AUDIT OF TERRESTRIAL ECOLOGY INFORMATION FOR THE CORONATION NORTH MINE CONSENT APPLICATION

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1. INTRODUCTION

Waitaki District Council and Dunedin City Council have received an application for resource consents from Oceana Gold Ltd (OGL) to extend and expand the existing Coronation Mine in east Otago. The 'Coronation North' project will include expansion of the existing mine pit, construction of a new Coronation North pit, construction of a new waste rock stack, extension of the existing haul road, realignment of a public road, construction of a freshwater dam, construction of new buildings, and associated water takes, diversions, and discharges.

Activities involved in these developments will have a range of terrestrial ecological effects. Reports prepared by ERA Ecology describe the terrestrial ecology of the affected sites (Appendix 6a), how adverse effects might be avoided, remedied, or mitigated (Appendix 22), and the terrestrial ecology of the Coal Creek freshwater reservoir (Appendix 7). In addition, clarification of terrestrial ecology issues is contained in Appendix 6b. Wildland Consultants were commissioned by Waitaki District Council to review these documents, and this report comprises that review.

Headings in this report are cross-referenced to those in the various appendices by placing the section numbers for the latter in brackets after the headings in this report. Headings used in this report are taken, where possible, from those in the appendices to assist cross-referencing. The Coal Creek reservoir report (Appendix 7) is treated separately as the AEE notes that the reservoir may not need to be constructed. A summary table in this report lists issues identified during the Wildland Consultants' reviews of these documents.

After a review of the various appendices had been completed, a series of additional reports of relevance to the Coronation North project were released by OGL. These documents included an Impact Management Plan 2.2, dated 8 June 2016, an annual ecological report and EMP, relating to compliance with ecological conditions for the consented Coronation mine (dated 14 June 2016), and an undated report on the use of constructed rock stacks by lizards. As these documents contained information that was relevant to this review, they were also reviewed and where warranted, consequent changes have been made to the earlier version of this report.

A site visit by one author (Kelvin Lloyd) was undertaken, to gain an overview of the proposed Coronation North mine extension site, on 9 June 2016. This site visit was undertaken with Dunedin City Council, Otago Regional Council, and OGL staff, and visited the area of the proposed waste rock stack, the western slopes of Highlay Hill, and the proposed Coal Creek reservoir dam site.

Kelvin Lloyd also undertook a visit to the potential Lower Deepdell compensation site on 5 July 2016, when a loop of the area was traversed on foot and ecological features observed were noted. A list of plant species was compiled but was not exhaustive as not all parts of the site were traversed, and the winter season made identifications more difficult for some plant species.

Following a request for further information (RFI) from the Councils, OGL responded to the request, and provided an additional report on the proposed Lower Deepdell compensation site.

2. ASSESSMENT METHODOLOGY

2.1 Literature review (4.5.1)

Appendix 6a states that bird location records maintained by eBird and Nature Watch databases were among the databases referred to gain information on the natural history of the Macraes area. The AEE also states in the assessment methodology section that the assessment involved "examining bird location records maintained by eBird (www.ebird.org) and Nature Watch" (www.naturewatch.org.nz). However no information from these databases is presented in Appendix 6a or AEE.

2.2 Flora survey (4.5.2.1)

Flora survey methods described in Appendix 6a, comprising desktop reviews of literature and databases, and subsequent field work on foot, are consistent with industry standards. Four days of field work were undertaken, which is commensurate with the size of the potentially-affected area.

A novel 'naturalness index' for the entire site was developed through summing abundance scores for indigenous plant species and dividing them by the sum of abundance scores for exotic plant species. This would provide a coarse index of naturalness across the whole site, but would not be sensitive to particular sites which were more or less intact than the whole site.

2.3 Avifauna survey (4.5.2.2)

Bird observations were made during the walk-through surveys for plants. These observations were likely, as a result, to have been incidental to the flora survey. The flora survey was undertaken over several days - one in December and three in January - towards the end of the bird breeding season. The avifauna surveys are therefore limited to a short period of the year, and are unlikely to have had the full attention of the flora surveyor. It is also not clear whether the four waterways that will be affected by the proposal (Maori Hen Creek, Trimbells Gully, Mare Burn, and Camp Creek) were specifically surveyed for birds.

Appendix 6a states that bird species diversity and abundance is low in the Macraes area, and this makes more intensive survey efforts such as distance sampling or five-minute bird counts of limited utility. When coupled with a later statement about the Central Otago bird assemblage being depauperate, there is a sense that further assessment of bird abundance and diversity within the project area was not undertaken due to a perception that the avifauna community present at the site is unimportant. No evidence of this low bird diversity in the Macraes area is provided in Appendix 6a. Limited avifauna survey undertaken during the flora survey, and the lack of inclusion of relevant database information, means that the reported bird assemblage will significantly under-represent the actual bird assemblage using the site.

OGL's response to the Councils' RFI suggests that a specific avifauna survey will not be provided. The response states that it "is possible to survey flora and birds

concurrently in dryland Central Otago". This statement is correct, but better practice would be for surveys to be designed to assess specific potential avifauna features of the proposed site, for example surveys for New Zealand pipit to determine numbers and distribution, and breeding surveys for falcon. Concurrent flora and avifauna surveys are considered insufficient for a development the size of Coronation North Mine, will not describe the assemblages in sufficient detail, and are likely to miss rare species.

2.4 Herpetofauna survey (4.5.2.3)

Appendix 6a refers to this section as 4.5.2.1 but it should correctly be numbered 4.5.2.3. The AEE stated in adequate detail how lizard values were assessed; this detail was provided in Appendix 6a. In terms of literature/desktop review of records, there was suitable detail provided, again, in Appendix 6a, and this information covered all the footprints subject to the application, except areas to be considered for mitigation/compensation.

Following the RFI from the Councils, the Applicant provided information on a one-day winter walk-through lizard survey undertaken in July 2016 of the Island Block, in the Lower Deepdell Catchment. This survey was not well planned, in terms of time of year (lizards are inactive over most winter months) but a very experienced herpetologist was used for this work. This brief survey could not be reasonably expected to find rare species potentially occurring at the site, e.g. *Oligosoma inconspiccum*; *O. chloronoton*; *Naultinus gemmeus*; *Oligosoma grande*; and even a relatively common species, one expected to be found over summer, *Oligosoma polychroma* (Clade 5) was not found indicating a potential time-of-year effect on the survey results. The Department of Conservation submission also raised concerns about the short duration of lizard surveys and their lack of ability to record rare species. No lizard survey methods/results have been provided for "Sailors Cutting", a second proposed compensation site.

