



Oceana Gold (NZ) Ltd

Macraes Gold Project

*Ecological Impact of
proposed Coal Creek
Water Storage Dam*

April 2016



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

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2 Executive Summary

This document summarises the current knowledge of the vegetation, avifauna and herpetofauna of the Coal Creek 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 5 vegetation communities within the project harbouring 2 Threatened, 6 At Risk, 1 Data Deficient and 4 rare species and two morphologically distinct forms. This is mainly due to the large schist bluff systems in the project area. Bird and herpetofauna communities are relatively depauperate (for the area), with few species at low (bird) or moderate (reptile) population densities. One At Risk bird species and 2 At Risk reptile species are present within, or are likely to occasionally utilise, the project. Most of the higher value ecological features are concentrated on the larger bluff systems. 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. The scale of impact on the area's ecological features varies, depending on the feature under consideration, from low to very high at the local scale, very low 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](#). Several notable ecological features are present in the area surrounding this project, and it is recommended to avoid these sites during planning project activities, particularly when identifying the site access route and borrow site.

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. Much of bluffs at this site are not accessible without an abseil safety system and because of this have not been surveyed.

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 Coal Creek Water Storage Dam Project

A new freshwater storage dam will be constructed in Coal Creek. OceanaGold plan to build an earth embankment in Coal Creek up to 25m high. It will hold up to 670 million litres at maximum capacity, when it will cover an estimated 1.36ha, and release a residual flow of 5L/s. The purpose of the dam is to maintain a permanent residual flow in the Mare Burn during dry and low flow periods.

4.2 Land Tenure

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

4.3 Regulatory Authorities

This project is situated within the Dunedin City Council (DCC) 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 has an environment policy whereby it 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 company's 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.

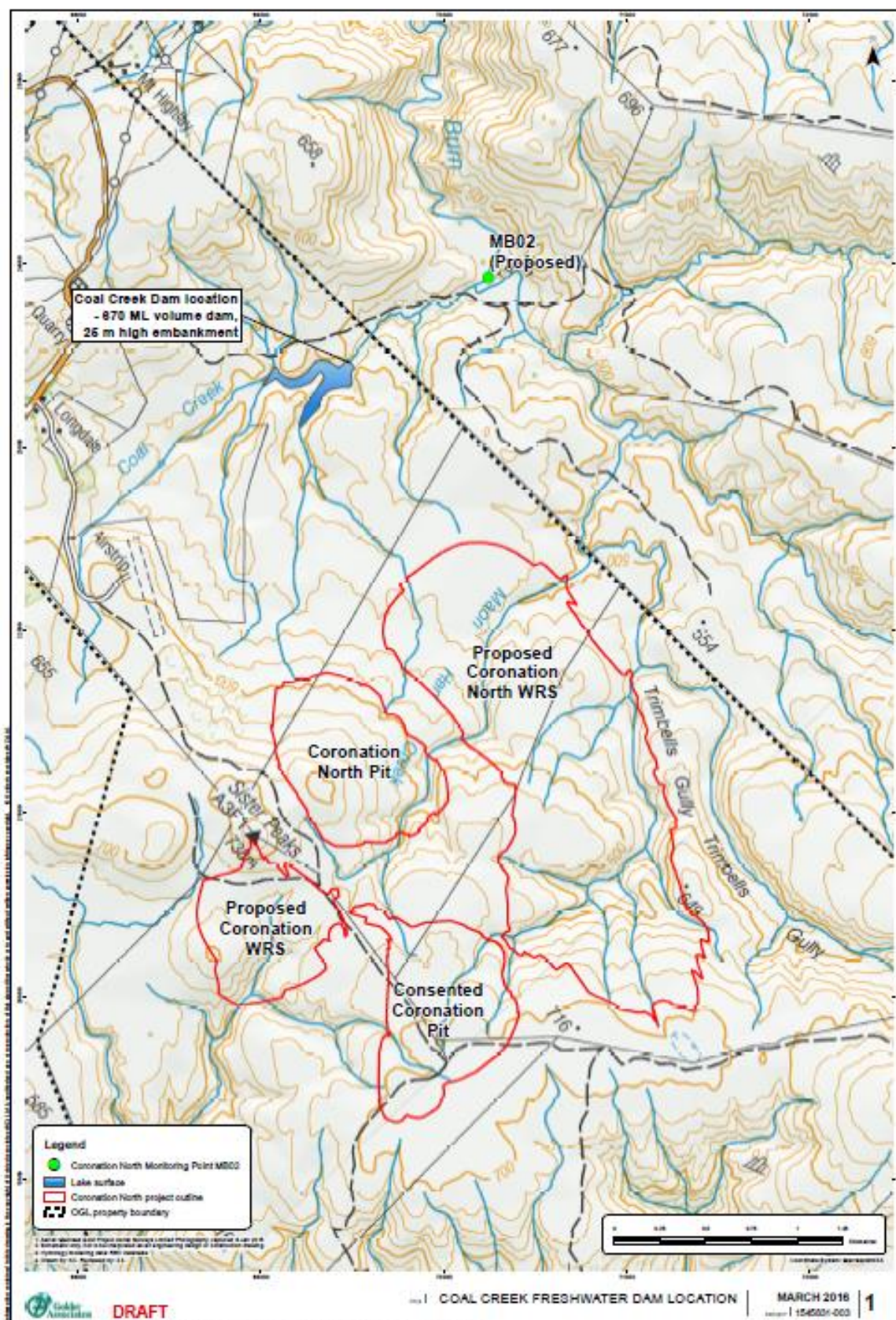


Figure 1. Location of Coal Creek dam project area.

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.

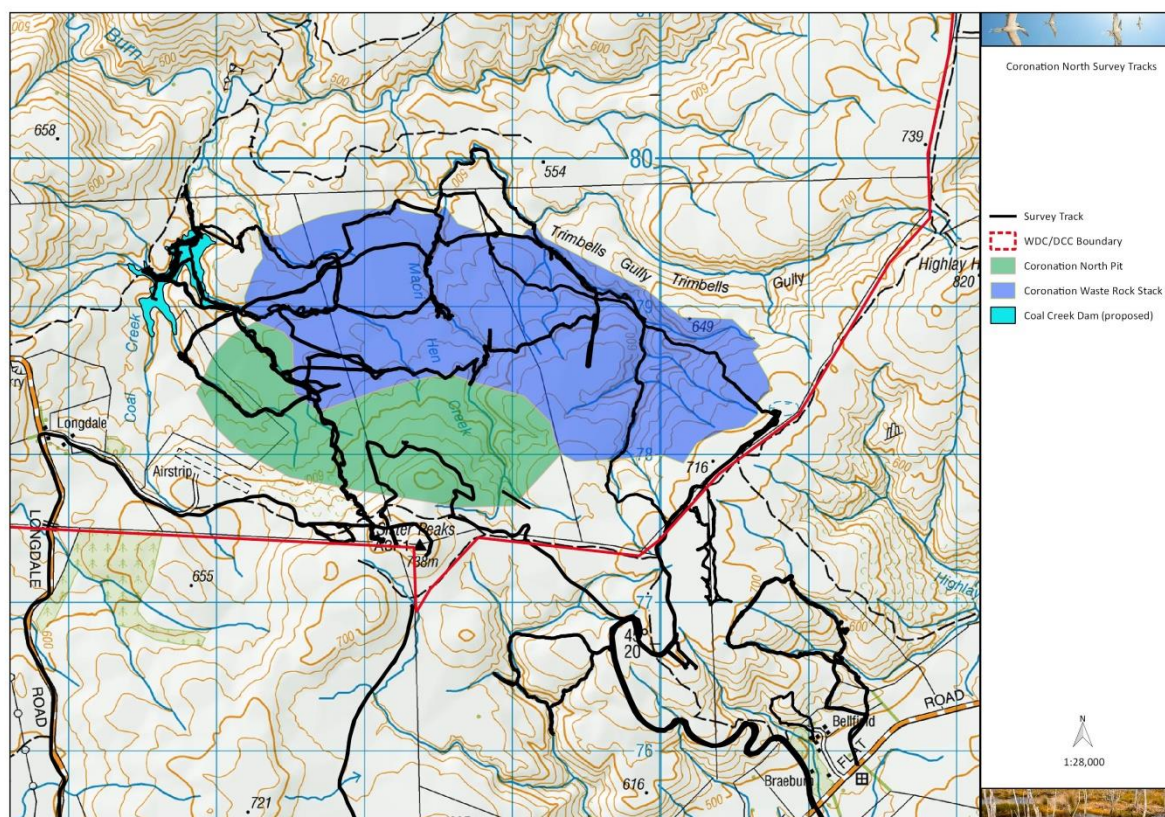


Figure 2. Paths taken by survey teams in the Coronation North area.

4.5.2.1 Flora survey

The flora survey of the Coronation North area was undertaken by Dr Mike Thorsen on 16 December 2015, 7, 14, 21 January and 1 April 2016. The PIA was specifically surveyed on 1 April 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](#).

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 surveys, 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 PIA area has previously been surveyed on 27 November 2014 (12 person daytime hours) (EcoGecko 2015) and was specifically surveyed by Mike Thorsen using spotlight-mounted binoculars for nocturnal lizard activity on 6 April 2016 (2 person night-time hours). 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 weather. 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 Sightings Per Unit Effort (SPUE). All locations were recorded onto ARDS cards and submitted to DOC. The herpetofauna survey of the adjacent Coronation North area was undertaken by Tony Jewell on 7 & 8 January 2016, with additional observations provided by Dr Mike Thorsen (see flora survey). 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.

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

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 Construction of dam embankment

Excavation of the borrow material and road access to constructions site and borrow site are likely to cause damage by removing or crushing plant material. There is also likely to be some noise disturbance during this activity. This activity will result in the damage to some vegetation and temporary disturbance to birds in yet-to-be identified areas surrounding the PIA.

4.7.1.2 Water inundation

A freshwater pond covering 1.36ha and measuring up to 25m deep will be created behind the embankment which will drown all vegetation within the PIA and create new wetland plant and waterfowl habitats around the pond margin.

4.7.1.3 Pond run-down

Lowering of water level by release of water from the pond will create bare areas of silts and rock which, depending on timing and duration of exposure, may create habitat for a wetland plant community and be of some use to waterfowl species.

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 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.

4.7.1.6 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.

4.7.1.7 Wind-blown dust

The unconsolidated fine rock and dust that will be created during embankment construction, 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. This effect will be temporary as it is not expected to continue past construction of the embankment.

4.7.1.8 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 impact area 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. 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.

4.7.3 *Surrounding area*

The area surrounding the PIA may also host notable ecological features that should be avoided, if possible, when planning project infrastructure, particularly site access routes and borrow sites.

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 proposed Coal Creek dam is sited in a c. 30m deep gorge of Coal Creek, a tributary of the Mare Burn, which flows into the Taieri River near the township of Hyde. 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 hygroscopic 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

The Coal Creek dam embankment and impoundment area (PIA) includes five vegetation types: riparian herbage along streams and stream flat sedges and grasses, and *Carex coriacea* sedgeland (2.5ha together), bluff herb and shrub vegetation on schist bluffs (0.2ha), gully slope shrublands and mixed vegetation (10.9ha together, 3ha of which is shrubland). These vegetation communities intergrade to some degree.

On the gully bottoms and along streams the vegetation is primarily composed of scattered silver tussock *Poa cita* and hard tussock *Festuca novae-zelandiae* (which forms patches at a few sites) with patches of copper tussock *Chionochloa rubra* subsp. *cuprea* and hybrid tussock (*Chionochloa rubra* subsp. *cuprea* x *Chionochloa rigida* subsp. *rigida*) and pukio *Carex secta* and rushes (mainly exotic soft rush *Juncus effusus*) with large areas of exotic grassland and discrete patches of *Carex coriacea* and *Carex kaloides*. Within the stream bed and along the banks are a range of mainly exotic herbs, rushes edges and grasses intermixed with some indigenous species.

Gully slopes are primarily exotic pasture with extensive areas of low diversity matagouri *Discaria toumatou* and *Coprosma propinqua* shrubland and narrow-leaved tussock *Chionochloa rigida* subsp. *rigida* at varying stature and density, some scattered golden spaniard *Aciphylla aurea*, and rare plants of coral broom *Carmichaelia crassicaulis* subsp. *crassicaulis*. Some small groves of *Coprosma intertexta* are present.

The schist bluffs are large examples for the area and have a high diversity of mainly indigenous herbs, shrubs and grasses, including patches of *Veronica rakaiensis* and narrow-leaved tussock, with many plants of blue tussock *Poa colensoi*, wheatgrass *Anthosachne solandri* and porcupine shrub *Melicytus alpinus*.

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 gully wetlands and bluff vegetation is typical of this area.

The bluff communities are representative of those that occur in shallow incised gullies throughout the Macraes E.D., but with higher species diversity reflecting their larger nature.

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

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.

Some areas within the PIA are reasonably ecologically intact, although there is some damage in nearly all areas (excepting parts of the bluff communities) from ongoing grazing by sheep and cattle. 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.

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

5.2.4 *Vegetation rarity*

Because of the size of the bluff communities they 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.

5.2.5 *Botanical diversity*

The total botanical diversity of the PIA is not recorded, being part of the wider botanical survey of the Coronation North area. The Coronation North area has high botanical diversity, with 162 indigenous

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

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.

species and 79 exotic species being recorded within 539ha. The Coal Creek dam area contains species that were not noted elsewhere during the Coronation North botanical survey, namely *Senecio dunedinensis*, *Veronica rakaiensis*, *Pachycladon cheesemanii*, *Dracophyllum uniflorum* var. *rosmarinifolium*, a distinctive form of *Carex testacea* and a distinctive form of *Coprosma dumosa*.

Overall, the PIA is assessed⁵ 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.

5.2.6.2 Buffering

The PIA probably plays a **minor** role in buffering increased sedimentation arising from nearby cultivated areas.

5.2.6.3 Support services

The PIA apart has a **moderate-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.

⁵ Using <http://ecan.govt.nz/publications/Plans/ecological-significance-indigenous-vege-canterbury.pdf>.

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 $\leq 20\%$ remaining in indigenous cover (Ministry for Environment and Department of Conservation 2007, Walker *et al.* 2007, 2008).

Three Level IV LENZ categories are mapped for the PIA (Figure 4), all of which are currently classified as Threatened Land Environments: the majority of the area is within the Acutely Threatened N3.1e, N3.3a, with small areas of the Chronically Threatened Q4.3a and q4.3b.

N3.1e at this site is largely covered by either a mosaic of community types including gully wetlands, short tussock grassland, gully slope shrublands and bluff communities.

Q4.3a&b at this site is gully bottom *Chionochloa rubra* subsp. *cuprea* and *Carex secta* gully wetland.

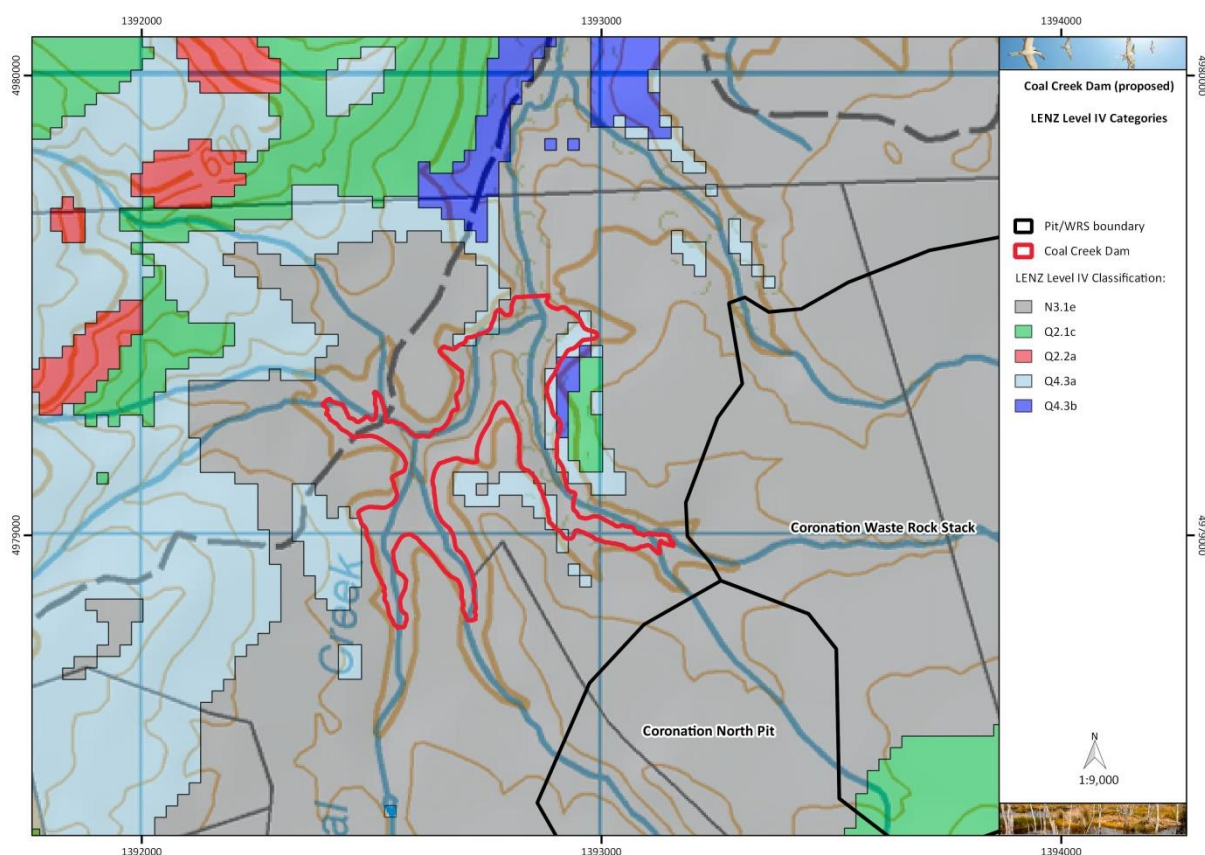


Figure 4. LENZ classification of the PIA at Level IV.

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 no vegetation communities that are a National Priority for Protection.

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 no Historically Rare ecosystems.

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. 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.

5.2.7.7 Sites identified as recommended for protection

This site was not identified by Bibby (1997) as a Recommended Area for Protection (RAP).

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 importance. There are three Threatened Level IV land environments that are overlain by some natural vegetation.

5.3 Threatened, At Risk, or rare plant species

Thirteen 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).

