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Macraes Gold Project

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MP4 Project

Assessment of Effects on Vegetation & Avifauna

March 2024

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1 Contents

Abbreviations used in text

DOC	Department of Conservation
E.D.	Ecological District
EMP	Ecological Management Plan
IMP	Impact Management Plan
OceanaGold	Oceana Gold (New Zealand) Ltd
ORC	Otago Regional Council
ZOI	Zone of Impact (area potentially affected by project)
WDC	Waitaki District Council
WRS	Waste Rock Stack

2 Executive Summary

This report assesses the potential impact of the proposed open pit extensions and Frasers Tailings Storage Facility associated with OceanaGold's Macraes Phase 4 project (MP4) on the affected vegetation and avifauna. The MP4 project will remove 36 ha of indigenous vegetation comprising ephemeral wetlands, riparian vegetation, wetlands, shrubland and tussockland. These vegetation types provide habitat for 128 indigenous plants including 14 nationally At Risk, Data Deficient or locally uncommon species and 10 indigenous bird species, including one Threatened and two At Risk species. The indigenous vegetation communities occur on three Threatened land environments and the ephemeral wetland vegetation communities at Coronation 6 are classified as Naturally Uncommon and Critically Endangered and as a priority for protection. The indigenous vegetation communities are generally of low species diversity and most are characterised by high weed diversity and cover. The populations of the 14 At Risk or locally uncommon plant species are mostly small, except for the At Risk - Declining matagouri which is dominant in the shrubland vegetation community at Golden Bar. The project will also directly impact on 45 ha of exotic vegetation communities including felled pine forest, rough pasture and small areas of shelter belt amenity plantings. There may be indirect effects on the vegetation surrounding the project activities extending to 100 m beyond the project disturbance areas (the buffer area). The buffer area consists of 46 ha of indigenous vegetation and 45 ha of exotic vegetation.

All the indigenous vegetation communities, except the wetlands, are assessed as ecologically significant using the criteria in the National Policy Statement – Indigenous Biodiversity, Otago Regional Plan, Dunedin City District Plan (Coronation 6 only) and Waitaki District Plan on the basis of representativeness, rarity, distinctiveness and providing habitat for rare species. The type and quantity of significant vegetation varies in the project components with almost none at Frasers - Innes Mills , to all indigenous vegetation at Coronation 6 and Golden Bar.

Overall, the MP4 project is assessed as having a low to moderate effect on most of the terrestrial ecological features. The exception to this is a very high impact on three ephemeral wetlands at Coronation 6 that are critically endangered, naturally uncommon ecosystems, and high impacts on tussockland, desert broom, NZ falcon and pipit at Golden Bar. These effects will be addressed through a separate Impact Management Plan[1].

[1] Ahikā Consulting Ltd. 2024. Macraes Phase 4 Project: Ecological Impact Management Plan.

3 Project Description

3.1 The Macraes Phase 4 Project

OceanaGold is continually reviewing remaining life of mining at Macraes. Recent exploration success and sustained high gold price has highlighted opportunities to economically extend the life of mine to around 2034 by expanding some areas of the current operation, and revisiting areas previously mined over the last 30 years and processing low grade ore that has been stockpiled on site. This new project is known as the Macraes Phase 4 Project. It includes the following key components:

- Frasers Pit Tailings Storage Facility;
- Down dip extensions of some of three existing open pits (Coronation stage 6, Innes Mills stages 9-10 and Golden Bar stage 2)
- Realignment of a small portion of Golden Bar Road.

Macraes Phase 4 also includes rehandling waste rock at the Northern Gully Wate Rock Stack. However, the Northern Gully Waste Rock has not been assessed as part of this report and the effects on this will be provided separately. A relatively small channel is planned to provide drainage of the pit lake after mine closure from the Coronation 6 Pit has also not yet been included in this document. The area calculations given in this report therefore exclude the Northern Gully Waste Rock Stack and the Coronation 6 Pit lake spill channel.

3.2 Frasers Pit Tailings Storage Facility

To provide the necessary tailings storage capacity to support the current life of mine and the proposed life of mine extension, a new tailings storage facility will be established in the mined-out Frasers Pit. An embankment will be constructed at the northern end of Frasers Pit using backfilled waste rock stripped from the nearby Innes Mills pit. This will allow for storage of about 36 million tonnes of tailings within the pit void.

The top of the resulting backfill embankment will be approximately 20 m below the lowest point on the Frasers pit crest.

The Project Site is approximately 2.5 kms east of Macraes village and will be fully within an area that has been heavily modified by previous and current mining activity.

Once deposited, the tailings surface may need to be capped, fully or partially. The FTSF will then flood to form a pit lake which connects to Innes Mills Pit lake. The first stage of the Frasers Pit Tailings Storage Facility is being applied for as a separate consent.

3.3 Open Pit Expansions

The proposed open pit expansions involve extending the Innes Mills Pit, Golden Bar Pit and Coronation Pit to recover deeper ore generally located east of the current pit limits.

3.3.1 *FrIM*

The largest of the open pit developments is the extension of existing Innes Mills Pit (IM) – stage 9 to the west and stage 10 to the east - and establishment of the Frasers Tailings Storage Facility (FTSF) (together "**FrIM**"). The IM pit extension and FTSF will be largely within an area that has already been heavily modified by previous and current mining activity. The existing consented pits at RH, IM and Frasers have a combined footprint of 169.5 ha. The proposed IM pit expansion includes an additional pit footprint of approximately 11.4 ha.

Mining will occur in a sequenced manner which will enable the partial backfilling of Frasers, Innes Mills and Golden Point Pits as well as disposal at Frasers South waste rock stack to meet the required cut and fill balance of the MP4 mine plan.

Mining will utilise existing haul roads and mining infrastructure located in the vicinity of the proposed pit extensions.

Table 1. Summary of open pit expansions.

Pit	Hectares of new disturbance (ha)	Additional Ore (Mt)	Additional Waste Rock (Mt)	Total Additional Movement (Mt)
Innes Mills Pit	11.4	3.35	39.6	42.9
Golden Bar Stage 2 Pit	23	1.5	27.9	29.4
Coronation Stage 6 Pit	6	2.0	31.5	33.5

The IM pit expansion details are discussed further below for the constituent pits.

Innes Mills Pit

Innes Mills is currently actively being mined. MP4 proposes an expansion of 200 m to the east and northwest of the Innes Mills LOM pit. The expanded footprint is over existing mine haul roads and poor pastureland. The expansion will necessitate a realignment of the Golden Bar Road where it meets Macraes Road.

3.3.2 *Golden Bar Pit Extension*

The existing Golden Bar pit is located approximately 8 km to the south of the Processing Plant.

The proposed pit consists of an approximately 200 m expansion to the east and northeast. Much of the expanded footprint is rehabilitated previously disturbed ground from the first stage of mining at Golden Bar in 2004-2006. This land was previously used for equipment park up areas and crib facilities. There is some new disturbance over tussock land.

The proposed pit extension requires extension of the existing Golden Bar WRS. The planned WRS will consist of material placed over the existing WRS and an approximately 350m south-westward extension of the existing WRS and provides for an additional storage capacity of just over 30Mt. Most of the footprint is the rehabilitated previous WRS, but there is new disturbance for the southwest extension and along the flanks where the currently rehabilitated faces abut natural ground.

Overall, the Golden Bar Pit extension and associated WRS extension covers an area approximately 69 ha.

Ore from pit will be stockpiled adjacent to the WRS. This ore will then be rehandled using smaller equipment and hauled to the Processing Plant via the previously used private haul road which is adjacent to the public Golden Bar Road. At Frasers Pit, the haul road will divert into the mining area via the mine haul road system.

Some temporary mining related infrastructure will be established adjacent to the proposed pit and WRS, including:

- A portable smoko room will be required for the operators, located near the ore stockpile.
- A fuel tank (electric powered, double skinned).
- A small ablution facility and septic tank will be installed.

At closure, dewatering of the pit will cease and the pit void will eventually fill and spill to the south as it does currently. Waste Rock Stack slopes and other disturbed areas will be contoured and revegetated progressively, using standard site rehab techniques.

3.3.3 *Coronation Pit Extension*

The current Coronation Stage 5 pit is located approximately 7 km to the northwest of Macraes village on and to the immediate north of Taieri Ridge. The proposed Coronation Stage 6 Pit consists of an approximately 250 m expansion to the southeast, over exotic pine forest and pasture. This pit expansion will involve disturbing 11 ha of previously mined areas plus 14 ha of new disturbance. The expanded pit will be about 120 m deep, which is not as deep as the deepest part of the current Coronation 5 pit.

All waste rock from the proposed pit expansion will be placed as backfill within Coronation North Pit void covering 18.5 ha. No new disturbance is required for the disposal of waste rock from the Coronation pit extension.

Temporary stockpiles for rehabilitation soils will be formed in close proximity to the WRS for subsequent use.

No new infrastructure will be required as this is all in place currently for Coronation and Coronation North mining. Between the time of writing and commencement of the Proposal, some of this pit-related mining infrastructure (e.g. pit pumps, portable lighting) may be relocated to other parts of the mining operation and will need to be re-established to mine CO6.

At closure, dewatering of the CO6 pit will cease and the joined up Coronation stage 5 and 6 pits will slowly fill with water. The final CO5/6 pit lake will extend 500 m south of the Trimbells WRS. Surface and ground water flows are to be directed into the pit void to create the pit lake, along with seepage from the WRS. The resultant lake is not expected to be overflow for approximately 250 years.

The waste rock slopes will be shaped and revegetated progressively, using standard site rehabilitation techniques. Where possible, such as where the rock is soft or within the existing fill slope of Trimbells WRS, the cut or fill slopes above the final lake level will be shaped to provide a suitable lake edge, adequate for vegetation establishment.

The WRS slopes have been designed to blend into the surrounding topography as far as possible, but the slopes will frequently be less steep than some of the surrounding natural slopes in order to establish stable vegetation growth and minimise erosion damage.

In the final shaping of the WRS, slopes will be dozed down to a 3H:1V slope and rehabilitated back into pasture or other rural-based activities. For these areas and the completed WRS, this will include spreading the stockpiled topsoil and strippings, some of which will have been stockpiled.

3.3.4 *Realignment of Golden Bar Road*

The Macraes Road will need to be re-aligned in around 2028 after bulk filling of part of Frasers Pit and part of Innes Mills pit have been completed over a length of about 3000 metres.

The proposed nominally 150 m wide road corridor for the realignment of part of Macraes Dunback Road departs from the existing road formation to the north of the Top Tipperary Tailings Storage Facility and connects back to the existing road near Gay Tan cottage. From east to west the proposed road will pass to the north of Frasers Underground mine and over the former Frasers and Frasers West Pits which will be backfilled and support the new road formation. The proposed section of road corridor largely extends across land, modified, in some cases heavily, for mining activity. At the eastern end, the proposed corridor passes over retired farmland which includes some small forestry blocks and scattered trees. These trees will be removed to make way for the roading works.

The proposed realignment is approximately 650 m long. Starting from the western most extent and heading east

On the eastern side of the deep fill the road then turns gently to the north and ascends the natural topography through a series of cuts and fills before joining onto the current road adjacent to the Top Tipperary Tailings Storage Facility. Part of this section requires a new intersection with Golden Bar Road.

Several new culverts will be required to manage stormwater flows.

3.3.5 *Indicative Mining Schedule*

- 2023 to 2028: Innes Mills Open Pit mining
- 2027:Golden Bar Road realignment
- 2026 to 2027: Golden Bar Pit
- 2024-2026: Coronation Stage 6 Pit
- 2029-30: Start full site rehabilitation

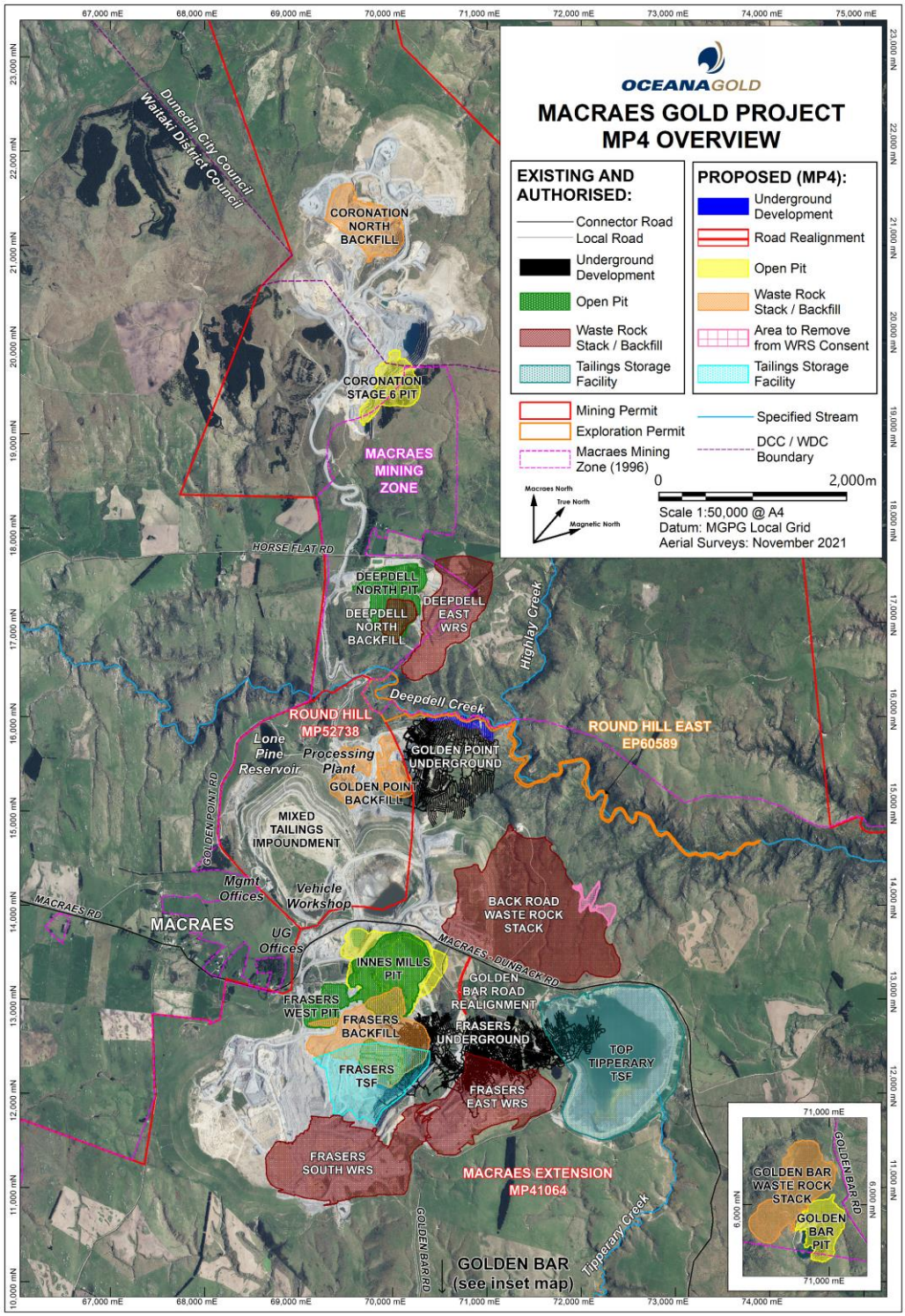

Figure 1. Locations of MP4 Project Components (Coronation Stage 6, Innes Mills, Golden Bar, Golden bar Road Realignment) in relation to existing OceanaGold projects.

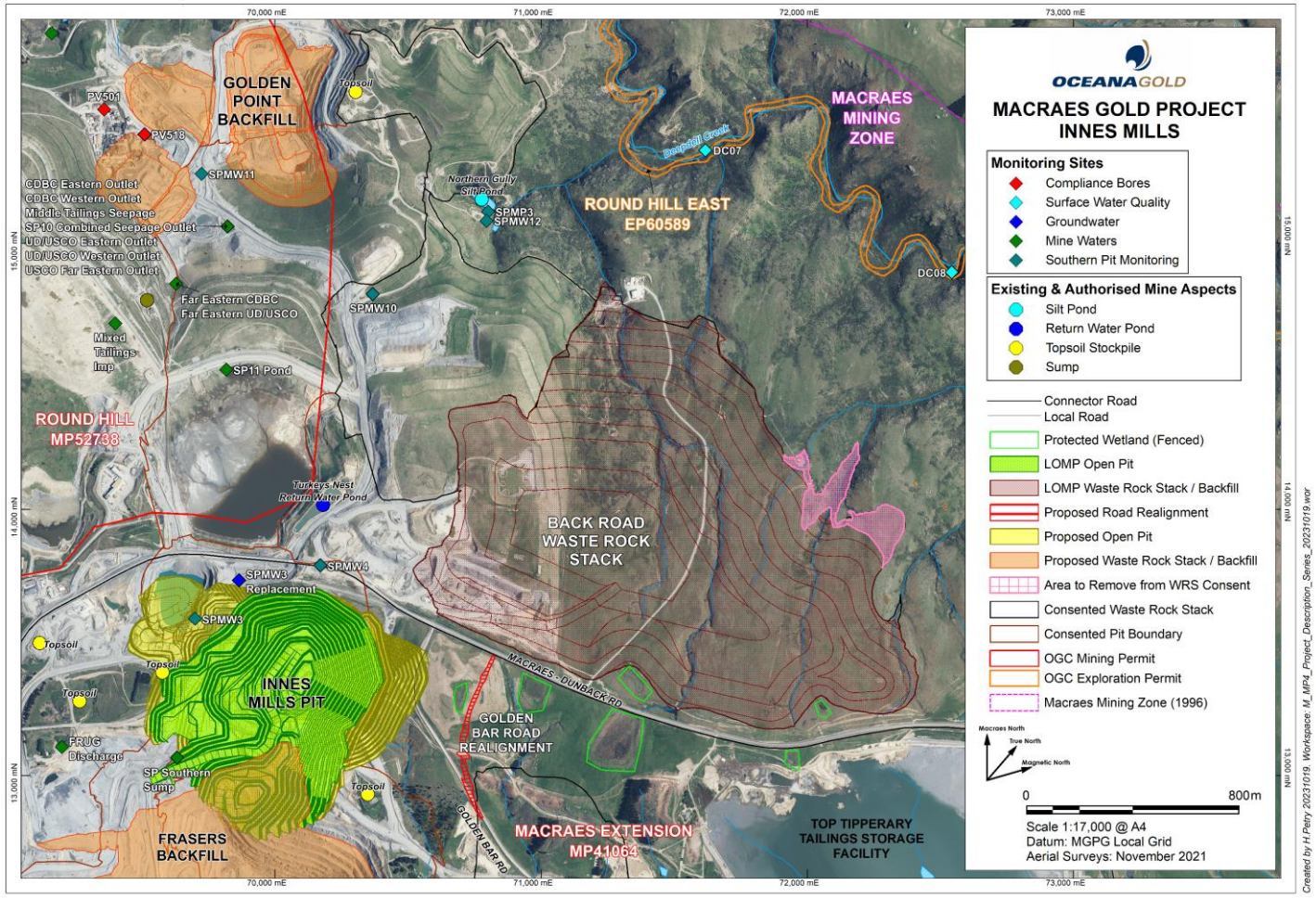

Figure 2. Locations of Innes Mills MP4 Project Components in the central project area.

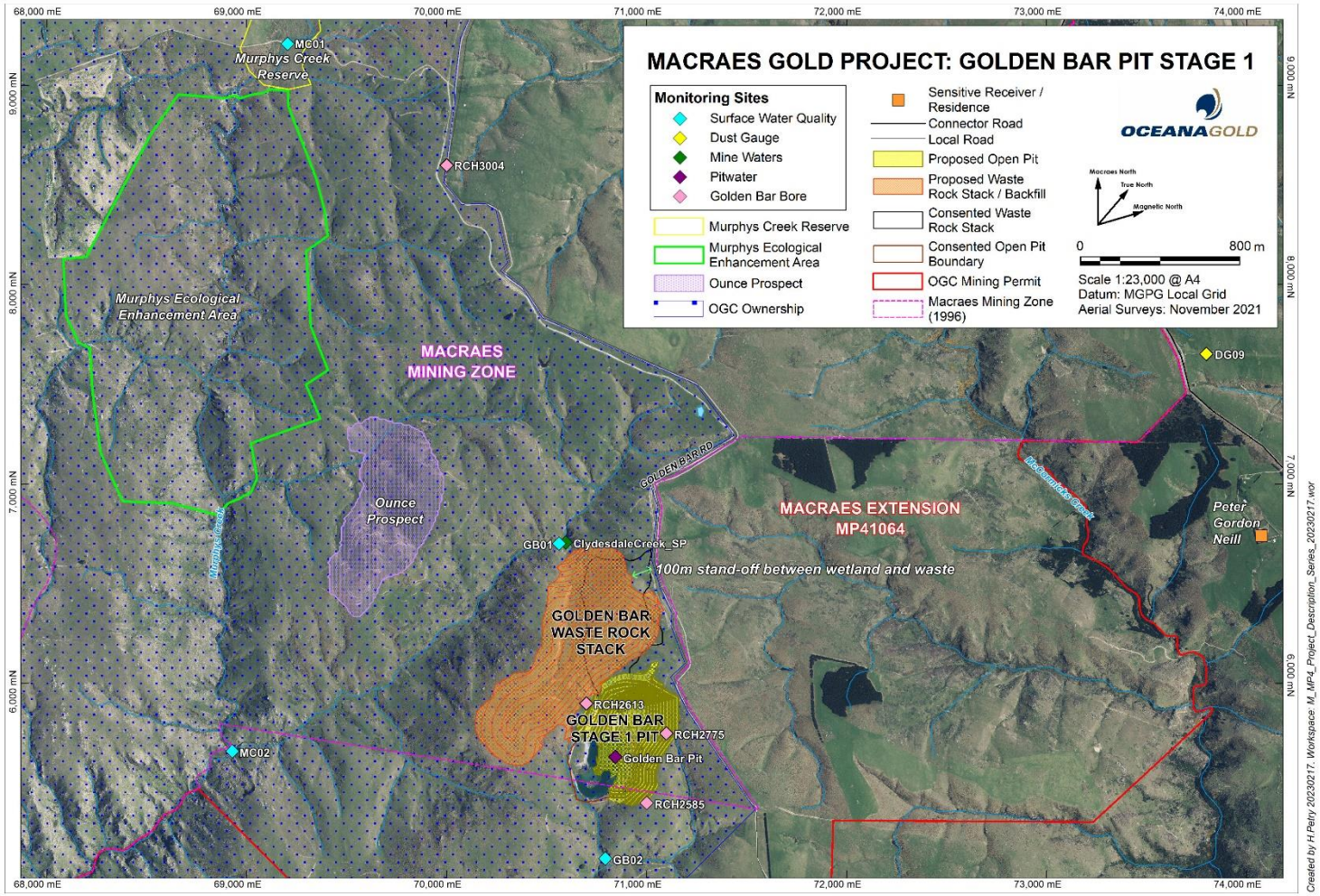

Figure 3. Locations of Golden Bar MP4 Project Components in the Golden Bar area.

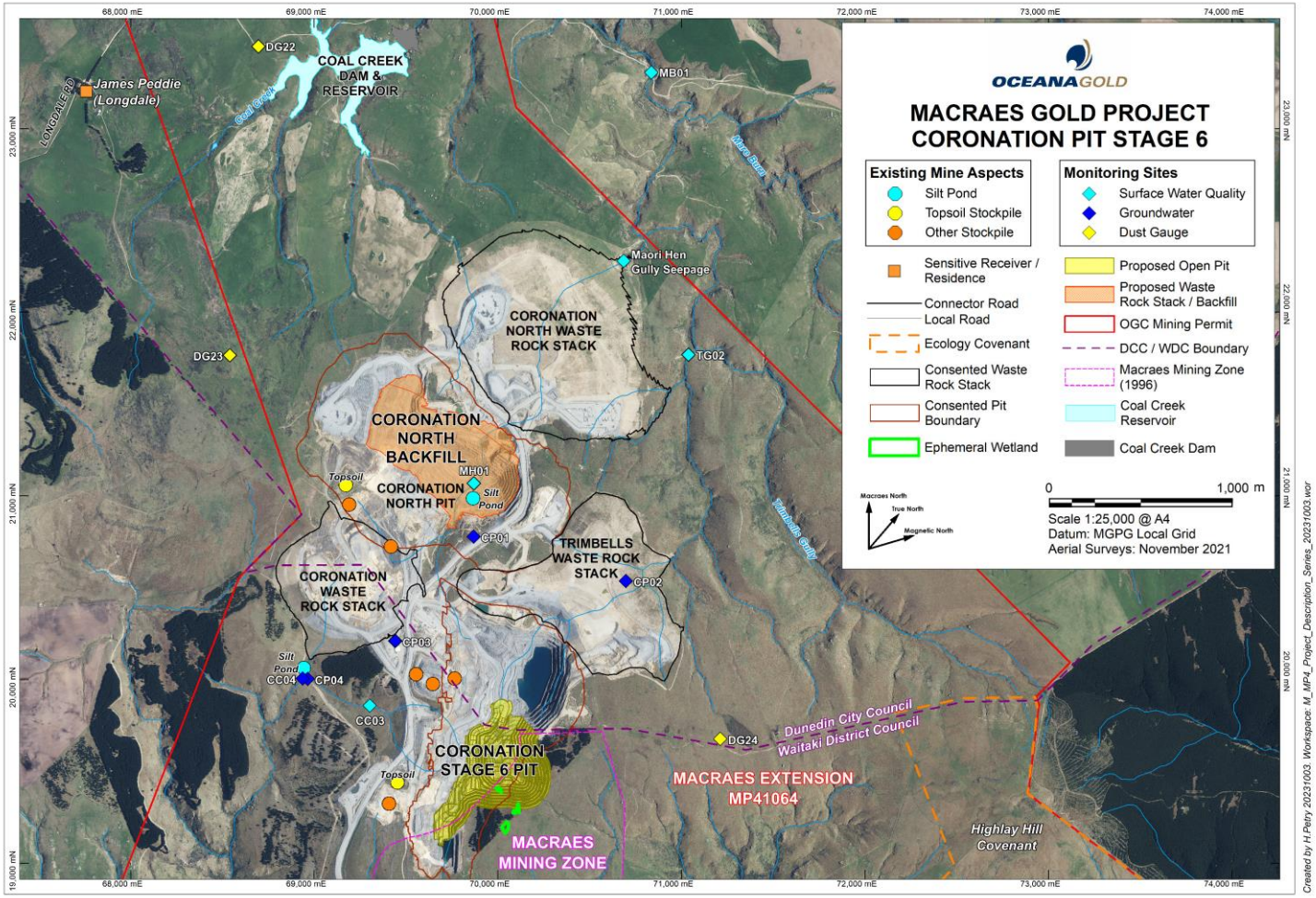

Figure 4. Locations of Coronation Stage 6 MP4 Project Components in the Coronation project area.

4 Methods

4.1 Scope of document

This document details the terrestrial vegetation and avifauna in the area of the MP4 Project and assesses the likely effects of the project on these ecological features. Separate reports cover the herpetofauna and invertebrate fauna.

Management of the project effects are described in the Impact Management Plan.

4.2 Boundary of ecological impact of the project

The ecological impact that arises from a project's activities includes the footprint of the planned project (the project area) but effects, for example dust 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. A 100 m buffer (as used in previous projects) has been used on the basis of the impact of project activities (Section 6), and the sensitivities of the ecological features at Macraes. Together, the footprint area and the buffer area comprise the Zone of Influence (ZOI) within which some impact on ecological features might be expected. At Macraes, some of the areas within the ZOI are already consented and therefore effects on those areas have already been considered and addressed.

The area outside of existing consents affected by MP4 is set out in Table 2. In summary:

- 101 ha is within the project footprint boundaries. This area will be subject to direct effects;
- 104 ha is within the 100 m wide buffer area which surrounds the project footprint and this area is subject to indirect effects.

There is an additional 328 ha within the ZOI which is already consented e.g. existing pits. See Figure 2, Figure 3, and Figure 4 for closer views of the project areas. 32 ha (28%) of the new area and 28 ha (31%) of the buffer are bare areas of existing or past mining activity undertaken under previous consents which are not mapped.

For the purposes of this document the Frasers Backfill, Frasers Waste Rock, Haul Road, (together the Frasers Tailings Storage Facility and Innes Mills Stage 9 and 10 Pits are combined into a single Frasers and Innes Mills (FrIM) project component as these features will have very

similar effects (being earthworks associated with excavation or deposition of rock) with large areas of overlap. The Golden Bar Pit and WRS and the Coronation 6 Pit and Coronation North Backfill are also combined into two project components (Golden Bar and Coronation 6) as the individual components will have similar effects and they are co-located in the same area.

Table 2. Area (in ha) of the project components. Note: the area of the project components sums to higher than the ZOI area resulting from overlap of some project components.

Project Component	Total Area (ha)	New Area (ha)
Coronation 6 Pit	25.0	5.5
Coronation North Backfill	37.6	0.1
Golden Bar Pit	22.7	22.7
Golden Bar Waste Rock Stack	48.0	48.0
Innes Mills Stage 9 Pit	5.6	3.47
Innes Mills Stage 10 Pit	5.9	5.88
Frasers Backfill	59.1	0
Frasers Waste Rock Stack	52.2	0
Golden Bar road realignment	1.2	1.1
Golden Point Backfill Buttress	49.4	14.2
Northern Gully WRS borrow	5.6	0

4.3 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), iNaturalist (www.iNaturalist.org.nz) and the author's unpublished database of plants observed in the Macraes area; invertebrate records on iNaturalist; reptile location records maintained by the Department of Conservation (DOC) in their Amphibian and Reptile Distribution Scheme (ARDS), bird location records maintained by eBird (www.ebird.org) and iNaturalist (https://inaturalist.nz/).

4.4 On-site survey methodology

The flora and birds of the ZOI (see Section 5), except for the area bordering the Golden Point Buttresses, were assessed using expert walk-through surveys, as it is considered that these are better at finding rare features compared to plot-based assessments. The area outside of existing mine areas bordering the Golden Point Buttresses was assessed from aerial photographs and a previous visit to the area by Mike Thorsen in 2021.

4.4.1 *Flora survey*

The main flora survey was undertaken by Mike Thorsen (Ahikā Consulting Ltd) on 24 April & 5 May 2022. Since then the scope of the MP4 project has been amended, however it has not increased the ZOI and therefore the survey results are still valid. During the flora survey all plant species (indigenous and exotic) were recorded during a walk-through survey of the ZOI. The survey path traversed what appear to be the most botanically interesting areas, and an estimate of each plant's abundance ZOI was made using the following criteria: I

- 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).

Following the initial site surveys the sites have been revisited on a number of times to inspect certain ecological features.

The locations of plant species or vegetation communities of interest were recorded using a hand-held GPS unit (accuracy ~5m).

Photographs of general vegetation patterns and sites of interest were taken (Appendix 3). The results of the flora survey are provided in Section 5.

To provide an estimate of percentage vegetation cover by indigenous species over the site, a Naturalness Index was calculated. This Index is calculated by first assigning each plant species an abundance value assigned during the site inspection. The abundance values used are: Rare = 2, Local = 3, Occasional = 5, Common = 7, Abundant = 10. The abundance values of all indigenous and exotic species encountered during this survey are then summed, and the Naturalness Index is calculated by dividing the summed abundance values for indigenous species divided by the sum of all abundance values of indigenous and exotic species combined. The Naturalness Index was applied only to the parts of the sites that are not transformed by past mining activity (such as WRS or pit construction). This Naturalness Index was then compared with results from nearby comparison sites.

4.4.2 *Avifauna survey*

Ahika have been surveying avifauna in the Macraes area since 2004. Bird species diversity and abundance, particularly of indigenous species, 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 ZOI, a record was made of all birds seen or heard during the day-time walkthrough surveys conducted by Kalinka Rexer-Huber (Parker Conservation) on 31 March (Innes Mills), 30-31 March (Golden Bar), 19 April (Coronation) 2022. The locations of species of interest were recorded using a hand-held GPS unit. The results of this survey are provided in Section 5.

4.5 The Permitted Baseline

This impact assessment is in consideration to the permitted baseline and current ecological condition of the area. The activities that are permitted in regional and district plans and that are known to occur within the project area and that are likely to be having some influence on the site's ecological condition are: farming activities such as grazing of stock, topdressing, pasture grass establishment and maintenance and vegetation clearance (up to extent specified in plans).

Consent is already held for extensive areas within the ZOI (Figure 5). Consent is also held for various activities as part of the MP3 project that may occur outside of the mapped consent areas. Application has also been made for the Innes Mills Stage 8 project, and this proposal addresses some of the ecological effects arising from the Innes Mills Stage 9 and Stage 10 projects.