2.5 Assessing ecological importance (4.6)

In Appendix 6a, ecological importance was assessed by referring to criteria from Environment Institute of Australia and New Zealand (EIANZ) impact assessment guidelines. This is a departure from standard practice, which is to assess ecological values against the ecological significance criteria of the relevant district plan. While the EIANZ guidelines cover many of the matters that are normally included in district plan significance criteria sets, the EIANZ guidelines have no statutory basis.

In addition to criteria in relevant districts plans, consent authorities must have regard to any relevant Regional Policy Statement (both operative and proposed) when considering an application for resource consent; in this case this includes both the Proposed Otago Regional Policy Statement (RPS; notified 23 May 2015) and the 1998 Regional Policy Statement. Significance assessments carried out by the Applicant to date, only refer to the 1998 RPS. Second generation RPSs, when available, are likely to better reflect the interests of the community (Peart & Reaburn, 2011).

2.6 Assessing project impact (4.7)

Potential adverse effects of the project were assessed by referring to EIANZ guidelines, using a combination of the magnitude of the effect and the importance of the ecological feature to assign the overall level of an adverse effect at local and national scales. This is a potentially useful framework with which to determine the level of effects. The project activities that are likely to affect ecological features are identified and each are subjectively ranked low, moderate, high or very high.

As covered below in Section 9, the preparation of separate impact reports for Coronation North Project and for the proposed Coal Creek Water Storage Dam (e.g. Appendix 6a and 7) may reduce focus on any cumulative-effects generated from these applications, if the proposed Coal Creek Water Storage Dam does go ahead. This may result in the need to reassess impacts once a final decision is made on the proposed Coal Creek Water Storage Dam project.

2.7 Determining the boundary of the ecological impact of the project (4.7.2)

Appendix 6a proposes a 100 m buffer around the margin of the proposed mining impacts. It is not clear whether this buffer is included in the figures within Appendix 6a. The outline of the impact area in Appendix 6a figures is significantly larger than that in the AEE, but the revised footprint was clarified by Appendix 6b, which is consistent with the AEE footprint. It would be helpful for consideration of effects to resolve the buffer issue, because the direct effects caused by mining will be immediate and irreversible, whereas effects within the buffer will occur over time and are likely to be of much lesser magnitude. This is particularly relevant to the Threatened, At Risk, and locally rare plant species occurring within the project area.

2.8 General ecological setting (5.1)

The setting of the Coronation North mine project is generally described well with respect to geology, topography, and current and former vegetation, but Appendix 6a doesn't quantify the remaining extent of indigenous vegetation types within Macraes Ecological District. This is important to help assess the significance of the examples of indigenous vegetation and habitat within the affected area.

A summary of broad indigenous cover classes (Land Cover Database Version 4.1) within the Macraes Ecological District shows the current dominance of high producing exotic grassland (79,644 ha; 69.9% of the Ecological District), which is greater than the 50% estimated in Appendix 6a, followed by low producing grassland (11,919 ha; 10.5%), tall tussock grassland (10,470 ha; 9.2%), and matagouri or grey scrub (3,306 ha; 2.9%), with scarce mānuka and/or kānuka (242 ha; 0.2%), and exceeding small remnants of broadleaved indigenous hardwoods (13 ha; 0.01%) and indigenous forest (3 ha; 0.002%).

3. VEGETATION AND FLORA

3.1 Flora ecological features (5.2)

Ten vegetation communities were identified within the project area, including several types of wetland, grassland, and shrubland. Current and historic factors such as grazing by cattle and fire are identified as influences on the vegetation.

3.2 Vegetation representativeness and pattern (5.2.2)

In this section, representativeness is couched as similarity to the same types of vegetation currently present elsewhere in the Macraes Ecological District. Representativeness is normally assessed as similarity to the vegetation at a selected historic baseline, commonly 1840, but sometimes pre-human. Thus, more intact indigenous vegetation types, that are the most similar in structure and composition to those present at the baseline date, are given higher rankings for representativeness. Using current vegetation as the standard could have unintended outcomes, whereby the best example of a natural vegetation type would not be similar to other current examples of that type and thus would not be assessed as being representative.

Appendix 6a states that representativeness was assessed using guidelines prepared by Wildland Consultants[1] to help interpret ecological significance criteria in the Canterbury Regional Policy Statement. The Wildland Consultants guidelines state that 1840 is a commonly used baseline date for the assessment of representativeness, and an 1840 baseline is recommended for the assessment of representativeness in the Canterbury Region. It is not clear why the Canterbury guidelines have been used in Appendix 6a, as the site is within the Otago Region, Waitaki District, and Dunedin City District.

OGL's response to the Councils' request for information (RFI) remains confused on the meaning of representativeness. It suggests the land cover database (LCDB) could be used as a baseline for representativeness, but LCDB contains no information on vegetation structure and very little on vegetation composition. These two attributes, vegetation structure and composition, are key for assessing representativeness. The response to the RFI continues to assert that various vegetation types have high representativeness, but no evidence on their structure and composition, and how similar it is likely to have been to former indigenous vegetation, is offered. The conclusions on representativeness are therefore unreliable.

3.3 Vegetation rarity (5.2.4)

Appendix 6a states that silver and hard tussock grassland, seepage wetlands, and long-inundation ephemeral wetlands should be considered to be the communities that are rare within the Macraes Ecological District. Narrow-leaved snow tussock grassland, which formerly covered much of the Macraes Ecological District, can also be considered to be a much-reduced indigenous vegetation type.

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[1] Wildland Consultants 2013: Guidelines for the application of ecological significance criteria for indigenous vegetation and habitats of indigenous fauna in Canterbury. *Wildland Consultants Ltd Contract Report No. 2289i*. Prepared for Environment Canterbury.

3.4 Botanical diversity (5.2.5)

The project area is clearly very botanically diverse, with Appendix 6a noting that 163 indigenous plant species were recorded in it, likely due to considerable habitat diversity.

3.5 Notable vegetation communities or sites (5.2.7)

In this section, Appendix 6a discusses three of the four national priorities for the protection of rare and threatened indigenous biodiversity on private land[1]. The assessment of threatened land environments, which comprises National Priority 1, identifies large areas of the site as being covered by Acutely Threatened land environments, with less than 10% of their original indigenous cover remaining nationally. Appendix 6a identifies ephemeral wetlands and seepages as meeting National Priority 2, and notes that these are also historically rare ecosystems (National Priority 3), which have been classified[2] as Critically Endangered and Endangered, respectively.

