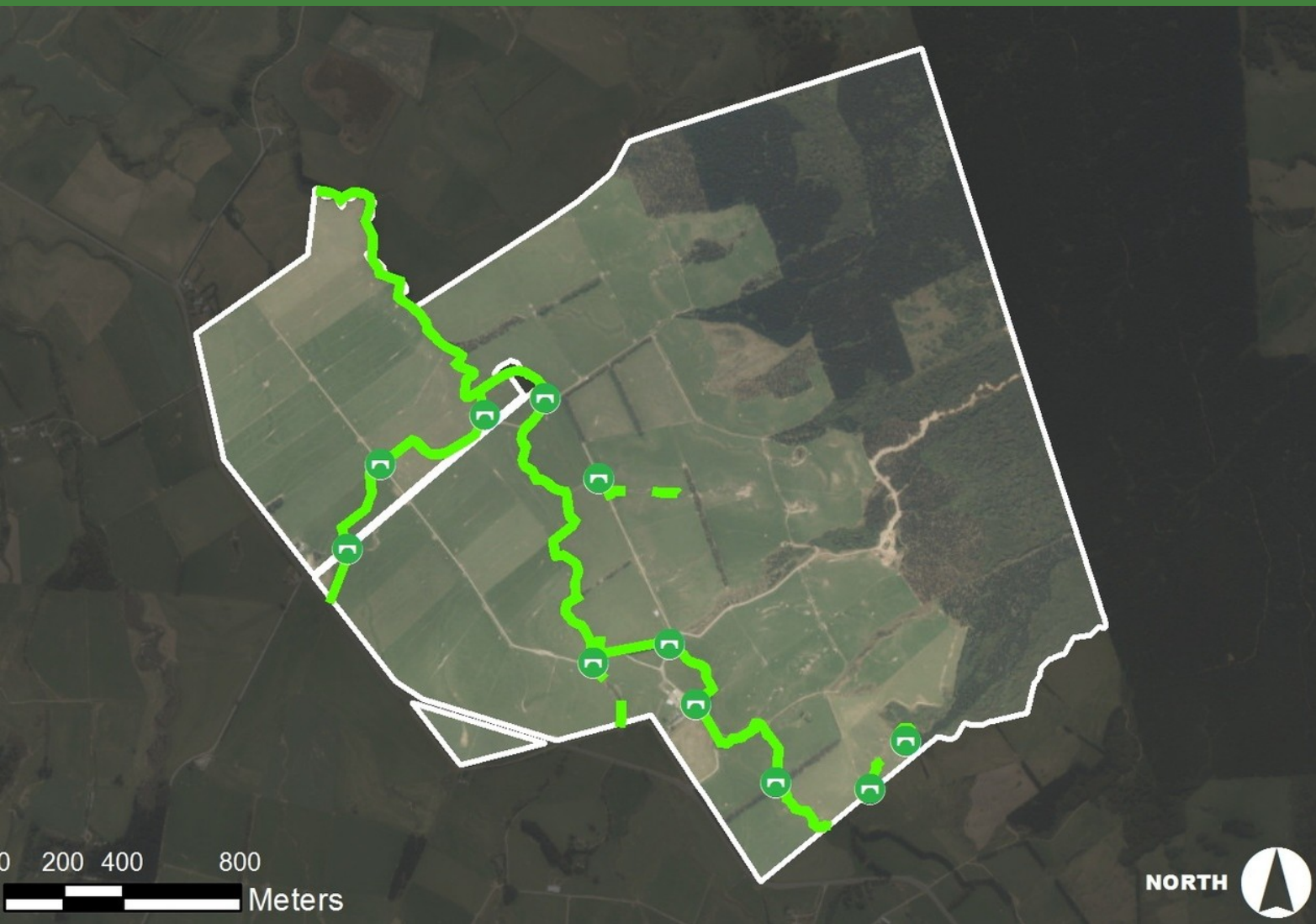







- | | | | |
|--|--|--|------------------------------------|
| | Accord Defined Stock Excluded Waterway | | Compliant Crossing |
| | Accord Defined Stock Not Excluded Waterway | | Non-Compliant Crossing |
| | Non-Accord Defined Stock Excluded Waterway | | Non-Compliant Non-Regular Crossing |
| | Non-Accord Defined Stock Not Excluded Waterway | | Dispensation Crossing |
| | Farm Boundary | | Dairy Shed |








MERRIVALE FARM OVERVIEW MAP

The map below presents the land on which the farming operations covered in this document occur and identifies some key points of interest. More detailed maps looking at specific environmental management topics are contained throughout the document.












-  Accord Defined Stock Excluded Waterway
-  Accord Defined Stock Not Excluded Waterway
-  Non-Accord Defined Stock Excluded Waterway
-  Non-Accord Defined Stock Not Excluded Waterway
-  Farm Boundary

-  Compliant Crossing
-  Non-Compliant Crossing
-  Non-Compliant Non-Regular Crossing
-  Dispensation Crossing
-  Dairy Shed



MERRIBURN SUMMARY OF OPEN ACTIONS

This table includes all open or ongoing actions that have been agreed as part of this Farm Environment Plan. They are organized by their target due date. Where an action has been identified as especially important an additional (Flag) icon may have been added.

CATEGORY	FEATURE TYPE & NAME	ACTION REQUIRED	TARGET DATE
 W1	Waterway Fencing - Foats Stream - Fencing	 Fence Foats Stream - 2m Buffer	1 Aug 20
 L3	Critical Source Area - Critical Source Areas - Overland Flow Paths	Extend Riparian Buffers - Critical Source Areas	1 Aug 21
 W2	Waterway Fencing - Fenham Creek Tributary Fencing	Fence off Fenham Creek (Central Section)	1 Aug 21
 W3	Waterway Fencing - Waterway Fencing - Other Areas	Fence Waterways - Other Areas	1 Aug 21
 W4	Waterway Fencing - Buckton Creek Tributary Fencing	Fence off Buckton Creek Tributary	1 Aug 21
 W6	Critical Source Area - Culvert - Lane Between Paddocks 11 & 19	Build Up Sides of Culvert (Sth Paddock 11)	1 Aug 21
 L4	Race Maintenance & Management - Lane Run-off - Paddock 12	Modify Lane / Move Gateway / Install riser	1 Feb 22
 W5	Critical Source Area - Stock Ford	Re-instate Bridge between Paddocks 5 and 6	1 Aug 22

MERRIVALE SUMMARY OF OPEN ACTIONS

This table includes all open or ongoing actions that have been agreed as part of this Farm Environment Plan. They are organized by their target due date. Where an action has been identified as especially important an additional (Flag) icon may have been added.