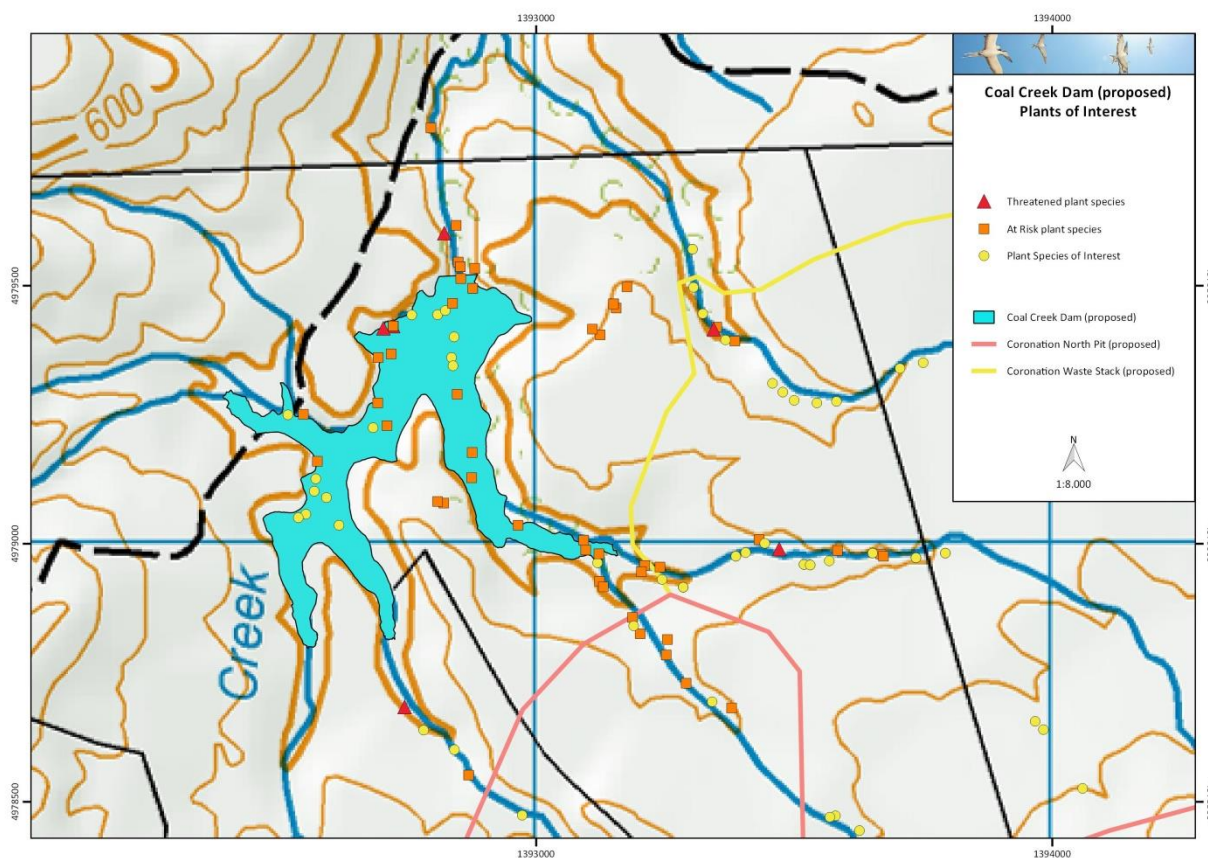


Figure 5. Locations of Threatened, At Risk and other plant species of interest (Data Deficient, rare plants) within the PIA.

5.3.1 Threatened species

Two Threatened (Townsend et al. 2007) species occur within the PIA, the Nationally Vulnerable groundsel *Senecio dunedinensis* and the Nationally Vulnerable cress *Pachycladon cheesemanii*.

5.3.1.1 Nationally Vulnerable species

1. *Pachycladon cheesemanii* Heenan et A. Mitch. (a dryland cress, Brassicaceae).

Distribution within project

Two plants of *Pachycladon cheesemanii* are present in an overhang in one bluff within the PIA.

Summary of existing information

Pachycladon cheesemanii (previously known as *Ischnocarpus novae-zelandiae* (Hook.f.) O.E.Schulz) is currently classified as Nationally Vulnerable, with the qualifier Sparse, on the basis that the total population is estimated to consist of 5,000 – 20,000 individuals in widely scattered sites and there is a predicted decline of 30-70%. Previously it has been assessed as Sparse in 1999, Gradual Decline in 2004 and Nationally Vulnerable in 2009.

Pachycladon cheesemanii is distributed throughout drier areas of the eastern South Island from Marlborough to northern Southland, with the majority of records in western Otago and the Rock & Pillar Range. This is the first known record of this species from the Macraes E.D. This species has been included in past studies evaluating the biogeographic pattern of New Zealand.

Pachycladon cheesemanii is considered threatened through weed invasion of the naturally sparsely vegetated environments it favours and its palatability to browsing animals. Nowadays most plants are known only from bluffs or overhangs. 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 few individuals at the sites where it occurs;
- 3) the inferred loss of previously occupied sites through weed invasion;
- 4) its vulnerability to browsers;
- 5) its use in biogeographic theory.

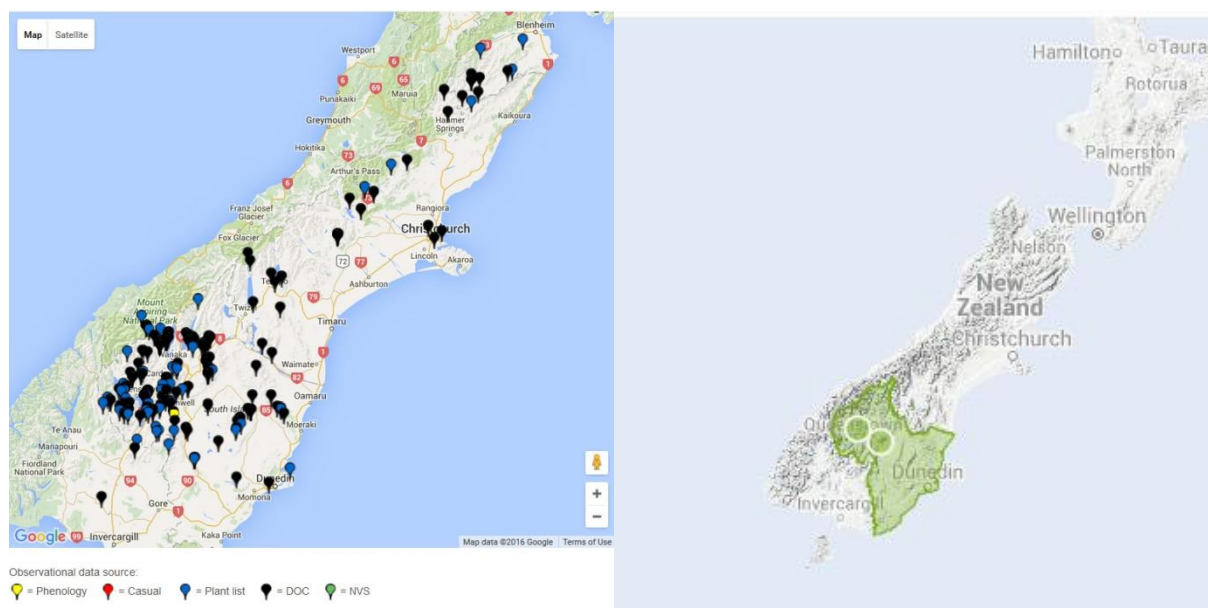


Figure A. Distribution of *Pachycladon cheesemanii* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

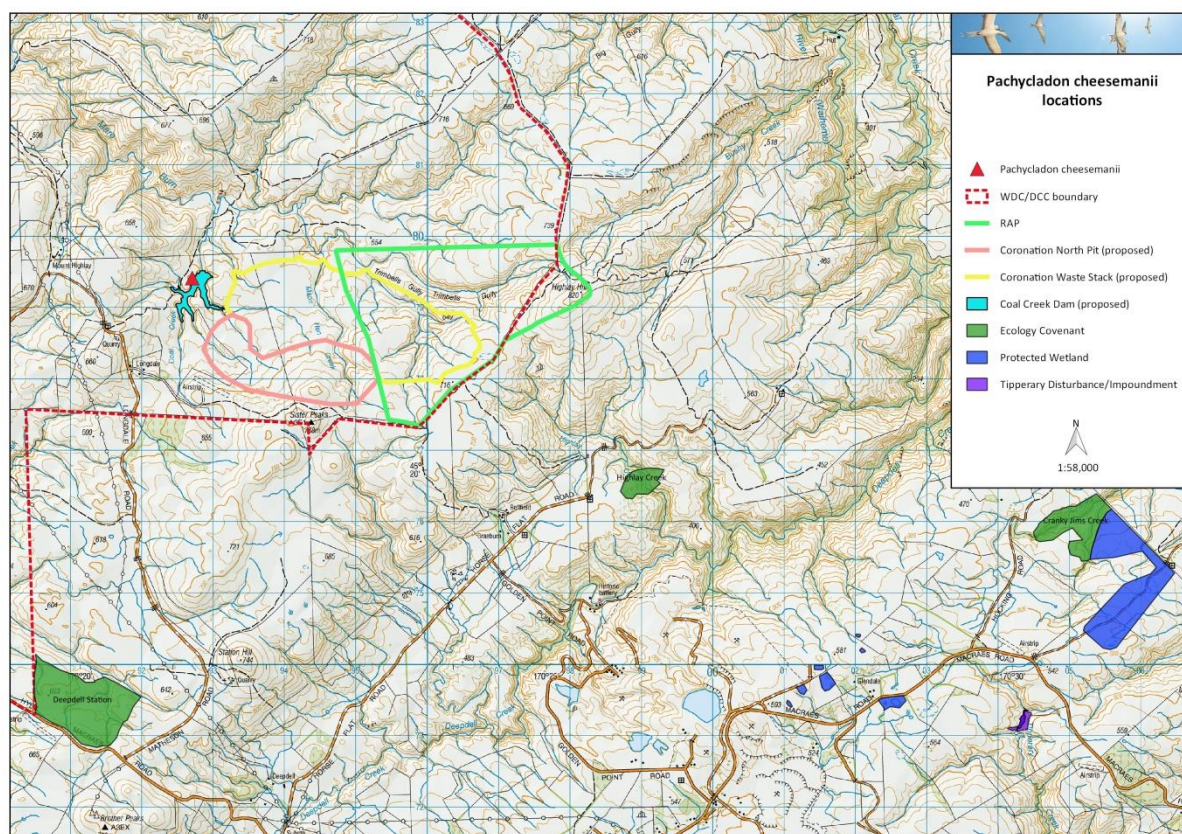


Figure B. Distribution of *Pachycladon cheesemanii* within the PIA and the wider OceanaGold project area.

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.
- Heenan, P.B; Mitchell, A.D; Koch, M. 2002. Molecular systematics of the New Zealand *Pachycladon* (Brassicaceae) complex: generic circumscription and relationships to *Arabidopsis* sens. lat. and *Arabis* sens. lat. New Zealand Journal of Botany 40: 543-562.
- Mitchell, A.D; Heenan, P.B. 2002. Genetic variation within the *Pachycladon* (Brassicaceae) complex based on fluorescent AFLP data. Journal of the Royal Society of New Zealand 32: 427-443.
- Heenan, P.B; Mitchell, A.D. 2003. Phylogeny, biogeography and adaptive radiation of *Pachycladon* (Brassicaceae) in the mountains of South Island, New Zealand. Journal of Biogeography 30: 1737-1749.
- 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.
- McBreen, K; Heenan, P.B. 2006. Phylogenetic relationships of *Pachycladon* (Brassicaceae) species based on three nuclear and two chloroplast DNA markers. New Zealand Journal of Botany 44: 377-386.
- 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=186 accessed 15 April 2016.
- Nature Watch <http://naturewatch.org.nz/taxa/404450-Pachycladon-cheesemanii> accessed 15 April 2016.
- OceanaGold file records
- Dr M. Thorsen unpub. file notes.
- Dr M. Thorsen personal communication with Marcia Dale, Dunedin.

2. *Senecio dunedinensis* Belcher (a groundsel daisy, Asteraceae).

Distribution within project

Single plants of *Senecio dunedinensis* are present on ledges at two sites within the PIA.

Summary of existing information

Senecio dunedinensis 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 be stable and occupy an area of ≤ 100 ha (1 km^2), 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 Sparse in 1999 and 2004, and Naturally Uncommon in 2009.

This species is distributed as widely spaced populations in the east of the South Island, with the majority of records being in west Otago and the Mt Cook area. In the wider Macraes area it is known from one site on OceanaGold tenure land, in the Cranky Jims Wetland Covenant, and from one plant between Redbank and Ramrock Roads. It inhabits cliffs and damp areas in wetlands.

This species is considered to be in decline primarily through competition with exotic plants, but many flower heads are parasitized by invertebrate larvae and the foliage is also susceptible to exotic invertebrates. 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 lack of information on the species.

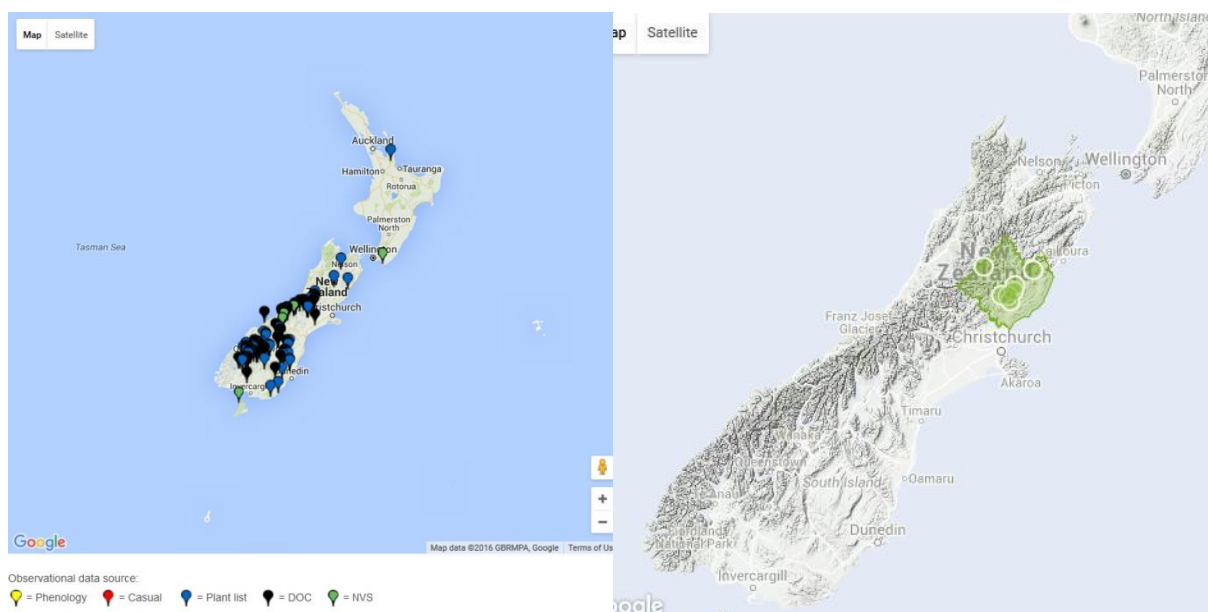


Figure A. Distribution of *Senecio dunedinensis* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right, no wild records) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

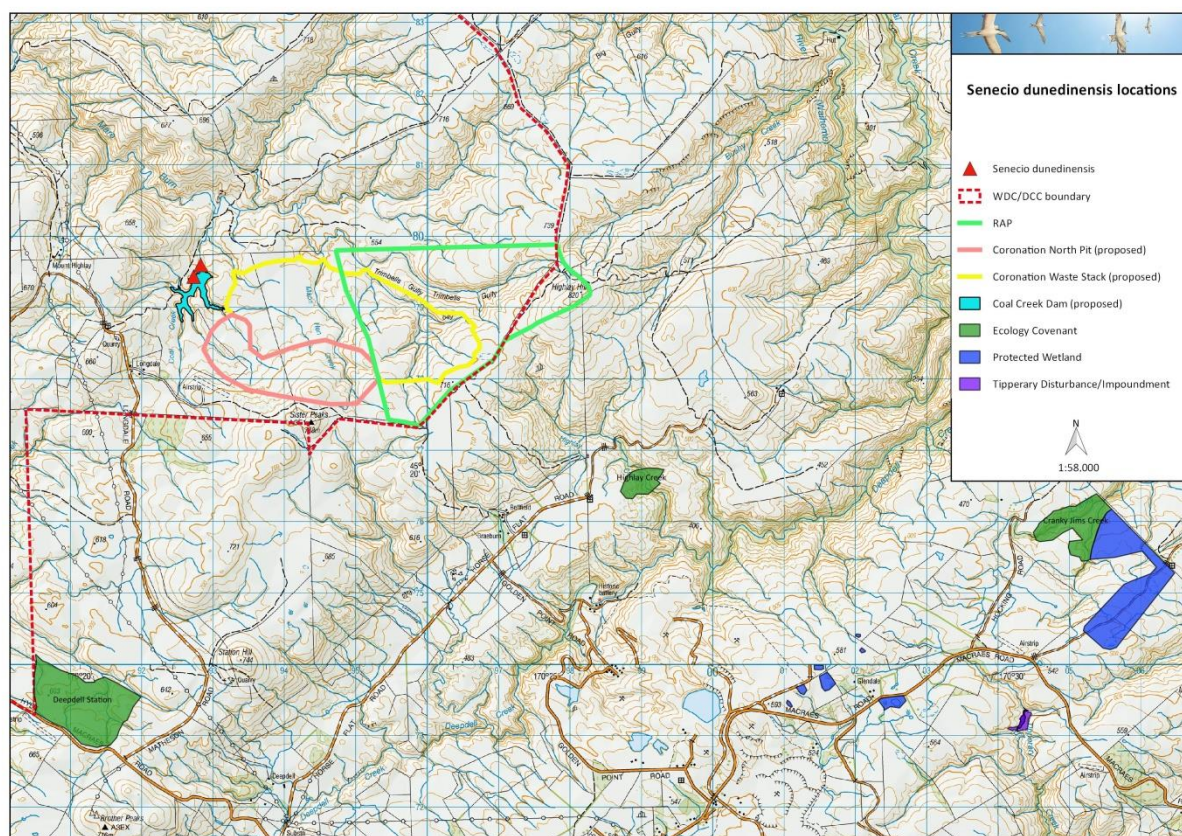


Figure B. Distribution of *Senecio dunedinensis* within the PIA and the wider OceanaGold project area.

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=318 accessed 14 April 2016.

Nature Watch <http://naturewatch.org.nz/taxa/405962-Senecio-dunedinensis> accessed 14 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

5.3.2 At Risk species

Six At Risk plant species are known to occur within the PIA: two species that are classified as Declining and four species classified as Naturally Uncommon.

5.3.2.1 Declining

Two species classified as Declining are known to occur within the PIA: coral broom *Carmichaelia crassicaulis* subsp. *crassicaulis* and the divaricating shrub *Coprosma intertexta*.

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

Distribution within project

This thick-stemmed broom was recorded at twelve sites within and four sites near the PIA. All sites were on rock outcrops or gully slopes 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.

