



Oceana Gold (NZ) Ltd

Macraes Gold Project

Coronation North

Ecological Impact

Assessment-

Vegetation,

Avifauna &

Herpetofauna

April 2016



Consultation Report prepared for Oceana Gold (New Zealand) Ltd by Dr M. J. Thorsen,
25 April 2016

Report number: 0219-04

©ERA Ecology New Zealand Limited

159 Evans Street

Dunedin 9010

New Zealand

Reliance and Disclaimer

The professional analysis and advice in this report has been prepared by ERA Ecology NZ Ltd for the exclusive use of the party or parties to whom it is addressed (the addressee) and for the purposes specified in it. This report is supplied in good faith and reflects the knowledge, expertise and experience of the consultants involved. ERA Ecology NZ Ltd accepts no responsibility whatsoever for any loss occasioned by any person acting or refraining from action as a result of reliance on the report, other than the addressee.

In preparing this report ERA Ecology NZ Ltd has endeavoured to use what it considers as the best information available at the date of publication, including information supplied by the addressee. Unless stated otherwise, ERA Ecology NZ Ltd does not guarantee the accuracy of any forecast or prediction in this report.

This publication and the information therein and attached compose a privileged communication between ERA Ecology New Zealand Limited (“ERA”) and Oceana Gold New Zealand Limited (“OceanaGold”). This report, or parts therein, must not be published, quoted or disseminated to any other party without prior written consent from ERA and OceanaGold.

ERA Ecology NZ Ltd guarantees its work as free of political bias and as grounded in sound ecological principles based on quality knowledge.

1 Contents

2	Executive Summary	6
3	Quality Assurance.....	6
4	Project Overview	8
4.1	The Coronation North Project.....	8
4.2	Land Tenure.....	9
4.3	Regulatory Authorities	9
4.4	OceanaGold Environmental Standards	9
4.5	Assessment Methodology	13
4.6	Assessing Ecological Importance.....	15
4.7	Assessing Project Impact	16
5	Assessment of Ecological Importance.....	19
5.1	General Ecological Setting.....	19
5.2	Flora Ecological Features.....	20
5.3	Threatened, At Risk, or rare plant species	30
5.4	Avifauna Ecological Features.....	100
5.5	Herpetofauna Ecological Features	104
5.6	Summary Table of Ecological Features	108
6	Project Impact on Biodiversity Features	110
6.1	Impact on Vegetation Communities	110
6.2	Threatened, At Risk, or Rare Plant Species	111
6.3	Impact on Avifauna Ecological Features	146
6.4	Impact on Herpetofauna Ecological Features	148
6.5	Summary of Project Impacts	150
8	References.....	151
9	Appendices	153
	Appendix 1. Biodiversity recorded during site inventory.....	154
	Appendix 2. Abbreviations used in text	169

2 Executive Summary

This document summarises the current knowledge of the vegetation, avifauna and herpetofauna of the Coronation North project area based on previous studies, databases and site inventory surveys and evaluates the potential impact of the proposed project on the relevant ecological features. There are 10 vegetation communities within the project: eight indigenous communities (including Critically Endangered ephemeral wetlands and Endangered seepages and flushes), and extensive areas of exotic pasture and disused pine plantation. Part of a Recommended Area for Protection is situated within the project area. Botanical diversity is high, with 166 indigenous plant species (including 5 Threatened, 8 At Risk, 2 Data Deficient and 7 rare species). This botanical diversity and number of species of interest is mainly due to the project's size and the type of vegetation communities that are present. Bird and herpetofauna communities are relatively depauperate (for the area), with few species at low population densities. One At Risk bird species and 2 At Risk reptile species are present within the project. Most of the higher value ecological features are concentrated along the lower boundaries of the project, particularly in gullies to the west. A summary of the ecological features of the project area is provided in [Section 5.6](#).

The project will have a large impact on these features, which will result in the loss of all ecological features within the project boundary. Impact on ecological features in the area surrounding the project is expected to be minor and mainly concentrated within 100m of the project edge. This scale of impact on the area's ecological features varies, depending on the feature under consideration, from low to high at the local scale, negligible to high at a national scale, and overall from negligible to very high (for some vegetation communities and Threatened plant species). A summary of the project's impact on the ecological features is provided in [Section 6.5](#).

Mitigation of project impact on ecological features is yet to be assessed.

3 Quality Assurance

The practices and methods set out in this Ecological Impact Assessment are those considered appropriate for delivering accurate information, and would withstand scrutiny from a majority of competent ecologists.

No survey can guarantee to detect every species present in an area, and non-detection is likely to be more of a factor in cryptic or rare species, or species with no flowering material at the time of survey. All reasonable effort was made in the detection of these species during survey. There is also an element of uncertainty in the distribution of some species that are difficult to identify, or smaller herbs and grasses as these are frequently overlooked during informal surveys. There is approximately 20% of the flora that lacks a formal name and there is limited information available both on how to identify these entities and where they are found.

Due to the limited period of survey the results in this document will not reflect: 1) seasonal variation in abundance or site usage by some species, or 2) inter-annual variation in abundance or site usage by any species.

The identity and boundary of vegetation communities have been determined from interpretation of aerial photographs together with ground-truthing and oblique photography. The map may not accurately represent the correct vegetation community or current border of some vegetation communities, particularly those with a dispersed character or where bordered by similar communities. Smaller occurrences (<1 ha) of some vegetation communities are generally not represented in this document's reports and maps.

This document uses information drawn from previous reports by other organisations and no guarantee can be made on the quality, comprehensiveness or accuracy of that information.

4 Project Overview

4.1 The Coronation North Project

The Coronation North Project (the Project) is an extension to the existing consented Coronation project at OceanaGold's Macraes Gold Project (MGP). The main elements of the Project are:

- Extension of the existing consented Coronation Pit from a total area of about 62 hectares to about 85 hectares, which will expand expected ore recovery from 5Mt to approximately 8.5Mt (including that which has already been processed).
 - The extension will be primarily to the southern end of the Coronation pit, expanding from the currently consented edge of the pit.
 - The expanded Coronation Pit will continue to be opportunistically partially backfilled where practicable and a pit lake, similar to that currently consented, will remain on closure.
- Mining of a resource which has been identified within the area of the existing consented Coronation Waste Rock Stack. A new open pit (Coronation North Pit) will be developed. Coronation North Pit is estimated to contain approximately 9Mt of ore.
 - The Coronation North Pit will be opportunistically partially backfilled where practicable and will be closed as a pit lake.
- The existing Coronation Waste Rock Stack will not be constructed to the fully consented extent. The total volume of waste rock will reduce from the currently consented 94Mt (an area of approximately 105 hectares). The consented maximum height will remain 730 mRL.
- A new waste rock stack (Coronation North Waste Rock Stack) will be constructed to the north east of the existing Coronation Waste Rock Stack. The maximum height will be 495 mRL.
 - The Coronation North Waste Rock Stack is capable of containing the total excavated waste material from Coronation North Pit and the Coronation Pit expansion.
 - With the potential for opportunistic backfill placement within the Coronation pits, the size of the waste rock stack may reduce in proportion to the amount of backfill placed in the pits.
- All water from the Coronation North Pit and Coronation North Waste Rock Stack and any overflow from the Coronation Pit lake will report to the Mare Burn catchment, a tributary of the Taieri River.
- The existing haul road will be extended by about 2km to the north to reach the Coronation North Pit.
 - As is currently occurring, ore will be hauled from the pits to the Macraes processing plant via the existing haul road across Horse Flat Road and along the Golden Point Road alignment to the processing plant.
 - In other respects the roading for the Project will remain the same as for the consented Coronation project.
- New temporary buildings (including toilet facilities and crib room) may be located adjacent to Coronation North Pit.
 - Temporary buildings already in place beside Coronation Pit will remain.
 - The portable diesel storage and refuelling facility installed adjacent to Coronation Pit will remain and be utilised for the Project.

The Project will be carried out, managed and monitored on substantially the same basis as the consented Coronation Project during operations in terms of mining methods, operating 24 hours a day seven days a week, drilling and blasting, use of the existing fleet of diesel powered mining equipment, transport movements, dust management, sediment control, progressive rehabilitation of waste rock stacks, and opportunistic backfilling of pits during operations.

The Project will be carried out on substantially the same basis as the consented Coronation Project during closure in terms of formation of pit lakes, removal of any buildings and other temporary structures, decommissioning of the silt ponds to likely become stock water ponds, removal of the haul road crossing over Horse Flat Road, rehabilitation of the main haul road from the pits and waste rock stacks to Horse Flat Road and reinstatement of Matheson Road on a new alignment. On the completion of mining and rehabilitation Golden Point Road will be reopened for public access.

The estimated duration of the operation and rehabilitation phases of the Project will be approximately 5 years and the Project will add approximately 3 years to the MGP mine life.

The processing rate at the Macraes processing plant of about 6Mt per annum will be unchanged by the Project.

4.2 Land Tenure

This project is entirely on Oceana Gold New Zealand Limited freehold land.

4.3 Regulatory Authorities

The bulk of this project is situated within the Dunedin City Council (DCC) territorial boundary, with the Coronation Pit Extension area extending into the Waitaki District Council (WDC) territorial boundary. The entire area is located within the Otago Regional Council and Department of Conservation's Kā Moana Haehae/Alexandra Office territorial boundaries.

4.4 OceanaGold Environmental Standards

OceanaGold's environmental management programme is based on the complete mine life cycle, from exploration through development and operation, to eventual decommissioning, closure and site rehabilitation. The company seeks to not only meet, but consistently exceed regulatory requirements in place, to protect the environment for future generations and safeguard the sustainability of nearby communities.

OceanaGold is committed to continued improvement in the identification, assessment, mitigation, and monitoring of the environmental effects of its operations. The company works hard to plan and implement environmental projects that protect and support the natural environments associated with its operations, and that demonstrate its focus on international best practice environmental stewardship. Clearly, the company's activities can impact the environment and in some cases, create lasting effects. Wherever possible, OceanaGold seeks to ensure a net environmental gain from its activities, and is diligent in its adherence to all applicable laws and standards in New Zealand and offshore.

The Company aims to be an industry leader in the identification, assessment, mitigation and monitoring of its environmental impacts. Specifically, OceanaGold commits to:

- Identify and mitigate all environmental and human health impacts associated with its activities. In undertaking mitigation measures, the company will aim for a net environmental gain.
- Comply with all applicable laws and standards, and apply company-wide standards, based on international best practice, that minimise adverse environmental impacts arising from its operations.
- Rehabilitate all mine sites to a stable landscape and land use which does not pose any unacceptable risk to the environment.
- Develop an end-of-mine-life land use, in consultation with stakeholders, which will leave a positive legacy.

The aim of this policy is to provide direction to OceanaGold's employees, and contractors undertaking activities on the Company's behalf. The policy aims to place OceanaGold at the forefront of environmental impact identification and mitigation within the mining industry.

The purpose of ecological work at OceanaGold's Macraes mine site is to:

1. Ensure monitoring, management and reporting of flora, fauna and habitat meets relevant legislation, permits or licenses and community consultation outcomes.
2. Pursue a practice of minimum disturbance for the flora, fauna and habitat in the areas the site operates.
3. Ensure that the conservation status of flora and fauna species is not threatened.

These works will be undertaken to at least the Minimum Standard where:

- Sites will develop an Environmental Impact Assessment or Management Plan which will address management of land, flora, fauna and habitat, taking into account relevant legislation, permits or licenses, and community consultation.
- The Environmental Impact Assessment is to be updated where there are changes to any part of the operation (either man-made or natural) that significantly impact on it.
- The minimum area of vegetation required for exploration, construction and operation will be cleared.

- Where practicable, topsoil to a depth of 15 cm will be stockpiled prior, for use in rehabilitation.
- Sites will develop a programme to monitor and evaluate the health of flora and fauna affected by the location, and take steps to mitigate any adverse effects revealed.
- The monitoring programme will include weed and pest species, and appropriate management practices will be used to mitigate adverse effects.
- All employees are prohibited from capturing, purchasing or acquiring native wildlife for any purpose.

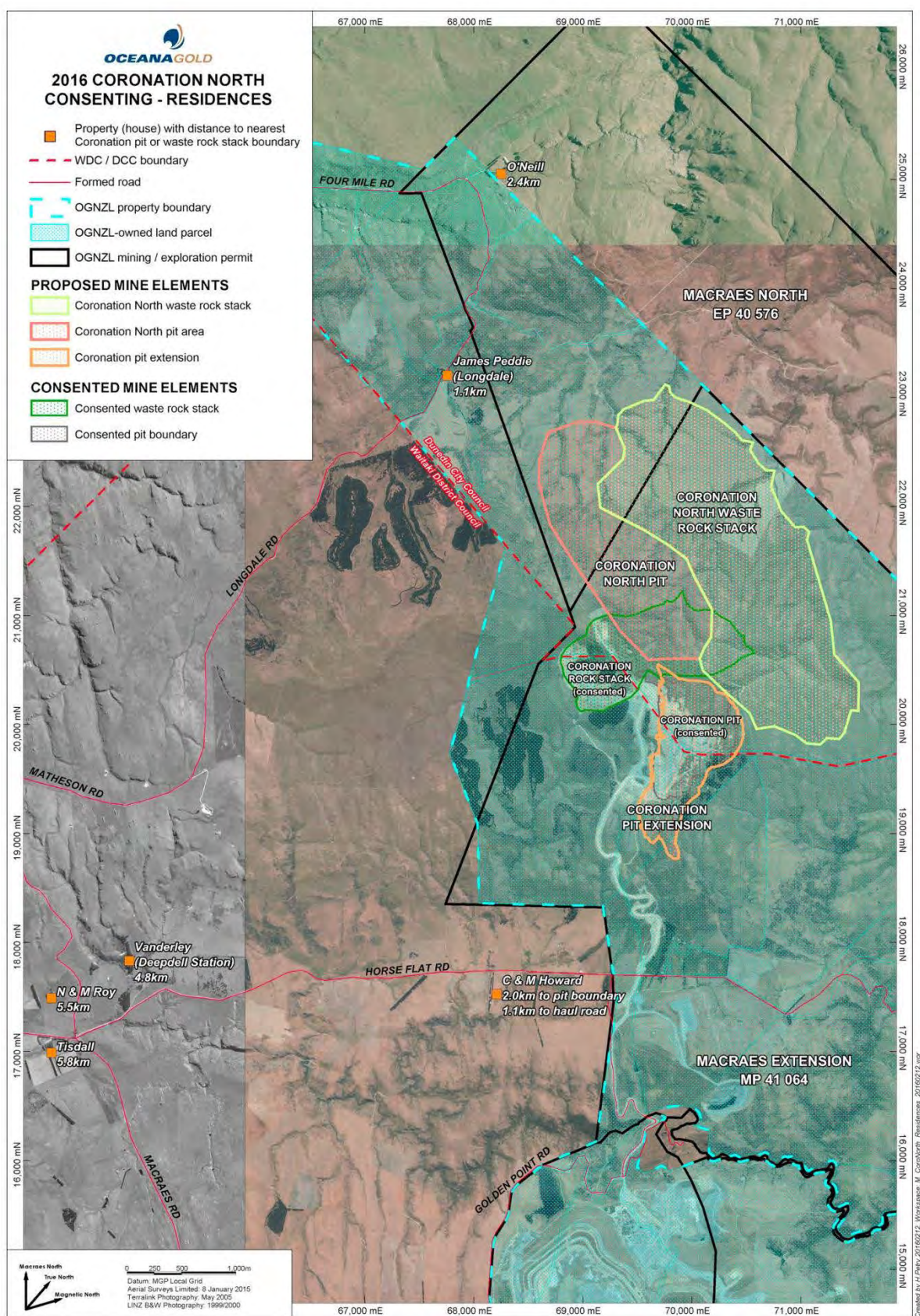


Figure 1. Location of Coronation North project area.

4.5 Assessment Methodology

4.5.1 Literature review

All available literature on the natural history of the Macraes area was reviewed as part of the assessment process. Unpublished databases were also utilised: plant location records maintained by the New Zealand Plant Conservation Network (www.nzpcn.org.nz), Nature Watch (www.naturewatch.org.nz) and the author's unpublished database of plants observed in the Macraes area; reptile location records maintained by the Department of Conservation (DOC) in their Amphibian and Reptile Distribution Scheme (ARDS), and bird location records maintained by eBird (www.ebird.org) and Nature Watch.

4.5.2 On-site inventory survey methodology

The flora, reptiles and birdlife of the Project Impact Area (PIA, see [Section 4.7.2](#)) was assessed using expert walk-through surveys (Figure 2), these being better at finding rare features compared to plot-based assessments.

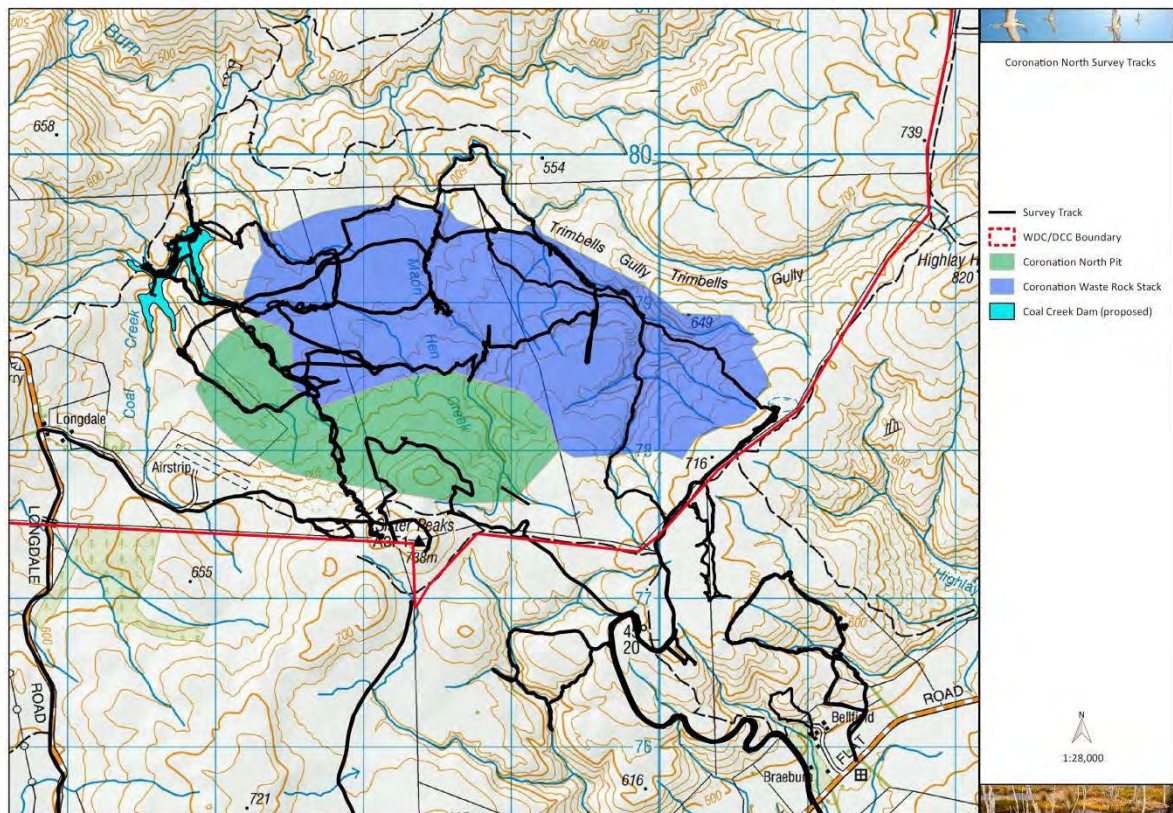


Figure 2. Paths taken by survey teams during this survey.

4.5.2.1 Flora survey

The flora survey was undertaken by Dr Mike Thorsen on 16 December 2015, 7, 14, and 21 January 2016. During the flora survey all plant species (indigenous and exotic) were recorded during a walk-through survey of the PIA, where the path traversed what were considered to be the most botanically interesting areas, and an estimate of their abundance within the PIA was made using the following criteria: Previously Present (recorded by previous visitors, but not recorded during this survey); Rare (infrequently seen during survey and in very low numbers covering <1% of area); Local (only seen at few areas during survey, but could be quite common within these areas and covering <5% of total area); Occasional (individuals were scattered throughout site or were in widely scattered clumps and covering 5-20% of area); Common (frequently encountered during survey, but not a dominant part of the flora and covering 20-60% of area); Abundant (a dominant part of the flora and covering >60% of area). The locations of plant species or vegetation communities of interest were recorded using a hand-held GPS unit. Photographs of general vegetation patterns and sites of interest were taken. The results of this flora survey are provided in [Section 5.2](#).

To provide an estimate of percentage vegetation cover by indigenous species, a Naturalness Index was calculated. This Index is calculated by first assigning each plant species an abundance value which reflects its abundance class assigned during the site inspection. The abundance values used are: Rare = 2, Local = 3, Occasional = 5, Common = 7, Abundant = 10. The abundance values of all indigenous and exotic species encountered during this survey are then summed, and the Naturalness Index is calculated by dividing the summed abundance values for indigenous species divided by the sum of all abundance values of indigenous and exotic species combined. This Naturalness Index was then compared with results from nearby comparison sites.

4.5.2.2 Avifauna survey

Bird species diversity and abundance is low in the Macraes area, and this makes more intensive survey efforts such as distance-sampling or 5-minute bird counts of limited utility. For the survey of the PIA, a record was made of all birds seen or heard during the walkthrough flora survey, and the locations of species of interest were recorded using a hand-held GPS unit. The results of this survey are provided in [Section 5.4](#).

4.5.2.1 Herpetofauna survey

The herpetofauna survey of the PIA was undertaken by Tony Jewell on 7 & 8 January 2016, with additional observations provided by Dr Mike Thorsen (see flora survey). During the survey, a path was followed that traversed areas considered the most likely to harbour reptiles or amphibians. At likely sites (and over the space travelled between sites) the area was scanned for visible animals, crevices were inspected (using a torch) for signs of animals or shed skins, and potential retreats (rocks and overhanging vines) were physically searched. The surveys were conducted during reasonably warm and sunny weather, but there were periods of overcast weather (particularly on the 8th), when visible lizard activity would have been lower. All species seen were identified to species when possible (some sightings were too brief to allow a positive identification of species). A record of the time spent searching and the number of animals was recorded for calculating Catch Per Unit Effort (CPUE). All

locations were recorded onto ARDS cards and submitted to DOC. The results of this herpetofauna survey are provided in [Section 5.5](#).

4.6 Assessing Ecological Importance

The information that was gathered during the inventory surveys was used to evaluate the ecological importance of the vegetation, birds and reptiles and their habitats, against the following criteria (based on those recommended in the Environment Institute of Australia and New Zealand's 2015 Ecological Impact Assessment Guidelines available at <http://www.eianz.org/resources/publications>):

- Representativeness of communities.
- Distinctiveness of communities.
- Ecological functionality of communities (intactness, connectivity, buffering).
- Rarity of communities.
- Community diversity.
- Role in ecosystem servicing.
- Sites or communities of significance at
 - National (Threatened Land Environments, National Priorities for Conservation, Historically Rare or Threatened Ecosystems, Wetlands of National Importance, Ramsar Sites).
 - Regional (as identified in the Regional Plan), or
 - Local (as identified in District Plans) scales.
- Sites identified as worthy of protection.
- Presence of rare, At Risk or Threatened species.
- Presence of species of biogeographical interest.
- Presence of genetically or morphologically distinct forms.

The results of this assessment of ecological importance, based on Table 3, Table 5, Table 6 and supporting text of the Environment Institute of Australia and New Zealand (EIANZ) guidelines, is provided in [Section 5](#), and summarised in [Section 5.6](#).

4.7 Assessing Project Impact

The impact of the project on the ecological features, at both a local and national scale, is assessed by considering the effects of the project activities ([Section 4.7.1](#)) identified as having a potential to impact on the ecological features ([Section 5](#), summarised in [Section 5.6](#)), within the area identified as the PIA ([Section 4.7.2](#)). The magnitude of the effect on the ecological feature is assessed based on Table 9 of the EIANZ guidelines, and the combination of magnitude and importance of the ecological feature is used to assign an overall estimate of the degree¹ of the effect at both a local and national scale based on Table 12 of the EIANZ guidelines. An indication of the confidence in the assessment is provided.

The assessment of effect on the vegetation is in [Section 6.1](#), and for avifauna and herpetofauna, the assessment is in [Section 6.3](#) and [Section 6.5](#), respectively.

A summary of the project impacts is provided in [Section 6.6](#).

4.7.1 *Project activities likely to affect ecological features*

The following have been identified as project activities which are likely to result in an effect on the PIA's ecological features. Ecological feature-specific impacts are assessed in [Section 6](#), but general effects are discussed here.

4.7.1.1 Excavation of Pits

Removal of overburden and ore material from the pits will be through a combination of bed-rock blasting and removal of material using heavy machinery, moving along a haul road graded into the ground surface. Overall, this activity will result in the removal of all vegetation from the Coronation North Pit and Coronation Pit Extension Zones.

4.7.1.2 Deposition of rock material in the Waste Rock Stack

The overburden and rock remnants of the processed ore will be deposited by heavy machinery on the Waste Rock Stack (WRS), which will be built up from an initial layer that will fill to the boundaries of the WRS Zone. Overall, this activity will bury all vegetation within the WRS Zone.

4.7.1.3 Sediment run-off

The unconsolidated fine rock and dust that will be deposited with the rock material into the WRS will, if uncontained, be washed into the waterways that lead from the WRS. Overall this could, if

¹ 'Level' is used in place of 'degree' in the EIANZ guidelines.

unmanaged, inundate areas of streambed vegetation under a layer of sediment that could extend for 100m or more downstream.

4.7.1.4 Effect of changes in weed populations

Importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitats in the surrounding area, making them unsuitable for many species. The severity of this effect depends on the nature of the weed species and the ability to detect and manage an emerging weed problem.

4.7.1.5 Displacement of pests into surrounding area

Project activities are likely to cause resident pests such as pigs, hares, mustelids and rodents to move into the surrounding area, where they will increase browsing and predation on the surrounding areas' fauna and flora. This effect is likely to be temporary.

4.7.1.6 Displacement of resident animals

Some animal species, particularly birds, will be displaced from the PIA as a result of project activities. These displaced individuals will compete with individuals from the surrounding area. As the area is assumed to be at carrying capacity, this competition will eventually result in the mortality of either the displaced or resident individuals.

4.7.1.7 Noise

Blasting and operating heavy machinery creates considerable noise which is likely to create a negative reaction in animal species, though this reaction will vary depending on species. Plants are not known to have a reaction to noise.

4.7.1.8 Wind-blown dust

The unconsolidated fine rock and dust that will be deposited with the rock material into the WRS, fine material created during pit excavation, and dust created by vehicle traffic will, if unmanaged, be blown into the surrounding area. Dust accumulation in areas where this is managed, such as those within existing Macraes mine operations, produce very little wind-blown dust, and noticeable dust accumulation only occurs within the immediate vicinity (<100m) of mine works. Within this zone there is likely to be some reduction in a plant's photosynthetic capacity, potentially resulting in a loss of growth and reproductive output.

4.7.1.9 Artificial lighting

The project may use artificial lighting during night operations. Strong artificial lighting can cause both a negative or positive reaction in animals, depending on species. Moths in particular are drawn to these lights, and these could attract nocturnal predators. Other nocturnal species are likely to avoid brightly lit areas. No seabirds are known to fly near the PIA, and therefore there is no risk of artificial lighting disorienting overflying seabirds.

4.7.1.10 Accidental fire

The Macraes environment is often dry, and accidental fires, if unmanaged, have the potential to burn large areas.

4.7.2 *Determining the boundary of ecological impact of project.*

The ecological impact that arises from a project's activities may extend beyond the area where that activity occurs. How far this effect may extend depends primarily on the nature of the activity, the mechanism of the impact, and the sensitivity of the ecological features in the surrounding area. In this case the PIA is considered to be the project outline as mapped, plus a 100m buffer where, at worst, there could be either dust blow sufficient to interfere with a plant's photosynthesis, or where downstream streambed sedimentation, if uncontrolled, could have a negative effect of plant life by smothering plants to a degree that mortality would occur. A buffer of 100m was chosen on the basis of the observation of the current extent of these effects in currently active areas of the mine (albeit these effects are managed through mine operating procedures), where negligible impact is observable on plants, even at a distance of 5m from waste rock stacks.

5 Assessment of Ecological Importance

5.1 General Ecological Setting

The Coronation North project (Figure 1), located 6.5km north-west of Macraes Flat township, is situated on the northern end of the Taieri Ridge in the Macraes Ecological District (E.D.), being one of two Ecological Districts that make up the Lammerlaw Ecological Region of Otago (Bibby 1997). The climate is moderate, with periodic snow-lie during winter and occasional summer drought. The topography of the area consists of rolling hill country with rounded ridge crests and shallowly to deeply incised drainage associated with the Otago peneplain of the Rakaia Terrane, which has probably been exposed since the late Miocene (Forsyth 2001). Rock outcropping is predominantly associated with drainage systems, with frequent tor formation on ridge crests. Underlying lithology is well foliated quartzo-feldspathic biotite greenschist and lesser chlorite schist, with occasional auriferous quartz reefs of Chlorite Subzone 3 and 4, Haast Schist Group, and areas of overlying Miocene to Quaternary sediments (Mutch 1963, McKellar 1966, Forsyth 2001). Soils are loess-derived hygrous Wehenga upland and high country yellow-brown earths.

Past vegetation cover of the Macraes ED is thought to have comprised montane short tussockland grading into subalpine tall tussockland, with areas of mixed hardwood and podocarp forest, kanuka forest and *Coprosma*-flax scrub (Bibby 1997). In Otago, much of the original vegetation cover has been dramatically altered as a result of anthropogenic factors (McGlone et al. 1995), and this massive vegetation change has also occurred at Macraes (Whitaker 1996). Since European settlement in the 1850's (Thompson 1949), areas have been burnt (sometimes repeatedly) and exotic grasslands induced by ploughing, oversowing, and fertilisation (Whitaker 1996). The present vegetation of the Macraes ED is of a highly modified nature, with approximately 50% of the district dominated by improved pastureland and the remainder comprised of varying density narrow-leaved tussockland, copper tussock-based wetlands and grey shrubland interspersed with remnants of original forest cover and scattered ephemeral wetlands (Bibby 1997, Thorsen pers. obs.). The remaining native vegetation communities currently present within the Macraes area are botanically diverse (Thorsen 2008). They are likely to be derived from the original vegetation communities that existed before human colonisation of the region, but are likely to be considerably reduced in extent and species diversity. Invasion by exotic shrub and tree species, particularly gorse and broom, is an increasing problem in the area.

Of the fauna, fifty-three species of birds have been recorded from the Coronation area, of which thirty-two are indigenous and the remaining twenty-one are introduced (Ryder 2013). The area is also noted for its high diversity of seven lizard species (Whitaker et al. 2002). Some catchments provide habitat for populations of non-migratory galaxiids, freshwater crayfish and longfin eel.

5.2 Flora Ecological Features

5.2.1 Description of vegetation communities

Ten vegetation communities are identified within the PIA (Figure 3): riparian herbfield & sedgeland, basalt contact seepage wetlands, ephemeral wetlands, seepage and flush wetlands, short tussock grassland, narrow-leaved tussock grassland, exotic pasture, shrubland, disused *Pinus radiata* plantation, and bluff vegetation. Some gully slope areas have not been classified as they are a matrix of the other indigenous communities. This unclassified vegetation type is shown as unshaded in Figure 3, and totals 59ha.

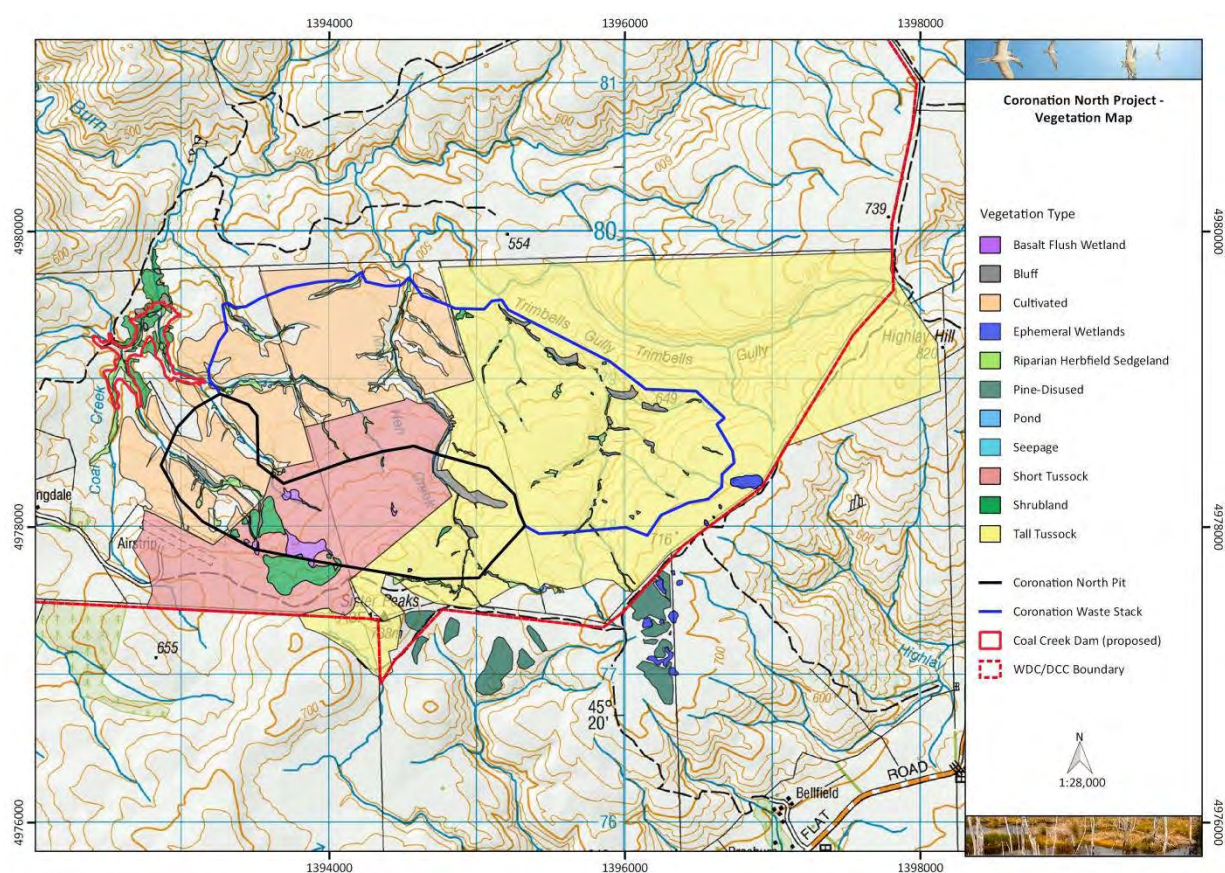


Figure 3. Vegetation communities within the PIA.

5.2.1.1 Riparian herbfield & sedgeland

Riparian herbfield & sedgeland (Johnson & Gerbeaux 2004) cover 9.3ha in most of the tributaries of Coal Creek, Maori Hen Creek, Trimbells Gully and, to a lesser extent, in tributaries of Highlay Creek. The riparian herbfield & sedgeland within the PIA become more dominated by exotic species towards their heads, and it is only within the more incised or wetter areas where more intact gully wetland vegetation comprising reasonably continuous cover of *Chionochloa rubra* subsp. *cuprea* and/or *Carex secta* with interspersed patches of low herbaceous vegetation, are found. Elsewhere are patches of

Carex coriacea sedgeland (mainly on flushes), rare patches of *Schoenus pauciflorus* sedgeland, scattered tussocks of *Poa cita* and *Festuca novae-zelandiae*, and occasional patches of *Carex kaloides*. Small shrubs of *Olearia bullata* are not uncommon along the gully margins, particularly in gullies in the west of the PIA. The majority of the gully wetland vegetation type is a mixture of exotic and indigenous rushes, sedges, herbs and grasses (including hybrid copper tussock) with exotic species dominating the ground cover, and are often heavily pugged by cattle. In ungrazed areas, the gully bottoms are dominated by the grass Yorkshire fog *Holcus lanatus*.

5.2.1.2 Basalt contact seepage wetlands

The basalt contact seepage wetlands at the basalt/schist rock contact zone of the Sisters Peak cone cover 4.2ha, and are comprised of a mix of indigenous and native herbs, sedges, rushes and grasses, such as *Carex gaudichaudiana*, *Ranunculus glabrifolius*, *Juncus effusus*, *Eleocharis acuta*, *Juncus articulatus*, areas of *Carex coriacea* sedgeland, and they are often bordered by *Carex testacea*. These wetlands are often heavily pugged by cattle, which results in the formation of raised hummocks.

5.2.1.3 Ephemeral wetlands

The seven ephemeral wetlands that cover 4ha within the PIA are of the type which forms on schist pans in some areas of Central Otago. The examples within the PIA are all long-inundation type, in that they only dry out for short periods over the summer period and are dominated by hummocks created by taller grasses, rushes and sedges such as *Juncus effusus*, *Carex gaudichaudiana*, *Carex sinclairii*, *Holcus lanatus*, *Anthoxanthum odoratum*, and *Agrostis capillaris*. Some have a high preponderance of the indigenous *Agrostis personata* and *Deschampsia cespitosa* grasses. Inter-hummock spaces are dominated by moss and liverwort species, with patches of *Alopecurus geniculatus*, *Ranunculus glabrifolius* and *Gonocarpus micranthus*. One vehicle-damaged ephemeral wetland had slightly higher species diversity, containing *Gentianella amabilis* and *Oreobolus impar*.

5.2.1.4 Seepage wetlands

Seepage wetlands are present as very small examples total 0.2ha in the heads of some gullies. They are dominated by moss with scattered herbs, rushes and sedges, particularly *Ranunculus glabrifolius* and *Carex gaudichaudiana*.

5.2.1.5 Short tussock grassland

This vegetation community occurs over 86.8ha on the western and northern basalt slopes of the Sister Peaks cone, and is comprised of an approximately 50% cover of *Poa cita* and *Festuca novae-zelandiae* tussocks interspersed by patches of predominantly exotic herbs and grasses and scattered *Melicytus alpinus* and *Muehlenbeckia complexa* shrubs. This vegetation community merges with a *Festuca novae-zelandiae* dominated short tussock grassland on the schist underlain lower slopes of the Sister Peaks. There are patches of matagouri and *M. complexa* shrubland with a 1m to 1.8m high canopy

throughout the short-tussock grassland. This vegetation type is probably fire-induced, as the eastern and southern slopes of the cone are covered with narrow-leaved tussock grassland.

5.2.1.6 Narrow-leaved tussock grassland

This vegetation type is extensive over 231.1ha in the eastern area of the PIA and along the top ridge. It is comprised mainly of recently-burnt 70-80cm tall (to 1m in some areas, such as parts of the Trimbells Gully Recommended Area for Protection [RAP]) *Chionochloa rigida* subsp. *rigida* with a ground cover of 30-70%, with interspersed *Aciphylla aurea*, areas of matagouri shrubland and dry *Pilosella officinalis* herbfield. The native grass *Rytidosperma clavatum* is common over large, open, dry areas within the narrow-leaved tussock grassland.

5.2.1.7 Exotic pasture

Exotic pasture has been induced over 132ha through ploughing and oversowing on the flatter spurs between the incised gullies. Exotic pasture is comprised mainly of *Bromus hordaceus*, *Lolium perenne*, *Erodium cicutarium*, *Rumex acetosella*, *Cerastium semidecandrum*, *Dactylis glomerata* and *Leontodon autumnalis*. An area that has recently planted in what appears to be turnip is also included in this vegetation type.