CATEGORY	FEATURE TYPE & NAME	ACTION REQUIRED	TARGET DATE
 L5	Culvert Management - Culvert (Paddock 101)	Unblock Culvert - Paddock 101	1 Aug 19
 L1	Critical Source Area - Fenham Creek Tributary (Northern Section)	Extend Riparian Margin (Fenham Creek North)	1 Aug 21
 L2	Critical Source Area - Critical Source Areas - Overland Flow	Extend Riparian Buffers - Critical Source Areas	1 Aug 21
 L6	Erosion Control - Gully Paddock 27	Exclude Stock from Hill Face (Paddock 27)	1 Aug 22
 L7	Critical Source Area - Crossing - Paddocks 6 & 7	Extend Riparian Margin (Drain Paddock 6 & 7)	1 Aug 22
 L4	Critical Source Area - Gully Paddocks 10 & 15	Exclude Stock from Erosion Areas (Pad 10 & 15)	1 Aug 25
 L8	Sediment Trap - Sediment Trap (Paddock 58)	Sediment Trap Installation (Paddock 58)	1 Aug 25
 L3	Critical Source Area - Gully Paddock 9	Re-fence Gully - Paddock 10	Ongoing



Phosphorus Overview (Merriburn & Merrivale)

DESCRIPTION:

Woldwide Runoff (WRO) is comprised of two farm in close proximity to each other. The Merrivale block is owned by WRO and the Merriburn block is leased. The properties have numerous waterways flowing through them and the topography is generally rolling with some area of flat land and some areas of steeper hill country. Due to the topography of the farms there are many critical source areas and these are likely to be the conduit for the majority of the farms phosphorus losses.

Overseer is not spatially explicit and is unable to take into account landscape features. It assumes a hydrological connection exists to second order streams and that there is a transport mechanism to get phosphorus to those streams (Gray, 2016).

The initiation and transport of phosphorus from the landscape requires conditions conducive to either overland or subsurface flow. In many situations, P loss to the stream is dominated by overland flow since soil will sorb most phosphorus from subsurface flow, unless, as with mole-pipe drainage, there is a direct conduit to the stream (McDowell et al. 2001). In general, more P is lost from soils with increasing slope, largely as particulate phosphorus.

Critical source areas are included in the model in general terms as the model was calibrated against catchment studies where losses from critical source areas would have occurred (Gray, 2016). On this basis, protecting critical source areas is a mitigation that needs to be applied outside of Overseer and will reduce phosphorus losses further from those modelled.

The estimated reductions in P referenced in this report are derived from the following calculations and research:

Phosphorus Loss – Culverts & Small Riparian Margin Increases

There will be a reduction in phosphorus loss from mitigations applied around culverts but there is no robust research information to base an estimate on, however experience indicates these areas can result in significant losses of sediment (and associated P) to water. On this basis estimated reductions in phosphorus have been referenced as >0 Kg/P. In addition to this, small increases in riparian margins to include areas of erosion or unproductive land have also been referenced as >0 Kg/P and are not included in the overall phosphorus reduction figure.

Phosphorus Loss – Critical Source Areas & Waterway Fencing

Overseer predicts 425kg of phosphorus will be lost to water from paddocks (effective area of 647ha). Assuming phosphorus loss occurs evenly over the effective area of the farm, then critical source areas and unfenced waterways and their associated catchments would account for 32% of the phosphorus loss from blocks on the property. This equated to 136kg of phosphorus.

Assuming a 30-40% reduction in phosphorus loss occurs through waterway fencing and the implementation of wider, vegetated riparian buffers (at locations where critical source areas enter waterways) and better management of critical source areas, then a further reduction of 55.8kg of phosphorus is estimated to occur beyond that modelled in Overseer (with all mitigations implemented). See Table 1 and 2 below.

Site and Fencing Length (m)	Catchment Area (% of Catchment)	P Loss (kg)	Mitigations (% Reduction)	Reduction in P Loss (kg)
W1 (L2) – 1900	78 (12)	51	40	20.5
W2 – 800	10.5 (1.6)	6.9	40	2.7
W4 – 420	4.5 (0.7)	2.9	40	1.2
W3– 960	12 (1.9)	7.9	40	3.2
L1 – 1000 (Merrivale)	7 (1.1)	4.6	30*	1.4
				29

Table 1 – Phosphorus Loss – Unfenced Waterways (*30% as already small riparian margin in place)

Site and Catchment Area	% of Total Catchment	P Loss (kg)	Mitigations (% Reduction)	Reduction in P Loss (kg)
L3 – 42.3ha	6.5	27.8	40	11.1
L4 – 2.5ha	0.3	1.6	40	0.66
L2 – 57ha (Merrivale)	8.8	37.4	40	15
				26.8

Table 2 – Phosphorus Loss – Critical Source Areas

The 40% reduction is based on research that shows management of critical source areas and vegetated buffers can reduce phosphorus loss by 38-59% (Figure 1). A lower range reduction figure of 40% has been used to try and ensure the impact of the proposed mitigations is not over estimated.

It is acknowledged by McDowell et al, 2005 in the original design of the Overseer sub-model that, in some areas, 90% of phosphorus loss may come from only 10% of the catchment area (Sharpley et al, 1999). McDowell states that defining and isolating critical source areas, combined with adaptive management over the farm is the best approach to decreasing phosphorus loss. For the purposes of this analysis, it has been assumed that phosphorus loss occurs evenly over the farm as there is insufficient data to quantify phosphorus losses to a critical source area level. This means mitigations centred on critical source areas are likely to have more of an impact than stated in this report and as such result in a larger reduction in phosphorus losses to those outlined above.