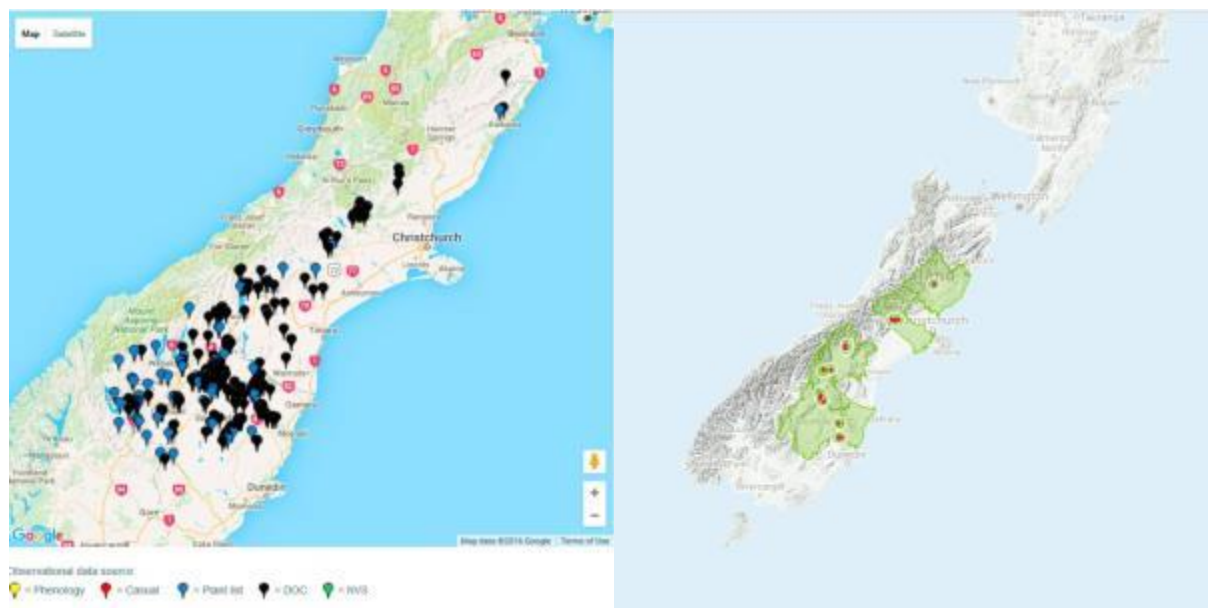


Figure A. Distribution of *Carmichaelia crassicaulis* subsp. *crassicaulis* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

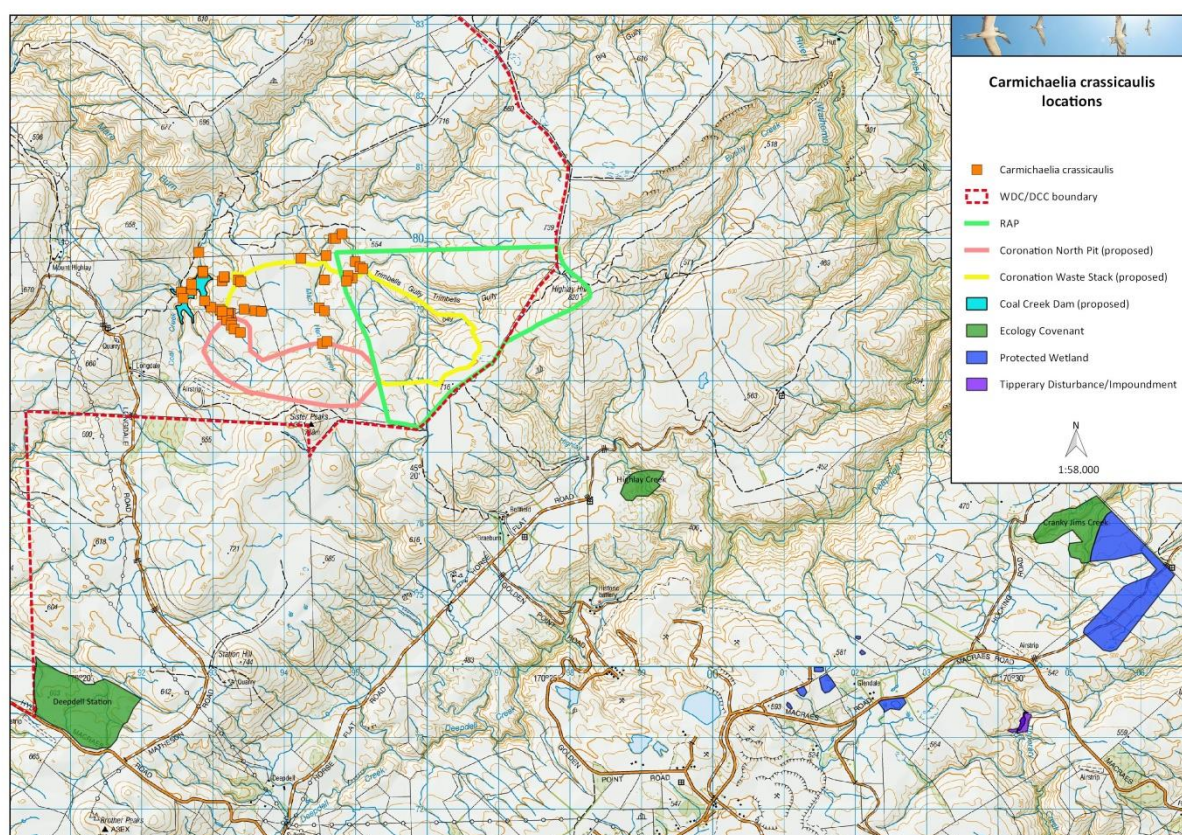


Figure B. Distribution of *Carmichaelia crassicaulis* subsp. *crassicaulis* within the PIA and the wider OceanaGold project area.

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.

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

Distribution within project

This reddish divaricating small-leaved *Coprosma* was recorded at 6 sites within the PIA and one adjacent site upstream at the base of rock outcrops bordering incised gullies or in bluff couloirs and comprise 1 individual to groups covering 20m x 10m.

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 km²), 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.

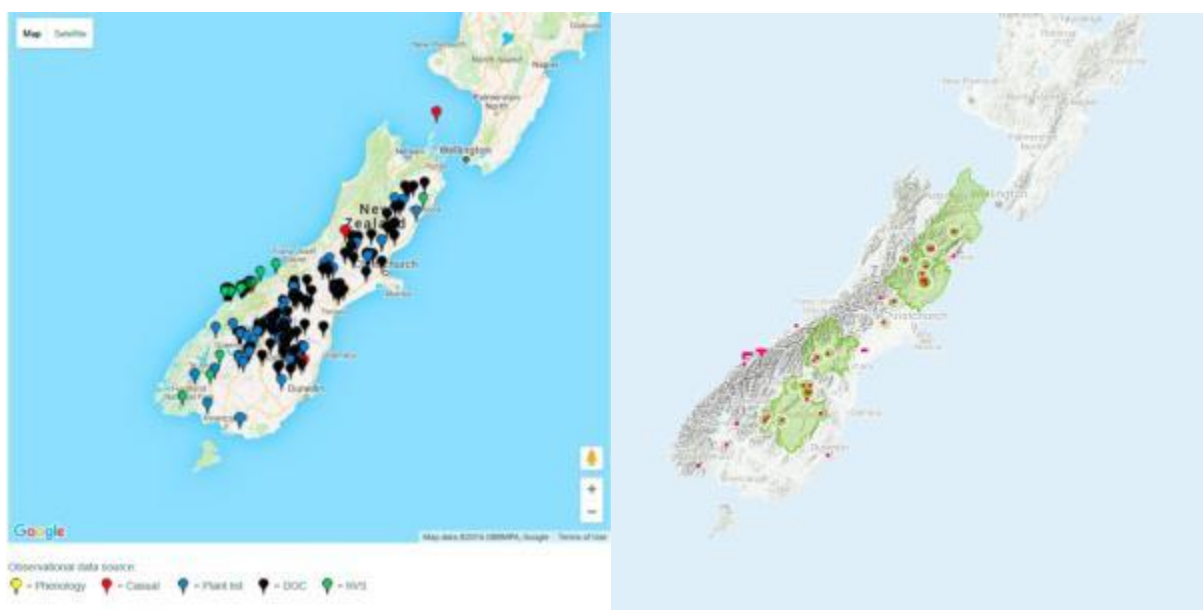


Figure A. Distribution of *Coprosma intertexta* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

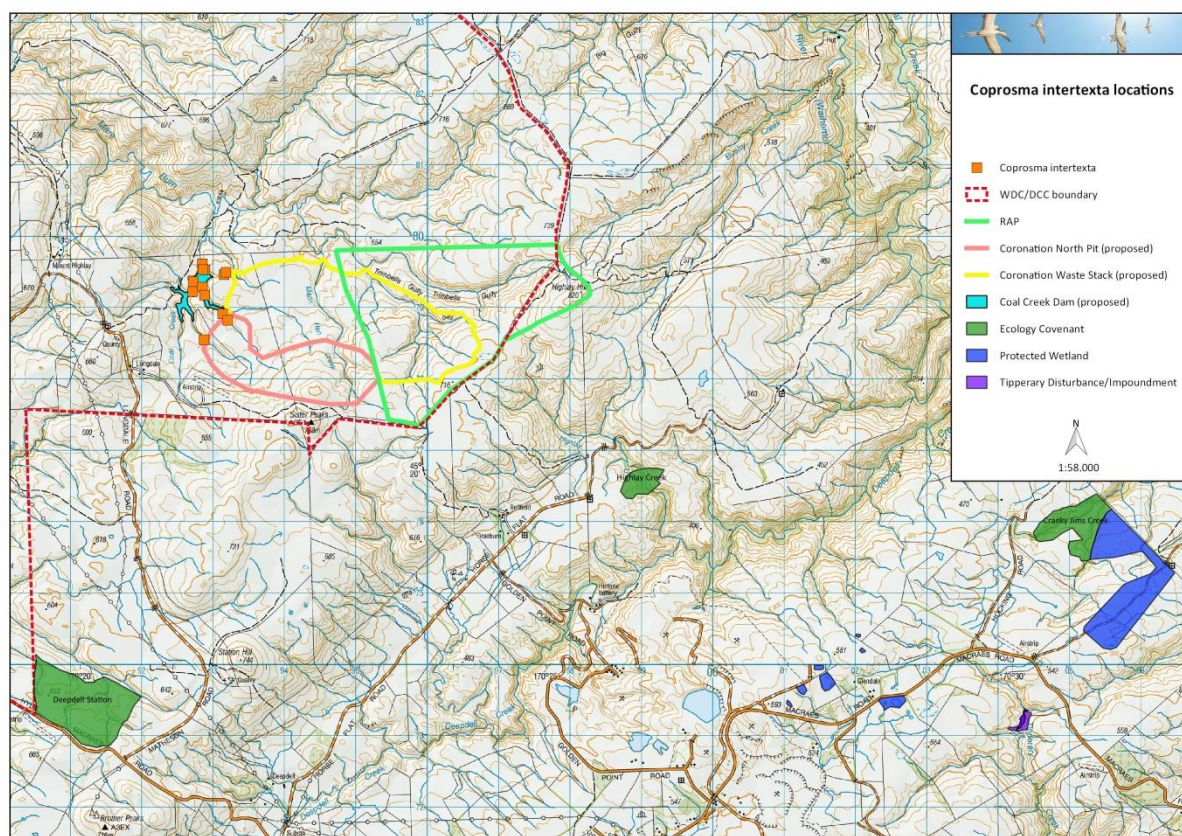


Figure B.

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.

5.3.2.2 Naturally Uncommon

Four species classified as Naturally Uncommon are known to occur within the PIA: Hooker's mountain daisy *Celmisia hookeri*, sprawling inaka *Dracophyllum uniflorum* var. *frondosum*, cress *Cardamine bilobata* and wetland daisy *Lagenophora barkeri*.

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

Distribution within project

This cliff daisy was recorded as scattered plants and large groups of plants inhabiting the larger schist rock outcrops and bluffs in the PIA and surrounding area.

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, Cranky Jims Shrubland Covenant, and Crank Jims Wetland Covenant, and it is known from eight sites between Red Bank and Ramrock Roads (which is the eastern limit for this species). 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.

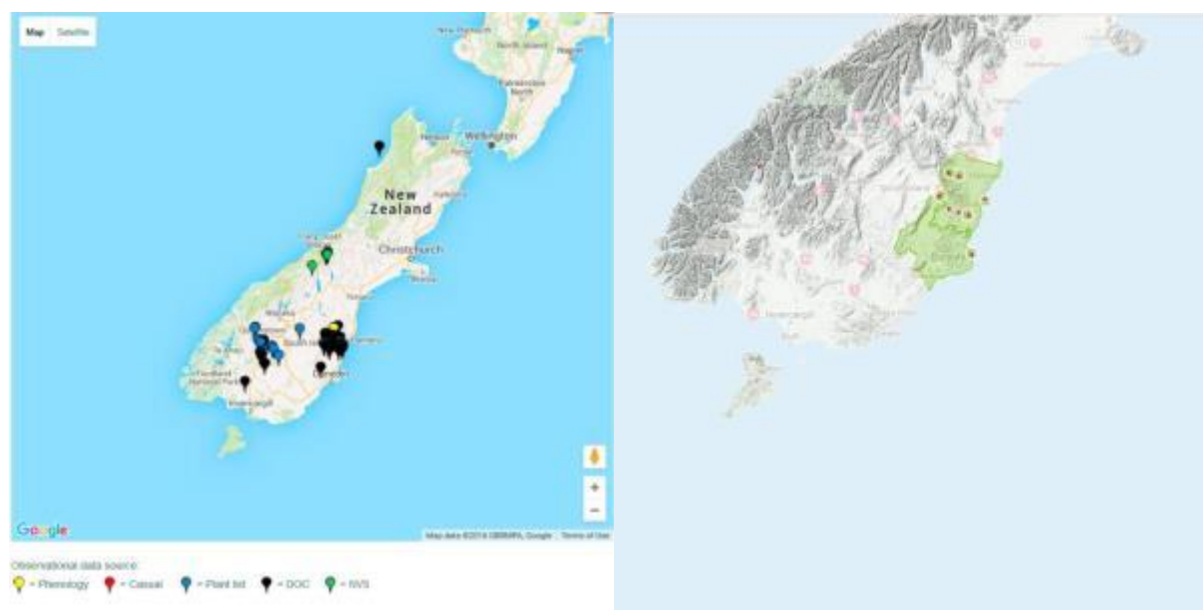


Figure A. Distribution of *Celmisia hookeri* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

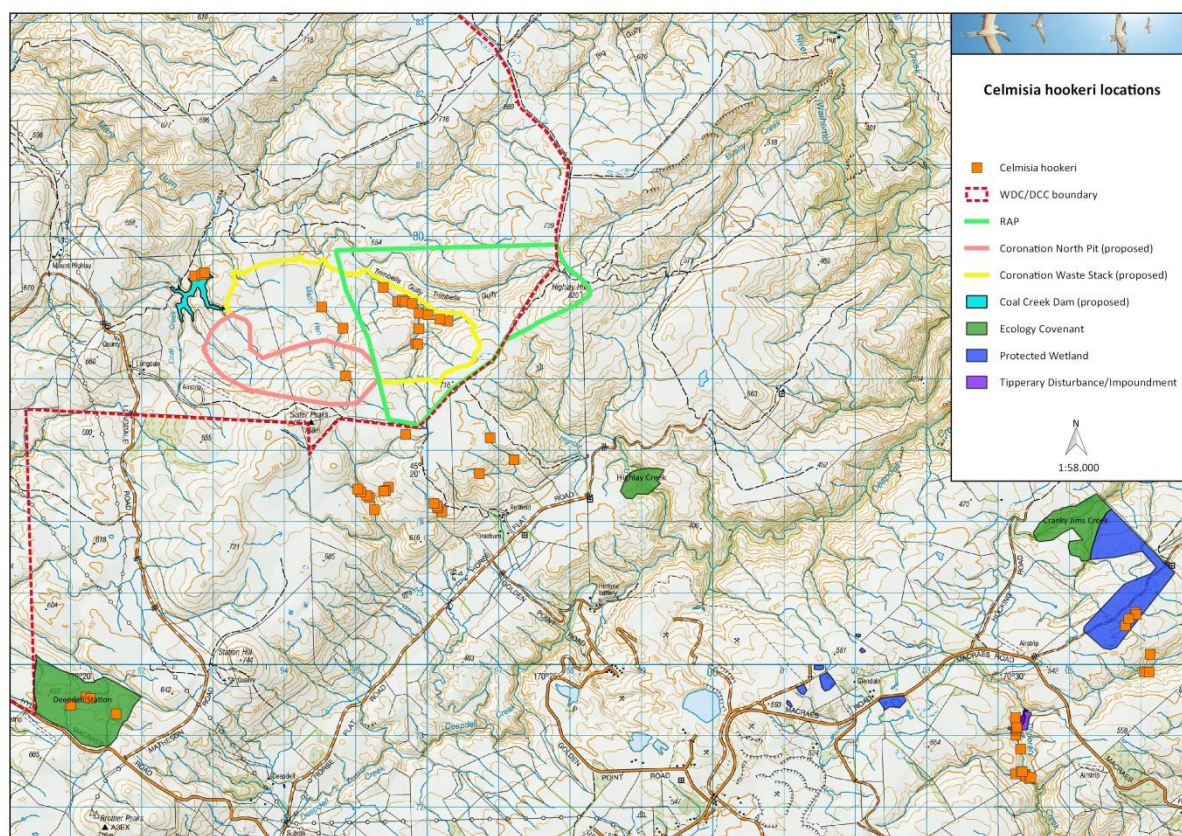


Figure B. Distribution of *Celmisia hookeri* within the PIA and the wider OceanaGold project area (notes: not all locations of this species are mapped).

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.

2. *Dracophyllum uniflorum* var. *frondosum* G.Simpson (sprawling inaka, Epacridaceae).

Distribution within project

This sprawling needle-leaved shrub was recorded as scattered plants and larger groups on the larger schist rock outcrops and bluffs in the PIA.

Summary of existing information

Dracophyllum uniflorum var. *frondosum* is currently classified as Naturally Uncommon, with the qualifier Sparse, on the basis of its range being restricted to two areas, with widely spaced populations. Previously it has been assessed as Range Restricted in 2004, and Naturally Uncommon in 2009.

This species occurs on valley slopes, rock outcrops and bluffs in Otago and Nelson Lakes, where it can be locally abundant. In the wider Macraes area it occurs on OceanaGold tenure land at several sites, including in the Deepdell Covenant, and it is known from multiple sites between Red Bank and Ramrock Roads. Population sizes in these area ranges up to around a hundred plants at some sites, though 10-20 plants at a site is more usual. It inhabits schist rock bluffs and occasionally smaller rocky outcrops.

This species is considered to be at risk because of its limited range and restriction to rocky habitats. 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) restricted habitat.