5.2.1.8 Shrubland

Areas of shrubland occur as scattered patches over 5ha throughout the PIA, although they are more prevalent in areas of short tussock grassland and narrow-leaved tussock grassland. The main species present are matagouri, *Coprosma propinqua* and *Muehlenbeckia complexa*, although at a few sites there are remnant clumps of *Carmichaelia crassicaulis* subsp. *crassicaulis* and *Coprosma intertexta*, which are interpreted as fire refuges. In damper areas are patches of the fern *Polystichum vestitum*. Most of the shrublands are of very short stature (to 1.8 m canopy height) with very low shrub species diversity, probably because of repeated burning of the area.

5.2.1.9 Disused *Pinus radiata* plantation

Some areas of disused and unmaintained *Pinus radiata* plantation are present over 22.8ha within the Coronation Pit Extension Zone.

5.2.1.10 Bluff vegetation.

Bluff vegetation is scattered over 11.5ha on schist rock outcropping throughout the PIA, but is particularly notable in Maori Hen Creek, the lower areas of Trimbells Gully and Coal Creek. Bluff vegetation comprises mainly indigenous species such as *Chionochloa rigida* subsp. *rigida*, *Poa colensoi* (particularly the green form of this species), *Asplenium richardii*, *Brachyglottis bellidioides*, *Anisotome*

aromatica, *Rytidosperma corinum*, *Luzula banksii* var. *rhadina*, *Muehlenbeckia complexa*, *Asplenium flabellifolium*, fringed with *Polystichum vestitum* and shrubs such as *Melicytus alpinus* and *Coprosma propinqua*, and with large populations of *Celmisia hookeri* in some areas (particularly in Trimbells Gully).

5.2.2 Vegetation representativeness & pattern

The PIA is representative of the general vegetation patterns in this area of the Macraes E.D., although there is a gradient from west to east in this area with some species becoming less, or more, common. This influences the species composition of the vegetation types. The community patterning of narrow-leaved tussock grassland on broad-topped spurs and slopes with short tussock grassland in drier and/or heavier grazed areas and where flatter and less-rocky areas have been cultivated using ploughing, and with interfingered shallowly- to moderately-incised drainage systems hosting riparian herbfield & sedgeland and bluff vegetation is typical of this area.

The narrow-leaved tussock grassland that covers large areas of the PIA is very representative of that which covers large areas mainly along the slopes and tops of the broad ridges in the Macraes area.

The mixed species short tussock grassland is also representative of that which is locally common in the Macraes E.D.

The silver and hard tussock grassland on the Sisters Peak basalt cone is representative of that which occurs on open basalt areas, and is also similar to that which occurs along grazed toe slopes in some pastoral areas and on some stream terraces in the area.

The bluff communities are representative those that occur in shallow incised gullies throughout the Macraes E.D.

The riparian herbfield & sedgeland are representative of a vegetation community that occurs in most gully heads in the Macraes E.D. (and upland areas of Central Otago, where there is a higher representation of seepage and flush wetlands).

Long-inundation ephemeral wetlands are also known on Red Bank Ridge, the OceanaGold Protected Wetlands along the Macraes road, and in Cranky Jims Wetland Covenant.

The basalt contact seepage wetlands at the basalt/schist contact zone on the Sisters Peak cone are probably representative of this vegetation community.

Overall, the PIA is assessed² as of **high** representativeness importance.

² Using <http://ecan.govt.nz/publications/Plans/ecological-significance-indigenous-vegetation-canterbury.pdf>.

5.2.3 *Ecological integrity*

The PIA is part of a mosaic of natural and exotic vegetation communities that are found throughout the wider Macraes area. All natural vegetation communities (except possibly bluff communities) in the Macraes E.D. are decreasing in extent due to conversion to pasture through ploughing and, to a lesser extent, irrigation. They are also being degraded through weed invasion, which is being facilitated by repeated burning, changes in stocking, and fertiliser application. Exotic mammals and invertebrates are likely to be having both a negative (through browsing of plants and preventing regeneration) and positive effect (through maintaining some plant communities by suppressing competing weed species). In areas where sheep grazing and land management practices has been continued in a similar fashion for many years, the vegetation appears to reach a semi-stable state with a high diversity of both indigenous and exotic species.

Areas mapped as semi-natural or natural vegetation communities cover 357.7 ha (73% of PIA) and exotic plant communities cover 132 ha (27% of PIA). Overall, the PIA has a Naturalness Index of 0.60 (i.e. approximately 60% of the area is covered by indigenous species). Some areas within the PIA are reasonably ecologically intact, although there is some impact in nearly all areas (excepting parts of the bluff communities) from ongoing grazing by sheep and cattle. Some extensive areas of cultivated communities are present. The only ecological value of these is that they may occasionally be used as foraging areas for some bird species. The PIA is likely to be playing some role in supporting a metapopulation of some plant species, but the extent and type of this role is unknown and likely to vary between species. To some extent the PIA buffers the Trimbells Gully RAP.

Overall, the PIA is assessed³ as of **moderate** ecological integrity importance.

5.2.4 *Vegetation rarity*

Within the PIA, the silver and hard tussock grassland, basalt contact seepage wetlands, seepage wetlands and long-inundation ephemeral wetlands could be considered as vegetation communities that are rare in the Macraes E.D., mainly due to their limited extent and infrequent representation.

Overall, the vegetation communities within the PIA are assessed⁴ as of **high** rarity importance.

³ Ecological integrity (community intactness) is not addressed in the EIANZ Guidelines. The value used here is an expert assessment.

⁴ The use of the Land Environment New Zealand (LENZ) model for assessing vegetation rarity, as proposed by some organisations (e.g., Ecan), is evaluated separately in this document. This assessment of the rarity of vegetation communities is based on estimated representation within the Ecological District of physical vegetation communities.

5.2.5 Botanical diversity

The total botanical diversity of the PIA is high, with 163 indigenous species and 79 exotic species being recorded within 539ha (Table 1). This botanical diversity is due to the size of the PIA, and/or the diversity of plant communities present, as the number of species hectare⁻¹ is lower than within the OceanaGold covenants (Table 1), which also represent fewer vegetation communities. The total botanical diversity of the PIA represents 57% of the total of 423 indigenous and exotic species listed for the Macraes E.D. by Bibby (1997), though there are differences with the species composition of the list given by Bibby (1997), mainly due to new discoveries in the area. The 162 indigenous species component represents 39% of the 419 indigenous species known by the author from the Macraes area, and the total of 241 plant species represents 43% of the 566 plant species now known from this area.

Site	Area (hectares)	# indigenous species	# exotic species	Indigenous species hectare ⁻¹	Naturalness Index
Coronation North PIA	539 ⁵	163	79	0.3	0.60
Cranky Jims Shrubland Covenant	47.1	98	39	2.1	0.65
Cranky Jims Wetland Covenant	97.3	92	40	0.9	-
Deepdell Tussock Covenant	109.8	108	37	1.0	0.72
Highlay Creek Covenant	16.9	52	47	3.1	0.55

Table 1. Comparison of botanical diversity and naturalness at sites within the Macraes area

Overall, the PIA is assessed⁶ as of **high** botanical diversity importance.

5.2.6 Ecological function and ecosystem services

5.2.6.1 Linkages and networks

The PIA probably plays a **moderate** role in providing a patchwork of natural ecological areas assisting the local persistence of some species.

⁵ This area total does not include the southern extension of the existing Coronation pit

5.2.6.2 Buffering

THE PIA probably plays a **moderate** role in buffering one boundary of a recommended area for protection (Macraes RAP 4: Trimbells Gully) from weed incursion and increased sedimentation arising from nearby cultivated areas.

5.2.6.3 Support services

The PIA apart has a **minor** ecosystem support services role in protecting genetic diversity.

5.2.6.4 Regulating services

The PIA apart has a **minor** ecosystem regulating services role in reducing erosion of underlying soils, and regulating flood flows in the area.

5.2.6.5 Cultural services

The PIA apart has a **negligible** ecosystem cultural services role.

5.2.6.6 Provisioning services

The PIA apart has a **minor** ecosystem provisioning services role in providing irrigation water to downstream areas.

Overall, the PIA is assessed as providing a **moderate** ecosystem service.

5.2.7 *Notable vegetation communities or sites*

5.2.7.1 Indigenous vegetation associated with Threatened land environments (defined by Land Environments of New Zealand at Level IV) that have ≤20% remaining in indigenous cover (Ministry for Environment and Department of Conservation 2007, Walker *et al.* 2007, 2008).

⁶ Using <http://ecan.govt.nz/publications/Plans/ecological-significance-indigenous-vege-canterbury.pdf>.

Eight Level IV LENZ categories are mapped for the PIA (Figure 4), of which three are currently classified as Threatened Land Environments: the Acutely Threatened N3.1e, N3.3a, and the Chronically Threatened Q4.1d.

N3.1e occurs over 351.4ha on much of the schist slope, and is largely covered by either narrow-leaved tussock grassland or exotic pasture.

N3.3a occurs as 1.7ha on the Sisters Peaks and Maori Hen Creek. The vegetation of these tiny patches is likely to be exotic pasture (lower patch) or short tussock grassland (upper patch).

Q4.1d occurs as a 0.06ha patch on Sisters Peaks and is likely to be short tussock grassland.

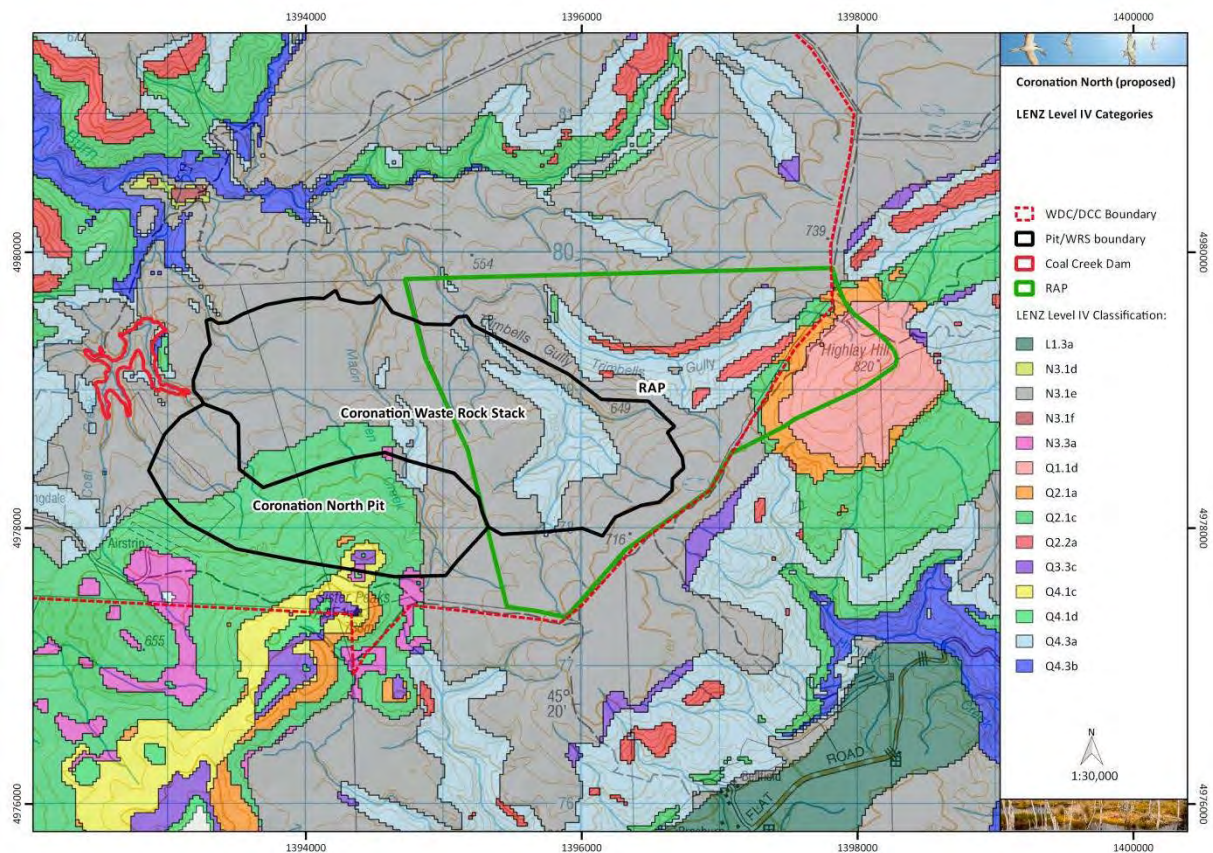


Figure 4. LENZ classification of the PIA at Level IV.

5.2.7.2 Indigenous vegetation associated with sand dunes and wetlands, ecosystem types that have become uncommon due to human activity and are a National Priority for Protection (Ministry for Environment and Department of Conservation 2007).

The PIA includes three wetland vegetation communities that are a National Priority for Protection: the long-inundation ephemeral wetlands, the basalt contact seepage wetlands, and the seepage wetlands.

5.2.7.3 Indigenous vegetation associated with ‘Historically Rare’ or ‘Threatened’ terrestrial ecosystem types (Ministry for Environment and Department of Conservation 2007, Williams *et al.* 2007, Holdaway *et al.* 2012).

The PIA includes two wetland vegetation communities that are Historically Rare: the long-inundation ephemeral wetlands and seepage wetlands. The long-inundation ephemeral wetlands are also a Critically Endangered ecosystem and the seepage wetlands are an Endangered ecosystem.

5.2.7.4 Wetlands of National Importance or Ramsar sites.

The PIA includes no Wetlands of National Importance or Ramsar sites.

5.2.7.5 Sites or communities identified as significant in Regional Plan

The indigenous vegetation communities within the PIA are assessed as significant under the criteria in the ORC Regional Plan, on the basis that they are representative and are habitat for rare or threatened indigenous species. Additionally, the long-inundation ephemeral wetlands are a vegetation association that is rare nationally. There are no wetlands identified by the ORC as Regionally Significant within the PIA.

5.2.7.6 Sites or communities identified as significant in District Plans

No indigenous vegetation communities within the PIA that are located within the DCC boundary have been listed as significant in Schedule 25.4 of the DCC District Plan.

The small examples of indigenous vegetation communities within the PIA that are located within the WDC boundary are assessed as significant under the WDC District Plan on the basis of representativeness, rarity, distinctiveness, diversity, ecological context (buffering the RAP), and as providing habitat for rare or threatened species.

5.2.7.7 Sites identified as recommended for protection

One site identified by Bibby (1997) as a Recommended Area for Protection (RAP) is partially situated within the PIA, Macraes RAP 4: Trimbells Gully. This RAP was selected by Bibby (1997) on the basis of its representativeness, diversity, naturalness, special features (southern limit of *Sophora prostrata* on

Highlay Hill [outside the PIA], basalt boulder slope [outside the PIA]), buffering and viability. Inspection of the section of the RAP that lies within the PIA during this survey shows that many of these features are still present, though it is obvious that much of the area has been recently burnt and the remaining narrow-leaved tussock grassland is of low stature. The species diversity noted by Bibby (1997) is higher in the lower areas of the RAP, and are concentrated on the larger bluff systems and areas of the gully floor. There appears to have been considerable changes in the vegetation composition since the visit by Bibby (1997) as the species he records as common in the narrow-leaved tussock grassland were found to be rare in this visit (namely *Geranium microphyllum*, *Helichrysum filicaule*, *Raoulia subsericea*, *Ranunculus multiscapus*, *Gaultheria depressa* var. *depressa* and *Gaultheria macrostigma*). The grass *Rytidosperma racemosum* noted by Bibby (1997) as a species of limited distribution was not seen during the inspection. It is not known why Bibby (1997) considered *R. racemosum* a notable species as it is an exotic. It is likely that he has confused it with *R. clavatum* which is a native grass common in this area and which is conspicuous when in flower.

5.2.1 Importance overall of vegetation communities

Overall, the vegetation communities present within the PIA are assessed as being of **very high** ecological importance. The communities are of high representation, diversity and moderate integrity and ecosystems service importance. There are rare vegetation communities present, wetland vegetation communities that are a national priority for protection, the long-inundation ephemeral wetlands and seepage wetlands are historically rare and classified as Nationally Critical or Endangered, an area has previously been recommended for protection on the basis of its ecological features, and there are three Threatened Level IV land environments that are overlain by some natural vegetation. The remainder of the natural vegetation types are significant under the ORC Regional Plan and WDC District Plan.

5.3 Threatened, At Risk, or rare plant species

Twenty two plant species that occur within the PIA are either currently classified as Threatened, At Risk or Data Deficient (Townsend et al. 2007, de Lange et al. 2013), or are listed as 'Threatened Plants' in Appendix 16A of the DCC District Plan, or are thought to be rare in the Macraes E.D. based on the author's observations (Figure 5).

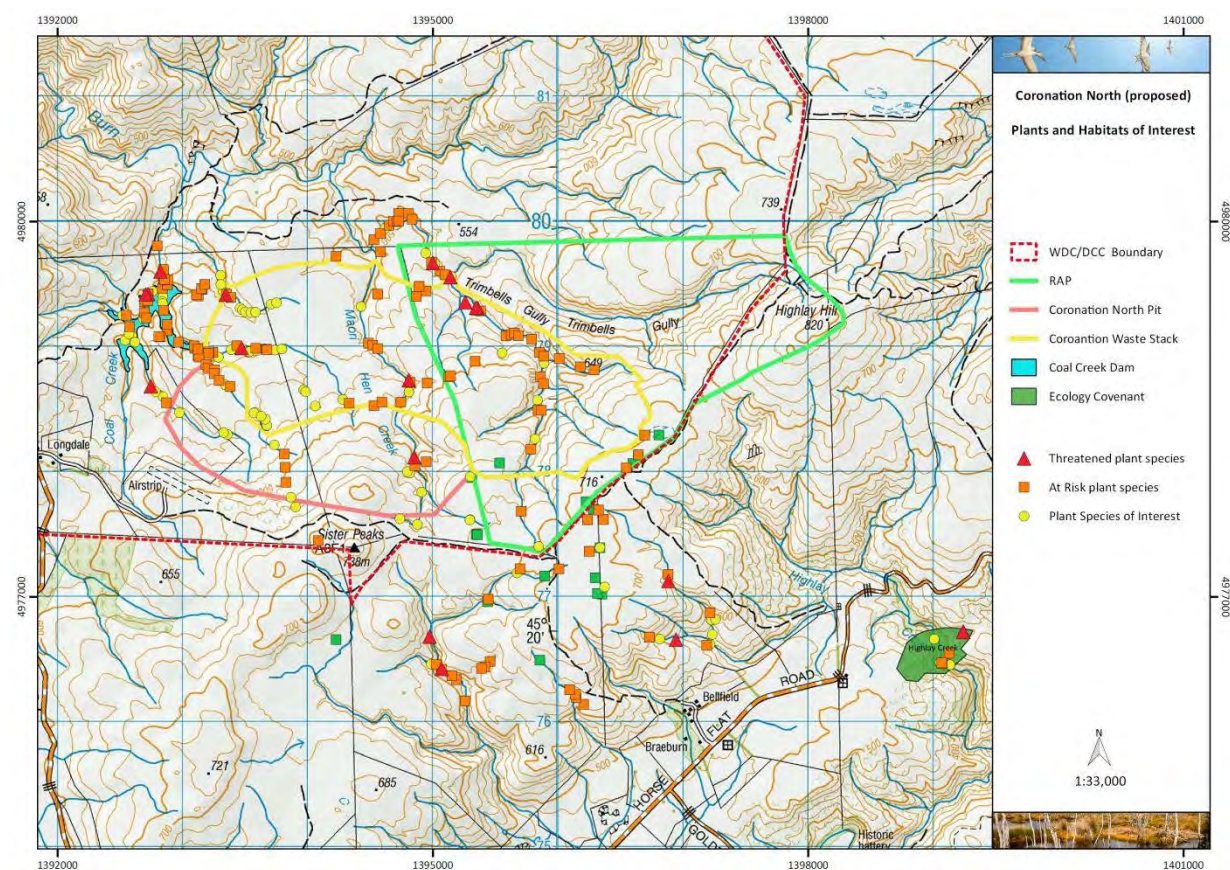


Figure 5. Locations of Threatened, At Risk and other plant species of interest (Data Deficient, rare plants) and habitats of interest (copper tussock wetland [some localities obscured below species localities], and ephemeral wetlands) within the PIA.

5.3.1 Threatened species

Four Threatened species occur within the PIA: the grass *Simplicia laxa*, the annual fern *Anogramma leptophylla*, the wetland buttercup *Ranunculus ternatifolius* and the unnamed daisy *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff").

5.3.1.1 Nationally Critical species

One Nationally Critical species is present within the PIA: the grass *Simplicia laxa*.

1. *Simplicia laxa* Kirk (a grass, Poaceae)

Distribution within project

Simplicia laxa was recorded from 2 sites in the WRS Zone. Both sites are under overhangs in schist bluffs bordering incised gullies, and several plants were noted at each site in the highly shaded area at the rear of the overhangs.

Summary of existing information

Simplicia laxa is currently classified as Nationally Critical, with the qualifiers Conservation Dependent and Sparse, on the basis that the total population is estimated to occupy ≤ 1 ha (0.01 km²), occupied sites are widely separated, and the majority of plants are situated within areas that receive some level of conservation protection. Previously it has been assessed as Rare and Endangered in 1976, as Nationally Endangered in 1999 and 2004, and Nationally Critical in 2009.

The distribution of this species nationally is relatively poorly known. From the date of its formal description in 1897, it received little attention until it was discovered on the Old Man range in 1969 and at a second site in the 1990's. To date, the majority of records are post-2005. Currently it is known to occur wild in the central North Island, Wairarapa, northern West Coast and Otago (the stronghold), with unconfirmed records from Fiordland and Mt Aspiring National Park. Within the wider Macraes area it is known from a further 3 sites on OceanaGold tenure land (including 1 site in Deepdell Covenant), and 35 sites between Ramrock and Red Bank Roads on private farmland, covenants and DOC reserve.

The habitat of this very shade-tolerant species is browsed lowland dry alluvial forests in the North Island, and lowland to montane rock overhangs and cave entrances in the South Island, all on base-rich substrates. The sites it occupies are usually widely separated, and it is not known how, or if, the species colonises new sites or how long it persists at a site once it is occupied. Not all apparently suitable sites have *S. laxa* present. The rock overhang habitat in Otago is thought to be a refuge colonised by *S. laxa* following removal of the original natural grey scrubland and dry low-stature forest cover.

At none of the sites where *S. laxa* is known is it common, with most records being of 1-5 plants occupying c. 1-2m². It has been lost from some sites at Macraes following removal of stock, probably due to being shaded out by regrowth of taller exotic grasses and native vegetation.

An attempt is being made to introduce *S. laxa* to the Orokonui Ecosanctuary, and QEII are managing it at one site near Ngapara. These are the only known active conservation programmes for this species, and at both of these sites success has been limited.

There are considerable genetic differences and some morphological differences between populations of this grass, particularly between those in the North Island and South Island.

The ecological importance of the population of this species within the PIA is categorised as **very high** on the basis of its:

- 1) Nationally Critical conservation status;
- 2) the few individuals at the sites where it occurs;
- 3) the inferred loss of previously occupied sites through habitat change subsequent to de-stocking as a conservation measure of protected areas;
- 4) possible lack of ability to colonise new sites;
- 5) limited benefit to date from conservation programmes;
- 6) genetic and, to a lesser extent, morphological differences with North Island populations and South Island populations elsewhere.

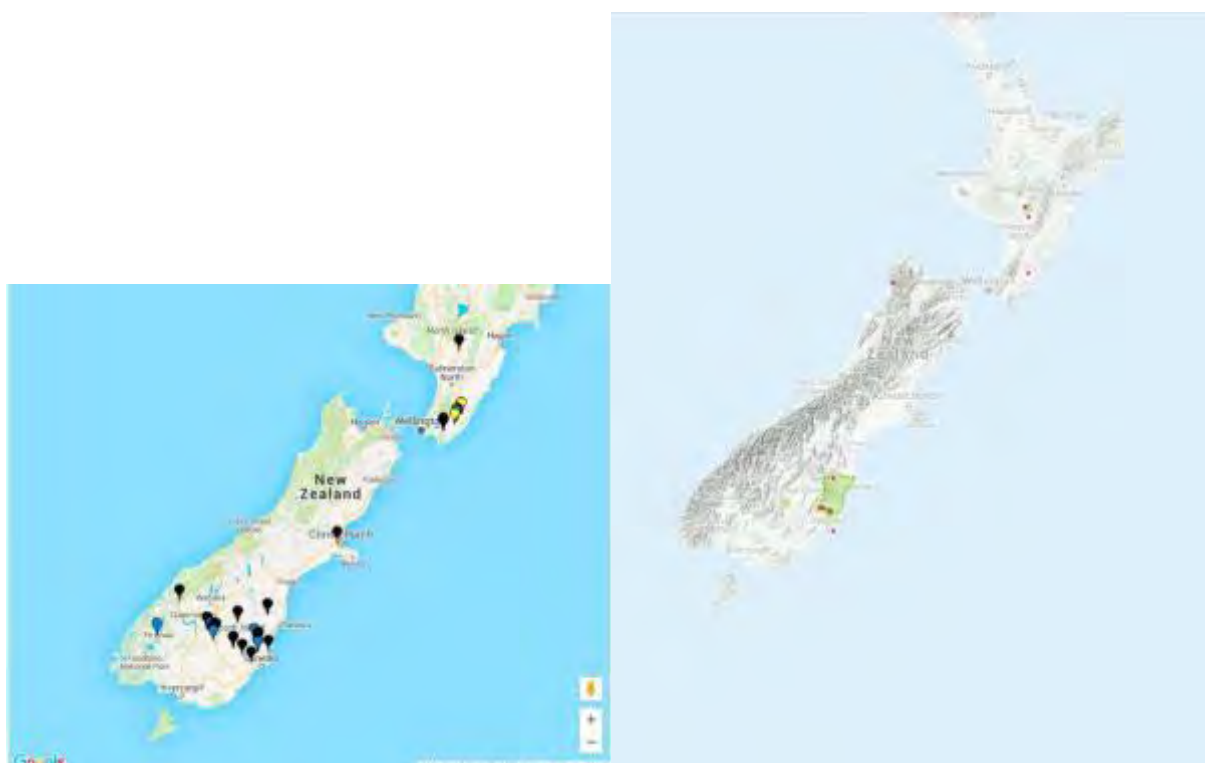


Figure A. Distribution of *Simplicia laxa* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

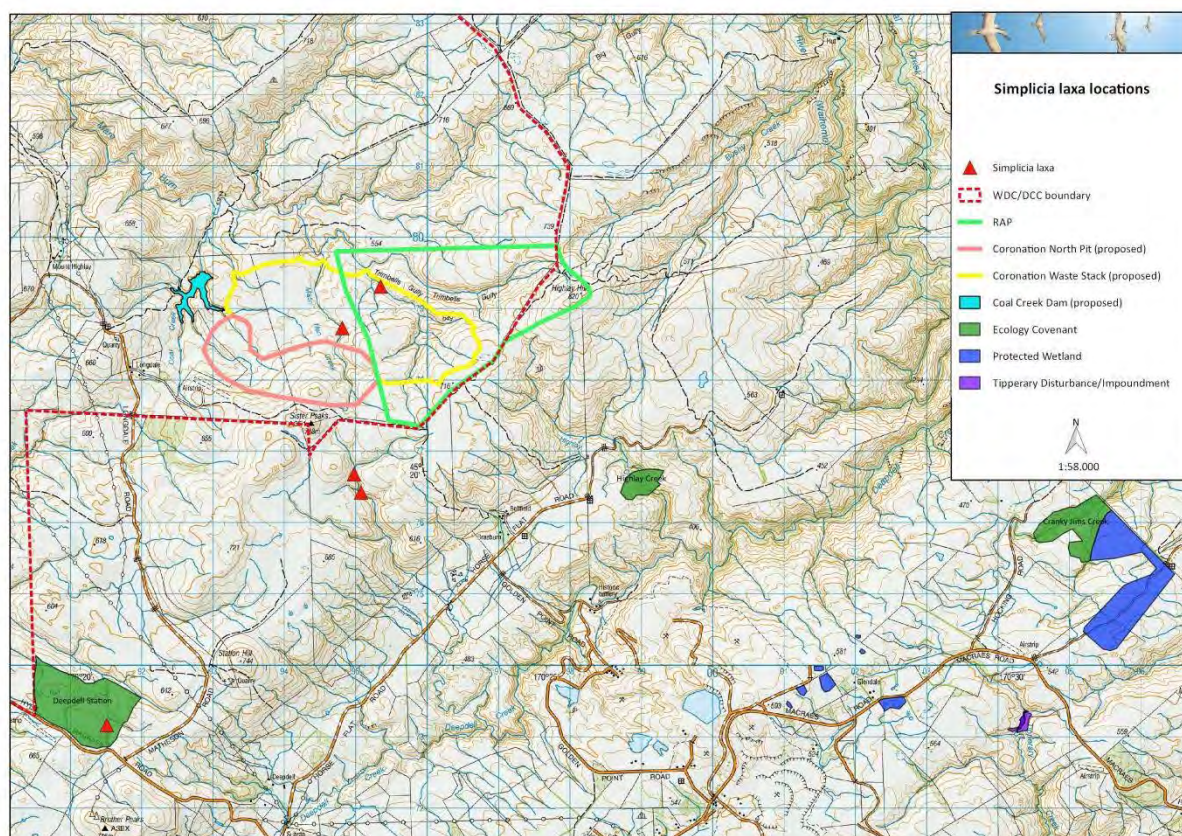


Figure B. Distribution of *Simplicia laxa* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Given, D.R. 1976. A register of rare and endangered indigenous plants in New Zealand. New Zealand Journal of Botany 14: 135–149.

Given, D.R. 1981. Rare and endangered plants of New Zealand. Reed, Auckland.

Wilson, C.M; Given, D.R. 1989. Threatened plants of New Zealand. DSIR Publishing, Wellington.

Johnson, P.N. 1992. The rare grass, *Simplicia laxa*: how to recognise it. Unpublished Report. Landcare Research, Dunedin.

Johnson, P.N. 1995. The rare grass, *Simplicia laxa*: field status, ecology and conservation. Science for Conservation No. 15. Department of Conservation, Wellington.

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

Dopson, S.R, de Lange, P.J; Ogle, C.C; Rance, B.D; Courtney, S.P; Molloy, J. 1999. The conservation requirements of New Zealand's nationally threatened vascular plants. Threatened Species Occasional Publication No. 13. Department of Conservation, Wellington.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P; Heenan, P; Norton, D; Rolfe, J; Sawyer, J. 2010. Threatened plants of New Zealand. Canterbury University Press, Christchurch.

Ogle, C.C. 2010. Rediscovery of a rare species of grass in the genus *Simplicia*. Wellington Botanical Society Bulletin 51: 38-46.

Smitsen, R.D; de Lange, P.J; Thorsen, M.J; Ogle, C.C. 2011. Species delimitation and genetic variation in the rare New Zealand endemic grass genus *Simplicia*. New Zealand Journal of Botany 49: 187-199.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

de Lange, P.J; Rolfe, J.R; Silberry, T. 2014. Seen but unseen – rediscovering *Simplicia laxa* in the southern North Island. Trilepidia 124: 5-9.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=94 accessed 25 January 2016.

Nature Watch <http://naturewatch.org.nz/taxa/406057-Simplicia-laxa> accessed 25 January 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

Dr M. Thorsen personal communication with Dr Kelvin Lloyd, Otago Natural History Trust.

Dr M. Thorsen personal communication with Alice Shanks, QEII National Trust.

Dr M. Thorsen personal communication with Graeme Loh, Department of Conservation.

5.3.1.2 Nationally Endangered species

No Nationally Endangered species are known within the PIA

5.3.1.3 Nationally Vulnerable species

Four Nationally Vulnerable species are known to occur within the PIA: the fern *Anogramma leptophylla*, the sedge *Carex inopinata*, the wetland buttercup *Ranunculus ternatifolius* and the cliff dwelling daisy *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff").

1. *Anogramma leptophylla* (L.) Link (annual fern, Pteridaceae).

Distribution within project

This small delicate fern was recorded at one site within the WRS Zone, where 3-4 plants occupy a shaded overhanging face of a large schist bluff bordering an incised gully.

Summary of existing information

Anogramma leptophylla is currently classified as Nationally Vulnerable, with the qualifiers Extreme Fluctuations, Range Restricted, Secure Overseas and Sparse, on the basis that the total population is estimated to consist of 5,000 – 20,000 individuals and there is a predicted decline of 30-70%, the species dies down to tubers or spores over summer, it is thought to occur only at a few widely separated sites within a narrow geographic area, and it is thought to be secure from extinction in other countries. Previously it has been assessed as Rare and Endangered in 1976, as Vulnerable in 1990, as Gradual Decline in 1999 and 2004, and Nationally Critical in 2009.

This species is widespread in temperate areas of the world. In New Zealand it is known from widely scattered sites in the east from Northland to Otago. Within the wider Macraes area it is also known from one site in OceanaGold tenure land, in the Deepdell Covenant. It usually occurs on shaded or partially shaded bare clay banks or rock walls, often in association with a *Targionia* liverwort.

Anogramma leptophylla is considered to be in decline in the northern North Island and to be threatened by competition from shading grasses and herbs. It is managed at one site in Auckland (an abandoned quarry), but the current status of this project is unknown.

The ecological importance of the population of this species within the PIA is categorised as **very high** on the basis of its:

- 1) Nationally Vulnerable conservation status;

- 2) the few individuals at the sites where it occurs;
- 3) the inferred loss of previously occupied sites through weed invasion.

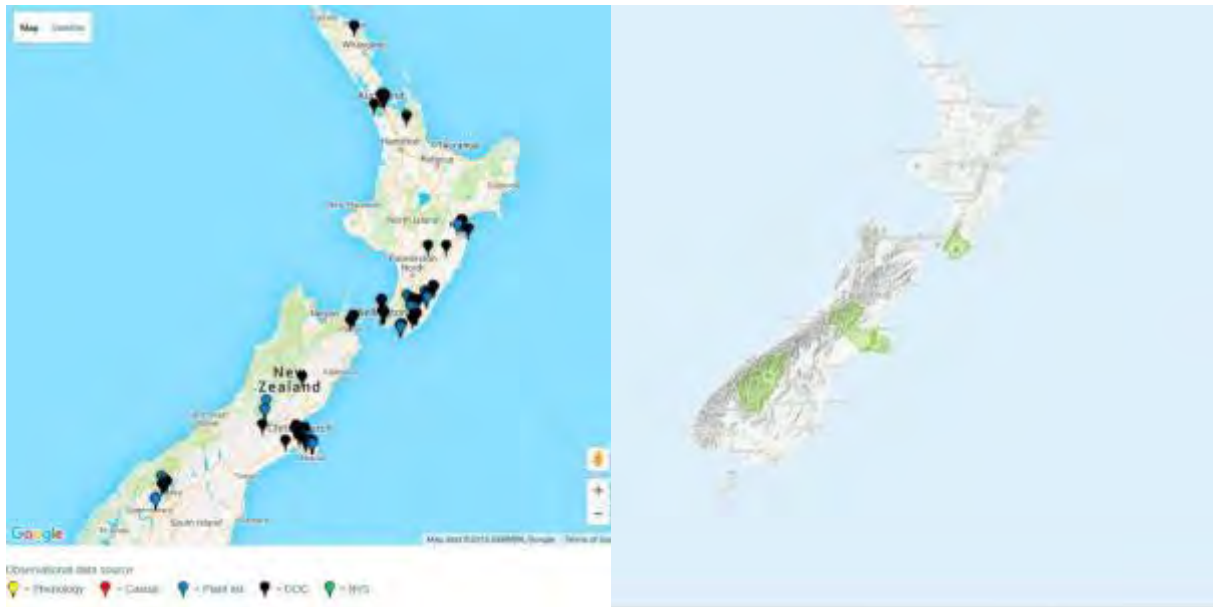


Figure A. Distribution of *Anogramma leptophylla* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

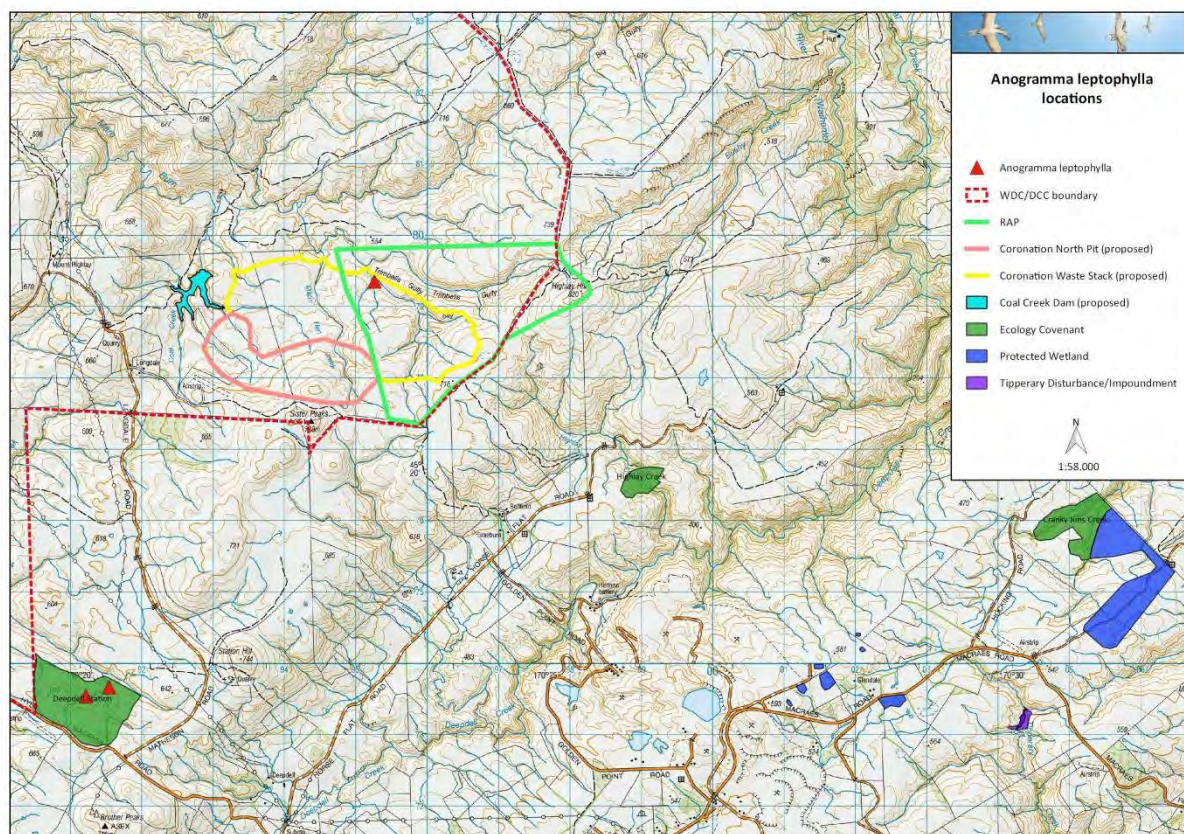


Figure B. Distribution of *Anogramma leptophylla* within the PIA and the wider OceanaGold project area (notes: Deepdell locality is not mapped).

Data sources used in this assessment:

Given, D.R. 1976. A register of rare and endangered indigenous plants in New Zealand. New Zealand Journal of Botany 14: 135–149.