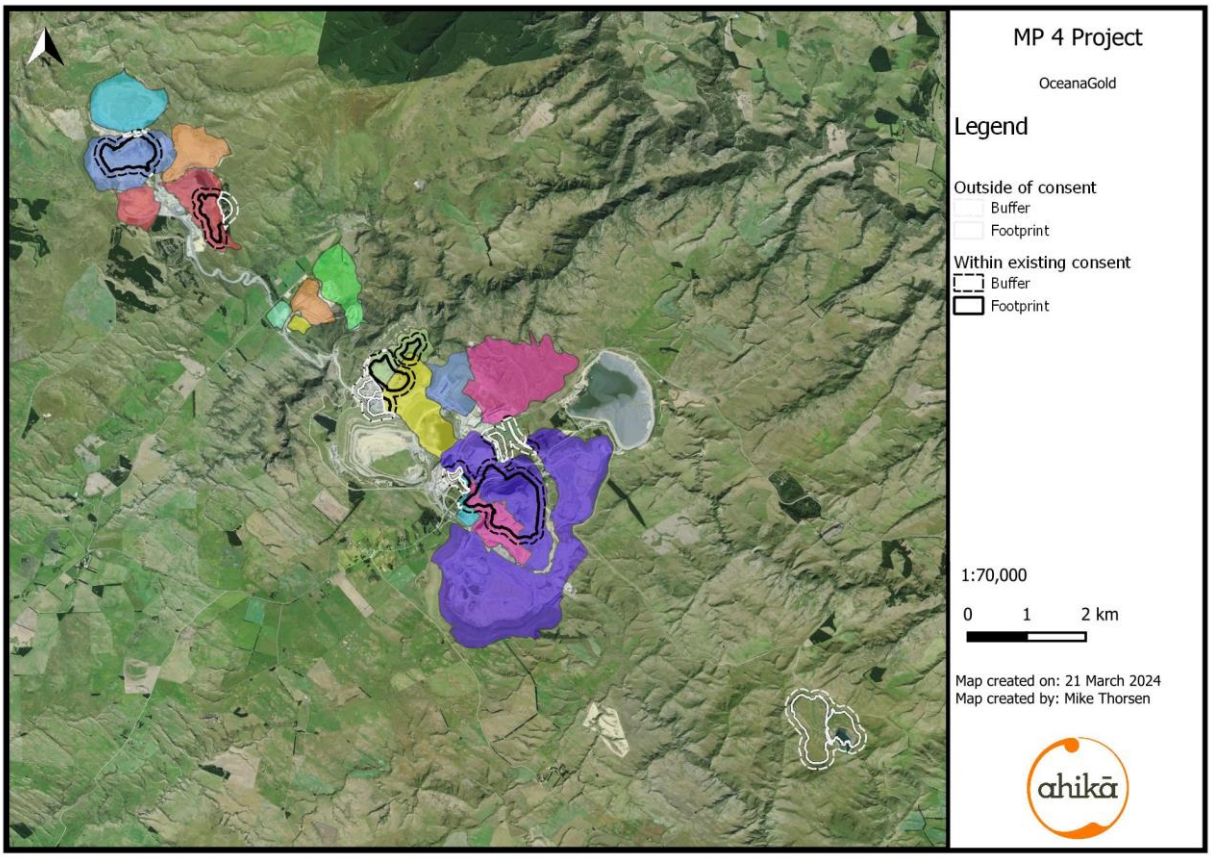

Figure 5. Extent of current consents (coloured) to the MP4 project components (black = overlying an existing consent, white = outside of an existing mapped consent, dashed lines represent 100 m buffer).

4.6 Ecological importance

The information that was gathered during the inventory surveys was used to evaluate the ecological importance of the vegetation and birds and their habitats within and surrounding the Project Impact Area (ZOI):

- 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 4, Table 5, Table 6 and supporting text in the Environment Institute of Australia and New Zealand (EIANZ) guidelines (2nd Edition, available at http://www.eianz.org/resources/publications) is provided in Section 6, and summarised in Table 9.

4.7 Assessment of effects

The impact of the project on the ecological features is assessed by considering the effects of the project activities (Section 6 for project components, Appendix 3 for rare flora and Appendix 4 for fauna; all project effects are summarised in Section 6.5), within the area identified as the ZOI (Section 4.2) against the current ecological condition and permitted baseline/existing environment. The magnitude of the effect on the ecological feature is assessed at both a local (within approximately 10 km of the site[2]) and national scale for rare flora and fauna based on

[2] This scale is used as much of the Macraes E.D. has not been explored (especially the southern half) and therefore effects at an Ecological District scale are difficult to quantify.

Table 8 of the 2018 EIANZ guidelines. The overall level of effect of the project on the ecological feature at the local scale is based on Table 10 of the EIANZ guidelines. An indication of the confidence in the assessment is provided.

Project Component-specific impacts are assessed in Section 6.1, and general effects are assessed in Section 6.2.

A summary of the project impacts is provided in Section 6.5.

4.8 Assessment against national, regional and local planning documents.

The ecological values of the sites and effects of the project components on these are evaluated against the biodiversity protection policies within the National Policy Statement for Indigenous Biodiversity (2023) (NPS-IB), National Policy Statement for Freshwater Management (January 2024) (NPS-FM), Partially Operative Otago Regional Policy Statement (POOPRS), the proposed Otago Regional Policy Statement (pORPS), the Waitaki and Dunedin City District Plans (WDP and DCDP, respectively) and the proposed 2nd Generation Dunedin City District Plan for Coronation 6 in Sections 5.9, for FrIM in Section 5.10, for the Macraes Road Realignment in Section 5.12, for the Golden Point backfill buttresses and excavation of the Northern Gully WRS in Section 5.11. Sites or features assessed as significant are summarised in Section 5.14.

4.9 Quality Assurance

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

4.10 Limitations

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, invertebrates, or plant 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 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. There is limited information on invertebrates.

Due to the limited period of the 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 companies or organisations and no guarantee can be made on the quality, comprehensiveness, or accuracy of that information.

5 MP4 Project Flora and Avifauna Ecological Values

5.1 General Ecological Setting

The MP4 project (Figure 1), located in the vicinity of Macraes township, is situated on the northern end of the Taieri Ridge (Coronation Site) or on a northern peneplain (Golden Point, FrIM, Golden Bar) in the Macraes Ecological District (E.D.), being one of two Ecological Districts that make up the Lammerlaw Ecological Region of Otago (Bibby 1997). The climate is moderate, with periodic snow-lie during winter and occasional summer drought. The topography of the area consists of rolling hill country with rounded ridge crests and shallowly to deeply incised drainage associated with the Otago peneplain of the Rakaia Terrane, which has probably been exposed since the late Miocene (Forsyth 2001). Rock outcropping is predominantly associated with drainage systems, with some tor formation on ridge crests. Underlying lithology is well foliated quartzo-feldspathic biotite greenschist and lesser chlorite schist, with occasional auriferous quartz reefs of Chlorite Subzone 3 and 4, Haast Schist Group, and areas of overlying Miocene to Quaternary sediments (Mutch 1963, McKellar 1966, Forsyth 2001). Soils are loess-derived hygrous Wehenga upland and high country yellow-brown earths.

The pre-human vegetation cover of the Macraes ED is thought to have comprised mainly dryland forest and shrubland (Bibby 1997). Montane short tussockland grading into subalpine tall tussockland, with areas of mixed hardwood and podocarp forest, kanuka forest and *Coprosma*-flax scrub (Bibby 1997) developed after much of the original vegetation cover was dramatically altered over the past c. 750 years as a result of anthropogenic factors (particularly repeated burning) (McGlone et al. 1995, 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 applying fertiliser (Whitaker 1996). The present vegetation of the Macraes ED is of a highly modified nature, with approximately 75% of the district dominated by exotic vegetation types (mainly improved pastureland). The remaining indigenous vegetation types are predominantly comprised of varying density narrow-leaved tussockland, copper tussock-based wetlands and grey shrubland interspersed with remnants of original forest cover and scattered ephemeral ponds (Bibby 1997, Thorsen pers. obs.). Loss of natural vegetation cover continues, particularly through ploughing of tussock grassland and planting of winter feed crops (Thorsen pers. obs.). The remaining indigenous vegetation communities currently present within the Macraes area are botanically diverse (Thorsen 2008) and are comprised of 621 indigenous plant species (including 17 Data Deficient, 82 At Risk and 30 Threatened species) and 236 exotic plant species, likely the highest per hectare diversity of

rare plant species of any area in New Zealand[3]. The vegetation communities present are likely to be derived from the original vegetation communities that existed prior to human colonisation of the region, but many are likely to be considerably reduced in extent and species diversity. Invasion by exotic shrub and tree species, particularly gorse and broom, and clearance of tussock grassland are increasing problems in the area.

Changes in vegetation extent in the Macraes E.D. between 2008 and 2012.

The extent of the vegetation communities in the Macraes E.D. is changing over time. Table 3 gives the estimated change in extent for the plant communities present in the ZOI. The plant communities showing the largest changes in extent over that time period are rough pasture (= low producing grassland in LCDB5) which has more than quadrupled in extent. In the Otago area (where analysis is available) the increase in extent of rough pasture has been a result of conversion of exotic forest and clearance of gorse and broom on farmland. The decrease in shrubland has mainly been due to conversion to exotic forest. Information is not available to meaningfully assess changes in the other vegetation communities.

Table 3. Changes in extent in the Macraes E.D. between 2012 and 2018 of the vegetation communities present in the MP4 ZOI based on LCDB5 mapping using rough Macraes E.D. A "?" denotes a vegetation community present in MP4 but which are not mapped in the Land Cover Database.

Vegetation Community	**Area within Macraes E.D. in 2012**	**Area within Macraes E.D. in 2018**	**% change in extent**
Ephemeral Wetland	?	?	?
Riparian vegetation	?	?	?
Rough Pasture[4]	17,976	90,421	403.0
Shrubland	4,525	4,284	-5.3

[3] This is partly at least a result of the multitude of surveys that have occurred in this part of the Ecological District by staff of the Department of Conservation involved in the grand and Otago skink programme and ecologists working on mining projects. For example, Dr Thorsen has contributed over 13,600 plant observations for the area since 2004.

[4] In Macraes areas mapped as this vegetation community frequently contain areas of degraded short-tussock grassland.

Tussockland	11,055	11,357	2.7

5.2 Notable Vegetation Communities and Protected Areas

The ZOI includes no Wetlands of Regional Importance or Ramsar sites and no sites were identified by Bibby (1997) as a Recommended Area for Protection (RAP). The ZOI contains no sites identified within District Plans as Significant Natural Areas by the Waitaki District Council or Areas of Significant Biodiversity Value by the Dunedin City Council.

5.2.1 *Natural Inland Wetlands*

Two ephemeral wetlands at Coronation 6 are considered as natural inland wetlands as defined in the NPS-FM (Wetland Coro3 0.04 ha and Wetland Coro4 0.16 ha; plot data provided in Appendix 6, see Figure 6). A third ephemeral wetland site (Wetland Coro2 0.02 ha) is now dominated by exotic pasture species (0% dominance score, Prevalence Index 3.4) and is not considered a natural inland wetland under the pasture exclusion criteria.

A 0.49 ha ephemeral wetland within 20 m of the indicative location of the Golden Bar Road realignment is also considered a natural inland wetland due to the predominance of wetland indicator species in the annual site inspection data. This wetland (Protected Wetland 6) was fenced to exclude cattle as part of the MP3 consent.

Two areas in the buffer of Innes Mills 10 are considered natural inland wetlands as defined in the NPS-FM based as a Rapid Test visual assessment of the vegetation shows that it is dominated by species classified as OBL or FACW, there is little presence of listed pasture species, there are visible signs of a high water table such as moist soils and high bryophyte cover and it occurs in a gully head above where it would be classified as a river.

5.2.2 Indigenous vegetation associated with Threatened land environments (defined by Land *Environments of New Zealand at Level IV) that have ≤20% remaining in indigenous cover (Ministry for Environment and Department of Conservation 2007, Walker et al. 2007, 2015).*

The Threatened Environment Classification (TEC) (Walker 2012) combines data from three national databases – the Land Environments New Zealand (LENZ), the Land Cover Database (LCDBv4.0), and the national protected areas network (as at 2012) into a six-category map of NZ. 'Threatened land environments (categories 1–5) are those environments in which either much (<30%) of the original indigenous cover remains and/or low proportions (<20%) of land is legally protected. Category 6 includes environments in which indigenous cover has been less reduced (>30% of indigenous cover remains) and more than 20% of the land area is protected. The TEC is used to provide information on the loss and protection context of indigenous biodiversity components within the ZOI.

Four Level IV LENZ categories underlying areas with a cover of indigenous vegetation are present in the new area of the ZOI (Table 4), three of which are currently classified as Threatened Land Environments: TEC 1 (< 10% indigenous cover left) LENZ N3.1e, TEC 2 (10-20% indigenous cover left) LENZ Q4.3b and TEC 3 (20-30% indigenous cover left) LENZ Q4.3a. These three threatened land environments are widely distributed in the Macraes area and the MP4 project components are situated in extensive areas (Figure 6).

Table 4. Threatened Environment Classifications in the new area of the ZOI where indigenous vegetation occurs. All areas are given in hectares.

Project Component	Land Environment	Protection Class	Protection Description	Ephemeral wetland	Riparian vegetation	Rock tor	Shrubland	Tussockland
Coronation 6 Pit	**N3.1e**	1	< 10% indigenous cover left	0.02	0.02	0		7.6
Golden Bar Pit	**N3.1e**	1	< 10% indigenous cover left		0.03	0.01		3.16
Golden Bar Pit	**Q4.3a**	3	20-30% indigenous cover left					1.16
Golden Bar Road realignment (indicative) Buffer	**N3.1e**	1	< 10% indigenous cover left	0.44	0.22			0.52
Golden Bar Road realignment (indicative)	**N3.1e**	1	< 10% indigenous cover left		0.02			0.06
Coronation North Backfill	**N3.1e**	1	< 10% indigenous cover left					0.05
Innes Mills Stage 10 Pit	**N3.1e**	1	< 10% indigenous cover left					0
Innes Mills Stage 9 Pit	**N3.1e**	1	< 10% indigenous cover left		0.07		0.05	0.21
Golden Bar Waste Rock Stack	**N3.1e**	1	< 10% indigenous cover left		0.13	0.03	0.06	13.35
Golden Bar Waste Rock Stack	**Q4.3a**	3	20-30% indigenous cover left					6.43
Golden Bar Waste Rock Stack	**Q4.3b**	2	10-20% indigenous cover left		0.65			3.18
Coronation North Backfill Buffer	**N3.1e**	1	< 10% indigenous cover left					1.13
Coronation 6 Pit Buffer	**N3.1e**	1	< 10% indigenous cover left	0.1	0.1	0		5.76
Coronation 6 Pit Buffer	**Q3.3c**	6	> 30 % left and > 20% protected					0.11
Golden Bar Pit Buffer	**N3.1e**	1	< 10% indigenous cover left		0.11	0.01	0.03	4.54
Golden Bar Pit Buffer	**Q4.3a**	3	20-30% indigenous cover left		0.01	0		6.64
Golden Bar Pit Buffer	**Q4.3b**	2	10-20% indigenous cover left					0.07
Golden Point Backfill Buttress Buffer	**Q4.3b**	2	10-20% indigenous cover left				0.25	
Innes Mills Stage 10 Pit Buffer	**N3.1e**	1	< 10% indigenous cover left		0.01			

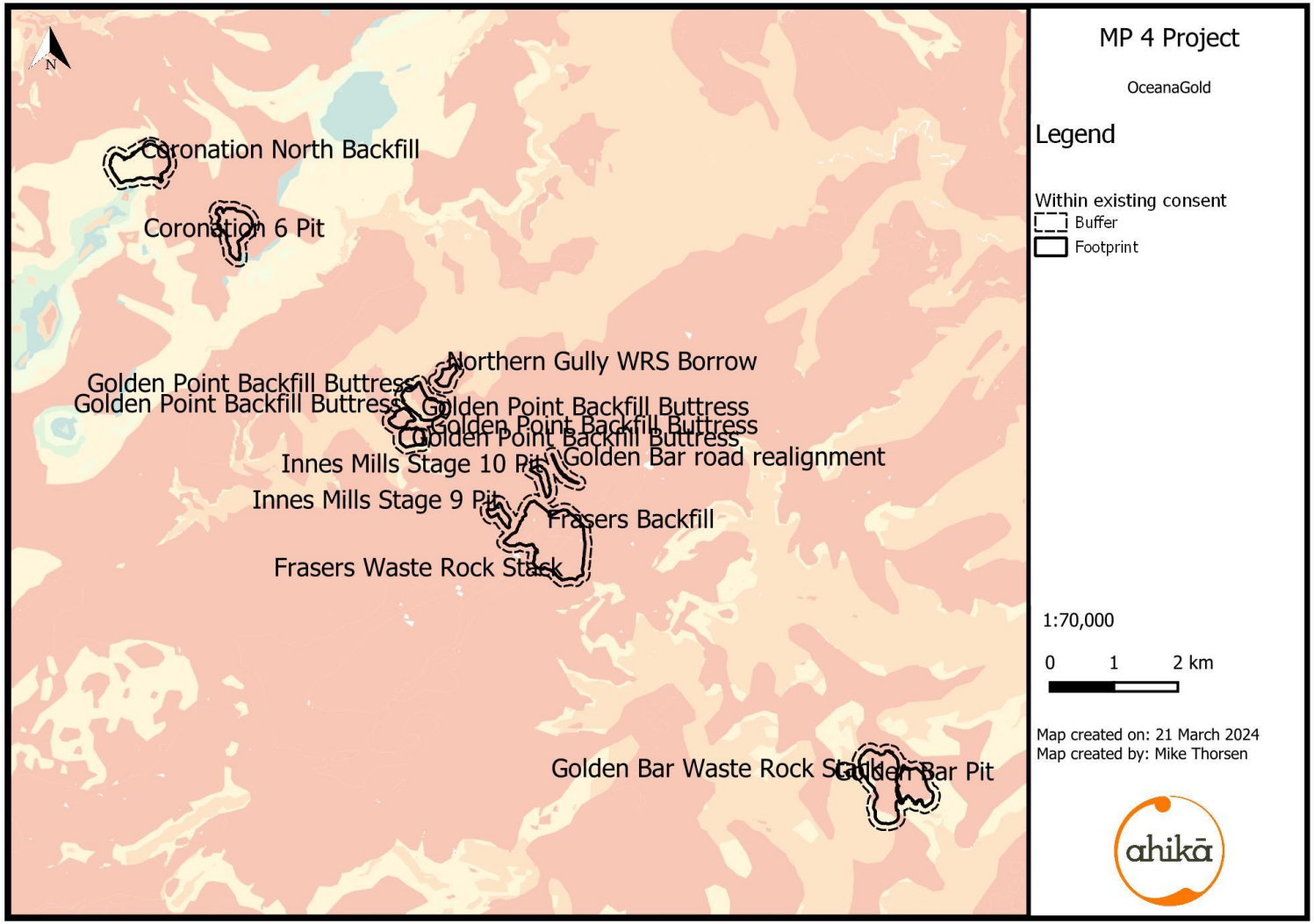

Figure 6. Threatened Environment Threat Classifications in the vicinity of the MP4 project.

5.2.3 *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 footprint and buffer at Coronation 6, buffer of Innes Mills Stage 10 and buffer of Golden Point Road realignment include two vegetation communities that are a National Priority for Protection: the ephemeral wetlands and wetlands.

5.2.4 *Indigenous vegetation associated with 'Naturally Uncommon or 'Threatened' terrestrial ecosystem types (Ministry for Environment and Department of Conservation 2007, Williams et al. 2007, Holdaway et al. 2012).*

The footprint and buffer at Coronation 6, buffer of Innes Mills Stage 9/10 and buffer of Golden Point Road realignment includes one wetland vegetation community that is Naturally Uncommon (= Historically Rare): the ephemeral wetlands, which are a Critically Endangered Threatened ecosystem. Two of the three examples at Coronation 6 Pit have been largely dewatered and are now largely comprised of exotic plant species.

5.3 Land cover and vegetation communities within the ZOI

Land cover within the ZOI includes farm infrastructure, mine workings and rehabilitated Waste Rock Stacks and nine broad vegetation communities, including wetlands, ephemeral wetlands, pasture (improved and rough), pine forest (standing and felled), ponds, riparian vegetation, shrubland and tussockland and small areas of shelter belt amenity plantings (Table 5, Figure 7, Figure 8, Figure 9). Areas mapped as semi-natural or natural vegetation communities in total cover 36 ha (13% of project footprint) and exotic dominated plant communities cover 45 ha (16% of project footprint), the remainder is mine workings. Existing or recent mining covers 196 ha (70%) of the project footprint. In the new area, semi-natural or natural vegetation communities cover 32 ha (31%) of project footprint and, exotic dominated plant communities cover 44 ha (43% of project footprint), the remainder being existing mine workings covering 28 ha (28%) of the project footprint. Much of the mine workings are active and consist of large areas of bare rock and rubble. Some WRS are rehabilitated to exotic pasture consisting of primarily browntop and

cocksfoot and part of the original Golden Bar WRS has had some tussock planted. Descriptions of the semi-natural vegetation communities are provided in the Project Component section.

Some extensive areas of cultivated plant communities are present. Of the exotic vegetation, exotic pasture (including shelter belts) is present in many places over much of the ZOI. Exotic pastures are comprised mainly of browntop, *Bromus hordaceus, Lolium perenne, Erodium cicutarium, Rumex acetosella, Dactylis glomerata* and *Hypochoeris radicata*. Shelter belts are present in some areas near farm infrastructure in the buffer of the central project area. Felled and standing pine plantation of mainly *Pinus radiata* but with occasional Douglas fir *Pseudotsuga menziesii* are present in the Coronation 6 Pit. These vegetation communities are not known to harbour many indigenous plant species but do provide habitat for some common exotic bird species and the cultivated pasture may be used for foraging by common and widespread indigenous birds such as harrier hawks, paradise shelduck, black-backed gull and spur-winged plover. The farm ponds and Coronation and Golden Bar pit lakes are used by several waterbirds.

Table 5. Landcover within the project footprint areas[5]

Project Component	Area of Project Component	Mine Workings	Rehabilitated Waste Rock Stack	Pine Forest	Pine Forest (felled)	Improved Pasture	Rough Pasture	Pond	Tussockland	Rock Tor	Shrubland	Riparian Vegetation	Ephemeral Wetland	Indigenous Vegetation	%
Coronation 6 Pit	25.0	13.2	0.0	0.0	4.1	0.0	0.0	0.0	7.6	0.00	0.00	0.02	0.06	7.7	31
Coronation North Backfill	37.6	37.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.00	0.00	0.00	0.0	0.1	0
Golden Bar Pit	22.7	9.6	8.6	0.0	0.0	0.0	0.1	0.1	4.3	0.01	0.00	0.03	0.0	4.4	19
Golden Bar Waste Rock Stack	48.0	0.2	23.8	0.0	0.0	0.0	0.1	0.1	23.0	0.03	0.06	0.78	0.0	23.8	50
Innes Mills Stage 9 Pit	5.6	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Innes Mills Stage 10 Pit	5.9	2.0	0.0	0.0	0.0	3.6	3.2	0.0	0.2	0.00	0.00	0.27	0.0	0.5	8
Frasers Backfill	59.1	59.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Frasers Waste Rock Stack	52.2	52.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Golden Bar road realignment	1.2	0.3	0.0	0.0	0.0	0.3	0.3	0.0	0.1	0.00	0.00	0.00	0.0	0.1	5
Golden Point Backfill Buttress	49.4	48.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Northern Gully WRS borrow	5.6	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Quantity in MP4 Footprint	**280.8**	**196.0**		**0.0**	**4.1**	**4.0**	**3.6**	**0.2**	**35.2**	**0.04**	**0.06**	**1.10**	**0.06**	**35.3**	**13**
Coronation 6 Pit Buffer	27.1	17.3	0.0	0.0	3.7	0.0	0.0	0.0	5.9	0.00	0.00	0.10	0.2	6.1	23
Coronation North Backfill Buffer	30.5	29.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.00	0.00	0.00	0.0	1.1	4

[5] The footprints of some project components overlap. All areas are given in hectares.

Golden Bar Pit Buffer	20.1	4.6	4.1	0.0	0.0	0.0	0.0	0.0	11.2	0.02	0.03	0.12	0.0	11.4	57
Golden Bar Waste Rock Stack Buffer	32.8	1.3	6.4	0.0	0.0	0.0	0.3	0.0	24.7	1.37	0.03	0.00	0.0	26.1	79
Innes Mills Stage 10 Pit Buffer	16.3	8.3	0.0	0.0	0.0	4.6	6.9	0.0	0.7	0.00	0.00	0.25	0.1	1.0	6
Innes Mills Stage 9 Pit Buffer	15.6	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Frasers Backfill Buffer	26.5	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Frasers Waste Rock Stack Buffer	24.4	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Golden Bar road realignment buffer	16.6	2.6	0.0	1.0	0.0	7.5	4.6	0.0	0.3	0.00	0.00	0.20	0.7	1.2	7
Golden Point Backfill Buttress Buffer	61.1	54.6	5.8	0.0	0.0	0.0	0.5	0.0	0.0	0.00	0.25	0.00	0.0	0.3	0
Northern Gully WRS borrow buffer	13.9	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0
Quantity in 100 m buffer	**252.5**	**153.1**	**13.5**	**1.0**	**3.7**	**11.9**	**12.0**	**0.1**	**42.9**	**1.39**	**0.23**	**0.68**	**0.18**	**27.8**	**11**
Total	**533.3**	**349.1**	**13.5**	**1.0**	**7.8**	**15.8**	**15.6**	**0.2**	**78.1**	**1.43**	**0.29**	**1.78**	**0.24**	**63.1**	**12**
% of ZOI		65	3	0	1.5	3	3	0.0	15	0.27	0.05	0.33	0.05	12	

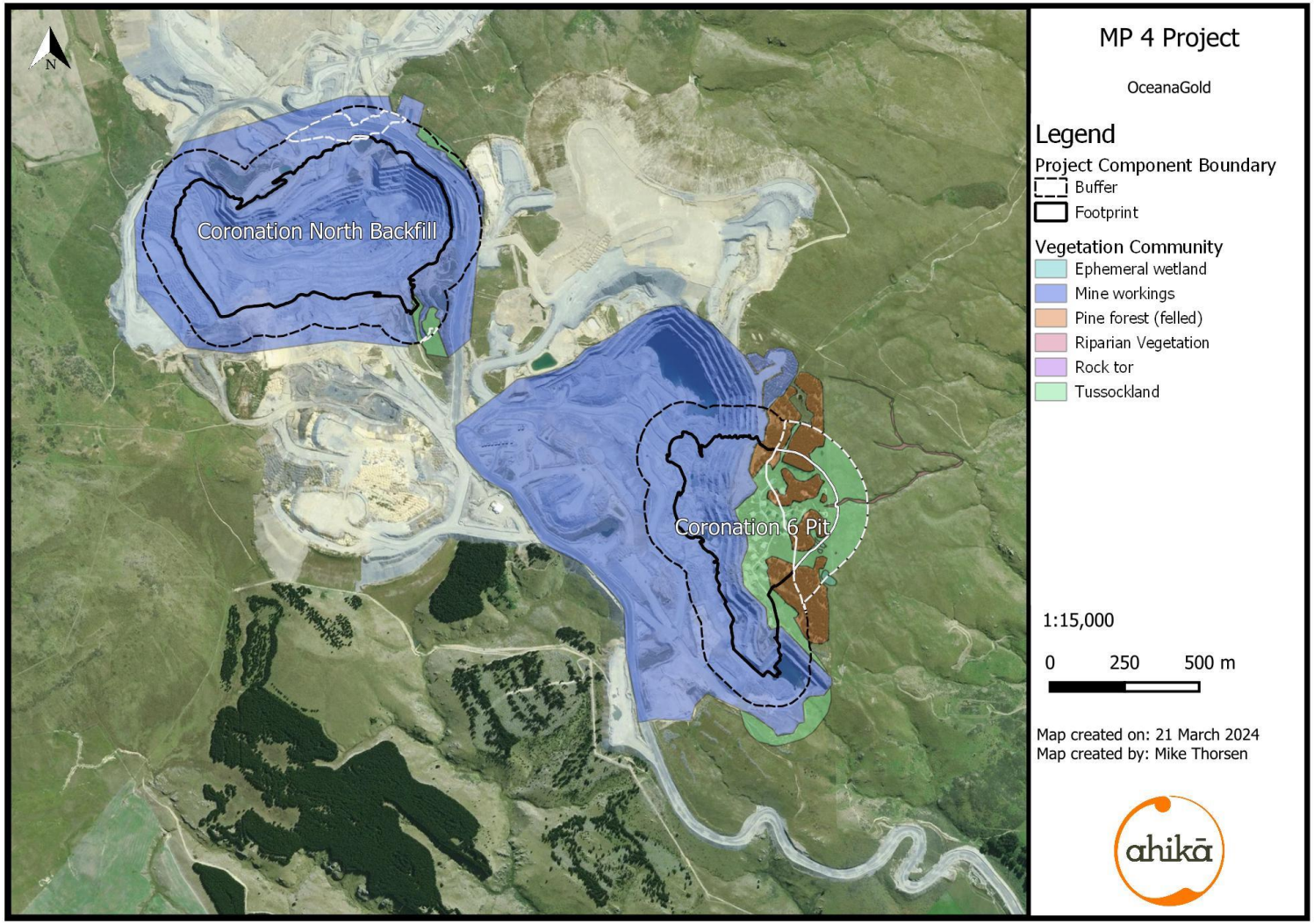

Figure 7. Landcover within the Coronation 6 ZOI. Project Component boundary outlined in dark grey, new areas outlined in white.

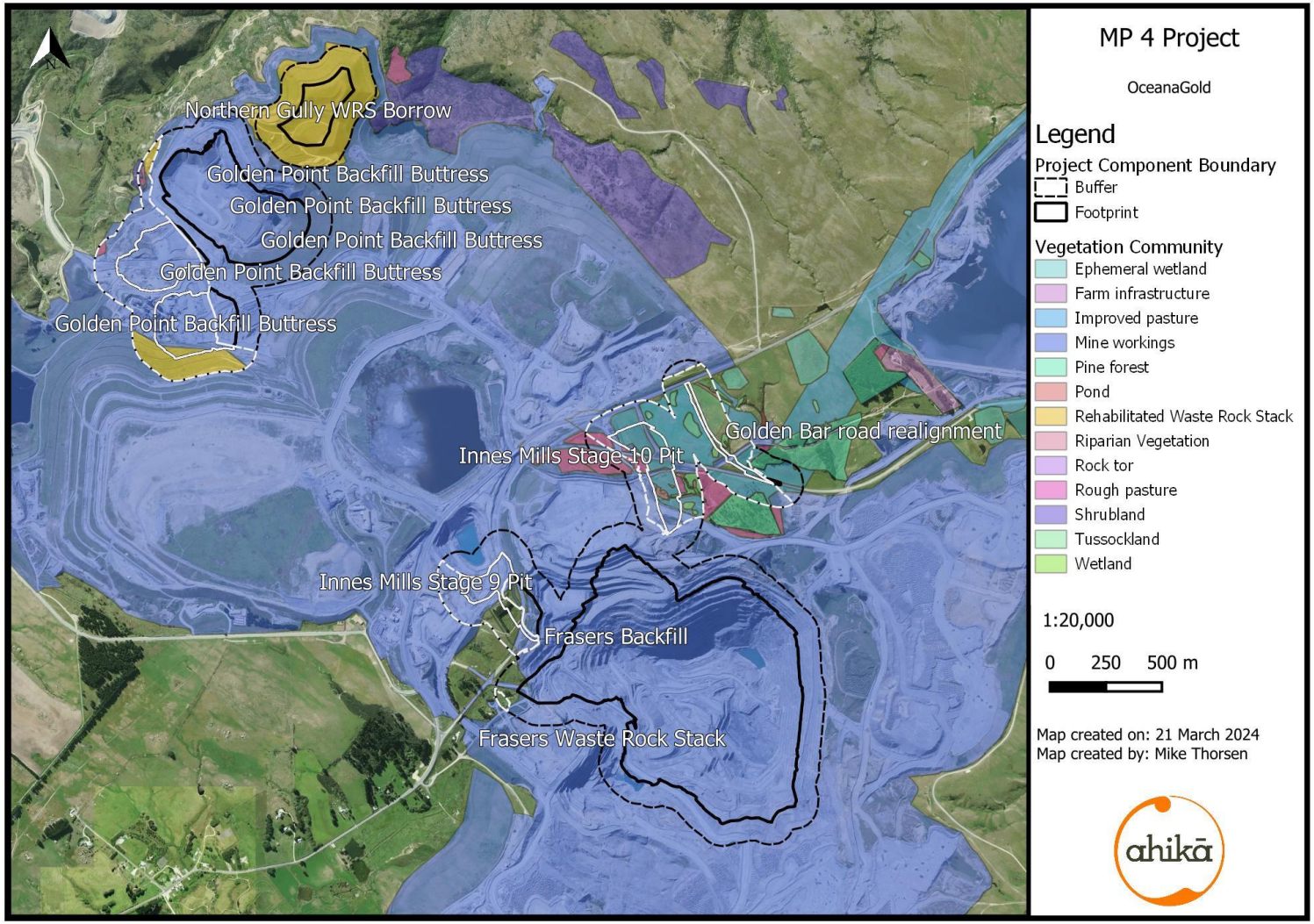

Figure 8. Landcover within the central ZOI. Project Component boundary outlined in dark grey, new areas outlined in white.