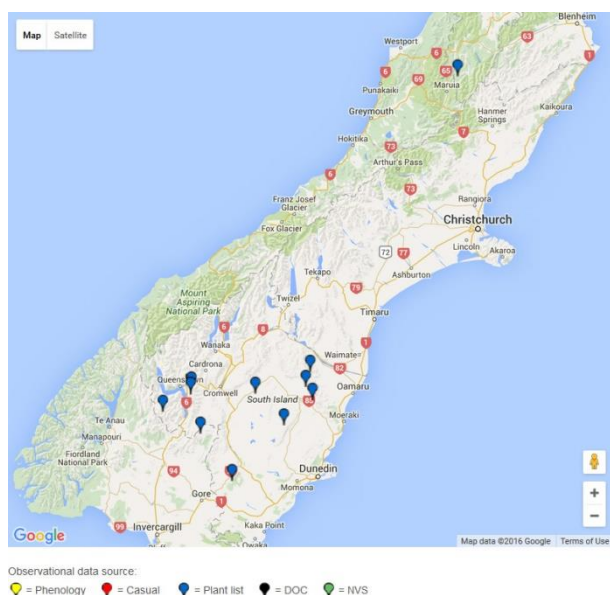


Figure A. Distribution of *Dracophyllum uniflorum* var. *frondosum* in New Zealand from the NZ Plant Conservation Network database (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

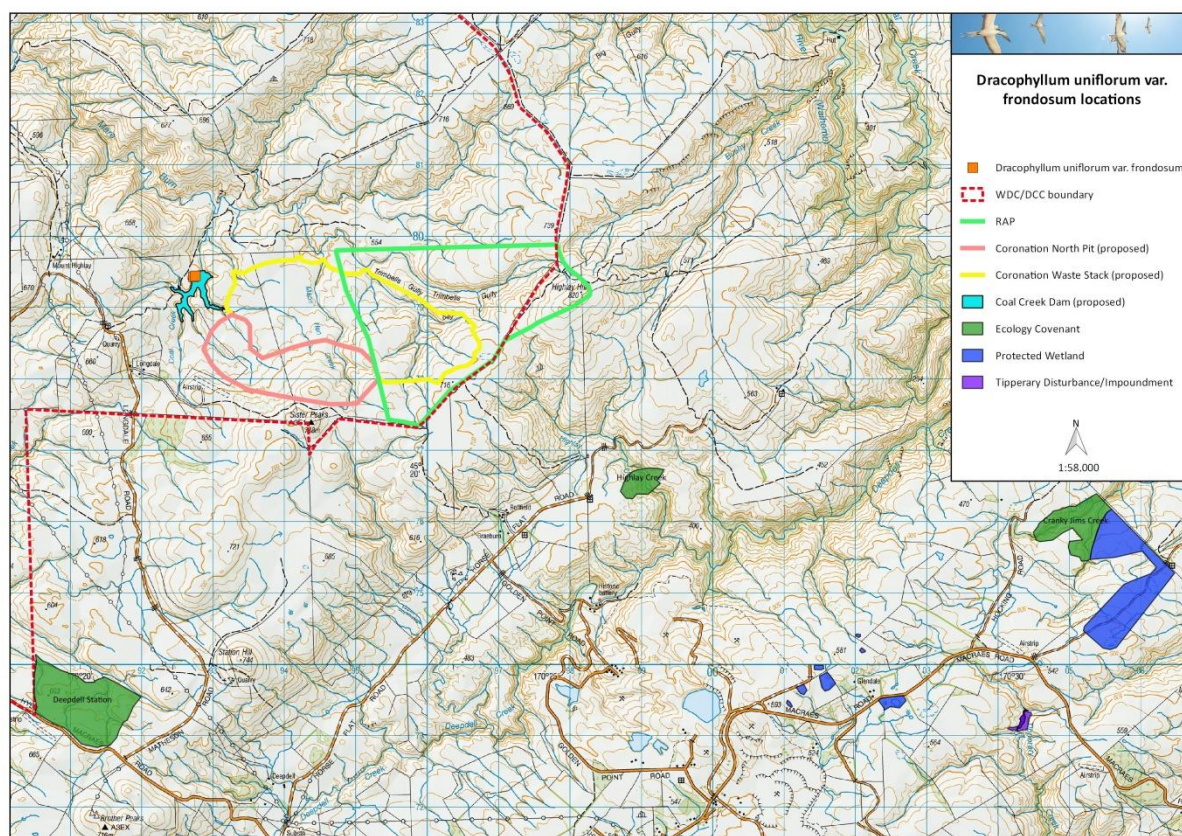


Figure B. Distribution of *Dracophyllum uniflorum* var. *frondosum* within the PIA and the wider OceanaGold project area (notes: not all locations of this species are mapped).

Data sources used in this assessment:

de Lange, P.J; 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.

Venter, S. 2009. A taxonomic revision of the genus *Dracophyllum* Labill. (Ericaceae). Unpub. PhD Thesis, Victoria university of Wellington.

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=475 accessed 14 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

3. *Cardamine bilobata* Kirk (a native bittercress, Brassicaceae).

Distribution within project

This small herb was recorded as scattered individuals totalling c. 20 plants on two of the larger schist rock bluffs in the PIA. It is probable more plants are present in the higher areas of the bluffs.

Summary of existing information

Cardamine bilobata is currently classified as Naturally Uncommon, with the qualifiers Range Restricted and Sparse because of the widely spaced populations (the reasoning behind the qualifier Range Restricted is not readily apparent). Previously it has been assessed as Data Deficient in 2004 and Naturally Uncommon in 2009.

This species occurs on rocky sites and tussockland along the Southern Alps and in scattered eastern localities. This is the first record of this species for the Ecological District. There is an element of taxonomic uncertainty with this species, particularly involving plant growing at higher elevations and on different mineral substrates. The plants within the PIA are very similar to those collected from the type locality at Kurow.

This species is considered to be at risk because of its susceptibility to browsers. No conservation programmes are known for this species.

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) first record of the species within the E.D.;
- 3) only known locality of this form of the species in Central Otago;
- 4) susceptibility to browsers.

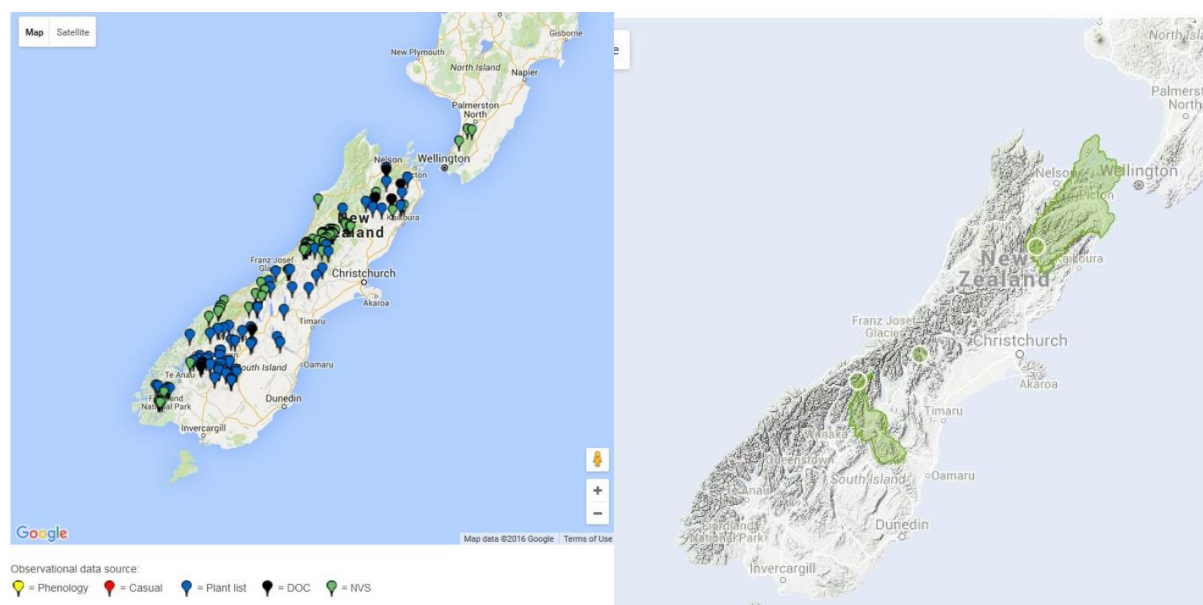


Figure A. Distribution of *Cardamine bilobata* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

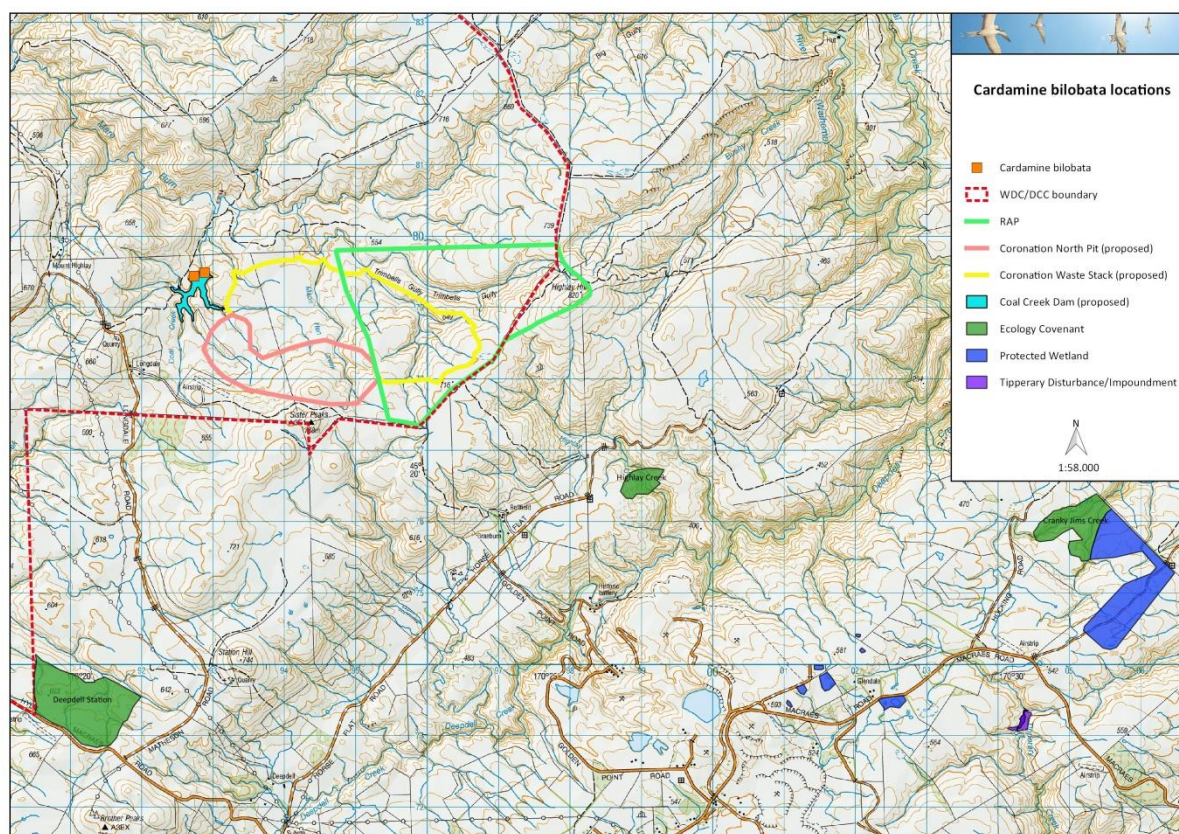


Figure B. Distribution of *Cardamine bilobata* within the PIA and the wider OceanaGold project area.

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.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=733 accessed 14 April 2016.

Nature Watch <http://naturewatch.org.nz/taxa/400384-Cardamine-bilobata> accessed 14 April 2016.

Te Papa collections online <http://collections.tepapa.govt.nz/taxon/22129> accessed 14 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

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

Distribution within project

This wetland daisy was recorded at one site in the PIA, in a wetland at the base of a bluff.

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 in Maori Hen Creek. It inhabits gully wetlands, 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.

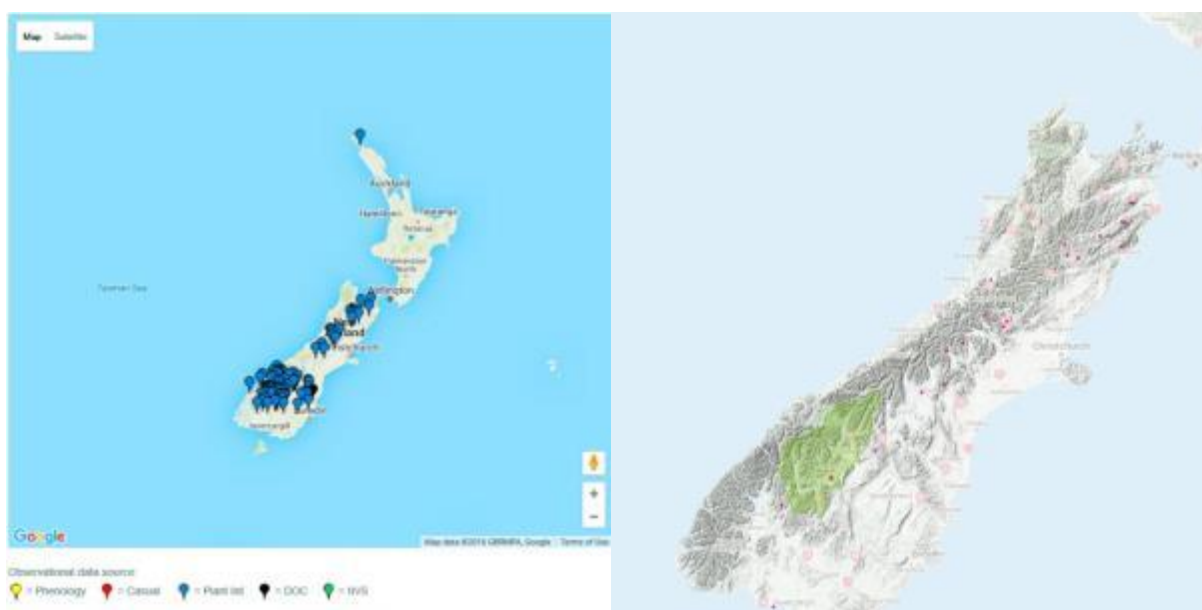


Figure A. Distribution of *Lagenophora barkeri* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

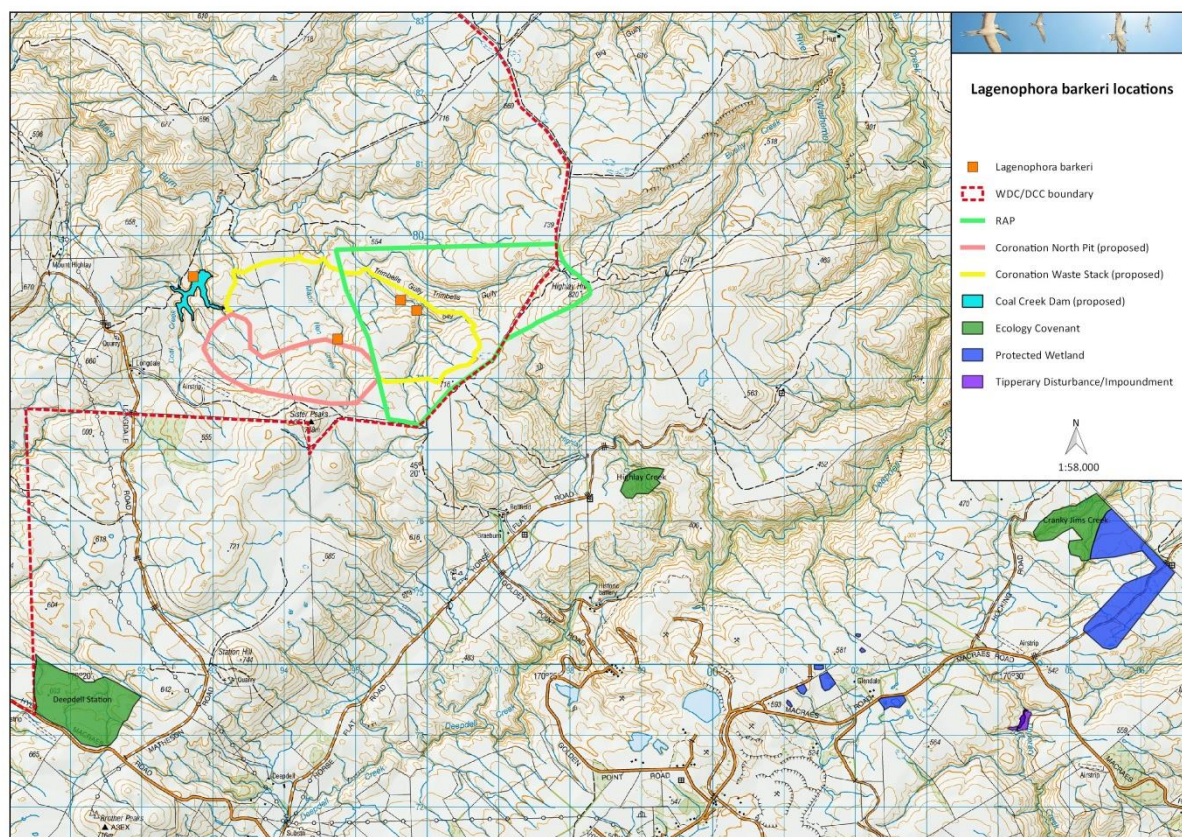


Figure B. Distribution of *Lagenophora barkeri* within the PIA and the wider OceanaGold project area.

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

One species classified as Data Deficient are known to occur within the PIA: the wetland willowherb *Epilobium insulare*.

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

Distribution within project

This wetland willowherb was recorded as small populations of 20-30 plants at three sites in the PIA, and several groups in areas immediately adjacent to 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 modification⁶ 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.