Given, D.R. 1981. Rare and endangered plants of New Zealand. Reed, Auckland.

The *Anogramma* – *Targionia* association. Bulletin of the Wellington Botanical Society 44: 16-18.

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

Brownsey, P.J; Smith-Dodsworth, J.C. 2000. New Zealand ferns and allied plants, 2nd Edn. Bateman, Auckland

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

Bouma, W.L.M; Ritchie, P; Perrie, L.R. 2010. Phylogeny and generic taxonomy of the New Zealand Pteridaceae ferns from chloroplast *rbcL* DNA sequences. Australian Systematic Botany 23: 143-151.

de Lange, P; Heenan, P; Norton, D; Rolfe, J; Sawyer, J. 2010. Threatened plants of New Zealand. Canterbury University Press, Christchurch.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=147 accessed 26 January 2016.

Nature Watch <http://naturewatch.org.nz/taxa/180646> accessed 26 January 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

Dr M. Thorsen personal communication with Marcia Dale, Dunedin.

2. *Carex inopinata* Cook (grassy mat sedge, Cyperaceae).

Distribution within project

This sedge has been previously recorded from one site within the WRS Zone. It was not seen during this survey.

Summary of existing information

Carex inopinata is currently classified as Nationally Vulnerable, with the qualifier Sparse, on the basis that the widely separated groups that make up the total population is estimated to occupy ≤ 100 ha (1 km²), and the population is thought to be stable. Previously it has been assessed as Rare and Endangered in 1976, as Critically Endangered in 1999, and Nationally Endangered in 2004 and 2009.

This species is found in the eastern South Island. This is the first record of the species from the Macraes E.D. It usually occurs at the shaded base of rocks or under alluvial forest on dry terraces.

Carex inopinata is considered to be stable, but some at some sites it is under threat by competition from shading grasses and herbs. It is managed at within several conservation projects, including at the Orokonui Ecosanctuary.

The ecological importance of the population of this species within the PIA is categorised as **very high** on the basis of its:

- 1) Nationally Vulnerable conservation status;
- 2) the few individuals at the sites where it occurs;
- 3) its discovery within the E.D.

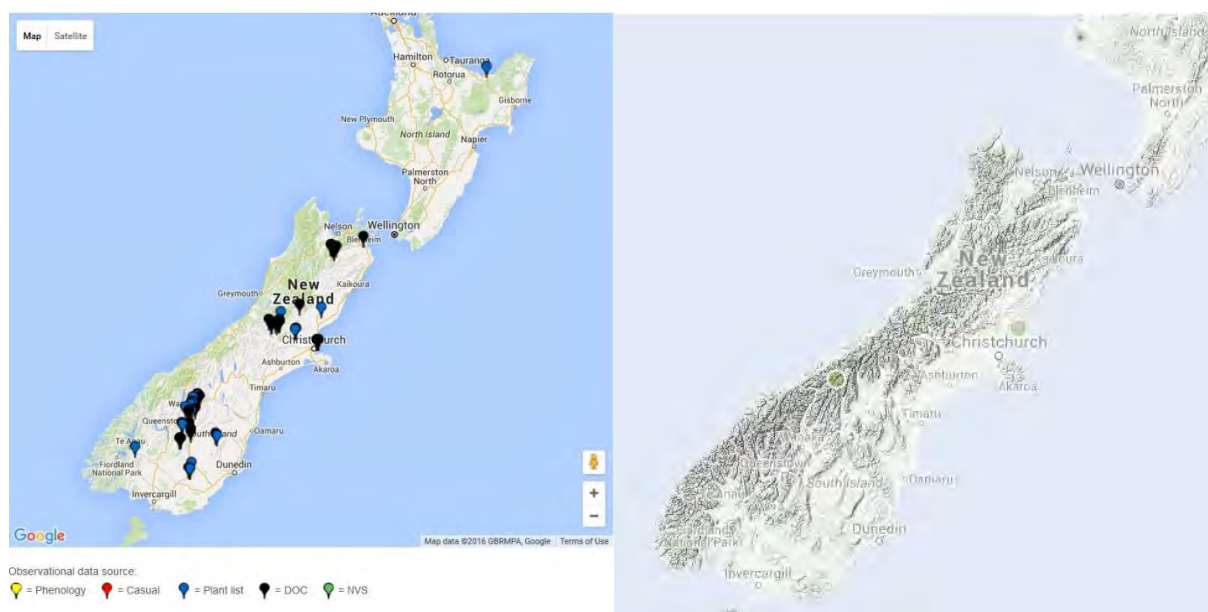


Figure A. Distribution of *Carex inopinata* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

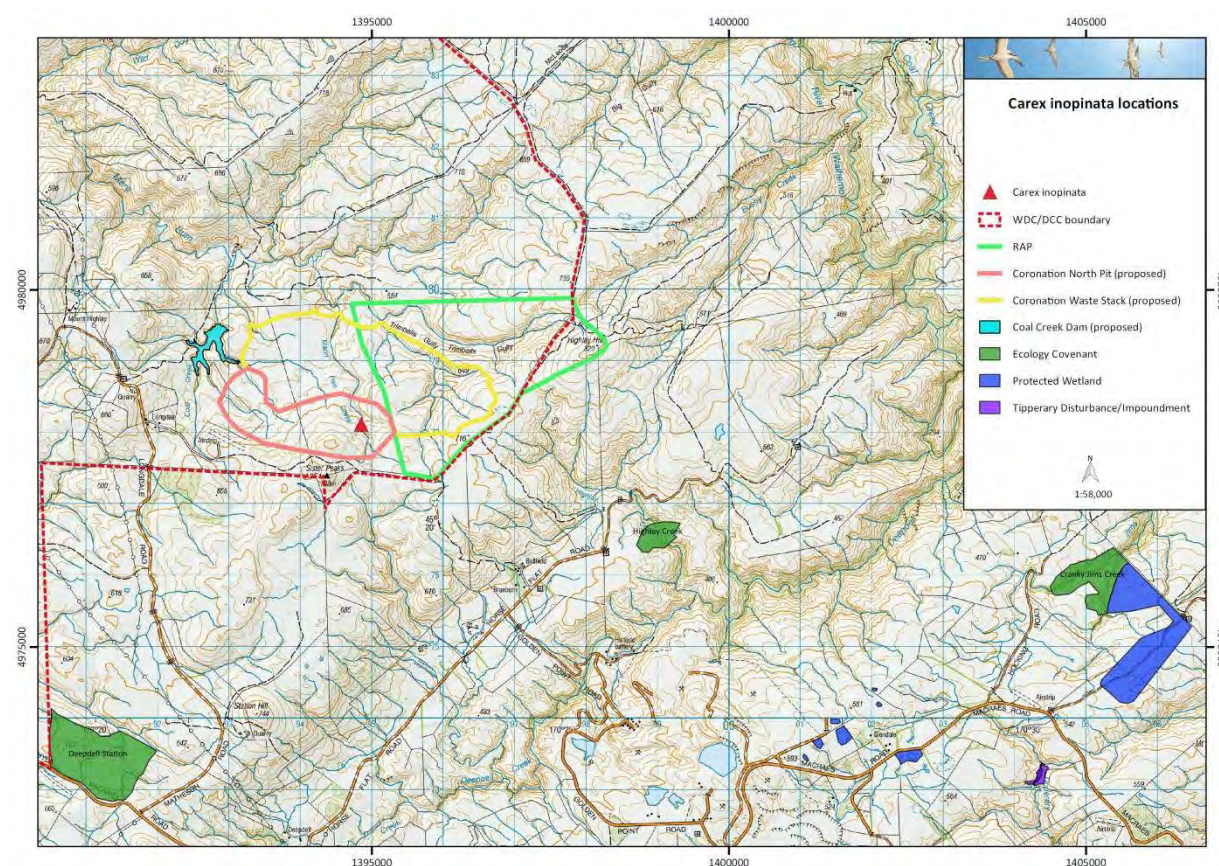


Figure B. Distribution of *Carex inopinata* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

- Given, D.R. 1976. A register of rare and endangered indigenous plants in New Zealand. New Zealand Journal of Botany 14: 135–149.
- Given, D.R. 1981. Rare and endangered plants of New Zealand. Reed, Auckland.
- Morgan, M.D; Norton, D.A. 1992. Growth response to light of *Carex inopinata* Cook, an endangered New Zealand sedge. New Zealand Journal of Botany 30: 429-433.
- de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.
- Dopson, S.R; de Lange, P.J; Ogle, C.C; Rance, B.D; Courtney, S.P. Molloy, J. 1999. The conservation requirement of New Zealand's nationally threatened vascular plants. Threatened Species Occasional Publication No. 13. Department of Conservation, Wellington.
- de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.
- de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.
- de Lange, P; Heenan, P; Norton, D; Rolfe, J; Sawyer, J. 2010. Threatened plants of New Zealand. Canterbury University Press, Christchurch.
- de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.
- Wildlands. 2013. Supplementary review of the ecological assessment for the proposed Coronation Mine, Otago. Contract Report No 3195d. Wildlands Ltd, Dunedin.
- NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=54 accessed 25 April 2016.
- Nature Watch <http://naturewatch.org.nz/taxa/400431-Carex-inopinata> accessed 25 April 2016.
- OceanaGold file records
- Dr M. Thorsen unpub. file notes.
- Dr M. Thorsen personal communication with Marcia Dale, Dunedin.

3. *Ranunculus ternatifolius* Kirk (wetland buttercup, Ranunculaceae).

Distribution within project

This small wetland buttercup was recorded at two sites within the WRS Zone and one site immediately downstream of the WRS Zone within the PIA. At all three sites small patches comprised of 1-5 plants were located in shaded wet areas under copper tussocks.

Summary of existing information

Ranunculus ternatifolius is currently classified as Nationally Vulnerable, with the qualifiers Data Poor, Extreme Fluctuations, and Sparse, on the basis that the total population is estimated to occupy an area of ≤ 100 ha (1 km^2) with a predicted decline of 10–50%, the widely spaced populations vary greatly in the number of individuals from year-to-year, and the paucity of information on this species. Previously it has been assessed as Vulnerable in 1999, Nationally Vulnerable in 2004, and Naturally Uncommon in 2009.

This species is distributed between the central North Island and Stewart Island, but is apparently absent in the mid-South Island. In the wider Macraes area it is known from one site on OceanaGold tenure land, in the Cranky Jims Wetland Covenant, and from the Shag Valley. It inhabits shaded wetlands, but is not present in all apparently suitable habitats in this area.

This species is considered to be in decline primarily through loss of its wetland habitat. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **very high** on the basis of its:

- 1) Nationally Vulnerable conservation status;
- 2) the reduction in extent of its wetland habitat.

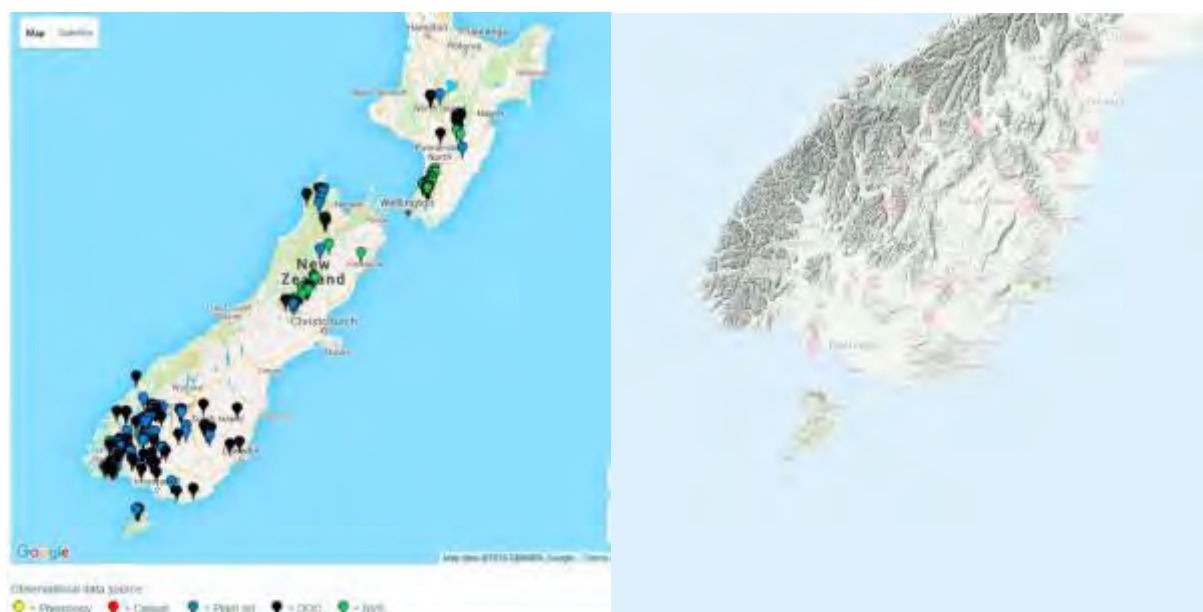


Figure A. Distribution of *Ranunculus ternatifolius* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right, no wild records) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

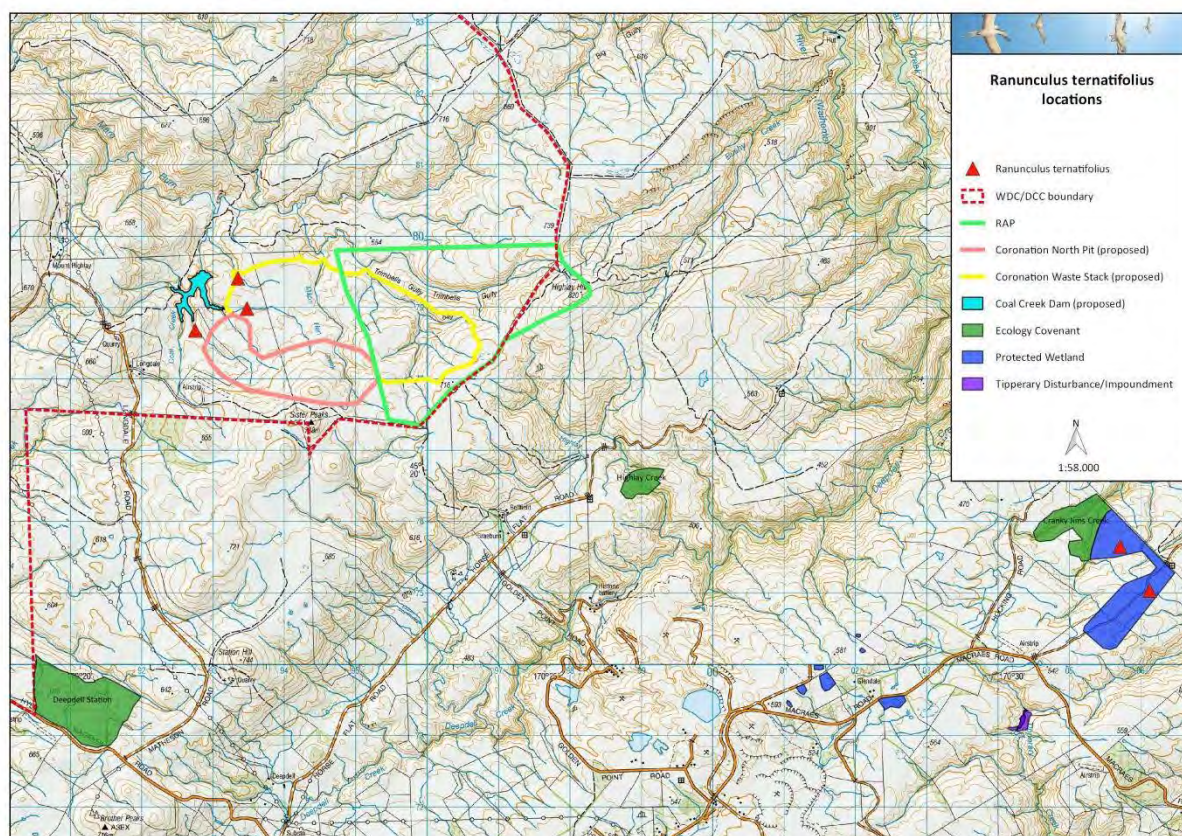


Figure B. Distribution of *Ranunculus ternatifolius* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series* 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=117 accessed 27 January 2016.

Nature Watch <http://naturewatch.org.nz/taxa/405612-Ranunculus-ternatifolius> accessed 27 January 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

4. *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff") (a daisy, Asteraceae).

Distribution within project

This apparently unnamed daisy was recorded at one site within the WRS Zone, where one plant occupies a shaded overhanging face of a large schist bluff bordering an incised gully. A further two sites are located downstream, where three and four plants are present.

Summary of existing information

Sonchus novae-zelandiae (previously *Kirkianella novae-zelandiae*, and including *Sonchus* (b) [CHR 596666; aff. *S. novae-zelandiae*; "cliff"]) is currently classified as Nationally Vulnerable, with the qualifiers Designated, Data Poor and Sparse. This is on the basis that the expert panel believes that the total population is estimated, using limited information, to occupy an area of ≤ 100 ha (1 km²) and with a predicted decline of 10–50%, and there are widely spaced populations. Previously it has been assessed as Range Restricted in 1999, Sparse in 2004, and Nationally Vulnerable in 2009.

This species is known from widely scattered sites in Canterbury and Otago. It is also known from offshore islands in the Marlborough Sounds and on the Three Kings Islands. Within the wider Macraes area it is known from 6 sites between Red Bank and Ramrock Roads. This species appears to consist of different forms, the status of which requires critical examination. The island populations have been named *Kirkianella novae-zelandiae* f. *glauca*, but similar glaucous plants are also known throughout its wider range, usually growing on cliffs or rocky sites, and are known by the tag name *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff"). Within the wider Macraes area both the glaucous and the more widespread farinose forms are known, with the glaucous form being prevalent. It is the glaucous form that is present in and adjacent to the PIA.

This species is considered to be in decline due to the loss of its short tussock grassland habitat through land conversion and weed invasion. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **very high** on the basis of its:

- 1) Nationally Vulnerable conservation status;
- 2) the reduction in extent of its short tussock grassland habitat;
- 3) the potential genetic differences.

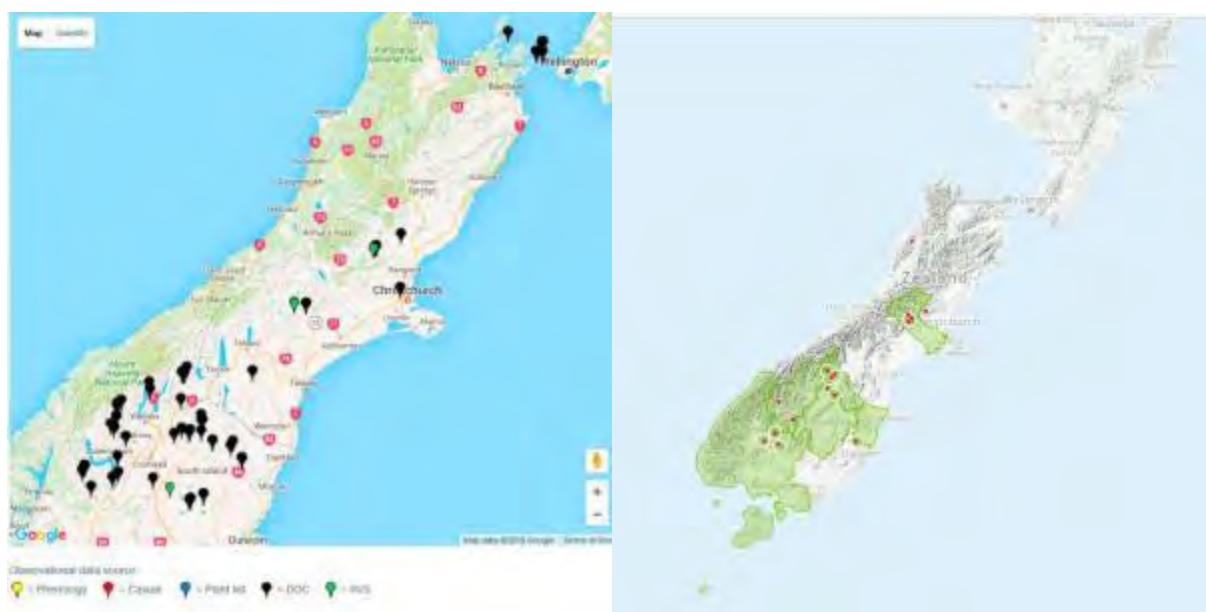


Figure A. Distribution of *Sonchus novae-zelandiae* (including *Sonchus* (b) [CHR 596666; aff. *S. novae-zelandiae*; "cliff"] in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

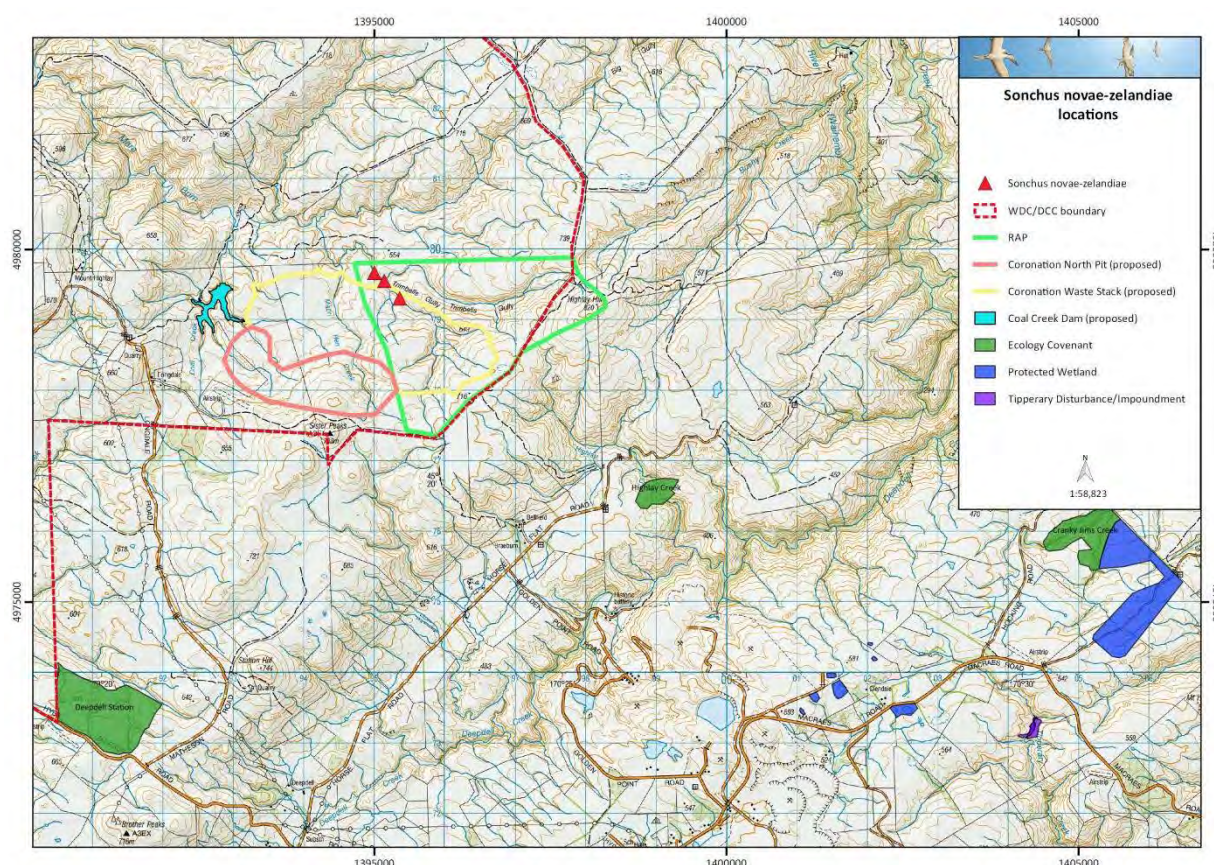


Figure B. Distribution of *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff") within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

- de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 37: 603–628.
- de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 42: 45–76.
- de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47: 61–96.
- de Lange, P; Heenan, P; Norton, D; Rolfe, J; Sawyer, J. 2010. Threatened plants of New Zealand. Canterbury University Press, Christchurch.
- de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series* 3. Department of Conservation, Wellington.
- NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=274 accessed 27 January 2016.
- Nature Watch <http://naturewatch.org.nz/taxa/402928-Kirkianella-novae-zelandiae> accessed 27 January 2016.
- OceanaGold file records
- Dr M. Thorsen unpub. file notes.

5.3.2 At Risk species

Nine At Risk plant species are known to occur within the PIA: six species that are classified as Declining and three species classified as Naturally Uncommon.

5.3.2.1 Declining

Six species classified as Declining are known to occur within the PIA: the speargrass *Aciphylla subflabellata*, the wetland sedge *Carex tenuiculmis*, the dwarf broom *Carmichaelia corrugata*, coral broom *Carmichaelia crassicaulis* subsp. *crassicaulis*, divaricating shrub *Coprosma intertexta* and the wetland grass *Deschampsia cespitosa*.

1. *Aciphylla subflabellata* W.R.B. Oliver (needle-leaved speargrass, Apiaceae).

Distribution within project

This speargrass was recorded at three sites within the Coronation North Pit Zone and two sites within the WRS Zone. All five sites comprised few (1-5) plants and were located either on stream banks or in short tussock grassland on alluvial loess deposits near wetlands. Several populations are present in the area downstream of the WRS, and one large population immediately adjacent to the upper boundary of the WRS.

Summary of existing information

Aciphylla subflabellata is currently classified as Declining, with the qualifiers Data Poor and Sparse, on the basis that the total population is estimated, using limited information, to consist of 20,000–100,000 mature individuals with a predicted decline of 10-30%, and it occurs as widely spaced populations. Previously it has been assessed as Not Threatened in 1999, Sparse in 2004, and Declining in 2009.

This species is distributed in the east of the South Island, and with one record from the Wairarapa south coast. In the wider Macraes area it is known on OceanaGold tenure land at six sites in Trimbells Gully, one site on the Coronation Ridge, four sites in the Cranky Jims Wetland Covenant (and one nearby site). It is also known from 13 sites between Red Bank and Ramrock Roads. It inhabits damp but well drained sites on stream banks and on loess deposits, often those bordering wetlands, and rock outcrops. The number of plants at each site is usually low, but the Coronation Ridge site is estimated to consist of 50-60 individuals.

This species is considered to be in decline primarily through loss of its fertile alluvium habitat. Plants are often heavily browsed (presumably by cattle or hares in most instances). No conservation programmes are known for this species, but it occurs in several protected areas where there appear to

be few threats. It appears to have become uncommon at some sites following retirement of land from grazing to protect conservation values.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

- 1) Declining conservation status;
- 2) the reduction in extent of its wetland habitat.

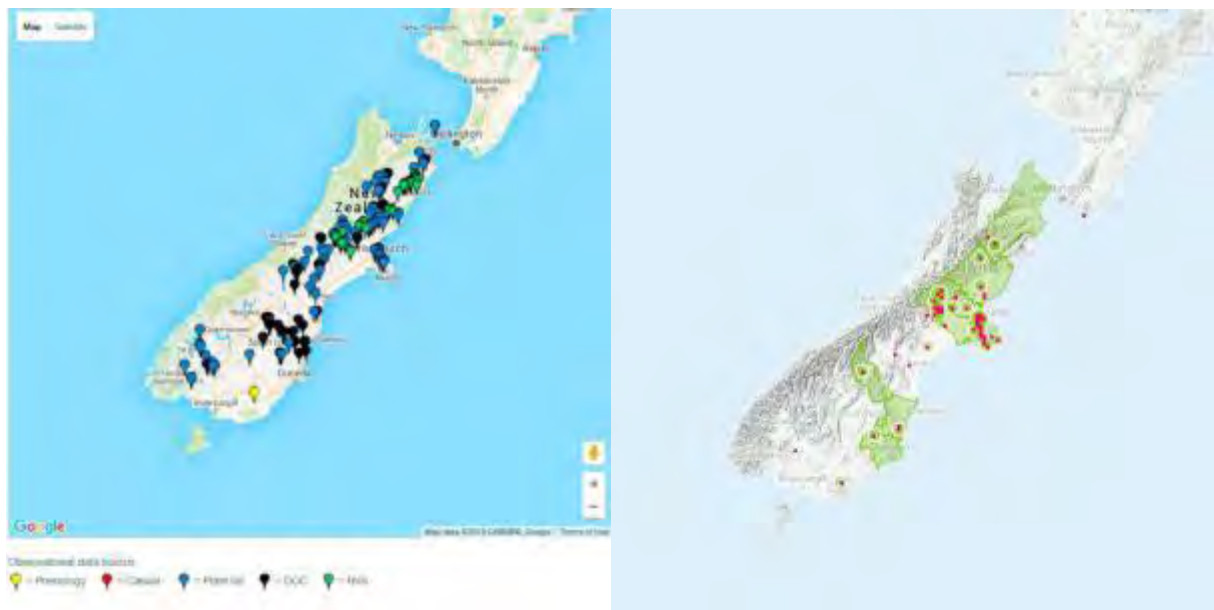


Figure A. Distribution of *Aciphylla subflabellata* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right, no wild records) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

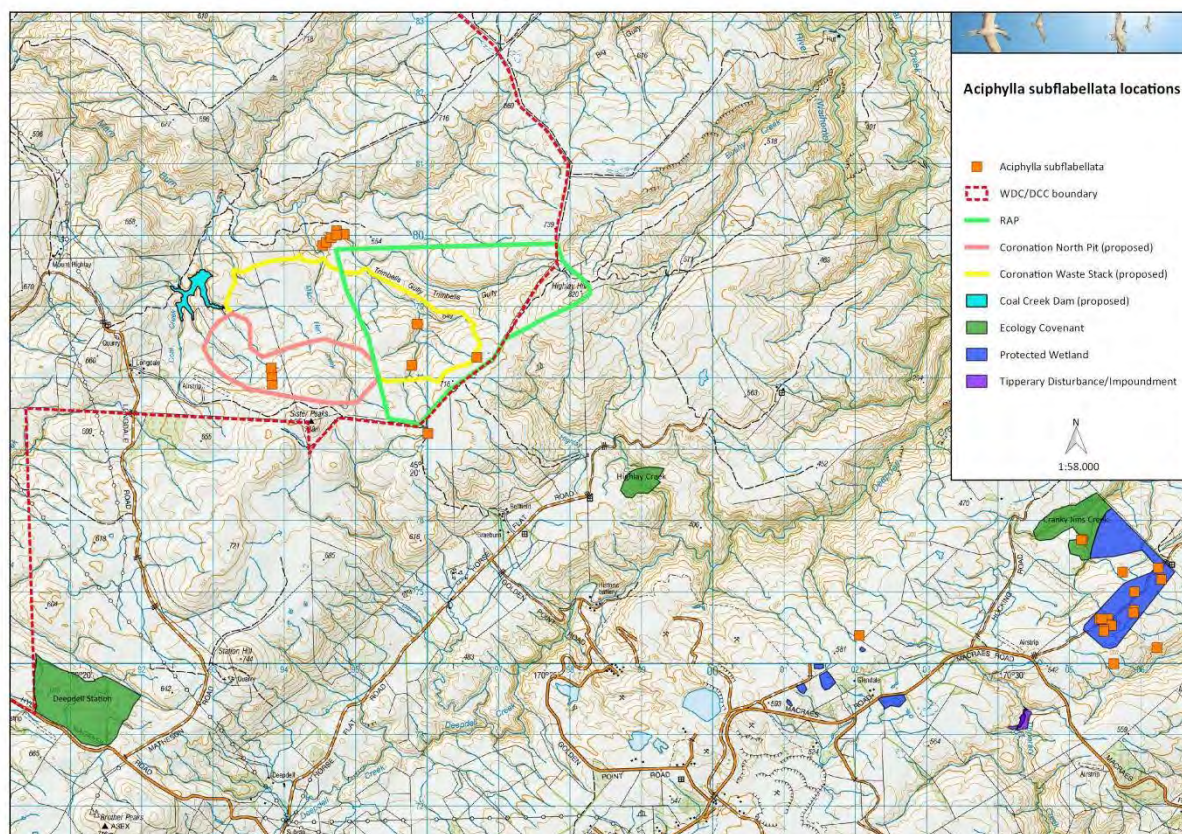


Figure B. Distribution of *Aciphylla subflabellata* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=215 accessed 27 January 2016.

Nature Watch <http://naturewatch.org.nz/taxa/399352> accessed 27 January 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

2. *Carex tenuiculmis* (Petrie) Heenan et de Lange (slender niggerhead, Cyperaceae).

Distribution within project

This wetland sedge was recorded at one site within the Coronation Pit Extension Zone, where 6 plants are present in a gully-head wetland.

Summary of existing information

Carex tenuiculmis is currently classified as Declining, with the qualifiers Data Poor and Sparse, on the basis that the total population is estimated, using limited information, to consist of 5,000–20,000 mature individuals with a predicted decline of 10–30%, and populations are widely spaced. Previously it has been assessed as Vulnerable in 1999, Sparse in 2004, and Declining in 2009.

This species is distributed nearly throughout the South Island (although rarely in the mid-South Island or Marlborough), Stewart Island and on the Chatham Islands. In the wider Macraes area it is known on OceanaGold tenure land in Tipperary Creek, several plants in ephemeral wetlands within the existing Coronation project area, a large population in one of the OceanaGold Protected Wetlands along the Macraes-Dunback Road and at one site in the Cranky Jims Wetland Covenant. It is also known from 19 sites between Red Bank and Ramrock Roads. It inhabits permanently damp or wet wetlands.

This species is considered to be in decline primarily through loss of its wetland habitat and weed encroachment. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

- 1) Declining conservation status;
- 2) the reduction in extent of its wetland habitat.

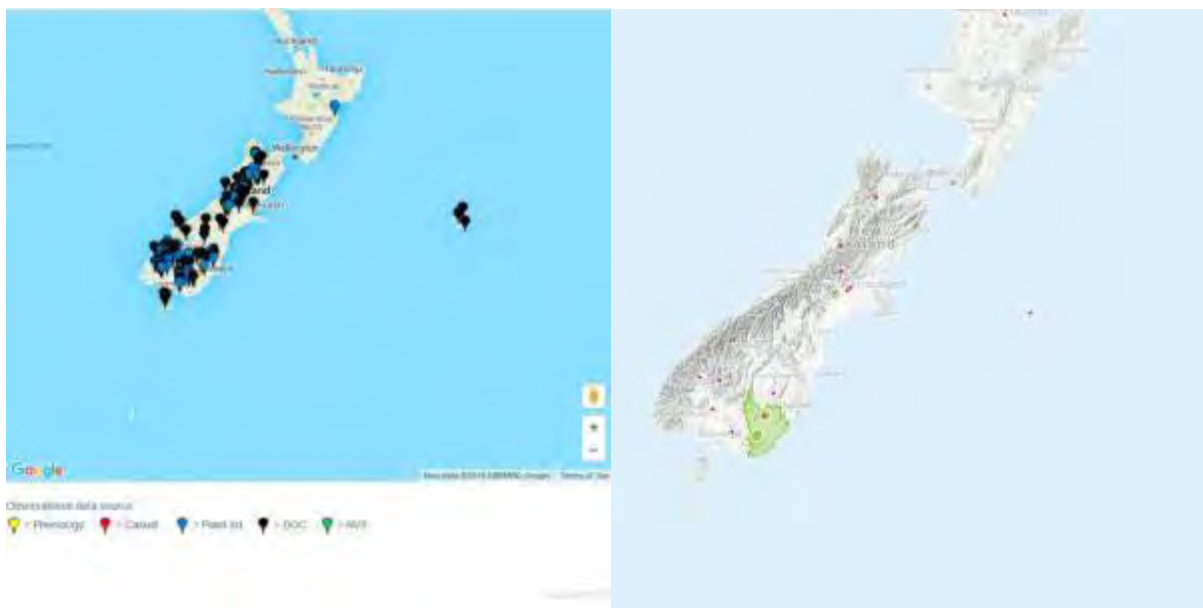


Figure A. Distribution of *Carex tenuiculmis* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

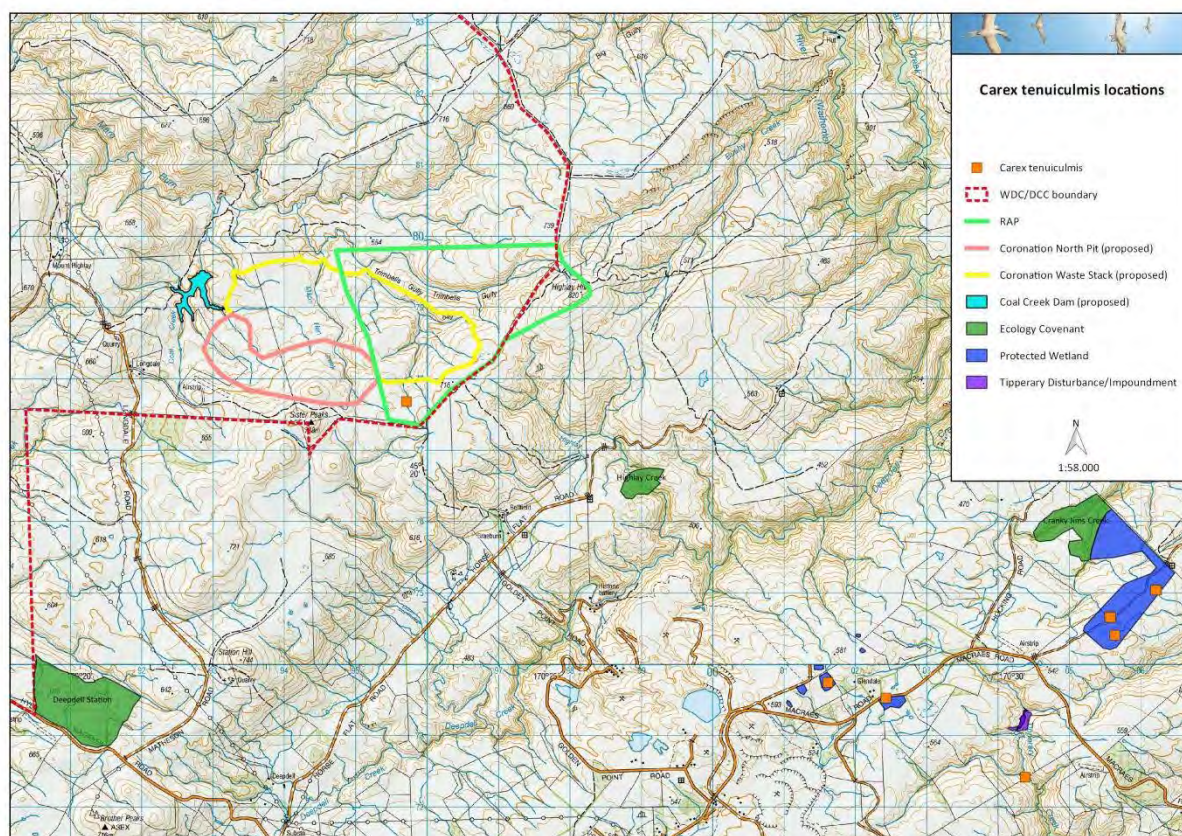


Figure B. Distribution of *Carex tenuiculmis* within the PIA and the wider OceanaGold project area (notes: not all locations shown).

Data sources used in this assessment:

Heenan, P.B; de Lange, P.J; Murray, B.G. 1997. *Carex tenuiculmis* comb. et stat. nov. (Cyperaceae), a threatened red-leaved sedge from New Zealand. New Zealand Journal of Botany 35: 159-165.

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=238 accessed 27 January 2016.

