CANTERBURY COAL MINE

TARA STREAM SEDIMENT RETENTION POND ECOLOGICAL ASSESSMENT

Prepared for Bathurst Resources Ltd

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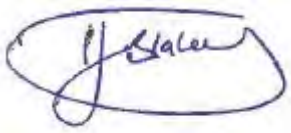
Reviewed by:	Tanya Blakely Principal / Senior Ecologist Boffa Miskell Limited	
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Cover photograph: Proposed sediment retention pond location, Tara Stream Wetland © Boffa Miskell, 2017

CONTENTS

1.0 Introduction 1

1.1 Scope 1

1.2 Report Structure 1

2.0 Project Description 3

3.0 Methodology 4

3.1 Site Investigation 4

3.2 Evaluation of the Level of Ecological Effects 5

4.0 Existing Environment 8

4.1 Ecological Context 8

4.2 Vegetation and Habitats 8

4.3 Birds 9

4.4 Lizards 10

5.0 Assessment of Ecological Value 10

5.1 Assessment against Ecological Significance Criteria 10

5.2 Assessment of Ecological Value 13

6.0 Assessment of Ecological Effects 14

6.1 Direct Effects 14

6.2 Indirect Effects 15

6.3 Summary of Assessment 17

7.0 Assessment Against Relevant Objectives and Policies 17

7.1 Section 3 - Objectives 17

7.2 Section 4 - Policies 18

7.3 Section 11 – Policies (Selwyn - Te Waihora) 19

8.0 Recommendations 19

9.0 Conclusions 22

10.0 References 24

Appendices

Appendix 1: Plant Species List

Appendix 2: Site Photos

1.0 Introduction

Bathurst Resources Limited (Bathurst) engaged Boffa Miskell Ltd (BML) to undertake a terrestrial ecology assessment for a resource consent application to Environment Canterbury (ECan) to construct and operate a sediment retention pond at the Canterbury Coal Mine in the Malvern Hills, Canterbury.

The proposed location of the sediment retention pond is within part of Tara Stream Wetland (Figure 1). Reducing the area of a wetland by the taking, use, damming or diversion (including draining) of water or other means, including vegetation clearance, cultivation, burning or earthworks, is a non-complying activity in the Canterbury Land and Water Regional Plan (ECan 2017) (Rule 5.162).

1.1 Scope

The scope of this report is confined to assessing the effects of:

- The proposal on terrestrial ecology values, including the wetland, its habitats and terrestrial fauna; and
- The construction and operation of the larger sediment retention pond that Bathurst is proposing to construct within this wetland.

The scope of this report does not include assessing the effects of, or consideration of:

- The proposal on aquatic ecology values (including freshwater fish, macro-invertebrates and other instream aquatic values);
- The construction and operation of a smaller sediment retention pond that has already been constructed and is outside of the wetland; and
- The potential adverse effects of acid mine drainage (AMD) and other mine related effects on ecological value on the wetland and Tara Stream.

1.2 Report Structure

This ecological assessment:

- Describes the project (Section 2);
- Outlines the methodology used to undertake the assessment (Section 3);
- Describes the existing environment (Section 4);
- Provides a summary of the ecological values (Section 55.0);
- Assesses the ecological effects of the project (Section 6);
- Assesses the proposal against the relevant legislation (Section 7); and
- Provides recommendations to avoid, remedy or mitigate effects (Section 8);
- Lastly, provides conclusions (Section 9).

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Data Sources:

Projection: NZGD 2000 New Zealand Transverse Mercator

Legend

- Proposed Sediment Retention Pond
- Water monitoring stations
- Wetland

Canterbury Coal Mine

Location Map

Date: 24 August 2017 | Revision: 0

Plan prepared for Bathurst Resources Ltd by Boffa Miskell Limited

Project Manager: **scott.hooson@boffamiskell.co.nz** | *Drawn:* SHo | *Checked:* BMc

Figure 1

2.0 Project Description

Bathurst is proposing to construct and operate two sediment retention ponds at its Canterbury Coal Mine. The smaller sediment retention pond, which is upslope of the second, larger pond and not within Tara Stream Wetland, has already been constructed[1]. The second, larger sediment retention pond is within part of the Tara Stream Wetland (Figures 1 and 2).

The proposal will involve using an excavator to remove the existing wetland vegetation and construct a sediment retention pond (the larger pond shaded blue in Figure 2) and associated bund (shaded green in Figure 2). This, larger pond and the existing sediment retention pond, are required to provide further sediment treatment of runoff from the mine site before it is discharged under existing consents at discharge point CCO2, located immediately downstream of the proposed pond site. The total area of the larger pond and its bund is approximately 850 m^2 (Landpro 2017).

We understand that the aspect and topography of the mine, and the slopes above the proposed sediment retention ponds, as well as the location of the existing discharge point, mean that alternative locations for the sediment retention ponds are not feasible (Eden Sinclair - Bathurst Resource Geologist/Mine Planner *pers. comm*. 2017). Not installing the sediment retention pond will result in ongoing sediment discharges into the wetland and Tara Stream, and is not an option we recommended.

[1] However, a high intensity rain event occurred prior to our site investigation, resulting in localised slope failure above this pond, which filled it with sediment. The smaller, existing pond will need to be re-excavated (Eden Sinclair *pers. comm*. 2017).