⁶ Data deficient species are not explicitly discussed in the EIANZ guidelines. In this document they are assumed to be a rare species

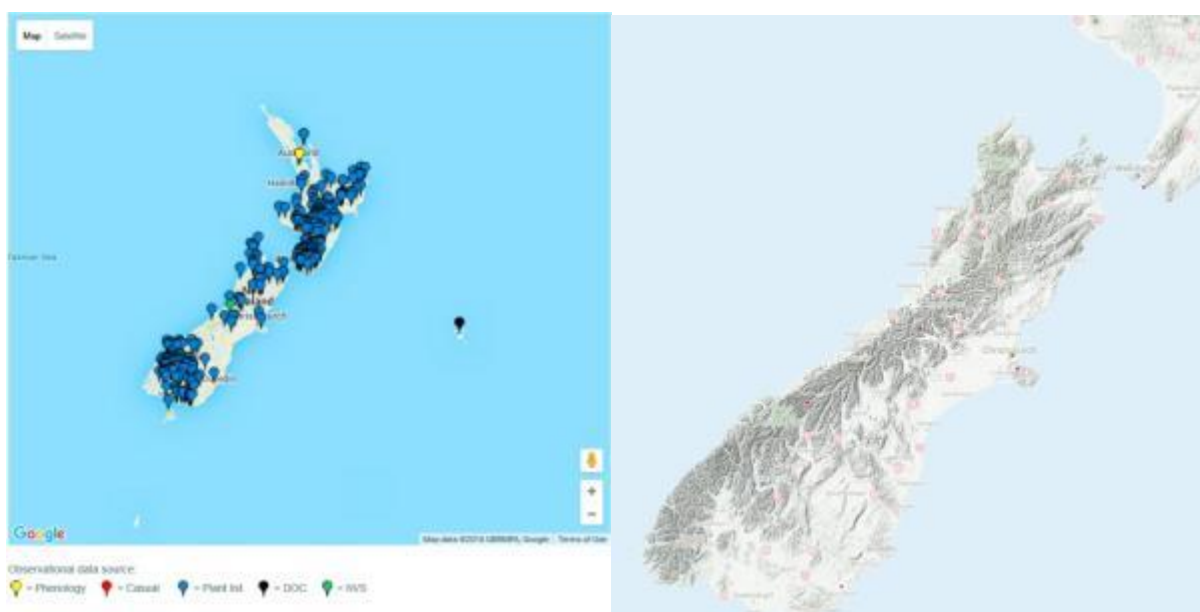


Figure A. Distribution of *Epilobium insulare* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

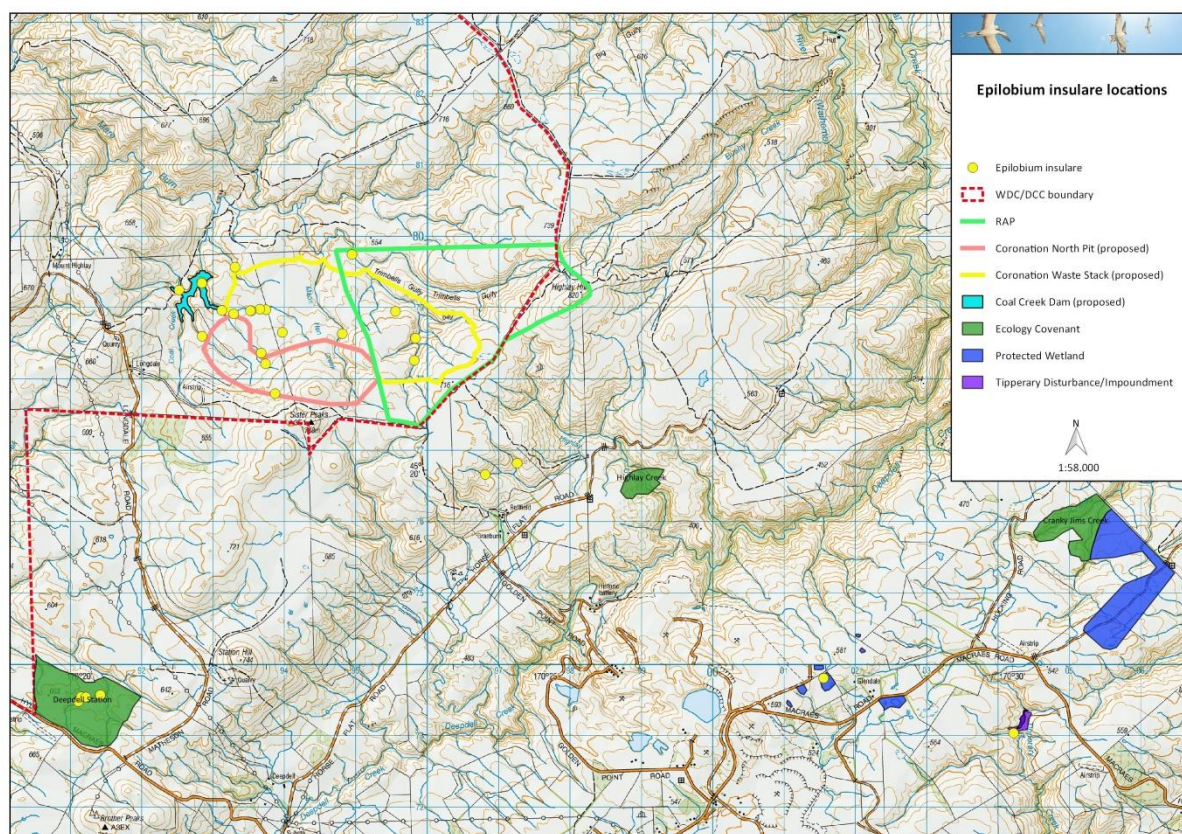


Figure B. Distribution of *Epilobium insulare* within the PIA and the wider OceanaGold project area.

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.

5.3.4 Rare species

Four species that are considered rare are known to be present within the PIA: two that 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 Ecological District

Two species that are uncommon within the Macraes Ecological District are known to be present within the PIA: the sedge *Carex kaloides* and shrub *Veronica rakaiensis*.

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

Distribution within project

This sedge was recorded in gully bottoms at several sites in the PIA. Population size varies between patches of 1m² to patches 5m x 3m in size.

Summary of existing information

Carex kaloides occurs throughout the eastern South Island, usually inhabiting damp stream terraces. This species 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 as a large population near Sutton.

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.

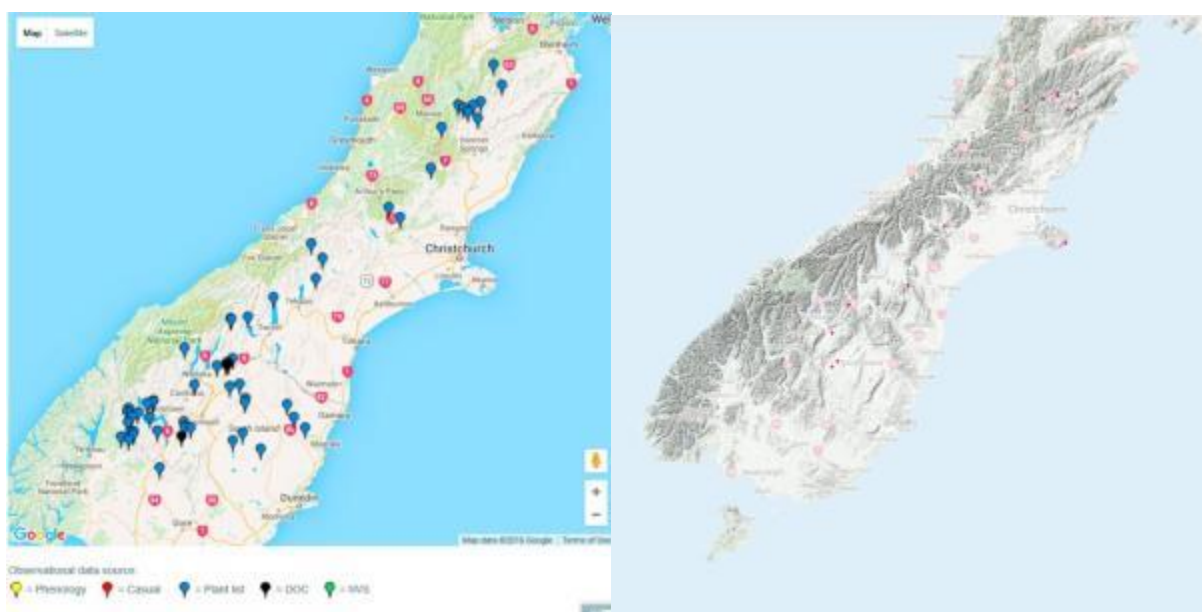


Figure A. Distribution of *Carex kaloides* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

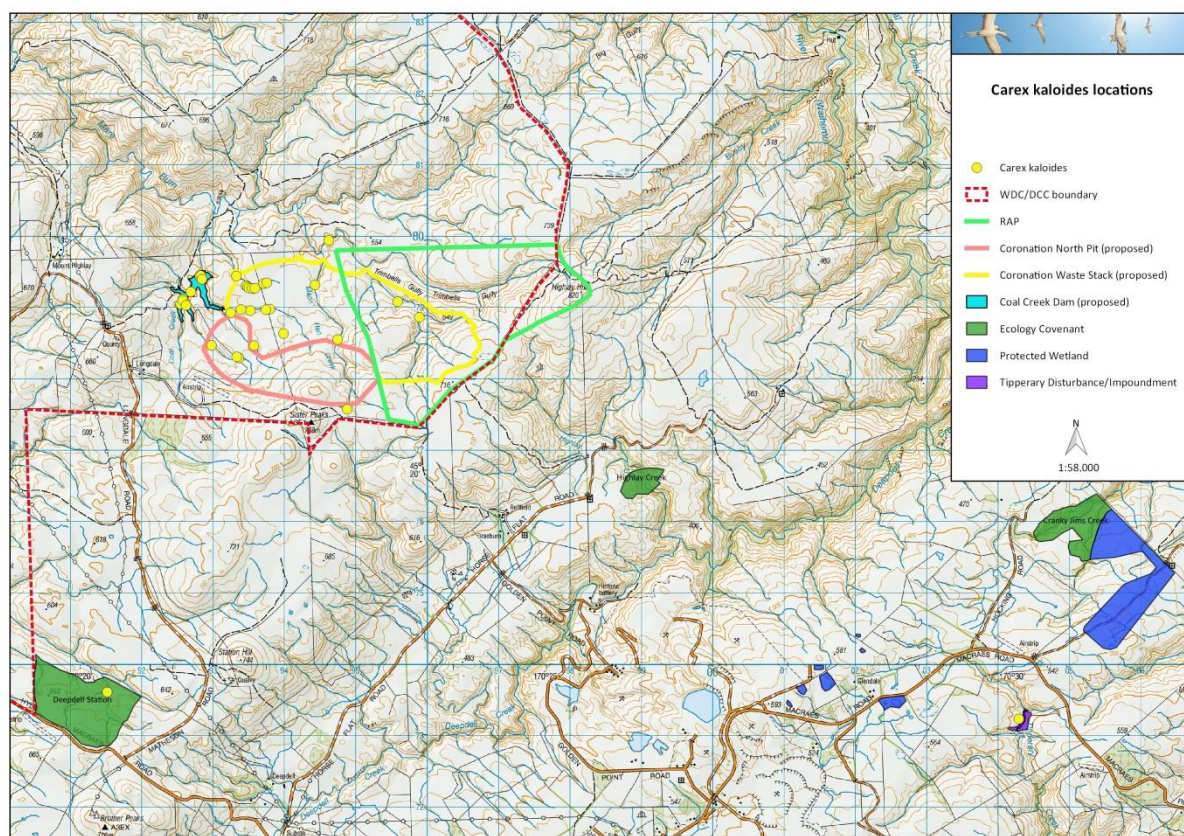


Figure B. Distribution of *Carex kaloides* within the PIA and the wider OceanaGold project area.

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.

2. *Veronica rakaiensis* J.B.Armstr. (a shrub hebe, Plantaginaceae).

Distribution within project

Veronica rakaiensis was recorded from one large schist bluff in the PIA where there is a population of c. 100 plants.

Summary of existing information

Veronica rakaiensis is a species rarely recorded within the Macraes E.D. It occurs in damper gullies throughout the eastern South Islands, with the majority of records in western Otago and Southland. It is known from the wider Macraes area on OceanaGold tenure land at Trimbells Gully and the Deepdell Covenant and at two sites between Red Bank and Ramrock roads.

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.

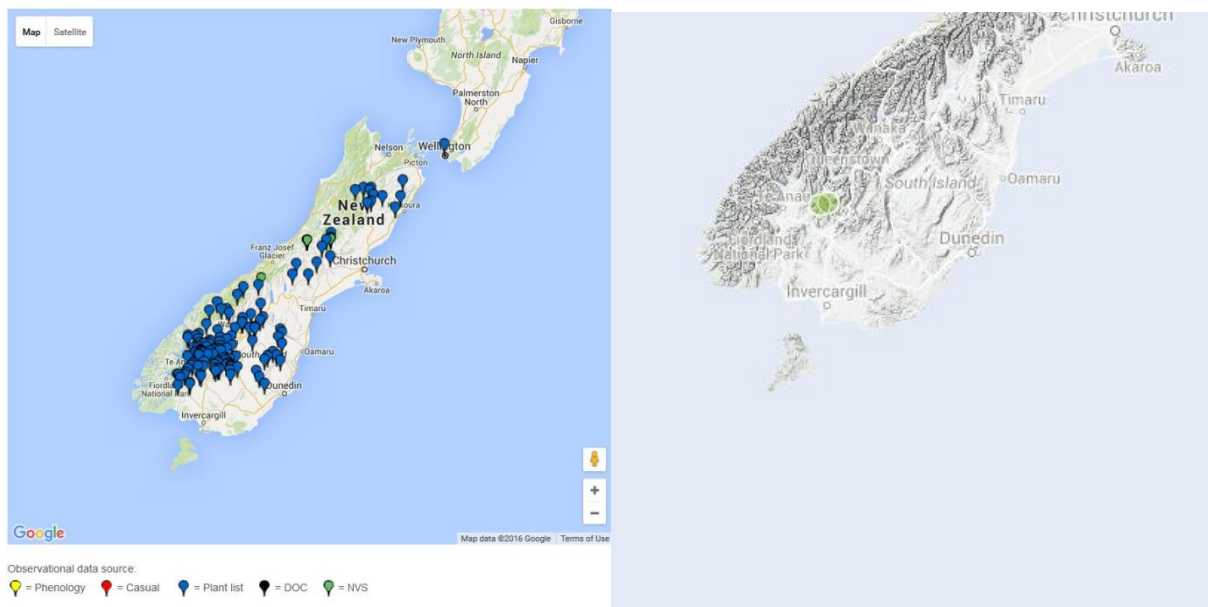


Figure A. Distribution of *Veronica rakaiensis* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

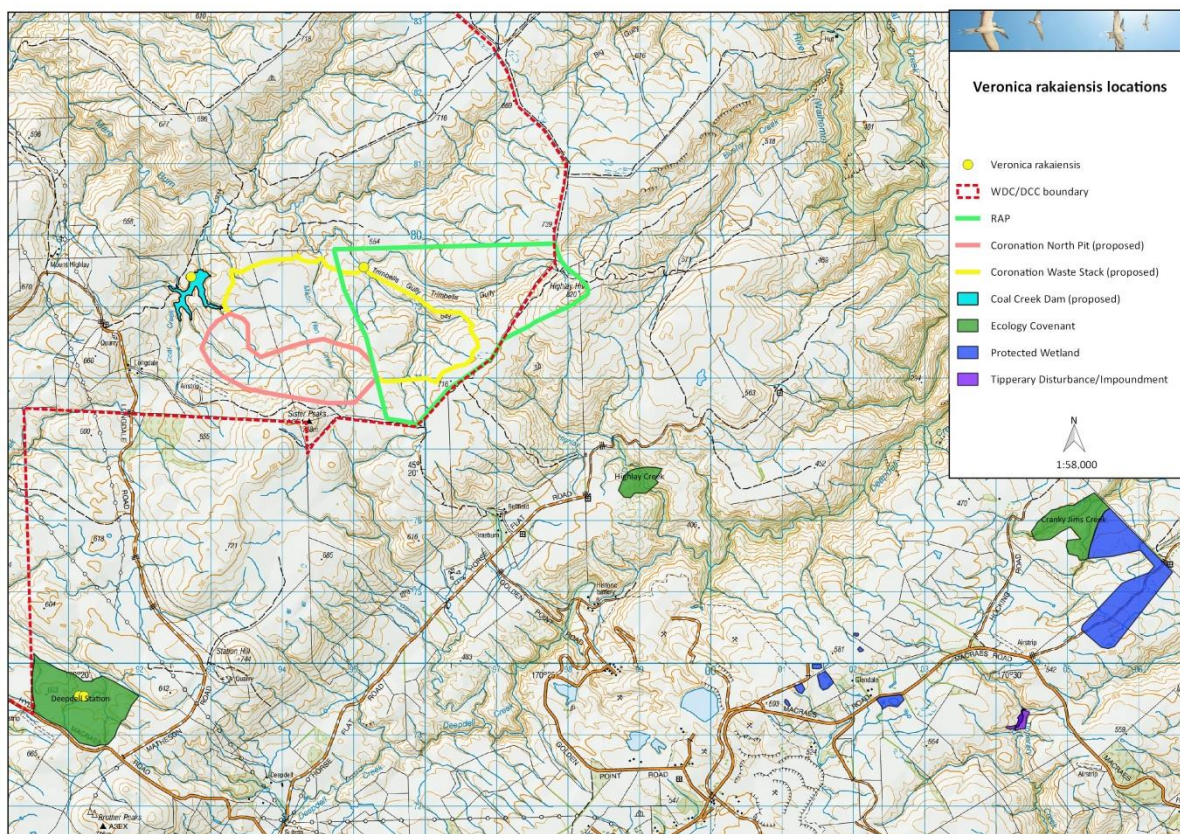


Figure B. Distribution of *Veronica rakaiensis* within the PIA and the wider OceanaGold project area.

Data sources used in this assessment:

Bayly, M; Kellow, A. 2006. An illustrated guide to New Zealand hebes. Te Papa Press, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=2004 accessed 14 April 2016.

Nature Watch <http://naturewatch.org.nz/taxa/406883-Veronica-rakaiensis> accessed 14 April 2016.

OceanaGold file records

Dr M. Thorsen unpub. file notes.

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

Three species present within the PIA are listed in Appendix 16A of the DCC District Plan: *Carmichaelia crassicaulis* subsp. *crassicaulis*, *Olearia bullata* and *Chionochloa rubra* subsp. *cuprea*. Assessments of the status of *Carmichaelia crassicaulis* subsp. *crassicaulis* is 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 plants and groups of *Olearia bullata* in the PIA.

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 value⁷ than ‘moderate’ using Table 5 of EIANZ guidelines) on the basis of its:

- 1) Rarity within the Dunedin City boundary.

⁷ 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.