Nature Watch <http://naturewatch.org.nz/taxa/400449> accessed 27 January 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

3. *Carmichaelia corrugata* Colenso (common dwarf broom, Fabaceae).

Distribution within project

This dwarf broom was recorded at four sites within the WRS Zone. All sites were in degraded short tussock grassland, and comprised 2 - 50 individuals.

Summary of existing information

Carmichaelia corrugata is currently classified as Declining, with the qualifiers Data Poor, Recruitment Failure and Sparse, on the basis that the total population is estimated, using limited information, to occupy $\leq 1,000$ ha (10 km^2) with a predicted decline of 10–30%, and there is little evidence of young plants in the widely spaced populations. Previously it has been assessed as Not Threatened in 1999, 2004, and 2009.

This species is distributed through the eastern South Island from Marlborough to northern Otago. In the wider Macraes area it has recently been discovered on Mt Royal, near Palmerston, which is the southern limit for this species. It inhabits short tussock grasslands on dry soils or well drained alluvium.

This species is considered to be in decline primarily through loss of its dryland habitat and lack of recruitment of young individuals into populations. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats (but even at these sites recruitment appears to be rare).

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

- 1) Declining conservation status;
- 2) the reduction in extent of its dryland habitat;
- 3) the lack of young plants within populations;
- 4) it representing the near southern limit for this species.

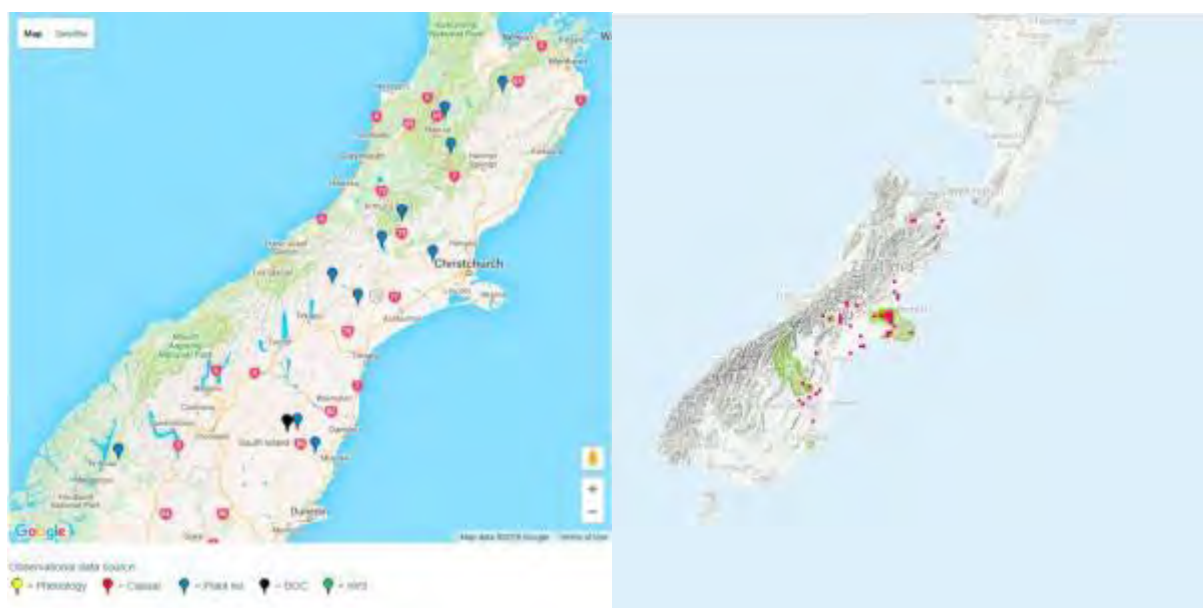


Figure A. Distribution of *Carmichaelia corrugata* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

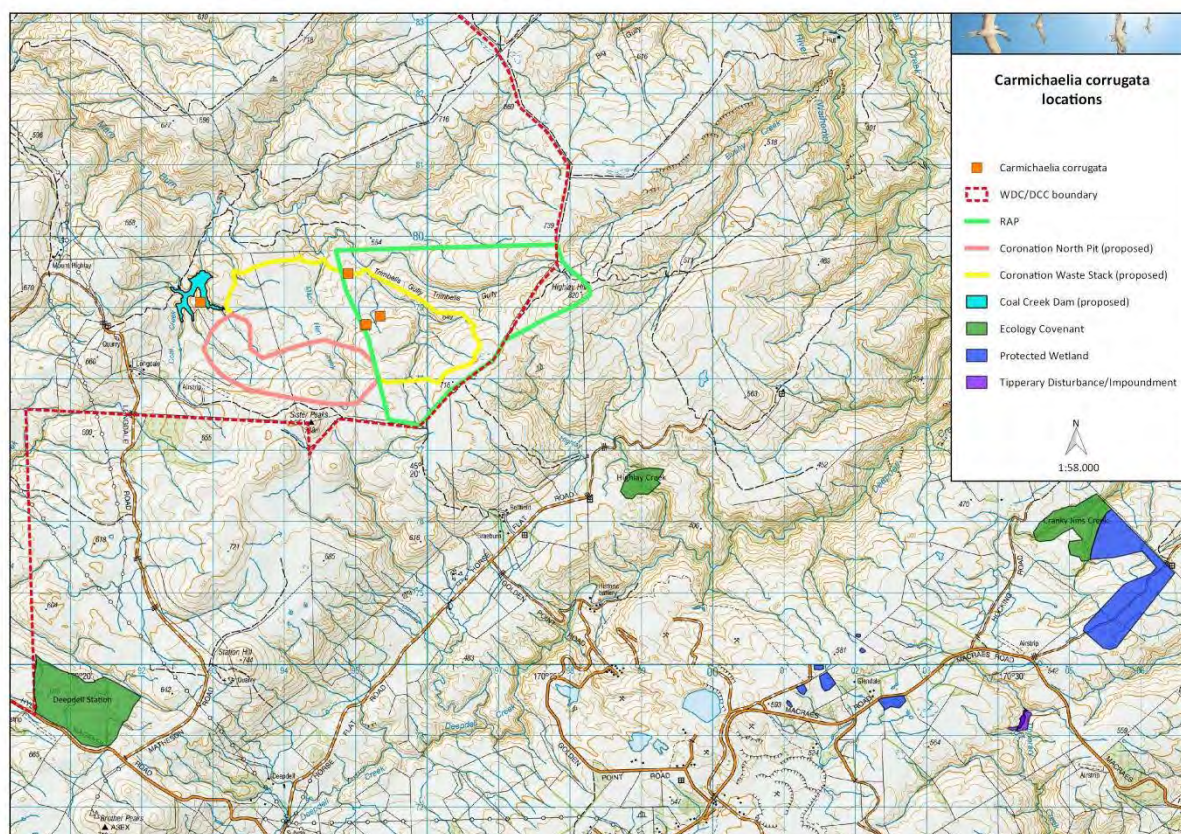


Figure B. Distribution of *Carmichaelia corrugata* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

- Heenan, P.B. 1995. A taxonomic revision of *Carmichaelia* (Fabaceae – Galegeae) in New Zealand (part 1). New Zealand Journal of Botany 33: 455-475.
- de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.
- de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.
- de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.
- de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.
- NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1597 accessed 27 January 2016.
- Nature Watch <http://naturewatch.org.nz/taxa/400479> accessed 27 January 2016.
- OceanaGold file records
- Dr M. Thorsen unpub. file notes.
- Dr M. Thorsen personal communication with G. Loh, DOC.

4. *Carmichaelia crassicaulis* Hook.f. subsp. *crassicaulis* (coral broom, Fabaceae).

Distribution within project

This thick-stemmed broom was recorded at multiple sites within the WRS and Coronation North Pit Zones. All sites were on rock outcrops bordering incised gullies, and comprise 2 - 50 individuals, including some young plants.

Summary of existing information

Carmichaelia crassicaulis subsp. *crassicaulis* is currently classified as Declining, with the qualifier Recruitment Failure, on the basis that the total population is estimated to number 20,000–100,000 mature individuals with a predicted decline of 10–50%, and there is little evidence of young plants in the populations. Previously it has been assessed as Declining in 1999, as Gradual Decline in 2004, and as Declining in 2009.

This species is distributed through the eastern South Island from Marlborough to Otago, with the majority of the populations in Otago. In the wider Macraes area it occurs on OceanaGold tenure land adjacent to the PIA in Coal Creek and Trimbells Gully. It is known from 41 sites between Red Bank and Ramrock Roads. It inhabits a variety of dry, usually rocky, sites.

This species is considered to be in decline primarily through loss of its dryland habitat and lack of recruitment of young individuals into populations. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats (but even at these sites recruitment appears to be rare). A nearby population at Nenthorn has many young seedlings that have germinated after stock were fenced from the area.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

- 1) Declining conservation status;
- 2) the reduction in extent of its dryland habitat;
- 3) the lack of young plants within populations.

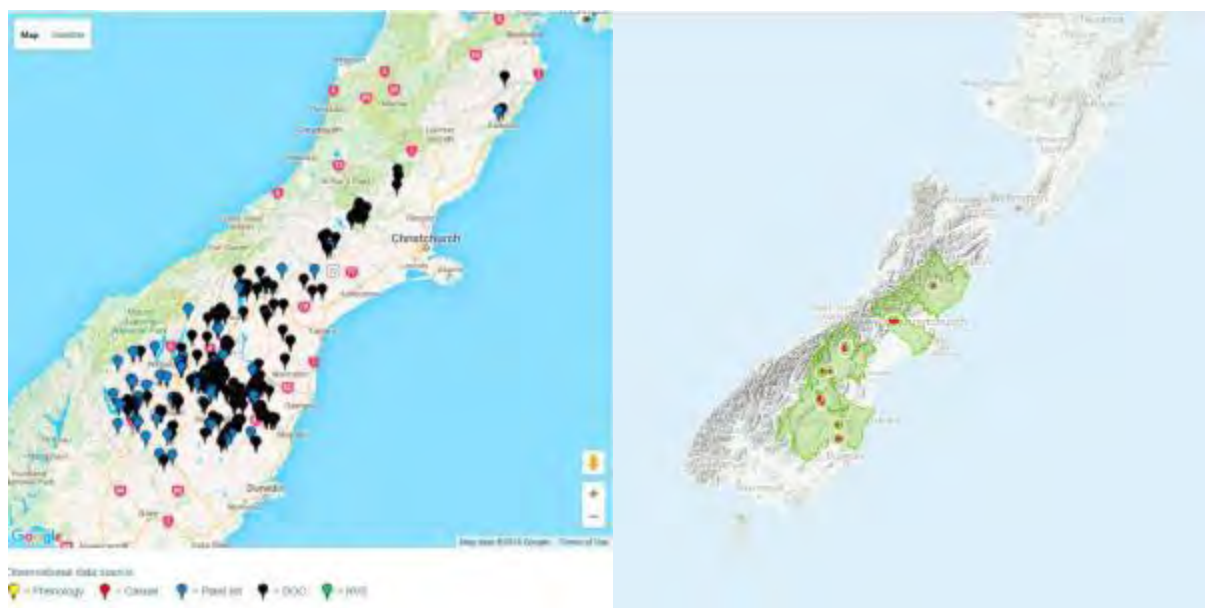


Figure A. Distribution of *Carmichaelia crassicaulis* subsp. *crassicaulis* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

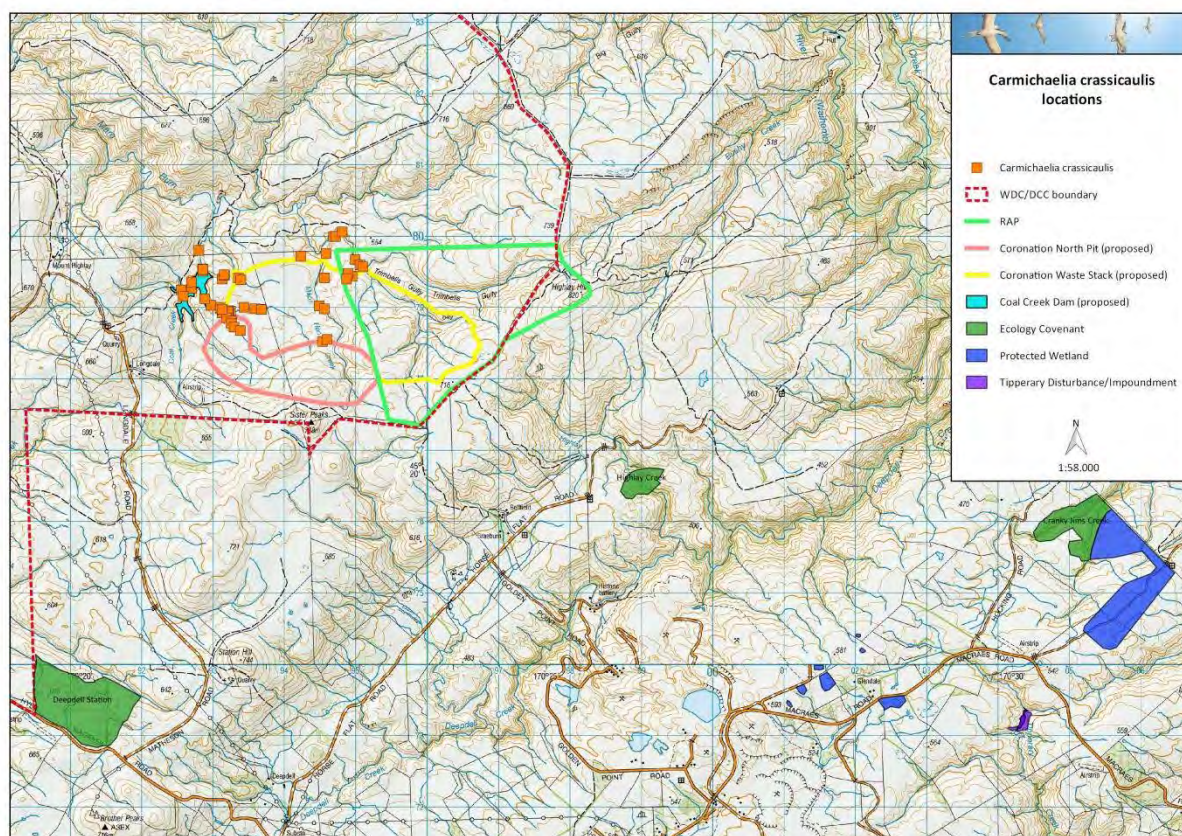


Figure B. Distribution of *Carmichaelia crassicaulis* subsp. *crassicaulis* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Heenan, P.B. 1998. An emended circumscription of *Carmichaelia*, with new combination, a key, and notes on hybrids. New Zealand Journal of Botany 36: 53-63.

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=152 accessed 27 January 2016.

Nature Watch <http://naturewatch.org.nz/taxa/412101> accessed 27 January 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5. *Coprosma intertexta* G.Simpson (a narrow-leaved divaricating coprosma, Rubiaceae).

Distribution within project

This reddish divaricating small-leaved *Coprosma* was recorded at one site within the Coronation North Pit Zone and three sites adjacent to the Coronation North Pit and WRS Zones. All sites are on rock outcrops bordering incised gullies, and comprise 1 - 6 individuals.

Summary of existing information

Coprosma intertexta is currently classified as Declining, with the qualifiers Data Poor and Sparse, on the basis that the total population is estimated, using limited data, to occupy a total of $\leq 10,000$ ha (100 km^2), with a predicted decline of 10–50%, and populations are widely spaced. Previously it has been assessed as Rare and Endangered in 1976, Sparse in 1999 and 2004, and as Relict in 2009.

This species is distributed through the eastern South Island from Marlborough to Otago. Records west of the Southern Alps are likely to be misidentifications of other narrow-leaved *Coprosma* species. In the wider Macraes area it occurs on OceanaGold tenure land adjacent to the PIA in Coal Creek. It is known from three sites between Red Bank and Ramrock Roads. It inhabits a variety of dry, usually rocky, sites.

This species is considered to be in decline primarily through loss of its dry, shrubland habitat. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **High** on the basis of its:

- 1) Declining conservation status;
- 2) the reduction in extent of its dry shrubland habitat.



Figure A. Distribution of *Coprosma intertexta* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

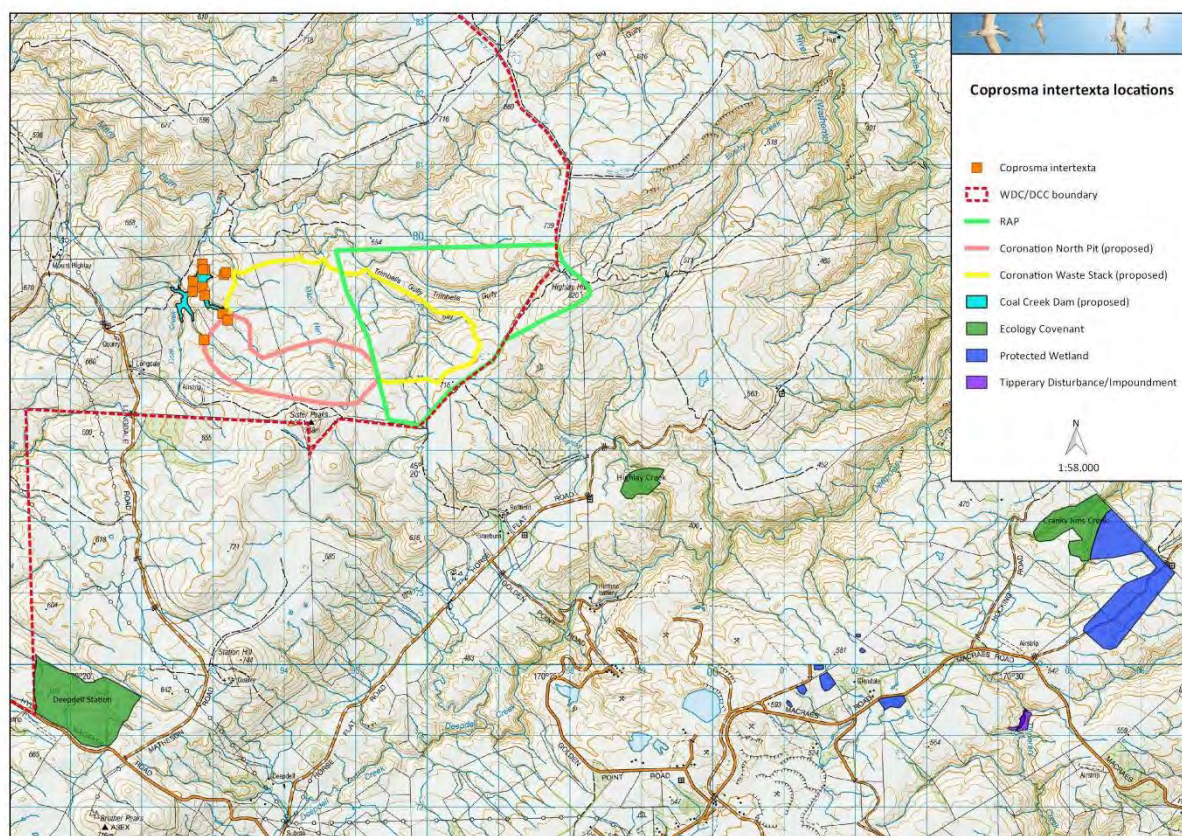


Figure B. Distribution of *Coprosma intertexta* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

- de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 37: 603–628.
- de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 42: 45–76.
- de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47: 61–96.
- Glenny, D., Cruickshank, J., Morse, C. and Rolfe, J. 2010. Key to *Coprosma* species of New Zealand. <http://www.landcareresearch.co.nz/resources/identification/plants/coprosma-key> accessed 27 January 2016.
- de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington.
- NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=245 accessed 27 January 2016.
- Nature Watch <http://naturewatch.org.nz/taxa/401020-Coprosma-intertexta> accessed 27 January 2016.
- OceanaGold file records
- Dr M. Thorsen unpub. file notes.

6. *Deschampsia cespitosa* (L.) P.Beauv. (tufted hair-grass, Poaceae).

Distribution within project

This wetland grass was recorded at five sites within the Coronation Pit Extension Zone, in ephemeral wetlands.

Summary of existing information

Deschampsia cespitosa is currently classified as Declining, with the qualifiers Conservation Dependent and Secure Overseas, on the basis that the total population is estimated to number > 100,000 mature individuals, with a predicted decline of 10–70%, its status is likely to worsen if current conservation efforts cease, and populations overseas are considered secure from extinction. Previously it has been assessed as Vulnerable in 1999, as Gradual Decline in 2004, and as Declining in 2009.

This species is distributed in temperate and cold regions throughout the world. In New Zealand it occurs from Te Aroha to Stewart Island, and on the Chathams and Antipodes Islands. In the wider Macraes area it occurs on OceanaGold tenure land in the Deepdell Covenant and an OceanaGold Protected Wetland along the Macraes Road, and it is known from 11 sites between Red Bank and Ramrock Roads. It inhabits a variety of permanently to seasonally wet areas.

This species is considered to be in decline primarily through grazing of its wetland habitat. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **high** on the basis of its:

- 1) Declining conservation status;
- 2) reduction in extent of its wetland habitat.



Figure A. Distribution of *Deschampsia cespitosa* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

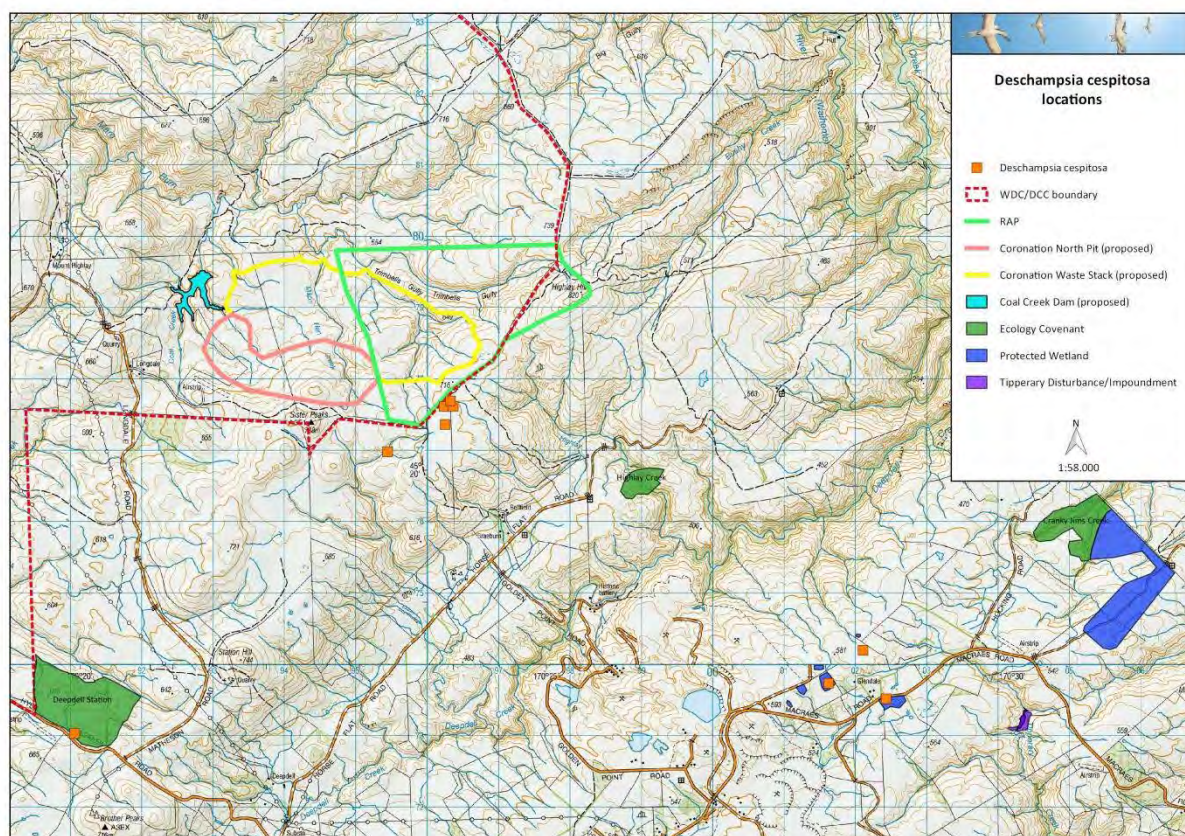


Figure B. Distribution of *Deschampsia cespitosa* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47: 61–96.

Edgar, E; Connor, H.E. 2010. *Flora of New Zealand Vol. 5: Gramineae*, 2nd Ed. Manaaki Whenua Press, Lincoln.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=163 accessed 1 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/76639> accessed 1 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5.3.2.2 Recovering

No Recovering species are known within the PIA

5.3.2.3 Relict

No Relict species are known within the PIA

5.3.2.4 Naturally Uncommon

Three species classified as Naturally Uncommon are known to occur within the PIA: the grass *Anthosachne falcis*, the daisy *Celmisia hookeri*, and the wetland herb *Lagenophora barkeri*.

1. *Anthosachne falcis* (Connor) Barkworth et S.W.L.Jacobs (dwarf wheatgrass, Poaceae).

Distribution within project

This dryland grass was recorded as scattered plants inhabiting short tussock grassland in the Coronation North Pit and WRS Zones.

Summary of existing information

Anthosachne falcis is currently classified as Naturally Uncommon, with the qualifier Sparse, on the basis of its range being restricted to dryland basins with widely spaced populations. Previously it has been assessed as Insufficiently Known in 1999, as Range Restricted in 2004, and Naturally Uncommon in 2009.

This species occurs in the dry inland basins of the Waimakariri, Ashburton Lakes, Mackenzie, Waitaki and Central Otago. It had previously been misidentified as *Anthosachne solandri* “channel” in botanical surveys, and it was only during this work that its correct identity was realised. Subsequent to this discovery it has been found to be widely but sparsely scattered in semi-natural grasslands in the area. It inhabits dry, short tussock grassland.

This species is considered to be at risk due to of conversion of its dryland habitat. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **moderate-high** on the basis of its:

- 1) Naturally Uncommon conservation status;
- 2) discovery in the Macraes area.

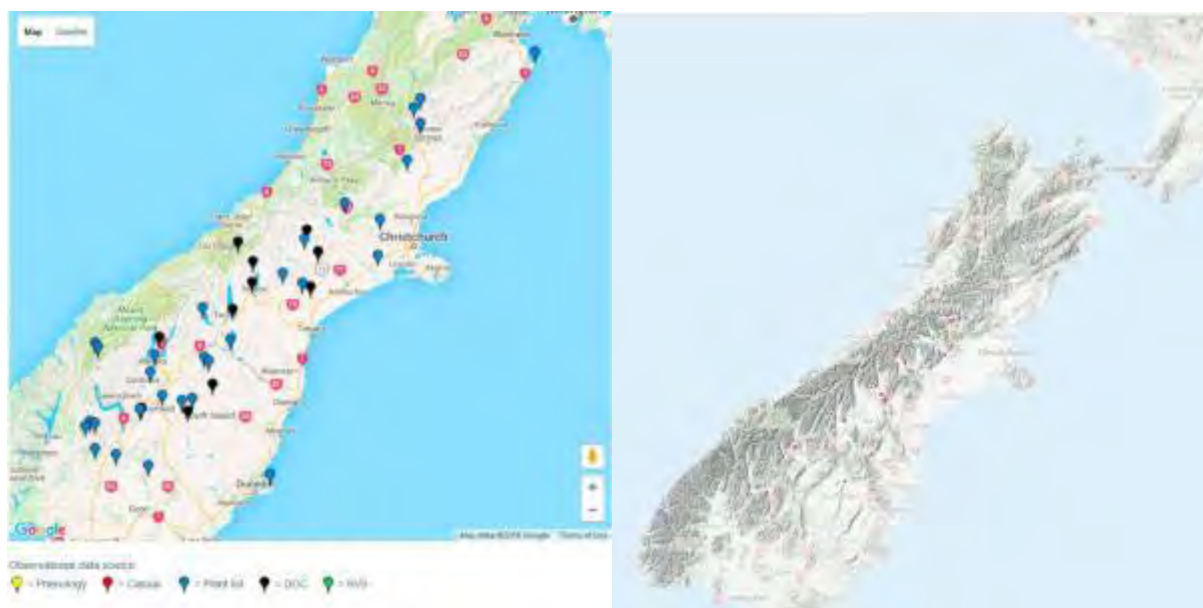


Figure A. Distribution of *Anthosachne falcis* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

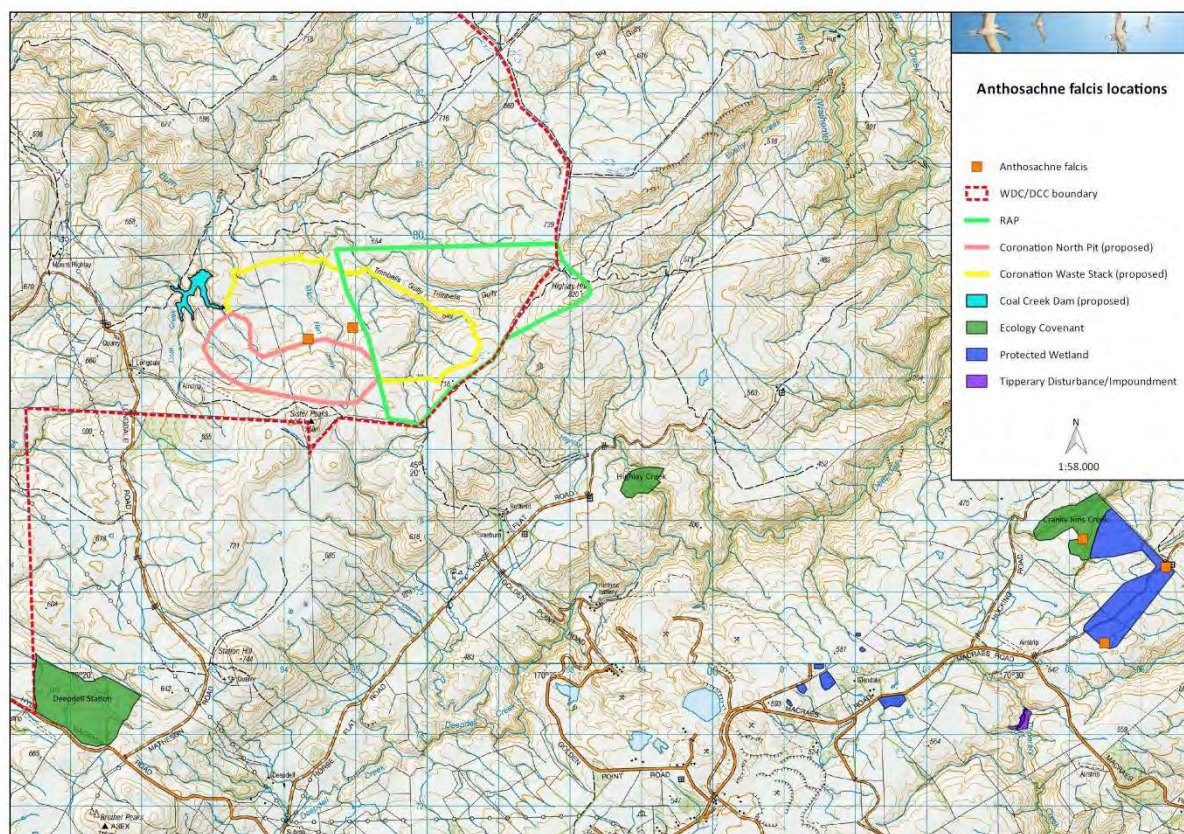


Figure B. Distribution of *Anthosachne falcis* within the PIA and the wider OceanaGold project area (NB: most locations of this grass are not mapped, due to the frequency of occurrence).

Data sources used in this assessment:

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

Edgar, E; Connor, H.E. 2010. Flora of New Zealand Vol. 5: Gramineae, 2nd Ed. Manaaki Whenua Press, Lincoln.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=478 accessed 1 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/470787> accessed 1 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

2. *Celmisia hookeri* Cockayne (Hooker's mountain daisy, Asteraceae).

Distribution within project

This cliff daisy was recorded as scattered plants and large groups of hundreds of plants inhabiting schist rock outcrops and bluffs in the WRS (particularly in Trimbells Gully) Zone, and less frequently in the Coronation North Pit Zone.

Summary of existing information

Celmisia hookeri is currently classified as Naturally Uncommon, with the qualifier Sparse, on the basis of its range being restricted to two areas: north-eastern Otago and northern Southland, with widely spaced populations. Previously it has been assessed as Sparse in 1999, as Range Restricted in 2004, and Naturally Uncommon in 2009.

This species occurs on rock outcrops and bluffs in north-eastern Otago and northern Southland. In the wider Macraes area it occurs on OceanaGold tenure land at multiple sites, including in the Deepdell Covenant and Crank Jims Wetland Covenant, and it is known from eight sites between Red Bank and Ramrock Roads. Population sizes in these area ranges up to several hundred plants at some sites, though 20-50 plants at a site is more usual. It inhabits schist rock bluffs, outcrops and rocky areas, and (where stock are absent) steep gully sides.

This species is considered to be at risk because of its limited range and susceptibility to browsers. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **moderate-high** on the basis of its:

- 1) Naturally Uncommon conservation status;
- 2) susceptibility to browsers.

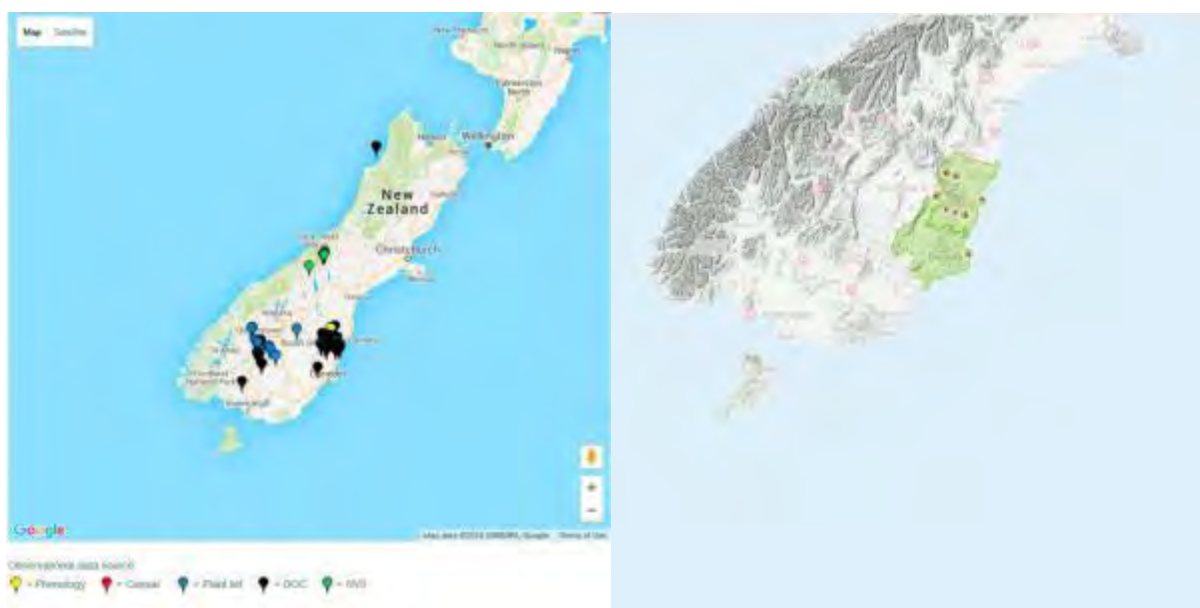


Figure A. Distribution of *Celmisia hookeri* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

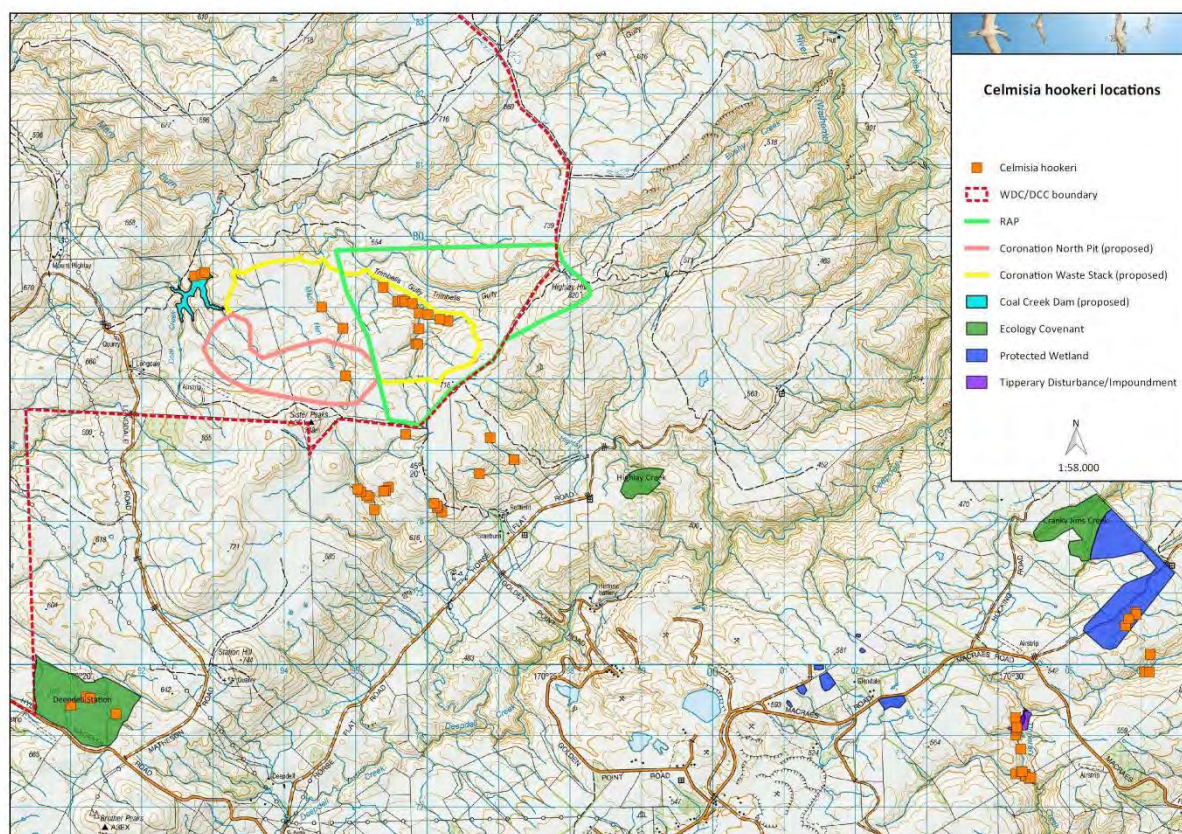


Figure B. Distribution of *Celmisia hookeri* within the PIA and the wider OceanaGold project area (notes: not all locations of this species are mapped).

Data sources used in this assessment:

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany* 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=239 accessed 1 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/400560> accessed 1 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

3. *Lagenophora barkeri* Kirk (a wetland daisy, Asteraceae).

Distribution within project

This wetland daisy was recorded as small patches in stream edges and bluff bases at two sites in the WRS Zone.

Summary of existing information

Lagenophora barkeri is currently classified as Naturally Uncommon, with the qualifier Sparse, on the basis of its range being restricted to South Island wetlands, and with widely spaced populations. Previously it has been assessed as Not Threatened in 1999 and 2004, and Naturally Uncommon in 2009.

This species occurs in higher-altitude wet places in the east of the South Island. In the wider Macraes area it occurs on OceanaGold tenure land at Coal Creek and Maori Hen Creek downstream of the PIA. It inhabits stream edges and wet bluff bases.