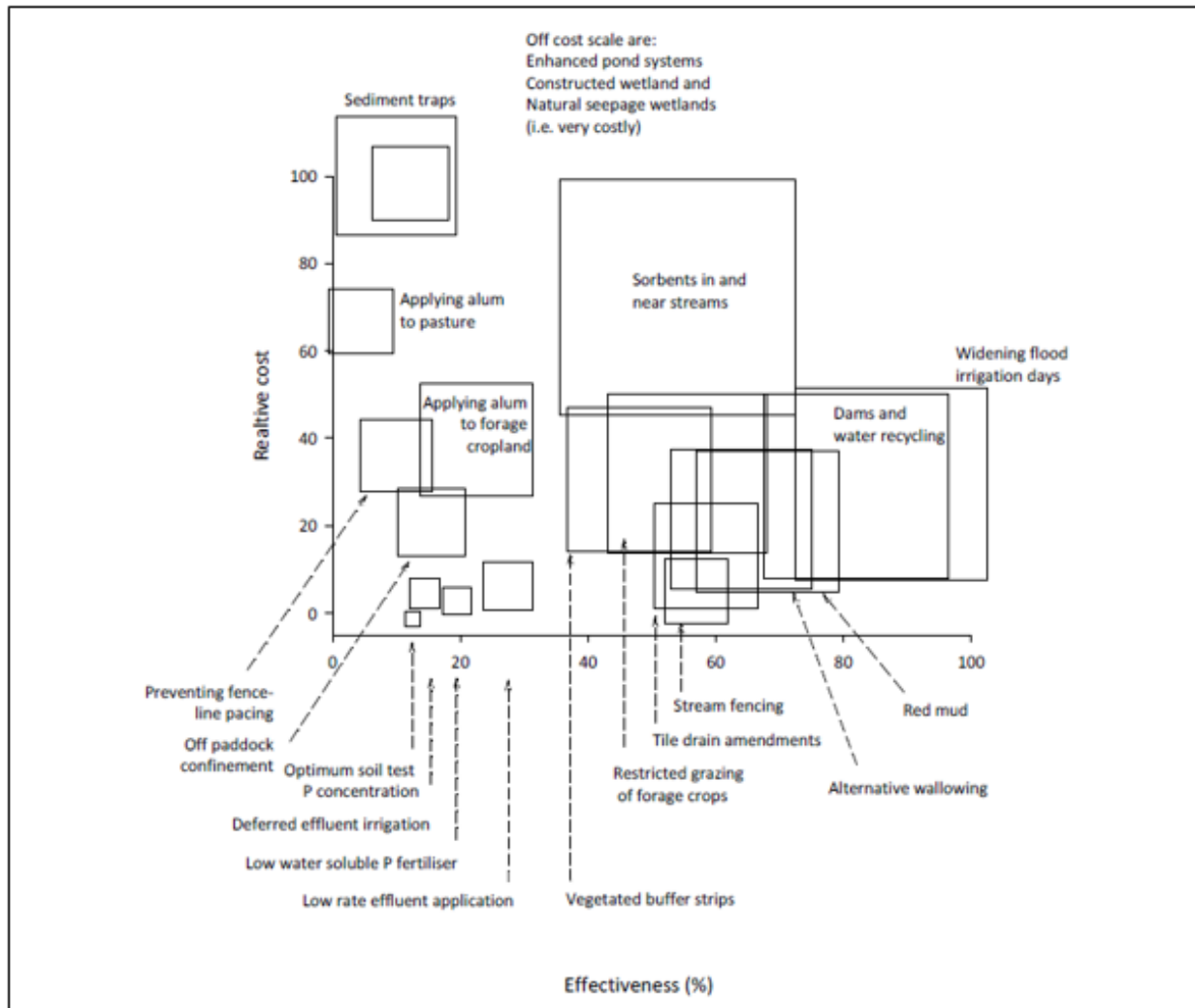


Figure 1 - Cost and effectiveness of strategies to mitigate phosphorus losses (McDowell et al, 2013)

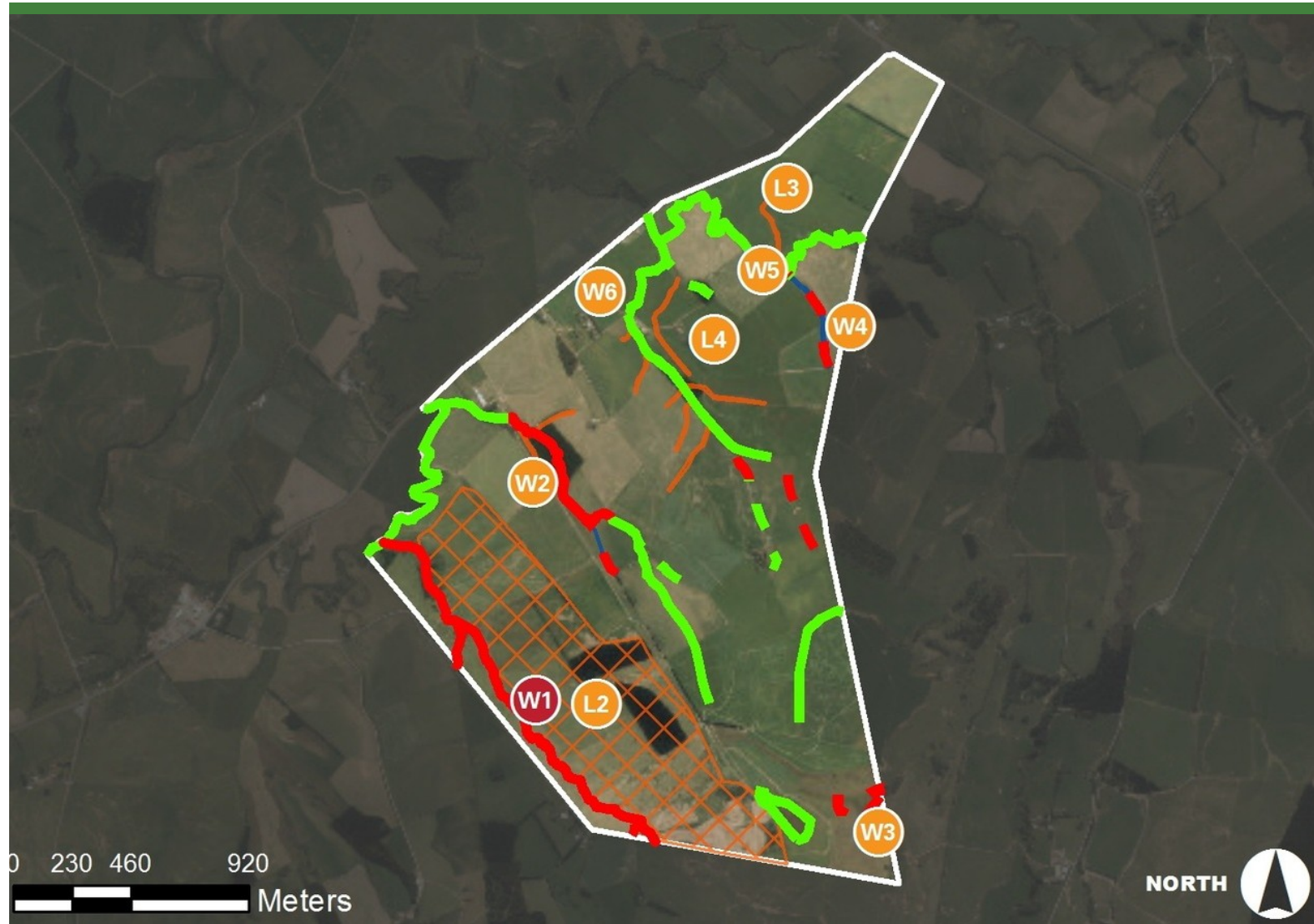
References:

- Fertiliser and Lime Research Centre. (2014). *Sustainable Nutrient Management Introductory Notes and Mastery Test*. Massey University.
- Gray, C.W., Wheeler, D.M. and McDowell, R. (2016). *Review of the phosphorus loss submodel in OVERSEER®*. Report prepared for OVERSEER® owners under AgResearch core funding contract A21231(A). AgResearch. Report RE500/2015/050.
- McDowell, R; Monaghan, R and Wheeler, D. (2005). *Modelling phosphorus losses from pastoral farming systems in New Zealand*, New Zealand Journal of Agricultural Research, 48:1, 131-141.
- McDowell, RW; Sharpley, AN; Beegle, D and Weld J. (2001). *Comparing phosphorus management strategies at the watershed scale*. Journal of Soil and Water Conservation 56: 306-315.
- McDowell, R; Wilcock, B and Hamilton, D. (2013). *Assessment of Strategies to Mitigate the Impact or Loss of Contaminants from Agricultural Land to Fresh Waters*. Report prepared for MfE. AgResearch. Report RE500/2013/066.
- Sharpley, AN; Gburek, WJ; Folmar G and Pionke, HB. (1999). *Sources of phosphorus exported from an agricultural watershed in Pennsylvania*. Agricultural Water Management 41: 77-89.

MERRIBURN RISK RATING

The map below shows the location of the risk areas identified on your farm. The Risk Rating presented here is a combined measure of the impact and likelihood of contamination occurring from each risk area.

- LOW
- MEDIUM
- HIGH
- SEVERE



L2 Critical Source Area - Western Hill Face - Critical Source Areas

L3 Critical Source Area - Critical Source Areas - Overland Flow Paths

L4 Race Maintenance & Management - Lane Run-off - Paddock 12

W1 Waterway Fencing - Foats Stream – Fencing

W6 Critical Source Area - Culvert - Lane Between Paddocks 11 & 19

W2 Waterway Fencing - Fenham Creek Tributary Fencing

W3 Waterway Fencing - Waterway Fencing - Other Areas

W4 Waterway Fencing - Buckton Creek Tributary Fencing

W5 Critical Source Area - Stock Ford



Critical Source Area

Western Hill Face - Critical Source Areas

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

The western hill face slopes down from the top of the farm into Foats Stream. There are a multitude of critical source areas along the hill face that will collect overland flow (and associated contaminants) from surrounding paddocks and direct it down to Foats Creek. Mitigations have already been discussed as part of the actions to fence Foats Creek and include having a wider riparian buffer where critical source areas enter Foats Stream. In addition to this, some of the steeper gullies where land is marginal for production purposes could be fenced off and planted in native vegetation.

Estimated Reduction in Phosphorus: See Foats Creek Fencing

IMAGES:





L3

Critical Source Area

Critical Source Areas - Overland Flow Paths

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

MEDIUM RISK RATING

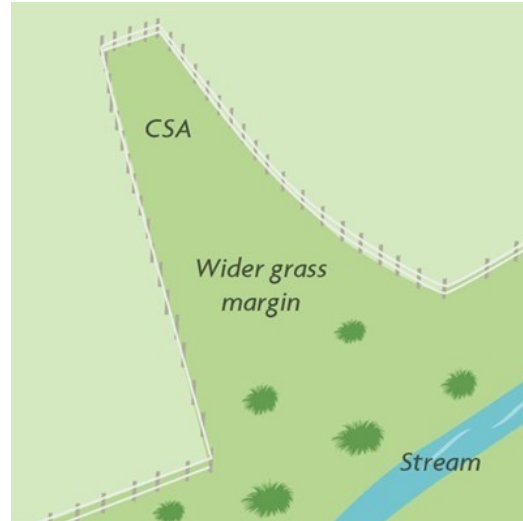
DESCRIPTION:

There are a number of critical source areas (overland flow paths) on the farm as identified on the map at the start of this section. Those shown are not an exhaustive list but form a guide to the areas that should be investigated further. Critical source areas are areas where water and contaminants off surrounding paddocks are concentrated and transported over the land surface to nearby waterways. Where these areas enter waterways a larger riparian buffer should be provided to filter sediment and associated contaminants (such as phosphorus). Buffers should be appropriately sized for the catchment area of the critical source area (normally 5m minimum). The approximate catchment area of the critical source areas identified (not including the western hill face) is 42.3ha.

Estimated Reduction in Phosphorus: 11 Kg/P

IMAGES:





OPEN ACTIONS:

Extend Riparian Buffers - Critical Source Areas

Extend the riparian buffers where critical source areas such as gullies and swales enter waterways. Buffers should generally be a minimum of 5m or larger depending on the size of the critical source area catchment. Buffer areas should be left in rank grass or planted in native grasses such as carex secta, red tussock and toetoe.