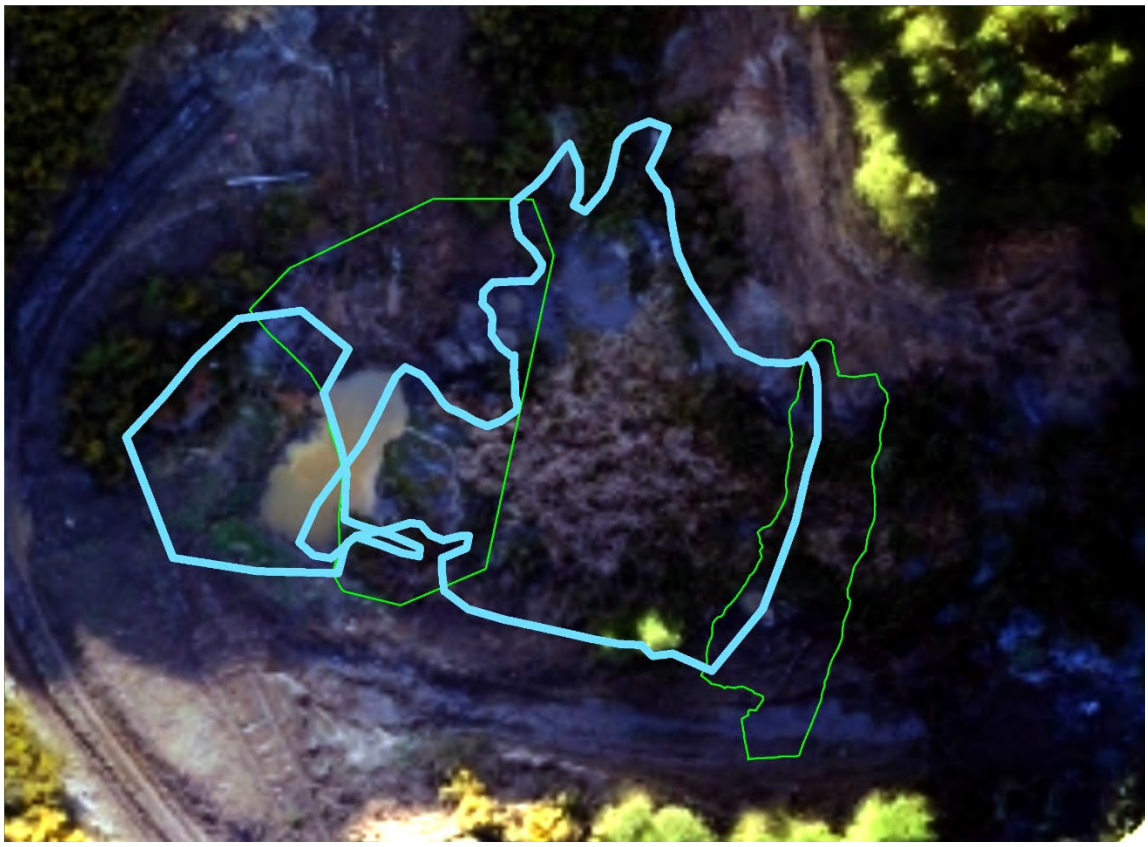

Figure 2: The approximate locations of the sediment retention ponds (blue outline) and associated bunds (green outline). The smaller sediment retention pond, which had already been constructed at the time of the site investigation, is on the left. The larger pond, which is the subject of this assessment, is on the right (spatial data sourced from Bathurst).

3.0 Methodology

3.1 Site Investigation

A site investigation was carried out on 21 August 2017 by Scott Hooson (Principal/Senior Ecologist, Boffa Miskell) and Katie Noakes (Graduate Ecologist, Boffa Miskell).

The vegetation and habitats that will be impacted by the construction of the proposed sediment retention pond were surveyed. Notes were made on the vegetation communities and habitats present within, and surrounding, the proposed construction footprint. All plant species observed in each of the vegetation communities, and all indigenous fauna sighted or heard during the site investigation were recorded. Photographs were taken and a handheld Garmin Global Positioning System (GPS) was used to mark points of interest and vegetation community boundaries.

Prior to the survey a high intensity rain event had caused significant erosion and localised slope failure above the smaller (constructed) sediment retention pond. This had resulted in substantial downstream sediment deposition (up to 30 cm in places), including throughout the wetland within

the footprint of the proposed sediment retention pond. This sediment was covering much of the ground tier vegetation within the wetland at the time of the site investigation. A consequence of this is that the sediment cover may have affected the survey results because some ground tier species may have been present but were not visible.

Where possible, common names for plants and animals have been used in this report. Where a species does not have a common name, or its common name cannot be used to identify the species without ambiguity, scientific names have been used. The common and scientific names of the plants mentioned in this report are listed in Appendix 1.

3.2 Evaluation of the Level of Ecological Effects

The methodology for assessing the significance of the ecological effects associated with the proposed sediment retention pond was based on Regini (2002) and the Environment Institute of Australia and New Zealand's (EIANZ) Draft Ecological Impact Assessment Guidelines (EIANZ 2015).

In summary, this method required an assessment of:

- Ecological significance using the criteria listed in Appendix 3 of the Canterbury Regional Policy Statement (CRPS) (ECan 2013);
- Ecosystem/habitat and species values as described in Table 1 and Table 2, Section 3.2.1;
- The magnitude of impact using the criteria listed in
- Table ***3***, Section 3.2.2; and
- The level of ecological effect using the decision matrix presented in Table 4, Section 3.2.3, which determines the level of effect based on the ecological value of the ecosystems or species assessed and the magnitude of impact.

3.2.1 Assigning ecological value

Ecological significance was assessed following Policy 9.3.2 of the CRPS, using the criteria listed in Appendix 3 of the CRPS. The draft guidelines for the application of the CRPS criteria (Wildland Consultants, 2013) were used to assist interpretation of the criteria. Following Policy 9.3.1 (3) the site was considered to be significant under the criteria if it met one or more of the criteria.

Under the significance criteria in Appendix 3 of the CPRS indigenous vegetation and habitats of indigenous fauna are either significant or not. However, to use the significance of ecological effects matrix (as described in Regini 2002 and EIANZ 2015), a score of ecological value is also required.

Assigning Value to Vegetation and Habitats

For vegetation and habitats, we have assigned ecological value based on the determining factors outlined in (Table 1) (from EIANZ 2015).

Table 1: *Assigning value to vegetation or habitats for assessment purposes.*

Determining Factors	Assigned Value
Supporting more than one national priority type[2]	Very High
Supporting one national priority type or naturally uncommon ecosystem[3]	High
Locally rare or threatened, supporting no threatened or at risk species	Moderate
Nationally and locally common, supporting no threatened or at risk species	Low

Assigning Values to Species

For individual plant and animal species, the national threat status was used for scoring of ecological value (Table 2).