This species is considered to be at risk because of its limited range. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **moderate-high** on the basis of its:

- 1) Naturally Uncommon conservation status.
- 2) Degradation of its wetland habitat.

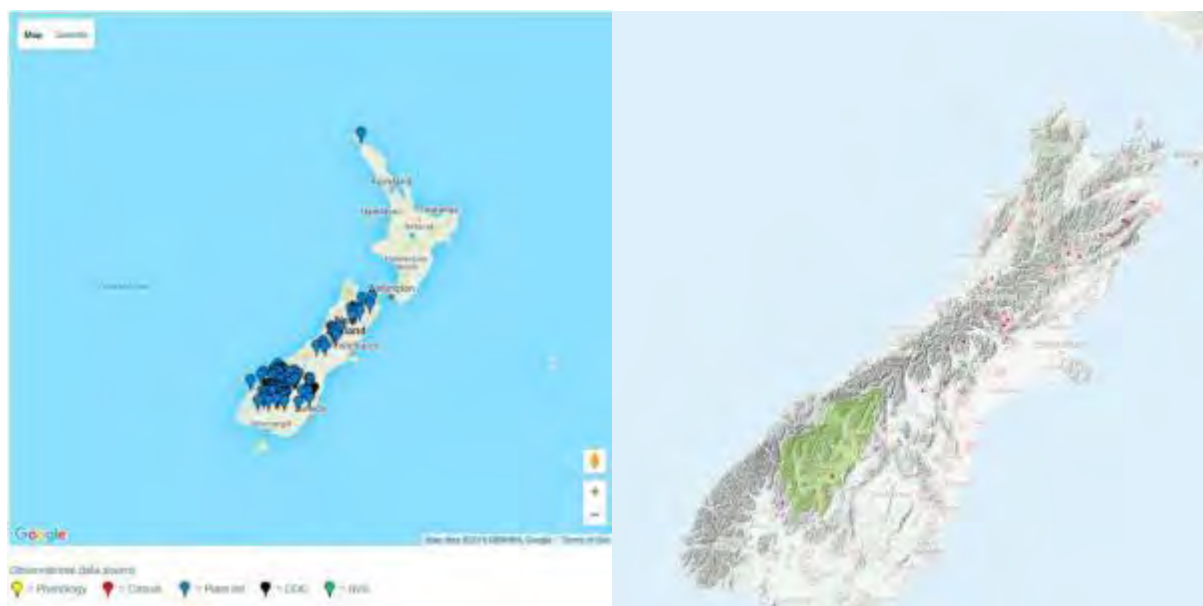


Figure A. Distribution of *Lagenophora barkeri* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

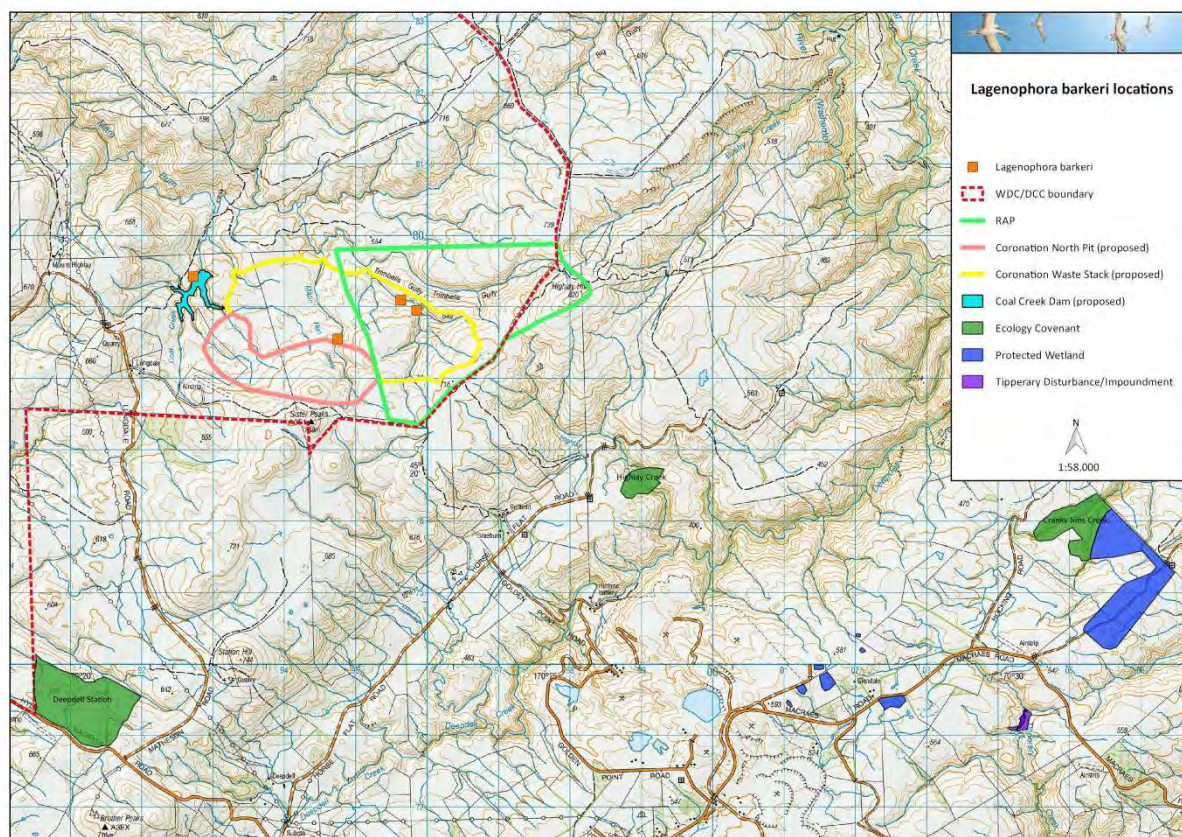


Figure B. Distribution of *Lagenophora barkeri* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Drury, D.G. 1974. A broadly based taxonomy of *Lagenifera* and *Solenogyne* (Compositae-Astereae), with an account of their species in New Zealand. New Zealand Journal of Botany 12: 365-396.

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=2182 accessed 1 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/468638-Lagenophora-barkeri> accessed 1 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5.3.3 Data Deficient species

Two species classified as Data Deficient are known to occur within the PIA: the wetland willowherb *Epilobium insulare* and wetland herb *Tetrachondra hamiltonii*.

1. *Epilobium insulare* Hausskn. (a wetland willowherb, Onagraceae).

Distribution within project

This wetland willowherb was recorded as single plants to small populations of 20-30 plants at several wetland sites in the Coronation North Pit and WRS Zones, and in areas immediately downstream of the PIA.

Summary of existing information

Epilobium insulare is currently classified as Data Deficient, with the qualifier Range Restricted, on the basis of the lack of knowledge on its distribution and conservation status. Previously it has been assessed as Not Threatened in 1999 and 2004, and Declining in 2009.

This species occurs nearly throughout New Zealand from the Waikato south, and on the Chatham Islands. In the wider Macraes area it occurs on OceanaGold tenure land in the Deepdell and Cranky Jims Wetland Covenants, and is widespread between Red Bank and Ramrock Roads. It inhabits higher-altitude wetlands.

This species is considered to be at risk because of the lack of knowledge of its distribution and threats. Recent survey work has shown it to be widespread, with numerous populations in areas where it is present, and therefore of little concern, although at most sites only a few plants are present. No conservation programmes are known for this species, but it occurs in several protected areas where there appear to be few threats.

The ecological importance of the population of this species within the PIA is categorised as **Moderate** (using a modification⁷ of Table 5 of EIANZ guidelines) on the basis of its:

- 1) Data Deficient status;
- 2) degradation of wetland habitats;
- 3) rarity within the E.D.

⁷ Data deficient species are not explicitly discussed in the EIANZ guidelines. In this document they are assumed to be a rare species

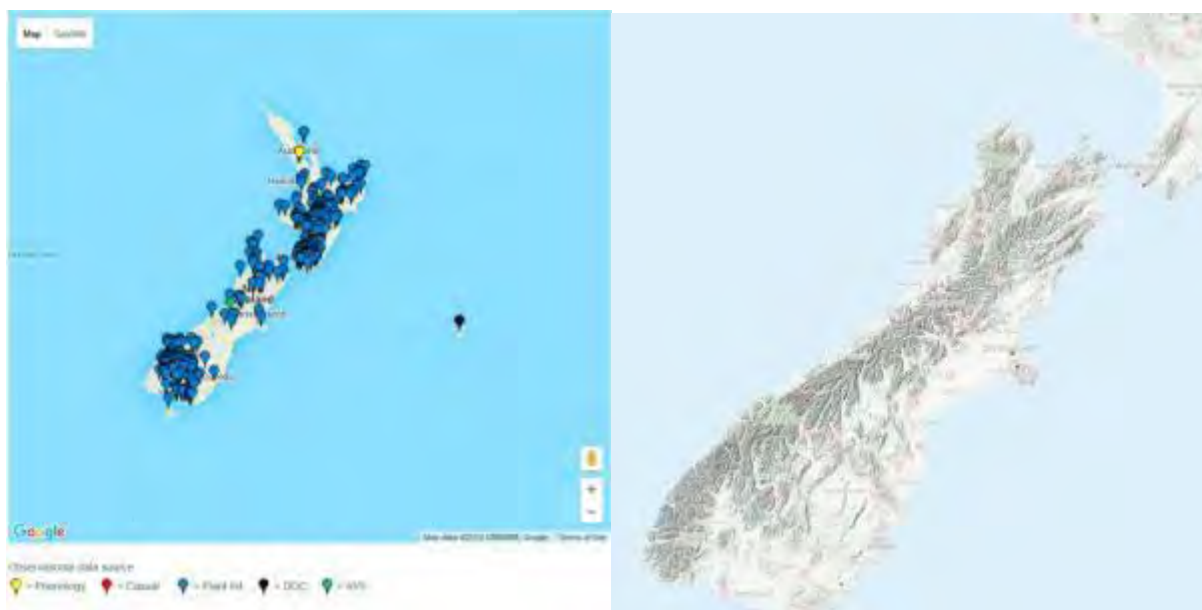


Figure A. Distribution of *Epilobium insulare* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

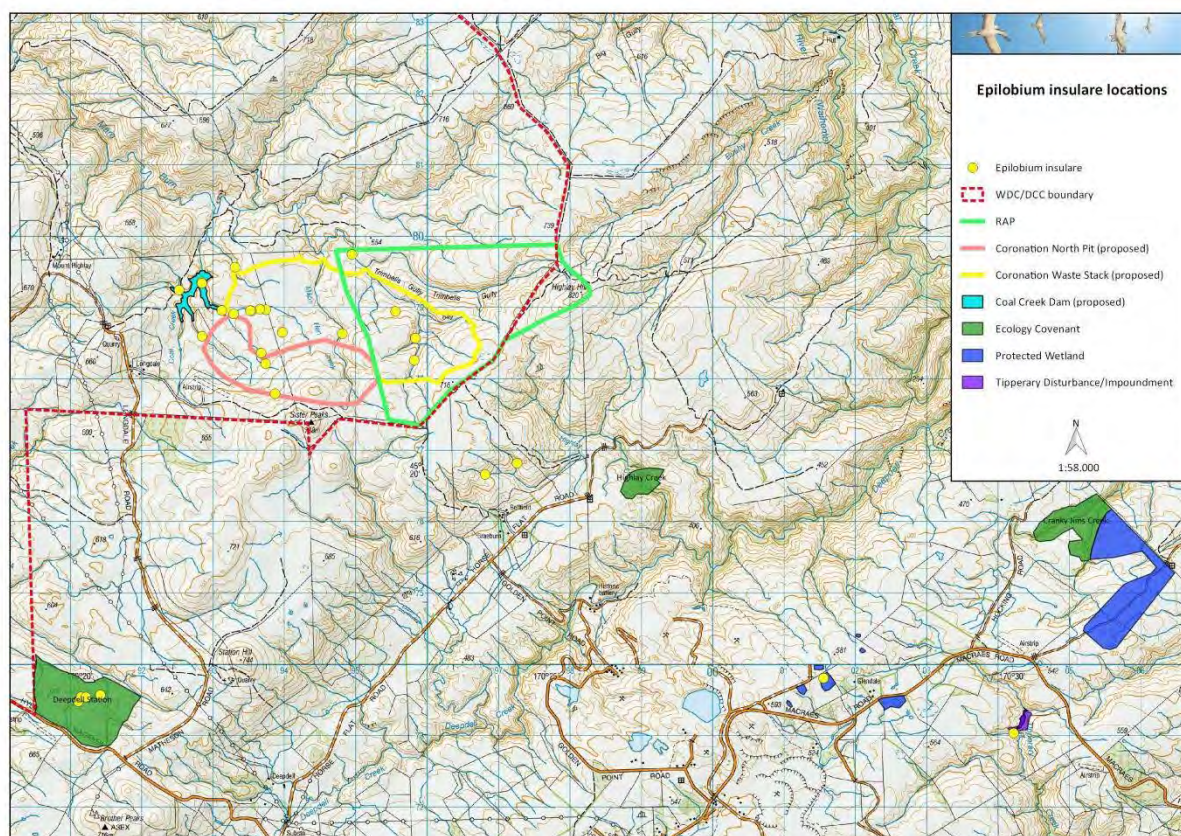


Figure B. Distribution of *Epilobium insulare* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Raven, P.H; Raven, T.E. 1976. The genus *Epilobium* (Onagraceae) in Australasia: a systematic and evolutionary study. DSIR Bulletin No. 216. DSIR, Wellington.

de Lange, P.J; Heenan, P.B; Given, D.R; Norton, D.A; Ogle, C; Johnson, P.N; Cameron, E.K. 1999. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 37: 603–628.

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1849 accessed 1 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/401681-Epilobium-insulare> accessed 1 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

2. *Tetrachondra hamiltonii* Petrie ex Oliv. (a wetland herb, Tetrachondraceae).

Distribution within project

This wetland herb has previously been recorded in the ephemeral wetlands of the Coronation Pit Extension Zone. It was not seen during these surveys.

Summary of existing information

Tetrachondra hamiltonii is currently classified as Data Deficient, with the qualifier Sparse, on the basis of the lack of knowledge on its distribution and conservation status and its widely spaced populations. Previously it has been assessed as Serious Decline in 2004, and Declining in 2009.

This species occurs in one area of the central North Island and in scattered sites in the north and south of the South Island. In the wider Macraes area it is known from nine sites between Red Bank and Ramrock Roads. It inhabits higher-altitude sparsely vegetated wetlands.

This species is considered to be at risk because of the lack of knowledge of its distribution and threats, though it is thought to be at risk from competition with taller exotic vegetation.

The ecological importance of the population of this species within the PIA is categorised as **Moderate** (using a modification⁸ of Table 5 of EIANZ guidelines) on the basis of its:

- 1) Data Deficient status;
- 2) degradation of wetland habitats;
- 3) rarity within the E.D.

⁸ Data deficient species are not explicitly discussed in the EIANZ guidelines. In this document they are assumed to be a rare species

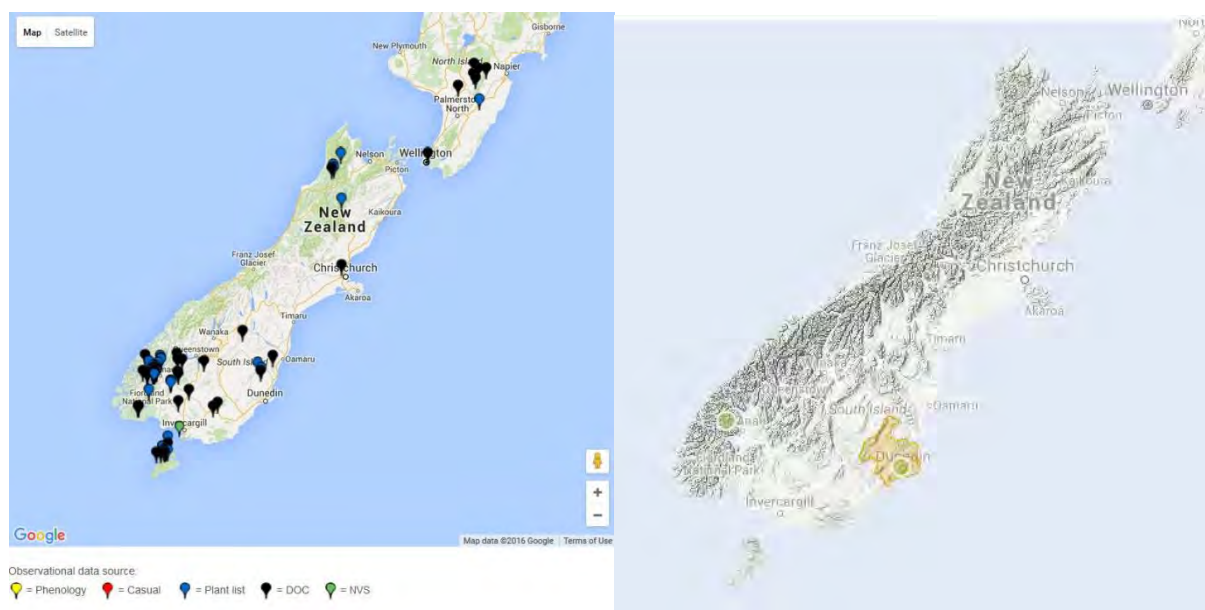


Figure A. Distribution of *Tetrachondra hamiltonii* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

Data sources used in this assessment:

de Lange, P.J; Norton, D.A; Heenan, P.B; Courtney, S.P; Molloy, B.P.J; Ogle, C.C; Rance, B.D; Johnson, P.N; Hitchmough, R.A. 2004. Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

de Lange, P.J; Norton, D.A; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Hitchmough, R.A; Townsend, A.J. 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

de Lange, P.J; Rolfe, J.R; Champion P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.

Environment Court, 2013. Evidence of John Worrell Barkla.

Johnson, P.N; Booth, P.A. 1998. Wetland plants in New Zealand. Manaaki Whenua Press, Lincoln.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=144 accessed 25 April 2016.

Nature Watch <http://naturewatch.org.nz/taxa/409811-Tetrachondra-hamiltonii> accessed 25 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5.3.4 Rare species

Seven species that are considered rare are known to be present within the PIA: three are uncommon within the Macraes ED. and two are listed as 'Threatened Plants' in Appendix 16A of the DCC District Plan.

5.3.4.1 Species uncommon in region

No species that are considered uncommon in the Otago region are known within the PIA.

5.3.4.2 Species uncommon in Ecological District

Five species that are uncommon within the Macraes Ecological District are known to be present within the PIA: the bidibids *Acaena dumicola* and *Acaena tesca*, the daisy *Brachyglottis southlandica*, the sedge *Carex kaloides*, and the wetland dock *Rumex flexuosus*.

1. *Acaena dumicola* B.H.Macmill. (a bidibid, Rosaceae).

Distribution within project

This bidibid has been previously recorded from one site within the WRS Zone. It was not seen during this survey.

Summary of existing information

Acaena dumicola is a species rarely recorded in eastern Otago. It occurs in higher rainfall areas of the eastern South Island and the North Island's south coast. This is the only record within the Macraes E.D. It inhabits shrublands on well drained soils, or the base of rocks.

The ecological importance of the population of this species within the PIA is categorised as **Moderate** on the basis of its:

- 1) Rarity within the Ecological District.

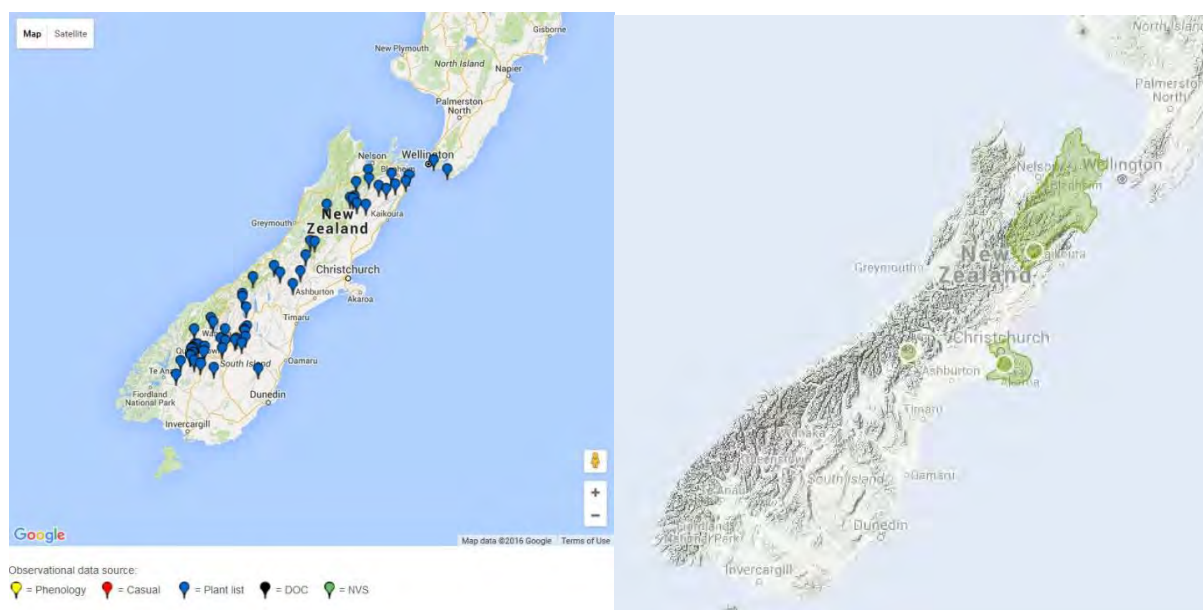


Figure A. Distribution of *Acaena dumicola* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

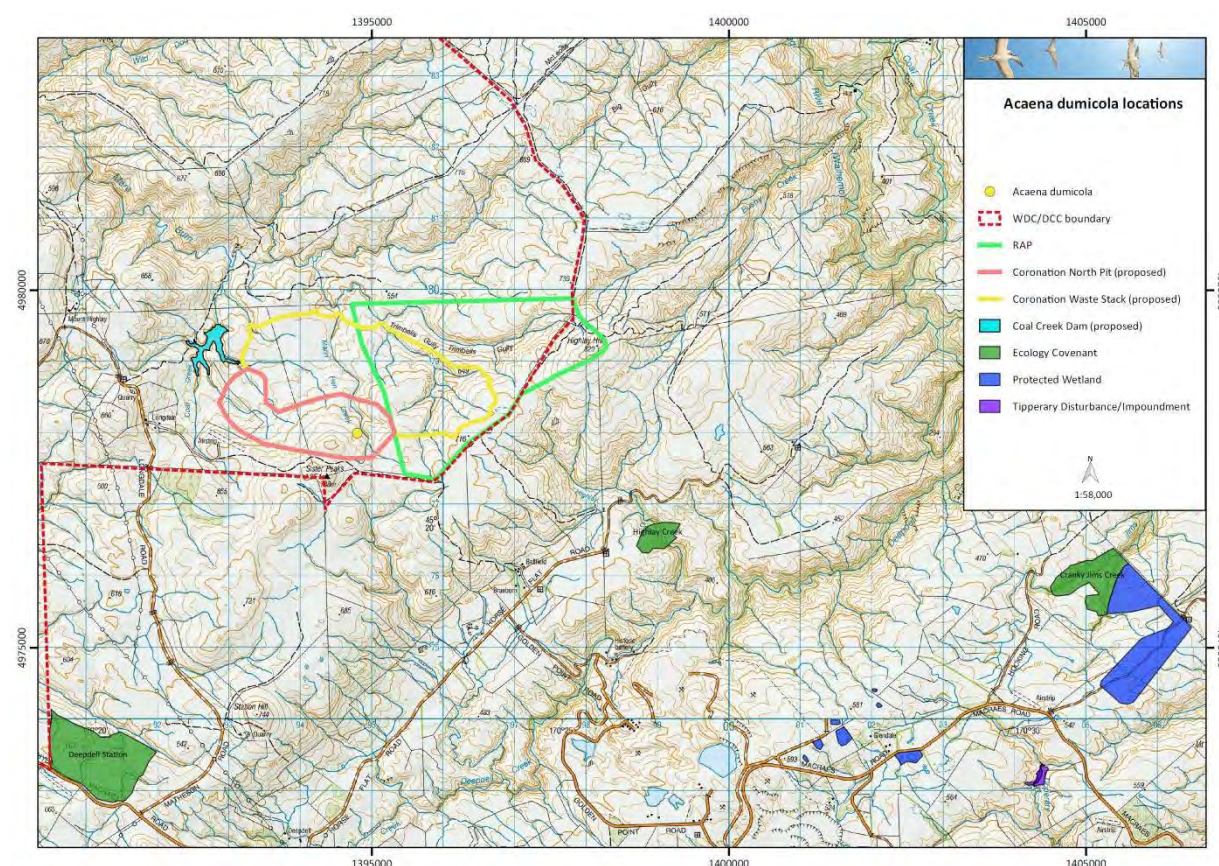


Figure B. Distribution of *Acaena dumicola* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Macmillan, B.H. 1985. *Acaea dumicola* (Rosaceae) – a new species from New Zealand. New Zealand Journal of Botany 23: 337-340.

Wildlands. 2013. Supplementary review of the ecological assessment for the proposed Coronation Mine, Otago. Contract Report No 3195d. Wildlands Ltd, Dunedin.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1438 accessed 25 April 2016.

Nature Watch <http://naturewatch.org.nz/taxa/399295-Acaena-dumicola> accessed 25 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

2. *Acaena tesca* B.H.Macmill. (a bidibid, Rosaceae).

Distribution within project

This bidibid has been previously recorded from one site within the WRS Zone. It was not seen during this survey.

Summary of existing information

Acaena tesca occurs on the Central Otago and northern Southland Mountains. This is the only record within the Macraes E.D. It inhabits tussock grasslands, or the base of rocks usually above 750m.

The ecological importance of the population of this species within the PIA is categorised as **Moderate** on the basis of its:

- 1) Rarity within the Ecological District.
- 2) unusually low elevation of the record

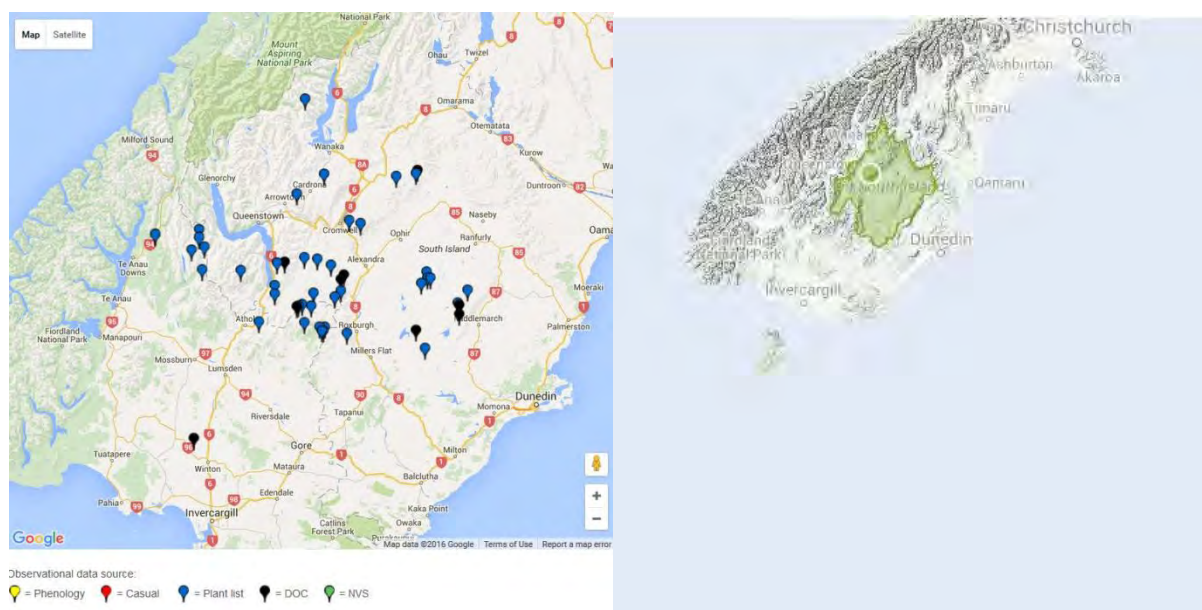


Figure A. Distribution of *Acaena tesca* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

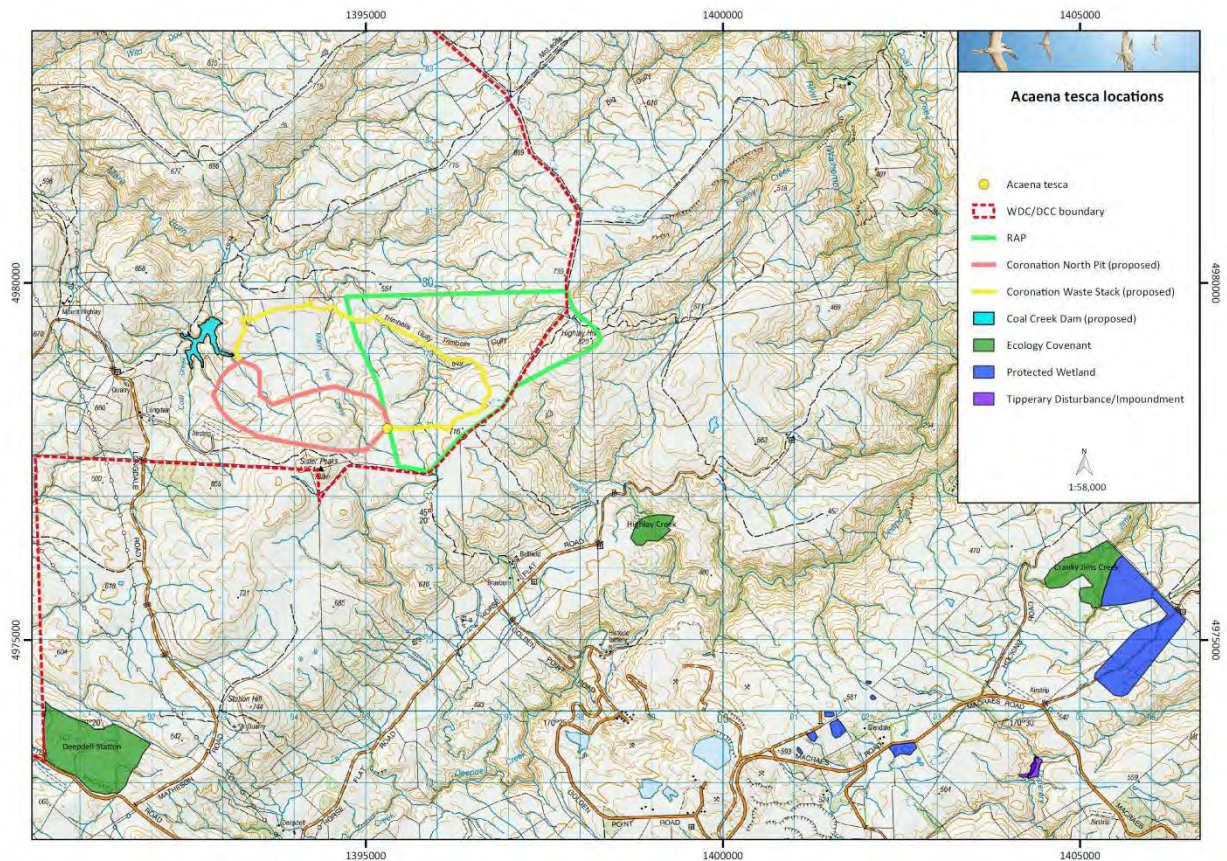


Figure B. Distribution of *Acaena tesca* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Macmillan, B.H. 1991. *Acaea rorida* and *Acaena tesca* (Rosaceae) – two new species from New Zealand. New Zealand Journal of Botany 29: 131-138.

Wildlands. 2013. Supplementary review of the ecological assessment for the proposed Coronation Mine, Otago. Contract Report No 3195d. Wildlands Ltd, Dunedin.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=347 accessed 25 April 2016.

Nature Watch <http://naturewatch.org.nz/taxa/399304-Acaena-tesca> accessed 25 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

3. *Brachyglottis southlandica* (Cockayne) B.Nord. (a daisy, Asteraceae).

Distribution within project

This cliff-dwelling daisy was recorded on a schist rock bluff at one site in the WRS Zone.

Summary of existing information

Brachyglottis southlandica is a species rarely recorded within the Macraes E.D. It occurs in northern Southland and western Otago, with few records in Central Otago. It is known from the wider Macraes area at Emerald Steam. It inhabits damper rock faces.

The ecological importance of the population of this species within the PIA is categorised as **Moderate** on the basis of its:

- 1) Rarity within the Ecological District.

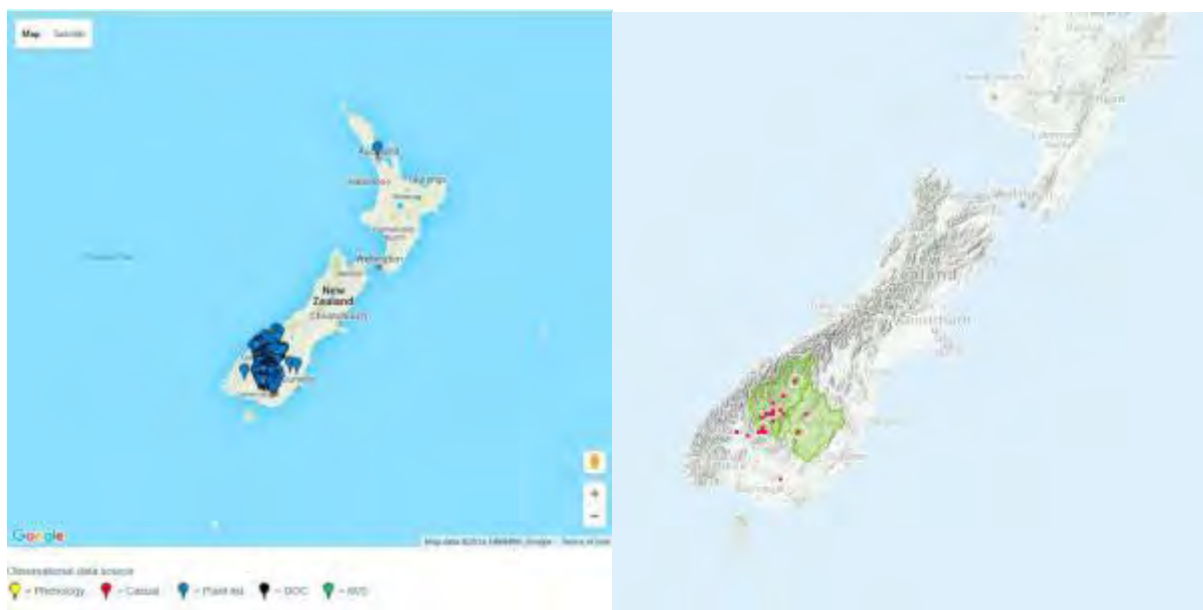


Figure A. Distribution of *Brachyglottis southlandica* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

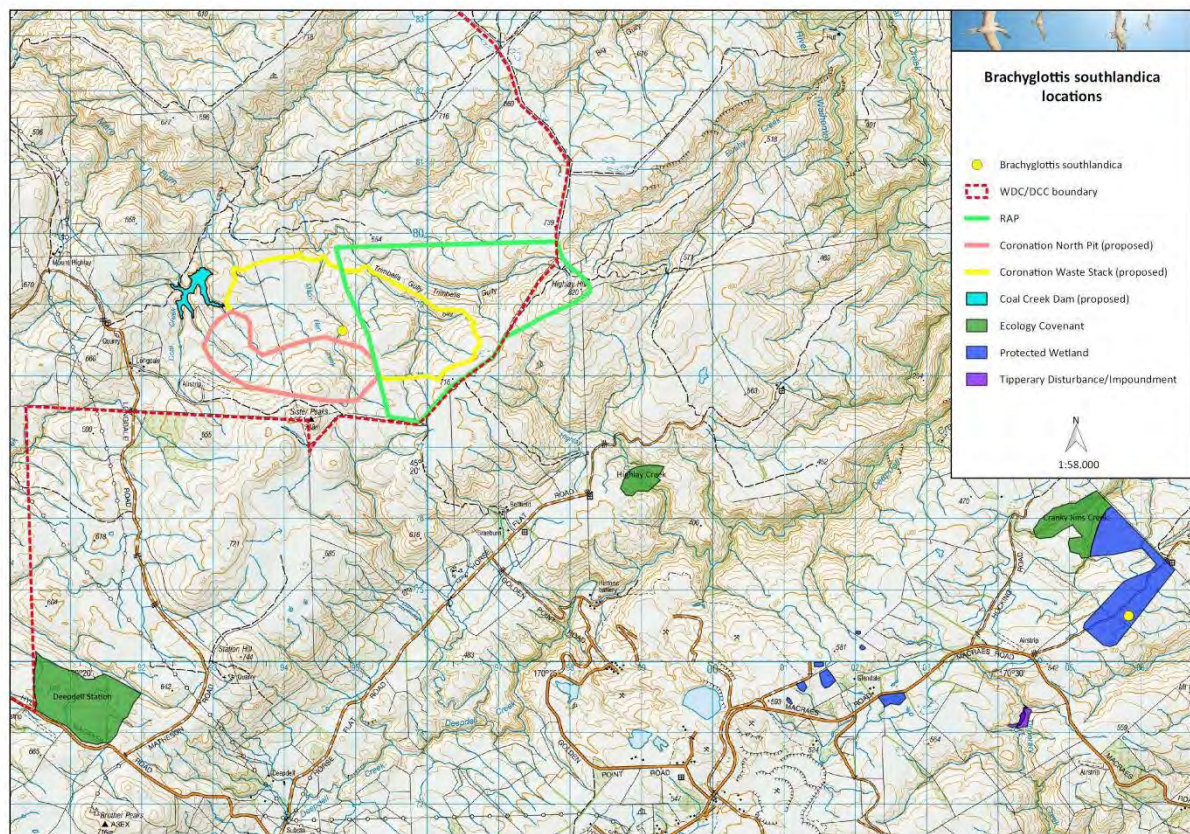


Figure B. Distribution of *Brachyglottis southlandica* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1570 accessed 3 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/400071-Brachyglottis-southlandica> accessed 3 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

4. *Carex kaloides* Petrie (a wetland sedge, Cyperaceae).

Distribution within project

This sedge was recorded in riparian herbfield & sedgeland at multiple sites in the Coronation North Pit and WRS Zones. Population size varies between patches of 1m² to patches 20m x 20m in size. The majority of sites within the PIA are in the lower reaches of tributaries of Coal Creek, and there are other sites downstream from these in Trimbells Gully and Coal Creek.

Summary of existing information

Carex kaloides was first recorded within the Macraes E.D. in 2014.. It is now known from the wider Macraes area on OceanaGold tenure land in the Tipperary Fenced Area and at sites downstream of the PIA, and as a large population near Sutton. It occurs throughout the eastern South Island. It inhabits damp stream terraces.

The ecological importance of the population of this species within the PIA is categorised as **Moderate** on the basis of its:

- 1) Rarity within the Ecological District.