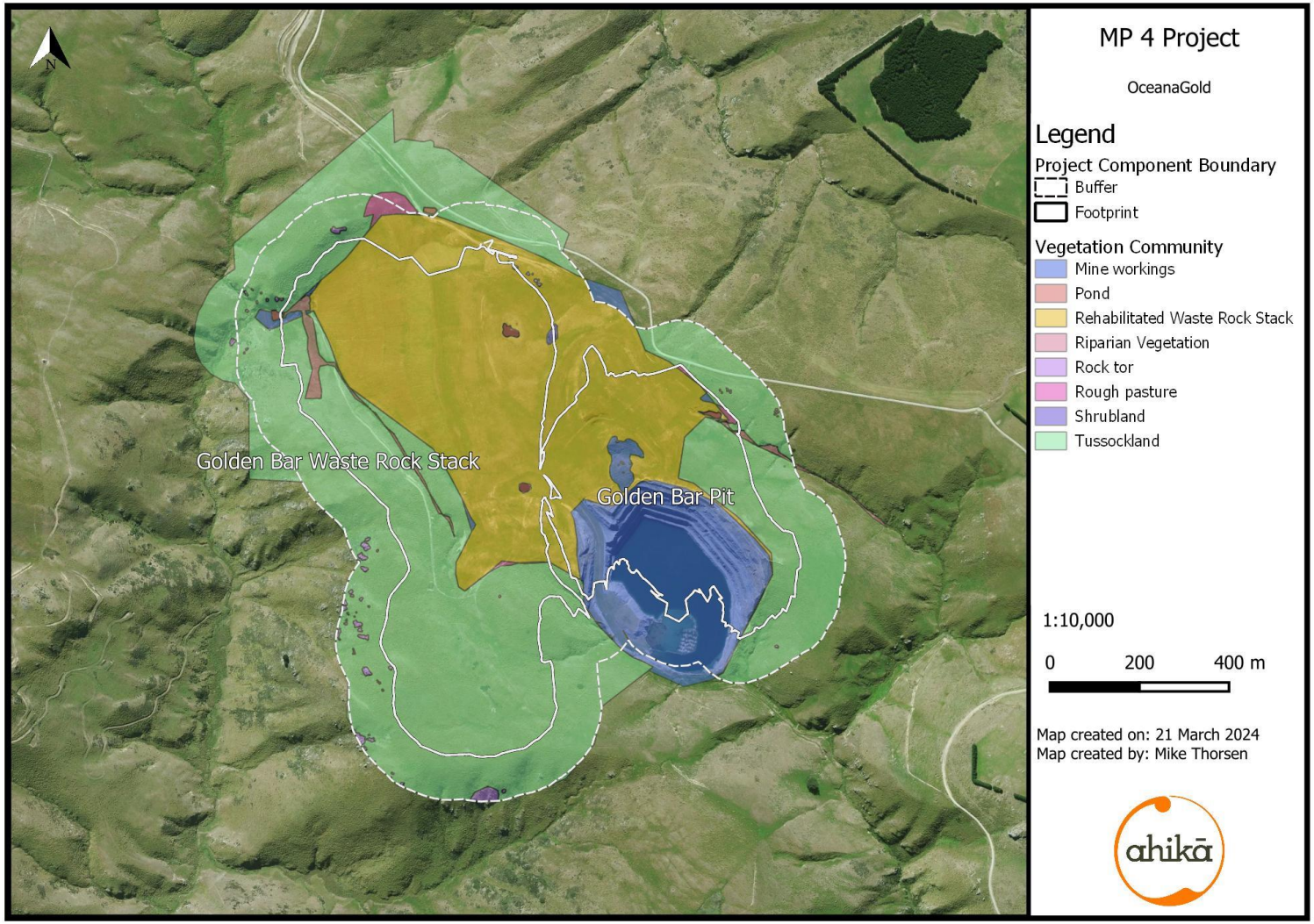

Figure 9. Landcover within the Golden Bar ZOI. Project Component boundary outlined in white (all new area).

5.4 Vegetation representativeness & pattern

The riparian vegetation community such as that present at Golden Bar and Coronation is not classified by Singers and Rogers (2014). It is likely to occur in other lowland gully areas in the Macraes E.D. This vegetation community at Golden Bar is inhabited by 6 plants of the At Risk - Declining willowherb *Epilobium insulare*. This vegetation community in the ZOI is modified by exotic species.

The ephemeral wetland vegetation community is classified by Singers and Rogers (2014) as WL14: Herbfield [Ephemeral wetland]. Various forms of ephemeral wetlands are found throughout New Zealand, though those formed in depressions in schist bedrock are restricted to Central Otago (Johnson and Rogers 2003). Schist-based ephemeral wetlands are most common in the Strath Taieri area and are particularly grouped in the Redbank Scenic Reserve, Paddy's Rock, Cranky Jims, Sutton and Styx areas. Mapping of the ephemeral wetlands in the Macraes E.D. for the Deepdell North Project in 2019 located 310 ephemeral wetlands in the upper area of the District and a further 172 potential sites. The examples in the MP4 area are considered short-inundation subtype in that their profile is so shallow that water is not retained during the driest periods of the year. Ephemeral wetlands are mainly under threat from invasion by exotic plants and cattle pugging. It is thought that sheep grazing is beneficial to this vegetation type by reducing competition from taller plants that tend to also be exotic species.

Narrow-leaved tussock grassland is not classified by Singers and Rogers (2014) but is a human-induced analogue of AL1: Narrow-leaved and slim snow tussock tussockland/shrubland. Narrow-leaved tussock grassland is present in many places in the Macraes E.D. and is very extensive in some localities. It is being lost, particularly from lower altitude sites, due to conversion to pasture and winter feed crops.

The shrubland vegetation community is not classified by Singers and Rogers (2014). It may be a fire- and grazing-induced community derived from assemblages that would have naturally occurred on cooler semi-arid slopes such as CDF2: *Dracophyllum*, mountain celery pine, *Olearia*, *Hebe* scrub [subalpine scrub], T12: Kanuka, *Olearia* scrub/treeland, or AL1: Narrow-leaved and slim snow tussockland/shrubland. The shrubland in the MP4 project area is probably anthropogenic, being created following early Māori burning of eastern South Island dryland forest (McGlone 1989) followed by repeated burning and fertiliser application of narrow-leaved tussock grassland and is well represented on lower-elevation hillslopes of Central Otago, though its extent is being reduced by conversion to pasture, invasion by exotic shrubs (particularly broom) and, in places, repeated burning.

The wetland vegetation community such as that present in the Innes Mills Stage 10 buffer is not classified by Singers and Rogers (2014). It is likely to occur at site in other lowland gully areas in the Macraes E.D. This vegetation community in the ZOI is dominated by exotic species.

5.5 Ecological integrity

The ZOI is part of a mosaic of natural and exotic vegetation communities that are found throughout the wider Macraes area. Several of the natural vegetation communities in the Macraes E.D. are decreasing in extent due to conversion to pasture. They are also being degraded through weed invasion, which is being facilitated by repeated burning, changes in stocking, and fertiliser application. However, some vegetation communities such as low-producing grasslands and shrublands may be increasing in areas within the E.D. as a result of less intensive farm management. 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.

Overall, the vegetated area of the ZOI has a Naturalness Index of 0.50 (i.e., approximately 50% of the area is covered by indigenous species). Few areas within the ZOI are reasonably ecologically intact, the exceptions being the small area of shrubland at Golden Bar and the tussocklands at Golden Bar and east of the fence at Coronation 6. There is some impact in most areas from ongoing grazing by sheep and cattle. The ZOI is likely to be playing some role in supporting a metapopulation of some plant species, but the extent and type of this role is unknown and likely to vary between species. To some extent the outer margin of the ZOI buffers the surrounding vegetation from mining effects.

5.6 Botanical diversity

The botanical diversity of the ZOI is moderate in relation to similar habitats within the E.D., with 128 indigenous species and 69 exotic species being recorded within the 513 ha footprint (Table 6). This relatively lower botanical diversity (for the area) is due to the large areas of pastoral land and mine workings in the ZOI, as the number of species hectare^{-1} is lower than within some

of the OceanaGold covenants (Table 6). The total botanical diversity of the ZOI represents 23% of the 857 known plant species and 21% of the 621 indigenous species known by the author from the Macraes area.

Table 6. Comparison of botanical diversity and naturalness at sites within the Macraes area

Site	Area (hectares)	# indigenous species	# exotic species	Indigenous species / hectare^{-1}	Naturalness Index
MP4	513	101	62	0.6	0.5
Deepdell North	109.4	71	78	0.6	0.40
Coronation North ZOI	494	175	78	0.4	0.62
Cranky Jims Shrubland Covenant	47.1	98	39	2.1	0.65
Cranky Jims Wetland Covenant	97.3	92	40	0.9	0.61
Deepdell Tussock Covenant	109.8	108	37	1.0	0.72
Highlay Creek Covenant	16.9	52	47	3.1	0.55

5.7 Threatened, At Risk, or uncommon species

5.7.1 *Flora*

No Threatened plant species are known to occur within the ZOI. Fourteen plant species that occur within the ZOI are either currently classified as At Risk or Data Deficient (Townsend et al. 2007, de Lange et al. 2018), or are thought to be locally uncommon in the Macraes E.D. based on the author's observations (Table 7, Figure 10, Figure 11, Figure 12). Five are At Risk – Declining, five are At Risk - Naturally Uncommon, two are Data Deficient and two species are considered uncommon within the E.D. (Table 7). Other species have been known from these areas historically, but are not known to be currently present, or have been mapped in the original source datasets as occurring at this location.

5.7.2 *Avifauna*

One of the ten indigenous bird species is classified as Threatened (NZ falcon) and two as At Risk (pipit, banded dotterel) (Table 7).

Table 7. Threatened, At Risk and Uncommon species known from ZOI.

Species	Common Name	Threat Status	Coronation 6	FrIM	Golden Bar
Falco novaeseelandiae	Falcon	Threatened – Nationally Vulnerable			A pair of falcon include the Golden Bar areas within their territory, but are not thought to be nesting there.
Anthus novaeseelandiae	NZ pipit	At Risk - Declining	Multiple pairs of pipit are present at all project sites within the ZOI including improved pasture and rehabilitated WRS		
Charadrius bicinctus	Banded dotterel	At Risk - Declining	Two pairs breeding on Trimbells WRS (part of Coronation WRS) and nearby		
Carmichaelia petriei	Desert broom	At Risk – Declining			This leafless broom was recorded at several sites in the Golden Bar areas where c. 100 plants are present.
Deschampsia cespitosa	A wetland grass	At Risk - Declining	Three plants of this grass were recorded in the Coronation 6 Pit on the margin of a degraded and partly dewatered ephemeral wetland.		
Discaria toumatou	Matagouri	At Risk – Declining			Matagouri was recorded at multiple sites and in large numbers in the Golden Bar Pit and WRS areas
Epilobium insulare	A wetland willowherb	At Risk – Declining			This wetland willowherb was recorded as 6 plants at two closely located sites in the Golden Bar WRS area.

Species	Common Name	Threat Status	Coronation 6	FrIM	Golden Bar
Mentha cunninghamii	Native mint	At Risk – Declining			This herb was recorded at one site in the buffer of the Golden Bar WRS where a 50 cm^2 patch is present at the base of a rock outcrop.
Agrostis pallescens	A wetland grass	At Risk – Naturally Uncommon	This small wetland grass was recorded in three ephemeral wetlands in the Coronation 6 Pit and buffer covering 506m^2.		
Cardamine grandiscapa	A bittercress	At Risk – Naturally Uncommon			Three individuals of this small cress were recorded in a rockfall in the Golden Bar WRS buffer.
Celmisia hookerii	Hooker's mountain daisy	At Risk – Naturally Uncommon			This cliff daisy was recorded as scattered plants and large groups of up to 100 plants on rocky outcrops in the west of the buffer of Golden Bar WRS.
Gingidea grisea	A cliff dwelling herb	At Risk – Naturally Uncommon			This herb was recorded as c. 6 plants on a rock outcrop in the buffer of Golden Bar WRS.
Juncus distegus	A wetland rush	At Risk – Naturally Uncommon			This rush was recorded as 6 plants in a damp area in Golden Bar WRS.

Species	Common Name	Threat Status	Coronation 6	FrIM	Golden Bar
Melicytus aff. *alpinus* (c) (CHR 541568; 'Otago')	A porcupine shrub	Data Deficient			Scattered plants and a group of about 20 in shrubland in the Golden Bar WRS.
Ranunculus aff. *reflexus* (CHR 394270; Mt Peel)	A buttercup	Data Deficient			About 5-10 plants over c. 1 m^2 were recorded at the base of a rock outcrop in the buffer of the Golden Bar WRS.
Fuchsia perscandens	Climbing fuchsia	Uncommon			A single individual of the vine *Fuchsia perscandens* is present in the shrubland at Golden Bar WRS.
Sophora microphylla	Kowhai	Uncommon			Kowhai is present as a single plant in the buffer of the Golden Bar WRS.

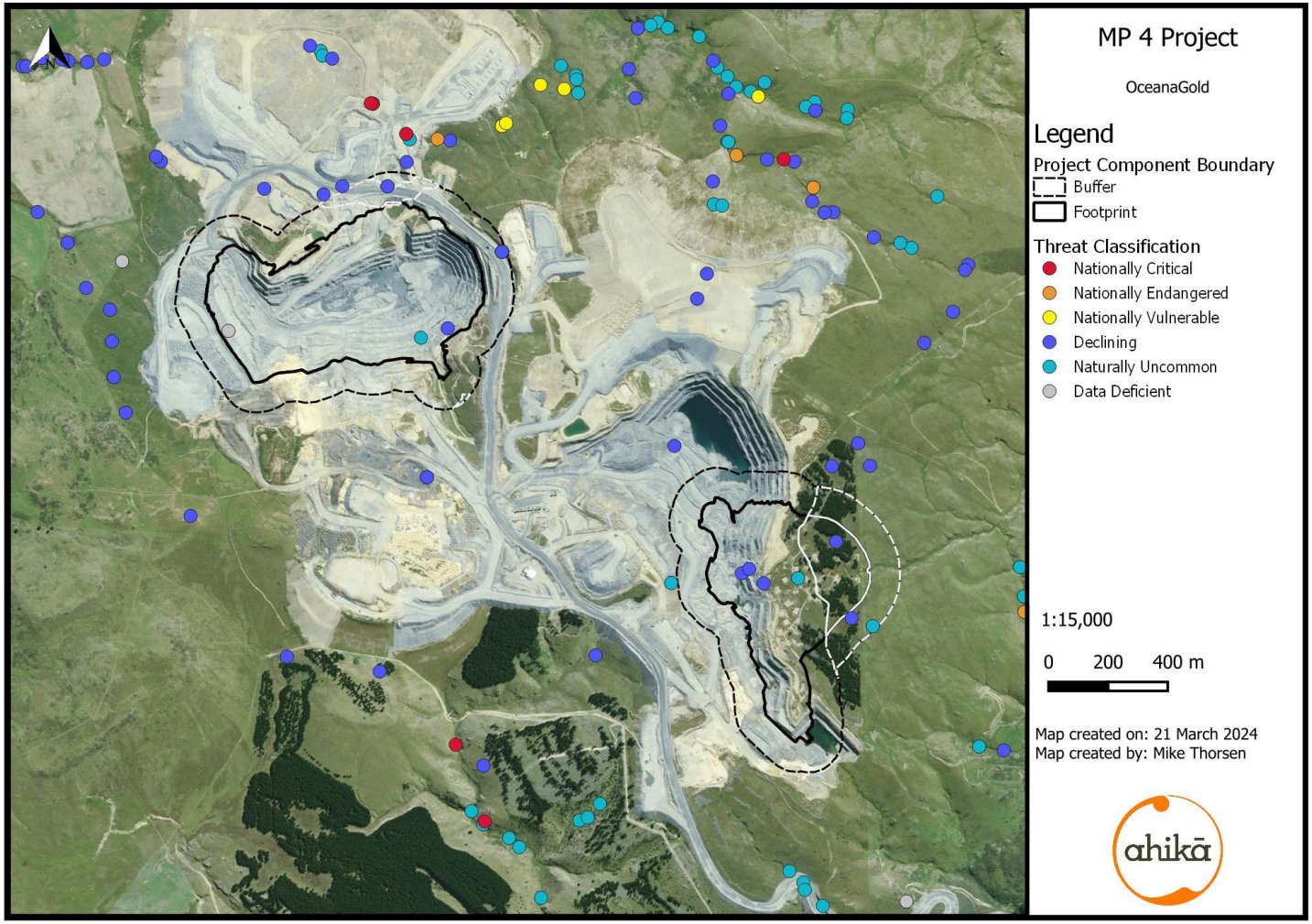

Figure 10. Locations of Threatened, At Risk, Data Deficient and locally uncommon plant species within the Coronation Area ZOI. Note that the records in this map include historic records and those mapped in the source dataset as occurring at this location in error.

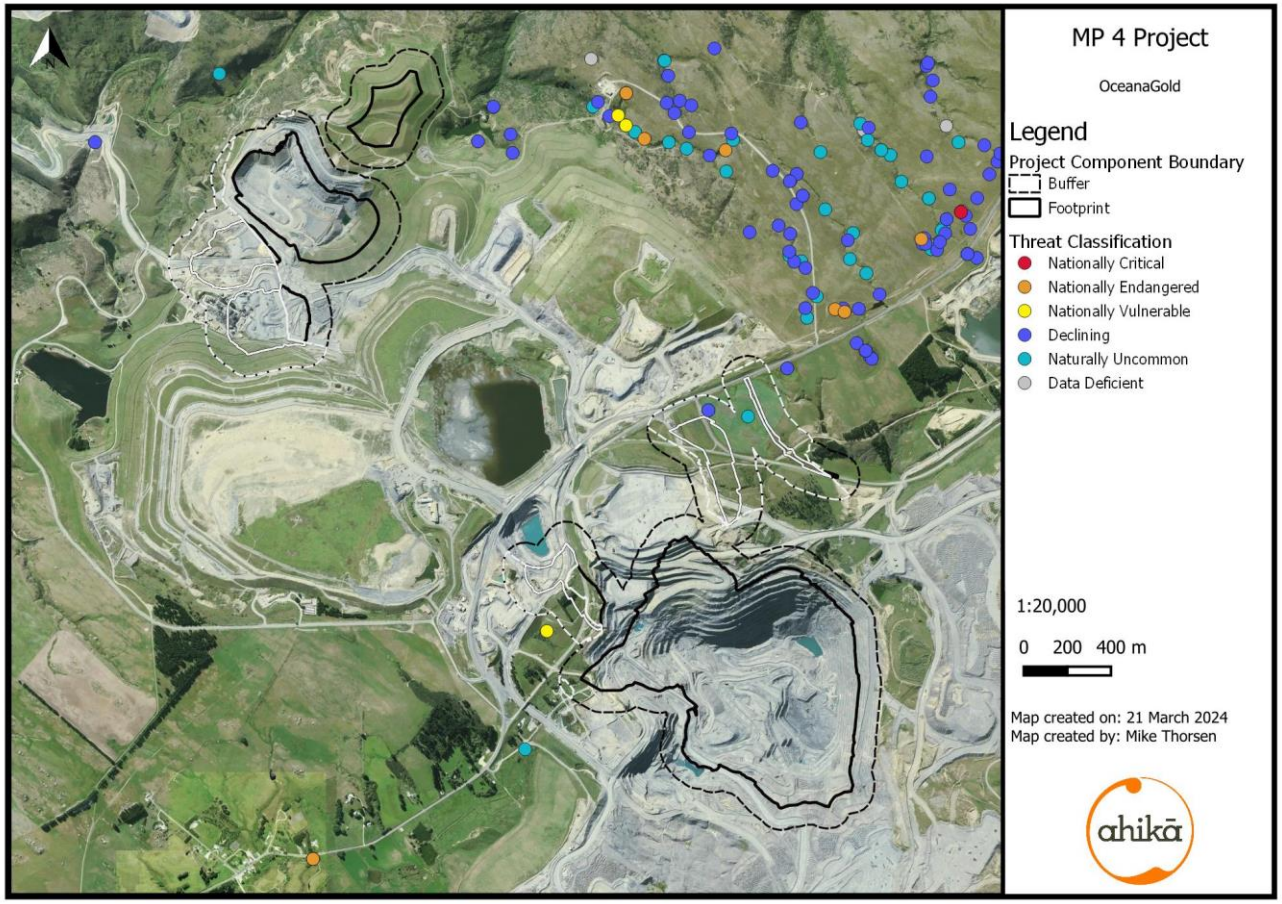

Figure 11. Locations of Threatened, At Risk and other plant species of interest (Data Deficient, rare plants) within the central project area ZOI. Species names not shown for clarity purposes. Note that the records in this map include historic records and those mapped in the source dataset as occurring at this location in error.

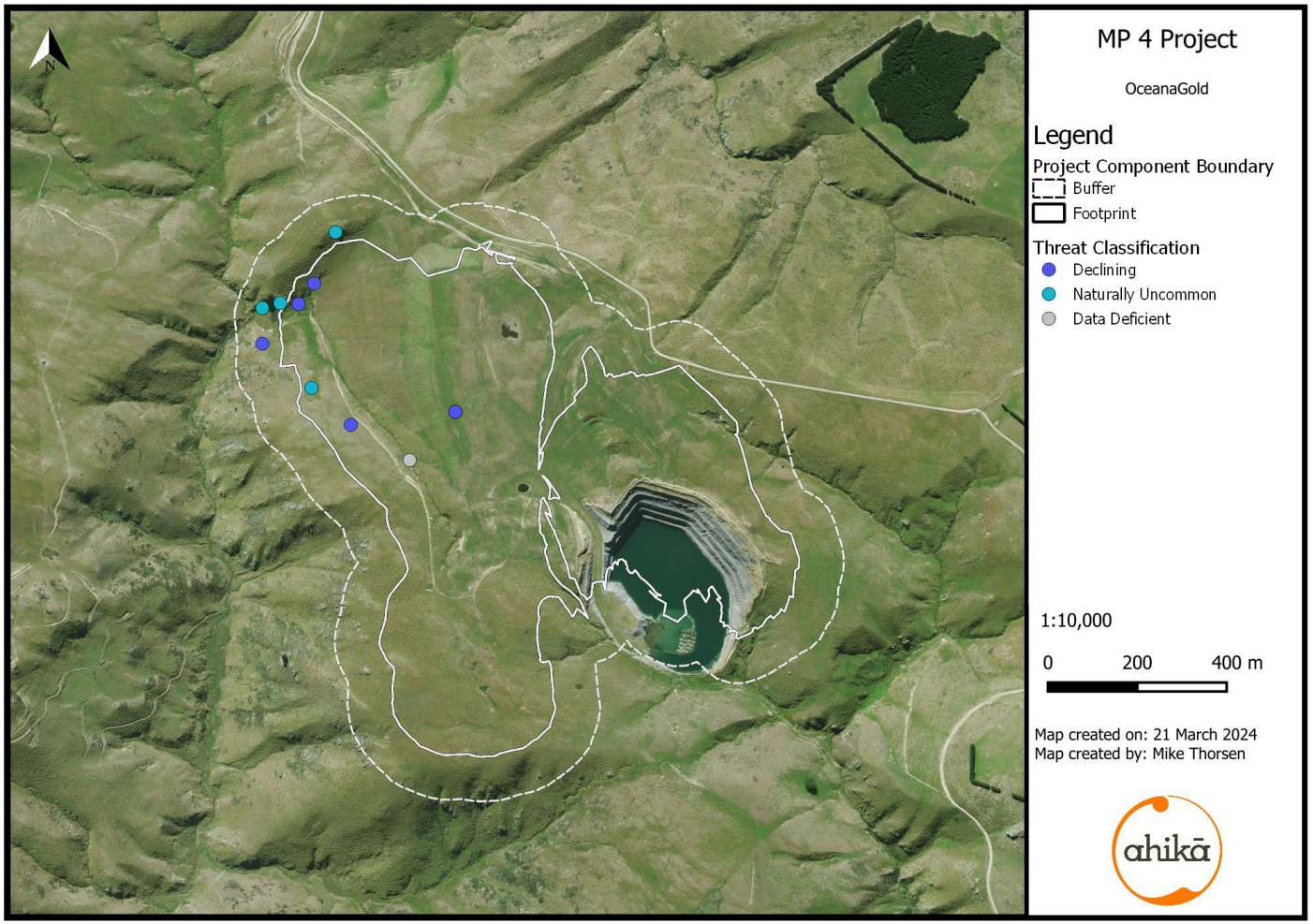

Figure 12. Locations of Threatened, At Risk and other plant species of interest (Data Deficient, rare plants) within the Golden Bar ZOI. Note that the records in this map include historic records and those mapped in the source dataset as occurring at this location in error.

5.8 Avifauna communities

Fifty-five species of birds have been recorded from the Macraes E.D., of which thirty-five are indigenous and twenty are introduced. Exotic mammalian predators are likely having a significant ongoing impact on the populations of a number of indigenous bird species in the ED, though the impact of this predation pressure on population dynamics is not known. They are also being impacted by changes to their habitats, however the nature of these changes and their impacts on the species is again not known.

Twenty three bird species were recorded from within the ZOI or nearby, ten of which are indigenous: bellbird, brown creeper, eastern falcon, South Island fantail, New Zealand pipit, banded dotterel, harrier hawk, grey warbler, paradise shelduck, and spur-winged plover, and thirteen of which are exotic: blackbird, skylark, cirl bunting, goldfinch, greenfinch, dunnock, starling, yellowhammer, chaffinch, redpoll, house sparrow, magpie, and song thrush. Dryland Central Otago is generally depauperate in bird species due to its aridity and lack of forest and wetland habitats. The ten indigenous and nine exotic bird species observed within the ZOI is the normal diversity expected for this area.

The indigenous bird species are all likely to be playing some ecological role within the ZOI. Pipits are mainly insectivores, but also disperse fruit of indigenous plants, as do silvereye and brown creeper (Thorsen et al. 2011). Harrier hawks play a role in regulating rabbit density and behaviour in the area and falcon influence bird numbers and behaviours. Grey warblers and fantail are predominantly insectivorous and play a role in regulating tree-dwelling invertebrate numbers. Paradise shelduck (and other waterfowl) influence the stature and composition of wetland plant communities. Spur-winged plovers are omnivorous, mainly feeding on plant material but also some animal material (Heather and Robertson 2000). They are a recent natural arrival to New Zealand, and their ecological function here is not well known. Of the exotic bird species, song thrush and blackbird have some ecological importance due to their role in dispersing fruit of indigenous shrubs. The exotic magpies are likely to be predators of indigenous lizards. Skylark, cirl bunting, goldfinch, yellowhammers, starlings, redpoll and house sparrow are considered of minor ecological importance, being insectivores or seed eaters and as such competing with few indigenous species.

5.9 Coronation 6 Pit Ecological Features

5.9.1 *Vegetation*

Twenty indigenous plant species were recorded at Coronation 6.

Narrow-leaved tussock grassland covers 7.6 ha (2.7 ha outside of mapped consent areas) of the Coronation 6 Pit or Coronation North Backfill and 7 ha (4.9 ha outside of mapped consent areas) of the buffer. Mostly this is comprised of 50 cm to 1 m tall low stature tussock at up to 80% cover. The area to the west of the heritage fence (which runs roughly north-south and bisects the footprint area) and adjacent to Coronation North Backfill has been degraded by past mine activities (parts are within the Zones of Influence of the 2016 Coronation North and Coronation Extension and the Coronation North Extension), and permitted exploratory pit drilling and pine felling and windrowing. Inter-tussock species reflect the higher elevation of the site and are mostly exotic herbs and grasses. Predominance of indigenous species becomes more frequent to the east of the fence.

Shallow incised gullies containing a seasonally wet or damp watercourse and bordered by water-dependent riparian vegetation cover a total of 0.02 ha in the Coronation Pit 6 and 0.1 ha in the buffer area (all are outside of the mapped consent areas). These sites are dominated by exotic grasses, rushes and sedges and have frequent pukio *Carex secta* pedestals.

One ephemeral wetland covering 0.04 ha that has been previously impacted by past and current mine activity occurs partly within the Coronation 6 Pit project and is now occupied by an increased density of pasture species as a result of past mine activities. A 0.02 ha site that has been previously impacted (through some dewatering, vehicle movements and dust) by past and current mine activity occurs in the buffer area and is now occupied by an increased density of pasture species as a result of past mine activities to the extent it no longer qualifies as a natural inland wetland. It is near a more natural 0.16 ha example which also occurs in the buffer area which is more distant from the exitsing pit edge. All three ephemeral wetland total 0.26 ha and all are outside of the mapped consent areas. Both the 0.04 ha and 0.16 sites are natural inland wetlands as defined in the NPS-FM. The ephemeral wetlands at Coronation 6 Pit are mostly dominated by browntop *Agrostis capillaris, Carex leporina* and floating sweetgrass *Glyceria fluitans* with c. 23% cover by the At Risk – Naturally Uncommon *Agrostis pallescens*, and have scattered representation by indigenous species including extensive patches of the At Risk – Naturally Uncommon grass *Agrostis pallescens* (especially in the 0.04 ha and 0.16 ha sites), the herbs *Myriophyllum propinquum, Gonocarpus micranthus* and buttercup *Ranunculus*

amphitrichus and the sedges *Carex sinclairii, Carex gaudichaudiana* and *Eleocharis acuta*. Three plants of the At Risk - Declining grass *Deschampsia cespitosa* are present on the margin of the 0.02 ha site. The ephemeral wetlands within the Coronation 6 Pit are within the ZOI of the 2016 Coronation North Project[6], which included the Stage 5 extension of Coronation Pit, and described impacts to all ephemeral wetlands within the ZOI. The actual effects to date of the 2016 Coronation North Project on these ephemeral wetlands has been a degree of dewatering and consequent ecological change, especially of the two closest to the pit edge. The ephemeral wetlands are habitat to three individuals of the At Risk – Declining wetland grass *Deschampsia cespitosa* and frequent patches of the At Risk – Naturally Uncommon wetland grass *Agrostis pallescens* (Table 7, Figure 10).

5.9.2 *Avifauna*

This area has low bird diversity and no birds were seen in the adjacent Coronation Pit or on the pit lake. Pipit (At Risk - Declining) are abundant in the Coronation 6 Pit site and are likely breeding there. The bare rock areas of the mine workings and drill platforms appear to be their favoured habitat. Banded dotterel have nested (22/23 breeding season) on the nearby (c. 800 m) recently created Trimbells WRS and on waste rock near Coronation North pit. Both sites are rock surfaces with sparse low vegetation. It is possible the ZOI is used for foraging by this species. Brown creeper and grey warbler were observed amongst the pine slash. The habitats present are noted as potential hunting and breeding habitat for the Threatened - Nationally Vulnerable falcon although they have not been observed there.

5.9.3 *Sites or communities at Coronation 6 identified as significant*

National Policy Statement for Indigenous Biodiversity

Criteria A. Representativeness

The 0.04 ha and 0.16 ha ephemeral wetlands, the tussockland, and the riparian vegetation types described in 5.9.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under both Attribute (a) and (b) in that the indigenous vegetation has ecological integrity that is typical of the ecological district and it provides habitat that supports

[6] Coronation North Project: Assessment of Environmental Effects, 24 May 2016.

a typical suite of indigenous fauna that is characteristic of the habitat type in the ecological district and retains at least a moderate range of fauna[7] species expected for that habitat type in the ecological district.

Criteria B. Diversity and Pattern

The 0.04 ha and 0.16 ha ephemeral wetlands, the tussockland, and the riparian vegetation types described in 5.9.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under Attribute (a) as there is a moderate diversity of indigenous species in the context of the ecological district.

It is not considered significant indigenous vegetation or significant habitats of indigenous fauna under Attribute (b) as there is no presence of indigenous ecotones, complete or partial gradients or sequences.

Criteria C. Rarity and Distinctiveness

The three ephemeral wetlands, the tussockland, and the riparian vegetation types described in 5.9.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under Attributes (a), (b), (d), (e), (g), (h) in that:

1. The ephemeral wetlands provides habitat for three individuals of the Declining wetland grass *Deschampsia cespitosa* and patches totalling approximately 506 m^2 of the Naturally Uncommon wetland grass *Agrostis pallescens* and the tussock grassland provides habitat for the Declining NZ pipit that qualify under Attribute (a): provides habitat for an indigenous species that is listed as Threatened or At Risk (declining) in the New Zealand Threat Classification System lists. These species also qualify under Attribute (b): an indigenous vegetation type or an indigenous species that is uncommon within the region or ecological district as both species are uncommon within the Macraes E.D.
2. The 0.02 ha of ephemeral wetland, 0.02 ha of riparian vegetation and 2.73 ha of tussockland that occurs on LENZ 3.1e qualify under Attribute (d): indigenous vegetation that has been reduced to less than 20 per cent of its prehuman extent in the ecological district, region, or land environment as the indigenous vegetation within this LENZ has been reduced to <10% of its original extent.

[7] While fauna is not mentioned in the second part of Attribute (b) the first part of the sentence refers to indigenous fauna and it is presumed that the mention of species in the second part of the sentence refers to faunal species.

3. The Naturally Uncommon ephemeral wetland vegetation communities also qualify under Attribute (e): indigenous vegetation or habitat of indigenous fauna occurring on naturally uncommon ecosystems and axiomatically qualifies under Attribute (b): an indigenous vegetation type or an indigenous species that is uncommon within the region or ecological district, Attribute (g): the presence of a distinctive assemblage or community of indigenous species and Attribute (h): the presence of a special ecological or scientific feature as naturally uncommon ecosystems are by their definition uncommon, distinctive and of a special ecological nature (and therefore of scientific interest).
4. The disturbed ground and open areas of the ZOI may be used for foraging by the At Risk – Declining banded dotterel and therefore may qualify under Attribute (a): provides habitat for an indigenous species that is listed as Threatened or At Risk (declining) in the New Zealand Threat Classification System lists.