TARGET DATE: 1 Aug 2021

L4

Race Maintenance & Management

Lane Run-off - Paddock 12

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

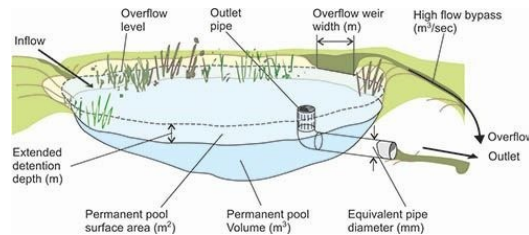
MEDIUM RISK RATING

DESCRIPTION:

Lane passing between paddocks 12 and 9. The lane slopes down to a stand of pine trees that has a small waterway running through it. Run-off from the lane and paddock 12 flow down to this point. The lane should be built up in this area to avoid run-off flowing into the adjacent creek. The gateway into paddock 12 could be moved out of the low lying area to a location further up the lane and a small bund installed in the low area with a riser and pipe under the lane into the creek. The bund will allow a small amount of water to pond, settling out sediment before discharging into the creek. This will avoid run-off from the paddock flowing across the lane, causing damage and picking up more contaminants.

Estimated Reduction in Phosphorus: 0.66 Kg/P (Paddock overland flow only)

IMAGES:





OPEN ACTIONS:

Modify Lane / Move Gateway / Install riser

Build up the lane so it slopes away from the creek and run-off flows into adjacent paddocks. The gateway into paddock 12 could be moved out of the low lying area to a location further up the lane and a small bund installed in the low area with a riser and pipe under the lane into the creek. The bund will allow a small amount of water to pond, settling out sediment before discharging into the creek.

TARGET DATE: 1 Feb 2022





WATERWAYS MANAGEMENT





- W1 Waterway Fencing - Foats Stream - Fencing
- W2 Waterway Fencing - Fenham Creek Tributary Fencing
- W3 Waterway Fencing - Waterway Fencing - Other Areas
- W4 Waterway Fencing - Buckton Creek Tributary Fencing


- W5 Critical Source Area - Stock Ford
- W6 Critical Source Area - Culvert - Lane Between Paddocks 11 & 19
- Accord Defined Stock Excluded Waterway
- Accord Defined Stock Not Excluded Waterway
- Non-Accord Defined Stock Excluded Waterway

 Non-Accord Defined Stock Not Excluded Waterway

 Compliant Crossing

 Non-Compliant Crossing

 Non-Compliant Non-Regular Crossing

 Dispensation Crossing

W1 Waterway Fencing
Foats Stream - Fencing

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

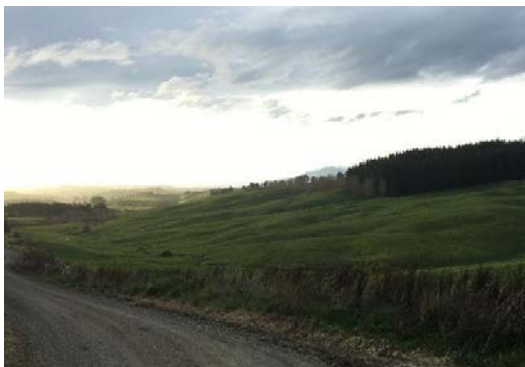
HIGH RISK RATING

DESCRIPTION:

A tributary of Foats Stream flows along the western side of the Merriburn Lease Block adjacent to Sim Road. Run-off from the steeper hill country to the east all flows down into the stream via a multitude of critical source areas. The stream is currently not fenced to exclude stock and there is no vegetated riparian margin. Fencing of the waterway will reduce phosphorus losses from the farm by preventing direct deposition into the stream by stock and filtering run-off from surrounding paddocks. Where critical source areas enter the stream it is recommended the riparian margin is maintained at 5m with a 2m rank grass margin maintained outside of these areas. Foats Stream Tributary has a catchment of approximately 78ha (located on the farm).

Estimated Reduction in Phosphorus: 20.5 Kg/P

IMAGES:



**OPEN ACTIONS:****▶ Fence Foats Stream - 2m Buffer**

Fence off the Foats Stream tributary running along the western side of the farm. It is recommended a 2m riparian buffer be established on both sides of the creek and this is extended to 5m in locations where swales or gullies (critical source areas) enter the stream.

TARGET DATE: 1 Aug 2020



Waterway Fencing

Fenham Creek Tributary Fencing

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

A tributary of Fenham Creek flows down from the higher elevations of the farm out to Otautau-Tuatapere Road. The upper and lower reaches of the Creek are permanently fenced to exclude stock (although the riparian buffers should be extended when adjacent paddocks are being winter grazed). In the middle section a small forestry block has recently been removed and the creek flows down through a gully to the bottom of the farm. Run-off from surrounding paddocks flows down into the stream via the general topography of the land and critical source areas.

Fencing of the central section of the waterway will reduce phosphorus losses from the farm by preventing direct deposition into the stream by stock and filtering run-off from surrounding paddocks. Where critical source areas enter the stream it is recommended the riparian margin is increased to 5m with a 3m rank grass margin maintained outside of these areas. The steeper sections of the hill could also be fenced off as these have minimal productive value. These areas could be planted in natives such as red tussock, toetoe, cabbage trees, broadleaf, etc to prevent erosion and add to the aesthetic and biodiversity values of the farm.

The unfenced section of the Fenham Creek Tributary has a catchment of approximately 10.5ha.

Estimated Reduction in Phosphorus: 2.7 Kg/P

IMAGES:





OPEN ACTIONS:

Fence off Fenham Creek (Central Section)

Fence off the central section of the waterway. Where critical source areas enter the stream it is recommended the riparian margin is increased to 5m with a 3m rank grass margin maintained outside of these areas. The steeper sections of the hill could also be fenced off as these have minimal productive value.