Table 2: *Assigning value to species for assessment purposes (from EIANZ 2015).*

Threat category (from Townsend et al. (2008))	Assigned Value
Threatened – Nationally Critical, Endangered or Vulnerable	Very High
Nationally At Risk – Declining	High
Nationally At Risk – Recovering, Relict or Naturally Uncommon	Moderate - High
Not Threatened, locally uncommon/rare	Moderate
Not Threatened, common locally	Low

3.2.2 Assessing magnitude of impact

Once ecological value had been determined the magnitude of the impact on ecological values was assessed. The magnitude of the impact was a measure of the extent, or scale, of the effect, its duration, and the degree of change that it will cause. A typical scale of magnitude ranged from very high to negligible, as shown in

Table 3: *Criteria for describing magnitude of effect (from EIANZ 2015)*

Magnitude	Description
Very High	• Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR • Loss of a very high proportion of the known population or range of the element/feature
High	• Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR • Loss of a high proportion of the known population or range of the element/feature

[2] Refer MFE & DOC (2007a, 2007b): Protecting Our Places.

[3] Refer to Williams et al. 2007 and Holdaway et al. (2012).

Moderate	• Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR • Loss of a moderate proportion of the known population or range of the element/feature
Low	• Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR • Having a minor effect on the known population or range of the element/feature
Negligible	• Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR • Having negligible effect on the known population or range of the element/feature

3.2.3 Assessing level of ecological effect

The overall level of the effect was determined by applying the following matrix (Table 4), which combined the ecological value of the site or species (Table 1 and Table 2) and the magnitude of impact (Table 3).

Table 4. *Criteria for describing level of effect (From EIANZ 2015)*

		ECOLOGICAL VALUE			
		Very High	**High**	**Moderate**	**Low**
MAGNITUDE	**Very High**	Very High	Very High	High	Moderate
	High	Very High	Very High	Moderate	Low
	Moderate	Very High	High	Low	Very Low
	Low	Moderate	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

The EIANZ (2015) guidelines note that the level of effect can be used as a guide to the extent and nature of ecological response (e.g. mitigation) required.

For example:

- 'Very high' and 'High' represent a high level of effect on ecological or conservation values and warrant avoidance and / or extremely high intensity mitigation and remediation actions. Biodiversity offsetting should be considered where these adverse effects cannot be avoided.
- 'Moderate' represents a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be mitigated through avoidance, design, or extensive appropriate mitigation actions.
- 'Low' and 'Very low' should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking mitigation into consideration, then it is essential that prescribed mitigation is carried out to ensure Low or Very low level effects.
- 'Very low' level effects can generally be considered to be classed as 'not more than minor' effects.

4.0 Existing Environment

4.1 Ecological Context

The site is within the Whitecliffs Ecological District (ED). In terms of the Threatened Environment Classification[4], it is on an Acutely Threatened land environment (E3.2b), where <10% indigenous vegetation remains on this land environment nationally (Walker et al., 2015).

The original and existing vegetation of the ED is described below (paraphrased from Harding (2009)).

The original vegetation of the Whitecliffs ED was dominated by mountain beech forest in montane areas. Low-altitude areas likely consisted of beech-podocarp and podocarp-hardwood forest. Mixed hardwood forest, dominated by narrow-leaved houhere and broadleaf, with occasional matai and mountain totara, were also present. Scrub and tussockland communities would also have been present, with red tussockland and short tussockland occupying moraine surfaces in the west of the region. Short tussockland, matagouri shrubland, and tree-land would have occupied glacial outwash surfaces (Harding, 2009).

Burning, logging, development of farmland, and in some cases mining, has substantially modified the vegetation of the ED. Introduced plants, notably gorse and broom, are also present throughout the area with relatively extensive areas of induced tall tussockland and scrub being present at some hill country sites (Harding 2009).

A small proportion (c. 3%) of the Whitecliffs ED is protected. Important protected areas are the Torlesse Forest, Thirteen Mile Bush, and the Rockwood Conservation Area.

The Waianiwaniwa catchment provides important habitat for Canterbury mudfish, which have a conservation status of Threatened - Nationally Critical (Goodman et al. 2014). The catchment is the most important refuge known for the conservation of this species (Harding et al. 2007).

4.2 Vegetation and Habitats

At the time of our site investigation earthworks had already been undertaken around the margins of the proposed sediment retention pond. These earthworks had removed the terrestrial vegetation around the margins of the proposed pond. From aerial imagery, and the inspection of the remaining adjacent terrestrial vegetation, it appears the vegetation that had been removed was gorse scrub, as well as a small area of radiata pine forest in the south-eastern corner of the construction footprint. Although some terrestrial (dryland) indigenous plant species are present in these exotic communities (refer to Appendix 1), the vegetation that had already been cleared is of low ecological value and outside the wetland extent. These terrestrial vegetation communities are not discussed or assessed further in this report.

The wetland within the proposed sediment retention pond (Photo 1, Appendix 2) is a palustrine swamp that supports the following vegetation types:

- Lowland flax flaxland (indigenous vegetation community);

[4] The Threatened Environment Classification is a combination of three national databases: Land Environments of New Zealand, Land Cover Database (Version 2) and the Protected Areas Network. The Threatened Environment Classification shows how much indigenous vegetation remains within land environments, how much is legally protected, and how the past vegetation loss and legal protection are distributed across New Zealand's landscape.

- Raupō reedland (indigenous vegetation community); and
- Tall fescue/Yorkshire fog-creeping bent grassland (exotic vegetation community).

The wetland vegetation downstream of the construction footprint (potential receiving environment) is:

- Lowland flax flaxland (indigenous vegetation community) (Photo 1, Appendix 2).

These wetland vegetation communities are described below and full species lists are provided in Appendix 1.

4.2.1 Lowland flax flaxland

This vegetation type (Photo 2, Appendix 2) is relatively intact and indigenous vegetation cover is high (approximately 90%). It is characterised by lowland flax, which is the dominant canopy cover, frequent purei and raupō and occasional toetoe and sharp spike sedge. Other less abundant indigenous plants are swamp kiokio, wiwi, water fern, *Carex geminata* and mingimingi. The exotic species; gorse, tall fescue, creeping bent Yorkshire fog, iris-leaved rush, cleavers, catsear, lotus and creeping buttercup are all infrequent.