Criteria D. Ecological Context

The ephemeral wetlands, tussockland, and riparian vegetation types described in 5.9.1 are not considered significant indigenous vegetation or significant habitats of indigenous fauna as they are small examples that are bordered by mine workings and have been degraded to some extent by weeds and pest animals as well as works associated with mining and farming.

It is very unlikely that these sites would be considered a Highly Mobile Fauna Area under Clause 3.20.

Partially Operative Otago Regional Policy Statement

Criteria 1. Representativeness

The ephemeral wetlands, tussockland, and riparian vegetation types described in 5.9.1 are **significant** under Criteria 1 in that they are "*an example of an indigenous vegetation type or habitat that is typical or characteristic of the natural diversity of the relevant ecological district. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas*."

Criteria 2. Rarity

The ephemeral wetland habitat of the At Risk – Declining grass *Deschampsia cespitosa* and At Risk – Uncommon grass *Agrostis pallescens* and the tussock grassland habitat of the At Risk – Declining pipit are **significant** under a. of Criteria 2 in that they are "a*n indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*". The disturbed ground and open areas of the ZOI may be used for foraging by the At Risk – Declining banded dotterel and therefore may qualify under this Criteria.

The areas of indigenous vegetation that occur on the mapped areas of TEC 1 (< 10% indigenous cover left) LENZ N3.1e and TEC 2 (10-20% indigenous cover left) LENZ Q4.3b (Table 4) are **significant** under b of Criteria 2 in that they have been mapped as "*Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, or freshwater environment including wetlands*". The natural vegetation communities at these sites are areas of tussockland, riparian vegetation and ephemeral wetland totalling 15.3 ha.

The ephemeral wetlands that occur in the ZOI are considered **significant**, despite their degraded character, under c. of Criteria 2 "*indigenous vegetation and habitats within originally rare ecosystems*".

<u>Criteria 3. Diversity</u>

The vegetation communities are considered **not significant** under Criteria 3 "*an area that supports a high diversity of indigenous vegetation and habitats of indigenous fauna or consists of a diverse range or sequence of interrelated vegetation and habitat types*" as 1) the number of species that occurs in each community is not diverse relative to other examples of that vegetation community in the area; 2) the diversity of habitats of indigenous fauna is lower than the diversity of habitats that occur in the surrounding area; 3) none contain a diverse range or sequence of vegetation types.

<u>Criteria 4. Distinctiveness.</u>

The terrestrial ecological features are considered **not significant** under a. of Criteria 4 "*indigenous species at their distributional limit within Otago or nationally*" as none of the species

recorded is at its distributional limit either nationally or within the Otago Regional Council territorial area.

The terrestrial ecological features are considered **not significant** under b. of Criteria 4 "*indigenous species that are endemic to the Otago region*" as none of the species is known to be endemic to the Otago Regional Council territorial area.

The ephemeral wetlands within the ZOI, though somewhat degraded, are considered **significant** under c. of Criteria 4 "*indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors*" as ephemeral wetlands are a distinctive vegetation community within Otago Regional Council territorial area, the ephemeral wetland vegetation community are of restricted occurrence within the Otago Regional Council territorial area and has developed as a result of unusual environmental factors (low rainfall, and flat or gently sloping terrain).

Criteria 5. Ecological Context.

The terrestrial ecological features are considered **not significant** under a. of Criteria 5 "*an area that has important connectivity value allowing dispersal of indigenous vegetation and fauna between different areas*" as though there is some connectivity between this site and adjoining sites, it is bordered by existing mine works, and this connectivity is not considered important at the scale of the Ecological District.

The terrestrial ecological features are considered **not significant** under b. of Criteria 5 "*an important buffering function that helps to protect the values of an adjacent area or feature*" as though there is some buffering between this site that may help protect the values of the adjacent areas, it is bordered by existing mine works, and this buffering is not considered important at the scale of the Ecological District.

The terrestrial ecological features are considered **not significant** under c. of Criteria 5 "*an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, nesting, breeding, or refuges from predation*" as though there is some use of this site for breeding, feeding, as a refuge and for other purposes, this usage is not considered important at the scale of the Ecological District for these species.

Otago Regional Council Regional Plan: Water for Otago

The ZOI contains no Regionally Significant Wetlands or Wetland Management Areas listed in Schedule 9 of the Regional Plan: Water for Otago.

Proposed Otago Regional Policy Statement (27 October 2017 Mediation Version)

The tussockland, ephemeral wetlands, and riparian vegetation are considered **significant** under Representativeness Criteria (a) in that they are "*an area that is an example of an indigenous vegetation type or habitat that is typical or characteristic of the original natural diversity of the relevant ecological district or coastal marine biogeographic region. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas.*"

Criteria (d): Rarity

The ephemeral wetlands are considered **significant**[8] under Criteria (a) (i) in that they are *"an area that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*." being habitat of the At Risk – Declining grass *Deschampsia cespitosa*, the At Risk – Naturally Uncommon grass *Agrostis pallescens.* The tussock grassland is considered **significant** in that it is habitat for the At Risk – Declining pipit.

The areas of indigenous vegetation that occur on the mapped areas of TEC 1 (< 10% indigenous cover left) LENZ N3.1e and TEC 2 (10-20% indigenous cover left) LENZ Q4. (Table 4) are considered **significant** under Criteria (a) (ii) in that they are *"an area that supports indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, coastal marine biogeographic region or freshwater environment including wetlands*." The natural vegetation communities at these sites are areas of tussockland, riparian vegetation and ephemeral wetland totalling 15.3 ha.

[8] It is important to note that under this wording of the criteria, any area containing some indigenous plant species qualifies as significant.

The ephemeral wetlands, though somewhat degraded, are considered **significant** under Criteria (a) (iii) in that they are *"an area that supports indigenous vegetation and habitats within originally rare ecosystems."*

The disturbed ground and open areas of the ZOI may be used for foraging by the At Risk – Declining banded dotterel and therefore may qualify under this Criteria.

The vegetation communities in the ZOI are considered **not significant** under Criteria (d) (iv) in that they are not *"an area that supports the site contains indigenous vegetation or an indigenous species that is endemic to Otago or that are at distributional limits within Otago*."

Criteria (e): Diversity

The vegetation communities in the ZOI are considered **not significant** under Criteria (e) in that they are not "*an area that supports a high diversity of indigenous ecosystem types, indigenous taxa or has changes in species composition reflecting the existence of diverse natural features or gradients*."

Criteria (f): Distinctiveness

The vegetation communities in the ZOI are considered **not significant** under Criteria (f) (i) in that they are not "*an area that supports or provides habitat for indigenous species at their distributional limit within Otago or nationally*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (f) (ii) in that they are not "*an area that supports or provides habitat for indigenous species that are endemic to the Otago region*".

The ephemeral wetlands in the ZOI are considered **significant** under Criteria (f) (iii) in that they are "*an area that supports or provides habitat for indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors*."

Criteria (g): Ecological context

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (i) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that has important connectivity value allowing dispersal of indigenous flora and fauna between different areas*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (ii) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that has an important buffering function that helps to protect the values of an adjacent area or feature*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (iii) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, resting, nesting, breeding, spawning or refuges from predation*" as none of the areas is considered important[9] for indigenous fauna.

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (iv) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including a wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal ecosystem.*"

Waitaki District Plan

The indigenous vegetation communities within the ZOI were assessed using the criteria within Policy 16.9.3(3) of the 2010 Waitaki District Plan, and the ephemeral wetlands and riparian vegetation types within the ZOI are considered **significant** as they are, or contain, species or vegetation that meet criteria:

Criteria (i): Representativeness

[9] Here the word 'important' is taken to mean that if the area was to become unavailable, then the viability of an indigenous species would be affected.

The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature.

In addition, the ephemeral wetlands vegetation community and the tussockland habitat of pipit is **significant** as they contain three rare plant species, one rare bird species and is a rare plant community and therefore meet criteria:

Criteria (ii): Rarity and distinctiveness

The area supports an indigenous species, habitat or community, which is rare and vulnerable within the ecological district or threatened nationally.

The disturbed ground and open areas of the ZOI may be used for foraging by the At Risk – Declining banded dotterel and therefore may qualify under this Criteria.

Dunedin City proposed 2GP[10]

Criteria: Rarity.

The ephemeral wetlands and tussock grassland are considered **significant** as they provide *habitat for indigenous species that are threatened, at risk, or uncommon, nationally or within an ecological district*.

The areas of indigenous vegetation that occur on the mapped areas of TEC 1 (< 10% indigenous cover left) LENZ N3.1e and TEC 2 (10-20% indigenous cover left) LENZ Q4. (Table 4) are considered **significant** as they are**.**

The ephemeral wetlands are considered **significant** as they contain "*indigenous vegetation and habitats within originally rare ecosystems*."

The disturbed ground and open areas of the ZOI may be used for foraging by the At Risk – Declining banded dotterel and therefore may qualify under this Criteria.

[10] Noting that some aspects, including the significance criteria, relevant to this assessment are under appeal.

Criteria: Representativeness.

The ephemeral wetlands, riparian vegetation and tussock grassland are considered **significant** as they are "*areas that are examples of an indigenous vegetation type or habitat that is typical or characteristic of the natural diversity of the relevant ecological district, which may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas*".[11]

Criteria: Distinctiveness.

None of the fauna or flora species at Coronation North are "*indigenous species at their distributional limit within Dunedin or nationally.*"

None of the fauna or flora species at Coronation North are "*indigenous species that are endemic to the Otago region*."

The ephemeral wetlands are considered **significant** as they contain "*indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors"* being vegetation that has developed in areas that are periodically wetted.

Criteria: Ecological Context.

None of the vegetation communities at Coronation 6 "*have important connectivity value allowing dispersal of indigenous vegetation and fauna between different areas*."

None of the vegetation communities at Coronation 6 "*perform an important buffering function that helps to protect the values of an adjacent area or feature."*

None of the vegetation communities at Coronation 6 "*are important for indigenous fauna, on a regular or temporary basis, for breeding, refuge, feeding or resting*."

Criteria: Diversity.

None of the vegetation communities at Coronation 6 are "*areas that support a high diversity of indigenous ecosystem types, indigenous taxa or have changes in species composition reflecting the existence of diverse natural features or gradients*."

[11] It is important to note that under this wording of the criteria, any area containing some indigenous plant species qualifies as significant.

Criteria: Size.

None of the vegetation communities at Coronation 6 are "*areas that are of a size to make them significant*."

Exotic vegetation communities

None of the exotic vegetation types are considered significant using the criteria outlined above.

5.10 Frasers Backfill, Waste Rock Stack and Innes Mills Stage 9 and Stage 10 (FrIM) Ecological Features

5.10.1 *Vegetation*

Within the 123 ha FrIM footprint are pine forest, exotic grassland and improved pasture which are dominated by the exotic cocksfoot grass *Dactylis glomerata*, thistles (*Cirsium vulgare, Cirsium arvense*), Yorkshire fog grass *Holcus lanatus*, rye grass *Lolium perenne,* chickweed *Cerastium fontanum*, sweet vernal grass *Anthoxanthum odoratum*. Patches of recently disturbed ground are colonised by hedge parsley *Torilis japonica* and mayweed *Tripleurospermum inodorum*.

Within the Innes Mills 10 buffer is a further 1.4 ha of tussock grassland bisected by a farm track which consists of narrow-leaved tussock grass *Chionochloa rigida* subsp. *rigida* to c. 1 m tall and with approximately 90% ground cover in association with scattered speargrass *Aciphylla aurea*, matagouri *Discaria toumatou*, creeping pohuehue vine *Muehlenbeckia complexa*, hard tussock *Festuca novae-zelandiae* and buttercup *Ranunculus multiscapus* with extensive exotic grasses and herbs providing much of the ground cover. The tussock grassland becomes sparser towards the east and patches of gorse *Ulex europaeus*, broom *Cytisus scoparius* and currant *Ribes sanguinolentum* are present in this area. Also in the Innes Mills 10 buffer is 0.31 ha of riparian vegetation that has higher water content than the example in the footprint. It is mostly dominated by exotic wetland grasses and herbs but there are areas of pukio (*Carex secta*) sedgeland and a few groups of toetoe *Cortaderia fulvida* and the shrub *Olearia bullata.* This area would qualify as a natural inland wetland under the NPS-FM. The At Risk – Naturally Uncommon daisy *Celmisia hookeri* s present within the buffer area where c. 50 plants are present at both sites. Also, within the Innes Mills Stage 10 100m buffer area, are two small wetlands totalling 0.07 ha in extent that are dominated by exotic wetland herbs and grasses with patches of pukio *Carex secta* and the sedge *Carex sinclairii* and scattered toetoe *Austroderia richardii* and one small grove of *Olearia bullata* shrubs.

A 0.07 ha example of ephemeral wetland vegetation with high representation of indigenous species including *Limosella lineata, Lobelia perpusilla* and *Myriophyllum propinquum* and the At Risk – Naturally Uncommon wetland herb *Lobelia ionantha,* dwarf rush, *Juncus pusillus* and *Juncus distegus* was present in the FrIM buffer area, but it has been destroyed through cultivation into a winter feed crop and a wheat crop.

5.10.2 *Avifauna*

Indigenous pipit (At Risk – Declining), spur-winged plover and paradise shelduck were recorded inhabiting the cultivated brassica crop and silvereye were recorded in a nearby scrub patch.

5.10.3 *Sites or communities within FrIM identified as significant*

National Policy Statement for Indigenous Biodiversity

Criteria A. Representativeness

The tussockland and the riparian vegetation types described in 5.10.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under both Attribute (a) and (b) in that the indigenous vegetation has ecological integrity that is typical of the ecological district and it provides habitat that supports a typical suite of indigenous fauna that is characteristic of the habitat type in the ecological district and retains at least a moderate range of fauna[12] species expected for that habitat type in the ecological district.

Criteria B. Diversity and Pattern

The tussockland and the riparian vegetation types described in 5.10.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under Attribute (a) as there is a moderate diversity of indigenous species in the context of the ecological district.

It is not considered significant indigenous vegetation or significant habitats of indigenous fauna under Attribute (b) as there is no presence of indigenous ecotones, complete or partial gradients or sequences.

Criteria C. Rarity and Distinctiveness

[12] While fauna is not mentioned in the second part of Attribute (b) the first part of the sentence refers to indigenous fauna and it is presumed that the mention of species in the second part of the sentence refers to faunal species.

The tussockland and riparian vegetation types described in 5.10.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under Attributes (b), (d) in that:

1. The tussock grassland provides habitat for a plant species that qualify under Attribute (b): an indigenous vegetation type or an indigenous species that is uncommon within the region or ecological district as they are species uncommon within the Macraes E.D.
2. The riparian vegetation and tussockland that occurs on LENZ N3.1e qualify under Attribute (d): indigenous vegetation that has been reduced to less than 20 per cent of its prehuman extent in the ecological district, region, or land environment as the indigenous vegetation within this LENZ has been reduced to <10% of its original extent.

Criteria D. Ecological Context

The tussockland, wetland, and riparian vegetation types described in 5.10.1 are not considered significant indigenous vegetation or significant habitats of indigenous fauna as they are small examples that are bordered by mine workings and/or farmland and have been degraded to some extent by weeds and pest animals as well as works associated with mining and farming.

It is very unlikely that these sites would be considered a Highly Mobile Fauna Area under Clause 3.20.

Partially Operative Otago Regional Policy Statement

Criteria 1. Representativeness

The tussockland and riparian vegetation types described in 5.10.1 are **significant** under Criteria 1 in that they are "*an example of an indigenous vegetation type or habitat that is typical or characteristic of the natural diversity of the relevant ecological district. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas*."

Criteria 2. Rarity

The tussockland habitat of the rare plant species is **significant** under a. of Criteria 2 in that they are "a*n indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*".

The tussockland that occurs on the mapped areas of TEC 1 (< 10% indigenous cover left) LENZ N3.1e (Table 4) are **significant** under b of Criteria 2 in that they have been mapped as "*Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, or freshwater environment including wetlands*" and

Criteria 3. Diversity

The vegetation communities are considered **not significant** under Criteria 3 "*an area that supports a high diversity of indigenous vegetation and habitats of indigenous fauna or consists of a diverse range or sequence of interrelated vegetation and habitat types*" as 1) the number of species that occurs in each community is not diverse relative to other examples of that vegetation community in the area; 2) the diversity of habitats of indigenous fauna is lower than the diversity of habitats that occur in the surrounding area; 3) none contain a diverse range or sequence of vegetation types.

Criteria 4. Distinctiveness.

The terrestrial ecological features are considered **not significant** under a. of Criteria 4 "*indigenous species at their distributional limit within Otago or nationally*" as none of the species recorded is at its distributional limit either nationally or within the Otago Regional Council territorial area.

The terrestrial ecological features are considered **not significant** under b. of Criteria 4 "*indigenous species that are endemic to the Otago region*" as none of the species is known to be endemic to the Otago Regional Council territorial area.

Criteria 5. Ecological Context.

The terrestrial ecological features are considered **not significant** under a. of Criteria 5 "*an area that has important connectivity value allowing dispersal of indigenous vegetation and fauna between different areas*" as though there is some connectivity between this site and adjoining

sites, it is bordered by existing mine works and farm pasture, and this connectivity is not considered important at the scale of the Ecological District.

The terrestrial ecological features are considered **not significant** under b. of Criteria 5 "*an important buffering function that helps to protect the values of an adjacent area or feature*" as though there is some buffering between this site that may help protect the values of the adjacent areas, it is bordered by existing mine works and farm pasture, and this buffering is not considered important at the scale of the Ecological District.

The terrestrial ecological features are considered **not significant** under c. of Criteria 5 "*an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, nesting, breeding, or refuges from predation*" as though there is some use of this site for breeding, feeding, as a refuge and for other purposes, this usage is not considered important at the scale of the Ecological District for these species.

Otago Regional Council Regional Plan: Water for Otago

The ZOI contains no Regionally Significant Wetlands or Wetland Management Areas listed in Schedule 9 of the Regional Plan: Water for Otago.

Proposed Otago Regional Policy Statement (27 October 2017 Mediation Version)

The tussockland and riparian vegetation are considered **significant** under Representativeness Criteria (a) in that they are "*an area that is an example of an indigenous vegetation type or habitat that is typical or characteristic of the original natural diversity of the relevant ecological district or coastal marine biogeographic region. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas.*"

<u>Criteria (d): Rarity</u>

The tussockland is considered **significant**[13] under Criteria (a) (i) in that they are *"an area that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*."

The tussockland that occurs on the mapped areas of TEC 1 (< 10% indigenous cover left) LENZ N3.1e (Table 4) are considered **significant** under Criteria (a) (ii) in that they are *"an area that supports indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, coastal marine biogeographic region or freshwater environment including wetlands*." The natural vegetation communities at these sites are areas of tussockland, riparian vegetation and ephemeral wetland totalling 15.3 ha.

The vegetation communities in the ZOI are considered **not significant** under Criteria (d) (iv) in that they are not *"an area that supports the site contains indigenous vegetation or an indigenous species that is endemic to Otago or that are at distributional limits within Otago*."

Criteria (e): Diversity

The vegetation communities in the ZOI are considered **not significant** under Criteria (e) in that they are not "*an area that supports a high diversity of indigenous ecosystem types, indigenous taxa or has changes in species composition reflecting the existence of diverse natural features or gradients*."

Criteria (f): Distinctiveness

The vegetation communities in the ZOI are considered **not significant** under Criteria (f) (i) in that they are not "*an area that supports or provides habitat for indigenous species at their distributional limit within Otago or nationally*."

[13] It is important to note that under this wording of the criteria, any area containing some indigenous plant species qualifies as significant.

The vegetation communities in the ZOI are considered **not significant** under Criteria (f) (ii) in that they are not "*an area that supports or provides habitat for indigenous species that are endemic to the Otago region*".

Criteria (g): Ecological context

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (i) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that has important connectivity value allowing dispersal of indigenous flora and fauna between different areas*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (ii) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that has an important buffering function that helps to protect the values of an adjacent area or feature*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (iii) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, resting, nesting, breeding, spawning or refuges from predation*" as none of the areas is considered important[14] for indigenous fauna.

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (iv) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including a wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal ecosystem.*"

Waitaki District Plan

[14] Here the word 'important' is taken to mean that if the area was to become unavailable, then the viability of an indigenous species would be affected.

The indigenous vegetation communities within the ZOI were assessed using the criteria within Policy 16.9.3(3) of the 2010 Waitaki District Plan, and overall the tussockland and riparian vegetation types are significant.

The tussockland and riparian vegetation types within the ZOI are considered **not significant** as, because of their small and fragmented nature, they are not, or do not contain, species or vegetation that meet criteria:

Criteria (i): Representativeness

The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature.

The tussockland within the ZOI are considered **significant** as they provide habitat for a rare plant species and therefore meet criteria:

Criteria (ii): Rarity and distinctiveness

The area supports an indigenous species, habitat or community, which is rare and vulnerable within the ecological district or threatened nationally.

Exotic vegetation communities

None of the exotic vegetation types are considered significant using the criteria outlined above.

5.11 Golden Bar Pit & WRS Ecological Features

5.11.1 *Vegetation*

Ninety-four indigenous plant species were recorded in the Golden Bar project area.

Three vegetation communities are present in the Golden Bar project area. Narrow-leaved tussock grassland covers 4.3 ha of the Golden Bar Pit, 23 ha of the Golden Bar WRS, and 36.1 ha of the buffer. Mostly this is comprised of 50 cm to 1 m low stature tussock at up to 80% cover. Cover by tussock grasses is higher and with greater inter-tussock diversity on the shaded faces. The At Risk – Declining desert broom *Carmichaelia petriei* and matagouri *Discaria toumatou* are present in tussock grassland in the project area and the At Risk – Declining native mint *Mentha cunninghamii*, At Risk – Naturally Uncommon bittercress *Cardamine grandiscapa*, Hooker's mountain daisy *Celmisia hookeri* and carrot *Gingidia grisea* as well as Data Deficient buttercup *Ranunculus* aff. *reflexus* (CHR 394270; Mt Peel) are present in tussock grassland (including rock outcrops) in the buffer area (Table 7, Figure 12).

A small 0.06 ha area of shrubland occurs in the Golden Bar WRS. The main plant species present are *Coprosma crassifolia*, *Muehlenbeckia complexa* and *Rubus schmidelioides* var. *subpauperatus* and includes a group of the Data Deficient shrub *Melicytus* "Otago" and the Locally Uncommon vine *Fuchsia perscandens* (Table 7, Figure 12).

Shallow incised gullies containing a seasonally wet or damp watercourse and bordered by water-dependent riparian vegetation cover a total of 0.8 ha in the Golden Bar Pit and WRS footprints and 0.1 ha in the buffer areas. These sites are dominated by exotic grasses, rushes and sedges, and have areas of frequent pukio *Carex secta* pedestals and occasional *Olearia bullata* shrubs and with the At Risk- Declining wetland willowherb *Epilobium insulare* (Table 7, Figure 12).

5.11.2 *Avifauna*

Spur-winged plover and paradise shelduck were more common at this site than the other sites surveyed. At Risk – Declining pipit inhabit the open areas of the rehabilitated WRS and the tussock grassland and likely nest in the area. Threatened – Nationally Vulnerable falcon were observed in the site, and birds swooped a harrier hawk - territorial behaviour indicative of it being near a breeding area. Harrier hawk are a regular visitor. A colony of black-backed gull are present in the pit lake.

5.11.3 *Sites or communities at Golden Bar identified as significant*

National Policy Statement for Indigenous Biodiversity

Criteria A. Representativeness

The shrubland, tussockland and riparian vegetation types described in 5.11.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under both Attribute (a) and (b) in that the indigenous vegetation that has ecological integrity that is typical of the ecological district and it provides habitat that supports a typical suite of indigenous fauna that is characteristic of the habitat type in the ecological district and retains at least a moderate range of fauna[15] species expected for that habitat type in the ecological district.

Criteria B. Diversity and Pattern

The shrubland, tussockland and riparian vegetation types described in 5.11.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under Attribute (a) as there is a moderate diversity of indigenous species in the context of the ecological district.

It is not considered significant indigenous vegetation or significant habitats of indigenous fauna and Attribute (b) as there is no presence of indigenous ecotones, complete or partial gradients or sequences.

Criteria C. Rarity and Distinctiveness

The shrubland, tussockland and riparian vegetation types described in 5.11.1 are **significant indigenous vegetation or significant habitats of indigenous fauna** under Attributes (a), (b), (d) in that:

1. The tussock grassland, shrubland and riparian vegetation provides habitat for a pair of Threatened falcon and two plant species that are classified as Declining (matagouri and desert broom) that qualify under Attribute (a): provides habitat for an indigenous species that is listed as Threatened or At Risk (declining) in the New Zealand Threat Classification System lists. These species, together with another eight plant species also qualify under Attribute (b): an indigenous vegetation type or an indigenous species that

[15] While fauna is not mentioned in the second part of Attribute (b) the first part of the sentence refers to indigenous fauna and it is presumed that the mention of species in the second part of the sentence refers to faunal species.

is uncommon within the region or ecological district as they are species uncommon within the Macraes E.D.

2. The 0.06 ha of shrubland, 0.8 ha of riparian vegetation and 19.7 ha of tussockland that occurs on LENZ N3.1e or Q4.3b qualify under Attribute (d): indigenous vegetation that has been reduced to less than 20 per cent of its prehuman extent in the ecological district, region, or land environment as the indigenous vegetation within this LENZ has been reduced to <10% of its original extent (N3.1e) or between 10 to 20% (Q4.3b).

Criteria D. Ecological Context

The tussockland vegetation type described in 5.11.1 is **considered significant indigenous vegetation or significant habitats of indigenous fauna** as it is of reasonable extent and likely to be part of a mosaic of tussock habitats in the local area though it has been degraded to some extent by weeds and pest animals as well as works associated with mining and farming.

It is very unlikely that these sites would be considered a Highly Mobile Fauna Area under Clause 3.20.

Partially Operative Otago Regional Council Regional Policy Statement 2019

Criteria 1. Representativeness

The tussockland and riparian vegetation are **significant** under Criteria 1 in that they are "*an example of an indigenous vegetation type or habitat that is typical or characteristic of the natural diversity of the relevant ecological district. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas*."

Criteria 2. Rarity

The tussockland and riparian habitat of the 12 rare species are **significant** under a. of Criteria 2 in that they are "a*n indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*".

The areas of indigenous vegetation that occur on the mapped areas of TEC 1 (< 10% indigenous cover left) LENZ N3.1e, TEC 2 (10-20% indigenous cover left) LENZ Q4.3b, or TEC 3 (20-30%

indigenous cover left) LENZ Q4.3a (Table 4) are **significant** under b of Criteria 2 in that they have been mapped as "*Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, or freshwater environment including wetlands*". The natural vegetation communities at these sites are areas of tussockland, shrublands, and riparian vegetation totalling 67.2 ha.

The vegetation communities that occur in the ZOI are considered **not significant** under c. of Criteria 2 "*indigenous vegetation and habitats within originally rare ecosystems*".

Criteria 3. Diversity

The vegetation communities are considered **not significant** under Criteria 3 "*an area that supports a high diversity of indigenous vegetation and habitats of indigenous fauna or consists of a diverse range or sequence of interrelated vegetation and habitat types*" as 1) the number of species that occurs in each community is not diverse relative to other examples of that vegetation community in the area; 2) the diversity of habitats of indigenous fauna is lower than the diversity of habitats that occur in the surrounding area; 3) none contain a diverse range or sequence of vegetation types.

Criteria 4. Distinctiveness.

The ecological features are considered **not significant** under a. of Criteria 4 "*indigenous species at their distributional limit within Otago or nationally*" as none of the species recorded is at its distributional limit either nationally or within the Otago Regional Council territorial area.

The tussockland in the buffer area is considered **significant** under b. of Criteria 4 "*indigenous species that are endemic to the Otago region*" namely providing habitat for the Otago endemic *Gingidia grisea*.

The vegetation communities within the ZOI are considered **not significant** under c. of Criteria 4 "*indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors*".

Criteria 5. Ecological Context.

The terrestrial ecological features are considered **not significant** under a. of Criteria 5 "*an area that has important connectivity value allowing dispersal of indigenous vegetation and fauna between different areas*" as though there is some connectivity between this site and adjoining sites, it is bordered by previous mine works and this connectivity is not considered important at the scale of the Ecological District.

The terrestrial ecological features are considered **not significant** under b. of Criteria 5 "*an important buffering function that helps to protect the values of an adjacent area or feature*" as though there is some buffering between this site that may help protect the values of the adjacent areas, it is bordered by previous mine works and this buffering is not considered important at the scale of the Ecological District.

The terrestrial ecological features are considered **not significant** under c. of Criteria 5 "*an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, nesting, breeding, or refuges from predation*" as though there is some use of this site for breeding, feeding, as a refuge and for other purposes, this usage is not considered important at the scale of the Ecological District for the species due to the small size of the natural areas and their degraded condition.

Otago Regional Council Regional Plan: Water for Otago

The ZOI contains no Regionally Significant Wetlands or Wetland Management Areas listed in Schedule 9 of the Regional Plan: Water for Otago.

Proposed Otago Regional Policy Statement

Criteria (a): Representativeness

The tussockland, shrubland, and riparian vegetation are considered **significant** under Criteria (a) in that they are "*an area that is an example of an indigenous vegetation type or habitat that is typical or characteristic of the original natural diversity of the relevant ecological district or coastal marine biogeographic region. This may include degraded examples of their type or*

represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas."

Criteria (d): Rarity

The tussockland, ephemeral wetlands, riparian vegetation, and shrubland areas are considered **significant**[16] under Criteria (a) (i) in that they are *"an area that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district*."

The tussockland, riparian vegetation, and shrubland are considered **not significant** under Criteria (a) (ii) in that they are not known to be *"an area that supports indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, coastal marine biogeographic region or freshwater environment including wetlands*."

The vegetation communities are considered **not significant** under Criteria (a) (iii) in that they are *"an area that supports indigenous vegetation and habitats within originally rare ecosystems."*

The tussockland vegetation community in the buffer is considered **significant** under Criteria (a) (iv) in that they are not *"an area that supports the site contains indigenous vegetation or an indigenous species that is endemic to Otago or that are at distributional limits within Otago*." namely providing habitat for the Otago endemic *Gingidia grisea*.

Criteria (e): Diversity

The vegetation communities in the ZOI are considered **not significant** under Criteria (e) in that they are not "*an area that supports a high diversity of indigenous ecosystem types, indigenous taxa or has changes in species composition reflecting the existence of diverse natural features or gradients*."

[16] It is important to note that under this wording of the criteria, any area containing some indigenous plant species qualifies as significant.

Criteria (f): Distinctiveness

The vegetation communities in the ZOI are considered **not significant** under Criteria (f) (i) in that they are not "*an area that supports or provides habitat for indigenous species at their distributional limit within Otago or nationally*."

The rocky outcrop in the Golden Bar WRS in the ZOI are considered **significant** under Criteria (f) (ii) in that they are "*an area that supports or provides habitat for indigenous species that are endemic to the Otago region*", namely providing habitat for the Otago endemic *Gingidia grisea*.

The ephemeral wetlands in the ZOI are considered **significant** under Criteria (f) (iii) in that they are "*an area that supports or provides habitat for indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors*."

Criteria (g): Ecological context

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (i) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that has important connectivity value allowing dispersal of indigenous flora and fauna between different areas*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (ii) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that has an important buffering function that helps to protect the values of an adjacent area or feature*."

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (iii) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including an area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis,*

e.g. for feeding, resting, nesting, breeding, spawning or refuges from predation" as none of the areas is considered important[17] for indigenous fauna.

The vegetation communities in the ZOI are considered **not significant** under Criteria (g) (iv) in that they do not reflect "*the relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including a wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal ecosystem.*

Waitaki District Plan

The indigenous vegetation communities within the ZOI were assessed using the criteria within Policy 16.9.3(3) of the 2010 Waitaki District Plan and the riparian vegetation and probably the shrubland vegetation types within the ZOI are considered **significant** as they are, or contain, species or vegetation that meet criteria:

Criteria (i): Representativeness

The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature.

In addition, the tussockland, riparian vegetation, and shrubland vegetation communities are **significant** as they provide habitat for rare plant and bird species that meet criteria:

Criteria (ii): Rarity and distinctiveness

The area supports an indigenous species, habitat or community, which is rare and vulnerable within the ecological district or threatened nationally.

[17] Here the word 'important' is taken to mean that if the area was to become unavailable, then the viability of an indigenous species would be affected.

5.12 Golden Bar Road Realignment

5.12.1 *Vegetation*

The road realignment area is predominantly exotic improved pasture with a small 0.1 ha of sparse narrow-leaved tussock grassland (0.1 ha). The main species present in the improved pasture are exotic grasses and herbs such as cocksfoot *Dactylis glomerata,* browntop *Agrostis capillaris*, sweet vernal *Anthoxanthum odoratum, Rytidosperma penicillatum*, sheep's sorrel *Rumex acetosella* and hawkweed *Pilosella officinarum.* The tussock grassland is a small area within an intensively farmed and mined area and consists of scattered to sparse with occasional small patches of tussock grasses to 0.5 m tall interspersed by predominantly exotic pasture species.