TARGET DATE: 1 Aug 2021

W3

Waterway Fencing

Waterway Fencing - Other Areas

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

Three additional areas have been identified as requiring fencing to exclude stock. Two of these areas have not been photographed and have been identified from aerial photography. These are small ephemeral waterways or gullies in paddocks 15, 16 and 17. Fencing these areas and maintaining a minimum 2m rank grass buffer will assist with the filtering of run-off from surrounding paddocks, including phosphorus. In addition to this there is a pond and wetland area in paddock 38 that should also be fenced to achieve similar benefits (see photos).

The overall catchment for these areas is approximately 12ha.

Estimated Reduction in Phosphorus: 3.2 Kg/P

IMAGES:



OPEN ACTIONS:

Fence Waterways - Other Areas
<p>Permanently fence off the waterways/gullies in paddocks 15, 16 and 17 as well as the wetland/pond area in paddock 38. A minimum 2m rank grass riparian margin should be established.</p>
<p>TARGET DATE: 1 Aug 2021</p>



Waterway Fencing

Buckton Creek Tributary Fencing

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

Small ephemeral waterway that runs between paddocks 6, 7 and 8. The waterway is not currently permanently fenced, however there is a variable riparian margin due to the slope of the bank and the fact the stream flows through a gully. Fencing will prevent stock access and allow rank grass to better establish within the riparian margin, assisting with filtering of run-off. It is recommended a permanent fence be installed at the top of the bank/gully.

The catchment area draining into the unfenced section of the Buckton Creek Tributary is approximately 4.5ha.

Estimated Reduction in Phosphorus: 1.2 Kg/P

IMAGES:



OPEN ACTIONS:

Fence off Buckton Creek Tributary

Permanently fence off the waterway that runs between paddocks 6, 7 and 8. There is a natural riparian buffer due to the topography of the land of approximately 2-4m. It is recommended the fence line follows this natural contour.

TARGET DATE: 1 Aug 2021



Critical Source Area
Stock Ford

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

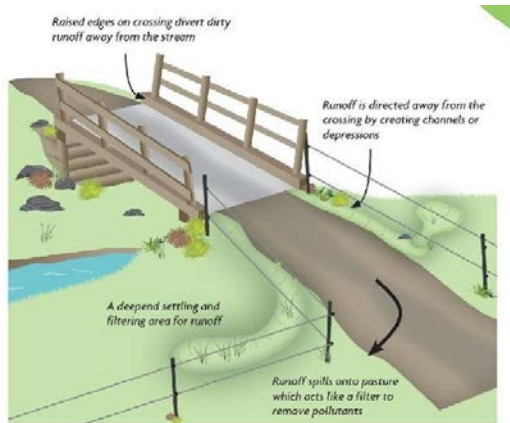
MEDIUM RISK RATING

DESCRIPTION:

Stock ford between paddocks 5 and 6. The ford is used to access paddocks to the east of the farm and replaces an unsafe bridge. Long term the use of the ford should be discontinued (due to the direct deposition of contaminants into the waterway) and a bridge re-instated.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:



OPEN ACTIONS:

Re-instate Bridge between Paddocks 5 and 6

Long term the use of the ford should be discontinued (due to the direct deposition of contaminants into the waterway) and a bridge re-instated.

TARGET DATE: 1 Aug 2022

W6

Critical Source Area

Culvert - Lane between Paddocks 11 & 19

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

Lane crossing the waterway to the south of paddock 11. The culvert has no raised sides which allows any runoff to flow off the side into the underlying water. Building up the sides of the culvert and directing run-off back into the paddock or at a minimum into a grass riparian area will assist with filtering sediment and associated phosphorus.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:





OPEN ACTIONS:

Build Up Sides of Culvert (Sth Paddock 11)

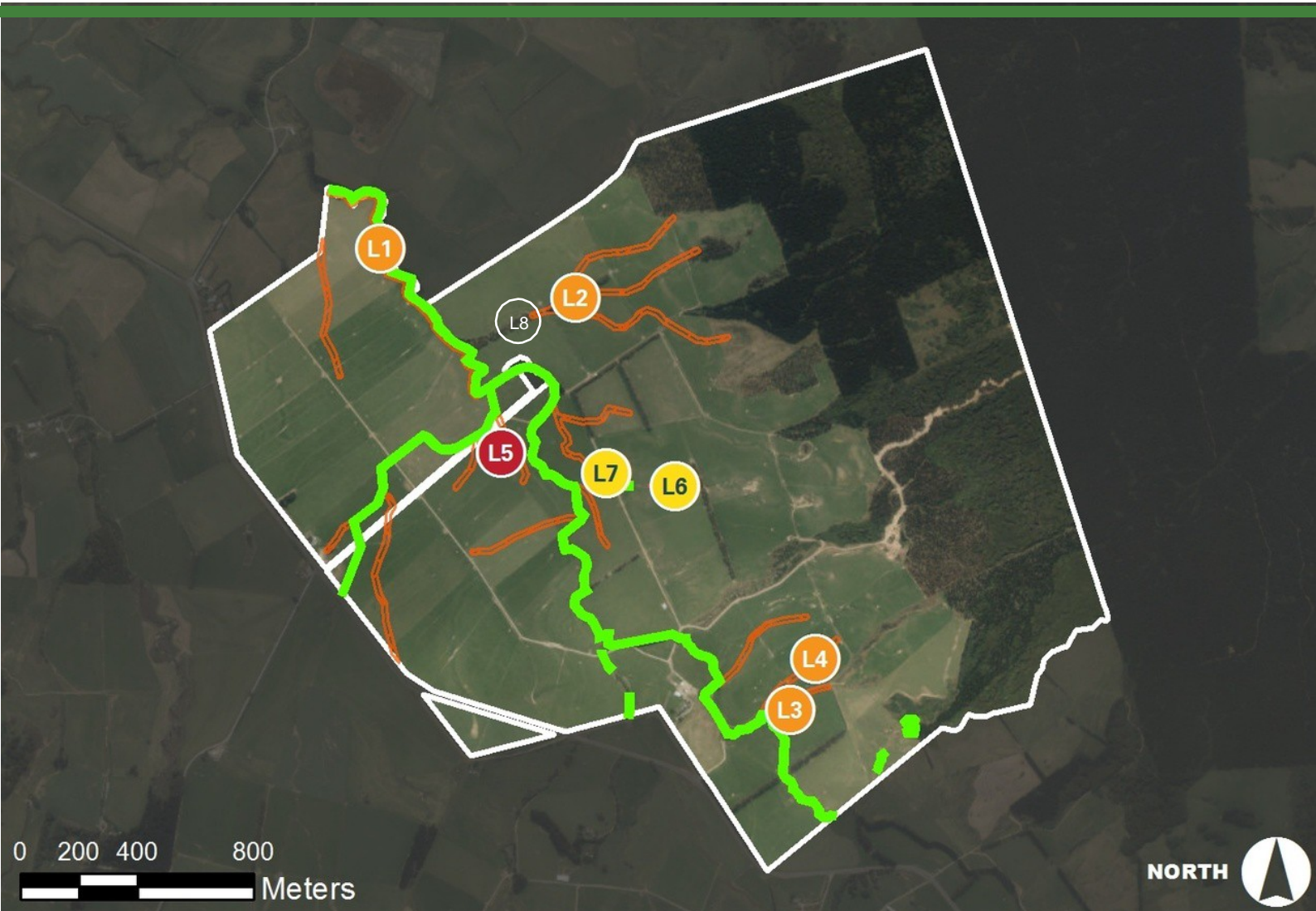
Build up the sides of the lane crossing the waterway to the south of paddock 11. This will prevent the direct deposition of sediment and associated phosphorus into the underlying waterway and allow for filtering via a grass buffer.