4.2.2 Raupō reedland

This vegetation type (Photo 3, Appendix 2) is also relatively intact with a high cover of indigenous vegetation (approximately 95%). Indigenous species diversity is low, but this is fairly typical of raupō reedlands. Raupō is the dominant canopy cover, but purei is also common. Other indigenous species; wiwi, toetoe and swamp kiokio are all scarce. Exotic species including gorse, creeping buttercup, and the grasses tall fescue, creeping bent and Yorkshire fog are present, but are very uncommon.

4.2.3 Tall fescue/Yorkshire fog-creeping bent grassland

This vegetation type only occupies a small area of the wetland within the construction footprint and at the time of the site investigation was largely covered in recently deposited sediment (Photo 4, Appendix 2). It is substantially more modified than the other vegetation types and is almost entirely dominated by the exotic grasses tall fescue, creeping bent and Yorkshire fog. The exotic herbs cleavers and creeping buttercup, and a small number of seedlings of the indigenous sedge purei were also recorded amongst the grassland.

4.3 Birds

No indigenous birds were recorded within the construction footprint during the site investigation. A previous ecological survey of a 1.1 km section of this wetland downstream of the site, between water monitoring station CC02 and the lower water monitoring station (CC03) (Figure 1) (Boffa Miskell 2017) found that the wetland generally provides poor habitat for wetland birds. Several terrestrial species were recorded in the riparian vegetation and adjoining pine trees during the previous survey, including several exotic bird species and four indigenous species; bellbird, grey warbler, fantail and silvereye.

Other indigenous bird species that could use the wetland habitat within the construction footprint are pukeko, swamp harrier, kingfisher and welcome swallow.

4.4 Lizards

There was no lizard habitat within the proposed sediment retention pond footprint.

5.0 Assessment of Ecological Value

This section assesses the values of the site and its flora and fauna, firstly in terms of its ecological significance under the criteria in Appendix 3 of the CRPS, and then using the tools outlined in the Draft Ecological Impact Assessment Guidelines (EIANZ 2015).

5.1 Assessment against Ecological Significance Criteria

The site (the area potentially affected by the proposed sediment retention pond) has been assessed against the ecological significance criteria in Appendix 3 of the CRPS (Table 5). Because the wetland area that will be impacted by the proposed sediment retention is part of the wider Tara Stream Wetland, and is physically and hydrologically connected to it, the ecological significance of the site has been assessed in the context of the wider wetland area.

Table 5: *Ecological Assessment of the area potentially affected by the construction and operation of the proposed sediment retention pond against the CRPS (ECan 2013) criteria for determining significant indigenous vegetation and significant habitat of indigenous biodiversity. Italicised text is from Appendix 3 of the CRPS.*

Criterion	**Criterion met?**	
Representativeness		
1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type, or represent all that remains of indigenous biodiversity in some areas.	Yes	The wetland is representative of a riverine swamp in the ED. The lowland flax flaxland and raupō reedland vegetation communities are relatively intact and indigenous vegetation cover is high. The wetland within the proposed construction footprint is also part of, and continuous with, the Tara Stream Wetland, which is significant under this criterion.
2. Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.	No	The wetland within the proposed construction footprint is part the Tara Stream Wetland. At approximately 1.4 ha, this wetland is of a moderate size relative to other wetlands of this type in the Whitecliffs Ecological District, but is not large enough to be significant under this criterion.
Rarity/Distinctiveness		

3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.	Yes	Wetland ecosystems have been reduced to less than 20% of their former extent at the regional, freshwater biogeographic unit, and national scales. Ausseil et al. (2008) estimate that wetlands have been reduced to 10.6% of their original extent in the Canterbury Region and 7.0% in the Canterbury freshwater biogeographic unit. The wetland is also on an Acutely Threatened land environment (E3.2b) where <10% indigenous vegetation is left on this land environment nationally (Walker et al., 2015).
4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within the relevant ecological district.	No?	The wetland is not known to support an indigenous species that is threatened, at risk, or uncommon, nationally or within the ED. Canterbury mudfish (Threatened – Nationally Critical) have been found in farm ponds downstream of the wetland, and further down the Tara Stream catchment. Previous surveys have not detected mudfish in the upper reaches of Tara Stream and it is unlikely they are present within the site. Waterways Consulting Ltd (2016) stated that it is reasonable to conclude that the upstream limit for Canterbury mudfish is somewhere within the farmland reach of Tara Stream (i.e. downstream of the wetland).
5. The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.	No	The site is not known to contain indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.
6. Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.	No	The site does not support indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors. It is typical of lowland swamps in the ED (and Region).
Diversity and Pattern		
7. Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition	No	The site contains a low number of indigenous habitats, is not part of a sequence of different indigenous vegetation types, and does not have

reflecting the existence of diverse natural features or ecological gradients.		changes in species composition reflecting ecological gradients. The diversity of indigenous taxa is low, but generally typical of these vegetation communities.
Ecological Context		
8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.	Yes	The wetland does not provide or contribute to an important ecological linkage or network. It is narrow, surrounded by plantation forestry and poorly buffered. It is likely to play a role in buffering downstream aquatic values (including Nationally Critical Canterbury mudfish habitat) by reducing peak flood flows and suspended sediment. Lowland flax provides a seasonal food source for nectar feeding species such as bellbirds, but this ecological function is unlikely to be important in the context of the wider landscape.
9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.	No	The site is an isolated riverine swamp and marsh wetland of moderate size that does not play an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.
10. Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.	No?	The site is not known to provide important habitat for indigenous species. Canterbury mudfish (Threatened – Nationally Critical) have been found in farm ponds downstream of the wetland, and further down the Tara Stream catchment. Previous surveys have not detected mudfish in the upper reaches of Tara Stream and it is unlikely they are present within the site.