Two small ephemeral wetlands are present within the buffer area. One of these (Protected Wetland 6) is within 20 m of the road footprint and has been fenced as part of the MP3 project to exclude stock and contains a moderate diversity of indigenous ephemeral wetland species. The other site is not fenced and was dominated by exotic wetland grasses, mostly kneed foxtail grass *Alopecurus geniculatus* with scattered exotic herbs such as sheep's sorrel *Rumex acetosella* and chickweed *Cerastium fontanum* but have now been destroyed through cultivation into a winter feed crop and a wheat crop. Also in the buffer area is 0.3 ha of sparse narrow-leaved tussock grassland of similar character to that in the footprint and which is bordering 0.2 ha of exotic-dominated riparian vegetation that would doubtfully qualify as a natural inland wetland.

5.12.2 *Avifauna*

Indigenous pipit (At Risk – Declining), spur-winged plover and paradise shelduck were recorded inhabiting the cultivated brassica crop and silvereye were recorded in a nearby scrub patch outside of the ZOI.

5.12.3 *Sites or communities within road realignment identified as significant*

The ephemeral wetland (Protected Wetland 6) in the buffer area of the road realignment is considered **significant** under the NPS-IB, POORPS, pORPS and Waitaki District Plan as a Naturally Uncommon ecosystem that harbours rare species.

None of the other vegetation communities are considered significant under either the NPS-IB, POORPS, pORPS or Waitaki District Plan as they are exotic communities with few ecological features and that are not important habitat for indigenous birds. It is very unlikely that these sites would be considered a Highly Mobile Fauna Area under Clause 3.20.

5.13 Golden Point Backfill Buttresses and Northern Gully WRS

5.13.1 *Vegetation*

The Golden Point Backfill Buttresses and excavation of the Northern Gully WRS borrow site will be predominantly on existing mine workings and the only vegetation (excluding weeds and rehabilitated WRS vegetation) occurs in the buffer area where there is 0.5 ha of rough pasture and 0.3 ha of shrubland comprised of moderately dense to isolated plants of matagouri, *Rubus schmidelioides* var. *subpauperatus* and *Coprosma propinqua.*

5.13.2 *Avifauna*

The avifauna of this site was not specifically examined as it is predominantly mine works. It is possible that parts of the Northern Gully WRS are used at times by the At Risk – Declining Pipit, but the tall and close rank grass on this site makes this unlikely.

5.14 Summary of ecological features identified as significant in district or regional planning documents

Table 8. Project component vegetation communities considered significant under regional and district plans.

Project Component	Vegetation Community	NPS-IB	POORPS	pORPS	WDC District Plan	Dunedin City 2GP
Coronation 6	Ephemeral Wetland	✓ representative, diversity, rarity, distinctive, habitat of rare species	✓ representative, distinctive, rarity, habitat of rare species	✓ representative, distinctive, rarity, habitat of rare species	✓ representative, habitat of rare species	✓ representative, distinctive, rarity, habitat of rare species
	Riparian vegetation	✓ representative, diversity	✓ representative, rarity	✓ representative, rarity	✓ representative	✓ representative
	Tussockland	✓ representative, diversity, habitat of rare species	✓ representative, rarity, habitat of rare species	✓ representative, rarity, habitat of rare species	✓ habitat of rare species	✓ representative, rarity, habitat of rare species
FrIM	Tussockland	✓ representative, diversity, rarity	✓ representative, rarity	✓ representative, rarity	✓ rarity	
	Riparian vegetation (in buffer)	✓ representative, diversity	✓ representative, rarity	✓ representative, rarity		
	Wetland (in buffer)					
Golden Bar	Tussockland	✓ representative, diversity, habitat of rare species	✓ representative, rarity, habitat of rare species, distinctive (buffer only)	✓ representative, rarity, habitat of rare species, distinctive (buffer only)	✓ habitat of rare species	
	Riparian vegetation	✓ representative, diversity, habitat of rare species	✓ representative, rarity, habitat of rare species	✓ representative, rarity, habitat of rare species	✓ representative	

	Shrublands	✓ representative, diversity, habitat of rare species	✓ representative, rarity, habitat of rare species	✓ representative, rarity, habitat of rare species	✓ representative, rarity	
Road Realignment	Ephemeral wetland	✓ representative, diversity, rarity, distinctive, habitat of rare species	✓ representative, distinctive, rarity, habitat of rare species	✓ representative, distinctive, rarity, habitat of rare species	✓ representative, habitat of rare species	
Golden Point Backfill Buttress & Northern Gully WRS						

6 Assessment of Ecological Effects

6.1 Impact on Ecological Values in Project Components

6.1.1 *Coronation 6*

Avifauna

The Coronation 6 project component involves the clearance and permanent removal of habitat probably used for breeding by an unknown number of pairs of pipit (At Risk - Declining), possibly used for feeding by 1-2 pairs of banded dotterel and which provides habitat for the Not Threatened brown creeper and grey warbler. The habitats that will be removed are potential hunting and breeding habitat for the Threatened - Nationally Vulnerable falcon.

Vegetation Communities

The Coronation 6 project component involves the clearance and permanent removal of approximately 2.8 ha of semi-natural or indigenous vegetation and 2.8 ha of exotic vegetation outside of the mapped consent area. In addition, there may be some effect on the surrounding vegetation resulting from project activities extending up to 100 m beyond the project area and outside of the mapped consent extent on 6.2 ha of indigenous vegetation and 1.1 ha of exotic vegetation. The extent of each vegetation type in each of these areas is provided in Table 2.

Narrow-leaved tussock grassland

Excavation of the Coronation 6 Pit will result in the permanent loss of 2.7 ha of narrow-leaved tussock grassland with some effect such as deposition of dust on the 4.9 ha in the buffer area. This vegetation community is currently mapped from satellite photography as covering 11,357 ha in the Macraes E.D.[18] (Figure 13), and the area within the ZOI represents 0.1% of this extent. Between 2012 and 2018, the Landcover Database (LCDB V5) mapped tussockland coverage

[18] All vegetation extents are calculated using updated mapping of Macraes E.D. boundary to reflect the boundary in the PNAP report.

had increased by 2.7% in the Macraes E.D, primarily due to better mapping. Tussock grassland appears to be currently decreasing in extent with widespread clearance to create improved pasture. Parts of this vegetation community in the ZOI are inhabited by the At Risk – Declining pipit.

This vegetation community is assessed as having:

moderate representativeness as it is very typical of tussock grasslands in this area but is degraded by grazing;

high rarity and diversity importance as it provides habitat for an At Risk – Declining bird species;

moderate diversity and pattern importance as it is very typical of tussock grasslands in this area, but is degraded by grazing and contains no elevational gradient or other ecological transitions;

moderate ecological context as it is of moderate size, relatively ecologically robust (much of the impacts have been manifested due to the activities of Māori and European settlers) and there is some connectivity of this site with adjoining areas of tussock grassland to the east. but it adjoins an area of previous mine disturbance.

Overall, the tussock grassland has **high** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the tussockland vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

The overall level of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature as which occurs over much of the Macraes E.D.

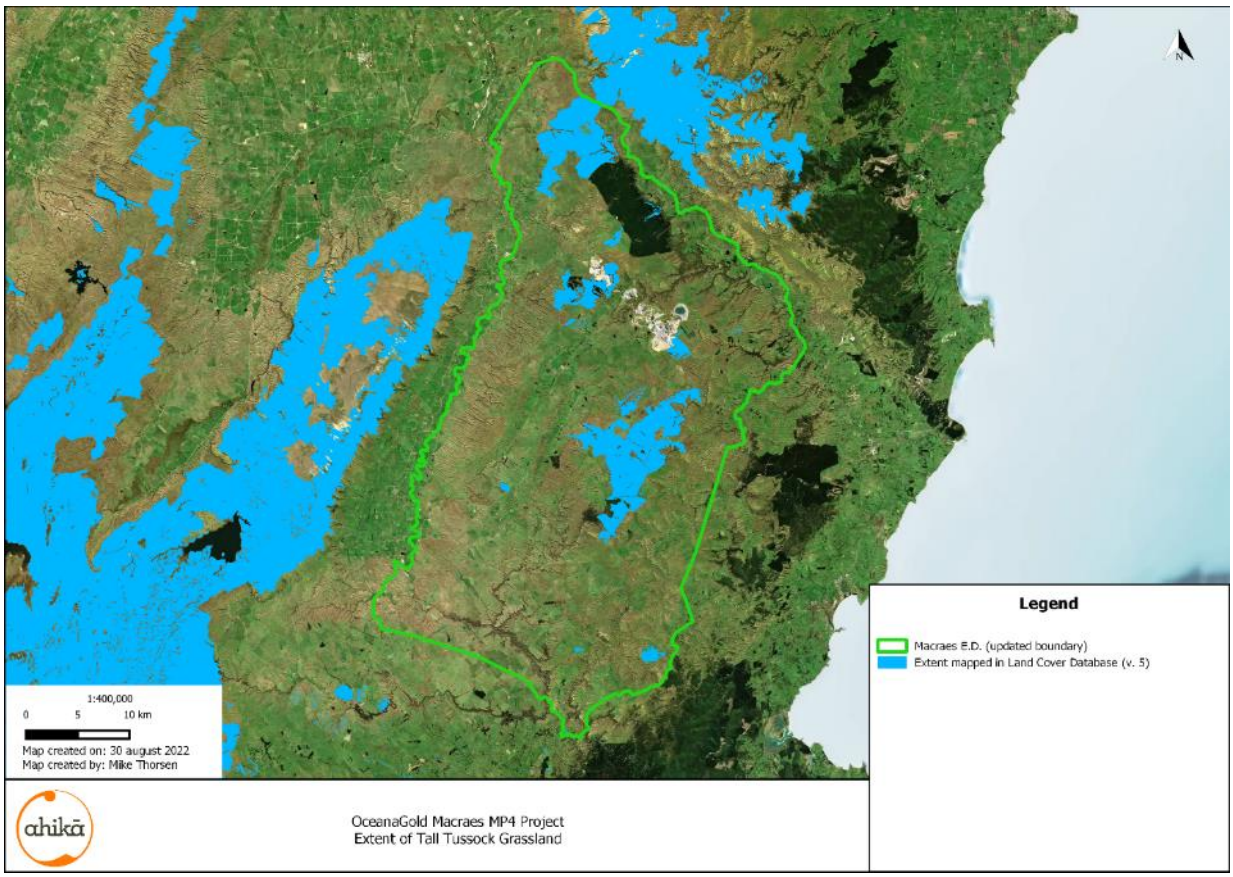

Figure 13. Distribution of tussockland vegetation community in the vicinity of Macraes E.D.

Riparian Vegetation

Excavation of the Coronation 6 Pit will result in the permanent loss of 0.02 ha of riparian vegetation. Dewatering is likely to result in changes to around 0.1 ha in the buffer area. This will shift the vegetation community in this area towards a drier community with higher preponderance of pasture grasses and reduction and eventual loss of more water dependent species such as the pukio *Carex secta*. The extent of freshwater herbaceous vegetation in the Macraes E.D. is c. 323 ha, but this figure will also include other sites (such as ponds) containing freshwater herbaceous vegetation and does not include riparian vegetation, and therefore the consequence of this reduction in area is difficult to assess but is probably much less than 0.51%.

This vegetation community is assessed as having:

moderate representativeness as it is very typical of riparian vegetation communities in this area but is degraded by grazing;

moderate rarity and diversity importance as it is a vegetation community restricted to stream environments;

moderate diversity and pattern importance as it is very typical of riparian vegetation communities in this area, is an example of a vegetation community that would have existed prior to human arrival in NZ, but is degraded by grazing and contains no elevational gradient or other ecological transitions;

moderate ecological context as it is of moderate size, and of moderate-high vulnerability to grazing, and there is some connectivity of this site with the downstream area and probably nearby streams.

Overall, riparian vegetation is assessed as having **moderate** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct and indirect**, **permanent**, **irreversible**, **local impact** on the riparian vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

The overall level of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate** as its extent in the wider area is to a degree unknown.

Ephemeral Wetlands

Excavation of the Coronation 6 Pit will result in the permanent loss of one previously-impacted ephemeral wetland covering 0.04 ha. Dewatering of the buffer area will result in further changes to a previously-impacted 0.02 ha ephemeral wetland situated 9 m from the new pit edge and to a more natural 0.16 ha example situated 76 m from the new pit edge. This is likely to shift the vegetation away from a community typical of long-inundation ephemeral wetlands to one more characteristic of short-inundation ephemeral wetlands mostly comprising the same species as currently, but at lower stature but with a higher preponderance of exotic pasture grasses such as Yorkshire fog *Holcus lanatus* and browntop *Agrostis capillaris*. The At Risk – Naturally Uncommon grass *Agrostis pallescens* is likely to disappear from the already impacted 0.04 ha site and be greatly reduced in coverage in the more-natural 0.16 ha site and the three plants of the At Risk - Declining grass *Deschampsia cespitosa* are likely to be lost as a result of

dewatering. The ephemeral wetlands within the Coronation 6 Pit are within the ZOI of the 2016 Coronation extension project[19] which described eventual loss of all ephemeral wetlands within the ZOI. The actual effects of the 2016 Coronation extension project on these ephemeral wetlands has been a degree of dewatering and consequent ecological change, especially of the two closest to the pit edge. The ephemeral wetlands are habitat to three individuals of the At Risk – Declining wetland grass *Deschampsia cespitosa* and frequent patches of the At Risk – Naturally Uncommon wetland grass *Agrostis pallescens*.

The extent of this vegetation community in the Otago region is unknown, but mapping of this community in the Macraes E.D. as part of the previous Deepdell North III Project (Figure 14) identified at least 1,360 ephemeral wetlands covering 162.39 ha (and at least a further 218 possible examples) mostly in the southern and western parts of the ecological district. The ecological integrity of the ephemeral wetlands in this area is unknown, but nearly all are dominated by exotic grasses and the majority have only 1-4 indigenous species present (Author pers. obs.). Ephemeral wetlands are known habitat for a number of rare plants (Johnson and Rogers, 2003), but these are present only in a few of the sites that have been inspected and seem to be lost from sites following invasion by sward forming grasses. They may be particularly at risk of this if grazing is removed (Author pers. obs.). The impact of this project on ephemeral wetlands of this type will result in an approximately 0.9% reduction in extent of the vegetation community in the Macraes E.D. and about a c. <1.1% reduction in the number of sites within the Macraes E.D. The loss in the ZOI being represented by sites with some to moderate indigenous plant component and including some rare plant species. This vegetation community is a Naturally Uncommon and Threatened plant community.

This vegetation community is assessed as having:

moderate representativeness as it retains some of the species that are typical of these vegetation communities, but is somewhat degraded by grazing and changed hydrological patterns;

high rarity and diversity importance due to the presence of an At Risk – Declining wetland grass and At Risk – Naturally Uncommon wetland grass;

high diversity and pattern importance as it is very typical of ephemeral wetland vegetation communities in this area, is a naturally uncommon and critically endangered ecosystem, is an

[19] Coronation North Project: Assessment of Environmental Effects, 24 May 2016.

example of a vegetation community that would have existed prior to human arrival in NZ, but is degraded by grazing and changed hydrological patterns;

moderate ecological context as it is of moderate size, and of moderate-high vulnerability to grazing, and there is probably some connectivity of this site with other ephemeral wetlands in the area.

Overall, the ephemeral wetlands are assessed as having **high** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct and indirect**, **permanent**, **irreversible**, **local impact** on the ephemeral wetland vegetation community.

The magnitude of the project's impact on this vegetation community 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 vegetation community is **very high**.

The confidence of this assessment is **low-moderate** as though this vegetation community is distinctive, it is difficult to map using available aerial imagery and therefore its extent in the Macraes E.D. or in Otago is largely unknown. The ecological integrity of sites is mostly unknown.

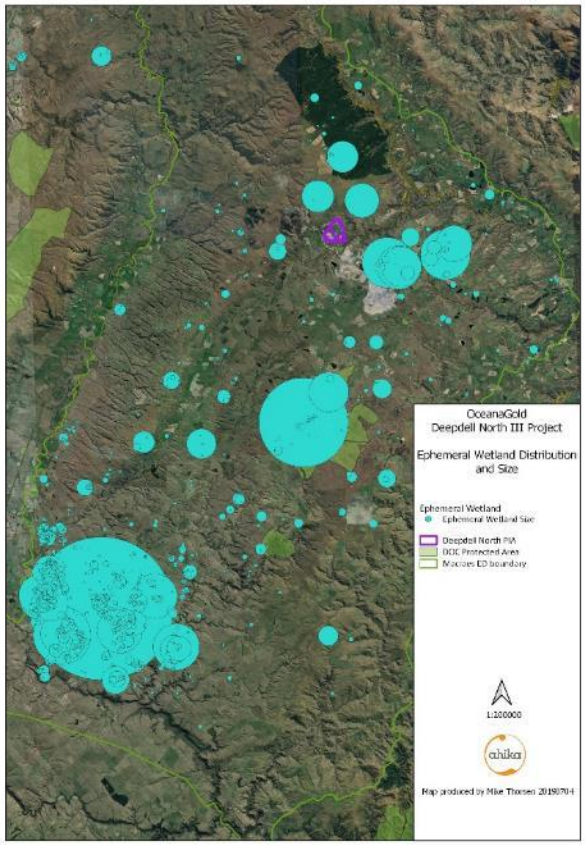

Figure 14. Mapped locations and size of ephemeral wetlands in the vicinity of Macraes E.D. Symbol size based on mapped area of the wetland and is centred on wetland location (map produced for Deepdell North III Project).

Effect on rare flora and fauna

Falco novaeseelandiae Gmelin subsp. novaeseelandiae (eastern New Zealand falcon, Falconidae) Threatened – Nationally Vulnerable.

The noise and disturbance associated with earth-moving activities involved in excavating the pit and construction of WRS will likely cause any falcons that may use the area as part of their feeding or breeding territory to shift their territory to avoid the project area. The loss of hunting habitat is also likely to have a temporary effect on falcon use of the area until the areas are revegetated. It is not known the extent to which this will replace the lost hunting territory. The result of these project effects will be the temporary displacement of the species from the project area at the Coronation 6 site. This may cause some negligible effect on the Macrae's falcon population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of the displaced pair is unknowable, but it is thought that there is likely adequate vacant territory

to support the pair of vacant territory in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of a breeding seasons of potentially one pair of falcon is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through tussock grasslands and pine forests of Central Otago and beyond.

The ecological importance of the population of this species possibly occurring within the ZOI is categorised as **very high.**

The impact of this project is assessed as having an **adverse**, **direct or indirect**, **temporary**, **local impact** on the species.

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

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

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Anthus novaeseelandiae Gmelin subsp. novaeseelandiae (pipit, Motacillidae) At Risk - Declining.

The earth-moving activities and changes in landform involved in excavating the Coronation 6 pit will cause the pairs of pipit resident there to temporarily relocate to other areas until rehabilitation of the areas has occurred. The result of these project effects will be the temporary displacement of the species from the project areas at all sites. This may cause some effect on the Macrae's pipit population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of a displaced pair is unknowable, but it is thought that the project effects are unlikely to cause mortality of the pair as they have shown an ability to utilise artificial habitats (grassed rock mounds) of which there is plenty in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of breeding is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through rough grasslands of Central Otago and beyond.

The ecological importance of the population of pipit within the ZOI is categorised as **high**.

The impact of this project is assessed as having both an **adverse**, **direct**, **temporary**, **local impact** on pipit.

The magnitude of the project's impact on pipit 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 **high**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Charadrius bicinctus Jardine & Selby subsp. bicinctus (banded dotterel, Charadriidae) At Risk - Declining.

The earth-moving activities and changes in landform involved in excavating the Coronation 6 pit will cause the 1-2 pairs of banded dotterel that may forage there to temporarily relocate to other areas until rehabilitation of the areas has occurred. The result of these project effects will be the temporary displacement of the species from the project area. This is unlikely to affect the Macrae's banded dotterel population as this species has recently re-colonised the area after being absent for probably decades and utilises man-made habitats such as that created by mine workings. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of breeding is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as the population at Macraes is re-establishing within mine workings.

The ecological importance of the population of banded dotterel possibly within the ZOI is categorised as **high**.

The impact of this project is assessed as having both an **adverse**, **indirect**, **temporary**, **local impact** on pipit.

The magnitude of the project's impact on pipit 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 **low**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Deschampsia cespitosa (L.) P.Beauv. (a wetland grass, Gramineae) At Risk - Declining.

Excavating the Coronation 6 pit will destroy 3 individuals of this species. This would have very little impact on local population dynamics as the species is widely but sparsely distributed in wet areas throughout Macraes. The impact on the species at a national scale is estimated to result in a negligible reduction in the total population.

The ecological importance of the population of this species within the ZOI is categorised as **high**.

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**.

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

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

Agrostis pallescens Cheesem. (wetland grass, Gramineae) At Risk – Naturally Uncommon.

Excavation of the Coronation 6 pit will destroy two sites totalling approximately 506 m^2 inhabited by this species and cause further loss of hydrological function in the remaining ephemeral wetland in the buffer area probably resulting in the eventual loss of this species from that site. These sites are mostly within the ZOI of the previous Coronation Extension project which assumed the likely loss from these sites and therefore the effects on this species are considered as partly mitigated as part of the Coronation Extension project. There is some risk of a reduction in the longer-term viability of the species in a local context as the distribution of this species is very poorly known. The impact on the species at a national scale is likely to be negligible.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

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 **negligible**.

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

The confidence of this assessment is **low**, as this species is very poorly known. This species is easily confused with other *Agrostis* grasses and it is relatively inconspicuous. There is also a shortage of people able to identify grasses such as this, and this contributes to our poor knowledge of this species.

6.1.2 *FrIM*

Avifauna

Construction of the FrIM pits and deposition of rock into the backfill areas will lead to temporary loss of habitat for indigenous pipit (At Risk – Declining), spur-winged plover and paradise shelduck.

Vegetation

Construction of the FrIM pits and deposition of rock into the backfill and waste rock stack areas will lead to the permanent loss of 0.2 ha of tussock grassland, 0.07 ha of wetland, and 0.07 ha of riparian vegetation as well as 3.2 ha of exotic rank grassland (including some patches of narrow-leaved tussock grassland) and 3.6 ha of improved pasture.

Pasture

The high producing grassland vegetation community has been mapped from satellite photography as covering 27,048 ha in the Macraes E.D. (Figure 15), and the area within the ZOI represents 0.3% of this extent. Between 2012 and 2018, cultivated pasture coverage decreased by 72.8% in the Macraes E.D.

These vegetation communities are assessed as having:

very low representativeness as it is a grazed mainly-exotic vegetation community;

high rarity and diversity importance due to the presence of an At Risk – Declining pipit;

very low diversity and pattern importance as it is a grazed exotic vegetation community;

very low ecological context as it is a grazed exotic vegetation community.

Overall, these vegetation communities are assessed as having **moderate** ecological importance due to the presence of an At Risk -Declining bird species.

The impact of this project is assessed as having an **adverse**, **direct**, **temporary**, **irreversible**, **local impact** on the cultivated pasture vegetation communities.

The magnitude of the project's impact on these vegetation communities at a local scale is assessed as **low**.

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

The confidence of this assessment is **moderate-high** as these vegetation communities are readily discernible in satellite images, except when it is reverting to low-producing grassland, shrublands or weed communities.

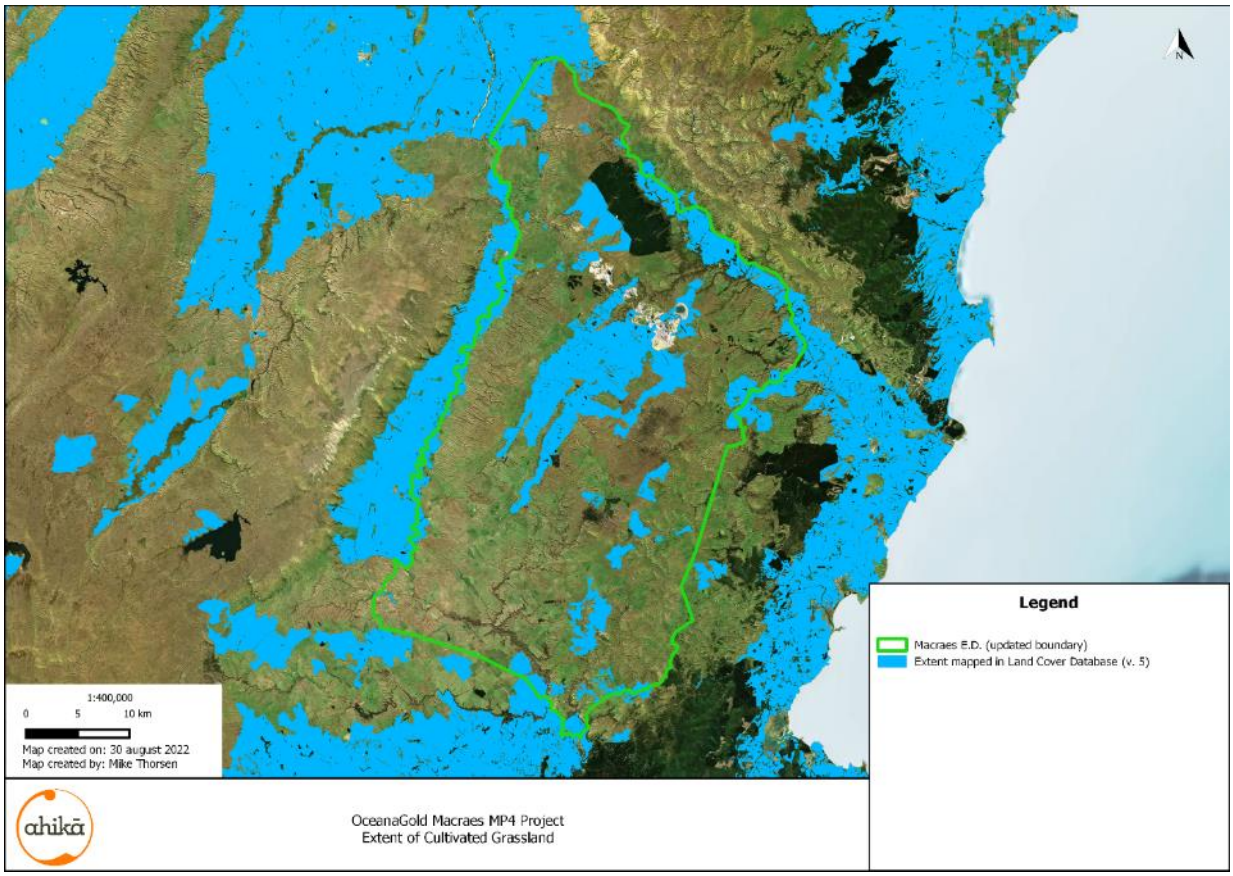

Figure 15. Distribution of cultivated pasture vegetation community in the vicinity of Macraes E.D.

Narrow-leaved tussock grassland

Excavation of the Innes Mills 10 Pit will lead to the permanent loss of 0.2 ha of narrow-leaved tussock grassland with some effect such as deposition of dust on the 0.7 ha in the buffer. This vegetation community is currently mapped from satellite photography as covering 11,357 ha in

the Macraes E.D. (Figure 13), and the area within the ZOI represents <0.01% of this extent. Between 2012 and 2018, tussockland coverage increased by 2.7% in the Macraes E.D, primarily due to better mapping. Tussock grassland appears to be currently decreasing in extent with widespread clearance to create improved pasture.

This vegetation community is assessed as having:

moderate representativeness as it is a small but reasonably ecologically intact example of tussock grasslands in this area;

moderate rarity and diversity importance as it provides habitat for a rare plant species;

moderate diversity and pattern importance as it is very typical of tussock grasslands in this area, but is degraded by grazing and contains no elevational gradient or other ecological transitions;

low ecological context as it is of very small size which is unlikely to harbour the ecological interactions that are typical of this vegetation community.

Overall, the tussock grassland is assessed as having **moderate** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct and indirect**, **permanent**, **mostly irreversible**, **local impact** on the tussockland vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

The overall level of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature as which occurs over much of the Macraes E.D.

Wetland vegetation

Excavation of the Innes Mills 10 Pit may result in a permanent change in plant community composition in the 0.07 ha of wetland vegetation the buffer area through potential lowering of the groundwater table around the gully in which they occur. This would shift the vegetation community in this area towards a drier community with higher preponderance of pasture

grasses and reduction and eventual loss of more water dependent species such as the pukio *Carex secta*, toetoe *Cortaderia fulvida* and the shrub *Olearia bullata*. The extent of freshwater herbaceous vegetation in the Macraes E.D. is c. 323 ha, but this figure will also include other sites (such as ponds) containing freshwater herbaceous vegetation, and therefore the consequence of this reduction in area is difficult to assess, but is probably much less than 0.1%.

This vegetation community is assessed as having:

moderate representativeness as it is very typical of wetland vegetation communities in this area though dominated by exotic species over much of its area and is degraded by grazing;

moderate rarity and diversity importance as it is a vegetation community restricted to stream environments;

low diversity and pattern importance as they are very degraded examples of wetland vegetation communities in this area, is an example of a vegetation community that would have existed prior to human arrival in NZ, but is degraded by grazing and weed species and contains no elevational gradient or other ecological transitions;

low ecological context as it is of small size, and of high vulnerability to grazing, and there is limited connectivity of this site with other wetland areas.

Overall, the wetland vegetation community is assessed as having **moderate** ecological importance.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **irreversible**, **local impact** on the wetland vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

The overall level of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate** as the extent of the wetland vegetation community in the wider area is to a degree unknown.

Riparian vegetation

Excavation of the Innes Mills 10 Pit will result in the permanent loss of 0.07 ha of riparian vegetation. Dewatering is likely to result in changes to 0.31 ha of the riparian vegetation in the buffer area. This will shift the vegetation community in this area towards a drier community with higher preponderance of pasture grasses and reduction and eventual loss of more water dependent species such as the pukio *Carex secta*, toetoe *Cortaderia fulvida* and the shrub *Olearia bullata*. The extent of freshwater herbaceous vegetation in the Macraes E.D. is c. 323 ha, but this figure will also include other sites (such as ponds) containing freshwater herbaceous vegetation and does not include riparian vegetation, and therefore the consequence of this reduction in area is difficult to assess, but is probably much less than 0.1%.

This vegetation community is assessed as having:

moderate representativeness as it is very typical of riparian vegetation communities in this area though dominated by exotic species over much of its area and is degraded by grazing;

moderate rarity and diversity importance as it is a vegetation community restricted to stream environments;

moderate diversity and pattern importance as it is very typical of riparian vegetation communities in this area, is an example of a vegetation community that would have existed prior to human arrival in NZ, but is degraded by grazing and weed species and contains no elevational gradient or other ecological transitions;

moderate ecological context as it is of moderate size, and of moderate-high vulnerability to grazing, and there is some connectivity of this site with the downstream area and probably nearby streams.

Overall, the riparian vegetation community is assessed as having **moderate** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct and indirect**, **permanent**, **irreversible**, **local impact** on the riparian vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

The overall level of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate** as its extent in the wider area is to a degree unknown.

Effect on rare flora and fauna

Anthus novaeseelandiae Gmelin subsp. novaeseelandiae (pipit, Motacillidae) At Risk - Declining.

The earth-moving activities and changes in landform involved in excavating the FrIM pits and backfill construction will cause the pairs of pipit resident there to temporarily relocate to other areas until rehabilitation of the areas has occurred. The result of these project effects will be the temporary displacement of the species from the project areas at all sites. This may cause some effect on the Macrae's pipit population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of a displaced pair is unknowable, but it is thought that the project effects are unlikely to cause mortality of the pair as they have shown an ability to utilise artificial habitats (grassed rock mounds) of which there is plenty in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of breeding is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through rough grasslands of Central Otago and beyond.

The ecological importance of the population of this species within the ZOI is categorised as **high**.

The impact of this project is assessed as having both an **adverse**, **direct**, **temporary**, **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 **high**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Celmisia hookeri Cockayne (Hooker's mountain daisy, Asteraceae) At Risk – Naturally Uncommon.

Excavation of the Innes Mills Stage 10 Pit is unlikely to impact on the up to 100 individuals of this species in the buffer area as this species inhabits rock outcrops which are not susceptible to dewatering and are naturally protected from inadvertent trampling due to the site's steepness and is far enough distant that dust is unlikely to be an issue. This species has reasonably coriaceous leaves and so probably has limited susceptibility to dust.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having a **potentially adverse**, **indirect**, **reversible**, **local impact** on the species.

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

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

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys but this species is likely to be present at sites visited if suitable habitat is present.

6.1.3 *Golden Bar Pit & WRS*

Avifauna

Excavation of the Golden Bar Pit and deposition of rock will lead to the temporary loss of habitat for Threatened – Nationally Vulnerable falcon and At Risk – Declining pipit as well as harrier hawk, spur-winged plover and paradise shelduck.

Vegetation

The Golden Bar project component involves the clearance and permanent removal of approximately 28.2 ha of semi-natural or indigenous vegetation and 0.4 ha of exotic vegetation. In addition, there may be some effect on the surrounding vegetation resulting from project activities extending to 100 m beyond the project area on 11.6 ha of indigenous vegetation. The extent of each vegetation type in each of these areas is provided in Table 2.