3.6 Sites or communities identified as significant in the Regional Plan (5.2.7.5)

Appendix 6a assesses indigenous vegetation communities as significant under the ecological significance criteria in the Otago Regional Plan, on the basis of their representativeness and rarity values. The Otago RPS criteria were not originally listed, however, so that the way in which site values have been assessed against them could not be verified. OGL's response to the RFI lists the Otago RPS criteria and provides an evaluation of site values against each. Appendix 6b provides an updated assessment of the significance of vegetation communities, and concludes that all of the natural vegetation types within the Coronation North project area are significant according to the operative Otago RPS (Section 10.5.2 (b) and (c)), and according to some or all of the five criteria in the proposed RPS.

3.7 Sites or communities identified as significant in District Plans (5.2.7.6)

Similarly, the small areas of indigenous vegetation within Waitaki District are assessed as being significant under the Waitaki District Plan for their representativeness, rarity, distinctiveness, diversity, and ecological context values and for providing habitat for rare and threatened species. Waitaki District Plan significance criteria are not listed, nor does the assessment list any evidence to support this conclusion. Significance criteria in the Dunedin District Plan are not been referred to in Appendix 6a, but Appendix 6b states that all the natural vegetation types within the revised project area are significant according to seven of the criteria in the operative Dunedin District Plan, and to some or all of the criteria in the proposed Dunedin District Plan. Again, the specific evidence supporting these assessments was

[1] Ministry for the Environment 2011: Protecting our places: information about the statement of national priorities for protecting rare and threatened biodiversity on private land. MfE, Wellington.

[2] Holdaway R.J., Wiser S.K., and Williams P.A. 2012: Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology 26*: 619-629.

not originally provided, but the response to the RFI includes evaluation of site values against each criterion.

3.8 Sites identified as recommended for protection (5.2.7.7)

Appendix 6a identifies that a Recommended Area for Protection (RAP) is present within the affected area. RAP4, Trimbell's Gully, occurs in the western part of the site.

3.9 Importance overall of vegetation communities (5.2.7.7)

Overall, the vegetation communities within the affected area are assessed as being of very high ecological importance.

3.10 Threatened, At Risk, or rare plant species (5.3)

A considerable part of Appendix 6a - some 80 pages - is devoted to detailed description of the Threatened, At Risk, or locally rare plant species found within the project area. While this information is comprehensive, and illustrates good skills in plant identification, it seems an excessive level of detail for the main body of the report, and it might be better to summarise the most important values in the body of the report, and include much of the detail in an appendix. Listing all of the references used under each species also involves significant repetition, and it would have been more efficient to cite these sources in the text and list the full citations in a references section at the end of the report. It would also have been more informative to cite these sources in the text as, in the current format, it is not possible to know which source of information is associated with which fact or conclusion in the text. Personal communications are listed but not dated, thus it is impossible to verify if the information that was communicated is out of date or has been succeeded by more recent information.

Figure 5 of Appendix 6a shows that the proposed Coronation waste rock stack will have the greatest effect on nationally Threatened plant species, directly affecting seven of the eleven populations of Threatened plants in the project area. However this conclusion may change depending on the resolution of the mapping differences between Appendix 6a and the AEE.

Figures produced in this section show 'protected wetland' areas to the northeast of Macraes Flat, but these do not appear to be legally protected. The nature of protection for these areas should be specified, as it has a bearing on security of the Threatened and At Risk plant species found within the wetlands within these areas. In addition, the large 'protected wetland' polygon near Cranky Jim's Creek covers mostly non-wetland habitats but also contains a number of ephemeral wetlands, which the 'protected wetland' status appears designed for. OGL's RFI response clarifies that the 'protected wetlands' have no legal protection status, but comprise ephemeral wetlands which have voluntarily been fenced to exclude cattle.

In relation to discussion of the ecological importance of the various Threatened, At Risk, Data Deficient, and locally rare species that have been found in the project area, Appendix 6a states that these ecological importance conclusions have been reached

on the basis of factors such as threat status, reduction in habitat, low numbers of individuals, lack of regeneration, distribution limits, and loss of previously occupied sites. However, only threat status seems to have been taken into account. In Appendix 6a, all Threatened taxa are given 'very high' importance, all At Risk-Declining taxa are given 'high' importance, all At Risk-Naturally Uncommon taxa are given 'moderate-high' importance, all Data Deficient and locally rare taxa are given 'moderate' importance, and all taxa listed in Appendix 16A of the Dunedin City District Plan are given 'low' importance. In our opinion, a more nuanced view of the importance these taxa at the site is warranted, taking into account the various factors that are mentioned in Appendix 6a, but which do not appear to have influenced the importance rankings. OGL's response to the RFI maintains a range of other factors were also considered, but if this is true, it means those factors had no additional relevance above threat status. This seems unlikely. For example, it is hard to see how the mechanism of impact differs for species with different threat status.

3.11 Threatened species (5.3.1)

Presence of four populations of nationally Threatened plant taxa - *Simplicia laxa*, *Anogramma leptophylla*, *Ranunculus ternatifolius*, and *Sonchus* aff. *novae-zelandiae* - in the project area is noted, but the presence of another, *Carex inopinata*, is not mentioned in this section of Appendix 6a. It is referred to in a later section on plant species with a Threatened-Nationally Vulnerable threat ranking.

The report describes the local and national status of *Simplicia laxa* well, but it is worth noting that the attempt to introduce this species to the Orokonui Ecosanctuary has failed[1]. In addition, the site near Ngapara where QEII are reported to be managing *Simplicia laxa* comprises two patches of this species beneath a roadside limestone overhang on land owned by Waitaki District Council. Regular weeding is required to maintain these individuals, and one has been lost recently (KML personal observation). Given the ongoing loss of *Simplicia laxa* populations in Otago, the genetic structuring that differentiates North Island and South Island entities, and the difficulty of managing it in conservation programmes, every remaining existing population is important. The small known population of *Carex inopinata* within the project area is also important as it comprises the only known location of this species within the Macraes Ecological District. We agree with the conclusion in Appendix 6a that the ecological importance of the *Simplicia laxa* and *Carex inopinata* populations is very high. The importance of the populations of *Ranunculus ternatifolius*, *Anogramma leptophylla*, and *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff") are also high but are slightly lower than for the former two species, due to the more widespread distributions of the latter three species.

3.12 At Risk species (5.3.2)

Discussion of *Aciphylla subflabellata* refers to its 'fertile alluvium habitat', but in east Otago this species is often found on dry ridges away from wetlands. In addition, many of its populations persist in ungrazed grassland and wetland habitats, thus the

[1] Lloyd K.M., Easton L., and Fay V. (In Prep.): Experimental translocation of the threatened New Zealand plants *Carex inopinata* Cook and *Simplicia laxa* (Kirk). Unpublished manuscript.

observation in Appendix 6a that it has become uncommon in ungrazed sites may be related to other factors.