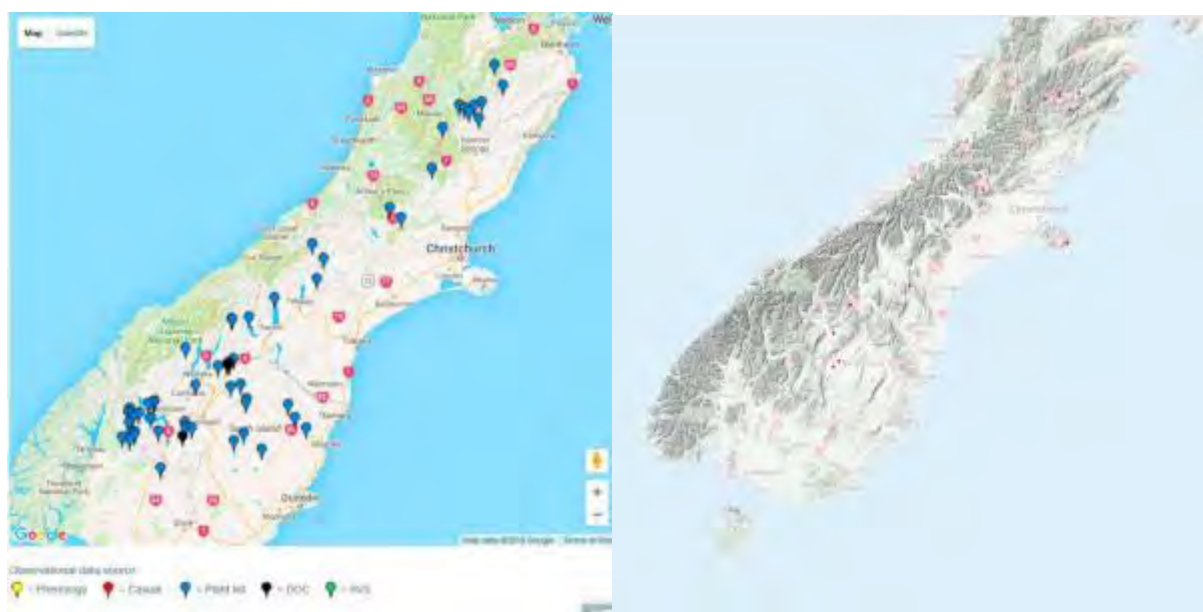


Figure A. Distribution of *Carex kaloides* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

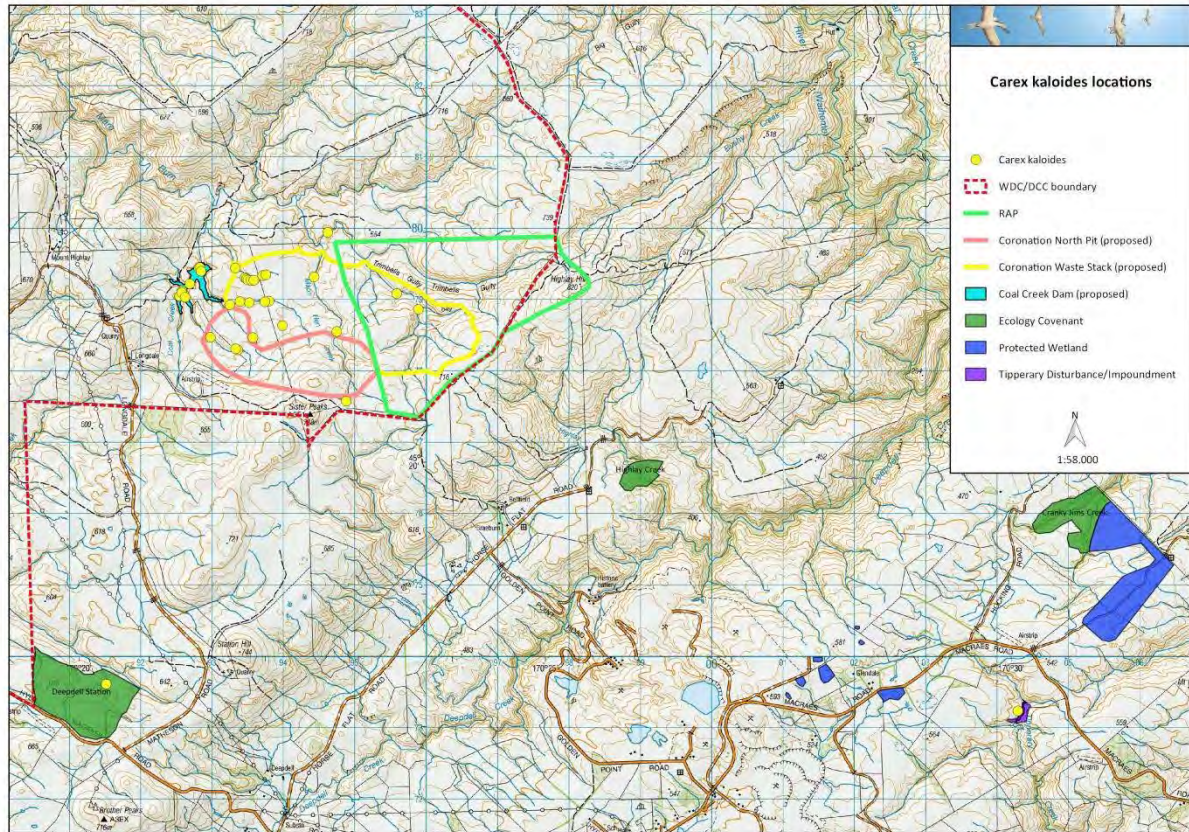


Figure B. Distribution of *Carex kaloides* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=235 accessed 3 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/400419-Carex-kaloides> accessed 3 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5. *Rumex flexuosus* Spreng. in Biehler (Maori dock, Polygonaceae).

Distribution within project

Maori dock was recorded from wetlands at five sites in the WRS and one site in the Coronation North Pit Zones. The size of the populations at these sites varied between two plants to a patch measuring 10m x 10m.

Summary of existing information

Rumex flexuosus is a species rarely recorded within the Macraes E.D. It occurs in wet areas throughout the North, South and Stewart Islands. It is known from the wider Macraes area at seven sites between Red Bank and Ramrock roads. It inhabits open areas in wetlands.

Ecological importance of species

The ecological importance of the population of this species within the PIA is categorised as **Moderate** on the basis of its:

- 1) Rarity within the Ecological District.



Figure A. Distribution of *Rumex flexuosus* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

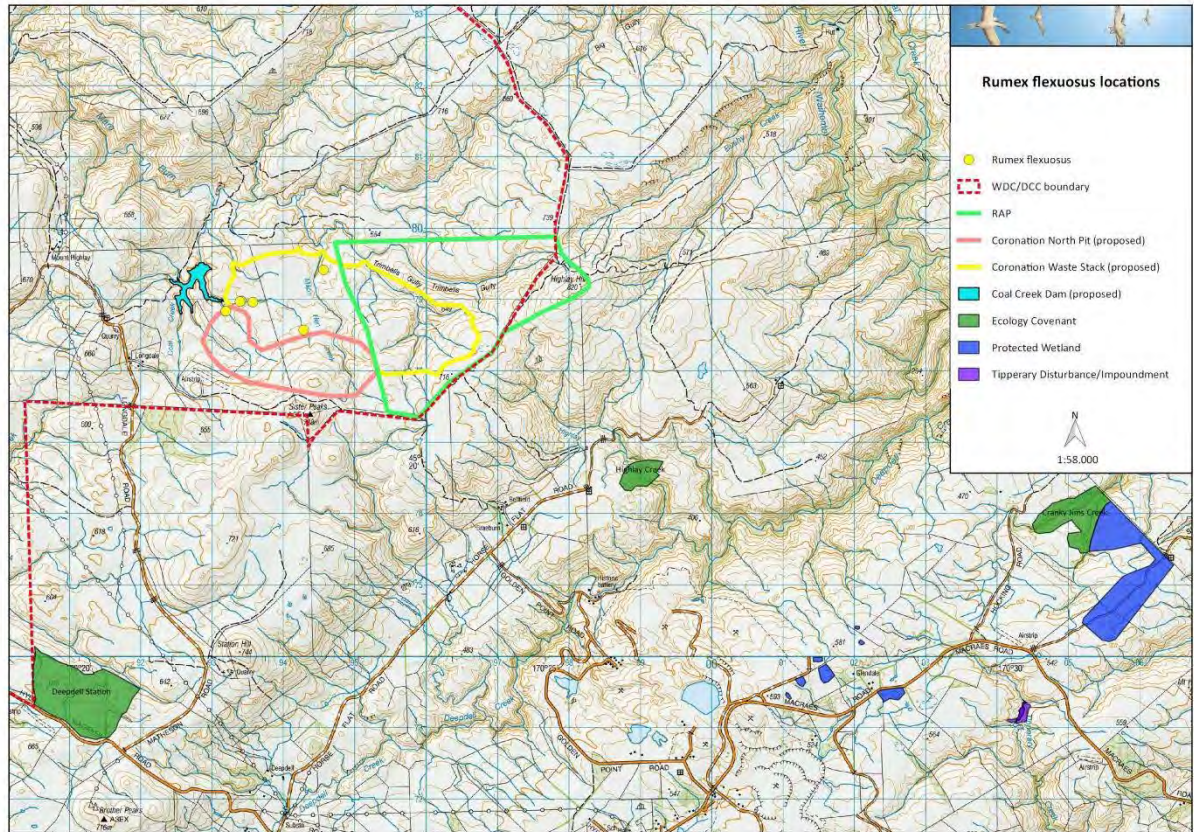


Figure B. Distribution of *Rumex flexuosus* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=2240 accessed 3 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/405775-Rumex-flexuosus> accessed 3 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5.3.4.3 Species listed as ‘Threatened Plants’ in Appendix 16A of the DCC District Plan.

Four species present within the PIA are listed in Appendix 16A of the DCC District Plan: *Carmichaelia crassicaulis* subsp. *crassicaulis*, *Aciphylla subflabellata*, *Olearia bullata* and *Chionochloa rubra* subsp. *cuprea*. Assessments of the status of *Carmichaelia crassicaulis* subsp. *crassicaulis* and *Aciphylla subflabellata* are provided in [Section 5.3.2.1](#).

1. *Olearia bullata* H.D.Wilson et Garn.-Jones (a small-leaved tree daisy, Asteraceae).

Distribution within project

There are scattered populations of *Olearia bullata* in the Coronation North Pit and WRS Zones. These are usually single trees or small groups of 5-12 individuals bordering wetlands in Maori Hen Creek and Coal Creek.

Summary of existing information

While rare within the Dunedin City boundary, *Olearia bullata* is not considered At Risk and is frequent in the Macraes area which is towards the eastern edge of its mainly south-eastern South Island distribution. At many sites within its range large numbers of plants are present, and it is one of few native *Olearia* shrubs that are capable of regeneration in pastoral areas.

The ecological importance of the population of this species within the PIA is categorised as **low** (a more appropriate value⁹ than ‘moderate’ using Table 5 of EIANZ guidelines) on the basis of its:

- 1) Rarity within the Dunedin City boundary.

⁹ While this species is rare within the Dunedin City boundaries, it is not a nationally rare species or a rare species in the Macraes E.D. Therefore its importance should be lower than species that are nationally rare.

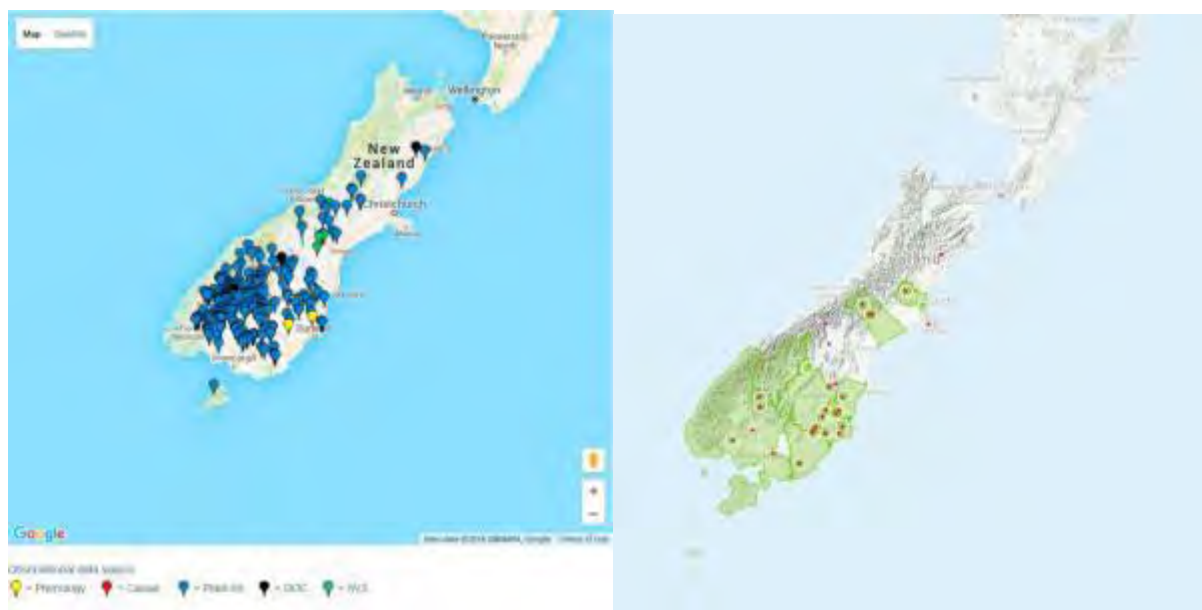


Figure A. Distribution of *Olearia bullata* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

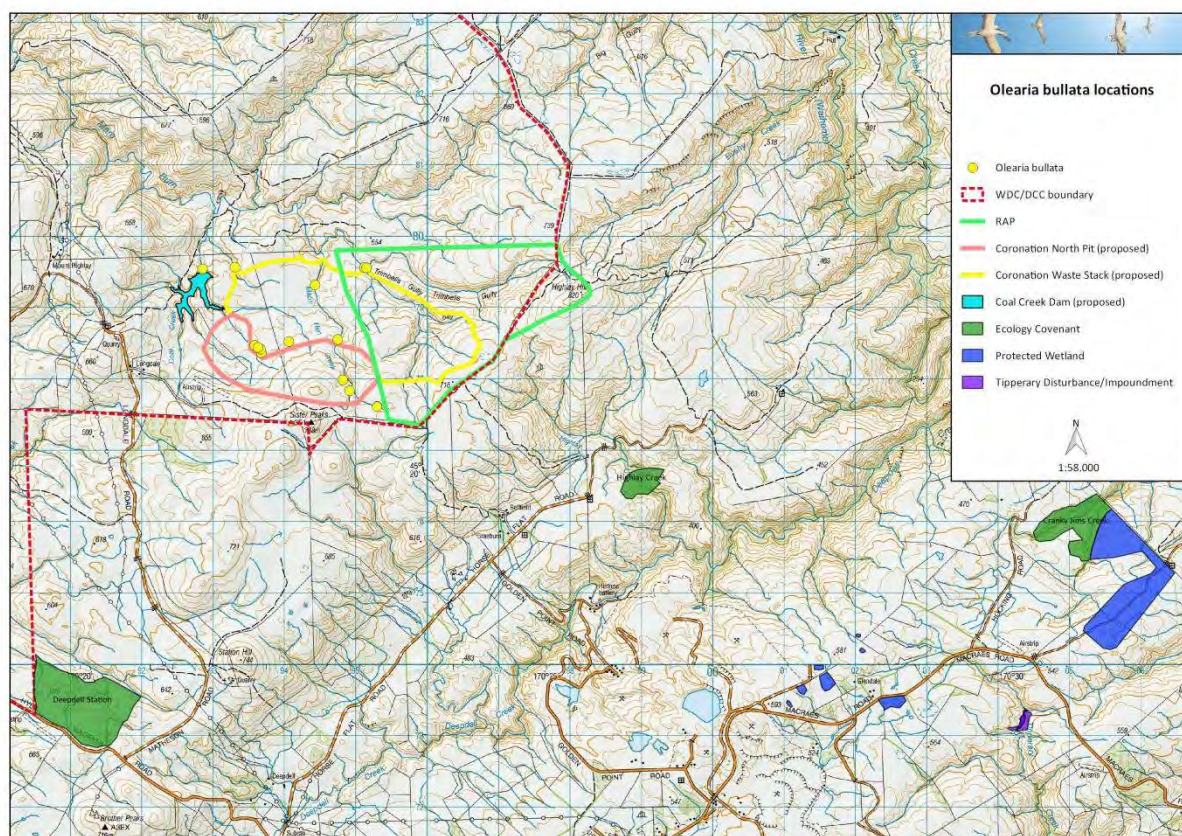


Figure B. Distribution of *Olearia bullata* within the PIA and the wider OceanaGold project area (NB: Distribution outside the Dunedin City boundary is not mapped).

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1045 accessed 5 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/404261-Olearia-bullata> accessed 5 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

2. *Chionochloa rubra* subsp. *cuprea* Connor (Copper tussock, Poaceae).

Distribution within project

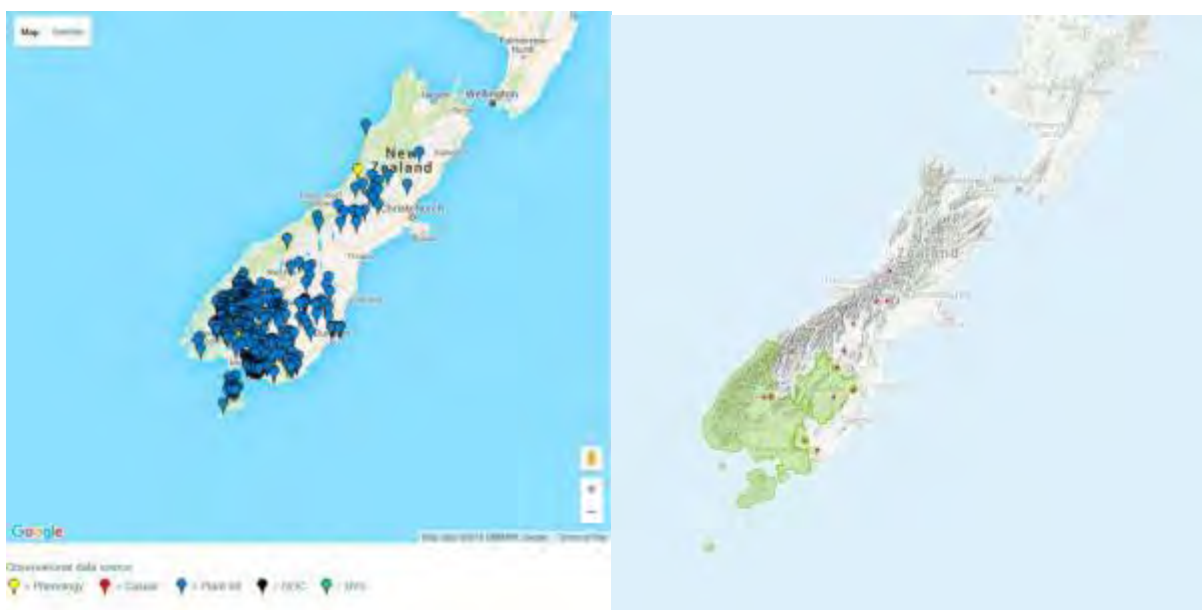
There are scattered populations of *Chionochloa rubra* subsp. *cuprea* in the Coronation North Pit and WRS Zones. These are usually small groups, although larger areas are found in the lower tributaries of Coal Creek and Trimbells Gully where some sites have a near continuous 1.5m tall canopy of this species, with or without *Carex secta*, extending over 30-50m of gully bottom.

Summary of existing information

While rare within the Dunedin City boundary, *Chionochloa rubra* subsp. *cuprea* is not considered At Risk and is frequent in the Macraes area, which is towards the eastern edge of its mainly southern South Island distribution. At many sites within its range, large numbers of plants are present although it is susceptible to wetland drainage, and sites at lower elevations where it forms an extensive canopy covering more than several hectares are now rare.

The ecological importance of the population of this species within the PIA is categorised as **low** (a more appropriate value¹⁰ than 'moderate' using Table 5 of EIANZ guidelines) on the basis of its:

- 1) Rarity within the Dunedin City boundary;
- 2) its role in creating habitat for other species, including the Threatened *Ranunculus ternatifolius*.



¹⁰ While this species is rare within the Dunedin City boundaries, it is not a nationally rare species or a rare species in the Macraes E.D. Therefore its importance should be lower than species that are nationally rare.

Figure A. Distribution of *Chionochloa rubra* subsp. *cuprea* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

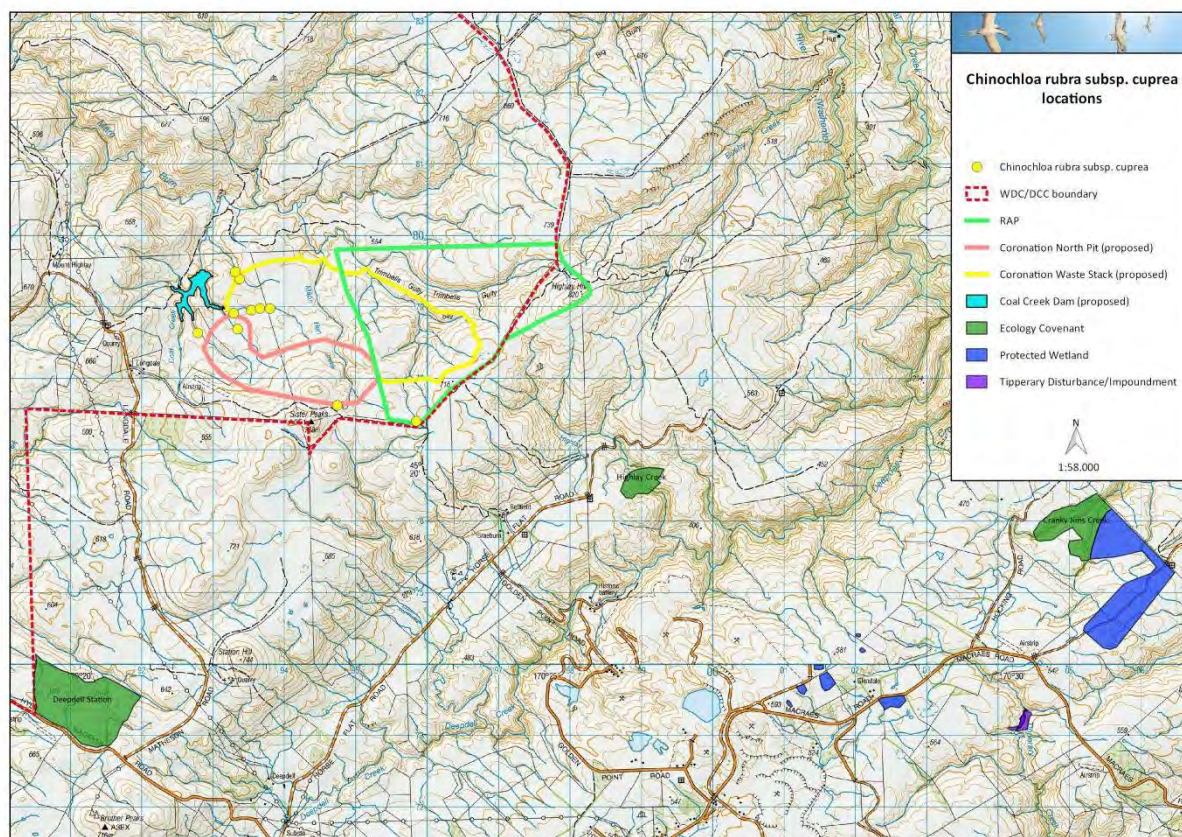


Figure B. To update Distribution of *Chionochloa rubra* subsp. *cuprea* within the PIA and the wider OceanaGold project area (NB: Only sites with larger patches forming a continuous canopy in the PIA are mapped).

Data sources used in this assessment:

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1674 accessed 5 February 2016.

Nature Watch <http://naturewatch.org.nz/taxa/412218-Chionochloa-rubra-cuprea> accessed 5 February 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5.3.5 *Species of biogeographic interest*

No species that are at their distribution limits or of other biogeographic interest occur within the PIA.

5.3.6 *Genetically or morphologically distinct forms*

No genetically or morphologically distinct plant species are present within the PIA.

5.4 Avifauna Ecological Features

5.4.1 Avifauna communities

Eleven bird species were recorded from within the PIA, five of which are indigenous: pipit, harrier hawk, grey warbler, paradise shelduck and spur-winged plover, and six of which are exotic: skylark, chaffinch, redpoll, house sparrow and song thrush.

Pipits were observed, occasionally as pairs, at several sites in the PIA, mainly in narrow-leaved tussock grassland. They are assumed to be breeding in the PIA. One harrier hawk was seen on most visits to the site. It is assumed that they regularly use the area for hunting and feeding, but are unlikely to be breeding there. A single grey warbler was seen in the WRS Zone. It is assumed that there are likely to be other birds present and they are breeding in some of the more intact shrubland areas. One pair of paradise shelduck and their still-dependent ducklings were seen on one of the ponds in the WRS Zone. Because of the size of the ducklings it is very likely that they bred at this site. Spur-winged plover were vocally conspicuous in the lower area of the Coronation North Pit and WRS Zones. It is estimated that two pairs were present, and it is likely that they breed there.

Skylarks are scattered throughout the PIA in areas of open vegetation. Chaffinches are rare in the PIA and were observed in some of the shrubby areas in gullies. Flocks of 5-15 redpolls were occasionally seen, usually feeding on tussock seed heads. House sparrows are rare, with a single bird seen in Trimbells Gully. Song thrushes are also rare, with a single bird seen in Maori Hen Creek. All of the exotic species are likely to be breeding within the PIA.

5.4.2 Ecological function

Of the eleven bird species recorded from within the PIA, six are exotic species. Four of these: skylark, chaffinch, redpoll and house sparrow are considered of little ecological significance, being insectivores or seed eaters which are likely competing with native species. The song thrush has some ecological significance due to its role in dispersing fruit of native shrubs.

The five indigenous species: pipit, harrier hawk, grey warbler, paradise shelduck and spur-winged plover, are all likely to be playing some ecological role within the PIA. Pipits are mainly insectivores, but also disperse fruit of native plants (Thorsen et al. 2011). Harrier hawks play a role in regulating rabbit density and behaviour in the area, but at the density encountered in the PIA, this is likely to be only a minor role. Grey warblers are predominantly insectivorous, and play a role in regulating tree-dwelling invertebrate numbers. Paradise shelduck and other waterfowl influence the stature and composition of wetland plant communities. Spur-winged plovers are omnivorous, mainly feeding on plant material but also some animal material (Heather and Robertson 2000). They are a recent natural arrival to New Zealand, and their ecological function here is not known.

5.4.3 Species diversity

Dryland Central Otago is depauperate in bird species due to its aridity and lack of forest and wetland habitats. The five indigenous and six exotic bird species observed within the PIA is the normal diversity expected for this site.

5.4.4 Threatened, At Risk, or rare bird species

One of the five indigenous bird species is classified as At Risk: pipit.

1. *Anthus novaeseelandiae* Gmelin subsp. *novaeseelandiae* (pipit, Motacillidae).

Pipits are currently classified as Declining on the basis of a >100,000 population that is predicted to decline by 10-70% (Robertson et al. 2012). This decline is mainly attributed to conversion of rough grasslands (particularly short tussock grassland) to pasture, and predation (Heather and Robertson 2000, <http://nzbirdsonline.org.nz/species/new-zealand-pipit> accessed 16/2/16). Pipit are distributed throughout the North, South and Stewart Islands, with subspecies on the offshore islands (Figure 6a). Within the Macraes area pipit are widespread, particularly in rough low grassland, although population density varies greatly from site to site. Pipits are mainly present within the WRS Zone in the RAP area (Figure 6), where it is estimated, based on encounter rate, that there are between 5 – 12 pairs of birds.

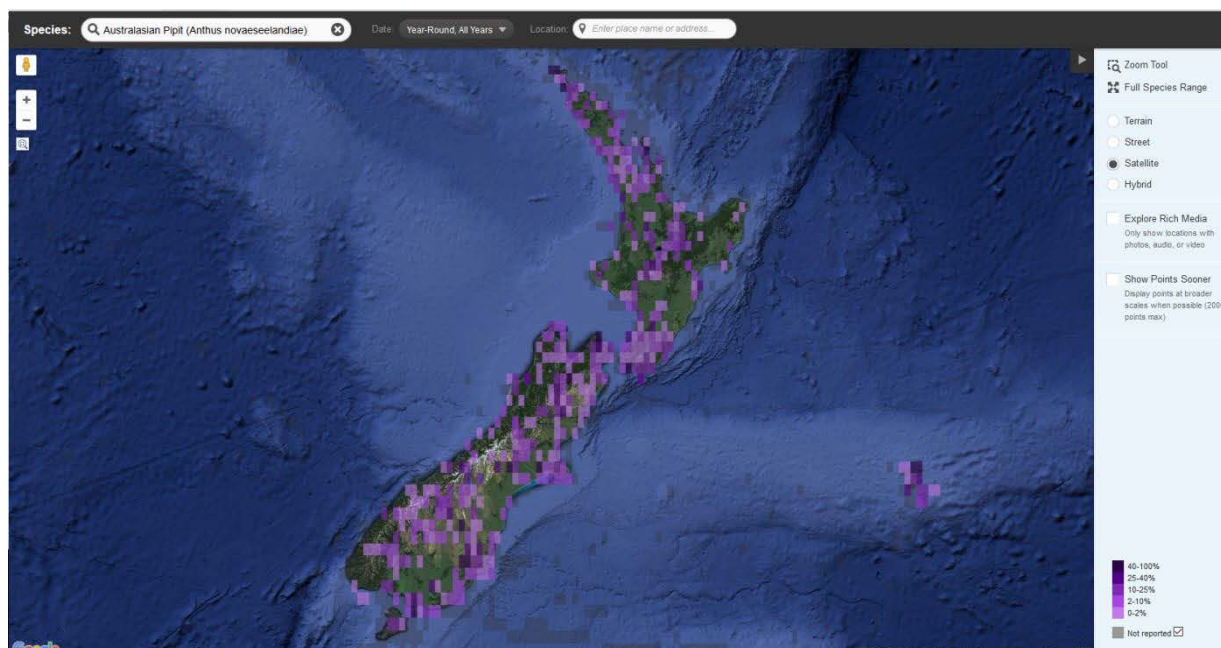


Figure 6a. National distribution of pipit and density of sightings, from:

<http://ebird.org/ebird/newzealand/map/auspip1?neg=true&env.minX=156.24755859375&env.minY=-47.82790816919327&env.maxX=-166.83837890625&env.maxY=-33.99802726234875&zh=true&gp=false&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2016> accessed 25 April 2016.

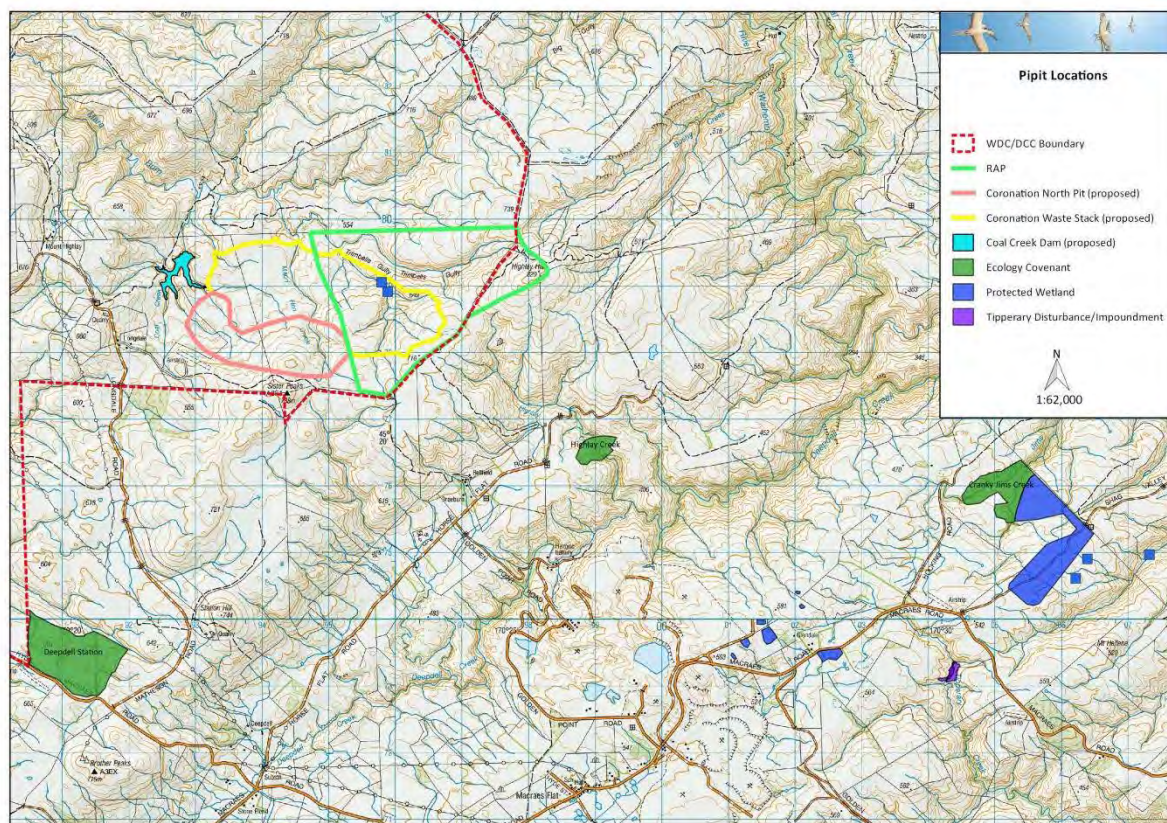


Figure 6b. Locations where pipit were recorded in the PIA. Note, records in Deepdell Covenant not shown.

5.4.5 *Species of biogeographic interest*

No bird species that are at their distribution limits or of other biogeographic interest were found within the PIA.

5.4.6 *Genetically or morphologically distinct forms*

No bird species within the PIA are thought to be of genetically or morphologically distinct forms.

5.4.7 *Importance overall of avifauna*

The ecological importance of the birds within the PIA is categorised as **moderate-low** on the basis of:

- 1) The presence of one At Risk species;

- 2) role in ecosystem function;
- 3) low species diversity and abundance.

5.5 Herpetofauna Ecological Features

5.5.1 Herpetofauna communities

Three reptile species were recorded in the PIA (Figure 7): the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype) and the gecko *Woodworthia* “Otago large”.

The McCann’s skink *O. maccanni* (clade 4 genotype) is present in reasonable numbers (one individual per 20m) throughout all vegetation communities, but it is absent from the majority of the exotic grassland. It is commoner in some areas such as rocky sites and areas with good cover from the vine *Muehlenbeckia complexa*.

The southern grass skink *Oligosoma polychroma* (clade 5 form) is present infrequently in some of the damper areas in the lower gullies. It is likely that it has seasonally moved to these sites due to the dryness of the surrounding vegetation.

The korero gecko *Woodworthia* “Otago large” was noted at several rock outcrops in the PIA, but the suitability of these sites for this species varied greatly within the PIA. It is likely to be common at only a few sites, but small groups or individuals are possibly present in many of the rock outcrops.

It can sometimes be difficult to detect all reptile species during a survey, and other species of reptile are known from the vicinity. Both grand skink *Oligosoma grande* and Otago skink *Oligosoma atagense* have been recorded historically from c. 1km north of the PIA (Figure 7), but were not seen in or near the PIA during this survey (the original sites were not resurveyed as they occur outside the PIA). As the habitat for these large skink species is scarce in the PIA, and they were not detected within the PIA during surveys, it is considered highly unlikely that these two species are present within the PIA. Green skinks *Oligosoma chloronoton* were present to the east of the Coronation Project Area in the 1960’s (Whitaker 1986), but there have been no recent records of this species from anywhere within the OceanaGold operational area, even during a ten day species-specific survey in 2015. It is considered unlikely that this species is present within the PIA. Finally, cryptic skinks *Oligosoma inconspicuum* inhabit some gully-bottom habitats in the area. No cryptic skinks were detected during this survey, and it was considered that most of the area consisted of unsuitable habitat due to a shortage of stream-fringing fruit-bearing shrub and vine species. However, it is possible that a small number of individuals may be present within the PIA.

No amphibians were recorded during the survey, though the exotic whistling frog *Litoria ewingii* is known to occur in the area (Figure 7). This species is increasingly widespread in the South Island and southern North Island (<http://www.nzfrogs.org/NZ+Frogs/Introduced+frogs.html> accessed 6/2/16).

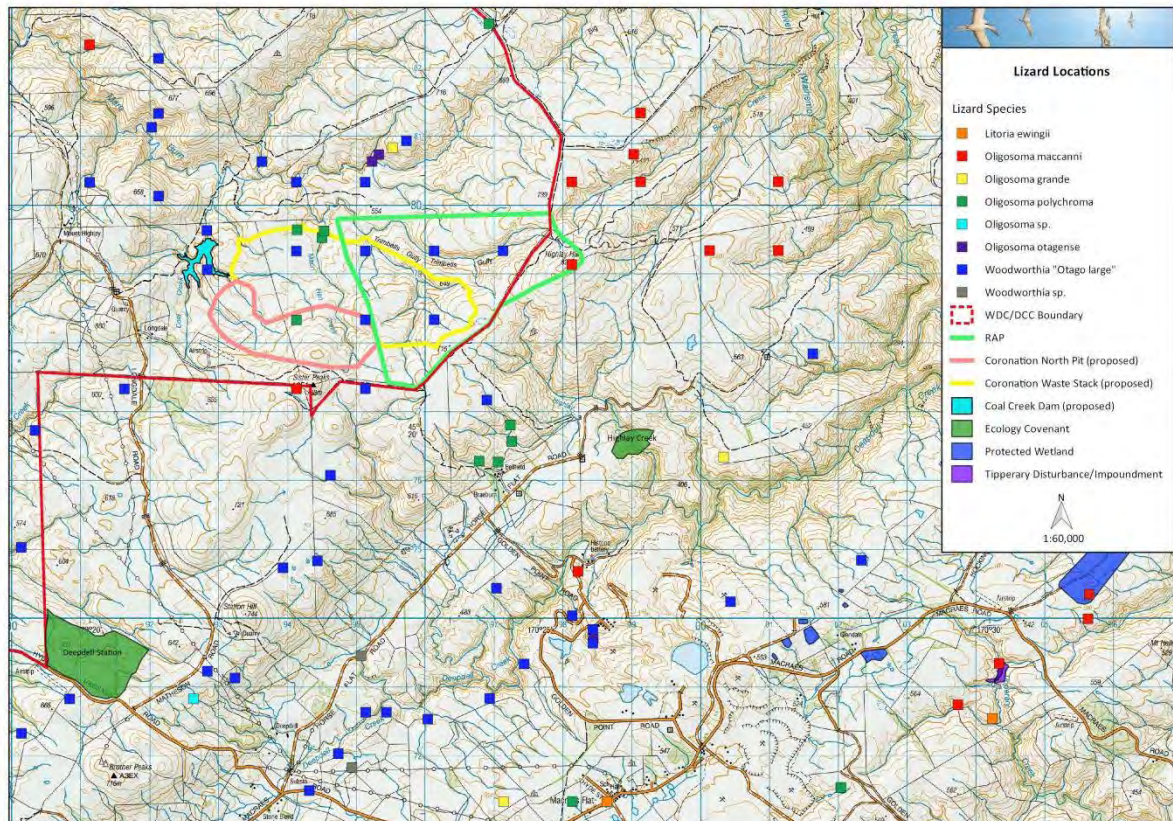


Figure 7. Records of lizard species in and around the PIA.

5.5.2 Ecological function

The three reptile species recorded in the PIA: the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype) and gecko *Woodworthia* “Otago large” play an ecological role in regulating invertebrate numbers and in dispersing the fruit of native plants. They are also prey items of native birds such as falcon (not known from PIA).