Narrow-leaved tussock grassland

Excavation of the Golden Bar pit and deposition of rock in the Golden Bar WRS will lead to the permanent loss of 27.3 ha of narrow-leaved tussock grassland with some effect such as deposition of dust on the 36.1 ha in the buffer. This vegetation community is currently mapped from satellite photography as covering 11,357 ha in the Macraes E.D. (Figure 13), and the area within the ZOI represents 0.5% of this extent. Between 2012 and 2018, tussockland coverage increased by 2.7% in the Macraes E.D, primarily due to better mapping. Tussock grassland appears to be currently decreasing in extent with widespread clearance to create improved pasture. This vegetation community is inhabited by rare plants and bird species including the Threatened – Nationally Vulnerable NZ falcon.

This vegetation community is assessed as having:

moderate-low representativeness as it is mostly a degraded example of tussock grasslands in this area;

high rarity and diversity importance as it provides habitat for a Threatened – Nationally Vulnerable and an At Risk – Declining bird species and some rare plant species occur in the buffer area;

moderate diversity and pattern importance as it is very typical of tussock grasslands in this area, but is degraded by grazing and contains no elevational gradient or other ecological transitions;

moderate ecological context as it is of moderate size, relatively ecologically robust (much of the impacts have been manifested due to the activities of Māori and European settlers) and there is some connectivity of this site with adjoining areas of tussock grassland in the area but it adjoins an area of previous mine disturbance.

Overall, the tussock grassland is assessed as having **high** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct and indirect**, **permanent**, **mostly irreversible**, **local impact** on the tussockland vegetation community.

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

The overall level of the project's effect on this vegetation community is **high**.

The confidence of this assessment is **moderate** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature as which occurs over much of the Macraes E.D.

Shrubland

The result of these project effects will be a permanent loss of 0.06 ha of this community and the loss of a group of the Data Deficient shrub *Melicytus* "Otago" and the Locally Uncommon vine *Fuchsia perscandens*. This vegetation community currently mapped from satellite photography as covering 4,284 ha in the Macraes E.D. (Figure 16), and the area within the ZOI represents <<0.001% of this extent. Between 2012 and 2018, shrubland coverage decreased by 5.3% in the Macraes E.D, primarily due to conversion to exotic forestry. This vegetation community is well-known in the Macraes area as being seral and quickly invading farmland unless prevented from doing so. The current extent of this type of vegetation community is probably greatly affected by farming profitability (especially funds available for vegetation control) and extent decreases when farm profitability is high and large areas of low-diversity and low stature shrublands develop when farm profitability is low.

This vegetation community is assessed as having:

low representativeness as it is typical of rock outcrop shrublands in this area, but is of small size;

moderate rarity and diversity importance due to the presence of a Data Deficient and a locally uncommon plant species;

low diversity and pattern importance as it is of very small size and of limited species diversity ;

low ecological context as it is of small size and probably limited connectivity with other shrublands in the area.

Overall, this vegetation community is assessed as having **low** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the shrubland vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

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

The confidence of this assessment is **moderate** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature as which occurs over much of the Macraes E.D.

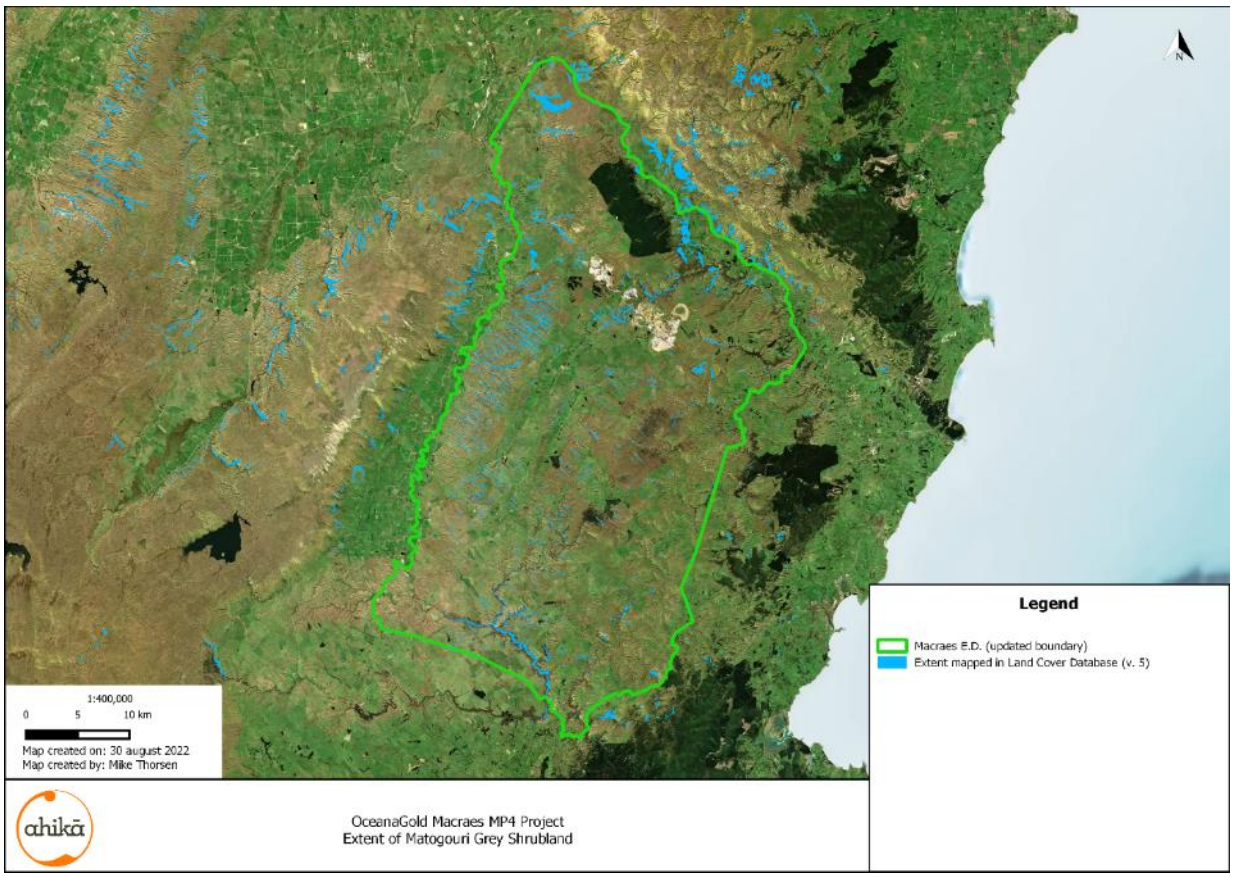

Figure 16. Distribution of shrubland vegetation community in the vicinity of Macraes E.D.

Riparian vegetation

Excavation of the Golden Bar Pit and deposition of rock in the Golden Bar WRS will result in the permanent loss of 0.8 ha of riparian vegetation and the loss of habitat of an At Risk-Declining plant species. Dewatering is likely to result in changes to around 0.1 ha of the riparian vegetation in the buffer area. This will shift the vegetation community in this area towards a drier community with higher preponderance of pasture grasses and reduction and eventual loss of more water dependent species such as the pukio *Carex secta*. The extent of freshwater herbaceous vegetation in the Macraes E.D. is c. 323 ha, but this figure will also include other sites (such as ponds) containing freshwater herbaceous vegetation and does not include riparian vegetation, and therefore the consequence of this reduction in area is difficult to assess, but is probably much less than 0.46%.

This vegetation community is assessed as having:

moderate representativeness as it is very typical of riparian vegetation communities in this area but is degraded by grazing;

high rarity and diversity importance as it is a vegetation community restricted to stream environments and provides habitat for a small population of an At Risk – Declining plant species;

moderate diversity and pattern importance as it is very typical of riparian vegetation communities in this area, is an example of a vegetation community that would have existed prior to human arrival in NZ, but is degraded by grazing and contains no elevational gradient or other ecological transitions;

moderate ecological context as it is of moderate size, and of moderate-high vulnerability to grazing, and there is some connectivity of this site with the downstream area and probably nearby streams.

Overall, the riparian vegetation community is assessed as having **high** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct and indirect**, **permanent**, **irreversible**, **local impact** on the riparian vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **low**.

The overall level of the project's effect on this vegetation community is **low**.

The confidence of this assessment is **moderate** as its extent in the wider area is to a degree unknown.

Effect on rare flora and fauna

Falco novaeseelandiae Gmelin subsp. novaeseelandiae (eastern New Zealand falcon, Falconidae) Threatened – Nationally Vulnerable.

The noise and disturbance associated with earth-moving activities involved in excavating the pit and construction of WRS will cause the pair of falcon at Golden Bar to shift their territory to avoid the project area. The loss of hunting habitat is also likely to have a temporary effect on

falcon use of the area until the areas are revegetated. It is not known the extent to which this will replace the lost hunting territory. The result of these project effects will be the temporary displacement of two pairs of the species from the project area at the Golden Bar site. This may cause some negligible effect on the Macrae's falcon population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of the displaced pair is unknowable, but it is thought that there is plenty of vacant territory in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of a breeding seasons of two pairs is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through tussock grasslands and pine forests of Central Otago and beyond.

The ecological importance of the population of this species within the ZOI is categorised as **very high.**

The impact of this project is assessed as having an **adverse**, **direct**, **temporary**, **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 **high**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Anthus novaeseelandiae Gmelin subsp. novaeseelandiae (pipit, Motacillidae) At Risk - Declining.

The earth-moving activities and changes in landform involved in excavating the Golden Bar, pit and construction of the Golden Bar WRS will cause the pairs of pipit resident there to temporarily relocate to other areas until rehabilitation of the areas has occurred. The result of these project effects will be the temporary displacement of the species from the project areas at all sites. This may cause some effect on the Macrae's pipit population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of a displaced pair is unknowable, but it is thought that the project effects are unlikely to cause mortality of the pair as they have shown an ability to utilise artificial habitats (grassed rock mounds) of which there is plenty in the

surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of breeding is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through rough grasslands of Central Otago and beyond.

The ecological importance of the population of this species within the ZOI is categorised as **high**.

The impact of this project is assessed as having both an **adverse**, **direct**, **temporary**, **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 **high**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Carmichaelia petriei Petrie (desert broom, Fabaceae) At Risk - Declining.

Depositing waste rock material in the Golden Bar WRS will destroy c. 100 individuals of this species. As this species is widely and patchily distributed within natural sites in the Macraes area and is known to occur at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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

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

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

The confidence of this assessment is **moderate**, as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Discaria toumatou Petrie (matagouri, Rhamnaceae) At Risk - Declining.

Excavation of the Golden Bar Pit and depositing waste rock material in the Golden Bar WRS will destroy an unknown number of individuals of this species. As this species is abundant and widely distributed within natural sites in the Macraes area and is known to occur over very large areas at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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 **negligible**, 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-high** as this is a well-marked species whose current distribution is reasonably well known. However, its main habitat (grey scrub) is thought to be in decline nationally, but the speed of this loss is not known. Determining speed of loss of this species is partly complicated by its propensity to establish itself in pasture areas in montane South Island unless actively prevented from doing so.

Epilobium insulare Hausskn. (a wetland willowherb, Onagraceae) At Risk - Declining.

Depositing rock material in the Golden Bar WRS will destroy 6 plants of this species in the ZOI. This will cause some loss 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. It is widely but sparsely distributed in watercourses at Macraes and the mechanism of

interbreeding between such widely spaced populations is not known. Overall, the loss of the one site in the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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 **low**.

The confidence of this assessment is **moderate-low** as the distribution of this species is poorly known.

Mentha cunninghamii Benth. (mint, Lamiaceae) At Risk - Declining.

Depositing rock into the Golden Bar WRS material could impact the one patch at one site of this species in the ZOI through changes to local habitat conditions or by facilitating weed invasions. The result could be the loss of c. 1 ^{m2} of the species from one site within the ZOI. This could cause some loss 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. Overall, the loss of the one site in the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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

The magnitude of the project's impact on this species at a local scale is assessed as **negligible**, 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-low** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Cardamine grandiscapa Heenan (cress, Brassicaceae) At Risk – Naturally Uncommon.

Deposition of waste rock stack material may affect the 3 individuals of this species in one site in the Golden Bar WRS buffer zone. There is some risk of a reduction in the longer-term viability of the species in a local context as the distribution of this species is very poorly known. The impact on the species at a national scale is likely to be negligible.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **negligible**.

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

The confidence of this assessment is **low**, as this species was only recently described, its distribution is poorly known, and identification of *Cardamine* species can be difficult, particularly in the absence of flowering and fruiting material.

Celmisia hookeri Cockayne (Hooker's mountain daisy, Asteraceae) At Risk – Naturally Uncommon.

Deposition of waste rock stack material may impact on up to 100 individuals of this species in one site in the Golden Bar WRS. The impact on the species at both a local and a national scale is likely to be negligible due to the large number of sites occupied by large numbers of this species.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **low**.

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys but this species is likely to be present at sites visited if suitable habitat is present.

Gingidia grisea Heenan (a mountain carrot, Apiaceae) At Risk – Naturally Uncommon.

Deposition of waste rock stack material may impact 6 individuals of this species in the Golden Bar WRS buffer. The impact on the species at both a local and a national scale is likely to be negligible as very few plants could be impacted.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

Therefore, the impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **low**.

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Juncus distegus Edgar (Two-storey rush, Juncaceae) At Risk – Naturally Uncommon.

Depositing rock material will destroy 6 plants at Golden Bar WRS. This will cause some loss 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. It is probably widely but sparsely distributed. It is considered that the loss will have little impact on local population dynamics and is very unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **moderate.**

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 **low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known and it is difficult to distinguish from similar *Juncus* species.

Melicytus aff. alpinus (c) (CHR 541568; 'Otago') (a porcupine shrub, Violaceae) Data Deficient.

Depositing WRS material will destroy about 30 plants of this species in the footprint of the ZOI. As this species is very poorly known the loss of individuals from the ZOI is difficult to assess, but it is considered that there could be an effect on the local population of this species through loss of one of few known populations. The distribution nationally is unknown and therefore is very difficult to assess.

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

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

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

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

The confidence of this assessment is **very low**, as the taxonomic validity of this species is not known, its distinguishing characters are unknown[20], and it is difficult to distinguish from the other taxa of porcupine shrubs that inhabit the same area.

Ranunculus aff. reflexus (CHR 394270; Mt Peel) (a buttercup, Ranunculaceae) Data Deficient.

Depositing rock material in the Golden Bar WRS could impact the one patch at one site of this species in the buffer area of the ZOI through changes to local habitat conditions or by facilitating weed invasions. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. Overall, the loss of the one site in the ZOI is considered unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **moderate**.

The confidence of this assessment is **low** as it was only recently recognised that this taxon inhabited the Macraes E.D., it is very poorly known and its distinguishing features are not well known, much of the Macraes area has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys.

[20] Identification as this taxon is provisional.

Fuchsia perscandens (climbing fuchsia, Onagraceae).

Depositing rock material into the Golden Bar WRS material will destroy 1 individual of this species in the ZOI. This is unlikely to impact on the population of this species at a local scale or national scale as this species is known at several other sites in the vicinity.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

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 **low**.

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Sophora microphylla (kowhai, Fabaceae).

Deposition of rock into the Golden Bar WRS may have some affect on the one individual in the buffer area. This is very unlikely to affect the population on a local scale or a national scale.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 probably **negligible**.

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

The confidence of this assessment is **moderate**, as much of the Macraes area 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.

6.1.4 *Golden Bar Road Realignment*

Avifauna

The Golden Bar Road Realignment will cause some loss of habitat for indigenous pipit (At Risk – Declining), spur-winged plover and paradise shelduck, however this effect is considered to be less than minor as it occurs at a site with ever-changing habitats associated with mining and intensive farming and there is a very small (0.1 ha) of remaining natural habitat within the footprint.

Vegetation Communities

The Golden Bar Road Realignment involves the clearance and permanent removal of approximately 0.1 ha of semi-natural or indigenous vegetation. In addition, there may be some effect on the surrounding vegetation resulting from project activities extending to 100 m beyond the project area and on 1.2 ha of indigenous vegetation (including a fenced area of Naturally Uncommon ephemeral wetland) and 6.9 ha of exotic vegetation. The extent of each vegetation type in each of these areas is provided in Table 5.

Narrow-leaved tussock grassland

Roadworks associated with construction of the Golden Bar road realignment will result in the permanent loss of 0.1 ha of narrow-leaved tussock grassland with some effect such as deposition of dust on the 0.3 ha in the buffer area. The effect of this is likely to be less than minor as it occurs at a site with ever-changing habitats associated with mining and intensive farming and this vegetation community widespread (though decreasing in extent) and is

currently mapped from satellite photography as covering 11,357 ha in the Macraes E.D.[21] (Figure 13). Parts of this vegetation community in the ZOI are inhabited by the At Risk – Declining pipit.

This vegetation community is assessed as having:

low representativeness as it is a degraded and depauperate example of tussock grasslands in this area;

low rarity and diversity importance

low diversity and pattern importance as it is a degraded and depauperate example of tussock grasslands in this area, but is degraded by grazing and contains no elevational gradient or other ecological transitions;

very low ecological context as it is of small size in a context of ever-changing habitats associated with mining and intensive farming.

Overall, the tussock grassland has **low** ecological importance.

The impact of this project is assessed as having an **adverse**, **direct**, **permanent**, **irreversible**, **local impact** on the tussockland vegetation community.

The magnitude of the project's impact on this vegetation community at a local scale is assessed as **neglible**.

The overall level of the project's effect on this vegetation community is **very low**.

The confidence of this assessment is **moderate** as this vegetation community can be very difficult to map accurately from satellite images, particularly when it is of a fragmented nature as which occurs over much of the Macraes E.D.

Ephemeral Wetlands

[21] All vegetation extents are calculated using updated mapping of Macraes E.D. boundary to reflect the boundary in the PNAP report.

Construction of the Golden Bar Road Realignment could affect one fenced[22] example of a moderate-diversity Naturally Uncommon ephemeral wetland of 0.4 ha in the buffer area by creating a source of sediment inflow. However, any effect is likely to be manageable using commonly used mitigation techniques such as silt-intercept barriers. This type of habitat is not sensitive sediment deposition as they are formed on wind-blown loess-derived sediments.

This vegetation community is assessed as having:

moderate representativeness as it retains some of the species that are typical of these vegetation communities, but is somewhat degraded by historic grazing and changed hydrological patterns;

high rarity and diversity importance as it is a Naturally Uncommon ecosystem;

high diversity and pattern importance as it is very typical of ephemeral wetland vegetation communities in this area, is a naturally uncommon and critically endangered ecosystem, is an example of a vegetation community that would have existed prior to human arrival in NZ, but is degraded by grazing and changed hydrological patterns;

moderate ecological context as it is of moderate size, and of moderate-high vulnerability to grazing, and there is probably some connectivity of this site with other ephemeral wetlands in the area.

Overall, the ephemeral wetlands are assessed as having **high** ecological importance.

The impact of this project is assessed as having an **adverse**, i**ndirect**, **temporary**, **irreversible**, **local impact** on the ephemeral wetland vegetation community.

The magnitude of the project's impact on this vegetation community, if effectively managed, at a local scale is assessed as **low**, and at a national level as **very low**.

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

The confidence of this assessment is **low**-**moderate** as though this vegetation community is distinctive, it is difficult to map using available aerial imagery and therefore its extent in the

[22] Fenced as per MP3 consent.

Macraes E.D. or in Otago is largely unknown. The ecological integrity of sites is mostly unknown.

6.1.5 *Golden Point Backfill Buttress & Northern Gully WRS*

The construction of the Golden Point Backfill Buttresses is not considered to create any adverse effect on the site's avifauna or vegetation if rockfall into the shrubland from the buttress slopes is managed. Excavation of the Northern Gully WRS as borrow material for the buttresses may impact on At Risk – Declining pipit, but this is considered unlikely.

6.2 General project effects with potential to affect ecological features

The following have been identified as general effects of project activities which are likely to result in an effect on the ZOI's ecological features at several project sites.

6.2.1 *Sediment run-off*

The unconsolidated fine rock and dust that will be deposited with the rock material during the construction of backfill, haul road and road realignment construction will be washed into the waterways which could cause an increase in wet, bare ground which is usually colonised by weed species. There is potential for sediment run-off to enter waterways and affect riparian vegetation that could extend for 100m or more downstream. This is expected to have a moderate effect on 0.12 ha of the riparian vegetation in the gullies exiting the Golden Bar WRS. Sediment run off is not expected to impact on any bird species.

6.2.2 *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 transform habitats in the surrounding area, could have the effect of making them unsuitable for some 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. This could have a low or very low effect (depending on the weed species involved) on all vegetation communities but particularly the more natural plant communities at Golden Bar and Coronation 6. Weed invasion could have a negligible to major effect on bird species as proliferation of weed species could transform habitat for a bird species and making the area unsuitable.

6.2.3 *Displacement of pests into surrounding area*

Project activities are likely to cause resident pests such as pigs, rabbits, hares, cats, mustelids and rodents to move into the surrounding area, where they will increase browsing and predation on the surrounding areas' fauna and flora. This effect is likely to be temporary. This is expected to have a minor effect on the fauna and plant communities at all project sites as these pest species are already present in the surrounding area. The effect is expected to be temporary as pest species leave the area. Mustelids and rodents, displaced by the commencement of mining activities, will have a temporary minor effect on populations of surrounding birds, particularly ground-nesting birds such as pipits.

6.2.4 *Displacement of resident birds*

Some bird species will be displaced from the ZOI as a result of project activities. These displaced individuals will compete with individuals from the surrounding area. As the surrounding area is assumed to be at the carrying capacity of that habitat, this competition will eventually result in the mortality of either the displaced or resident individuals. Displacement of individuals will have a low effect as the birds resident within the ZOI are likely to move into the surrounding area where they will compete for space and food with that area's residents. This will lead to increased competition which could result in some mortality of either resident birds or displaced birds.

6.2.5 *Noise and Vibration*

Blasting and operating heavy machinery creates considerable noise and vibration. Any adverse effects due to noise and vibration are likely to be species specific depending in part

on the auditory ability of the species and the frequency and proximity of the noise. Previous exposure to such noise is also likely to be important. Noise and vibration will have a negligible effect on the bird populations surrounding the ZOI as most of the species appear to habituate to regular disturbance. During project establishment and construction phases it is likely that harrier hawks will avoid hunting the nearby surrounding area, and that paradise shelducks will not nest within sight of the project.

6.2.6 *Wind-blown dust*

Dust can be generated from exposed surfaces (such as roads or rock deposition areas) at higher wind speeds and at lower wind speeds from surfaces disturbed by machinery and vehicle movements. Dust is actively managed within existing Macraes mine operations, and as a result the activities onsite produce little wind-blown dust. Noticeable dust accumulation only occurs within the immediate vicinity (<100 m) of mine works. Within this zone there is likely to be some reduction in a plant's photosynthetic capacity and respiration and transpiration (and possibly some chemical poisoning depending on dust type and composition)[23] and potentially also pollination effectiveness, possibly resulting in a loss of growth and reproductive output. Wind-blown dust is expected to have a minor effect on vegetation communities immediately adjacent to all project boundaries. Most lowland plant communities in Central Otago do not seem to be affected by dust at the sites where they occur close to gravel roads, and a similar effect is expected in this project. The effect of dust on vegetation surrounding existing mine operations appears to be confined to less than 100 m where dust coating can be obvious, but no obvious effects have been observed on plant health or mortality. Beyond as close as 10 m the dust coasting is visibly less and is regularly removed by rainfall. Negligible effect is expected on bird species as dust-fall is minimal at distance. There may be some avoidance of dusty fruit by frugivorous species.

6.2.7 *Artificial lighting*

The project may use artificial lighting during night operations. Strong artificial lighting can cause either a negative or positive reaction in animals, depending on species. Moths and

[23] Farmer, A.M. 1993. The effects of dust on vegetation – a review. Environmental Pollution 79: 63-75.

other nocturnal invertebrates in particular are drawn to lights and this can disrupt breeding[24] and also could attract nocturnal predators such as the exotic little owl. No seabirds are known to fly near the ZOI, and therefore there is no risk of artificial lighting disorienting overflying seabirds. Other nocturnal species are likely to avoid brightly lit areas. Overall, artificial lighting is expected to have a minor effect on bird species. There is little evidence of the effect of artificial lighting on NZ invertebrates, but the effect is likely to be similar to that observed overseas. The effect is of particular concern for species of restricted distribution.

6.2.8 *Accidental fire*

The Macraes environment is often dry, and accidental fires have the potential to burn large areas. Fire would have a minor to major effect, if uncontrolled, depending on the moisture content of vegetation community and whether it occurs near a natural fire refugia where it is unlikely that heat levels would reach a level sufficient to affect plant health. Accidental fire could have a minor to moderate effect on bird species 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. Deep-rooted (hot) fires can dramatically effect tussock grassland, an effect that can last for 1-2 decades and can lead to a reduction in their extent. Deep-rooted fires can also lead to loss of shrubland and forest that inhabit fire refugia. Deep-rooted fires occur following prolonged dry spells, or in sites where fire loads are high.

6.2.9 *Changed hydrological regimes*

Excavation of the pit may result in drainage or decreased surface and subsurface flow of water into, or away from, some water courses or ephemeral wetlands affecting the vegetation communities that occupy these areas. Changes to hydrological regimes are expected to have a nil to moderate effect depending on vegetation community and location. Water draw-down and altered subsurface flow is expected to result in a degree of drying of the unimpacted

[24] See Insect Conservation and Diversity Vol. 14:2. 2021. Special Issue: Impacts of artificial lighting at night on insect conservation.

downstream areas of riparian vegetation and on the ephemeral wetlands in the Coronation 6 buffer.

6.3 Cumulative effects

Please note that as this report assesses vegetation and avifauna, this section is only discussing cumulative effects on vegetation and avifauna.

Some projects that have staged implementation, such as OceanaGold's Macraes mine, can have effects from previous projects that accumulate over time and act in conjunction with other human activities in the area to produce an overall effect greater than that envisioned at the project stage. These cumulative effects can be difficult to discern. Over more than 30 years, the Macraes Gold Mine has now impacted a total of approximately 2,150 ha of land, of which an unknown proportion was indigenous vegetation. Each project has implemented an impact management procedure to address project effects, and these are considered to be achieving their objectives of minimising the environmental impact of the mine's operations in that project. One way in which effects have been addressed is through covenanting areas[25] and undertaking planting and wetland restoration works. However, there are likely to be other non-direct cumulative effects on the biodiversity in the area arising from surrounding land use by pastoral activities and the spread of pests, weeds and diseases. These cumulative effects have reduced the extent and quality of the indigenous vegetation communities and habitats for indigenous fauna, but quantifying the extent of these effects is difficult to measure beyond the changes in extent of vegetation communities reported in Section 6.1.1.

In 2023 OceanaGold applied for consents for the expansion and extension of the Golden Point Underground, the Innes Mills 8 extension and Frasers Tailings Storage Facility. At the time of writing these consents have not been decided.

[25] 656 ha at 13 sites have now been established in covenants. A further 54 ha is in the process of covenanting as a result of the Deepdell North project.

6.4 Climate Change

The climate at Macraes is likely changing as a result of greenhouse gas accumulation in the atmosphere. The likely effects of this on the climate in Otago has been modelled by the Otago Regional Council[26] which predicts an increase in sunshine hours and dry days with less wind for the area at Macraes vicinity[27]. Greater frequency and severity of storm effects is also expected.

Overseas, climate changes are resulting in widespread changes to ecosystem productivity, species interactions, vulnerability to biological invasions, and changes in morphology and behaviour, phenology, and range shifts of species[28,29]. In New Zealand, information on observed effects of a changing climate on terrestrial biota is scarce but is likely to include habitat fragmentation, shifts in the altitudinal zone of alpine biodiversity, drought effects on native fish and the effect of extreme weather events on species with very small populations[30,31] and these effects could be exacerbated by changes in pest abundance and also resource use[32]. The outcome of a changing climate on the biodiversity at Macraes is unknown but is likely to include similar effects to that observed elsewhere. There are likely to be effects at a variety of levels such as changes in community extent and structure as well as species-specific effects. An increase in aridity in the Macraes environment could lead to a reduction in distribution of narrow-leaved tussock grassland as this community requires a reasonable degree of soil moisture. This will also predispose it to easier clearance by fires and ploughing. Shrub communities will also be more vulnerable to fires, especially if the dry

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[26] https://www.orc.govt.nz/media/7591/niwa_climatechangereport_2019_final.pdf

[27] Though Macraes is on the boundary with a more coastal zone where rainfall is expected to increase and so dry days will be less. The prevalence of El Niño and La Niña conditions (and other long-term climate cycles such as the Interdecadal Pacific Oscillation and the ozone-influenced Southern Annular Mode) will also influence local weather.

[28] https://doi.org/10.1016/j.scitotenv.2020.137782

[29] https://spj.science.org/doi/10.1080/20964129.2018.1530054

[30] https://dx.doi.org/10.20417/nzjecol.46.10

[31] https://researchspace.auckland.ac.nz/bitstream/handle/2292/54890/fee.2285.pdf?sequence=1&isAllowed=y

[32] https://www.doc.govt.nz/documents/science-and-technical/sap257.pdf

conditions lead to an increase in their frequency and severity. Some of the long-inundation ephemeral wetland vegetation communities could shift from a sedge and copper tussock dominated vegetation to a low herb vegetation community more typical of short-inundation ephemeral wetlands. Riparian vegetation communities are likely to be reduced in extent as a result of less water within watercourses.

These ecosystem-level effects will have flow-on effects on the species which inhabit them, in addition to direct climate-related effects on individuals and populations. Of particular concern are species where the Macraes E.D. houses the bulk of the known population. This includes grand and Otago skink and flora such as *Cardamine dilitata*, *Wurmbea novae-zelandiae*, *Crassula peduncularis, Lagenophora schmidiae, Simplica laxa, Euchiton ensifer, Celmisia hookeri,* and *Gingidia grisea*.

6.5 Summary of Project Impacts

The Macraes Phase 4 project will permanently remove 36 ha (32 ha is outside of the mapped consent footprint) of indigenous vegetation comprising ephemeral wetlands, riparian vegetation, wetlands, shrubland and tussockland that together support 128 indigenous plants (including 14 At Risk or locally uncommon plant species) and 11 indigenous bird species (including one Threatened and two At Risk species). The indigenous vegetation communities are underlain by three Threatened LENZ and the ephemeral wetland vegetation community is Naturally Uncommon and Critically Endangered and is a priority for protection. The indigenous vegetation communities are generally of low or moderate species diversity and some are characterised by high weed representation. The populations of the 14 At Risk or locally uncommon plant species are mostly small, except for the Declining matagouri which is common in the tussockland vegetation community at Golden Bar. There may be some effect on the surrounding vegetation resulting from project activities extending to 100 m beyond the project area containing 46 ha of indigenous vegetation.

The indigenous vegetation communities at Coronation 6 and Golden Bar and the tussockland within the Innes Mills Stage 10 ZOI are all significant under the representativeness, rarity or distinctiveness criteria of the National Policy Statement for Indigenous Biodiversity, partially operative and proposed Otago Regional Policy Statements and proposed Dunedin City 2GP (Coronation 6 only) and under representativeness or rarity criteria of the Waitaki District Plan.

Mostly the MP4 project is assessed to have low to moderate effect on most of the terrestrial ecological features examined in this document (Table 9). The exception to this is a very high impact on three ephemeral wetlands at the Coronation 6 that are critically endangered naturally uncommon ecosystems, a high impact on tussockland, desert broom, NZ falcon and on pipit at Golden Bar. The project effects will be addressed through the Impact Management Plan.[33]

[33] Ahika Consulting Ltd. 2024. Macraes Phase 4 Project: Ecology Impact Management Plan. Unpub. Report 01015-22-221019 to Oceana Gold NZ Ltd.

Table 9. Summary table of project impacts on terrestrial ecological features assessed using the Environment Institute of Australia and New Zealand's 2018 Ecological Impact Assessment Guidelines.