In contrast, *Carex tenuiculmis* and *Deschampsia cespitosa*, which share At Risk-Declining status with *Aciphylla subflabellata*, depend on wetlands and thus are more vulnerable to habitat loss.

The presence of *Carmichaelia corrugata* within the project area is more significant, as these are the only known occurrences of this species within the Macraes Ecological District, and they comprise part of a southern distribution limit for this species. Similarly, the discovery of the grass *Anthosachne falcis* within the project area is significant, as this species is also a new record for Macraes Ecological District and is near its southeastern distribution limit, albeit also being present at one site on the Otago Peninsula[1]. As noted in a previous report[2], the presence of the two indigenous bidibids, *Acaena dumicola* and *A. tesca*, within the project area is important as these are the only known occurrences of these species in Macraes Ecological District, and the current southeastern distribution limits for them. *Brachyglottis southlandica* and *Rumex flexuosus* are also important as both are rare within Macraes Ecological District, with *Brachyglottis southlandica* at an apparent eastern distribution limit.

Copper tussock (*Chionochloa rubra* subsp. *cuprea*) within the project area is given low ecological importance, despite providing habitat for the Threatened *Ranunculus ternatifolius*. Thus the copper tussock vegetation should be given high habitat importance, even if copper tussock itself is not particularly important.

3.13 Species of biogeographic interest (5.3.5)

Appendix 6a states that no species at their distribution limits or of other biogeographic interest occur within the project area, but this is not consistent with earlier descriptions of, for example:

- *Carex inopinata* at it southeastern distribution limit.
- *Acaena tesca* at an unusually low elevation limit.
- *Celmisia hookeri* being restricted to two disjunct regions.
- *Carmichaelia corrugata* near its southern limit.

In addition, *Anthosachne falcis*, *Acaena dumicola*, *A. tesca*, and *Brachyglottis southlandica* are all at or near their national distribution limits.

3.14 Genetically or morphologically distinct forms (5.3.6)

Appendix 6a states that no genetically or morphologically distinct plant species are present within the project area, but this is not consistent with earlier descriptions of the following, for example:

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1 Johnson P. 2004: Otago Peninsula plants. Save the Otago Peninsula, Dunedin.

2 Wildland Consultants 2013: Supplementary review of the ecological assessment for the proposed Coronation Mine, Otago. *Wildland Consultants Ltd Contract Report No. 3195d*. Prepared for Waitaki District Council.

- Genetic and morphological differences within *Simplicia laxa*.
- *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff") being noted as having potential genetic differences from related taxa.

4. AVIFAUNA ECOLOGICAL FEATURES (5.4)

4.1 Avifauna communities (5.4.1)

Appendix 6a states that 11 bird species were recorded from within the project area: five indigenous species and six introduced species. However, only five indigenous and five introduced species are listed and discussed. The ten bird species included in Appendix 6a are[1]:

- New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*; At Risk-Declining).
- Swamp harrier (*Circus approximans*; Not Threatened).
- Grey warbler (*Gerygone igata*; Not Threatened).
- Paradise shelduck (*Tadorna variegata*; Not Threatened).
- Spur-winged plover (*Vanellus miles novaehollandiae*; Not Threatened).
- Skylark (*Alauda arvensis*; Introduced).
- Chaffinch (*Fringilla coelebs*; Introduced).
- Redpoll (*Carduelis flammea*; Introduced).
- House sparrow (*Passer domesticus*; Introduced).
- Song thrush (*Turdus philomelos*; Introduced).

The global bird database eBird contains three records close to the project area. One is of a single historical sighting of a New Zealand falcon at the Macraes Flat township in 1987. A more recent record was from 2010 at Camp Creek. The observer spent four hours, covered an estimated 17 ha and recorded 20 bird species, including six indigenous species. The primary habitat recorded was "scrub". The general location is directly west (approximately 1 km) of the Macraes mine, and five kilometres from the proposed Coronation North mining operation.

A further 13 species that were not recorded in Appendix 6a, including two At Risk-Declining species, are listed from the Camp Creek eBird record, while New Zealand pipit, swamp harrier, and chaffinch were not recorded. The 'new' species were:

- Eastern or New Zealand falcon (one individual) (*Falco novaeseelandiae* "eastern"; At Risk-Recovering)
- South Island pied oystercatcher (four adults and two juveniles) (*Haematopus finschi*; At Risk-Declining)
- Southern black-backed gull (*Larus dominicanus dominicanus*; Not Threatened)
- Mallard (*Anas platyrhynchos*; Introduced)
- California quail (*Callipepla californica*; Introduced)

[1] Common names, species names, and threat classifications as per Robertson H.A., Dowding J.E., Elliott G.P., Hitchmough R.A., Miskelly C.M., O'Donnell C.F.J., Powlesland R.G., Sagar P.M., Scofield R.P. and Taylor G.A. 2013: Conservation status of New Zealand birds, 2012. *New Zealand Threat Classification Series 4*. Department of Conservation, Wellington. 26 pp.

- Rock pigeon (*Columba livia*; Introduced)
- Australian magpie (*Gymnorhina tibicen*; Introduced)
- Blackbird (*Turdus merula*; Introduced)
- Starling (*Sturnus vulgaris*; Introduced)
- Dunnock (*Prunella modularis*; Introduced)
- Yellowhammer (*Emberiza citronella*; Introduced)
- Greenfinch (*Carduelis chloris*; Introduced)
- Goldfinch (*Carduelis carduelis*; Introduced).

The third eBird record was submitted in 2009, within a few hundred metres of the existing mine. The observer recorded 18 species in 40 minutes, including two South Island pied oystercatcher and one New Zealand pipit.