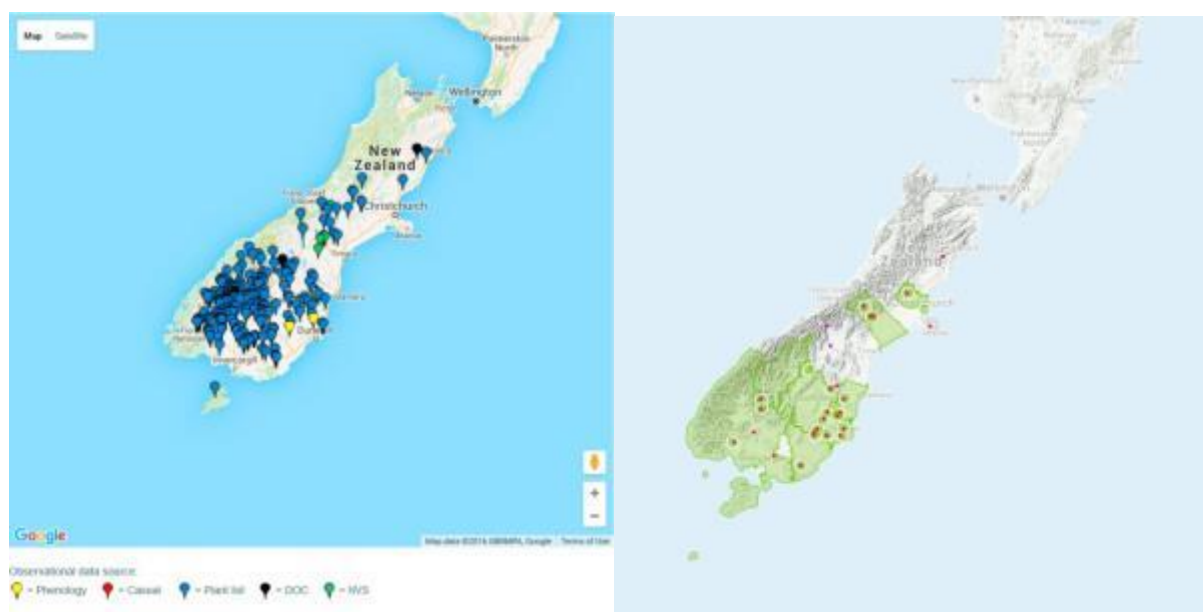


Figure A. Distribution of *Olearia bullata* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

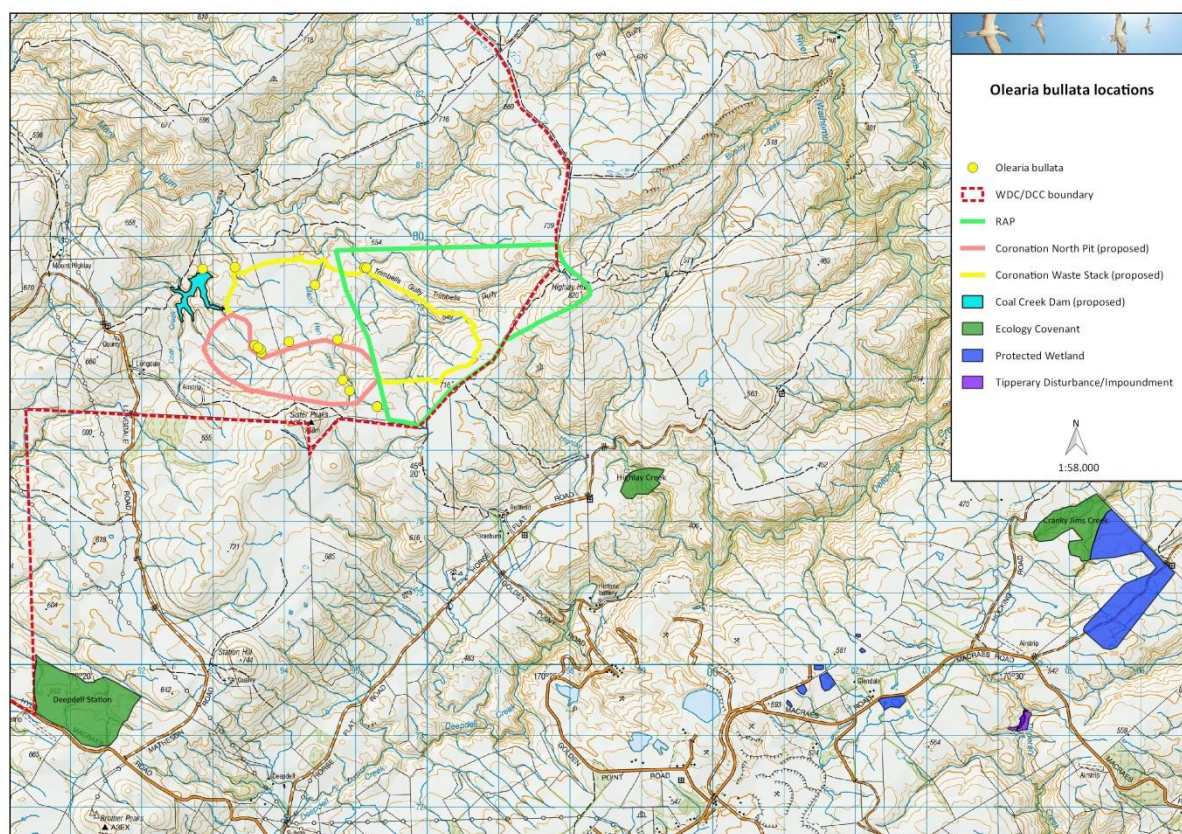


Figure B. Distribution of *Olearia bullata* within the PIA and the wider OceanaGold project area (NB: Distribution outside the Dunedin City boundary is not mapped).

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 plants to large groups of *Chionochloa rubra* subsp. *cuprea* in the PIA 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 value⁸ 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*.

⁸ 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.

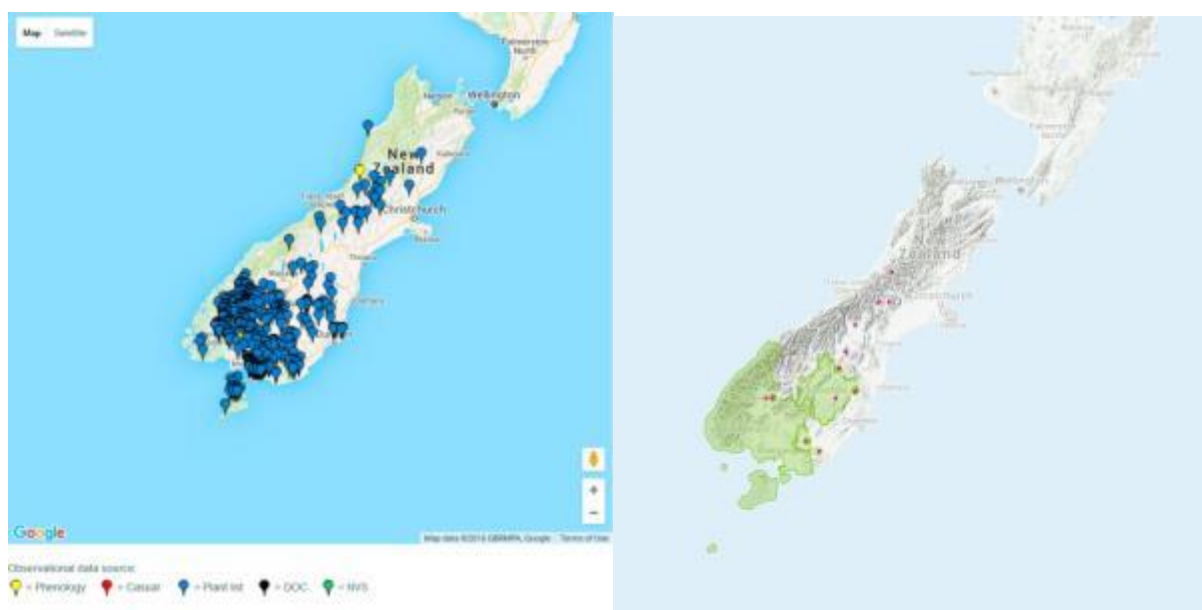


Figure A. Distribution of *Chionochloa rubra* subsp. *cuprea* in New Zealand from the NZ Plant Conservation Network (left) and Nature Watch (right) databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.

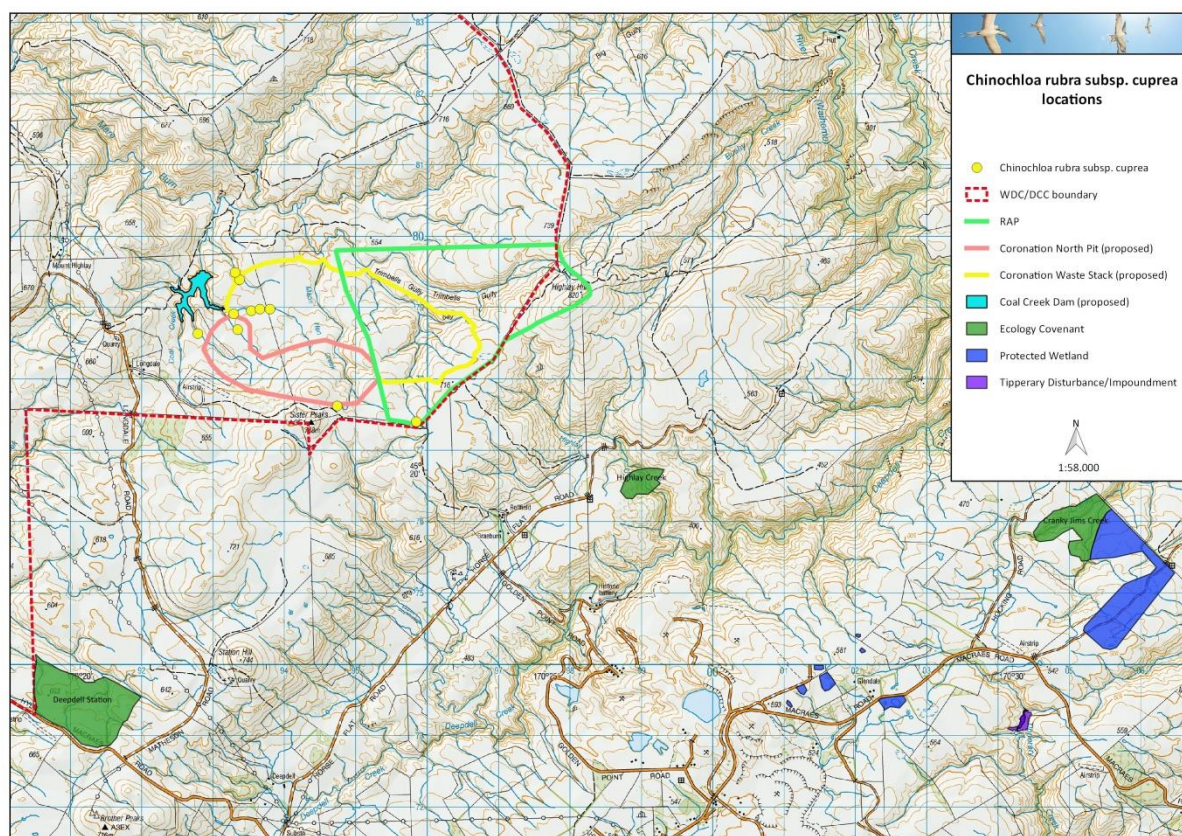


Figure B. Distribution of *Chionochloa rubra* subsp. *cuprea* within the PIA and the wider OceanaGold project area (NB: Only sites with larger patches forming a continuous canopy in the PIA are mapped).

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

One species of biogeographic interest occur within the PIA: the cress *Pachycladon cheesemanii*.

1. *Pachycladon cheesemanii* Heenan et A. Mitch. (a dryland cress, Brassicaceae).

This species is part of a group of cress species that have been the focus of biogeographic studies. It has been mentioned in the following studies:

Heenan, P.B; Mitchell, A.D; Koch, M. 2002. Molecular systematics of the New Zealand *Pachycladon* (Brassicaceae) complex: generic circumscription and relationships to *Arabidopsis* sens. lat. and *Arabis* sens. lat. New Zealand Journal of Botany 40: 543-562.

Mitchell, A.D; Heenan, P.B. 2002. Genetic variation within the *Pachycladon* (Brassicaceae) complex based on fluorescent AFLP data. Journal of the Royal Society of New Zealand 32: 427-443.

Heenan, P.B; Mitchell, A.D. 2003. Phylogeny, biogeography and adaptive radiation of *Pachycladon* (Brassicaceae) in the mountains of South Island, New Zealand. Journal of Biogeography 30: 1737-1749.

McBreen, K; Heenan, P.B. 2006. Phylogenetic relationships of *Pachycladon* (Brassicaceae) species based on three nuclear and two chloroplast DNA markers. New Zealand Journal of Botany 44: 377-386.

5.3.6 Genetically or morphologically distinct forms

Two morphologically distinct plant forms are present within the PIA: a red-fruited narrow-leaved form of *Coprosma dumosa* and a brown-leaved cliff dwelling form of *Carex testacea*.

1. Red-fruited narrow-leaved form of *Coprosma dumosa* (a divaricating shrub, Rubiaceae).

The red-fruited narrow-leaved form of *C. dumosa* is present as a small grove of 5-6 plants growing within the PIA intermixed with *Coprosma propinqua* on a toe slope. This entity is morphologically distinct from the normal range of forms within *Coprosma dumosa* (pers. obs.), particularly in the bright red non-translucent fruit and narrow, acute-tipped leaves. It also has slightly decurved branches (a feature shared with the similar *Coprosma decurva* Heads, but which otherwise differs in the glabrous petiole and obtuse leaf tip). It is illustrated without comment in the *Coprosma* key and no mention was made of this variation by Jane (2005). The wider distribution of this entity is not known. This entity is probably best viewed as a morphologically distinct form within *Coprosma dumosa* (Cheeseman) G.T.Jane, pending further investigation.

Data sources used in this assessment:

Jane, G.T. 2005. An examination of *Coprosma ciliata* and *C. parviflora* complex. New Zealand Journal of Botany 43: 735-752.

Glenny, D; Cruickshank, J. 2011. Taxonomic notes on the New Zealand flora: *Coprosma dumosa* and *C. tayloriae*, are there two species? New Zealand Journal of Botany 49: 481-488.

Landcare Research. Coprosma Key

<http://resources.landcareresearch.co.nz/interactivekeys/CoprosmaKey/> accessed 19/4/16

2. *Carex testacea* (trip-me-up grass, Cyperaceae).

A distinctive form of *Carex testacea* was noted at one site on one bluff in the PIA. This plant has congested spikes and membranous glumes that are longer than the utricle and a lax growth habit. Plants with a similar appearance to this are occasionally encountered in the area (the nearest other known record is Tipperary Creek). At least two other distinctive forms of *Carex testacea* are present in the Macraes area: an orange-leaved erect form growing on the margins of wetlands and a more 'usual' form of *Carex testacea* with green leaves and spaced spikes. *Carex testacea* s.l. is morphologically variable and the taxonomic status of the morphological forms currently identified as this species requires further investigation. In the meantime, this plant is treated as a morphologically distinct form, pending further investigation.

5.4 Avifauna Ecological Features

5.4.1 Avifauna communities

Eleven bird species have been recorded from the Coal Creek and Coronation North area, 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.

Only harrier was observed in the PIA, on one occasion. It is assumed that they regularly use the area for hunting and feeding, but are unlikely to be breeding there. The other species are likely to occasionally visit the area and it is possible that one or two pairs of grey warbler and song thrush breed within the PIA.

5.4.2 Ecological function

Of the eleven bird species recorded from within the Coal Creek and Coronation North area, six are exotic species. Four of these: skylark, chaffinch, redpoll and house sparrow are considered of little positive 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 a minor 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 would influence the stature and composition of the wetland plant communities created by the dam. 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 Coal Creek and Coronation North area 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). Within the Macraes area pipit are widespread, particularly in rough low grassland, although population density varies greatly from site to site. Pipits are thought to be occasional visitors to the PIA.

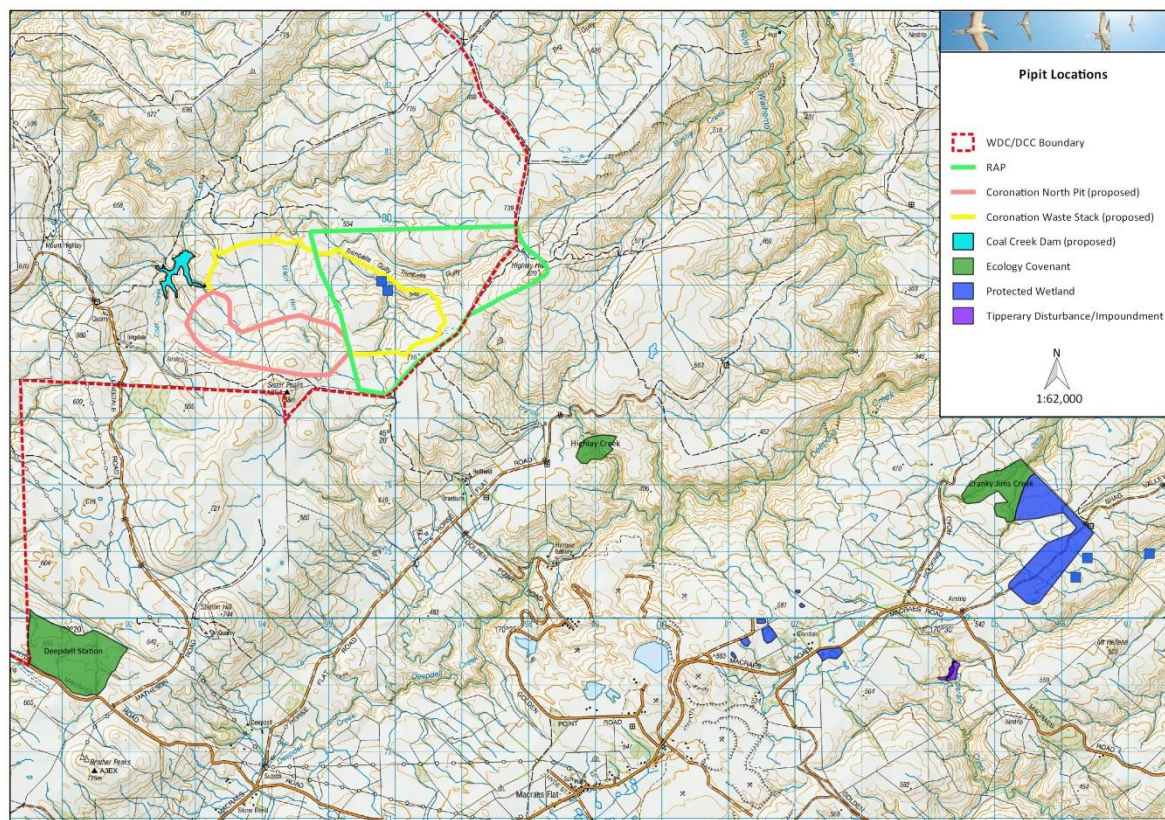


Figure 6. Locations where pipit were recorded in the Macraes area. Records at Deepdell Covenant are not shown.

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 **low** on the basis of:

- 1) The occasional presence of one At Risk species;
- 2) minor role in ecosystem function;
- 3) low species diversity and abundance.

5.5 Herpetofauna Ecological Features

5.5.1 Herpetofauna communities

Three reptile and one amphibian species were recorded in and adjacent to the PIA (Figure 7): the skinks *Oligosoma maccanni* (clade 4 genotype), *Oligosoma polychroma* (clade 5 genotype), the gecko *Woodworthia* “Otago large” and the exotic whistling frog *Litoria ewingii*.