Project Component	Ecological Feature Class	Ecological Feature Type	Ecological Feature	Classification of Feature	Footprint [34]	Buffer	Amount Affected[35]	Unit of Measurement	Accuracy of measurement	Ecological Importance of Feature	Magnitude of Project Impact on Feature		Overall Project Effect
											Local Scale	National Scale	
Coronation 6	**Bird**	Community	Indigenous Species Diversity				5	species	Estimated				
Coronation 6	**Bird**	Rare Species	Pipit	Declining			Unknown	pairs	Estimated	High	Moderate		High
Coronation 6	**Bird**	Rare Species	Banded dotterel	Declining			1-2	pairs	Estimated	High	Low		Low
Coronation 6	**Environment**	LENZ	Threatened LENZ with indigenous vegetation		2.77			Hectares	Measured				
Coronation 6	**Flora**	Community	Ephemeral Wetland	Critically Endangered Historically Uncommon ecosystem type National Priority for Protection	0.06	0.16	0.22	Hectares	Measured	High	High	Moderate	Very High
Coronation 6	**Flora**	Community	Riparian vegetation		0.03	0.1	0.04	Hectares	Measured	Moderate	Low		Low
Coronation 6	**Flora**	Community	Tussockland		2.7	4.9	2.95	Hectares	Measured	High	Low		Low
Coronation 6	**Flora**	Community	Natural Inland Wetlands	National Priority for Protection	0.02	0.1	0.12	Hectares	Measured				
Coronation 6	**Flora**	Community	Extent of semi-natural & natural communities		2.8	6.2	3.11	Hectares	Measured				
Coronation 6	**Flora**	Rare Species	Deschampsia cespitosa	Declining	3		3	individuals	counted	High	Low		Low
Coronation 6	**Flora**	Rare Species	Agrostis pallescens	Naturally Uncommon			506	m^2	Estimated	Moderate	High		Moderate
Coronation 6	**Kai Tahu Taoka**	Bird	Karearea/Falcon	Taonga species			1?	pairs	Estimated				
Coronation 6	**Kai Tahu Taoka**	Bird	Kahu/Harrier	Taonga species			Present		Estimated				

[34] Area outside of mapped extent area

[35] Area within footprint + 5% of area in buffer unless all area in buffer affected (ephemeral wetlands and riparian communities)

Coronation 6	**Kai Tahu Taoka**	Bird	Pihoihoi/pipit	Taonga species			Unknown		Estimated				
Coronation 6	**Kai Tahu Taoka**	Bird	Rirorirо/Grey Warbler	Taonga species			Present		Estimated				
Coronation 6	**Kai Tahu Taoka**	Plant	Patotara/*Leucopogon fraseri*	Taonga species			Occasional	plant	Estimated				
Coronation 6	**Kai Tahu Taoka**	Plant	Taramea/*Aciphylla aurea*	Taonga species			Occasional	plant	Estimated				
Coronation 6	**Kai Tahu Taoka**	Plant	Wiwi/*Juncus edgarae* and *juncus distegus*	Taonga species			local	patch	Estimated				
FrIM	**Bird**	Community	Indigenous Species Diversity				3	species	Estimated				
FrIM	**Bird**	Species	Pipit	Declining			Unknown	pairs	Estimated	High	Low		Low
FrIM	**Flora**	Community	Pasture communities				8.2	Hectares	Measured	Moderate	Low		Low
FrIM	**Flora**	Community	Tussockland		0.2	0.7	0.2	Hectares	Measured	Moderate	Low		Low
FrIM	**Flora**	Community	Riparian vegetation		0.07	0.31	0.38	Hectares	Measured	Moderate	Low		Low
FRim	**Flora**	Community	Wetland	National Priority for Protection	0.0	0.07	0.07	Hectare	Measured	Moderate	Low		Low
FrIM	**Kai Tahu Taoka**	Bird	Pihoihoi/pipit	Taonga species			Unknown		Estimated				
FrIM	**Kai Tahu Taoka**	Bird	Putakitaki/Paradise shelduck	Taonga species			Present		Estimated				
Golden Bar	**Bird**	Community	Indigenous Species Diversity				5	species	Estimated				
Golden Bar	**Bird**	Rare Species	Falcon	Vulnerable	1		1	pairs	Estimated	Very High	Moderate		High
Golden Bar	**Bird**	Rare Species	Pipit	Declining	Unknown		Unknown	pairs	Estimated	High	Moderate		High
Golden Bar	**Environment**	LENZ	Threatened LENZ with indigenous vegetation		28.2		28.2	Hectares	Measured				
Golden Bar	**Flora**	Community	Riparian vegetation		0.8	0.1	0.9	Hectares	Measured	High	Lo		Low
Golden Bar	**Flora**	Community	Shrubland		0.06	0	0.06	Hectares	Measured	Low	Low		Low
Golden Bar	**Flora**	Community	Tussockland		27.3	36.1	29.1	Hectares	Measured	High	Moderate	Low	High
Golden Bar	**Flora**	Community	Extent of semi-natural & natural communities		28.2	11.6	28.8	Hectares	Measured				
Golden Bar	**Flora**	Rare Species	Carmichaelia petriei	Declining	100		100	individuals	Estimated	High	Moderate		High
Golden Bar	**Flora**	Rare Species	Discaria toumatou	Declining	Common		Unknown	individuals	Estimated	High	Negligible		Very Low

Golden Bar	**Flora**	Rare Species	Epilobium insulare	Declining	6		6	individuals	counted	High	Low		Low
Golden Bar	**Flora**	Rare Species	Mentha cunninghamii	Declining	0.25		0.25	m^2	Estimated	High	Negligible		Very Low
Golden Bar	**Flora**	Rare Species	Cardamine grandiscapa	Naturally Uncommon		3	3	individuals	Counted	Moderate	High		Moderate
Golden Bar	**Flora**	Rare Species	Celmisia hookeri	Naturally Uncommon		150	150	individuals	Estimated	Moderate	Low		Low
Golden Bar	**Flora**	Rare Species	Gingidia grisea	Naturally Uncommon, Otago endemic		6	6	individuals	Counted	Moderate	Low		Low
Golden Bar	**Flora**	Rare Species	Juncus distegus	Naturally Uncommon	6		6	individuals	Estimated	Moderate	Low		Low
Golden Bar	**Flora**	Rare Species	Melicytus 'Otago'	Data Deficient	20		20	individuals	Estimated	Moderate	High		Moderate
Golden Bar	**Flora**	Rare Species	Ranunculus 'Peel'	Data Deficient		1	1	m^2	Estimated	Moderate	Moderate		Moderate
Golden Bar	**Flora**	Rare Species	Fuchsia perscandens	Uncommon E.D.	1		1	individuals	Counted	Moderate	Low		Low
Golden Bar	**Flora**	Rare Species	Sophora microphylla	Uncommon E.D.		1	1	individuals	Counted	Moderate	Low		Low
Golden Bar	**Kai Tahu Taoka**	Bird	Karearea/Falcon	Taonga species			1	pairs	Estimated				
Golden Bar	**Kai Tahu Taoka**	Bird	Kahu/Harrier	Taonga species			1?	pairs	Estimated				
Golden Bar	**Kai Tahu Taoka**	Bird	Karoro/Black-backed hull	Taonga species			Colony in lake		Estimated				
Golden Bar	**Kai Tahu Taoka**	Bird	Pihoihoi/pipit	Taonga species			Unknown		Estimated				
Golden Bar	**Kai Tahu Taoka**	Bird	Putakitaki/Paradise shelduck	Taonga species			Present		Estimated				
Golden Bar	**Kai Tahu Taoka**	Plant	Aruhe/Bracken	Taonga species			Scattered	patches	Estimated				
Golden Bar	**Kai Tahu Taoka**	Plant	Taramea/*Aciphylla aurea*	Taonga species			Occasional	plant	Estimated				
Golden Bar	**Kai Tahu Taoka**	Plant	Wi/*Poa cita*	Taonga species			rare	plant	Estimated				
Golden Bar	**Kai Tahu Taoka**	Plant	Wiwi/*Juncus edgarae* and *juncus distegus*	Taonga species			rare	plant	Estimated				
Golden Bar Road Realignment	**Flora**	Community	Tussockland		0.1	0.3	0.1	Hectares	Measured	Low	Very Low		Low
Golden Bar Road Realignment	**Flora**	Community	Ephemeral Wetland	Critically Endangered Historically Uncommon ecosystem type National Priority for Protection		0.4	0	Hectares	Measured	High	Low		Low

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7 Appendices

Appendix 1. Biodiversity recorded during site inventory

Flora

Site Name	Current Name + Authority	Common name	Group 1	Group 2	Family (Tribe)	Threat ranking (212)	Abundance Class
Coronation 6	Aciphylla aurea W.R.B.Oliv.	Golden spaniard, golden speargrass	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	o
Coronation 6	Cirsium arvense	Californian thistle	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	c
Coronation 6	Cirsium vulgare	Scotch thistle	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Coronation 6	Gentianella amabilis (Petrie) Glenny	Gentian	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Gentianaceae	Not Threatened	r
Coronation 6	Gonocarpus micranthus subsp. micranthus Thunb.		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Haloragaceae	Not Threatened	l
Coronation 6	Myriophyllum propinquum A.Cunn.	Common water milfoil	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Haloragaceae	Not Threatened	l
Coronation 6	Pilosella officinarum F.Schultz & Sch.Bip.	hawkweed, mouse-ear hawkweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	c
Coronation 6	Ranunculus amphitrichus Colenso	waoriki	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Ranunculaceae	Not Threatened	l
Coronation 6	Raoulia subsericea Hook.f.	Turf mat daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	o
Coronation 6	Rumex acetosa	sorrel	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Polygonaceae	Exotic	c
Coronation 6	Senecio glomeratus Poir. subsp. glomeratus	fireweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	l
Coronation 6	Trifolium repens	white clover	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	o

Coronation 6	Viola cunninghamii Hook.f.	Mountain violet, white violet	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Violaceae	Not Threatened	r
Coronation 6	Wahlenbergia albomarginata subsp. albomarginata Hook.	New Zealand harebell, harebell	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Campanulaceae	Not Threatened	r
Coronation 6	Cytisus scoparius	wild broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Exotic	r
Coronation 6	Gaultheria macrostigma (Colenso) D.J.Middleton	prostrate snowberry	DICOTYLEDONOUS TREES AND SHRUBS		Ericaceae	Not Threatened	l
Coronation 6	Leucopogon fraseri complex (mountain ecotype)		DICOTYLEDONOUS TREES AND SHRUBS		Ericaceae	Not Threatened	o
Coronation 6	Olearia bullata H.D.Wilson & Garn.-Jones		DICOTYLEDONOUS TREES AND SHRUBS		Asteraceae	Not Threatened	r
Coronation 6	Pinus radiata D.Don	radiata pine, P Rad	GYMNOSPERM TREES AND SHRUBS		Pinaceae	Exotic	l
Coronation 6	Agrostis capillaris L.	browntop	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	a
Coronation 6	Agrostis pallescens Cheeseman	swamp bent	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Naturally Uncommon	l
Coronation 6	Anthoxanthum odoratum L.	sweet vernal	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Coronation 6	Carex breviculmis R.Br.	grassland sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	o
Coronation 6	Carex gaudichaudiana Kunth	Gaudichaud's sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	r
Coronation 6	Carex leporina L.	oval sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Exotic	l
Coronation 6	Carex sinclairii Boott	Sinclair's sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	l
Coronation 6	Chionochloa rubra subsp. cuprea X C. rigida subsp. rigida		MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Hybrid	l
Coronation 6	Dactylis glomerata L.	cocksfoot	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Coronation 6	Deschampsia cespitosa (L.) P.Beauv.	tufted hair-grass, wavy hair-grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Declining	r
Coronation 6	Deyeuxia avenoides (Hook.f.) Buchanan	mountain oat grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Coronation 6	Deyeuxia avenoides (Hook.f.) Buchanan	mountain oat grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Coronation 6	Eleocharis acuta R.Br.	sharp spike sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	l

Coronation 6	Festuca novae-zelandiae (Hack.) Cockayne	Fescue tussock, hard tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Coronation 6	Glyceria fluitans (L.) R.Br.	floating sweetgrass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Coronation 6	Holcus lanatus L.	Yorkshire fog	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Coronation 6	Juncus articulatus L.	jointed rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Coronation 6	Juncus edgariae L.A.S.Johnson & K.L.Wilson	Wiwi, Edgars rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Not Threatened	l
Coronation 6	Juncus effusus var. compactus		MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Coronation 6	Luzula rufa Edgar var. rufa	Red woodrush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Not Threatened	o
Golden Bar	Acaena agnipila var. aequispina Orchard	sheeps bur	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Exotic	l
Golden Bar	Acaena novae-zelandiae Kirk X Acaena inermis Hook.f.		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rosaceae	Hybrid	r
Golden Bar	Achillea millefolium L.	yarrow	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Golden Bar	Aciphylla aurea W.R.B.Oliv.	Golden spaniard, golden speargrass	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	o
Golden Bar	Anaphalioides bellidioides (G.Forst.) Glenny	Hells Bells	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	l
Golden Bar	Anisotome aromatica Hook.f.		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	l
Golden Bar	Bellardia viscosa (L.) Fisch. & C.A.Mey.	tarweed	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Orobanchaceae	Exotic	l
Golden Bar	Brachyglottis lagopus (Raoul) B.Nord.		DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	l
Golden Bar	Callitriche petriei R.Mason subsp. petriei	Petrie's starwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Not Threatened	l

Golden Bar	Cardamine forsteri Govaerts		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Brassicaceae	Not Threatened	l
Golden Bar	Cardamine grandiscapa Heenan		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Brassicaceae	Naturally Uncommon	r
Golden Bar	Celmisia (g) (CHR 274779; "rhizomatous")		DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Assessed	r
Golden Bar	Celmisia hookeri Cockayne	Hooker's mountain daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Naturally Uncommon	l
Golden Bar	Celmisia hookeri Cockayne	Hooker's mountain daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Naturally Uncommon	
Golden Bar	Celmisia hookeri Cockayne	Hooker's mountain daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Naturally Uncommon	
Golden Bar	Celmisia hookeri Cockayne	Hooker's mountain daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Naturally Uncommon	
Golden Bar	Celmisia hookeri Cockayne	Hooker's mountain daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Naturally Uncommon	
Golden Bar	Cerastium fontanum subsp. vulgare (Hartm.) Greuter & Burdet		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	o
Golden Bar	Chaerophyllum ramosum (Hook.f.) K.F.Chung		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	l
Golden Bar	Cirsium vulgare	Scotch thistle	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Golden Bar	Crassula sinclairii (Hook.f.) A.P.Druce & Given	Sinclairs stonecrop	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Crassulaceae	Not Threatened	l
Golden Bar	Crepis capillaris	hawksbeard	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Golden Bar	Dichondra repens J.R.Forst. & G.Forst.	Mercury Bay weed, Dichondra	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Convolvulaceae	Not Threatened	l
Golden Bar	Epilobium insulare Hausskn.	willowherb	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Onagraceae	Declining	

Golden Bar	Epilobium insulare Hausskn.	willowherb	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Onagraceae	Declining	
Golden Bar	Epilobium pubens A.Rich.	Willowherb	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Onagraceae	Not Threatened	r
Golden Bar	Galium aparine	cleavers	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rubiaceae	Exotic	r
Golden Bar	Galium perpusillum (Hook.f.) Allan	dwarf bedstraw	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Rubiaceae	Not Threatened	r
Golden Bar	Gingidia grisea Heenan	none known	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Naturally Uncommon	
Golden Bar	Gonocarpus aggregatus (Buchanan) Orchard		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Haloragaceae	Not Threatened	r
Golden Bar	Helichrysum filicaule Hook.f.	Creeping or slender everlasting daisy	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	l
Golden Bar	Hieracium lepidulum	tussock hawkweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	l
Golden Bar	Hypochaeris radicata	catsear	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Golden Bar	Lilaeopsis ruthiana Affolter		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	l
Golden Bar	Limosella lineata Glück	mudwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Plantaginaceae	Not Threatened	l
Golden Bar	Mentha cunninghamii Benth.	New Zealand mint, Hihoi	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Lamiaceae	Declining	r
Golden Bar	Oxalis rubens Haw.		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Oxalidaceae	Not Threatened	r

Golden Bar	Pilosella officinarum F.Schultz & Sch.Bip.	hawkweed, mouse-ear hawkweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	c
Golden Bar	Ranunculus aff. reflexus (CHR 39427; Mt Peel)		DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Ranunculaceae	Data Deficient	
Golden Bar	Ranunculus amphitrichus Colenso	waoriki	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Ranunculaceae	Not Threatened	l
Golden Bar	Ranunculus foliosus Kirk	Grassland buttercup	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Ranunculaceae	Not Threatened	l
Golden Bar	Ranunculus sceleratus L.	celery-leaved buttercup	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Ranunculaceae	Exotic	r
Golden Bar	Rumex acetosella	sheep's sorrel	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Polygonaceae	Exotic	c
Golden Bar	Rumex conglomeratus	clustered dock	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Polygonaceae	Exotic	l
Golden Bar	Sagina procumbens L.	procumbent pearlwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	r
Golden Bar	Scandia geniculata (G.Forst.) J.W.Dawson	Scandia	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Apiaceae	Not Threatened	r
Golden Bar	Scorzoneroides autumnalis (L.) Moench	autumn hawkbit	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	
Golden Bar	Senecio glomeratus Poir. subsp. glomeratus	fireweed	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Not Threatened	r
Golden Bar	Spergularia rubra (L.) J.Presl & C.Presl	sand spurrey	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	l
Golden Bar	Stellaria alsine Grimm	bog stichwort	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	l

Golden Bar	Stellaria media (L.) Vill. subsp. media	chickweed	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Exotic	r
Golden Bar	Stellaria parviflora Hook.f.	New Zealand chickweed	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Caryophyllaceae	Not Threatened	l
Golden Bar	Taraxacum officinale agg.	dandelion	DICOTYLEDONOUS HERBS	Composites	Asteraceae	Exotic	o
Golden Bar	Trifolium dubium	suckling clover	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	c
Golden Bar	Trifolium pratense	red clover	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	o
Golden Bar	Trifolium repens	white clover	DICOTYLEDONOUS HERBS	Dicotyledonous Herbs other than Composites	Fabaceae	Exotic	o
Golden Bar	Clematis marata J.B.Armstr.		DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS		Ranunculaceae	Not Threatened	r
Golden Bar	Fuchsia perscandens Cockayne & Allan	Fuchsia	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS		Onagraceae	Not Threatened	l
Golden Bar	Muehlenbeckia australis (G.Forst.) Meisn.	Pohuehue, large-leaved muehlenbeckia	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS		Polygonaceae	Not Threatened	r
Golden Bar	Muehlenbeckia complexa (A.Cunn.) Meisn. var. complexa	Small-leaved pohuehue, scrub pohuehue, wire vine	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS		Polygonaceae	Not Threatened	l
Golden Bar	Muehlenbeckia complexa (A.Cunn.) Meisn. var. complexa	Small-leaved pohuehue, scrub pohuehue, wire vine	DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS		Polygonaceae	Not Threatened	l
Golden Bar	Rubus cissoides A.Cunn. x Rubus schmidelioides var. subpauperatus (Cockayne) Allan		DICOTYLEDONOUS LIANES & RELATED TRAILING PLANTS		Rosaceae	Hybrid	l
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	

Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Carmichaelia petriei Kirk	desert broom	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Declining	
Golden Bar	Coprosma crassifolia Colenso		DICOTYLEDONOUS TREES AND SHRUBS		Rubiaceae	Not Threatened	l
Golden Bar	Coprosma propinqua var. propinqua A.Cunn.	mingimingi	DICOTYLEDONOUS TREES AND SHRUBS		Rubiaceae	Not Threatened	l
Golden Bar	Discaria toumatou Raoul	matagouri, wild Irishman	DICOTYLEDONOUS TREES AND SHRUBS		Rhamnaceae	Declining	o
Golden Bar	Melicytus aff. alpinus (c) (CHR 541568; Otago)		DICOTYLEDONOUS TREES AND SHRUBS		Violaceae	Data Deficient	r
Golden Bar	Melicytus aff. alpinus (c) (CHR 541568; Otago)		DICOTYLEDONOUS TREES AND SHRUBS		Violaceae	Data Deficient	
Golden Bar	Melicytus aff. alpinus (c) (CHR 541568; Otago)		DICOTYLEDONOUS TREES AND SHRUBS		Violaceae	Data Deficient	l
Golden Bar	Melicytus aff. alpinus (c) (CHR 541568; Otago)		DICOTYLEDONOUS TREES AND SHRUBS		Violaceae	Data Deficient	r
Golden Bar	Melicytus aff. alpinus (c) (CHR 541568; Otago)		DICOTYLEDONOUS TREES AND SHRUBS		Violaceae	Data Deficient	r
Golden Bar	Melicytus alpinus (Kirk) Garn.-Jones	Porcupine shrub	DICOTYLEDONOUS TREES AND SHRUBS		Violaceae	Not Threatened	r
Golden Bar	Olearia bullata H.D.Wilson & Garn.-Jones		DICOTYLEDONOUS TREES AND SHRUBS		Asteraceae	Not Threatened	l
Golden Bar	Olearia bullata H.D.Wilson & Garn.-Jones		DICOTYLEDONOUS TREES AND SHRUBS		Asteraceae	Not Threatened	l
Golden Bar	Sophora microphylla Aiton	Kowhai, weeping kowhai, small-leaved kowhai	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Not Threatened	

Golden Bar	Ulex europaeus	gorse	DICOTYLEDONOUS TREES AND SHRUBS		Fabaceae	Exotic	r
Golden Bar	Asplenium appendiculatum (Labill.) C.Presl subsp. appendiculatum	ground spleenwort	FERNS		Aspleniaceae	Not Threatened	l
Golden Bar	Asplenium flabellifolium Cav.	butterfly fern, walking fern, necklace fern	FERNS		Aspleniaceae	Not Threatened	l
Golden Bar	Asplenium richardii (Hook.f.) Hook.f.	Richards spleenwort	FERNS		Aspleniaceae	Not Threatened	l
Golden Bar	Blechnum montanum T.C.Chambers & P.A.Farrant	mountain kiokio, Dunedin-Cass blechnum	FERNS		Blechnaceae	Not Threatened	r
Golden Bar	Blechnum penna-marina subsp. alpina (R.Br.) T.C.Chambers &	little hard fern, alpine hard fern	FERNS		Blechnaceae	Not Threatened	l
Golden Bar	Paesia scaberula (A.Rich.) Kuhn	Lace fern, Ring fern, Scented fern	FERNS		Dennstaedtiaceae	Not Threatened	l
Golden Bar	Pteridium esculentum (G.Forst.) Cockayne	bracken, rarauhe, bracken fern	FERNS		Dennstaedtiaceae	Not Threatened	l
Golden Bar	Agrostis capillaris L.	browntop	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Golden Bar	Alopecurus geniculatus L.	kneed foxtail	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Golden Bar	Anthosachne "green" (plants erect, with long droppoing to erect culms, spikelets small and florets easily dropped. Exotic?)		MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Assessed	c
Golden Bar	Astelia nervosa Hook.f.	Mountain astelia	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Asteliaceae	Not Threatened	r
Golden Bar	Astelia nervosa Hook.f.	Mountain astelia	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Asteliaceae	Not Threatened	r
Golden Bar	Austroderia richardii (Endl.) N.P.Barker & H.P.Linder	Toetoe	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	r
Golden Bar	Bulbinella angustifolia (Cockayne & Laing) L.B.Moore		MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Asphodelaceae	Not Threatened	o
Golden Bar	Carex resectans Cheeseman	Desert Sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	l
Golden Bar	Carex secta Boott	Purei, Pukio, Niggerhead	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	l
Golden Bar	Carex sinclairii Boott	Sinclair's sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	l
Golden Bar	Chionochloa rigida (Raoul) Zotov subsp. rigida	narrow-leaved snow tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	c
Golden Bar	Cynosurus cristatus L.	crested dogstail	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Golden Bar	Dactylis glomerata L.	cocksfoot	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o

Golden Bar	Deyeuxia avenoides (Hook.f.) Buchanan	mountain oat grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Golden Bar	Dichelachne crinita (L.f.) Hook.f.	long-hair plume grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Golden Bar	Eleocharis acuta R.Br.	sharp spike sedge	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	r
Golden Bar	Festuca novae-zelandiae (Hack.) Cockayne	Fescue tussock, hard tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	o
Golden Bar	Glyceria declinata Bréb.	blue sweet grass, glaucous sweet grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Golden Bar	Glyceria fluitans (L.) R.Br.	floating sweetgrass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Golden Bar	Holcus lanatus L.	Yorkshire fog	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	o
Golden Bar	Juncus articulatus L.	jointed rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Golden Bar	Juncus bufonius var. bufonius	toad rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Golden Bar	Juncus distegus Edgar	two storey rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Naturally Uncommon	
Golden Bar	Juncus edgariae L.A.S.Johnson & K.L.Wilson	Wiwi, Edgars rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Not Threatened	r
Golden Bar	Juncus effusus L. var. effusus	leafless rush	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Exotic	l
Golden Bar	Luzula picta var. limosa Edgar		MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Juncaceae	Not Threatened	r
Golden Bar	Phleum pratense L.	timothy	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	r
Golden Bar	Phormium cookianum Le Jol. subsp. cookianum	Mountain flax, whaririki	MONOCOTYLEDONOUS HERBS	Rushes & Allied Plants	Xanthorrhoeaceae	Not Threatened	l
Golden Bar	Poa annua L.	annual poa	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	l
Golden Bar	Poa cita Edgar	Silver tussock	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	r
Golden Bar	Poa colensoi Hook.f. (small glaucous form with short ligule & scabrid lemma)		MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Assessed	r
Golden Bar	Poa colensoi Hook.f. (tall green form with long ligule & smooth lemma)		MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Assessed	o
Golden Bar	Rytidosperma penicillatum (Labill.) Connor & Edgar	danthonia	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Exotic	c
Golden Bar	Rytidosperma unarede (Raoul) Connor & Edgar	bristle grass	MONOCOTYLEDONOUS HERBS	Grasses	Poaceae	Not Threatened	l

Golden Bar	Schoenus pauciflorus (Hook.f.) Hook.f.	Bog rush, sedge tussock	MONOCOTYLEDONOUS HERBS	Sedges	Cyperaceae	Not Threatened	I

Avifauna

Name	Common Name	Status	Family	Number of observations
Alauda arvensis	skylark, kaireka, common skylark	Exotic	Alaudidae	58
Anas gracilis Buller, 1869	tētē moroiti, tētē, tete moroiti, tete, gray teal	Not Threatened	Anatidae	6
Anas platyrhynchos Linnaeus, 1758	mallard duck, wild duck, northern mallard, greenhead	Exotic	Anatidae	6
Anthus novaeseelandiae Gmelin subsp. *novaeseelandiae*	New Zealand pipit, pipit, pīhoihoi, pihoihoi, Richard's pipit	Declining	Motacillidae	2
Carduelis carduelis L	goldfinch	Exotic	Fringillidae	29
Carduelis flammea subsp. *cabaret*	redpoll	Exotic	Fringillidae	63
Charadrius bicinctus Jardine & Selby *bicinctus*	Banded dotterel, double-banded plover, tūturiwhatu, tuturiwhatu	Declining	Charadriidae	Reported by Environment Team
Circus approximans Peale	Australian harrier, harrier hawk, hawk, kāhu, kahu, swamp harrier	Not Threatened	Accipitridae	14
Emberiza citrinella subsp. *caliginosa*	yellow bunting, yellowhammer	Exotic	Emberizidae	66
Falco novaeseelandiae "Eastern"	Eastern race NZ falcon	Vulnerable	Falconidae	1
Gerygone igata Quoy & Gaimard	grey warbler, riroriro, rainbird, teetotum, gray warbler, New Zealand gerygone, grey gerygone	Not Threatened	Acanthizidae	2
Gymnorhina tibicen subsp.	Australian magpie, magpie, white-backed magpie, black-backed magpie, makipae	Exotic	Artamidae	9

Hemiphaga novaeseelandiae (Gmelin, 1789)	kererū, kereru, kukupa, kuku, wood pigeon, indigenous pigeon, kokopa	Not Threatened	Columbidae	1
Hirundo neoxena Gould, 1842	Welcome swallow, warou, house swallow	Not Threatened	Hirundinidae	19
Larus dominicanus Lichtenstein, 1823	southern black backed gull, karoro, kelp gull, dominican gull, black-backed gull, mollyhawk, seagull, blackbacked gull	Not Threatened	Laridae	5
Passer domesticus Linnaeus, 1758 subsp. *domesticus*	House sparrow, tiu, English sparrow	Exotic	Passeridae	44
Sturnus vulgaris L. subsp. *vulgaris*	common starling, starling, European starling	Exotic	Sturnidae	140
Tadorna variegata Gmelin	paradise shelduck, paradise duck, pūtangitangi, putangitangi, pari, parry, parrie	Not Threatened	Anatidae	6
Turdus merula L	Eurasian blackbird, blackbird, manu pango	Exotic	Turdidae	14
Turdus philomelos subsp. *clarkei*	song thrush, thrush	Exotic	Turdidae	3
Vanellus miles (Boddaert, 1783)	spur winged plover, masked lapwing, masked plover, spur-wing, spurwinged plover	Not Threatened	Charadriidae	14

Appendix 2. Site photographs

Figure 17. View of tussockland of Golden Point WRS (to left) and pit (to right) looking north from 1406480 4968011. Headwall of old Golden Bar pit in right midground. Photo taken 28 April 2022.

[Type text]

Figure 18. View of Golden Bar WRS looking south-east from 1405877 4968789 showing exotic grassland with scattered tussock and Carmichaelia petriei shrubs (left mid slope line). Existing Golden Bar WRS rear left. Photo taken 28 April 2022.

Figure 19. Shrubland remnant in Golden Bar WRS at 1406153 4968526. Photo taken 28 April 2022.

Figure 20. Carmichaelia petriei shrubs in Golden Bar WRS at 1405984 4968682. Photo taken 28 April 2022.

Figure 21. View of tussockland and felled pine plantation in Coronation 6 pit area looking south from 1396116 4977347. Photo taken 2 May 2022.

Figure 22. Partially dewatered ephemeral wetland in Coronation 6 Pit area at 1396310 4977134. Photo taken 2 May 2022.

Figure 23. Ephemeral wetland in brassica winter crop in buffer of Innes Mills pit area of FrIM at 1400884 4973499. Photo taken 28 April 2022.

Figure 24. Exotic grassland at Innes Mills area of FrIM looking north-west from 1400732 4973280. Photo taken 28 April 2022.

Figure 25. Wetland vegetation in buffer area of Innes Mills Stage 10 showing indigenous toetoe (left) and pukio pedestals in exotic grasses and herbs including Californian thistle (grey).

Figure 26. View of rehabilitated rank exotic grassland on Northern Gully WRS showing primarily cocksfoot and browntop grasses.

Appendix 3. Details of At Risk and Uncommon Plant Species

Sixteen plant species that occur within the ZOI are either currently classified as Threatened, At Risk or Data Deficient (Townsend et al. 2007, de Lange et al. 2018), or are thought to be uncommon in the Macraes E.D. based on the author's observations. This section evaluates the impact of the project components on these species.

At Risk - Declining

Carmichaelia petriei Petrie (desert broom, Fabaceae).

Distribution within project

This leafless broom was recorded at several sites in the Golden Bar areas where c. 100 plants are present.

Summary of existing information

Carmichaelia petriei is distributed throughout the eastern South Island from the Mackenzie Basin to Southland and on Stewart Island, with the majority of the populations in Otago. In the wider Macraes area it occurs in most areas of indigenous shrubland and grasslands, including those that are highly degraded, though numbers vary between sites. Plants are often heavily grazed when smaller, but this does not seem to cause mortality of the plants except during unnaturally dry periods. It is a new addition to the threatened plant list and is classified as Declining, with the qualifiers Data Poor and 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 (Townsend et al. 2007, de Lange et al. 2018). 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 at Macraes (including the Deepdell Tussock and Cranky Jims Shrubland covenants) where there appear to be few threats (but even at these sites recruitment appears to be rare).

Figure 27. Distribution of Carmichaelia petriei in New Zealand from the iNaturalist database (see data sources). No guarantee is given as to the accuracy of the map or the identification of the species.

Project effects

Depositing waste rock material in the Golden Bar WRS will destroy c. 100 individuals of this species. As this species is widely and patchily distributed within natural sites in the Macraes area and is known to occur at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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

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

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

The confidence of this assessment is **moderate**, as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Data sources used in this assessment:

Heenan, P.B. 1996. A taxonomic revision of *Carmichaelia* (Fabaceae-Galegeae) in New Zealand (part II). New Zealand Journal of Botany 34: 157-177.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1602 accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=6803&taxon_id=52110 accessed 24 May 2022

Dr M. Thorsen unpub. file notes.

Deschampsia cespitosa (L.) P.Beauv. (a wetland grass, Gramineae).

Distribution within project

Three plants of this grass were recorded in the Coronation 6 Pit on the margin of a degraded and partly dewatered ephemeral wetland.

Summary of existing information

Deschampsia cespitosa has a Circumpolar[36] distribution. In New Zealand, this species is sparsely distributed from central North Island to Stewart Island also on the Chatham Islands and Antipodes. In the wider Macraes area it is widely by patchily distributed and has been recorded from 11 sites. It usually occurs in permanently damp environments. It is classified as Declining, with the qualifiers Data Poor, Partial Decline and Secure Overseas, on the basis that the species is estimated to occupy less than 1,000 ha and is predicted to decline at 10-30% (Townsend et al. 2007, de Lange et al. 2018). Previously it was assessed as Declining in 2013 & 2009, as Gradual Decline in 2004, Vulnerable in 1999 (de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013). This species is considered to be in decline primarily through loss of its wetland habitat and possibly by the actions of browsers (particularly deer). No conservation programmes are known for this species, but it occurs in several protected areas at Macraes (including in two of the OGL Covenants).

[36] Though there is doubt around the taxonomic status of New Zealand plants (https://www.nzpcn.org.nz/flora/species/deschampsia-cespitosa/)

Figure 28. Distribution of Deschampsia cespitosa *in New Zealand from the iNaturalist database (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.*

Project Effects

Excavating the Coronation 6 pit will destroy 3 individuals of this species. This would have very little impact on local population dynamics as the species is widely but sparsely distributed in wet areas throughout Macraes. The impact on the species at a national scale is estimated to result in a negligible reduction in the total population.