Lastly, Ryder Consulting (2013)[1] undertook a much more extensive literature search for birds in the general vicinity of the 'Coronation Project Area', and found records for 50 bird species comprising 30 indigenous and 20 introduced species. They obtained the raw ornithological atlas data for the 10 km^2 square that overlapped the mine site[2][3]. These data comprised 37 species. A further nine species were added by Whitaker from his surveys in 1986, a further three by Bibby in 1997, and one more by Ryder Consulting in 2010 (see references in Ryder Consulting 2013). The indigenous species that are additional to those of ERA Ecology and the eBird records are:

- Black-billed gull (*Larus bulleri*; Threatened-Nationally Critical)
- Black-fronted tern (*Chlidonias albostriatus*; Threatened-Nationally Endangered)
- Banded dotterel (*Charadrius bicinctus bicintus*; Threatened-Nationally Vulnerable)
- Red-billed gull (*Larus novaehollandiae scopulinus*; Threatened-Nationally Vulnerable
- Pied stilt (*Himantopus himantopus leucocephalus*; At Risk-Declining)
- Black shag (*Phalacrocorax carbo novaehollandiae*; At Risk-Nationally Uncommon)
- Bellbird (*Anthornis melanura melanura*; Not Threatened)
- Black swan (*Cygnus atratus*; Not Threatened)
- Brown creeper (*Mohoua novaeseelandiae*; Not Threatened)
- South Island fantail (*Rhipidura fuliginosa fuliginosa*; Not Threatened)
- Grey teal (*Anas gracilis*; Not Threatened)
- Kereru (*Hemiphaga novaeseelandiae*; Not Threatened)
- Kingfisher (*Todiramphus sanctus vagans*; Not Threatened)
- Little shag (*Phalacrocorax melanoleucos brevirostris*; Not Threatened)
- New Zealand shoveler (*Anas rhynchotis*; Not Threatened)

[1] Ryder Consulting 2013: OceanaGold (New Zealand) Ltd Coronation Project Ecological Assessment. Unpublished report by Dale M., Ludgate B. and Ryder G. Ryder Consulting Ltd Dunedin.

[2] Raw data was used to produce the publication Robertson C.J.R., Hyvönen P., Fraser M.J., and Pickard C.R. 2007: Atlas of bird distribution in New Zealand 1999-2004. The Ornithological Society of New Zealand, Inc., Wellington, New Zealand.

[3] Wildland Consultants note that two 10 km^2 grid squares in fact cover this site. It is possible that Ryder Consulting (2013) actually obtained data for both squares as the text states that "7-12+" bird surveys were undertaken by the Ornithological Society; Atlas categories for survey frequency for mapping are 7-11 and 12+).

- Pukeko (*Porphyrio melanotus melanotus*; Not Threatened)
- Scaup (*Aythya novaeseelandiae*; Not Threatened)
- South Island tomtit (*Petroica macrocephala macrocephala*; Not Threatened)
- Welcome swallow (*Hirundo neoxena neoxena*; Not Threatened)
- White-faced heron (*Egretta novaehollandiae*; Not Threatened)

This list is particularly notable for a number of nationally Threatened species typical of braided and gravel-bedded rivers (black-billed gull, black-fronted tern and banded dotterel), despite the fact that no such habitat is present within the two grid squares overlapping the wider mine site. Ryder Consulting (2013) note that both black-fronted terns and banded dotterels have been seen on dredge ponds near the Macraes Flat township, and that Whitaker (1986) noted that the dotterels breed in the area. Both black-fronted terns and black-billed gulls forage over tussock grasslands, and both are capable of flying significant distances to forage from breeding locations[1]. Virtually nothing is known of either species movements from inland breeding locations to coastal wintering locations.

Ryder Consulting (2013) also reference Whitaker (1986) and Bibby (1997) in regard to eastern falcon, stating that falcon are relatively numerous in the Macraes Ecological District and that the area is considered a stronghold for the species. ERA Ecology (June 2016)[2] note that falcon are "likely to utilise the gullies and rock outcrops within the Coronation Project Area when hunting" but Appendix 6a does not mention them in reference to the Coronation North proposal.

In summary, it seems very likely that many more species would have been recorded within the project area with focused survey, and indicates that insufficient resourcing was given to assessing avifauna, including no evaluation of previous work and data from the relevant area.

The project site should be resurveyed during the breeding season (e.g. October-November) by someone with experience undertaking surveys for potential falcon nesting habitats and nests. The survey should focus on the presence of South Island pied oystercatcher and eastern falcon, but also better assess pipit abundance and distribution, by habitat type. All bird species observed should be recorded.

The potential presence of eastern falcon and South Island pied oystercatcher is of particular interest. The only two other records in eBird within the general vicinity of the project area are both from Redbank Ridge (2001 and 2007; approximately five kilometres to the south), and both checklists contain falcon (two resting falcons in one record), and one lists South Island pied oystercatcher.

OGL's response to the Councils' RFI corrects the error regarding the number of species (11) present within the proposed site. It also presents the results of a literature review on bird species observed within the site and its surrounds, and used this to

[1] An individually banded black-billed gull has been observed feeding *c.*50 km from its breeding colony, and gulls regularly forage 10-20 kilometres from colonies (R.K McClellan unpublished data), and black-fronted terns have been observed foraging for lizards more than 20 km from their nearest breeding colony (REF).

[2] ERA Ecology June 2016: Coronation Site Ecological Management Plan. Report prepared for Oceana Gold (New Zealand) Ltd by Dr M. J. Thorsen, 14 June 2016. *Report number: 0219-02*.

populate a list a further 10 species that are considered likely to be present within the site, and a further four species that may make "rare visits" to the site. This effectively more than doubles the number of species assessed as using or potentially using the proposed mine site, compared to the original report.

4.1.1 Eastern falcon

Falcon have very large home ranges, up to 9 km^2 in North Island pine forest[1], and 17 km^2 in North Canterbury rough pasture on rolling hills[2]. Given that falcon have been recorded in 'Camp Creek', it is likely that individuals are also using the project area for foraging, and possibly also breeding. Bird habitat has not been characterised in the avifauna sections (e.g. relative areas of scrub, tussock grasslands, waterways), but it seems likely that suitable breeding habitat would be present, such as steep gullies and rocky outcrops. The flora survey was undertaken at the time when falcons, particularly breeding falcons, would be at their most vocal. Nevertheless, given that the flora survey would have concentrated on ground-level vegetation, silent flights of falcon could easily have been missed. If falcon are using the project area, numbers are likely to be small given the low density nature of falcon populations.

OGL's response to the Councils' request for information (RFI) considers that falcon may use the habitat within the proposed mine site for foraging on rare occasions. The response states that falcon are not believed to be nesting at the site, but doesn't recognise the possibility that falcon may use the site for breeding in the future, despite stating that potential nesting habitat is available in the Coal Creek dam area. It states: "only definitive recent records from near PIA from 2.8 km away in Camp Creek (1 bird) in 2010, and 7.5 km away in Island Block (1-2 birds) in 2016". In the Island Block/Deepdell report[3], the observation is given as a pair of falcon, whereas in Table 7 of the RFI response, the Deepdell observation is given as one male.