TARGET DATE: 1 Aug 2021

MERRIVALE RISK RATING

The map below shows the location of the risk areas identified on your farm. The Risk Rating presented here is a combined measure of the impact and likelihood of contamination occurring from each risk area.

● LOW
 ● MEDIUM
 ● HIGH
 ● SEVERE



- L1 Critical Source Area - Fenham Creek Tributary (Northern Section)
- L2 Critical Source Area - Critical Source Areas - Overland Flow
- L3 Critical Source Area - Gully Paddock 9
- L8 Sediment Trap - Sediment Trap (Paddock58)

- L4 Critical Source Area - Gully Paddocks 10 & 15
- L5 Culvert Management - Culvert (Paddock 101)
- L6 Erosion Control - Gully Paddock 27
- L7 Critical Source Area - Crossing - Paddocks 6 & 7



Critical Source Area

Fenham Creek Tributary (Northern Section)

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

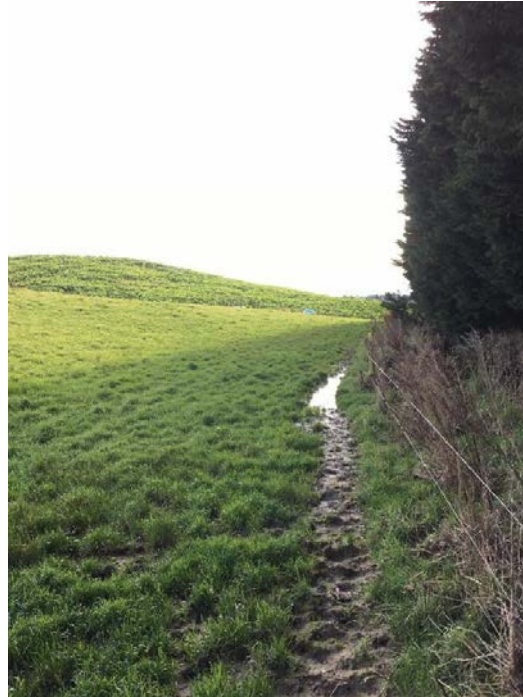
Northern end of the Fenham Creek Tributary flowing along the bottom of paddocks 88, 90, 92, 94, 96 and 98. The riparian buffer on the western side is approximately 1-1.5m yet there is a significant slope from the adjoining paddocks down to the creek. It is recommended that a 3m grass buffer is fenced off to allow for filtering of overland flow and associated contaminants off the surrounding paddocks. This is especially important when adjacent paddocks are being winter grazed (buffer should be temporarily extended to at least 5m).

The catchment flowing into the riparian buffer is approximately 7 ha over a length of approximately 1km.

Estimated Reduction in Phosphorus: 1.4 Kg/P

IMAGES:





OPEN ACTIONS:

Extend Riparian Margin (Fenham Creek North)

It is recommended that the riparian margin of the Fenham Creek Tributary flowing below paddocks 88, 90, 92, 94, 96 and 98 be extended to 3m and maintained in rank grass to.

TARGET DATE: 1 Aug 2021



Critical Source Area

Critical Source Areas - Overland Flow

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

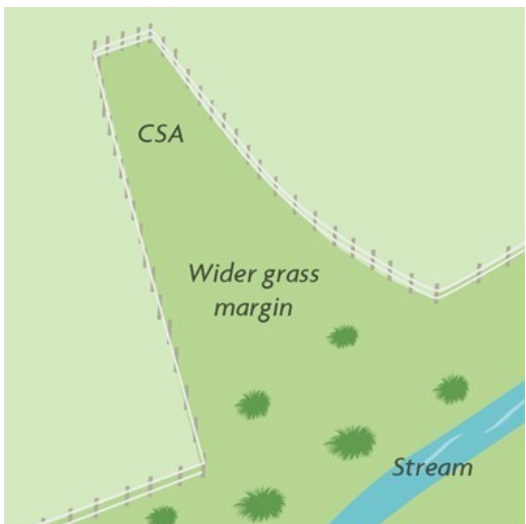
There are a number of critical source areas (overland flow paths) on the farm as identified on the map at the start of this section. Those shown are not an exhaustive list but form a guide to the areas that should be investigated further. The critical source areas across the farm are areas where water and contaminants off surrounding paddocks are concentrated and transported over the land surface to nearby waterways. Where these areas enter waterways a larger riparian buffer should be provided to filter sediment and associated contaminants (such as phosphorus). Buffers should be appropriately sized for the catchment area of the critical source area (normally 5m minimum).

The approximate catchment area of the critical source areas identified (not including specific areas identified elsewhere in this plan) is 57ha.