The McCann’s skink *O. maccanni* (clade 4 genotype) is present in reasonable numbers (106 sightings over 12 person hours: 8.8 sightings hr⁻¹) 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 near good cover from vegetation.

The southern grass skink *Oligosoma polychroma* (clade 5 form) is present infrequently (16 sightings over 12 person hours: 1.3 sightings hr⁻¹) in the more vegetated areas.

The korero gecko *Woodworthia* “Otago large” was noted 95 times in at several rock outcrops in the area including the PIA. Eight individuals were recorded over 2 hours (4 individuals hr⁻¹) within the PIA during the night survey, all high on the larger bluffs. 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.

At least one whistling frog was heard during the night survey at one site within the PIA. 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).

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 otagense* have been recorded in 1992 from c. 2.5km 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 they have not been detected within the PIA during the 1990’s survey and these 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, but it is possible that a small number of individuals may be present within the PIA.

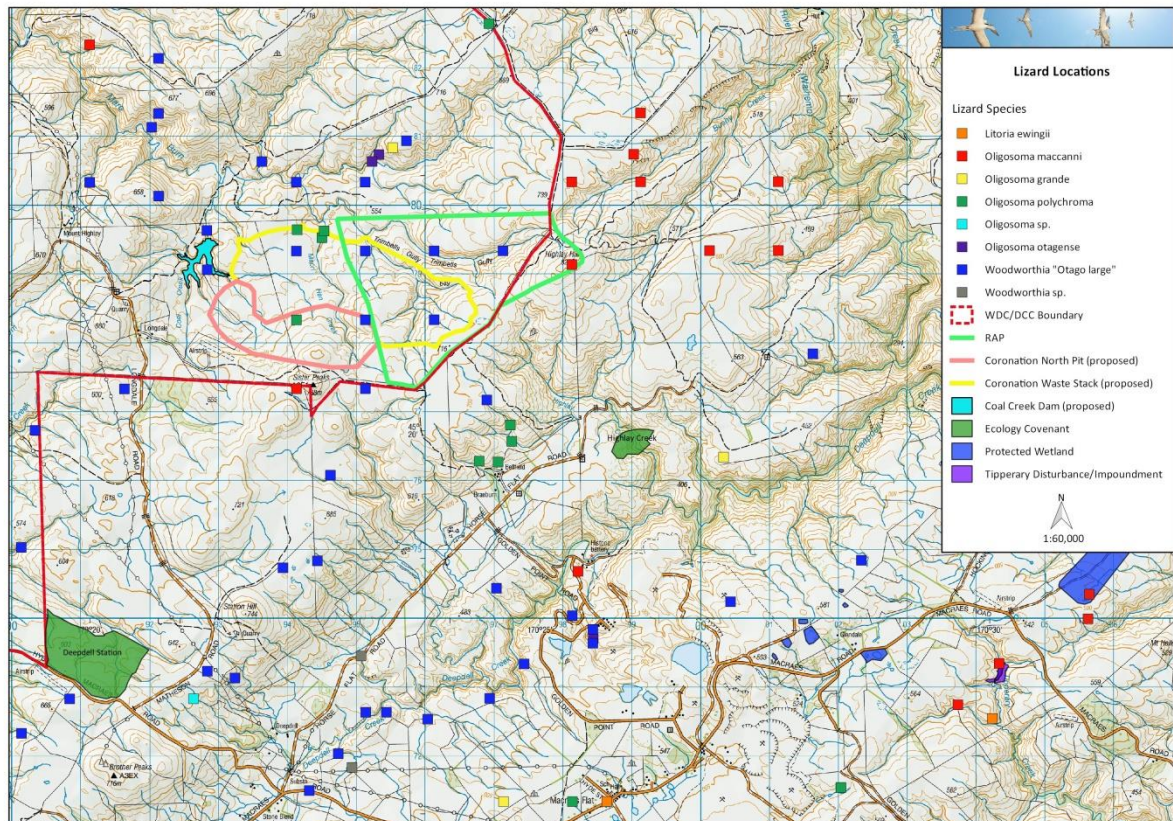


Figure 7. Records of lizard species in and around the PIA.

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). The ecological function of the exotic frog *Litoria ewingii* is not known. In this instance, and at this density, their ecological role is considered minor.

5.5.1 Species diversity

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

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

Two of the reptile species known within the PIA 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.

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 likely to be present in many of the smaller rock outcrops that are scattered through the PIA.

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 together as *Hoplodactylus 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 also 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	5 indigenous	Very high
	Community representativeness	High	
	Community distinctiveness	None	
	Community ecological integrity	Moderate	
	Community rarity	High	
	Ecological function and services	Moderate	
	Botanical diversity	High	
	Threatened land environments	3	Very high
	National priorities for Conservation	-	
	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	-	
	Threatened plant species	2	Very high
	At Risk plant species	6	
	Data Deficient plant species	1	
	Rare plant species	4	
	Species of biogeographic interest	1	
	Genetically or morphologically distinct species	2	
Avifauna	Ecological function	Low	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, 1 exotic	
	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

Five 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 is one rare vegetation community present 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.

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.

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

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

The confidence of this assessment is **moderate-low**, 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

Eleven 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 Vulnerable species

1. *Pachycladon cheesemanii* Heenan et A. Mitch. (a dryland cress, Brassicaceae).

Two plants of *Pachycladon cheesemanii* are present in an overhang in one bluff within the PIA.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the death the two plants.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

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 resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

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 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. This could have a minor effect on the biogeographic pattern 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-low**.

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

The confidence of this assessment is **low**, as this is the first record of the species in the Macraes E.D., and it is likely under-recorded as a result of its inconspicuous nature and relatively inaccessible cliff habitat. 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.

2. *Senecio dunedinensis* Belcher (a groundsel daisy, Asteraceae).

Single plants of *Senecio dunedinensis* are present on ledges at two sites within the PIA.

Effect of construction of dam escarpment

Construction of the dam escarpment is likely to cause the death of one plant through being buried in dam material.

Effect of water inundation

This will cause the death of one plant.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

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 resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

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 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.

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-low**.

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

The confidence of this assessment is **low**, as this species is likely under-recorded as a result of its similarity to other *Senecio* species (particularly *Senecio quadridentatus* which is common in the area) and relatively inaccessible cliff habitat. 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.

6.2.2 At Risk species

Six At Risk plant species are known to occur within the PIA: two species that are classified as Declining and four species classified as Naturally Uncommon.

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

This thick-stemmed broom was recorded at twelve sites within and four sites near the PIA comprising 2 - 50 individuals at each site.

Effect of construction of dam escarpment

Construction of the dam escarpment is likely to cause the death of several plants through being buried in dam material.

Effect of water inundation

This will cause the death of approximately 90 plants.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

Effect of changes in weed populations

Slight risk for this species as its dry rocky habitat is not particularly vulnerable to weed invasion.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as this species occurs in habitats that are naturally dusty, such as beside gravel roads.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is 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 bulk of the local population from the site which may also reduce longer-term viability of the species in a local context, both through a decrease in total population size, and loss of a site that may have importance in maintaining what is likely to be 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**⁹.

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 very distinctive and unlikely to be mis-recorded.

⁹ '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.

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

This reddish divaricating small-leaved *Coprosma* was recorded at 6 sites within the PIA and one adjacent site upstream comprise 1 individual to groups covering 20m x 10m at each site.

Effect of construction of dam escarpment

Construction of the dam escarpment is likely to cause the death of several plants through being buried in dam material.

Effect of water inundation

This will cause the death of approximately 30-50 plants.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

Effect of changes in weed populations

Moderate risk for this species as its dry rocky habitat is not particularly vulnerable to weed invasion, except for woody weeds.

Effects of displacement of resident animals

Moderate effect for this species as it is dependent on birds for fruit dispersal.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as this species occurs in habitats that are naturally dusty, such as beside gravel roads.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is 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 much of the population from the site which may also reduce longer-term viability of the species in a local context, both through a decrease in total population size, and loss of a site that may have importance in maintaining what is likely to be 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**.

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 similar to *Coprosma rugosa* which also occurs in the area and therefore is also likely to be mis-recorded.

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

This cliff daisy was recorded as scattered plants and large groups of plants inhabiting the larger schist rock outcrops and bluffs in the PIA and surrounding area.

Effect of construction of dam escarpment

Construction of the dam escarpment is likely to cause the death of several large groups totally c. 200 plants through being buried in dam material.

Effect of water inundation

This will cause the death of other large groups of 20-100 plants.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

Effect of changes in weed populations

Slight risk for this species as its rocky habitat is not particularly vulnerable to weed invasion.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor to moderate effect as the rock habitat of this species naturally protects it from dust-fall, but plants in higher dust-fall areas may be affected, though it would be unlikely to cause the death of plants.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is 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 within the PIA. 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 **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'¹⁰ 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.

¹⁰ 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.

4. *Dracophyllum uniflorum* var. *frondosum* G.Simpson (sprawling inaka, Epacridaceae).

This sprawling needle-leaved shrub was recorded as scattered plants and larger groups on the larger schist rock outcrops and bluffs in the PIA.

Effect of construction of dam escarpment

Construction of the dam escarpment is likely to cause the death of several plants through being buried in dam material.

Effect of water inundation

This may cause the death of approximately 30-50 plants, depending on maximum water level.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

Effect of changes in weed populations

Slight risk for this species as its dry rocky habitat is not particularly vulnerable to weed invasion.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the needle-like leaves of this species is not likely to be coated with thick layers of dust.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is 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 bulk of the population from the site which may also reduce longer-term viability of the species in a local context, both through a decrease in total population size, and loss of a site that may have importance in maintaining what is likely to be 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 **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 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 similar to *Dracophyllum rosmarinifolium* and is likely to be mis-recorded.

5. *Cardamine bilobata* Kirk (a native bittercress, Brassicaceae).

This small herb was recorded as scattered individuals totalling c. 20 plants on two of the larger schist rock bluffs in the PIA. It is probable more plants are present in the higher areas of the bluffs.

Effect of construction of dam escarpment

Construction of the dam escarpment is likely to cause the death of at least 5 plants through being buried in dam material.

Effect of water inundation

This will cause the death of the remaining c. 15 plants.

Effect of pond run-down

Nil effect as this species does not occur in this type of habitat.

Effect of changes in weed populations

Slight risk for this species as its rocky habitat is not particularly vulnerable to weed invasion.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor to moderate effect as the rock habitat of this species naturally protects it from dust-fall, but plants in higher dust-fall areas may be effected by dust, though it would be unlikely to cause the death of plants.

Effects of accidental fire

Nil to minor effect as the habitat of this species within the PIA is 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 within the PIA. This will result in the loss of the only known population of this form of the species in the Central Otago area. However, this form of the species appears to be more common in higher rainfall areas closer to the Southern Alps, but even there few populations are currently known. It is likely to be very palatable to exotic animals.

Therefore, the impact of this project is assessed as having both 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 **very high**, and at a national level as **high**.

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

The confidence of this assessment is **very low**, as this is the first record of this species (in the strictest sense) from the Central Otago area. 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. There is also considerable uncertainty surrounding the taxonomy of this species.

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

This wetland daisy was recorded at one site in the PIA, in a wetland at the base of a bluff.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the death of the one patch of this species in the PIA.

Effect of pond run-down

Probably nil effect as this species is unlikely to colonise this habitat.

Effect of changes in weed populations

Slight risk for this species as its shaded wetland habitat is not particularly vulnerable to weed invasion.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor to moderate effect as the rock base habitat of this species naturally protects it from dust-fall, but plants in higher dust-fall areas may be effected by dust, though it would be unlikely to cause the death of plants.

Effects of accidental fire

Nil effect as the habitat of this species within the PIA is naturally wet.

The result of these project effects will be the loss of the species from one site 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 site 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*.

6.2.3 Data Deficient species

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

This wetland willowherb was recorded as small populations of 20-30 plants at three sites in the PIA, and several groups in areas immediately adjacent to the PIA.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the loss of the three sites of this species in the PIA.

Effect of pond run-down

Probably nil effect as this species is unlikely to colonise this habitat.

Effect of changes in weed populations

Moderate risk for this species as its wetland habitat is vulnerable to weed invasion, but it does persist at sites together with exotic species.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the wetland habitat and low stature of this species naturally washes off dust-fall.

Effects of accidental fire

Nil effect as the habitat of this species within the PIA is naturally wet.

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.

6.2.4 Rare species

6.2.4.1 Species uncommon in Ecological District

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

This sedge was recorded in gully bottoms at several sites in the PIA. Population size varies between patches of 1m² to patches 5m x 3m in size.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the loss of the three sites of this species in the PIA.

Effect of pond run-down

Probably nil effect as this species is unlikely to colonise this habitat.

Effect of changes in weed populations

Moderate risk for this species as its wetland habitat is vulnerable to weed invasion, but it does persist at sites together with exotic species.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the wetland habitat and low stature of this species naturally washes off dust-fall.

Effects of accidental fire

Nil effect as the habitat of this species within the PIA is naturally wet.

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 and 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 in the area is unknown.

2. *Veronica rakaiensis* J.B.Armstr. (a shrub hebe, Plantaginaceae).

Veronica rakaiensis was recorded from one large schist bluff in the PIA where there is a population of c. 100 plants.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the loss of the one site of this species in the PIA.

Effect of pond run-down

Probably nil effect as this species is unlikely to colonise this habitat.

Effect of changes in weed populations

Moderate risk for this species as its bluff habitat is moderately vulnerable to weed invasion, but it does persist at sites together with other, non-woody, exotic species.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Moderate effect as the coriaceous leaves of this species should be resistant to dust-fall.

Effects of accidental fire

Nil effect as the bluff habitat of this species is naturally resistant to fire.

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.

6.2.4.2 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 plants and groups of *Olearia bullata* in the PIA.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the loss of the species in the PIA.

Effect of pond run-down

Probably nil effect as this species is unlikely to colonise this habitat.

Effect of changes in weed populations

Moderate risk for this species as its wetland habitat is vulnerable to weed invasion, but it does persist at sites together with exotic species.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the small leathery leaves of this species are likely to be resistant to dust-fall.

Effects of accidental fire

Nil effect as the habitat of this species within the PIA is naturally wet.

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 plants to large groups of *Chionochloa rubra* subsp. *cuprea* in the PIA 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.

Effect of construction of dam escarpment

Minor effect as few plants occur in this zone.

Effect of water inundation

This will cause the loss of the species in the PIA.

Effect of pond run-down

Probably nil effect as this species is unlikely to colonise this habitat.

Effect of changes in weed populations

Moderate risk for this species as its wetland habitat is vulnerable to weed invasion, but it does persist at sites together with exotic species due to its tall stature.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the narrow coriaceous leaves of this species are likely to be resistant to dust-fall.

Effects of accidental fire

Minor effect as the habitat of this species within the PIA is naturally wet.

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. 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.

6.2.1 Species of biogeographic interest

One species of biogeographic interest occur within the PIA: the cress *Pachycladon cheesemanii*.

1. *Pachycladon cheesemanii* Heenan et A. Mitch. (a dryland cress, Brassicaceae).

The effects of the project on this species are discussed in [Section 6.2.1.](#)

6.2.2 Genetically or morphologically distinct forms

Two morphologically distinct plant forms are present within the PIA: a red-fruited narrow-leaved form of *Coprosma dumosa* and a brown-leaved cliff dwelling form of *Carex testacea*.

1. Red-fruited narrow-leaved form of *Coprosma dumosa* (a divaricating shrub, Rubiaceae).

The red-fruited narrow-leaved form of *C. dumosa* is present as a small grove of 5-6 plants growing within the PIA.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the loss of the plant in the PIA.

Effect of pond run-down

Nil effect as this plant would not colonise this habitat.

Effect of changes in weed populations

Moderate risk for this plant as its habitat is vulnerable to weed invasion, but it does persist at the site together with some exotic species.

Effects of displacement of resident animals

Moderate effect for this plant as it is dependent on birds for fruit dispersal.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the small coriaceous leaves of this plant are likely to be resistant to dust-fall.

Effects of accidental fire

Minor effect as the habitat of this plant within the PIA is apparently a fire refugia.

Assessment of project impact

The result of these project effects will be the loss of the plant from within the PIA. This will remove the only known occurrence of this plant within the E.D. The wider effect of this impact on the species at a national scale is unknown due to uncertainty surrounding its taxonomic validity, but it is apparently present in other localities.

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

The magnitude of the project's impact on this plant 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 plant is **moderate**.

Confidence of assessment

The confidence of this assessment is **very low**, due to the uncertainty of the taxonomic status of this entity, its similarity to other small-leaved *Coprosma* species, and that 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.

2. *Carex testacea* (trip-me-up grass, Cyperaceae).

A distinctive form of *Carex testacea* was noted at one site on one bluff in the PIA.

Effect of construction of dam escarpment

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

Effect of water inundation

This will cause the loss of the one plant in the PIA.

Effect of pond run-down

Nil effect as this plant would not colonise this habitat.

Effect of changes in weed populations

Moderate risk for this plant as its habitat is vulnerable to weed invasion.

Effects of displacement of resident animals

Nil effect for this species as it is not dependent on any of the resident animal species that are likely to be displaced.

Effects of noise

Nil effect as plants are not susceptible to noise.

Effects of dust

Minor effect as the narrow coriaceous leaves of this plant are likely to be resistant to dust-fall.

Effects of accidental fire

Minor effect as the habitat of this plant within the PIA is apparently a fire refugia.

Assessment of project impact

The result of these project effects will be the loss of the one known plant from within the PIA. The wider effect of this impact on the plant at a national scale is unknown due to uncertainty surrounding its taxonomic validity, but it is apparently present in other localities.

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

The magnitude of the project's impact on this plant 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 plant is **moderate**.

Confidence of assessment

The confidence of this assessment is **very low**, due to the uncertainty of the taxonomic status of this entity, its similarity to other *Carex* species, and that 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.

6.3 Impact on Avifauna Ecological Features

Eleven bird species were recorded from within the vicinity of 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 possible occasional 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 dam escarpment

Major effect on bird species that would use this zone through destroying habitat.

Effect of water inundation

This will displace all bird species that would use this area as a result of inundating their habitat. This will also create habitat that is likely to attract waterfowl species such as the endemic paradise shelduck *Tadorna variegata* (which is known to breed nearby), and the exotic mallard *Anas platyrhynchos* and Canada goose *Branta canadensis*. It is less likely that the endemic little pied shag *Phalacrocorax melanoleucos brevirostris*, indigenous white-faced heron *Egretta novaehollandiae*, indigenous black swan *Cygnus atratus*, indigenous (possibly endemic) Critically Endangered grey duck *Anas superciliosa* (but much more likely are hybrids between this species and mallard) or At Risk black shag *Phalacrocorax carbo* would be attracted to this pond.

Effect of pond run-down

Moderate effect as some of the waterfowl species that would be attracted to the pond would likely use this habitat also.