Habitat clearance should ideally be undertaken outside of the breeding season. However, the falcon breeding season is potentially very long, starting in August, with the last young fledging from nests in March. Because of this, a survey for nesting falcon may be more practical. This should be undertaken in suitable breeding habitat during November, prior to clearance of that habitat. Detailed guidelines for minimising the effects on falcon nests have been developed for plantation forestry operations[4] which, in short, aim to minimise all mechanical work within 200 m of a nest until chicks have fledged. These guidelines can be applied here.

4.1.2 South Island pied oystercatcher

South Island pied oystercatchers are very widespread through inland eastern South Island including Central Otago. Breeding birds can be found in a variety of habitats

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1 Seaton R. 2007: The ecological requirements of the New Zealand falcon (*Falco novaeseelandiae*) in plantation forestry. *PhD thesis*. Massey University.

2 Golder Associates 2012: New Zealand falcon monitoring and risk assessment, Hurunui Wind Farm. *Report No. 0978205297*. Prepared for Meridian Energy Ltd.

3 ERA Ecology 2016: Island Block, lower Deepdell catchment. Vegetation, avifauna, and herpetofauna. Report prepared for Oceana Gold Ltd.

4 For example, http://www.ernslaw.co.nz/assets/resources-contractors/EMS/RTE/NZ-Falcon-Forestry-Management-Protocols-Wingspan-Aug-13.pdf

including farmland, riverbeds, and high country grasslands, and may well be breeding within the project area. The flora surveys may have missed the presence of breeding birds, as they generally migrate to coastal areas by December-January. The national population of South Island pied oystercatcher is large, probably over 100,000 birds, but declining. However, dryland Otago habitats may potentially only support low numbers of pied oystercatcher, making this association relatively rare in a national context.

OGL's response to the Councils' request for information (RFI) considers that New Zealand pied oystercatcher breeds in the locality, but may only use the proposed mine site on rare occasions for feeding. The RFI response states the nearest record is of one bird 2.8 km from the site, in Camp Creek. However, the correct eBird record is actually of four adults and two juveniles seen in October (submitted by Marcia Dale, Ryder Consulting Ltd). The RFI response has also missed the eBird record of two South Island oystercatcher within a few hundred metres of the existing mine site in November 2009 (submitted by Derek Onley). These records tentatively indicate that the species may breed in the vicinity of the proposed mine.

The response also notes that New Zealand pied oystercatcher was not recorded on 23 visits by eight ecologists. However, these numbers do not make clear that only three of those visits (aside from the two made by Marcia Dale in November, who recorded oystercatcher) were undertaken during the main part of the breeding season from September to December. This further demonstrates the general inadequacy of most of the surveys of the proposed site for avifauna, including the surveys for this project, particularly as few have been timed to coincide with the period when most bird species are breeding. Species such as New Zealand pied oystercatcher (At Risk-Declining), banded dotterel (Threatened-Nationally Vulnerable), black-billed gull (Threatened-Nationally Critical), and black-fronted tern (Threatened-Nationally Endangered) may all be largely absent from the region between January and August.

As for falcon, habitat clearance should ideally be undertaken outside of the breeding season which lasts from approximately August to December. If this is not possible, a survey for breeding oystercatcher should be undertaken during November within areas of suitable habitat, prior to clearance of that habitat. In the absence of species-specific guidelines, clearance should not be undertaken within 100 m of a nest until chicks have fledged.

4.1.3 New Zealand pipit (5.4.4)

Appendix 6a states that there are 5-12 pairs of pipits based on encounter rates during the flora survey. The accuracy of the estimate is questionable given that specific bird surveys were not undertaken. A survey focused on pipit would generate a more accurate estimate and better comparative densities between habitat types, and provide more confidence in an assessment of the impact on the species.

4.1.4 Species diversity (5.4.3)

Appendix 6a states that dryland Central Otago is depauperate in bird species and that the five indigenous and five exotic species observed within the project area is the normal diversity expected for the site. This statement is not supported by any

evidence. On the contrary, previous bird surveys indicate that 30 indigenous and 20 introduced bird species are known from the area surrounding the wider Coronation Mine area, which is far from depauperate.

OGL's response to the Councils' request for information (RFI) maintains their earlier opinion, despite providing new information on the number of species described from a restricted area relevant to the proposed mine site, based on literature review. The literature review found 54 species, comprising 34 indigenous species and 20 exotic species. Again, this is not evidence of a depauperate avifauna assemblage. In comparison, in vastly different habitats on the West Coast, based on literature reviews and specific surveys, the Denniston Plateau was found to have 36 resident or visiting bird species, and the Gouland Downs in Kahurangi National Park was found to have 34 species, both having a higher proportion of indigenous species than the area encompassing the proposed mine site[1].

OGL's response references Wilson *et al.* (2014)[2] in regard to the depauperate nature of Otago drylands. This paper is about the effects of woody succession in dryland areas on passerines, makes no comment about bird species diversity in the region, and is not an appropriate reference to use for an assessment of bird diversity in the region.

It may be that many of the 54 species found in the area encompassing the project site occur only rarely. However, many Threatened or At Risk species are rare or uncommon by definition, and their occasional presence within an area may nevertheless be of ecological significance. For example, the common but highly threatened black-billed gull is relatively rare in Otago[3], and foraging locations in the region could be argued to be regionally important. Again, most visits to the proposed mine site have not been undertaken at times that would be most appropriate to detect presence of black-billed gull (September-December).

4.2 Summary table of ecological features (5.6)

The summary of ecological features is consistent with the report's conclusions but, as noted above, the vegetation and sites component does not list species of biogeographic interest or genetic or morphological distinctness. Also, community distinctiveness for vegetation and sites is described as 'none' in the table, which seems inconsistent with the botanical findings. What the results of the botanical survey reveal is, in fact, a very distinctive indigenous grassland, shrubland, rock outcrop, and wetland community, which is an emergent property of the large number of indigenous plant species recorded at the site, the large number of Threatened, At Risk, and locally uncommon species present, several new records for the Macraes Ecological District, and species at or near the distribution limits or with genetic or morphological distinctness. Together, these values give the site very high value for the distinctiveness of the plant species assemblage at the site.

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1 Statement of Evidence of Rachel Katherine McClellan, Denniston Escarpment Mine proposal, 2011.

2 Wilson D.J., Norbury G. and S. Walker 2014: How does woody succession affect population densities of passerine birds in New Zealand drylands? *New Zealand Journal of Ecology* 38: 257-267.