Estimated Reduction in Phosphorus: 15 Kg/P

IMAGES:





**OPEN ACTIONS:****Extend Riparian Buffers - Critical Source Areas**

Extend the riparian buffers where critical source areas such as gullies and swales enter waterways. Buffers should generally be a minimum of 5m or larger depending on the size of the critical source area catchment. Buffer areas should be left in rank grass or planted in native grasses such as carex secta, red tussock and toetoe.

TARGET DATE: 1 Aug 2021

L3

Critical Source Area

Gully Paddock 9

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

MEDIUM RISK RATING

DESCRIPTION:

The gully through paddock 9 has previously been fenced off (posts in place). This should be re-fenced to exclude stock. The area is of low production potential and having stock in this area is likely to cause pugging and sediment (and associated phosphorus) loss to the nearby waterway.

Estimated Reduction in Phosphorus: None - Area was previously fenced (will prevent an increase)

IMAGES:



OPEN ACTIONS:

Re-fence Gully - Paddock 10
Reinstate the fence around the gully in Paddock 10.
TARGET DATE: Ongoing

L4 Critical Source Area
Gully Paddocks 10 & 15

IMPACT OF CONTAMINATION



+



LIKELIHOOD OF CONTAMINATION

=

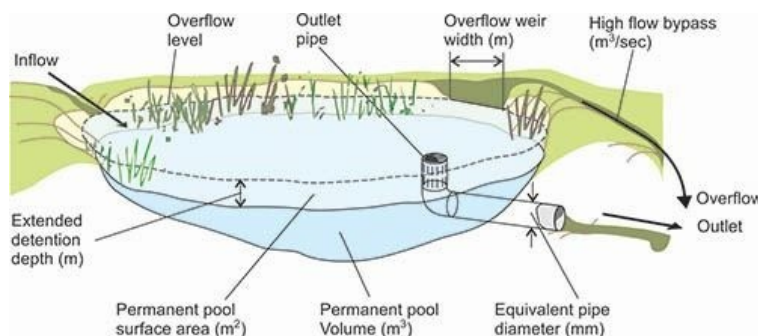
MEDIUM RISK RATING

DESCRIPTION:

Gully through the center of paddocks 10 and 15. In some places erosion is occurring. These areas should be fenced off to avoid further damage (consider planting with natives to stabilise). In addition to this, the gully is a conduit for overland flow down to the waterway at the bottom. Due to the location of the lane there is minimal opportunity to extend the riparian margin, however long term there is an opportunity to install a sediment trap at the bottom of the gully with an overflow into the creek.

Estimated Reduction in Phosphorus: None Attributed - Long Term Project

IMAGES:



OPEN ACTIONS:

Exclude Stock from Erosion Areas (Pad 10 & 15)

Fence off areas of the gully that are eroding. Long term consider the installation of a sediment trap at the bottom of the gully to remove sediment and associated phosphorus from overland flow off the adjacent paddocks.

TARGET DATE: 1 Aug 2025

L5

Culvert Management

Culvert (Paddock 101)

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

HIGH RISK RATING

DESCRIPTION:

The culvert joining paddocks 101 and 86 is blocked resulting in the build-up of water in the surrounding paddocks. This will result in contaminants including phosphorus and sediment being washed off the adjacent paddocks in the flood waters. Unblock the culvert and ensure it is adequately sized.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:



OPEN ACTIONS:

Unblock Culvert - Paddock 101

Unblock the culvert and ensure it is adequately sized.

TARGET DATE: 1 Aug 2019

L6

Erosion Control

Gully Paddock 27

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

LOW RISK RATING

DESCRIPTION:

Fencing of the gully/ephemeral waterway through paddock 27 has taken place. There is a section of hill above the fence line that is steep and suffers from erosion. This area has minimal productive value and could be fenced out to reduce sediment and subsequent phosphorus loss. Planting of the area in low natives such as red tussock and toetoe would help prevent erosion and filter run-off from the adjacent paddock.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:



OPEN ACTIONS:**Exclude Stock from Hill Face (Paddock 27)**

Extend the fence around the waterway flowing through Paddock 27 so it excludes stock out of the steep gully face that is beginning to erode. This area could be planted in red tussock and toetoe to help with stabilisation and for aesthetic reasons.

TARGET DATE: 1 Aug 2022



Critical Source Area

Crossing - Paddocks 6 & 7

IMPACT OF
CONTAMINATION



+



LIKELIHOOD OF
CONTAMINATION

=

LOW RISK RATING

DESCRIPTION:

Crossing and low point in paddock between paddocks 6 and 7. Water and contaminants can flow of this area into the adjacent drain. The riparian buffer should be moved out at the top of the drain to allow for filtration of overland flow. Maintain this area in rank grass.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:



OPEN ACTIONS:

Extend Riparian Margin (Drain Paddock 6 & 7)

Extend the riparian margin of the drain, below the crossing from Paddocks 6 & 7. Keep the riparian margin in rank grass to filter run-off from the adjacent crossing and paddocks.

TARGET DATE: 1 Aug 2022



Sediment Trap

Sediment Trap (Paddock 58)

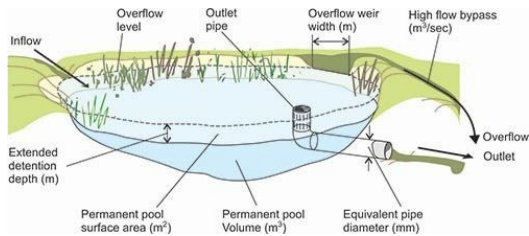
DESCRIPTION:

A number of critical source areas enter into a small waterway running down the side of the pine trees on the boundary of paddock 58. There is the potential to construct a sediment trap in the upper section of this area following the harvesting of the pine trees. This will assist in trapping sediment and any sediment bound phosphorus, preventing it reaching the main surface waterways on the farm. This is an aspirational, long term project and has not been factored into current phosphorus reduction figures.

Estimated Reduction in Phosphorus: Not Calculated - Long Term Project

IMAGES:





OPEN ACTIONS:

Sediment Trap Installation (Paddock 58)

There is potential to construct a sediment trap in the upper section of the pine plantation on the boundary of paddock 58, following the harvesting of the trees. This will assist in trapping sediment and any sediment bound phosphorus, preventing it reaching the main surface waterways on the farm. Long term, aspirational project.

TARGET DATE: 1 Aug 2025