5.1.1 Summary of Ecological Significance

The area of wetland within the proposed sediment retention pond footprint, downstream of the construction footprint, is ecologically significant under the representativeness (criterion 4), rarity/distinctiveness (criterion 3) and ecological context criteria (criterion 8) in Appendix 3 of the CRPS.

5.2 Assessment of Ecological Value

5.2.1 Wetland Vegetation and Habitats

There is wetland vegetation within the proposed sediment retention pond footprint that is continuous with, and part of the larger Tara Stream wetland that extends downstream from the location of the proposed sediment retention pond. This wetland a riverine swamp as defined by Johnson and Gerbeaux (2004). This wetland formerly extended further up a tributary of Tara Stream but has been infilled by mining operations. The wetland and the indigenous vegetation it supports is naturally occurring.

The indigenous lowland flax flaxland and raupō reedland vegetation within the proposed sediment retention pond, and the lowland flax flaxland downstream of the construction footprint is:

- Indigenous vegetation on land environments that have <20% indigenous vegetation cover (National Priority 1); and
- Indigenous vegetation associated with wetlands (National Priority 2).

Because these indigenous lowland flax flaxland and raupō reedland vegetation communities meet two of the national priority types (refer to Table 1), following the Draft EIANZ guidelines (EIANZ 2015) they are of *very high* ecological value.

The tall fescue/Yorkshire fog-creeping bent grassland within the construction footprint is an exotic vegetation community of low ecological value and is not considered further in this assessment.

5.2.2 Birds

The habitats potentially affected by the construction and operation of the proposed sediment retention pond provide limited habitat for small numbers of common and widespread indigenous bird species. All of these species have a threat classification of Not Threatened, and are common locally. Their ecological value is low.

5.2.3 Lizards

There is no habitat for lizards within the construction footprint.

5.2.4 Summary of Ecological Value

Table 6 summarises our assessment of ecological value based on the EIANZ guidelines (EIANZ 2015).

Table 6: *Summary of ecological and biodiversity values assigned to flora and fauna within the site.*

		Overall Score
Indigenous Wetland Vegetation and Habitats		
Lowland flax flaxland and raupō reedland	Meet two of the national priorities for protection (MfE and DOC 2007a). Indigenous vegetation associated with: 1) land environments that have 20% or less remaining in indigenous cover; and 2) areas of indigenous vegetation associated with wetlands.	Very High
Indigenous Wetland Vegetation and Habitats (Downstream Receiving Environment)		
Lowland flax flaxland outside of the construction footprint	Meets two of the national priorities for protection (MfE and DOC 2007a). Indigenous vegetation associated with: 1) land environments that have 20% or less remaining in indigenous cover; and 2) areas of indigenous vegetation associated with wetlands.	Very High
Indigenous Fauna		
Indigenous bird species	Not threatened and common locally	Low

6.0 Assessment of Ecological Effects

6.1 Direct Effects

6.1.1 Indigenous Wetland Vegetation and Habitats

The construction of the proposed sediment retention pond will result in the permanent removal of approximately 540 m^2 of wetland vegetation.

Of this approximately 475 m^2 is indigenous wetland vegetation comprised of:

- 215 m^2 of lowland flax flaxland; and
- 260 m^2 of raupō reedland.

In relation to the wider Tara Stream Wetland (from its upper boundary at the proposed sediment retention pond, and the lower water monitoring station (CC03); Figure 1), the indigenous wetland vegetation communities that would be removed represents:

- 3.5% of the approximately 6,050 m^2 of lowland flax flaxland; and

- All (100%) of the raupō reedland (although raupō is also present as a component of the lowland flax flaxland vegetation); and
- 3.9% of the approximately 1.4 ha Tara Stream wetland.

The construction of the sediment retention pond will result in the loss of a small proportion of the flaxland within the wetland, and the ecological district. The magnitude of the loss has been assessed as low in this context. The level of ecological effect is *moderate* (a *low* magnitude impact on a *very high* ecological value).

The construction of the sediment retention pond will result in the loss of all the raupō reedland from the wetland (although raupō is also present as a component of the lowland flax flaxland vegetation). At the scale of the ecological district the magnitude of this loss is low. Overall the magnitude of the effect is low and the level of ecological effect is *moderate* (a *low* magnitude impact on a *very high* ecological value.

A moderate level of ecological effect on these indigenous wetland vegetation communities requires mitigation.

Construction of the sediment retention ponds will create a small area of open water for some indigenous fauna such as waterfowl (i.e. paradise ducks), but the small size and modified nature of this pond means it will provide very low quality habitat.

6.1.2 Birds

The habitats potentially affected by the construction and operation of the proposed sediment retention pond provide limited habitat for small numbers of common and widespread indigenous bird species. The magnitude of the loss of this habitat is *low* and the level of ecological effect is *very low* (a *low* magnitude of impact on *low* ecological values).

6.1.3 Lizards

There is no habitat for lizards within the construction footprint and no effects on lizards are expected.

6.2 Indirect Effects

6.2.1 Fauna (Disturbance)

Noise and increased activity associated with the construction of the proposed sediment retention pond has the potential to cause disturbance to fauna in the vicinity of the site. However, the duration of the construction works is temporary and the fauna in the vicinity of the wetland are largely exotic birds and common and widespread indigenous birds. It is unlikely that there are lizards in the area that will be affected by disturbance effects.

The magnitude of the indirect effect of disturbance on fauna has been assessed as *negligible* and the level of ecological effect is *very low* (a *negligible* magnitude of impact on a *low* ecological value). No mitigation is required.

6.2.2 Weed Establishment

Terrestrial weeds, including gorse and Himalayan honeysuckle both occur in the vicinity of the wetland, and gorse scrub is the dominant vegetation cover upslope of the sediment retention ponds. Establishment of these species, and other terrestrial weeds, on the areas of exposed soil following construction works is very likely, but not of concern in this context.

As long as the wetland vegetation adjacent to the proposed sediment retention pond and its associated bund is not disturbed or cleared during construction, the potential for weed establishment within the adjacent wetland vegetation is likely to be negligible. The level of ecological effect is low (a *negligible* magnitude of impact on a *very high* ecological value). No mitigation is required.