3 Statement of Evidence of Rachel Katherine McClellan, Blueskin Bay wind farm proposal, 2016.

5. HERPETOFAUNA ECOLOGICAL FEATURES (5.5)

5.1 Herpetofauna communities (5.5.1)

The lizard survey team had sufficient lizard expertise and lizard habitat values were adequately surveyed for; the areas of the footprint most likely to contain the three lizard species are identified in the AEE. It is agreed that either development footprint, but especially the Coal Creek footprint (See Section 11), may contain other species, including cryptic and green skink (and possibly jewelled geckos), at low densities, as noted in the body of the AEE and in Appendix 6a.

The RFI provided new survey results for one of the proposed compensation areas (the Deepdell Creek area) and most notably noted an old record for the very important grand skink (*Oligosome grande*). As such, it should be noted that this site contains potential habitat for a Threatened-Nationally Endangered species and, in the absence of information on the Sailors Cutting site, makes this site very important for lizard habitat values.

6. IMPACT ON VEGETATION COMMUNITIES (6.1)

Appendix 6a concludes that the adverse effects of the project will have an adverse, direct, permanent, irreversible, local impact on vegetation communities, with a national impact on the rarer vegetation communities. Rarer vegetation communities are defined as comprising the ephemeral wetlands and seepage wetlands. As indigenous wetlands are nationally reduced, covered by a national priority, and the indigenous wetland vegetation within the project area provides habitat for several Threatened, At Risk, and locally uncommon species, the loss of any indigenous wetlands can be considered to be regional- and national-scale effects.

6.1 Threatened, At Risk, or rare plant species (6.2)

Similar to repetition of information in the descriptions of Threatened, At Risk, and locally rare plant species, the effects assessment contains unnecessary information. For example, noise does not have any effect on plants, yet is assessed for each of the 18 species.

6.1.1 Nationally Threatened species (6.2.1-6.2.2)

Adverse effects of the project on *Simplicia laxa* are only assessed as 'high' in Appendix 6a, despite the EIANZ guidelines indicating a 'very high' impact. The importance of the *Simplicia laxa* population at the site is very high, and a very high impact is warranted, given the irreversible loss of the two *S. laxa* sites within the project area, and any other habitat that exists for this species. Appendix 6a notes that the loss of the two sites would constitute a 5% reduction in the total number of known sites, which would be a significant adverse effect, locally, regionally, and nationally. As noted elsewhere in Appendix 6a, *S. laxa* is being lost from known sites, even those under conservation management, and the only known translocation of it to a protected site has failed.

Local effects on the Threatened fern *Anogramma leptophylla* are assessed as high at a local scale, but low on a national scale. The low national-scale assessment is somewhat puzzling given the very high importance of this species at the site, and the very scattered distribution of this species within New Zealand. Loss of the three *Rancunculus ternatifolius* occurrences within the project area is also ranked low on a national scale, despite it being part of a fragmented metapopulation in the local area, which appears to be at an ecological distribution limit for this species. Loss of these populations constitutes a significant adverse effect on a national scale.

We agree that the direct adverse effects on *Sonchus* (b) (CHR 596666; aff. *S. novae-zelandiae*; "cliff") are lower, because only one individual will be affected, and the population of this species within the project area will not be eliminated. The loss of its habitats within the project area is an additional factor to consider, which together with the loss of an individual will affect the viability of the local population. The local effect is at least moderate and probably high.

6.1.2 At Risk species (6.2.3)

We agree with the statement in Appendix 6a that the loss of the *Carmichaelia corrugata* population is of greater significance than the other At Risk plant species, and should be considered a significant adverse effect given that it would cause a local extinction at the distribution limit for this species.

7. IMPACT ON AVIFAUNA ECOLOGICAL FEATURES (6.3)

The assessment of effects (Section 6.3) needs to be re-evaluated in light of the finding that numerous bird species have probably not been detected during the botanical surveys.

The main AEE document states (Page 86) that the indigenous species present "are likely to disperse into the surrounding farmland and disruption should be temporary and less than minor". However, Section 6.3 of Appendix 6a notes that the effects are considered moderate at a local scale (presumably Macraes Ecological District), and are permanent and irreversible. Appendix 6a also states that the distributions and density of birds within the wider Macraes area are largely unknown. These statements are repeated in the OGL response. Therefore, the conclusion of the OGL response of moderate potential impacts could be considered to be conservative.

The AEE makes no reference to the possibility that pipit will use the mine site itself, once operational. The Applicant has the ability to address this through survey of the existing mine. Clearly pipit do use the modified habitat as the main AEE document (Page 53 in Section 9.6.3.1) refers to an informal bird count on single days in both 1994 and 1995, where greater numbers of pipits were observed on the waste rock stack than the adjacent paddock: 1994, seven pipits versus two; 1995, nine pipits versus none. Information on methods, sites, and analyses would, however, be needed to verify these findings.

The AEE makes no mention of the effects of initial habitat clearance on absolutely protected bird species: birds and nests of species that are absolutely protected under

the Wildlife Act 1953 and cannot be destroyed. This list of species includes pipit, falcon, and pied oystercatcher. If habitat clearance was to be undertaken during the breeding season, it is very likely that nests of pipit (and possibly young birds) would be destroyed and, if present, nests of pied oystercatcher and falcon. OGL's response to the Councils'RFI has not rectified this omission.

Potential effects of loss of habitat-bird species associations with clearance of rare habitat types has also not been considered, or the cumulative effects of the new mine and the existing mine on indigenous bird species, particularly within Macraes Ecological District. Because the avifauna surveys appear to have missed numerous species that were likely to have been present, it is very possible that both eastern falcon and South Island pied oystercatcher both breed and/or forage in the project area. Both species and others may be in low numbers in Macraes Ecological District, and therefore any local effects on these species need to be assessed carefully.

Once further bird information has been evaluated, the Applicant should then address mitigation of the direct effects of habitat clearance on birds and bird nests. Lastly, the overall mitigation package needs to specifically address the revised potential effects on local bird populations.