Effect of changes in weed populations

Minor to major effect as some weed species can form monocultures that are avoided by birds.

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

This will have a temporary minor 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 during the construction phase.

Effects of dust

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

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 attraction of waterfowl species to the pond site. The result of this is some disruption of local bird populations, most of which are common on a national scale. The loss of a small area of habitat of the At Risk pipit is of minor importance on a national scale. Some of this effect could be reversed by decommissioning and emptying the pond.

Therefore, the impact of this project is assessed as having an **adverse and positive, direct, permanent, partially-reversible, local impact** on these species.

The magnitude of the project's impact on these 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 these species is **very 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 and one amphibian species were recorded in the PIA. The ecological importance of the herpetofauna 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 within the PIA.

Effect of construction of dam escarpment

Moderate effect on lizard species caused by destruction of habitat and death of some individuals through being crushed in earthworks.

Effect of water inundation

This will displace all lizards from within the PIA by inundating their habitat. Most are expected to move to the perimeter of the pond where they would compete for space and food with that area's residents. As the areas around the PIA are assumed to be at carrying capacity, this competition is likely to result in the mortality of a number of either resident lizards or displaced lizards, with a total mortality approaching the number of individuals that are displaced from the PIA. The pond margin is likely to create ideal habitat for the exotic frog *Litoria ewingii* which is expected to increase in numbers in this area. The flow-on effect of this on other species is not known, but there would be increased predation on invertebrates. However, much of their diet is likely to be aquatic invertebrates that have colonised the new habitat.

Effect of pond run-down

Minor effect as the reptile species would not use this habitat. There is likely to be some use of this habitat by the exotic amphibian *Litoria ewingii*.

Effect of changes in weed populations

Minor to major effect as some weed species can form monocultures that are avoided by lizards.

Effects of displacement of resident animals

This will be a temporary moderate effect, as lizards 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 likely to be at carrying capacity, this completion is likely to result in the mortality of

a number of either resident lizards or displaced lizards, with a total mortality approaching the number of individuals that are displaced from the PIA.

Effects of noise

Negligible effect as lizards are not particularly disturbed by noise and the noise effect is only temporary.

Effects of dust

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

Effects of accidental fire

Minor to moderate effect, particularly on animals in grassland, and depending on the timing of fire.

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, 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 in the wider area, the project is considered to have a minor impact on lizard populations at a national scale. Some of this effect could be reversed by decommissioning and emptying the pond.

Therefore, the impact of this project is assessed as having an **adverse and positive, direct, permanent, partially-reversible, local impact** on these species.

The magnitude of the project's impact on these 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 these species is **moderate** (a more appropriate value than 'low'¹¹ produced using Table 12 of EIANZ guidelines).

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.

¹¹ The intersection of a 'moderate' ecological value and 'moderate' magnitude effect produces a 'low' level of effect in Table 12. 'Moderate' would seem a more appropriate product.

6.5 Summary of Project Impacts

	Feature	Ecological Importance	Local Impact	National Impact	Overall
Vegetation & Sites	Communities	very high	high	moderate	moderate
	Threatened plant species	very high	high (2 species)	moderate-low (2 species)	moderate (2 species)
	At Risk plant species		moderate (3 species), high (2 species), very high (1 species)	low (2 species), moderate (3 species) high (1 species)	low (2 species), moderate (1 species), high (3 species)
	Data Deficient plant species		moderate (1 species)	low (1 species)	low (1 species)
	Rare plant species		low (1 species), moderate (2 species), high (1 species)	negligible (3 species), very low (1 species)	very low (4 species)
Avifauna		moderate-low	moderate	negligible	very low
Herpetofauna		moderate	moderate	moderate	moderate

7 Ecological features in surrounding area

Several notable ecological features were noted in the area surrounding the PIA, including additional populations to those in the PIA of *Carmichaelia crassicaulis* subsp. *crassicaulis*, *Coprosma intertexta*, *Epilobium insulare* and *Carex kaloides*, as well as populations of the Nationally Vulnerable buttercup *Ranunculus ternatifolius*, Declining bidibid *Acaena buchananii*, Naturally Uncommon hookgrass *Carex subtilis* and rare scented tree daisy *Olearia odorata*. Avoiding these sites during planning project activities is recommended, particularly when identifying the site access route and borrow site.

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9 Appendices

Appendix 1. Biodiversity recorded during Coal Creek dam site and Coronation North inventories

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 buchananii</i> Hook.f.	Declining	DICOTYLEDONOUS HERBS	Rosaceae	Rare	Short tussockland	
<i>Acaena caesiiglauc</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	
<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>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>Anogramma leptophylla</i> (L.) Link	Nationally Vulnerable	FERNS	Pteridaceae	Rare	Rocky 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>Anthriscus caucalis</i>	Exotic	DICOTYLEDONOUS HERBS	Apiaceae	Local	Shaded sites	
<i>Aphanes arvensis</i>	Exotic	DICOTYLEDONOUS HERBS	Rosaceae	Occasional	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>Asplenium flabellifolium</i> Cav.	Not Threatened	FERNS	Aspleniaceae	Local	Shaded sites	

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Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Asplenium richardii</i> (Hook.f) Hook.f.	Not Threatened	FERNS	Aspleniaceae	Local	Rocky areas	
<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>Blechnum montanum</i> T.C.Chambers et P.A.Farrant	Not Threatened	FERNS	Blechnaceae	Local	Rocky sites	
<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>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>Brassica rapa</i> L. var. <i>rapa</i>	Exotic	DICOTYLEDONOUS HERBS	Brassicaceae	Local	Cultivated areas	
<i>Bromus hordeaceus</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<i>Bulbinella angustifolia</i> (Cockayne et Laing) L.B.Moore	Not Threatened	MONOCOTYLEDONOUS HERBS	Asphodelaceae	Occasional	Gully	
<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>Cardamine bilobata</i> Kirk	Naturally Uncommon	DICOTYLEDONOUS HERBS	Brassicaceae	Rare	Rocky sites	
<i>Carex</i> (CHR 586013; aff. <i>C. punicea</i> ; Lammerlaw)	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Shaded sites	
<i>Carex breviculmis</i> R.Br.	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Rocky sites	
<i>Carex coriacea</i> Hamlin	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Carex flagellifera</i> Colenso	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Rocky sites	
<i>Carex gaudichaudiana</i> Kunth	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	ID provisional as plants not flowering
<i>Carex inversa</i> R.Br.	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Carex kaloides</i> Petrie	Locally Notable	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	

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<i>Carex ovalis</i> Gooden.	Exotic	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	ID provisional as plants not flowering
<i>Carex secta</i> Boott	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Carex sinclairii</i> Boott	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Carex tenuiculmis</i> (Petrie) Heenan et de Lange	Declining	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Wet sites	Two-three forms present?
<i>Carex testacea</i> Sol. ex Boott	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Carex subtilis</i> K.A.Ford	Naturally Uncommon	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Shaded sites	
<i>Carex wakatipu</i> Petrie	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Shaded 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>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	
<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>Chionochloa rigida</i> (Raoul) Zotov subsp. <i>rigida</i>	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Common	Gully	
<i>Chionochloa rubra</i> subsp. <i>cuprea</i> Connor	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Wet sites	
<i>Chionochloa rubra</i> subsp. <i>cuprea</i> X <i>C. rigida</i> subsp. <i>rigida</i>	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Wet sites	
<i>Cirsium arvense</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Cirsium vulgare</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Clematis marata</i> J.B.Armstr.	Not Threatened	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS	Ranunculaceae	Occasional	Shrubland	

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<i>Colobanthus apetalus</i> (Labill.) Druce	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Local	Rocky sites	
<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	Red-fruited form in Coal Creek dam area
<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	
<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>Critesion murinum</i> subsp. <i>murinum</i>	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Occasional	Dry sites & pasture	
<i>Cynosurus cristatus</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Occasional	Wet sites	
<i>Cystopteris fragilis</i> (L.) Bernh.	Exotic	FERNS	Cystopteridaceae	Rare	Rocky sites	
<i>Cytisus scoparius</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Fabaceae	Local	Gully	
<i>Dactylis glomerata</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Occasional	Throughout	
<i>Deschampsia cespitosa</i> (L.) P.Beauv.	Declining	MONOCOTYLEDONOUS HERBS	Poaceae (Aveninae)	Local	Ephemeral wetlands	
<i>Deyeuxia avenoides</i> (Hook.f.) Buchanan	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Agrostidinae)	Occasional	Tussockland	
<i>Dichelachne crinita</i> (L.f.) Hook.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Agrostidinae)	Local	Rocky 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>Discaria toumatou</i> Raoul	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Rhamnaceae	Common	Gully	
<i>Echinopogon ovatus</i> (G.Forst.) P.Beauv.	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Agrostidinae)	Rare	Rocky sites	

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<i>Eleocharis acuta</i> R.Br.	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	ID provisional as plants not flowering
<i>Epilobium alsinoides</i> A.Cunn.	Not Threatened	DICOTYLEDONOUS HERBS	Onagraceae	Rare	Rocky sites	
<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>Dracophyllum uniflorum</i> var. <i>frondosum</i> G.Simpson	Naturally Uncommon	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Rare	Rocky 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>Festuca filiformis</i> Pourr.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Gully	
<i>Festuca novae-zelandiae</i> (Hack.) Cockayne	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Poeae)	Common	Gully	
<i>Festuca rubra</i> subsp. <i>commutata</i>	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Occasional	Throughout	
<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>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>Gentianella amabilis</i> (Petrie) Glenny	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	

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<i>Geranium brevicaule</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>Glyceria declinata</i> Bréb.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Rare	Wet sites	
<i>Glyceria fluitans</i> (L.) R.Br.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Wet 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 filicaule</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Local	Shaded sites	
<i>Herpolirion novae-zelandiae</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Xanthorrhoeaceae	Rare	Tussockland	
<i>Hieracium lepidulum</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Local	Rocky sites	
<i>Histiopteris incisa</i> (Thunb.) J. Sm.	Not Threatened	FERNS	Dennstaedtiaceae	Rare	Wet sites	
<i>Holcus lanatus</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Throughout	
<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>Isolepis caligenis</i> (V.J.Cook) Soják	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Isolepis pottsii</i> (V.J.Cook) Soják	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Wet sites	
<i>Isolepis reticularis</i> Colenso	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Gully	
<i>Juncus amabilis</i>	Exotic	MONOCOTYLEDONOUS HERBS	Juncaceae	Rare	Wet sites	
<i>Juncus articulatus</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Juncaceae	Local	Wet sites	
<i>Juncus bufonius</i> var. <i>bufonius</i>	Exotic	MONOCOTYLEDONOUS HERBS	Juncaceae	Local	Wet sites	
<i>Juncus distegus</i> Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Juncaceae	Local	Wet sites	
<i>Juncus edgariae</i> L.A.S.Johnson et K.L.Wilson	Not Threatened	MONOCOTYLEDONOUS HERBS	Juncaceae	Rare	Wet sites	
<i>Juncus effusus</i> var. <i>compactus</i>	Exotic	MONOCOTYLEDONOUS HERBS	Juncaceae	Local	Wet sites	
<i>Juncus pusillus</i> Buch.	Not Threatened	MONOCOTYLEDONOUS HERBS	Juncaceae	Rare	Wet sites	
<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>Lemna disperma</i> Hegelm.	Not Threatened	MONOCOTYLEDONOUS HERBS	Araceae	Rare	Pond	

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<i>Leptinella pusilla</i> Hook.f.	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Shaded sites	
<i>Leontodon autumnalis</i> subsp. <i>autumnalis</i>	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Throughout	
<i>Leucopogon fraseri</i> complex (mountain ecotype)	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Gully	
<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>Lolium perenne</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<i>Luzula banksiana</i> var. <i>rhadina</i> (Buch.) Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Juncaceae	Local	Rocky sites	
<i>Luzula picta</i> var. <i>limosa</i> Buch. et Petrie	Not Threatened	MONOCOTYLEDONOUS HERBS	Juncaceae	Local	Wet sites	
<i>Luzula rufa</i> Edgar var. <i>rufa</i>	Not Threatened	MONOCOTYLEDONOUS HERBS	Juncaceae	Occasional	Throughout	
<i>Marrubium vulgare</i>	Exotic	DICOTYLEDONOUS HERBS	Lamiaceae	Occasional	Throughout	
<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>Mentha spicata</i> L. subsp. <i>spicata</i>	Exotic	DICOTYLEDONOUS HERBS	Lamiaceae	Local	Wet sites	
<i>Microtis unifolia</i> (G.Forst.) Rchb.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Orchidaceae	Rare	Tussockland	
<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>Muehlenbeckia axillaris</i> (Hook.f.) Endl.	Not Threatened	DICOTYLEDONOUS LIANES & RELATED 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 & RELATED TRAILING PLANTS	Polygonaceae	Common	Gully	
<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>Olearia odorata</i> Petrie	Locally Notable	DICOTYLEDONOUS TREES AND SHRUBS	Asteraceae	Rare	Rocky sites	
<i>Nasturtium microphyllum</i> Boenn. ex Rchb.	Exotic	DICOTYLEDONOUS HERBS	Brassicaceae	Local	Wet sites	

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<i>Nematoceras longipetalum</i> (Hatch) Molloy, D.L.Jones et M.A.Clem.	Not Threatened	MONOCOTYLEDONOUS HERBS	Orchidaceae	Local	Rocky sites	
<i>Olearia bullata</i> H.D.Wilson et Garn.-Jones	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Asteraceae	Local	Wet sites	
<i>Oreobolus impar</i> Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Rare	Ephemeral wetlands	
<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>Pachycladon cheesemanii</i> Heenan et A.Mitch.	Nationally Vulnerable	DICOTYLEDONOUS HERBS	Brassicaceae	Rare	Rocky sites	
<i>Pentachondra pumila</i> (J.R.Forst. et G.Forst.) R.Br.	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Ericaceae	Local	Tussockland	
<i>Phleum pratense</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Rare	Gully	
<i>Pilosella officinarum</i> F.Schultz & Sch.Bip.	Exotic	DICOTYLEDONOUS HERBS	Asteraceae	Common	Throughout	
<i>Pimelea oreophila</i> subsp. <i>lepta</i> C.J.Burrows	Not Threatened	DICOTYLEDONOUS TREES AND SHRUBS	Thymelaeaceae	Rare	Rocky sites	
<i>Pinus radiata</i> D.Don	Exotic	GYMNOSPERM TREES AND SHRUBS	Pinaceae	Local	Shelterbelts	
<i>Plantago lanceolata</i>	Exotic	DICOTYLEDONOUS HERBS	Plantaginaceae	Common	Pasture	
<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>Poa annua</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Occasional	Shaded areas	
<i>Poa breviglumis</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Poeae)	Local	Rocky sites	
<i>Poa cita</i> Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Poeae)	Local	Gullies	
<i>Poa colensoi</i> Hook.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Poeae)	Occasional	Throughout	Two forms present: larger green plants usually in shaded sites and smaller glaucous plants on open dry sites
<i>Poa imbecilla</i> Spreng.	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Poeae)	Local	Rocky sites	
<i>Poa kirkii</i> Buchanan	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Poeae)	Rare	Rocky sites	
<i>Poa palustris</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Rare	Wet sites	
<i>Poa pratensis</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<i>Poa trivialis</i> L.	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Local	Wet sites	
<i>Polystichum vestitum</i> (G. Forst.) C. Presl	Not Threatened	FERNS	Dryopteridaceae	Occasional	Gully	
<i>Potamogeton cheesemanii</i> A.Benn.	Not Threatened	MONOCOTYLEDONOUS HERBS	Potamogetonaceae	Rare	Wet sites	

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Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Potentilla anserinoides</i> Raoul	Not Threatened	DICOTYLEDONOUS HERBS	Rosaceae	Rare	Wet sites	
<i>Prunella vulgaris</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Lamiaceae	Local	Shaded sites	
<i>Pseudognaphalium luteoalbum</i> (L.) Hilliard et B.L.Burt	Not Threatened	DICOTYLEDONOUS HERBS	Asteraceae	Occasional	Rocky sites	
<i>Pteridium esculentum</i> (G. Forst.) Cockayne	Not Threatened	FERNS	Dennstaedtiaceae	Local	Gullies	
<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>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>Rubus schmidelioides</i> var. <i>subpauperatus</i> (Cockayne) Allan	Not Threatened	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS	Rosaceae	Occasional	Rocky sites	
<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>Rytidosperma clavatum</i> (Zotov) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Throughout	Slender form
<i>Rytidosperma corinum</i> Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Rocky areas	
<i>Rytidosperma gracile</i> (Hook.f.) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Shaded sites	
<i>Rytidosperma nigricans</i> (Petrie) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Wet sites	
<i>Rytidosperma pumilum</i> (Kirk) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Occasional	Tussockland	

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<i>Rytidosperma unarede</i> (Raoul) Connor et Edgar	Not Threatened	MONOCOTYLEDONOUS HERBS	Poaceae (Danthonieae)	Local	Shaded sites	
<i>Sagina procumbens</i> L.	Exotic	DICOTYLEDONOUS HERBS	Caryophyllaceae	Local	Wet sites	
<i>Sambucus nigra</i>	Exotic	DICOTYLEDONOUS TREES AND SHRUBS	Caprifoliaceae	Occasional	Rocky 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>Schoenus pauciflorus</i> (Hook.f.) Hook.f.	Not Threatened	MONOCOTYLEDONOUS HERBS	Cyperaceae	Local	Wet sites	
<i>Scleranthus brockiei</i> P.A.Will.	Not Threatened	DICOTYLEDONOUS HERBS	Caryophyllaceae	Rare	Short tussockland	
<i>Senecio dunedinensis</i> Belcher	Nationally Vulnerable	DICOTYLEDONOUS HERBS	Asteraceae	Rare	Rocky sites	
<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>Simplicia laxa</i> Kirk	Nationally Critical	MONOCOTYLEDONOUS HERBS	Poaceae (Agrostidinae)	Rare	Rocky 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>Thelymitra</i> sp.	Not Threatened	MONOCOTYLEDONOUS HERBS	Orchidaceae	Rare	Tussockland	
<i>Trifolium arvense</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Common	Throughout	
<i>Trifolium dubium</i>	Exotic	DICOTYLEDONOUS HERBS	Fabaceae	Occasional	Throughout	
<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 rakaiensis</i> J.B.Armstr.	Locally Notable	DICOTYLEDONOUS TREES AND SHRUBS	Plantaginaceae	Local	Rocky sites	

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Current name	Threat ranking (2012)	Group 1	Family (Tribe)	Abundance overall	Habitat	Notes
<i>Veronica salicifolia</i> G.Forst.	Locally Notable	DICOTYLEDONOUS TREES AND SHRUBS	Plantaginaceae	Rare	Rocky sites	
<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>Vulpia bromoides</i> (L.) Gray	Exotic	MONOCOTYLEDONOUS HERBS	Poaceae	Common	Throughout	
<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	

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