6.2.3 Stormwater Runoff and Sedimentation

The construction works already undertaken in the area (including construction access tracks and the smaller sediment retention pond and bund), in combination with a high intensity rainfall event prior to our site investigation, have resulted in slope failure and the smaller sediment retention pond being breached. This has resulted in substantial inputs of sediment into the wetland, and into Tara Stream downstream of the site. Re-excavating the smaller sediment retention pond and construction of the proposed larger pond is urgently required to prevent further sediment discharges.

There is the potential for adverse effects of as a result of sediment discharges during, and immediately following construction. This could negatively impact on the *very high* values of the wetland (and the instream values) downstream of the construction footprint by smothering wetland vegetation, affecting water quality and impacting freshwater fish (including Canterbury mudfish (Threatened – Nationally Critical) that are known to occur in farm ponds downstream of the wetland, and further down the catchment (Harding and McIntosh 2006, Golder Associates 2014) and other aquatic fauna.

The magnitude of this impact, over and above the existing baseline conditions, has been assessed as *low* and the level of ecological effect is *very high* (a *low* magnitude of impact on a *very high* ecological value) (i.e. the downstream wetland communities and aquatic values, including a population of the Threatened - Nationally Critical Canterbury mudfish). A high level of mitigation is required.

Once constructed, the sediment retention ponds will have a beneficial effect on downstream wetland and aquatic values by minimising further sediment inputs over their operational lifetime. This benefit is expected to outweigh the adverse sedimentation effects associated with their construction if robust erosion and sediment control measures are put in place (as is recommended in Section 8).

6.3 Summary of Assessment

Table 7 summarises the individual criteria applied to each of the ecological components in the process of the assessment of effects of the proposal.

Table 7. *Summary of the level of ecological effect without mitigation*

Valued Ecosystem Component	Ecological Value	Magnitude of Effect	Level of Effect
Direct Effects on Wetland Vegetation and Habitats			
• Lowland flax flaxland	Very High	Low	Moderate
• Raupō reedland	Very High	Low	Moderate
• Bird habitat	Low	Low	Very Low
Indirect Effects on Terrestrial Fauna			
• Indigenous fauna (disturbance)	Low	Negligible	Very Low
Indirect Effects on Wetland Vegetation and Habitats			
• Wetland vegetation and habitats (outside the construction footprint)- weed establishment	Very High	Negligible	Low
• Wetland vegetation and habitats (downstream of the construction footprint) - stormwater runoff and sedimentation	Very High	Low	Moderate

Mitigation is required for the removal of the lowland flax flaxland and raupō reedland and habitats and construction of the sedimentation pond, including for the potential effects associated with stormwater runoff and sedimentation.

7.0 Assessment Against Relevant Objectives and Policies

This section provides a brief assessment of the proposal against the relevant objectives and policies in the Canterbury Land and Water Regional Plan.

7.1 Section 3 - Objectives

3.17 "The significant indigenous biodiversity values of rivers, wetlands and hāpua are protected."

Assessment

The construction of the sediment retention pond will result in the removal of approximately 475 m^2 of significant indigenous wetland habitat. The primary purpose of constructing the sediment retention pond, however, is to avoid or minimise existing sediment discharges from the mine site and protect the wetland and downstream waterways from sedimentation.

3.18 "Wetlands that contribute to cultural and community values, biodiversity, water quality, mahinga kai, water cleansing and flood mitigation are maintained."

Assessment

The construction of the sediment retention pond will result in the removal of part of a wetland that contributes to biodiversity, water quality, and water cleansing in the catchment. However, as discussed above, the purpose of the proposal is to construct a sediment retention pond that avoids or minimises sediment being discharged from the mine that is part of maintaining downstream aquatic biodiversity values and water quality.

3.24 "All activities operate at good environmental practice or better to optimise efficient resource use and protect the region's fresh water resources from quality and quantity degradation."

Assessment

Construction of the sediment retention pond is required to ensure the mine operates 'at good environmental practice'. Minimising sediment inputs is important to protect downstream water resources from degradation.

7.2 Section 4 - Policies

4.81 *"Any take, use, damming or diversion of water, any discharge of contaminants onto land or into water, or any earthworks, structures, planting, vegetation removal or other land uses within a wetland boundary, do not adversely affect the significant values of wetlands, hāpua, coastal lakes and lagoons, except for:*

(a) a temporary and or minor adverse effect where that activity is part of installing, maintaining, operating or upgrading infrastructure, pest management, or habitat restoration or enhancement work; or

(b) the artificial opening of hāpua, coastal lakes or lagoons to assist in fish migration or achieving other conservation outcomes, customary uses, or to avoid land inundation."

Assessment

If appropriate erosion and sediment controls are put in place (as is recommended), the impact of the discharge of sediment should be limited to minor adverse effects. Because the smaller sediment pond that has already been constructed is insufficient to deal with sediment inputs, not installing the second, larger, sediment retention pond will result in ongoing sediment discharges into the wetland downstream.

The vegetation removal required to construct the sediment retention pond will result in a permanent adverse effect on the significant values of the Tara Stream Wetland. However, if the recommended mitigation is undertaken, the adverse effects of this vegetation removal are expected to be minor.

4.81(b) is not relevant to this assessment.

4.82 *Modification of wetlands, hāpua, coastal lakes and lagoons may occur if the modification is necessary, and necessarily has to be in that location to provide for the installation, upgrading or maintenance of infrastructure and any significant effects are offset by other*

improvements to or expansion of the same or another wetland, hāpua, coastal lake or lagoon.

Assessment

Modification of the wetland is necessary to install the sediment retention pond (Eden Sinclair *pers. comm*. 2017). We understand that it has to be in that location because the aspect and topography of the mine and the slopes above the proposed sediment retention ponds, and the location of the existing discharge point, mean that alternative locations for the sediment retention ponds are not feasible (Eden Sinclair *pers. comm*. 2017). The significant effects of removing wetland habitat will be offset by the remedial actions and mitigation recommended in Section 7 (above).