The ecological importance of the population of this species within the ZOI is categorised as **high**.

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**.

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

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

Data sources used in this assessment:

NZPCN https://www.nzpcn.org.nz/flora/species/deschampsia-cespitosa/ accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?taxon_id=76639 accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

Discaria toumatou Petrie (matagouri, Rhamnaceae).

Distribution within project

Matagouri was recorded at multiple sites and in large numbers in the Golden Bar Pit and WRS areas.

Summary of existing information

Matagouri is distributed patchily through the southern North Island and is widespread and common in montane areas of the South Island, particularly in the east. In the wider Macraes area it occurs in most areas of indigenous shrubland and grasslands, including those that are highly degraded. Plants are not grazed and it is well known to South Island farmers as a colonist of burnt, grazed and fertilised hillslopes. It is a new addition to the threatened plant list and is classified as Declining, with no qualifiers, on the basis that the total population is estimated to exceed 100,000 mature individuals with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018). In this assessment, the panel did not consider that the species is known to rapidly expand its range in many parts of the South Island unless physically prevented from doing so. This species is considered to be in decline primarily through loss of its dryland habitat, particularly in the Mackenzie Basin and intermontane basins of Central Otago. No conservation programmes are known for this species, but it occurs in multitude protected areas (including all OceanaGold covenants) where there appear to be few threats.

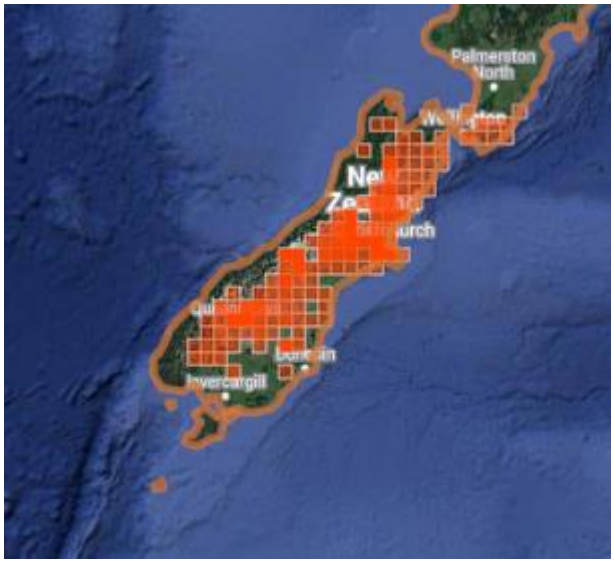

Figure 29. Distribution of Discaria toumatou in New Zealand from the iNaturalist database (see data sources). No guarantee is given as to the accuracy of the map or the identification of the species.

Project Effects

Excavation of the Golden Bar Pit and depositing waste rock material in the Golden Bar WRS will destroy an unknown number of individuals of this species. As this species is abundant and widely distributed within natural sites in the Macraes area and is known to occur over very large areas at multiple locations in the eastern South Island, including many in protected areas throughout its range, the loss of individuals from the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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 **negligible**, 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-high** as this is a well-marked species whose current distribution is reasonably well known. However, its main habitat (grey scrub) is thought to be in decline nationally, but the speed of this loss is not known. Determining speed of loss of this species is partly complicated by its propensity to establish itself in pasture areas in montane South Island unless actively prevented from doing so.

Data sources used in this assessment:

de Lange, P.J; Rolfe, J.R; Barkla, J.W; Courtney, S.P; Champion P.D; Courtney, S.P; Perrie, L.R; Beadel, S.M; Ford, K.A; Breitwieser, I; Schönberger, I; Hindmarsh-Walls, R; Heenan, Ladley, K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=1795 accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=6803&taxon_id=333825 accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

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

Distribution within project

This wetland willowherb was recorded as 6 plants at two closely located sites in the Golden Bar WRS area.

Summary of existing information

*Epilobium insulare o*ccurs 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 is currently classified as Declining with the qualifiers Data Poor, Range Restricted and Sparse, on the basis that the total population is thought to occur within a restricted area, is estimated to exceed 100,000 mature individuals with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018). Previously it has been assessed as Not Threatened in 1999 and 2004, Declining in 2009, and Data Deficient in 2013 (de Lange et al. 1999, de Lange et al. 2004, de Lange et al. 2009, de Lange et al. 2013). This species is considered to be at risk because of loss of wetland habitat, but there is considerable lack of knowledge of its distribution and threats. Recent survey work has shown it to be widespread at Macraes, 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 covenanted areas at Macraes where there appear to be few threats.

Figure 30. Distribution of Epilobium insulare *in New Zealand from the iNaturalist databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.*

Project Effects

Depositing rock material in the Golden Bar WRS will destroy 6 plants of this species in the ZOI. This will cause some loss 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. It is widely but sparsely distributed in watercourses at Macraes and the mechanism of interbreeding between such widely spaced populations is not known. Overall, the loss of the one site in the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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 **low**.

The confidence of this assessment is **moderate-low** as the distribution of this species is poorly known.

Data sources used in this assessment:

NZPCN https://www.nzpcn.org.nz/flora/species/epilobium-insulare/ accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=6803&subview=map&taxon_id=401681 accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

Mentha cunninghamii Benth. (mint, Lamiaceae).

Distribution within project

This herb was recorded at one site in the buffer of the Golden Bar WRS buffer where a 50 cm^2 patch is present at the base of a rock outcrop.

Summary of existing information

Mentha cunninghamii is sparsely distributed through the North Island, South Island, Stewart Island and Chatham Islands. In the wider Macraes area it is patchily distributed and has been recorded from 11 sites, usually in low numbers. It is most often found at the base of rock outcrops but is also occasionally present in depleted grassland at sites with higher moisture content. It is a new addition to the threatened plant list and is classified as Declining, with the qualifier Data Poor, on the basis that the total area of occupancy Is estimated to exceed > 10,000 ha with a predicted decline of 10–70% (Townsend et al. 2007, de Lange et al. 2018).

It is not known why this species is considered to be in decline. Its habitats appear reasonably secure, and it does not appear to be browsed. Competition from taller weeds is the most likely agent of decline as this species inhabits low turfs. No conservation programmes are known for this species, but it occurs in many protected areas where there appear to be few threats.

Figure 31. Distribution of Mentha cunninghamii *in New Zealand from the iNaturalist databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.*

Project Effects

Depositing rock into the Golden Bar WRS material could impact the one patch at one site of this species in the ZOI through changes to local habitat conditions or by facilitating weed invasions. The result could be the loss of c. 1 ^{m2} of the species from one site within the ZOI. This could cause some loss 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. Overall, the loss of the one site in the ZOI is unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **high.**

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

The magnitude of the project's impact on this species at a local scale is assessed as **negligible**, 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-low** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Data sources used in this assessment:

NZPCN https://www.nzpcn.org.nz/flora/species/mentha-cunninghamii/ accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=6803&subview=map&taxon_id=403844 accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

At Risk – Naturally Uncommon

Agrostis pallescens Cheesem. (wetland grass, Gramineae).

Distribution within project

This small wetland grass was recorded in three ephemeral wetlands in the Coronation 6 Pit and buffer where it covers an estimated (based on plots) 23% of wetland area (winter measurement) (an estimated cover of 506m^2).

Summary of existing information

Agrostis pallescens is a difficult to identify species which occurs in wetland environments in the central North Island and along the Southern Alps but is rare in the eastern South Island. In the wider Macraes area it is very patchily distributed and has been recorded from 3 sites. No conservation programmes are known for this species and its presence within the national protected areas network is unknown. It is currently classified as Naturally Uncommon because of the widely spaced populations (Townsend et al. 2007, de Lange et al. 2018).

Project Effects

Excavation of the Coronation 6 pit will destroy two sites inhabited by this species and cause further loss of hydrological function in the remaining ephemeral wetland in the buffer area probably resulting in the eventual loss of this species from that site. These sites are mostly within the ZOI of the previous Coronation Extension project which assumed the likely loss from these sites and therefore the effects on this species are considered as partly mitigated as part of the Coronation Extension project. There is some risk of a reduction in the longer-term viability of the species in a local context as the distribution of this species is very poorly known. The impact on the species at a national scale is likely to be negligible.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

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 **negligible**.

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

The confidence of this assessment is **low**, as this species is very poorly known. This species is easily confused with other *Agrostis* grasses and it is relatively inconspicuous. There is also a shortage of people able to identify grasses such as this, and this contributes to our poor knowledge of this species.

Data sources used in this assessment:

NZPCN https://www.nzpcn.org.nz/flora/species/agrostis-pallescens/ accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

Cardamine grandiscapa Heenan (cress, Brassicaceae).

Distribution within project

Three individuals of this small cress were recorded in a rockfall in the Golden Bar WRS buffer.

Summary of existing information

Cardamine grandiscapa is a newly-described difficult to identify species which occurs in fertile rocky areas of Canterbury, Otago and Southland. In the wider Macraes area it is very patchily distributed and has been recorded from 2 sites. No conservation programmes are known for this species and its presence within the national protected areas network is unknown. It is a newly described species (previously known as Cardamine 'Rata Peaks') that is classified as Naturally Uncommon because of the widely spaced populations (Townsend et al. 2007, de Lange et al. 2018).

Project Effects

Deposition of waste rock stack material may affect the 3 individuals of this species in one site in the Golden Bar WRS buffer zone. There is some risk of a reduction in the longer-term viability of the species in a local context as the distribution of this species is very poorly known. The impact on the species at a national scale is likely to be negligible.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **negligible**.

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

The confidence of this assessment is **low**, as this species was only recently described, its distribution is poorly known, and identification of *Cardamine* species can be difficult, particularly in the absence of flowering and fruiting material.

Data sources used in this assessment:

Heenan, P.B. 2017. A taxonomic revision of *Cardamine* L. (Brassicaceae) in New Zealand. Phytotaxa 330:1-154.

Dr M. Thorsen unpub. file notes

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

Distribution within project

This cliff daisy was recorded as scattered plants and large groups of up to 100 plants on rocky outcrops in the west of the buffer of Golden Bar WRS.

Summary of existing information

Celmisia hookeri occurs on rock outcrops and bluffs in north-eastern Otago and at one site in northern Southland. In the wider Macraes area it occurs on OceanaGold tenure land at multiple sites, including in the Deepdell Covenant and Cranky Jims Wetland Covenant. Population sizes in these areas are 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. It 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 and 2013. 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 in the Macraes area where there appear to be few threats.

Figure 32. Distribution of Celmisia hookeri *in New Zealand from the iNaturalist databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.*

Project Effects

Deposition of waste rock stack material may impact on up to 100 individuals of this species in one site in the Golden Bar WRS. The impact on the species at both a local and a national scale is likely to be negligible due to the large number of sites occupied by large numbers of this species.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **low**.

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys but this species is likely to be present at sites visited if suitable habitat is present.

Data sources used in this assessment:

NZPCN https://www.nzpcn.org.nz/flora/species/celmisia-hookeri/ accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=any&subview=map&taxon_id=400560accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

Gingidia grisea Heenan (a mountain carrot, Apiaceae).

Distribution within project

This herb was recorded as c. 6 plants on a rock outcrop in the buffer of Golden Bar WRS.

Summary of existing information

Gingidea grisea inhabits schist rock bluffs, outcrops and rocky areas in north-eastern Otago. In the wider Macraes area it occurs at 9 sites, including in the Island Block and Cranky Jims Shrubland Covenants. Population sizes in these areas are up to 100 plants at some sites, though 5-10 plants at a site is more usual. It is currently classified as Naturally Uncommon, with the qualifiers Data Poor and Range Restricted, on the basis of its only occurring in north-eastern Otago. Previously it has been assessed as Nationally Vulnerable in 2004, Naturally Uncommon in 2009 and 2013. This species is possibly at risk because of its limited range and susceptibility to browsers. No conservation programmes are known for this species, but it occurs in a few protected areas where there appear to be few threats.

Figure 33. Distribution of Gingidea grisea *in New Zealand from the iNaturalist databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.*

Project Effects

Deposition of waste rock stack material may impact 6 individuals of this species in the Golden Bar WRS buffer. The impact on the species at both a local and a national scale is likely to be negligible as very few plants could be impacted.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

Therefore, the impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **low**.

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Data sources used in this assessment:

P. B. Heenan (2004) *Gingidia grisea* (Apiaceae), a new species from north-east Otago, South Island, New Zealand, New Zealand Journal of Botany, 42:2, 175-180.

NZPCN https://www.nzpcn.org.nz/flora/species/gingidia-grisea/ accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=any&subview=map&taxon_id=40208724 May 2022.

Dr M. Thorsen unpub. file notes.

Juncus distegus Edgar (Two-storey rush, Juncaceae).

This rush was recorded as 6 plants in a damp area in Golden Bar WRS.

Summary of existing information

Juncus distegus is patchily distributed through the North, South and Chatham Islands. In the wider Macraes area it is patchily distributed and has been recorded from 22 damp areas. No conservation programmes are known for this species, but it probably occurs in many protected areas where there appear to be few threats. It is a new addition to the threatened plant list and is currently classified as Naturally Uncommon, with the qualifiers Data Poor and Sparse, on the basis that it occurs within naturally small and widely scattered populations with less than 20,000 individuals or occupies less than 100,000 ha and with no evidence of declining numbers (Townsend et al. 2007, de Lange et al. 2018).

Figure 34. Distribution of Juncus distegus *in New Zealand from iNaturalist databases (see data sources). No guarantee is given as to the accuracy of the maps or the identification of the species.*

Project Effects

Depositing rock material will destroy 6 plants at Golden Bar WRS. This will cause some loss 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. It is probably widely but sparsely distributed. It is considered that the loss will have little impact on local population dynamics and is very unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **moderate.**

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 **low**.

The confidence of this assessment is **moderate-low**. The distribution of this species is poorly known and it is difficult to distinguish from similar *Juncus* species.

Data sources used in this assessment:

Bodmin, K; Champion, P; James, T; Burton, T. 2015. New Zealand rushes: *Juncus* factsheets. NIWA, Hamilton.

NZPCN http://www.nzpcn.org.nz/flora_details.aspx?ID=868 accessed 24 May 2022.

iNaturalist https://inaturalist.nz/observations?place_id=6803&taxon_id=402872 accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

Data Deficient

Melicytus aff. alpinus (c) (CHR 541568; 'Otago') (a porcupine shrub, Violaceae).

Plants identified as *Melicytus* 'Otago' are of restricted distribution in the Macraes area, being known from a large population at Highlay Hill and scattered plants at 3 other localities. It was identified as scattered plants and a group of about 20 in shrubland in the Golden Bar WRS.

Project Effects

Depositing WRS material will destroy about 30 plants of this species in the ZOI. As this species is very poorly known the loss of individuals from the ZOI is difficult to assess, but it is considered that there could be an effect on the local population of this species through loss of one of few known populations. The distribution nationally is unknown and therefore is very difficult to assess.

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

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

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

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

The confidence of this assessment is **very low**, as the taxonomic validity of this species is not known, its distinguishing characters are unknown[37], and it is difficult to distinguish from the other taxa of porcupine shrubs that inhabit the same area.

[37] Identification as this taxon is provisional.

Ranunculus aff. reflexus (CHR 394270; Mt Peel) (a buttercup, Ranunculaceae).

Ranunculus aff. *reflexus* has only recently been recognised as occurring in the Macraes area. It occupies shaded sites at the base of rock outcrops. About 5-10 plants over c. 1 m^2 were recorded at the base of a rock outcrop in the buffer of the Golden Bar WRS.

Project Effects

Depositing rock material in the Golden Bar WRS could impact the one patch at one site of this species in the ZOI through changes to local habitat conditions or by facilitating weed invasions. The impact on the species at a local or national scale is difficult to assess, as the distribution of this species is poorly known. Overall, the loss of the one site in the ZOI is considered unlikely to majorly impact the longer-term security of the species locally or nationally.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 **moderate**.

The confidence of this assessment is **low** as it was only recently recognised that this taxon inhabited the Macraes E.D., it is very poorly known and its distinguishing features are not well known, much of the Macraes area has not been closely explored, and all available records from the area are the result of opportunistic (rather than structured) surveys.

Uncommon Species

Fuchsia perscandens (climbing fuchsia, Onagraceae).

A single individual of the vine *Fuchsia perscandens* is present in the shrubland at Golden Bar WRS. This species is sparsely distributed in the Macraes E.D., being mainly found in steep rocky areas.

Project Effects

Depositing rock material into the Golden Bar WRS material will destroy 1 individual of this species in the ZOI. This is unlikely to impact on the population of this species at a local scale or national scale as this species is known at several other sites in the vicinity.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

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 **low**.

The confidence of this assessment is **moderate** as much of the Macraes area has not been closely explored and all available records from the area are the result of opportunistic (rather than structured) surveys.

Sophora microphylla (kowhai, Fabaceae).

Kowhai is present as a single plant in the buffer of the Golden Bar WRS. This species is present as scattered mature individuals throughout the Macraes E.D. including the Cranky Jims Shrubland and Island Block Covenants. Recruitment is rare, but occurs at some steep sites or where stock are not present.

Project Effects

Deposition of rock into the Golden Bar WRS may have some affect on the one individual in the buffer area. This is very unlikely to affect the population on a local scale or a national scale.

The ecological importance of the population of this species within the ZOI is categorised as **moderate**.

The impact of this project is assessed as having an **adverse**, **indirect**, **permanent**, **reversible**, **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 probably **negligible**.

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

The confidence of this assessment is **moderate**, as much of the Macraes area 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.

Appendix 4. Details of Threatened and At Risk birds

One species that occur within the ZOI is classified as Threatened: eastern falcon and one species is classified as At Risk: pipit. This section evaluates the impact of the project components on these species.

Threatened

Falco novaeseelandiae Gmelin subsp. novaeseelandiae (eastern New Zealand falcon, Falconidae).

Distribution within project

A pair of falcon include the Golden Bar areas within their territory, but are not thought to be nesting there.

Eastern falcon are distributed throughout the eastern and central South Island and inhabit a range of natural and man-made habitats including tussock grassland, scrub, and cut-over forestry. Within the Macraes area falcon are widespread but in low numbers, particularly in areas containing large rock outcrops suitable for breeding. Falcon are present within the Golden Bar area, but appear to be using this area for feeding rather than breeding. Falcon are currently classified as Threatened – Nationally Vulnerable qualified Data Poor Size and Data Poor Trend on the basis of a 1000-5000 mature individuals and a stable population, but with insufficient population trend information (Robertson et al. 2021). They were previously assessed as At Risk - Recovering in 2016 and 2013 (Robertson et al. 2013, 2016) and were assessed as Gradual Decline in 2005 (Hitchmough et al. 2007). The Data Poor population qualifiers have been employed as this taxa is recovering in some areas, but may be declining in other regions (Robertson et al. 2021).

Project Effects

The noise and disturbance associated with earth-moving activities involved in excavating the pit and construction of WRS will cause the pair of falcon at Golden Bar to shift their territory to avoid the project area. The loss of hunting habitat is also likely to have a temporary effect on falcon use of the area until the areas are revegetated. It is not known the extent to which this will replace the lost hunting territory. The result of these project effects will be the temporary displacement of the species from the project area at the Golden Bar site. This may cause

some negligible effect on the Macrae's falcon population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of the displaced pair is unknowable, but it is thought that there is plenty of vacant territory in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of a breeding seasons of two pairs is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through tussock grasslands and pine forests of Central Otago and beyond.

The ecological importance of the population of this species within the ZOI is categorised as **very high.**

The impact of this project is assessed as having an **adverse**, **direct**, **temporary**, **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 **high**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Data sources used in this assessment:

Birds Online https://nzbirdsonline.org.nz/species/new-zealand-falcon accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

At Risk – Declining

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

Distribution within project

Multiple pairs of pipit are present at all project sites within the ZOI including improved pasture and rehabilitated WRS.

Pipit are distributed throughout the North, South and Stewart Islands, with subspecies on the offshore islands. Macraes is one of the highest densities of sightings of pipits in New Zealand, being recorded in 25-40% of the reports in this area (eBird accessed 24/5/22). Within the Macraes area pipit are widespread, particularly in rough low grassland, although population density varies greatly from site to site. Pipits are present within all of the vegetated parts of the sites and some of the open rock areas. They are likely to be breeding at or near all sites. Their presence in an artificially created habitat such as that which develops on WRS may be an indication of this species' adaptability to novel environments. Pipits are currently classified as At Risk - Declining with the qualifiers Climate Impact and Conservation Research Needed on the basis of a >100,000 population that is predicted to decline by 10-70% partly due to vulnerability to climate effects and a lack of management tools (Robertson et al. 2021). Robertson et al. (2021) also note a high degree of uncertainty in this assessment due to the widespread nature of this species. They also held this classification in the assessment in 2016 and 2012 (Robertson et al. 2012, 2016) and were assessed as Not Threatened in 2005 (Hitchmough et al. 2007). Their decline is mainly attributed to conversion of rough grasslands (particularly short tussock grassland) to pasture, predation, and possibly changes to habitat caused by drought and climate change (Heather and Robertson 2000, http://nzbirdsonline.org.nz/species/new-zealand-pipit accessed 19/2/18).

Project Effects

The earth-moving activities and changes in landform involved in excavating the Golden Bar, FrIM and Coronation 6 pits and construction of the Golden Bar WRS will cause the pairs of pipit resident there to temporarily relocate to other areas until rehabilitation of the areas has occurred. The result of these project effects will be the temporary displacement of the species from the project areas at all sites. This may cause some effect on the Macrae's pipit population as the displaced birds may interact with resident birds with the most likely outcome being that the newcomers will be excluded from the resident bird's area. The fate of the displaced pair is unknowable, but it is thought that the project effects are unlikely to cause

mortality of the pair as they have shown an ability to utilise artificial habitats (grassed rock mounds) of which there is plenty in the surrounding area. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of breeding is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as it is widely (though sparsely) distributed through rough grasslands of Central Otago and beyond.

The ecological importance of the population of this species within the ZOI is categorised as **high**.

The impact of this project is assessed as having both an **adverse**, **direct**, **temporary**, **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 **high**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

Figure 35. Lower South Island distribution of pipit and density of sightings, from:

https://ebird.org/newzealand/map/auspip1?neg=true&env.minX=156.24755859375&env.minY=-47.82790816919327&env.maxX=-166.83837890625&env.maxY=-33.99802726234875&zh=true&gp=false&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2016 accessed 24 May 2022.

Data sources used in this assessment:

Birds Online http://nzbirdsonline.org.nz/species/new-zealand-pipit accessed 24 May 2022.

Dr M. Thorsen unpub. file notes.

Charadrius bicinctus Jardine & Selby bicinctus (banded dotterel, Charadriidae).

Distribution within project

Banded dotterel have nested (22/23 breeding season) on the nearby (c. 800 m) recently created Trimbells WRS and on waste rock near Coronation North pit. Both sites are rock surfaces with sparse low vegetation. It is possible the ZOI is used for foraging by this species.

Banded dotterel are endemic to New Zealand and are distributed throughout the North, South, Stewart and Chatham Islands and are migratory to eastern Australia in winter. There is a subspecies on the Auckland Islands. Banded dotterel are a recent re-arrival at Macraes as they had last been recorded in the area in 1986, but in 2021 two pairs bred on the Deepdell North WRS and two pairs (presumed the same pairs) were observed breeding in the Coronation vicinity in the 2022/23 breeding season.

Within the Macraes area banded dotterel are mostly observed on disturbed rocky ground such as recently created Waste Rock Stacks that are sparsely vegetated and it is these sites where nesting occurs. They also forage within short pasture of the surrounding farmland. Their presence in an artificially created habitat such as that which develops on WRS may be an indication of this species' adaptability to novel environments. Banded dotterel are currently classified as At Risk - Declining with the qualifiers Conservation Dependent, Climate Impact and Conservation Research Needed, Partial Decline and Data Poor on Population Size on the basis of a population of 5000–20 000 mature individuals (though there is uncertainty around the actual population size) that is predicted to decline by 10-30% partly due to vulnerability to climate effects and a lack of management tools, but that the decline is not occurring in all areas and that some populations are dependent on ongoing conservation efforts (Robertson et al. 2021). Previously they had been assessed at Nationally Vulnerable in 2016 and 2012 (Robertson et al. 2012, 2016) but the decline rate was not as rapid as feared in that assessment. They were assessed as Gradual Decline in 2005 (Hitchmough et al. 2007). Their decline is mainly attributed to predation and weed invasion of rocky habitats but disturbance and damage to nests by recreational river users is also an issue (https://www.nzbirdsonline.org.nz/species/banded-dotterel accessed 12 October 2023).

Project Effects

The earth-moving activities and changes in landform involved in excavating the Coronation 6 pit and construction of the Coronation North Backfill could cause the pairs of banded dotterel (if they are present in the area at the time) to temporarily relocate to other areas until rehabilitation of the areas has occurred. The result of these project effects will be the

temporary displacement of the species from the project area. This is unlikely to effect on the Macrae's banded dotterel population as this species has recently re-colonised the area after being absent for probably decades and utilises man-made habitats such as that created by mine workings. There may be a temporary reduction in breeding output if displacement is to occur over the breeding season, but this loss of breeding is not considered significant to the local population. Overall, there is considered very little risk to the conservation status of this species as the population at Macraes is re-establishing within mine workings. If mine works were to occur when the birds had eggs or young chicks then these could be lost (and an authority Wildlife Act (1953) required).

The ecological importance of the population of banded dotterel possibly within the ZOI is categorised as **high**.

The impact of this project is assessed as having both an **adverse**, **indirect**, **temporary**, **local impact** on pipit.

The magnitude of the project's impact on pipit 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 **low**.

The confidence of this assessment is **moderate-low** as much of the area surrounding the ZOI has not been surveyed for this species and its population density and population trajectory in the area are unknown.

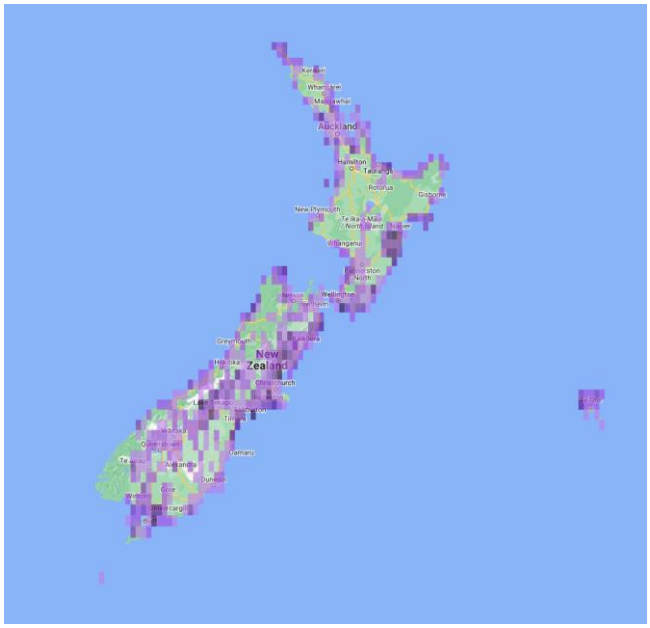

Figure 36. Distribution of pipit and density of sightings, from: https://ebird.org/species/dobplo1 accessed 12 October 2023.

Data sources used in this assessment:

Birds Online https://www.nzbirdsonline.org.nz/species/banded-dotterel accessed 12 October 2023.

Dr M. Thorsen unpub. file notes.

Appendix 5. Vegetation plot data for wetlands at Coronation 6.

Plant species presence in 5 x 5 cm squares of a 50 cm x 50 cm vegetation plot randomly located within potential wetlands at Coronation 6. Plots measured in May 2023 by Dr Mike Thorsen.

Wetland Label	Plot Number	Plant species	Number of 5 cm x 5cm squares where species present	Pasture Species?	Wetland Indicator Status
Wetland Coro2	Plot 1	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro2	Plot 1	Ranunculus amphitrichus Colenso	20	No	OBL
Wetland Coro2	Plot 2	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro2	Plot 2	Holcus lanatus L.	1	Yes	FAC
Wetland Coro2	Plot 2	Ranunculus amphitrichus Colenso	5	No	OBL
Wetland Coro2	Plot 3	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro2	Plot 4	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro2	Plot 5	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro2	Plot 5	Agrostis pallescens Cheeseman	5	No	FACW
Wetland Coro2	Plot 5	Juncus effusus L.	2	No	FACW
Wetland Coro3	Plot 1	Agrostis pallescens Cheeseman	2	No	FACW
Wetland Coro3	Plot 1	Alopecurus geniculatus L.	12	No	FACW
Wetland Coro3	Plot 1	Juncus articulatus L.	5	No	FACW
Wetland Coro3	Plot 1	Ranunculus amphitrichus Colenso	23	No	OBL
Wetland Coro3	Plot 10	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro3	Plot 10	Agrostis pallescens Cheeseman	16	No	FACW
Wetland Coro3	Plot 2	Agrostis pallescens Cheeseman	2	No	FACW
Wetland Coro3	Plot 2	Juncus articulatus L.	20	No	FACW
Wetland Coro3	Plot 2	Ranunculus amphitrichus Colenso	25	No	OBL
Wetland Coro3	Plot 3	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro3	Plot 3	Juncus effusus L.	2	No	FACW

Wetland Coro3	Plot 4	Agrostis pallescens Cheeseman	10	No	FACW
Wetland Coro3	Plot 4	Juncus articulatus L.	8	No	FACW
Wetland Coro3	Plot 4	Ranunculus amphitrichus Colenso	25	No	OBL
Wetland Coro3	Plot 5	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro3	Plot 5	Agrostis pallescens Cheeseman	2	No	FACW
Wetland Coro3	Plot 5	Carex sinclairii Boott	5	No	OBL
Wetland Coro3	Plot 6	Agrostis capillaris L.	25	Yes	FACU
Wetland Coro3	Plot 6	Agrostis pallescens Cheeseman	10	No	FACW
Wetland Coro3	Plot 6	Holcus lanatus L.	4	Yes	FAC
Wetland Coro3	Plot 7	Agrostis pallescens Cheeseman	20	No	FACW
Wetland Coro3	Plot 7	Juncus articulatus L.	10	No	FACW
Wetland Coro3	Plot 7	Juncus effusus L.	2	No	FACW
Wetland Coro3	Plot 7	Ranunculus amphitrichus Colenso	25	No	OBL
Wetland Coro3	Plot 8	Agrostis pallescens Cheeseman	22	No	FACW
Wetland Coro3	Plot 8	Carex sinclairii Boott	10	No	OBL
Wetland Coro3	Plot 8	Ranunculus amphitrichus Colenso	25	No	OBL
Wetland Coro3	Plot 9	Agrostis capillaris L.	15	Yes	FACU
Wetland Coro3	Plot 9	Agrostis pallescens Cheeseman	8	No	FACW
Wetland Coro3	Plot 9	Juncus articulatus L.	2	No	FACW
Wetland Coro3	Plot 9	Ranunculus amphitrichus Colenso	11	No	OBL
Wetland Coro4	Plot 1	Agrostis capillaris L.	10	Yes	FACU
Wetland Coro4	Plot 1	Agrostis pallescens Cheeseman	25	No	FACW
Wetland Coro4	Plot 1	Juncus effusus L.	3	No	FACW
Wetland Coro4	Plot 10	Agrostis pallescens Cheeseman	25	No	FACW
Wetland Coro4	Plot 10	Ranunculus amphitrichus Colenso	2	No	OBL
Wetland Coro4	Plot 2	Agrostis pallescens Cheeseman	25	No	FACW
Wetland Coro4	Plot 2	Carex leporina L.	2	No	FACW
Wetland Coro4	Plot 3	Agrostis pallescens Cheeseman	8	No	FACW
Wetland Coro4	Plot 3	Eleocharis acuta R.Br.	6	No	OBL

Wetland Coro4	Plot 3	Juncus articulatus L.	1	No	FACW
Wetland Coro4	Plot 3	Ranunculus amphitrichus Colenso	18	No	OBL
Wetland Coro4	Plot 4	Juncus articulatus L.	17	No	FACW
Wetland Coro4	Plot 4	Juncus effusus L.	8	No	FACW
Wetland Coro4	Plot 4	Ranunculus amphitrichus Colenso	20	No	OBL
Wetland Coro4	Plot 5	Agrostis capillaris L.	5	Yes	FACU
Wetland Coro4	Plot 5	Agrostis pallescens Cheeseman	23	No	FACW
Wetland Coro4	Plot 5	Carex leporina L.	2	No	FACW
Wetland Coro4	Plot 5	Juncus effusus L.	2	No	FACW
Wetland Coro4	Plot 6	Agrostis pallescens Cheeseman	5	No	FACW
Wetland Coro4	Plot 6	Glyceria declinata Bréb.	25	No	OBL
Wetland Coro4	Plot 6	Juncus effusus L.	3	No	FACW
Wetland Coro4	Plot 6	Ranunculus amphitrichus Colenso	17	No	OBL
Wetland Coro4	Plot 7	Glyceria declinata Bréb.	25	No	OBL
Wetland Coro4	Plot 8	Glyceria declinata Bréb.	25	No	OBL
Wetland Coro4	Plot 9	Agrostis pallescens Cheeseman	5	No	FACW
Wetland Coro4	Plot 9	Glyceria declinata Bréb.	10	No	OBL
Wetland Coro4	Plot 9	Ranunculus amphitrichus Colenso	25	No	OBL