5.5.1 Species diversity

Three reptile species is a low diversity in relation to other sites nearby, where five to eight species are regularly recorded.

5.5.1 *Threatened, At Risk, or rare reptile species*

Two of the reptile species are currently classified as At Risk: the skink *Oligosoma polychroma* (clade 5 genotype) and the gecko *Woodworthia* “Otago large”.

1. *Oligosoma polychroma* (Patterson & Daugherty 1990) (clade 5 genotype) (southern grass skink, Scincidae).

Southern grass skinks are currently classified as Declining with the qualifier Partial Decline on the basis of its population estimated to occupy >10,000 (100km²) with a predicted decline of 10-70% (Hitchmough et al. 2013). Within the wider Macraes area this species is frequently encountered at many sites and most suitable habitat is occupied. Nearby, a large lizard conservation programme run by DOC is benefitting this species (and others). Within the PIA this species has a local distribution mainly in lower gully areas and some of the larger rock outcrops.

2. *Woodworthia* “Otago large” (korero gecko, Gekkonidae).

Korero geckos are currently classified as Declining with the qualifier Partial Decline on the basis of its population estimated to total >100,000 mature individuals with a predicted decline of 10-70% on mainland New Zealand (Hitchmough et al. 2013). Within the wider Macraes area this species is frequently encountered at many sites and most suitable habitat is occupied. Nearby, a large lizard conservation programme run by DOC is benefitting this species (and others). Korero geckos are also likely to be present in many of the smaller rock outcrops that are scattered through the PIA.

Overall, both species are considered to be represented by small populations within the PIA when compared with those known at other nearby sites. This appears to be a result of the lack of high-quality habitat: complex rocky sites with a high diversity and dense cover of native shrubs and vines.

5.5.1 *Species of biogeographic interest*

No reptile species that are at their distribution limits or of other biogeographic interest were recorded within the PIA.

5.5.1 Genetically or morphologically distinct forms

Genetically distinct genotypes of all three reptile species are present in the PIA: skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype), and the gecko *Woodworthia* “Otago large”.

Oligosoma polychroma (clade 5 genotype) (Liggins et al. 2008) and *Oligosoma maccanni* (clade 4 genotype) (O’Neill et al. 2008) are members of populations that are genetically distinct from other populations of these species.

The gecko *Woodworthia* “Otago large” is an unnamed entity within the *Woodworthia* genus that contains several other unnamed entities that were previously classified as *Woodworthia maculatus* (Hitchmough 1997, Jewell 2008, Nielsen et al. 2011). The population that occurs at Macraes is thought to represent a distinctive eastern form of this unnamed entity (Jewell 2008).

All three of these genetically distinct populations are widespread in the area. The eastern form of *Woodworthia* “Otago large” occurs at multiples sites between the Waitaki and Clutha Rivers inland to the Rock and Pillar Range (Jewell 2008). The Clade 5 genotype of *Oligosoma polychroma* is known to occur between Banks Peninsula, Mackenzie Basin, Central Otago, Southland and Stewart Island (Liggins et al. 2008). The Clade 4 genotype of *Oligosoma maccanni* is known from south of the Waitaki River through Central Otago east of the Dunstan Mountains to northern Southland (O’Neill et al. 2008).

5.5.2 Importance overall of herpetofauna

The ecological importance of the lizard populations within the PIA is categorised as **Moderate** on the basis of:

- 1) The presence of two At Risk species;
- 2) the presence of genetically distinct lineages (that occur at multiple sites outside the PIA;
- 3) the role they are likely to be playing in ecosystem function;
- 4) low species diversity and abundance.

5.6 Summary Table of Ecological Features

	Feature	Value	Importance
Vegetation & Sites	Communities	8 indigenous, 2 exotic	Very high
	Community representativeness	High	
	Community distinctiveness	None	
	Community ecological integrity	Moderate	
	Community rarity	High	
	Ecological function and services	Moderate	
	Botanical diversity	High: 162 indigenous, 79 exotic species	Very high
	Threatened land environments	3 (1 larger Acutely Threatened with indigenous vegetation)	
	National priorities for Conservation	Wetlands	
	Historically rare ecosystems	One Critically Endangered, one Endangered historically rare ecosystems	
	Wetlands of National Importance or Ramsar Site	-	
	Significant habitats under Regional Plan	Yes	
	Significant habitats under District Plans	Yes?	
	Sites recommended for protection	One	
	Threatened plant species	5	Very high
	At Risk plant species	9	
	Data Deficient plant species	2	
	Rare plant species	7	
	Species of biogeographic interest	-	
	Genetically or morphologically distinct species	-	
Avifauna	Ecological function	Low	Moderate-low
	Diversity	5 indigenous, 6 exotic species	
	At Risk species	1	
	Species of biogeographic interest	-	
	Genetically or morphologically distinct species	-	
Herpetofauna	Ecological function	Moderate	Moderate
	Diversity	3 indigenous	
	At Risk species	2	
	Species of biogeographic interest	-	
	Genetically or morphologically distinct species	3	

6 Project Impact on Biodiversity Features

6.1 Impact on Vegetation Communities

Nine vegetation communities are identified within the PIA. Overall, the vegetation communities present within the PIA are assessed as being of **very high** ecological importance. The communities are of high representation, diversity and moderate integrity and ecosystems service importance. There are rare vegetation communities present, wetland vegetation communities that are a national priority for protection, the long-inundation ephemeral wetlands and seepage wetlands are historically rare and classified as Nationally Critical or Endangered, an area has previously been recommended for protection on the basis of its ecological features, and there are three Threatened Level IV land environments that are overlain by some natural vegetation. The remainder of the natural vegetation types are significant under the ORC Regional Plan and WDC District Plan.

The effects of the project will result in the loss of all vegetation communities within the PIA. This will reduce the extent of these vegetation communities in the local area, and for the rarer vegetation communities (long-inundation ephemeral wetlands, seepage wetlands and basalt contact seepage wetlands) this is likely to lead to a significant reduction in their extent on a national scale.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the vegetation communities, with a **national impact** on the rarer vegetation communities.

The magnitude of the project's impact on the area's vegetation communities at a local scale is assessed as **high**, and at a national level as **high**.

The overall degree of the project's effect on these communities is **very high**.

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored. Further, it is difficult to discriminate between vegetation communities using aerial photography, which makes it difficult to assess their distribution at a local scale. Lastly, vegetation communities in this area often interdigitate and intergrade, making it difficult to accurately determine their classification and extent.

6.2 Threatened, At Risk, or Rare Plant Species

Eighteen plant species that occur within the PIA are either currently classified as Threatened, At Risk or Data Deficient (Townsend et al. 2007, de Lange et al. 2013), or are listed as 'Threatened Plants' in Appendix 16A of the DCC District Plan, or are thought to be rare in the Macraes E.D. based on the author's observations.

6.2.1 Nationally Critical species

1. *Simplicia laxa* Kirk (a grass, Poaceae)

The grass *Simplicia laxa* was recorded from 2 sites in the WRS Zone.

Effect of construction of waste rock stack

Depositing WRS material is will destroy some known habitat in this area of this species and cause the mortality of all known individuals in the PIA.

Effect of removing rock material when excavating pit

Nil effect as this species does not occur within this zone.

Effect of sediment run-off

Nil effect as this species does not occur in watercourses.

Effect of changes in weed populations

Negligible risk for this species due to its tolerance of high shade environments, which are not vulnerable to weed invasion.

Effects of displacement of pest animals

Nil effect for this species as it occurs in areas not browsed by animals

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Nil effect as the rock overhang habitat of this species naturally protects it from dust-fall.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is within a natural fire refugia, and it is considered unlikely that heat levels would reach a level within this habitat sufficient to effect plant health.

The result of these project effects will be the loss of the species from two sites. The wider effect of these impacts on the species at a local or national scale is uncertain, but the loss of these two sites represents an approximately 5% reduction in total number of known sites. There is some risk of a reduction in the longer-term viability of the species, both through a decrease in total population size and loss of sites, which may have importance in maintaining a fragmented metapopulation of the species in the area.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **high**, and at a national level as **moderate**.

The overall degree of the project's effect on this species is **high** (a more appropriate value than 'very high'¹¹ produced using Table 12 of EIANZ guidelines).

The confidence of this assessment is **moderate** as the species is likely under-recorded as a result of its inconspicuous nature, recently discovered forest habitat, and unfamiliarity of most New Zealand botanists with grasses. Further, the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution, probably extending at least to the sites where it is known on the Old Man Range, Rough Ridge and Lammermoor Range. The number of plants at each site within the PIA is not known with

¹¹ The intersection of a 'very high' ecological value and a 'moderate' magnitude effect produces a 'very high' level of effect in Table 12. 'High' would seem a more appropriate product, and more in keeping with the progression from 'negligible' to 'very high' as ecological value and magnitude of effect increases in the rest of the table.

accuracy due to its sprawling habit and tendency to grow intermixed with other grass species (especially *Poa breviglumis*) that are similar in appearance.

6.2.2 *Nationally Vulnerable species*

1. *Anogramma leptophylla* (L.) Link (annual fern, Pteridaceae).

This small delicate fern was recorded at one site within the WRS Zone.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species, and cause the mortality of all known individuals within the PIA.

Effect of removing rock material when excavating pit

Nil effect as this species does not occur within this zone.

Effect of sediment run-off

Nil effect as this species does not occur in watercourses.

Effect of changes in weed populations

Negligible risk for this species as its shaded rock outcrop habitat is not vulnerable to weed invasion.

Effects of displacement of pest animals

Nil effect for this species as it is apparently not browsed by animals

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Nil effect as the rock overhang habitat of this species naturally protects it from dust-fall.

Effects of light

Nil effect as project lighting is unlikely to be at a level that it will influence plant growth.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is within a natural fire refugia, and it is considered unlikely that heat levels would reach a level within this habitat sufficient to effect plant health.

The result of these project effects will be the loss of the species from the site. There is some risk of a reduction in the longer-term viability of the species in a local context, both through a decrease in total population size, and loss of sites that may have importance in maintaining what is likely to be a fragmented metapopulation of the species in the area. It is likely that there are other sites inhabited by this species in the surrounding area, and the loss of the very few plants within the PIA poses little risk to the conservation status of this species

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **high**, and at a national level as **low**.

The overall degree of the project's effect on this species is **moderate**.

The confidence of this assessment is **low**, as the species was only recently (2012) recorded in the Macraes area, and it is likely under-recorded as a result of its inconspicuous nature and similarity to the ferns *Cystopteris fragilis* and *Cheilanthes distans*. Further, the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. The palatability to browsing mammals of this species is unknown.

2. *Carex inopinata* Cook (grassy mat sedge, Cyperaceae).

The impact on this species was previously been considered during the Coronation project consent process and is not considered further here.

3. *Ranunculus ternatifolius* Kirk (wetland buttercup, Ranunculaceae).

This small wetland buttercup was recorded at two sites within the WRS Zone and one site immediately downstream of the WRS Zone within the PIA. At all three sites small patches comprised of 1-5 plants were located in shaded wet areas under copper tussocks.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species, and cause the mortality of all known individuals within the PIA.

Effect of removing rock material when excavating pit

Nil effect as this species does not occur within this zone.

Effect of sediment run-off

Streambed sedimentation, if uncontrolled, could affect the downstream site. The effect of sedimentation on this population is unknown: it could both bury existing plants and increase weed prevalence, or it could create better conditions allowing the species to proliferate, if the over-shadowing copper tussock is unaffected.

Effect of changes in weed populations

Negligible to moderate effect as this species appears to cope with being heavily shaded, and its natural habitat is not vulnerable to weed invasion.

Effects of displacement of pest animals

Nil effect for this species as it is apparently not browsed by animals.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Nil effect as plants are protected by the over-shadowing copper tussocks.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is within a natural fire refugia, and it is considered unlikely that heat levels would reach a level within this habitat sufficient to effect plant health.

The result of these project effects will be the loss of the species from two of the three sites in the PIA. There is some risk of a reduction in the longer-term viability of the species in a local context, both through a decrease in total population size and loss of sites that may have importance in maintaining what is likely to be a fragmented metapopulation of the species in the area. This species is more commonly found in higher-rainfall areas where larger populations occur and the loss of these three sites represents a very small reduction (<1%) in either the total number of plants or number of sites where this species is known to occur.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **high**, and at a national level as **low**.

The overall degree of the project's effect on this species is **moderate**.

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution.

4. *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff") (a daisy, Asteraceae).

This apparently unnamed daisy was recorded at one site within the WRS Zone, a further two sites are located downstream.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species, and cause the mortality of the one known individual within the WRS Zone.

Effect of removing rock material when excavating pit

Nil effect as this species does not occur within this zone.

Effect of sediment run-off

Nil effect as this species does not occur in the stream bed of watercourses.

Effect of changes in weed populations

Negligible to minor effect on this species as it occurs on shaded cliff faces which are not vulnerable to weed invasion.

Effects of displacement of pest animals

Nil effect for this species as it inhabits sites (in the PIA) inaccessible to browsing animals.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Nil effect as the rock overhang habitat of this species naturally protects it from dust-fall.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is within a natural fire refugia, and it is considered unlikely that heat levels would reach a level within this habitat sufficient to effect plant health.

The result of these project effects will be the loss of the species from the PIA. As only one plant is present in the PIA, there is very little risk of a reduction in the longer-term viability of the species in a local context but there will be some reduction in local genetic diversity of this potentially unnamed entity. This loss is very unlikely to effect the national population.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**¹².

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. There is also uncertainty on the taxonomic status of this entity.

6.2.3 At Risk species

Eight At Risk plant species are known to occur within the PIA: five species that are classified as Declining and three species classified as Naturally Uncommon.

1. *Aciphylla subflabellata* W.R.B. Oliver (needle-leaved speargrass, Apiaceae).

This speargrass was recorded at three sites within the Coronation North Pit Zone and two sites within the WRS Zone. Several populations are present in the area downstream of the WRS, and one large population immediately adjacent to the upper boundary of the WRS.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species, and cause the mortality of all known individuals at two sites within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality of all individuals at three sites in the Coronation North.

Effect of sediment run-off

Nil effect as individuals that inhabit stream banks are situated above the level where stream bed sedimentation could occur.

¹² Low is considered more appropriate than moderate as only one individual is present in the PIA.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares and pigs. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Negligible effect as plants are usually growing within taller grasses that would intercept much of any dust present.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but is more likely to not destroy the active growing tip which is near ground level and enclosed in the developing leaves.

The result of these project effects will be the loss of the species from five sites. There is some risk of a reduction in the longer-term viability of the species in a local context, both through a decrease in total population size and loss of sites that may have importance in maintaining what is likely to be a fragmented metapopulation of the species in the area. The impact on the species at a national scale is estimated to result in a <1% reduction in the total population.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **moderate** (a more appropriate level than 'low'¹³ produced using table 12 of EIANZ guidelines).

The confidence of this assessment is **moderate** as the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. This species is inconspicuous when not in flower, and is likely to be under-recorded because of this.

2. *Carex tenuiculmis* (Petrie) Heenan et de Lange (slender niggerhead, Cyperaceae).

This wetland sedge was recorded at one site within the Coronation Pit Extension Zone.

Effect of construction of waste rock stack

Nil effect as this species does not occur in this zone

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality of the six individuals at the one site in the Coronation North Pit Zone.

Effect of sediment run-off

Moderate effect as stream bed sedimentation, if uncontrolled, could cause an increase in wet, bare ground which is usually colonised by weed species.

Effect of changes in weed populations

Negligible to moderate effect depending on weed species.

Effects of displacement of pest animals

Negligible effect for this species as it is apparently not browsed by animals except cattle.

¹³ The intersection of a 'high' ecological value and 'low' magnitude effect produces a 'low' level of effect in Table 12. 'Moderate' would seem a more appropriate product, and more in keeping with the progression from 'negligible' to 'very high' as ecological value and magnitude of effect increases in the rest of the table.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Negligible effect as plants are usually growing within taller grasses that would intercept much of any dust present.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is within a natural fire refugia, and it is considered unlikely that heat levels would reach a level within this habitat sufficient to effect plant health.

The result of these project effects will be the loss of the species from one site. There is very little risk of a reduction in the longer-term viability of the species in a local context as this species is increasing in numbers and individual plant health within nearby protected areas. The impact on the species at a national scale is a very small reduction (<1%) in the number of known sites inhabited by this species.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **low**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. This species can be confused with other wetland species that occur in the area, particularly *Carex kaloides*, red-leaved forms of both *Carex testacea* and *Carex flagellifera*, and smaller plants of *Carex secta* growing in drier environments.

3. *Carmichaelia corrugata* Colenso (common dwarf broom, Fabaceae).

This dwarf broom was recorded at four sites within the WRS Zone.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals at four sites within the WRS Zone.

Effect of removing rock material when excavating pit

Nil effect as this species does not occur in this zone.

Effect of sediment run-off

Nil effect as this species does not occur in streams.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as this species often grows in dusty conditions with no obvious sign of ill-health.

Effects of light

Nil effect as project lighting is unlikely to be at a level that it will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but is more likely that the paucity of vegetation will not allow a fire of sufficient heat to kill this plant's rootstock.

The result of these project effects will be the loss of the species from four sites and will cause the local extinction of the species in this area. The impact on the species at a national scale is the loss of a sizeable population very near the southern limit of this species.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **high**, and at a national level as **moderate**.

The overall degree of the project's effect on this species is **high**.

The confidence of this assessment is **moderate**, as this is the first record of the species in the local area, and the nearby Mt Royal population was only discovered in 2015. In addition, the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. This species is low-growing and inconspicuous and is likely to be under-recorded. However, it does appear to be a species that is rare in Otago, possibly because it is at the limit of its distribution.

4. *Carmichaelia crassicaulis* Hook.f. subsp. *crassicaulis* (coral broom, Fabaceae).

This thick-stemmed broom was recorded at multiple sites within the WRS and Coronation North Pit Zones.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals at several sites within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals at several sites within the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as this species does not occur in streams.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Negligible effect as plants are often found growing on the side of gravel roads in Otago without obvious signs of ill health.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but is more likely that the paucity of vegetation will not allow a fire of sufficient heat to kill this plant's rootstock.

The result of these project effects will be the loss of the species from multiple sites within the PIA. This will reduce the extent and size of the population both in this area and nationally. The overall effect of this loss is difficult to determine as this species has a fragmented and relictual distribution often represented by small groups of senescent individuals where recruitment is lacking. The loss of the sites within the PIA will result in an estimated <1% reduction in the size of the national population.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **high**, and at a national level as **moderate**.

The overall degree of the project's effect on this species is **high**.

The confidence of this assessment is **moderate-high** as the majority of the area surrounding the PIA has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys, therefore the distribution described here is likely to be a subset of a wider distribution. This species is reasonably conspicuous, and therefore is unlikely to be under-recorded.

5. *Coprosma intertexta* G.Simpson (a narrow-leaved divaricating coprosma, Rubiaceae).

This reddish divaricating small-leaved *Coprosma* was recorded at one site within the Coronation North Pit Zone and three sites adjacent to the Coronation North Pit and WRS Zones.

Effect of construction of waste rock stack

Nil effect as species does not occur in this Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals at several sites within the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as species does not occur in streams.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Negligible effect as plants are often found growing on the side of gravel roads without obvious signs of ill health.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but most remaining plants occur in areas that are naturally resistant to fires due to their rocky nature.

The result of these project effects will be the loss of the species from the one site in the PIA. This will slightly reduce the extent of the population in this area. The wider effect of this impact on the species at a national scale is considered to be minor, as this species is widespread in the eastern South Island with numerous populations containing hundreds of plants.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall significance of the project's impact on this species is **low** (using Table 12 in EIANZ guidelines).

The confidence of this assessment is **moderate** as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution. This species can be confused with the more widespread *Coprosma rugosa* and therefore is likely to be under-recorded.

6. *Deschampsia cespitosa* (L.) P.Beauv. (tufted hair-grass, Poaceae).

This wetland grass was recorded at five sites within the Coronation Pit Extension Zone.

Effect of construction of waste rock stack

Nil effect as species does not occur in this Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals at four sites within the Coronation Pit Extension Zone.

Effect of sediment run-off

Nil effect as this species does not occur in streams in this area.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect, if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but the plants occur in an area that is naturally resistant to fires due to their wet nature.

The result of these project effects will be the loss of the species from four sites in the PIA. This will decrease the number of known populations in the area. The impact on the species at a national scale is likely to be minor, as this species occurs at multiple locations, including many in protected areas throughout its range.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **moderate** (a more appropriate level than 'low'¹⁴ produced using table 12 of EIANZ guidelines).

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution. This species can be confused with other wetland grasses and can be greatly reduced in size in wetlands that are heavily grazed, and therefore is likely to be under-recorded.

7. *Anthosachne falcis* (Connor) Barkworth et S.W.L.Jacobs (dwarf wheatgrass, Poaceae).

This dryland grass was recorded in the Coronation North Pit and WRS Zones.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals within the WRS Zone.

¹⁴ The intersection of a 'high' ecological value and 'low' magnitude effect produces a 'low' level of effect in Table 12. 'Moderate' would seem a more appropriate product, and more in keeping with the progression from 'negligible' to 'very high' as ecological value and magnitude of effect increases in the rest of the table.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality of all known individuals in the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as this species does not occur in streams.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect, if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that it will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but the plants occur in an area that is naturally resistant to fires due to the sparse vegetation.

The result of these project effects will be the loss of the species from within the PIA. As this species is widely and patchily distributed within natural sites in the Macraes area, and is known to occur at

multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is moderate, as this species was only discovered to occur in the area in 2016. The majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution. This species is easily confused with other *Anthosachne* grasses, is relatively inconspicuous, and many New Zealand botanists are unfamiliar with grasses. Therefore it is likely to be often mis-recorded.

8. *Celmisia hookeri* Cockayne (Hooker's mountain daisy, Asteraceae).

This cliff daisy was recorded in the WRS Zone and in the Coronation North Pit Zone.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals within the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as this species does not occur in streams.

Effect of changes in weed populations

Negligible to minor effect as this species occupies rock bluffs, a habitat that appears less vulnerable to weed invasion.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares and pigs. Resident pest animals and stock are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect, if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Negligible to moderate effect depending on timing of fire and growth of surrounding vegetation. At worst, an accidental fire could cause the death of plants, but the plants occur in an area that is naturally resistant to fires due to their rocky nature.

The result of these project effects will be the loss of the species from within the PIA. However, the outer fringes of the WRS will create habitat for *Celmisia hookeri* which should naturally colonise these areas from nearby populations. Also, populations within the fenced operational area are likely to expand, as has been observed within the existing Coronation Project fenced area where population growth is to the point that they are likely to have replaced the individuals lost through haul road and Coronation Pit construction. The loss of the sites within the PIA will result in an estimated <5% reduction in the size of the national population.

Therefore, the impact of this project is assessed as having both a **beneficial and adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **moderate**.

The overall degree of the project's effect on this species is **moderate** (a more appropriate value than 'low'¹⁵ produced using Table 12 of EIANZ guidelines).

The confidence of this assessment is **moderate-high**, as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution. This species can be confused with other *Celmisia* species outside its known range, and therefore localities outside of north-eastern Otago and northern Southland are likely to be mis-identifications.

9. *Lagenophora barkeri* Kirk (a wetland daisy, Asteraceae).

This wetland daisy was recorded at two sites in the WRS Zone.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals within the WRS Zones.

Effect of removing rock material when excavating pit

Nil effect as this species does not occur within this zone.

Effect of sediment run-off

Streambed sedimentation, if uncontrolled, could affect the Maori Hen Creek site. The effect of sedimentation on the downstream population is unknown: it could either bury existing plants and increase weed prevalence (most likely), or it could create better conditions thus allowing the species to proliferate.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

¹⁵ The intersection of a 'moderate-high' ecological value and 'moderate' magnitude effect produces a 'high' or 'low' level of effect in Table 12. 'Moderate' would seem a more appropriate product, and more in keeping with the progression from 'negligible' to 'very high' as ecological value and magnitude of effect increases in the rest of the table.

Effects of displacement of pest animals

Temporary minor effect at worst for this species, as it is not known to be browsed by animals.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect, if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of plants, but the plants occur in areas that are naturally resistant to fires due to their wet nature.

The result of these project effects will be the loss of the species from two sites within the PIA. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known, but is thought likely to occur at multiple locations, including many in protected areas throughout its range. If this assumption is correct, then the loss of the two sites in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **low**, as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution. This species is very easily confused with the very similar *L. petiolata* and *L. montana*, both of which occur in similar habitats nearby, and populations that are one of these three species are not

infrequent in the Macraes area, although closer examination of plants from some sites have usually identified them as *L. petiolata*.

6.2.4 *Data Deficient species*

1. *Epilobium insulare* Hausskn. (a wetland willowherb, Onagraceae).

This wetland willowherb was recorded at several sites in the Coronation North Pit and WRS Zones, and in areas immediately downstream of the PIA.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals at several sites within the Coronation North Pit Zone.

Effect of sediment run-off

Streambed sedimentation, if uncontrolled, could affect the Maori Hen Creek site. The effect of sedimentation on the downstream population is unknown – it could both bury existing plants and increase weed prevalence, or it could create better conditions and allow the species to proliferate.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of plants, but the plants occur in areas that are naturally resistant to fires due to their wet nature.

The result of these project effects will be the loss of the species from within the PIA. This will cause some loss of small populations from the local area. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known, but is thought likely to occur at multiple locations, including many in protected areas throughout its range. If this assumption is correct, then the loss of the two sites in the PIA is unlikely to majorly impact the longer-term security of the species locally or nationally.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on this species is **low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is now much better known than when it was classified as Data Deficient. However, *Epilobium* species are notoriously difficult to identify, and this, together with its stature as a small herb, mean it is likely to be under-recorded.

2. *Tetrachondra hamiltonii* Petrie ex Oliv. (a wetland herb, Tetrachondraceae).

The impact on this species was previously been considered during the Coronation project consent process and is not considered further here.

6.2.5 *Rare species*

6.2.5.1 Species uncommon in Ecological District

1. *Acaena dunicola* B.H.Macmill. (a bidibid, Rosaceae).

The impact on this species was previously been considered during the Coronation project consent process and is not considered further here.

2. *Acaena tesca* B.H.Macmill. (a bidibid, Rosaceae).

The impact on this species was previously been considered during the Coronation project consent process and is not considered further here.

3. *Brachyglottis southlandica* (Cockayne) B.Nord. (a daisy, Asteraceae).

This cliff-dwelling daisy was recorded at one site in the WRS Zone.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals within the WRS Zone.

Effect of removing rock material when excavating pit

Nil effect as the species does not occur within this zone.

Effect of sediment run-off

Nil effect as this species does not occupy streambeds.

Effect of changes in weed populations

Negligible to minor effect as this species occupies shaded rock bluffs, a habitat not vulnerable to weed invasion.

Effects of displacement of pest animals

Negligible effect for this species as it occupies a habitat inaccessible to pest animals.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect, if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that it will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of plants, but the plants occur in an area that is naturally resistant to fires due to their rocky nature.

The result of these project effects will be the loss of the species from within the PIA. This will cause a reduction in the number of populations in the local area. The wider effect of this impact on the species at a national scale is thought to be negligible, as this species occurs at multiple locations, including in protected areas throughout its range.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **very low**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **low**, as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution.

4. *Carex kaloides* Petrie (a wetland sedge, Cyperaceae).

This sedge was recorded at multiple sites in the Coronation North Pit and WRS Zones, and there are other sites downstream in Trimbells Gully and Coal Creek.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals at many sites within the Coronation North Pit Zone.

Effect of sediment run-off

Minor effect as this species occurs at sites which are occasionally inundated with alluvial material, and it may require the higher fertility created in this process.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of plants, but the plants occur in an area that is naturally resistant to fires due to their wet nature, and they have the ability to resprout from their buried root.

The result of these project effects will be the loss of the species from within the PIA. This will cause a reduction in the number of populations in the local area. The wider effect of this impact on the species at a national scale is thought to be negligible, as this species occurs at multiple locations, including in protected areas throughout its range including at sites that are heavily grazed.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **high**, and at a national level as **very low**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **low**, as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution. In this area some patches of *Carex kaloides* are cryptic and difficult to detect within surrounding *Chionochloa rubra* subsp. *cuprea* tussocks. Also, this species is only recently known from the area, being first recorded in 2013, and as such its wider distribution is unknown.

5. *Rumex flexuosus* Spreng. in Biehler (Maori dock, Polygonaceae).

Maori dock was recorded at five sites in the WRS and one site in the Coronation North Pit Zones.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals at five sites within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the mortality all known individuals at one site within the Coronation North Pit Zone.

Effect of sediment run-off

Minor to moderate effect. There is a risk that excess sedimentation, if uncontrolled, could swamp plants. If sedimentation is less than around 5cm per year it likely that this species will be able to persist because of its rhizomatous growth.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect at worst for this species as it is not known to be browsed by animals.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of plants, but the plants occur in areas that are naturally resistant to fires due to their wet nature, and they have the ability to resprout from their buried roots.

The result of these project effects will be the loss of the species from within the PIA. This will cause a reduction in the number of populations in the local area. The wider effect of this impact on the species at a national scale is thought to be negligible as this species occurs at multiple locations, including in many protected areas throughout its range.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **moderate**, as the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys. Therefore the distribution described here is likely to be a subset of a wider distribution.

6.2.5.2 Species listed as 'Threatened Plants' in Appendix 16A of the DCC District Plan.

1. *Olearia bullata* H.D.Wilson et Garn.-Jones (a small-leaved tree daisy, Asteraceae).

There are scattered populations of *Olearia bullata* in the Coronation North Pit and WRS Zones.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals at several sites within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the loss of the species from several sites within the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as this species occurs on streambanks which are naturally inundated with silt during floods.

Effect of changes in weed populations

Negligible to major effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of some trees, but it occurs in areas that are naturally resistant to fires due to their wet nature.

Assessment of project impact

The result of these project effects will be the loss of the species from within the PIA. This will cause a small reduction in the number of populations in the local area. The wider effect of this impact on the species at a national scale is negligible, as this species occurs at multiple locations, including in many protected areas throughout its range.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **low** and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

The confidence of this assessment is **high**, as although the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys, this species is frequently encountered in large numbers in the wider area.

2. *Chionochloa rubra* subsp. *cuprea* Connor (Copper tussock, Poaceae).

There are scattered populations of *Chionochloa rubra* subsp. *cuprea* in the Coronation North Pit and WRS Zones.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of this species and cause the mortality of all known individuals at several sites within the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will cause the loss of several patches within the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as this species occurs on streambanks which are naturally inundated with silt during floods.

Effect of changes in weed populations

Negligible to moderate effect depending on species of weed.

Effects of displacement of pest animals

Temporary minor effect for this species as it is browsed by animals, particularly hares. Resident pest animals and cattle are likely to be a bigger problem for this species.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect if works are to occur nearby, which may affect plant growth and reduce reproductive output.

Effects of light

Nil effect as project lighting is unlikely to be at a level that will influence plant growth.

Effects of accidental fire

Nil to negligible effect depending on timing of fire. At worst, an accidental fire could cause the death of some plants, but they occur in areas that are naturally resistant to fires due to their wet nature.

Assessment of project impact

The result of these project effects will be the loss of the species from within the PIA. This will reduce the extent of copper tussock wetland in the local area and reduce the habitat of the Threatened buttercup *Ranunculus ternatifolius* (discussed in [Section 6.2.2](#)). The wider effect of this impact on the

species at a national scale is negligible, as this species occurs at multiple locations, including in many protected areas throughout its range.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **negligible**.

The overall degree of the project's effect on this species is **very low**.

Confidence of assessment

The confidence of this assessment is **high**, as although the majority of the area surrounding the PIA has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys, this species is frequently encountered in the wider area.

6.3 Impact on Avifauna Ecological Features

Eleven bird species were recorded from within the PIA, five of which are indigenous. The ecological importance of the birds within the PIA is categorised as **moderate-low** on the basis of the presence of one At Risk species, the avifauna's role in ecosystem function and the low species diversity and abundance within the PIA.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of bird species, and cause the displacement of all known individuals in the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will destroy some known habitat of bird species, and cause the displacement of all known individuals in the Coronation North Pit Zone.

Effect of sediment run-off

Nil effect as none of the bird species occur in watercourses in the PIA.

Effect of changes in weed populations

Negligible to major effect as importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitat for bird species in the surrounding area, making the area unsuitable.

Effects of displacement of pest animals

Mustelids and rodents, displaced by the commencement of mining activities, will have a temporary minor effect on populations of surrounding birds, particularly ground-nesting birds such as pipits.

Effects of displacement of resident animals

This will be a temporary moderate effect, as birds resident within the PIA are likely to move into the surrounding area where they will compete for space and food with that area's residents. As the areas around the PIA are assumed to be at carrying capacity, this completion is likely to result in the mortality of a number of either resident birds or displaced birds, with a total mortality approaching the number of individuals that are displaced from the PIA.

Effects of noise & disturbance

This will have a negligible effect on the bird populations surrounding the PIA, as most of the species appear to acclimate to regular disturbance. It is likely that harrier hawks will avoid hunting the nearby surrounding area, and that paradise shelducks will not nest within sight of the project.

Effects of dust

Negligible effect as dust-fall, when managed, is minimal at distance.

Effects of light

Minor effect as project lighting will attract insects which could attract birds, particularly little owls if they are in the area.

Effects of accidental fire

Minor to moderate effect depending on the timing of fire. If a fire was to occur during the nesting season then bird's nests would be at risk, particularly those of ground-nesting pipit.

The result of these project effects will be the displacement of bird individuals from within the PIA, with a temporary increase in competition with neighbouring resident birds leading to the mortality of some individuals. Longer term there is likely to be avoidance of the area by harrier hawks and paradise shelducks. The result of this is some disruption of local bird populations, most of which are common on a national scale. The loss of some habitat of the At Risk pipit is of minor importance on a national scale.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on these species.

The magnitude of the project's impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**.

The overall degree of the project's effect on these species is **low**.

The confidence of this assessment is **moderate-low**, as the distribution and density of birds within the wider Macraes area is largely unknown.

6.4 Impact on Herpetofauna Ecological Features

Three reptile species were recorded in the PIA. The ecological importance of the lizard populations within the PIA is categorised as **Moderate** on the basis of the presence of two At Risk species, the presence of genetically distinct lineages (that also occur at multiple sites outside the PIA), the role the herpetofauna is likely to be playing in ecosystem function, and the low species diversity and abundance within the PIA.

Effect of construction of waste rock stack

Depositing WRS material will destroy some known habitat of reptile species and cause the mortality of all known individuals in the WRS Zone.

Effect of removing rock material when excavating pit

Excavating the pit and associated processes will destroy some known habitat of reptile species and cause the mortality of all known individuals in the Coronation North Pit Zone.

Effect of sediment run-off

Negligible effect as sediment accumulation is unlikely to affect either the habitat or food supply of any lizards inhabiting gullies.

Effect of changes in weed populations

Negligible to major effect as importation of weed species, either directly through seed contamination of equipment or material, or indirectly by creating favourable establishment sites, could, if unchecked, transform habitat for reptile species in the surrounding area, making the area unsuitable.

Effects of displacement of resident animals

Displacement of individuals is only likely to occur along the fringes of the PIA. Most individuals within the PIA are likely to be killed outright as a result of earth-moving activities. Displaced individuals will likely compete with surrounding residents, resulting in the death of one of the individuals as the surrounding area is assumed to be at carrying capacity and incapable of supporting additional individuals over the medium-term.

Effects of noise & vibration

Negligible effect of noise on the reptile populations. There may be some effect of the vibrations caused by heavy machinery and earth moving. But the presence of reptiles very close to the existing mine activities indicates that any effect is short-range and minor.

Effects of dust

Negligible effect as dust-fall is minimal at distance.

Effects of light

Negligible effect. There is a chance that project lighting will attract insects which could attract *Woodworthia* “Otago large” into the area, although this is considered unlikely given the types of habitat and disturbance that surround lights.

Effects of accidental fire

Minor to moderate effect, depending on timing of fire and habitat burnt. Most of the larger reptile populations occur at sites that are considered natural fire refuges because of their rocky nature.

Assessment of project impact

The result of these project effects will be the death of all reptile individuals from within the PIA and some short term disruption to reptile populations in the area immediately surrounding the project. As the populations within the PIA of these lizards are relatively small (for the area), it is assessed that the project will have a moderate effect on local lizard populations. As the lizard species concerned are widespread and often numerous, the project is considered to have a minor impact on lizard populations at a national scale.

Therefore, the impact of this project is assessed as having an **adverse, direct, permanent, irreversible, local impact** on the species.

The magnitude of the project’s impact on this species at a local scale is assessed as **moderate**, and at a national level as **low**

The overall degree of the project’s effect on this species is **low**.

The confidence of this assessment is **moderate**, as although the distribution and density of reptiles to the south of the project area are among the best known in New Zealand, the area to the north and west of the project area is poorly known in regard to reptiles.

6.5 Summary of Project Impacts

	Feature	Ecological Importance	Local Impact	National Impact	Overall
Vegetation & Sites	Communities	very high	high	high	very high
	Threatened plant species	very high	moderate (1 species), high (3 species)	low (3 species), moderate (1 species)	low (1 species), moderate (2 species), high (1 species)
	At Risk plant species		low (1 species), moderate (5 species), high (2 species)	negligible (1 species), low (4 species), moderate (3 species)	very low (1 species), low (2 species), moderate (3 species), high (2 species)
	Data Deficient plant species		moderate (1 species)	low (1 species)	low (1 species)
	Rare plant species		low (1 species), moderate (3 species), high (1 species)	negligible (3 species), very low (2 species),	very low (5 species)
Avifauna		moderate-low	moderate	low	low
Herpetofauna		moderate	moderate	low	low

8 References

- Bibby, C.J. 1997. Macraes Ecological District, summary report for Protected Natural Areas Programme. Department of Conservation, Dunedin.
- de Lange, P.J.; Rolfe, J.R.; Champion, P.D.; Courtney, S.P.; Heenan, P.B.; Barkla, J.W.; Cameron, E.K.; Norton, D.A.; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. Department of Conservation, Wellington.
- Department of Conservation & Ministry for the Environment. 2007. Protecting our places. Publication ME 799. Ministry for the Environment, Wellington.
- Forsyth, P.J. (Comp.). 2001. Geology of the Waitaki area. Institute of Geological and Nuclear Sciences 1: 250 000 Geological Map 19. Institute of Geological and Nuclear Sciences, Lower Hutt.
- Heather, B.; Robertson, H. 2000. Field guide to the birds of New Zealand. Viking, Auckland.
- Hitchmough, R.A., 1997. A Systematic Revision of the New Zealand Gekkonidae. Unpub. Ph.D. Dissertation, Victoria University, Wellington. 370 pp.
- Hitchmough, R.; Anderson, P.; Barr, B.; Monks, J.; Lettink, M.; Reardon, J.; Tocher, M.; Whitaker, T. 2013. Conservation status of New Zealand reptiles, 2012. New Zealand Threat Classification Series 2. Department of Conservation, Wellington.
- Holdaway, R.J.; Wiser, S.K.; Williams, P.A. 2012. Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology* 26: 619-629.
- Jewell, T. 2008. A photographic guide to reptiles and amphibians of New Zealand. New Holland Publishers (NZ) Ltd, Auckland. 143 pp.
- Johnson, P.; Gerbeaux P. 2004. Wetland types in New Zealand. Department of Conservation, Wellington.
- Liggins, L.; Chapple, D.G.; Daugherty, C.H.; Ritchie, P.A. 2008. A SINE of restricted gene flow across the alpine fault: phylogeography of the New Zealand common skink (*Oligosoma nigriplantare polychroma*). *Molecular Ecology* 17: 3668-3683.
- Mutch, A.R. 1963. Geological Map of New Zealand 1:250000, Sheet 23, Department of Scientific and Industrial Research, Wellington.
- McGlone, M.S.; Mark, A.F.; Bell, D. 1995. Late Pleistocene and Holocene vegetation history, Central Otago, South Island, New Zealand. *Journal of the Royal Society of New Zealand* 25: 1-22.
- McKellar, I.C. 1966. Geological Map of New Zealand 1:250000, Sheet 25, Department of Scientific and Industrial Research, Wellington.
- Nielsen, S.V.; Bauer, A.M.; Jackman, T.R.; Hitchmough, R.A.; Daugherty, C.H. 2011. New Zealand geckos (Diplodactylidae): cryptic diversity in a post-Gondwanan lineage with trans-Tasman affinities. *Molecular Phylogenetics and Evolution* 59: 1-22.