7.3 Section 11 – Policies (Selwyn - Te Waihora)

11.4.1 *Manage water abstraction and discharges of contaminants within the entire Selwyn Te Waihora sub-region to avoid, remedy or mitigate adverse cumulative effects on the water quality of Te Waihora/Lake Ellesmere, rivers and shallow groundwater; and the flow of water in springs and tributaries flowing into Te Waihora/Lake Ellesmere and achieve, in combination with non-regulatory actions, the freshwater objectives and outcomes for the sub-region.*

Assessment

The sediment retention ponds are being constructed to manage the discharge of sediment into Tara Stream, one of the headwater streams in the Selwyn-Te Waihora sub-region, that ultimately flows into Te Waihora/Lake Ellesmere.

8.0 Recommendations

In summary, the following actions are recommended to avoid, remedy or mitigate any adverse effects on wetland ecology values of the construction and operation of the sediment retention pond.

Avoid and minimise

- All practicable steps should be taken to minimise disturbance or clearance of wetland vegetation outside the footprint of the proposed sediment retention pond.
- To minimise construction and post-construction discharge and sedimentation, robust erosion and sediment controls must be implemented in accordance with ECan's guidelines and in consultation with an appropriately qualified aquatic ecologist.
- All bare soil should be hydro-seeded as soon as practicable following construction to minimise erosion and sediment discharges.

Remediation

- Following the de-commissioning of the sediment retention pond (anticipated to occur in 3 - 4 years' time (i.e. 2020 – 2021), the stormwater retention ponds are remediated and planted in appropriate wetland vegetation similar to that being removed (e.g. lowland

flax, raupō reedland, purei and toetoe – refer to Appendix 1 for a list of the indigenous species recorded within the wetland).

Mitigation

- Restoration of at least 2,900 m^2 of wetland habitat in Bush Gully Stream [5],[6] (the "wetland restoration site"). The proposed wetland restoration site are two areas of crack willow forest (see Figure 3). The wider wetland area, within which the wetland restoration site are located, is a large riparian valley floor swamp and marsh wetland (approximately 3.65 ha) situated in a relatively flat floodplain that is up to 70 m wide (Figure 3, Photo 5). The majority of this wider wetland area is riparian marsh dominated by exotic tall fescue grassland with scattered gorse and Himalayan honeysuckle. There are, however, areas of lowland flax flaxland and *Carex secta* sedgeland in wetter areas. The downstream part of the wetland supports an extensive area of lowland flax flaxland.
- Proposed mitigation actions within the wetland restoration site are:
  - Control/removal of the two patches of crack willow (Figure 3). This will have the additional benefit of preventing the spread of willow into the wider wetland, and particularly downstream.
  - Following willow control, translocation of as many of the existing indigenous wetland plants as possible that can be salvaged from within the footprint of the proposed sediment retention pond (e.g. lowland flax, *Carex secta*, toetoe) into the wetland restoration site. Then, if required, plant appropriate and locally sourced wetland species (e.g. lowland flax, *Carex secta, raupo, toetoe, Coprosma propinqua*)[7] to complete the planting in the wetland restoration site.
  - Weed control within the wetland restoration site. Exotic weed species known to be present in the wider wetland, including on the wetland margins, are gorse, broom, Himalayan honeysuckle, blackberry and wilding radiata pine.
  - Maintenance of the plantings. This is likely to include weed control (above) and release from rank grasses.

Management Plan

- It is recommended that a Wetland Restoration Management Plan be prepared by a suitably qualified and experienced ecologist. The Wetland Restoration Management Plan should include, but not be limited to:
  a) The size and location of the wetland restoration site;
  b) The wetland restoration methodology, including the methods for willow control, planting methods, and the timing of works; and
  c) The indigenous species to be planted in the wetland;

[5] Options for wetland creation or enhancement in Tara Stream (within the same sub-catchment and nearer to the impact site) have also been considered. There are a number of limitations that make this site less suitable. These include: the proximity of radiata pine plantings and the potential for wetland damage during and following harvesting, the wetland is already dominated by indigenous wetland vegetation so there is less potential for net biodiversity gain) and machinery such as an excavator, would be required to create the hydrological conditions suitable for re-establishing indigenous swamp vegetation.

[6] This wetland and the proposed wetland restoration sites have not been surveyed, but the wetland has been viewed from the road while undertaking other surveys in the area.

[7] The appropriate wetland species will be dependent on the wetland's hydrology.

d) Weed species to be controlled, and the methods for weed control;

e) The maintenance or methods to be adopted to ensure the wetland endures;

f) Monitoring measures and methods to determine when wetland restoration has been successful (see below).

- The Wetland Restoration Management Plan should be agreed to with Canterbury Regional Council prior to earthworks commencing at the proposed sediment retention pond site.

Monitoring

- Monitoring of the success of the wetland restoration within the wetland restoration site is required. Possible measures to determine when the wetland restoration has been successful are:

  a) All crack willow has been removed from within the wetland restoration sites;

  b) The cover of indigenous plant species as a proportion of the total vegetation cover within the wetland restoration sites is ≥ 75%;

  c) The cover of exotic wetland pest plant species within the wetland restoration sites is ≤ 5%.

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0 40 m
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Data Sources:

Projection: NZGD 2000 New Zealand Transverse Mercator

Legend

- Approximate wetland extent
- Wetland Restoration Sites

Canterbury Coal Mine

Bush Stream Gully Wetland Restoration Sites

Date: 20 October 2017 | Revision: 0

Plan prepared for Bathurst Resources Ltd by Boffa Miskell Limited

Project Manager: **scott.hooson@boffamiskell.co.nz** | *Drawn:* SHo | *Checked:* BMc