- O'Neill, S.B; Chapple, D.G; Daugherty, C.H; Ritchie, P.A. 2008. Phylogeography of two New Zealand lizards: McCann's skink (*Oligosoma maccanni*) and the brown skink (*O. zelandicum*). Molecular Phylogenetics and Evolution 48: 1168-1177.
- Robertson, H.A; Dowding, J.E; Elliott, G.P; Hitchmough, R.A; Miskelly, C.M; O'Donnell, C.F.J; Powlesland, R.G; Sagar, P.M; Scofield, R.P; Taylor, G.A. 2012. Conservation status of New Zealand birds, 2012. New Zealand Threat Classification Series 4. Department of Conservation, Wellington.
- Ryder Consulting. 2013. OceanaGold (New Zealand) Ltd Coronation Project Ecological Assessment. Unpub. Report by Dale, M; Ludgate, B; Ryder, G. Ryder Consulting Ltd, Dunedin.
- Thompson, H.M. 1949. East of the Rock and Pillar: a history of the Strath Taieri and Macraes Districts. Otago Centennial Historical Publications, Whitcombe & Tombs, Christchurch.
- Thorsen, M. 2008. Where in New Zealand is the highest diversity of threatened plants? Trilepidea Newsletter 58: 4-8.
- Thorsen, M.J; Seddon, P.J; Dickinson, K.J.M. 2011. Faunal influences on New Zealand seed dispersal characteristics. Evolutionary Ecology 25: 1397-1426.
- Townsend, A.J; de Lange, P.J; Duffy, C.A.J; Miskelly, C.M; Molloy, J; Norton, D.A. 2007. New Zealand Threat Classification System Manual. Department of Conservation, Wellington.
- Walker, S; Cieraad, E; Grove, P; Lloyd, K; Myers, S; Park, T; Porteous, T. 2007. Guide for users of the threatened environment classification, Ver. 1.1. Landcare Research.
- Walker, S; Price, R; Rutledge, D. 2008. New Zealand's remaining indigenous cover: recent changes and biodiversity protection needs. Science for Conservation 284. Department of Conservation, Wellington.
- Whitaker, A.H. 1986. Macraes Flat Joint Venture area – Terrestrial fauna of the Deepdell catchment, North Otago. Unpub. report to Homestake New Zealand Exploration Ltd. Auckland. 136pp.
- Whitaker, A.H. 1996. Impact of Agricultural development on grand skink (*Oligosoma grande*) (Reptilia: Scincidae) populations at Macraes Flat, Otago, New Zealand. Science for Conservation 33. Department of Conservation, Wellington.
- Whitaker, A.H; Tocher, M.D; Blair, T.A. 2002. Conservation of lizards in Otago Conservancy 2002–2007. Department of Conservation, Wellington. 92 pp.
- Williams, P.A; Wiser, S; Clarkson, B; Stanley, M.C. 2007. New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. New Zealand Journal of Ecology 31: 119-128.

9 Appendices

Appendix 1. Biodiversity recorded during site inventory

9.1.1 Flora

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Acaena agnipila</i> var. <i>aequispina</i>	Exotic	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	Throughout	
<i>Acaena anserinifolia</i> (J.R.Forst. et G.Forst.) J.B.Armstr.	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Rare	Gully	
<i>Acaena caesiiglauca</i> (Bitter) Bergmans	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	Shaded sites	
<i>Acaena dumicola</i> B.H.Macmill.	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Previously recorded		
<i>Acaena tesca</i> B.H.Macmill.	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Previously recorded		
<i>Aciphylla aurea</i> W.R.B.Oliv.	Not Threatened	DICOTYLEDONOUS HERBS	Apiaceae	Common	Gully	
<i>Aciphylla subflabellata</i> W.R.B.Oliv.	Declining	DICOTYLEDONOUS HERBS	Apiaceae	Rare	Short tussockland	
<i>Anaphalioides bellidioides</i> (G.Forst.) Glenny	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Gully	
<i>Anisotome aromatica</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Apiaceae	Local	Shaded sites	
<i>Anthriscus caucalis</i>	Exotic	DICOTYLEDONOUS HERBS	Apiaceae	Local	Shaded sites	
<i>Aphanes arvensis</i>	Exotic	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	Throughout	
<i>Brachyglottis bellidioides</i> (Hook.f.) B.Nord. var. <i>bellidioides</i>	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Local	Rocky sites	
<i>Brachyglottis southlandica</i> (Cockayne) B.Nord.	Locally Notable	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Rocky sites	
<i>Brachyscome longiscapa</i> G.Simpson et J.S.Thomson	Data Deficient	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Tussockland	
<i>Brassica rapa</i> L. var. <i>rapa</i>	Exotic	DICOTYLEDONOUS HERBS	Brassicaceae	Local	Cultivated areas	
<i>Callitriche petriei</i> R.Mason subsp. <i>petriei</i>	Not Threatened	DICOTYLEDONOUS HERBS	Plantaginaceae	Local	Wet sites	
<i>Callitriche stagnalis</i> Scop.	Exotic	DICOTYLEDONOUS HERBS	Plantaginaceae	Local	Wet sites	
<i>Capsella bursa-pastoris</i>	Exotic	DICOTYLEDONOUS HERBS	Brassicaceae	Common	Throughout	
<i>Cardamine corymbosa</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Brassicaceae	Local	Shaded sites	
<i>Carduus nutans</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Local	Throughout	
<i>Celmisia</i> (g) (CHR 274779; "rhizomatous")	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Wet sites	
<i>Celmisia gracilentia</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Rocky sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Celmisia hookeri</i> Cockayne	Naturally Uncommon	DICOTYLEDONOUS HERBS	Asteraceae	Local	Rocky sites	
<i>Cerastium fontanum</i> subsp. <i>vulgare</i> (Hartm.) Greuter et Burdet	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Local	Shaded sites	
<i>Cerastium glomeratum</i> Thuill.	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Common	Throughout	
<i>Cerastium semidecandrum</i> L.	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Occasional	Pasture	
<i>Chaerophyllum ramosum</i> (Hook.f.) K.F.Chung	Not Threatened	DICOTYLEDONOUS HERBS	Apiaceae	Occasional	Shaded sites	
<i>Cirsium arvense</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Cirsium vulgare</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Colobanthus apetalus</i> (Labill.) Druce	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Local	Rocky sites	
<i>Crassula colligata</i> Toelken subsp. <i>colligata</i>	Not Threatened	DICOTYLEDONOUS HERBS	Crassulaceae	Rare	Rocky sites	
<i>Crepis capillaris</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Shaded sites	
<i>Dichondra repens</i> J.R.Forst et G.Forst	Not Threatened	DICOTYLEDONOUS HERBS	Convolvulaceae	Occasional	Throughout	
<i>Digitalis purpurea</i> L.	Exotic	DICOTYLEDONOUS HERBS	Scrophulariaceae	Rare	Gully	
<i>Epilobium alsinoides</i> A.Cunn.	Not Threatened	DICOTYLEDONOUS HERBS	Onagraceae	Rare	Rocky sites	ID provisional as plants not flowering
<i>Epilobium brunnescens</i> (Cockayne) P.H.Raven et Engelhorn subsp. <i>brunnescens</i>	Not Threatened	DICOTYLEDONOUS HERBS	Onagraceae	Rare	Rocky sites	
<i>Epilobium insulare</i> Hausskn.	Data Deficient	DICOTYLEDONOUS HERBS	Onagraceae	Local	Wet sites	
<i>Epilobium komarovianum</i> H.Lev	Not Threatened	DICOTYLEDONOUS HERBS	Onagraceae	Rare	Wet sites	
<i>Epilobium pubens</i> A.Rich.	Not Threatened	DICOTYLEDONOUS HERBS	Onagraceae	Local	Rocky sites	
<i>Erodium cicutarium</i> (L.) L'Hér.	Exotic	DICOTYLEDONOUS HERBS	Geraniaceae	Occasional	Throughout	
<i>Euchiton lateralis</i> (C.J.Webb) Breitw. et J.M.Ward	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Gully	
<i>Euchiton limosus</i> (D.G.Drury) Holub	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Wet sites	
<i>Euchiton ruahinicus</i> (D.G.Drury) Breitw. et J.M.Ward	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Short tussockland	
<i>Galium</i> (b) (CHR 469914; aff. <i>G. perpusillum</i> ; "lacustrine")	Not Threatened	DICOTYLEDONOUS HERBS	Rubiaceae	Local	Ephemeral wetlands	
<i>Galium aparine</i>	Exotic	DICOTYLEDONOUS HERBS	Rubiaceae	Rare	Shaded sites	
<i>Galium perpusillum</i> (Hook.f.) Allan	Not Threatened	DICOTYLEDONOUS HERBS	Rubiaceae	Rare	Wet sites	
<i>Galium propinquum</i> A.Cunn.	Not Threatened	DICOTYLEDONOUS HERBS	Rubiaceae	Rare	Rocky sites	
<i>Gentianella amabilis</i> (Petrie) Glenney	Not Threatened	DICOTYLEDONOUS HERBS	Gentianaceae	Rare	Ephemeral wetlands	
<i>Geranium</i> (d) (; aff. <i>G. microphyllum</i> ; "mainland")	Not Threatened	DICOTYLEDONOUS HERBS	Geraniaceae	Local	Shaded sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Geranium brevicale</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Geraniaceae	Rare	Rocky sites	
<i>Geum leiospermum</i> Petrie	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Rare	Shaded sites	
<i>Gonocarpus aggregatus</i> (Buchanan) Orchard	Not Threatened	DICOTYLEDONOUS HERBS	Haloragaceae	Rare	Rocky sites	
<i>Gonocarpus micranthus</i> Thunb. subsp. <i>micranthus</i>	Not Threatened	DICOTYLEDONOUS HERBS	Haloragaceae	Local	Wet sites	
<i>Helichrysum filicale</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Local	Shaded sites	
<i>Hieracium lepidulum</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Local	Rocky sites	
<i>Hydrocotyle hydrophila</i> Petrie	Not Threatened	DICOTYLEDONOUS HERBS	Araliaceae	Local	Wet sites	
<i>Hydrocotyle microphylla</i> A.Cunn.	Not Threatened	DICOTYLEDONOUS HERBS	Araliaceae	Rare	Wet sites	
<i>Hydrocotyle moschata</i> G.Forst. var. <i>moschata</i>	Not Threatened	DICOTYLEDONOUS HERBS	Araliaceae	Local	Rocky sites	
<i>Hypochaeris radicata</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Lagenophora barkeri</i> Kirk	Naturally Uncommon	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Wet sites	
<i>Lagenophora cuneata</i> Petrie	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Rocky sites	
<i>Lagenophora petiolata</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Local	Wet sites	
<i>Leontodon autumnalis</i> subsp. <i>autumnalis</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Linum catharticum</i> L.	Exotic	DICOTYLEDONOUS HERBS	Linaceae	Rare	Wet sites	
<i>Lobelia angulata</i> G.Forst.	Not Threatened	DICOTYLEDONOUS HERBS	Campanulaceae	Rare	Shaded sites	
<i>Marrubium vulgare</i>	Exotic	DICOTYLEDONOUS HERBS	Lamiaceae	Occasional	Throughout	
<i>Mentha spicata</i> L. subsp. <i>spicata</i>	Exotic	DICOTYLEDONOUS HERBS	Lamiaceae	Local	Wet sites	
<i>Montia fontana</i> L. subsp. <i>fontana</i>	Not Threatened	DICOTYLEDONOUS HERBS	Montiaceae	Local	Wet sites	
<i>Montia sessiliflora</i> (G.Simpson) Heenan	Not Threatened	DICOTYLEDONOUS HERBS	Montiaceae	Local	Wet sites	
<i>Myosotis discolor</i> Pers.	Exotic	DICOTYLEDONOUS HERBS	Boraginaceae	Local	Gully	
<i>Myosotis laxa</i> Lehm. subsp. <i>caespitosa</i> (Schultz) Nordh.	Exotic	DICOTYLEDONOUS HERBS	Boraginaceae	Local	Wet sites	
<i>Myriophyllum propinquum</i> A.Cunn.	Not Threatened	DICOTYLEDONOUS HERBS	Haloragaceae	Local	Ephemeral wetlands	
<i>Myriophyllum triphyllum</i> Orchard	Not Threatened	DICOTYLEDONOUS HERBS	Haloragaceae	Local	Pond	
<i>Nasturtium microphyllum</i> Boenn. ex Rchb.	Exotic	DICOTYLEDONOUS HERBS	Brassicaceae	Local	Wet sites	
<i>Oxalis exilis</i> A.Cunn.	Not Threatened	DICOTYLEDONOUS HERBS	Oxalidaceae	Local	Shaded sites	
<i>Oxalis magellanica</i> G.Forst.	Not Threatened	DICOTYLEDONOUS HERBS	Oxalidaceae	Local	Gully	
<i>Pilosella officinarum</i> F.Schultz & Sch.Bip.	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Common	Throughout	
<i>Plantago lanceolata</i>	Exotic	DICOTYLEDONOUS HERBS	Plantaginaceae	Common	Pasture	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Plantago major</i>	Exotic	DICOTYLEDONOUS HERBS	Plantaginaceae	Rare	Wet sites	
<i>Plantago raoulii</i> Decne.	Not Threatened	DICOTYLEDONOUS HERBS	Plantaginaceae	Local	Wet sites	
<i>Potentilla anserinoides</i> Raoul	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Rare	Wet sites	
<i>Pseudognaphalium luteoalbum</i> (L.) Hilliard et B.L.Burt	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Rocky sites	
<i>Ranunculus foliosus</i> Kirk	Not Threatened	DICOTYLEDONOUS HERBS	Ranunculaceae	Local	Shaded sites	
<i>Ranunculus glabrifolius</i> Hook.	Not Threatened	DICOTYLEDONOUS HERBS	Ranunculaceae	Local	Wet sites	
<i>Ranunculus multiscapus</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Ranunculaceae	Local	Gully	
<i>Ranunculus royi</i> G.Simpson	Not Threatened	DICOTYLEDONOUS HERBS	Ranunculaceae	Rare	Shaded sites	
<i>Ranunculus sceleratus</i> L.	Exotic	DICOTYLEDONOUS HERBS	Ranunculaceae	Rare	Wet sites	
<i>Ranunculus ternatifolius</i> Kirk	Nationally Vulnerable	DICOTYLEDONOUS HERBS	Ranunculaceae	Rare	Wet sites	
<i>Ranunculus trichophyllus</i> Chaix	Exotic	DICOTYLEDONOUS HERBS	Ranunculaceae	Local	Wet sites	
<i>Raoulia australis</i> Hook.f. ex Raoul	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Gully	
<i>Raoulia subsericea</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Tussockland	
<i>Rumex acetosella</i>	Exotic	DICOTYLEDONOUS HERBS	Polygonaceae	Common	Throughout	
<i>Rumex crispus</i>	Exotic	DICOTYLEDONOUS HERBS	Polygonaceae	Occasional	Gully	
<i>Rumex flexuosus</i> Spreng. in Biehler	Locally Notable	DICOTYLEDONOUS HERBS	Polygonaceae	Local	Wet sites	
<i>Sagina procumbens</i> L.	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Local	Wet sites	
<i>Schizeilema haastii</i> var. <i>cyanopetalum</i> (Domin) Cheeseman	Not Threatened	DICOTYLEDONOUS HERBS	Araliaceae	Local	Shaded sites	
<i>Schizeilema trifoliolatum</i> (Hook.f.) Domin	Not Threatened	DICOTYLEDONOUS HERBS	Araliaceae	Local	Rocky sites	
<i>Scleranthus brockiei</i> P.A.Will.	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Rare	Short tussockland	
<i>Scleranthus uniflorus</i> P.A.Will.	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Rare	Rocky areas	
<i>Senecio quadridentatus</i> Labill.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Rocky sites	
<i>Sherardia arvensis</i>	Exotic	DICOTYLEDONOUS HERBS	Rubiaceae	Rare	Shaded sites	
<i>Sonchus</i> (b) (CHR 596666; aff. <i>S. novae-zelandiae</i> ; "cliff")	Nationally Vulnerable	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Rocky sites	
<i>Stellaria alsine</i> Grimm	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Local	Wet sites	
<i>Stellaria gracilentia</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Rare	Rocky sites	
<i>Stellaria media</i> (L.) Vill. subsp. <i>media</i>	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Occasional	Shaded sites	
<i>Stellaria parviflora</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Rare	Shaded sites	
<i>Taraxacum officinale</i> agg.	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Shaded sites	
<i>Tetrachondra hamiltonii</i>	Data Deficient	DICOTYLEDONOUS HERBS	Tetrachondraceae	Previously recorded	Ephemeral wetlands	
<i>Trifolium arvense</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Common	Throughout	
<i>Trifolium dubium</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Occasional	Throughout	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Trifolium pratense</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Local	Shaded sites	
<i>Trifolium repens</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Common	Throughout	
<i>Verbascum thapsus</i> L.	Exotic	DICOTYLEDONOUS HERBS	Scrophulariaceae	Rare	Gully	
<i>Veronica serpyllifolia</i>	Exotic	DICOTYLEDONOUS HERBS	Plantaginaceae	Local	Wet sites	
<i>Vicia sativa</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Rare	Shaded sites	
<i>Viola cunninghamii</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Violaceae	Rare	Gully	
<i>Viola filicaulis</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Violaceae	Local	Wet sites	
<i>Wahlenbergia albomarginata</i> subsp. <i>albomarginata</i> (Linear leaved form <i>W. brockiei</i>)	Not Threatened	DICOTYLEDONOUS HERBS	Campanulaceae	Occasional	Gully	
<i>Wahlenbergia rupestris</i> G.Simpson	Not Threatened	DICOTYLEDONOUS HERBS	Campanulaceae	Rare	Rocky sites	
<i>Wahlenbergia violacea</i> J.A.Petterson	Not Threatened	DICOTYLEDONOUS HERBS	Campanulaceae	Rare	Rocky sites	
<i>Clematis marata</i> J.B.Armstr.	Not Threatened	DICOTYLEDONOUS LIANES & TRAILING PLANTS	Ranunculaceae	Occasional	Shrubland	
<i>Muehlenbeckia axillaris</i> (Hook.f.) Endl.	Not Threatened	DICOTYLEDONOUS LIANES & TRAILING PLANTS	Polygonaceae	Rare	Rocky sites	Many plants infested with red galls
<i>Muehlenbeckia complexa</i> (A.Cunn.) Meisn. var. <i>complexa</i>	Not Threatened	DICOTYLEDONOUS LIANES & TRAILING PLANTS	Polygonaceae	Common	Gully	
<i>Rubus schmidelioides</i> var. <i>subpauperatus</i> (Cockayne) Allan	Not Threatened	DICOTYLEDONOUS LIANES & TRAILING PLANTS	Rosaceae	Occasional	Rocky sites	
<i>Carmichaelia corrugata</i> Colenso	Declining	DICOTYLEDONOUS TREES AND SHRUBS	Fabaceae	Local	Short tussockland	
<i>Carmichaelia crassicaulis</i> Hook.f. subsp. <i>crassicaulis</i>	Declining	DICOTYLEDONOUS TREES AND SHRUBS	Fabaceae	Occasional	Rocky sites	
<i>Carmichaelia petriei</i> Kirk	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Fabaceae	Rare	Gully	
<i>Coprosma crassifolia</i> Colenso	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Rubiaceae	Local	Rocky sites	
<i>Coprosma dumosa</i> (Cheeseman) G.T.Jane.	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Rubiaceae	Rare	Rocky sites	
<i>Coprosma intertexta</i> G.Simpson	Declining	DICOTYLEDONOUS TREES AND SHRUBS	Rubiaceae	Local	Rocky sites	
<i>Coprosma petriei</i> Cheeseman	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Rubiaceae	Local	Short tussockland	
<i>Coprosma propinqua</i> A.Cunn. var. <i>propinqua</i>	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Rubiaceae	Local	Gully	
<i>Coriaria sarmentosa</i> G.Forst.	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Coriariaceae	Rare	Rocky sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Cytisus scoparius</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Fabaceae	Local	Gully	
<i>Discaria toumatou</i> Raoul	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Rhamnaceae	Common	Gully	
<i>Gaultheria antipoda</i> G.Forst.	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Rocky sites	
<i>Gaultheria depressa</i> Hook.f. var. <i>depressa</i>	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Short tussockland	
<i>Gaultheria macrostigma</i> (Colenso) D.J.Middleton	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Short tussockland	
<i>Leucopogon fraseri</i> complex (mountain ecotype)	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Gully	
<i>Melicytus alpinus</i> (Kirk) Garn.-Jones	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Violaceae	Occasional	Throughout	Possibly two forms present: one tall and shrubby and a commoner sprawling low shrub
<i>Olearia bullata</i> H.D.Wilson et Garn.-Jones	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Asteraceae	Local	Wet sites	
<i>Pentachondra pumila</i> (J.R.Forst. et G.Forst.) R.Br.	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Tussockland	
<i>Pimelea oreophila</i> subsp. <i>lepta</i> C.J.Burrows	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Thymelaeaceae	Rare	Rocky sites	
<i>Prunella vulgaris</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Lamiaceae	Local	Shaded sites	
<i>Ribes uva-crispa</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Grossulariaceae	Rare	Shrubland	
<i>Rosa rubiginosa</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Rosaceae	Occasional	Gully	
<i>Sambucus nigra</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Caprifoliaceae	Occasional	Rocky sites	
<i>Sorbus aucuparia</i> subsp. <i>aucuparia</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Rosaceae	Rare	Homestead	
<i>Veronica salicifolia</i> G.Forst.	Locally Notable	DICOTYLEDONOUS TREES AND SHRUBS	Plantaginaceae	Rare	Rocky sites	
<i>Anogramma leptophylla</i> (L.) Link	Nationally Vulnerable	FERNS	Pteridaceae	Rare	Rocky sites	
<i>Asplenium flabellifolium</i> Cav.	Not Threatened	FERNS	Aspleniaceae	Local	Shaded sites	
<i>Asplenium richardii</i> (Hook.f) Hook.f.	Not Threatened	FERNS	Aspleniaceae	Local	Rocky areas	
<i>Blechnum montanum</i> T.C.Chambers et P.A.Farrant	Not Threatened	FERNS	Blechnaceae	Local	Rocky sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Blechnum penna-marina</i> subsp. <i>alpina</i> (R.Br.) T.C.Chambers et P.A.Farrant	Not Threatened	FERNS	Blechnaceae	Occasional	Shaded sites	
<i>Blechnum vulcanicum</i> (Blume) Kuhn	Not Threatened	FERNS	Blechnaceae	Local	Rocky sites	
<i>Cystopteris fragilis</i> (L.) Bernh.	Exotic	FERNS	Cystopteridaceae	Rare	Rocky sites	
<i>Histiopteris incisa</i> (Thunb.) J. Sm.	Not Threatened	FERNS	Dennstaedtiaceae	Rare	Wet sites	
<i>Polystichum vestitum</i> (G. Forst.) C. Presl	Not Threatened	FERNS	Dryopteridaceae	Occasional	Gully	
<i>Pteridium esculentum</i> (G. Forst.) Cockayne	Not Threatened	FERNS	Dennstaedtiaceae	Local	Gullies	
<i>Pinus radiata</i> D.Don	Exotic	GYMNOSPERM TREES AND SHRUBS	Pinaceae	Local	Shelterbelts	
<i>Agrostis capillaris</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<i>Agrostis personata</i> Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Agrostidinae)	Local	Ephemeral wetlands	
<i>Agrostis stolonifera</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Wet sites	
<i>Aira caryophyllea</i> L. subsp. <i>caryophyllea</i>	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Rocky sites	
<i>Alopecurus geniculatus</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Wet sites	
<i>Anthosachne falcis</i> (Connor) Barkworth et S.W.L.Jacobs	Naturally Uncommon	MONOCOTYLEDONOUS HERBS	Poaceae (Hordeae)	Occasional	Short tussockland	
<i>Anthosachne solandri</i> (Steud.) Barkworth et S.W.L.Jacobs	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Hordeae)	Occasional	Gully	
<i>Anthoxanthum odoratum</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<i>Arrhenatherum elatius</i> subsp. <i>elatius</i> (L.) J.Presl et C.Presl.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Gully	
<i>Arthropodium candidum</i> Raoul	Not Threatened	MONOCOTYLEDONOUS HERBS	Liliaceae	Rare	Rocky sites	
<i>Astelia nervosa</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Asteliaceae	Rare	Gully	
<i>Austroderia richardii</i> (Endl.) N.P.Barker et H.P.Linder	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Cortaderiinae)	Rare	Wet sites	
<i>Bromus hordeaceus</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<i>Bulbinella angustifolia</i> (Cockayne et	Not Threatened	MONOCOTYLEDONOUS	Asphodelaceae	Occasional	Gully	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
Laing) L.B.Moore		HERBS				
<i>Carex</i> (CHR 586013; aff. <i>C. punicea</i> ; Lammerlaw)	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Rare	Shaded sites	
<i>Carex breviculmis</i> R.Br.	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Rocky sites	
<i>Carex coriacea</i> Hamlin	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
<i>Carex flagellifera</i> Colenso	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Rare	Rocky sites	
<i>Carex gaudichaudiana</i> Kunth	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	ID provisional as plants not flowering
<i>Carex inopinata</i> Cook	Nationally Vulnerable	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Previously recorded		
<i>Carex inversa</i> R.Br.	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
<i>Carex kaloides</i> Petrie	Locally Notable	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
<i>Carex ovalis</i> Gooden.	Exotic	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
<i>Carex secta</i> Boott	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
<i>Carex sinclairii</i> Boott	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	ID provisional as plants not flowering
<i>Carex tenuiculmis</i> (Petrie) Heenan et de Lange	Declining	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Rare	Wet sites	
<i>Carex testacea</i> Sol. ex Boott	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	Two forms present?
<i>Carex wakatipu</i> Petrie	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Cyperaceae	Rare	Shaded sites	
<i>Chionochloa rigida</i> (Raoul) Zotov subsp. <i>rigida</i>	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Poaceae (Danthonieae)	Common	Gully	
<i>Chionochloa rubra</i> subsp. <i>cuprea</i> Connor	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Poaceae (Danthonieae)	Local	Wet sites	
<i>Chionochloa rubra</i> subsp. <i>cuprea</i> X <i>C. rigida</i> subsp. <i>rigida</i>	Not Threatened	HERBS				
		MONOCOTYLEDONOUS	Poaceae (Danthonieae)	Local	Wet sites	
<i>Critesion murinum</i> subsp. <i>murinum</i>	Exotic	HERBS				
		MONOCOTYLEDONOUS	Poaceae	Occasional	Dry sites & pasture	
<i>Cynosurus cristatus</i> L.	Exotic	HERBS				
		MONOCOTYLEDONOUS	Poaceae	Occasional	Wet sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
		HERBS				
<i>Dactylis glomerata</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Occasional	Throughout	
		HERBS				
<i>Deschampsia cespitosa</i> (L.) P.Beauv.	Declining	MONOCOTYLEDONOUS	Poaceae (Aveninae)	Local	Ephemeral wetlands	
		HERBS				
<i>Deyeuxia avenoides</i> (Hook.f.) Buchanan	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Agrostidinae)	Occasional	Tussockland	
		HERBS				
<i>Dichelachne crinita</i> (L.f.) Hook.f.	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Agrostidinae)	Local	Rocky sites	
		HERBS				
<i>Echinopogon ovatus</i> (G.Forst.) P.Beauv.	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Agrostidinae)	Rare	Rocky sites	
		HERBS				
<i>Eleocharis acuta</i> R.Br.	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
		HERBS				
<i>Festuca filiformis</i> Pourr.	Exotic	MONOCOTYLEDONOUS	Poaceae	Local	Gully	
		HERBS				
<i>Festuca novae-zelandiae</i> (Hack.) Cockayne	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Poeae)	Common	Gully	
		HERBS				
<i>Festuca rubra</i> subsp. <i>commutata</i>	Exotic	MONOCOTYLEDONOUS	Poaceae	Occasional	Throughout	
		HERBS				
<i>Glyceria declinata</i> Bréb.	Exotic	MONOCOTYLEDONOUS	Poaceae	Rare	Wet sites	
		HERBS				
<i>Glyceria fluitans</i> (L.) R.Br.	Exotic	MONOCOTYLEDONOUS	Poaceae	Local	Wet sites	
		HERBS				
<i>Herpolirion novae-zelandiae</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS	Xanthorrhoeaceae	Rare	Tussockland	
		HERBS				
<i>Holcus lanatus</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Local	Throughout	
		HERBS				
<i>Isolepis caligenis</i> (V.J.Cook) Soják	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
		HERBS				
<i>Isolepis pottsii</i> (V.J.Cook) Soják	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Rare	Wet sites	
		HERBS				
<i>Isolepis reticularis</i> Colenso	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Rare	Gully	
		HERBS				
<i>Juncus amabilis</i>	Exotic	MONOCOTYLEDONOUS	Juncaceae	Rare	Wet sites	
		HERBS				
<i>Juncus articulatus</i> L.	Exotic	MONOCOTYLEDONOUS	Juncaceae	Local	Wet sites	
		HERBS				
<i>Juncus bufonius</i> var. <i>bufonius</i>	Exotic	MONOCOTYLEDONOUS	Juncaceae	Local	Wet sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
		HERBS				
<i>Juncus distegus</i> Edgar	Not Threatened	MONOCOTYLEDONOUS	Juncaceae	Local	Wet sites	
		HERBS				
<i>Juncus edgariae</i> L.A.S.Johnson et K.L.Wilson	Not Threatened	MONOCOTYLEDONOUS	Juncaceae	Rare	Wet sites	
		HERBS				
<i>Juncus effusus</i> var. <i>compactus</i>	Exotic	MONOCOTYLEDONOUS	Juncaceae	Local	Wet sites	
		HERBS				
<i>Juncus pusillus</i> Buch.	Not Threatened	MONOCOTYLEDONOUS	Juncaceae	Rare	Wet sites	
		HERBS				
<i>Lemna disperma</i> Hegelm.	Not Threatened	MONOCOTYLEDONOUS	Araceae	Rare	Pond	
		HERBS				
<i>Lolium perenne</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Common	Throughout	
		HERBS				
<i>Luzula banksiana</i> var. <i>rhadina</i> (Buch.) Edgar	Not Threatened	MONOCOTYLEDONOUS	Juncaceae	Local	Rocky sites	
		HERBS				
<i>Luzula picta</i> var. <i>limosa</i> Buch. et Petrie	Not Threatened	MONOCOTYLEDONOUS	Juncaceae	Local	Wet sites	
		HERBS				
<i>Luzula rufa</i> Edgar var. <i>rufa</i>	Not Threatened	MONOCOTYLEDONOUS	Juncaceae	Occasional	Throughout	
		HERBS				
<i>Microtis unifolia</i> (G.Forst.) Rchb.f.	Not Threatened	MONOCOTYLEDONOUS	Orchidaceae	Rare	Tussockland	
		HERBS				
<i>Nematoceras longipetalum</i> (Hatch) Molloy, D.L.Jones et M.A.Clem.	Not Threatened	MONOCOTYLEDONOUS	Orchidaceae	Local	Rocky sites	
		HERBS				
<i>Oreobolus impar</i> Edgar	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Rare	Ephemeral wetlands	
		HERBS				
<i>Phleum pratense</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Rare	Gully	
		HERBS				
<i>Poa annua</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Occasional	Shaded areas	
		HERBS				
<i>Poa breviglumis</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Poeae)	Local	Rocky sites	
		HERBS				
<i>Poa cita</i> Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Poeae)	Local	Gullies	
		HERBS				
<i>Poa colensoi</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Poeae)	Occasional	Throughout	Two forms present: larger green plants usually in shaded sites and smaller glaucous plants on open dry sites
		HERBS				
<i>Poa imbecilla</i> Spreng.	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Poeae)	Local	Rocky sites	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
		HERBS				
<i>Poa kirkii</i> Buchanan	Not Threatened	MONOCOTYLEDONOUS	Poaceae (Poeae)	Rare	Rocky sites	
		HERBS				
<i>Poa palustris</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Rare	Wet sites	
		HERBS				
<i>Poa pratensis</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Common	Throughout	
		HERBS				
<i>Poa trivialis</i> L.	Exotic	MONOCOTYLEDONOUS	Poaceae	Local	Wet sites	
		HERBS				
<i>Potamogeton cheesemanii</i> A.Benn.	Not Threatened	MONOCOTYLEDONOUS	Potamogetonaceae	Rare	Wet sites	
		HERBS				
<i>Rytidosperma clavatum</i> (Zotov) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae	Local	Throughout	Slender form
		HERBS	(Danthonieae)			
<i>Rytidosperma corinum</i> Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae	Local	Rocky areas	
		HERBS	(Danthonieae)			
<i>Rytidosperma gracile</i> (Hook.f.) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae	Local	Shaded sites	
		HERBS	(Danthonieae)			
<i>Rytidosperma nigricans</i> (Petrie) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae	Local	Wet sites	
		HERBS	(Danthonieae)			
<i>Rytidosperma pumilum</i> (Kirk) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae	Occasional	Tussockland	
		HERBS	(Danthonieae)			
<i>Rytidosperma unarede</i> (Raoul) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS	Poaceae	Local	Shaded sites	
		HERBS	(Danthonieae)			
<i>Schoenus pauciflorus</i> (Hook.f.) Hook.f.	Not Threatened	MONOCOTYLEDONOUS	Cyperaceae	Local	Wet sites	
		HERBS				
<i>Simplicia laxa</i> Kirk	Nationally Critical	MONOCOTYLEDONOUS	Poaceae	Rare	Rocky sites	
		HERBS	(Agrostidinae)			
<i>Thelymitra</i> sp.	Not Threatened	MONOCOTYLEDONOUS	Orchidaceae	Rare	Tussockland	
		HERBS				
<i>Vulpia bromoides</i> (L.) Gray	Exotic	MONOCOTYLEDONOUS	Poaceae	Common	Throughout	
		HERBS				
<i>Acaena agnipila</i> var. <i>aequispina</i>	Exotic	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	Throughout	
<i>Acaena anserinifolia</i> (J.R.Forst. et G.Forst.) J.B.Armstr.	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Rare	Gully	
<i>Acaena caesiiglauca</i> (Bitter) Bergmans	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	Shaded sites	
<i>Aciphylla aurea</i> W.R.B.Oliv.	Not Threatened	DICOTYLEDONOUS HERBS	Apiaceae	Common	Gully	
<i>Aciphylla subflabellata</i> W.R.B.Oliv.	Declining	DICOTYLEDONOUS HERBS	Apiaceae	Rare	Short tussockland	

OceanaGold – Coronation North: Vegetation, Avifauna & Herpetofauna Ecological Impact Assessment – FINAL

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Anaphalioides bellidioides</i> (G.Forst.) Glenny	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Gully	
<i>Anisotome aromatica</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Apiaceae	Local	Shaded sites	
<i>Anthriscus caucalis</i>	Exotic	DICOTYLEDONOUS HERBS	Apiaceae	Local	Shaded sites	
<i>Aphanes arvensis</i>	Exotic	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	Throughout	
<i>Brachyglottis bellidioides</i> (Hook.f.) B.Nord. var. <i>bellidioides</i>	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Local	Rocky sites	
<i>Brachyglottis southlandica</i> (Cockayne) B.Nord.	Locally Notable	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Rocky sites	
<i>Brachyscome longiscapa</i> G.Simpson et J.S.Thomson	Data Deficient	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Tussockland	
<i>Brassica rapa</i> L. var. <i>rapa</i>	Exotic	DICOTYLEDONOUS HERBS	Brassicaceae	Local	Cultivated areas	
<i>Callitriche petriei</i> R.Mason subsp. <i>petriei</i>	Not Threatened	DICOTYLEDONOUS HERBS	Plantaginaceae	Local	Wet sites	
<i>Callitriche stagnalis</i> Scop.	Exotic	DICOTYLEDONOUS HERBS	Plantaginaceae	Local	Wet sites	

9.1.2 Avifauna

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Alauda arvensis</i>	Exotic	VERTEBRATE	Alaudidae	Occasional		Several individuals seen in area
<i>Anthus novaeseelandiae</i> Gmelin subsp. <i>novaeseelandiae</i>	Declining	VERTEBRATE	Motacillidae	Local		Several seen in Trimbells Gully tussockland
<i>Carduelis flammea</i> subsp. <i>cabaret</i>	Exotic	VERTEBRATE	Fringillidae	Local		1 flock seen feeding on grasses
<i>Circus approximans</i> Peale	Not Threatened	VERTEBRATE	Accipitridae	Rare		1(-2) individuals seen flying in area.
<i>Emberiza citrinella</i> subsp. <i>caliginosa</i>	Exotic	VERTEBRATE	Emberizidae	Local		Occasional flock seen feeding in area
<i>Fringilla coelebs</i> L	Exotic	VERTEBRATE	Fringillidae	Rare		1 individual seen
<i>Gerygone igata</i> Quoy & Gaimard	Not Threatened	VERTEBRATE	Acanthizidae	Rare		1 seen in gully shrubland
<i>Passer domesticus</i> Linnaeus, 1758 subsp. <i>domesticus</i>	Exotic	VERTEBRATE	Passeridae	Local		Several pairs seen in gully shrublands. Probably breeding at site
<i>Tadorna variegata</i> Gmelin	Not Threatened	VERTEBRATE	Anatidae	Local		Breeding on farm pond
<i>Turdus philomelos</i> subsp. <i>clarkei</i>	Exotic	VERTEBRATE	Turdidae	Occasional		Several individuals seen in area
<i>Vanellus miles</i> (Boddaert, 1783)	Not Threatened	VERTEBRATE	Charadriidae	Local		1-2 pairs in area

9.1.3 Herpetofauna

Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Oligosoma maccanni</i> (Patterson & Daugherty, 1990) (clade 4 genotype)	Not Threatened	VERTEBRATE	Scinicipidae	Occasional		Mainly in tussock and shrubland areas
<i>Oligosoma polychroma</i> (Patterson & Daugherty, 1990) (clade 5 genotype)	Declining	VERTEBRATE	Scinicipidae	Local		Damp vegetated gully bottoms
<i>Woodworthia</i> "Otago Large"	Declining	VERTEBRATE	Gekkonidae	Local		Rock outcrops

Appendix 2. Abbreviations used in text

DCC	Dunedin city Council
DOC	Department of Conservation
E.D.	Ecological District
EMP	Ecological Management Plan
OceanaGold	Oceana Gold (New Zealand) Ltd
ORC	Otago Regional Council
PIA	Project Impact Area
WDC	Waitaki District Council
WRS	Waste Rock Stack