Figure 3

9.0 Conclusions

- The construction works already undertaken in the area, in combination with a high intensity rainfall event prior to our site investigation, have resulted in substantial inputs of sediment into the downstream wetland and Tara Stream. Re-excavating the smaller sediment retention pond and completion of the proposed larger pond is urgently required to prevent further sediment discharges of this magnitude.
- This assessment has confirmed that the indigenous wetland vegetation communities within the proposed construction footprint are ecologically significant and of very high ecological value. They are representative, occur on an Acutely Threatened land environment, and wetlands have been reduced to less than 20% of their former extent at the national, regional and freshwater biogeographic unit scales.
- The construction of the sediment retention pond and bund will result in the loss of approximately 475 m^2 of indigenous vegetation (lowland flax flaxland and raupō reedland). The level of this ecological effect is moderate.
- The following remediation and mitigation actions are recommended to remedy wetland vegetation clearance, and mitigate adverse effects:
    - Minimising disturbance or clearance of wetland vegetation outside the footprint of the proposed sediment retention pond;
    - Remediation of the stormwater retention ponds following their de-commissioning including planting of appropriate wetland vegetation;
    - Restoration of approximately 2,900 m^2 of wetland habitat in Bush Gully Stream through control of crack willow, translocation of indigenous wetland plants from the impact site, planting of appropriate and locally sourced wetland species, weed control and maintenance.
- Preparation of a Wetland Restoration Management Plan outlining the mitigation actions and monitoring at the wetland restoration site is recommended.
- Without mitigation, the potential effect of stormwater run-off and sedimentation during, and following construction, on downstream wetland and aquatic values has been assessed as *moderate*. It is very important that robust erosion and sediment control measures, that are in accordance with ECan's guidelines, are put in place to minimise further adverse effects on downstream wetland and aquatic ecology values. These measures should be developed in consultation with a suitably qualified aquatic ecologist.
- The levels of other potential ecological effects have been determined to be very low or low.
- Overall, taking in to account the recommended measures to minimise, remedy and mitigate potential effects, the construction of the sediment retention pond should have a low level of effect on ecological values.

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Appendix 1: Plant Species List

Common name	Scientific name	Lowland flax flaxland	Raupō reedland	Exotic grassland	Terrestrial
Indigenous plant species					
Cutty grass	*Carex geminata*	x			
Kiwikiwi	*Blechnum fluviatile*				X
Koromiko	*Hebe salicifolia*				X
Lowland flax	*Phormium tenax*	x	x		
Mingimingi	*Coprosma propinqua*	x			x
Purei	*Carex secta*	x	x	x	
Raupō	*Typha orientalis*	x	x		
Sharp spike sedge	*Eleocharis acuta*	x			
Swamp kiokio	*Blechnum minus*	x	x		
Water fern	*Histiopteris incisa*	x			x
Wiwi	*Juncus edgariae*	x	x		
	Hypolepis ambigua				x
Toetoe	*Austroderia richardii*	x	x		
Water fern	*Histiopteris incisa*	x			x
Wiwi	*Juncus edgariae*	x	x		
Exotic plant species					
Catsear	*Hypochaeris radicata*	x			
Cleavers	*Galium aparine*	x		x	x
Creeping bent	*Agrostis stolonifera*		x	x	x
Creeping buttercup	*Ranunculus repens*	x	x	x	
Gorse	*Ulex europaeus*	x	x		x
Himalayan honeysuckle	*Leycesteria formosa*				x
Iris-leaved rush	*Juncus ensifolius*				
Lotus	*Lotus pedunculatus*	x			
Radiata pine	*Pinus radiata*				x
Tall fescue	*Lolium arundinaceum*	x	x	x	x
Yorkshire fog	*Holcus lanatus*		x	x	x

Appendix 2: Site Photos

Photo 1: Overview of the wetland area that will be impacted by the construction of the sediment retention pond.

Photo 2: Lowland flax flaxland vegetation.

Photo 3: Raupō reedland vegetation with frequent purei.

Photo 4: A small area of what appears to have been exotic grassland that has largely been smothered by recently deposited sediment.

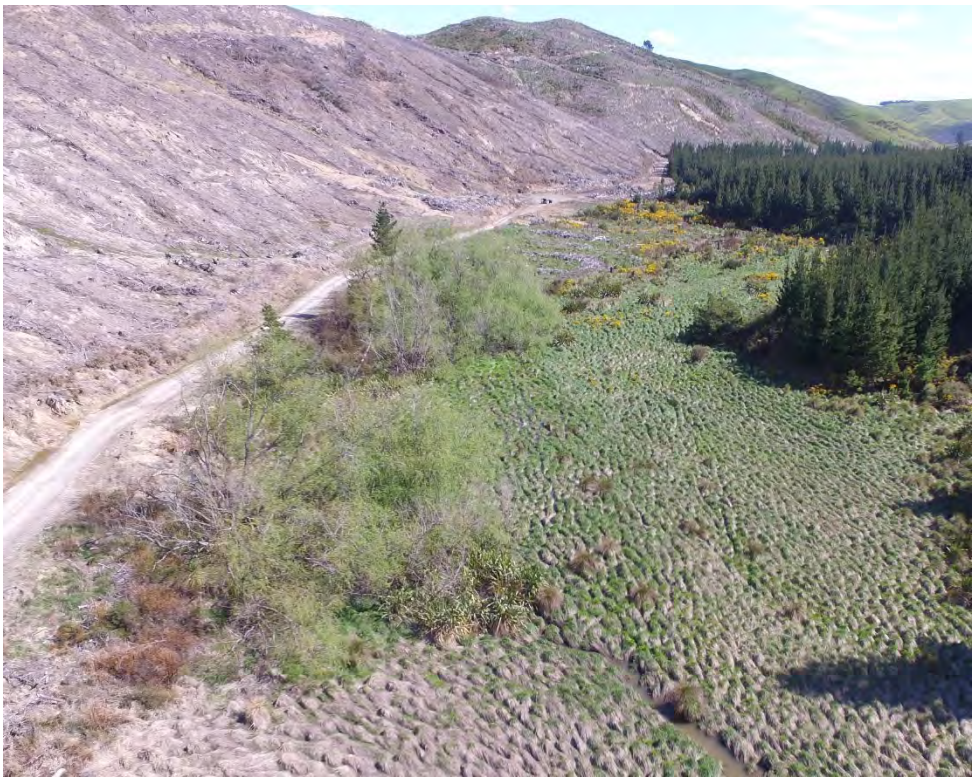

Photo 5: The two areas of crack willow in Bush Gully Stream proposed for willow control and restoration of indigenous swamp vegetation.