8. IMPACT ON HERPETOFAUNA ECOLOGICAL FEATURES (6.4)

Section 9.6.3.2 of the body of the AEE provides an inadequate assessment of the potential effects of the project on lizards. The section reiterates the species present within the footprints and notes that "*The Coronation North Project area contains a moderate amount of suitable lizard habitat, with many rocky outcrops surrounded by tussock land and pasture"* but fails to do the same for the Coal Creek Storage Area (but see Section 11). A more detailed assessment of effects is provided for the Coronation North project in Appendix 6a, but here all "reptiles" are considered together despite all three species having individual traits and characteristics which would have a very considerable bearing on the severity of actual and potential effects of this project on each of them. The Department of Conservation submission appropriately separates out lizard species in Section 4(a) where they express concern "*…about the effects of the proposal on lizards. In particular, affected populations of McCanns and southern grass skinks and the Otago large geckos.*"

This issue is also highlighted in the subheading "Assessment of Project Impact" (Appendix 6) where only a single species is referred to, as follows: "*The overall degree of the project's effect on this species is low*". We can only assume this comment refers to all three lizard species equally, i.e. At Risk korero gecko, southern grass skink, and the McCann's skink (not threatened) are all assumed to have the potential to suffer a low effect as a result of the Coronation Mine North project. When lizard values have been assessed as being moderately important, and local effects have been ranked as being of moderate severity, it is hard to see why the overall effect of the project on lizards would be low; indeed the Department of Conservation has the view that the development will result in the permanent loss of lizards and habitat for "*several thousand (possibly tens of thousands) of lizards*" (4(a) of Department of Conservation submission).

The inadequate effects assessment provided in the AEE does not facilitate an audit of the mitigation suggested for lizards contained in Appendix 22. For example, how much habitat for each of the three species, but especially any habitat considered to be significant in terms of Section 6(c) of the RMA (i.e. that supporting at risk species) will be lost? What number of individual lizards classified as being At Risk are expected to be lost or displaced? This information will be also required by the Department of Conservation in order to process Wildlife Act authorities, should these projects be consented. As such, it makes good sense to address the Wildlife Act and RMA processes in parallel, which will not be possible unless more information is provided on effects on the various species and habitats within the development footprint. We note that these two processes did not occur in parallel for the Coronation Mine application, leading to ambiguity about how best to implement mitigation conditions (e.g. Page 47, Paragraph 1 of the Annual Ecological Report 2015).

The Applicant's RFI response can be best described as "dismissive" of these concerns. When asked by the Councils to "*Please estimate the likely numbers of each of the individual species of herpetofauna are present in the project and provide information on the habitat preference of each of the species, in particular any Threatened or At Risk species, and an appropriate level of mitigation for affected species that are not likely to colonise artificial rock stack habitat*" the Applicant referred the Councils back to Section 5.5 of Appendix 6a for this information. Section 5.5, however, only refers to a quantitative measure for the not threatened McCanns skink as follows: "*The McCann's skink O. maccanni (clade 4 genotype) is present in reasonable numbers (one individual per 20 m)*". No information is provided for the at risk Otago large gecko or the southern grass skink, despite Councils request, and DOCs concerns around the quality of impact assessment not matching the scale of adverse effects expected (DOC submission, 4(a)).

The Applicant, in the RFI response, incorrectly refers to Patterson (1992) to substantiate the claim that there is much overlap in habitat use of the three species known to occur within the footprint. Patterson (1992) includes only two of the species in question: the southern grass skink and McCann's skink. The study does not include the At Risk gecko, which is almost entirely confined to rocky areas of the footprint, compared with the two skink species which may occur anywhere that provides adequate protection from predators and prevailing weather conditions. Commentary on lizard values requires expert input, to ensure that significant values are protected and maintained during land use considerations. Information provided in Section 5.5 is too vague to be able to assess effects given the scale of the proposed development. Also, the RFI contains factually incorrect material, meaning information necessary to enable calculation of lizard-specific mitigation is lacking.

9. CUMULATIVE EFFECTS

The AEE and Appendices 6a and 7 do not discuss cumulative effects. Appendix 6a often refers to likely under-reporting of Threatened and At Risk plant species, but at the same time, indigenous vegetation and habitats and species populations are also declining in the Macraes area. For example, the rate of conversion of indigenous grasslands to exotic vegetation has increased in recent decades in Waitaki District and

Dunedin City District and, in both districts, less than 20% of the remaining indigenous grasslands are protected[1]. These changes have contributed to changes in the threatened environment classification in the Macraes Ecological District, where 33,730 ha of land classified as having 10-20% indigenous cover remaining in 2002 was reclassified as having <10% of its original indigenous cover remaining in 2012. Mining operations over this time period will have contributed to these changes.

Similarly, there is no assessment of the contribution that the project makes to cumulative loss and modification of habitats for lizards and birds. Consistent with this oversight, the existing environment Section 9.6.3 (avifauna and herpetofauna) in the body of the AEE makes no mention of the consented environment and its cumulative effects on the avifauna and herpetofauna of the District.

Cumulative effects of mining on indigenous vegetation, habitats, and species should be assessed. As noted above in Section 2.6, we believe the separate reporting of project impact for Coronation North project (Appendix 6a), and then for the proposed Coal Creek Water Storage Dam (Appendix 7) may result in a reduced focus on cumulative effects generated by Oceana Gold for this project and other already consented projects over the Ecological District, should the Coal Creek Water Storage Dam go ahead. In effect, the AEE summarises impacts for sub-footprints and assesses impact for each individually without clearly combining impact of both and providing a combined (and cumulative) impact assessment.

OGL's response to the RFI assesses the cumulative effects of mining at the scale of indigenous grasslands across the South Island, but what is needed is the cumulative effects of mining on the local landscape within the affected part of the Macraes Ecological District.

On a theme related to cumulative effects assessment, it would be helpful if the Applicant were to acknowledge the long-term potential effect that the two proposals under consideration will have, i.e. the proposals - if implemented - will have the effect of depriving almost all lizard species of the Macraes area (with perhaps the exception of the species that are claimed to use the rehabilitated waste rock stack habitat), the opportunity to ever migrate into and establish within the post-development footprints, if populations build elsewhere and seek to expand, e.g. in areas managed for grand skink and Otago skinks within one kilometre of the project footprints.

Also, effects on species and habitats are addressed individually. For example, when weighed up as an assemblage, the 18 Threatened, At Risk, Data Deficient, and locally rare species represents a significant concentration of rare plant species, which suggests that the project area is an important refuge with many different habitat types. The implications of this concentration of rare species are not addressed.

[1] Weeks E., Walker S., Dymond J.R., Shepherd J.D., and Clarkson B.D. 2013: Patterns of past and recent conversion of indigenous grasslands in the South Island, New Zealand. *New Zealand Journal of Ecology 37*: 127-138.

10. AVOIDANCE, REMEDIATION, AND MITIGATION OF ADVERSE EFFECTS (APPENDIX 22)

10.1 Consideration of alternatives

Alternative sites for the proposed mining developments are not evaluated in AEE with respect to indigenous vegetation, habitats, and species. Appendix 22 also fails in this regard. Consideration of alternatives is particularly relevant to the Coal Creek reservoir proposal (discussed below). The OGL response to the RFI addresses a potential alternative design for the proposed waste rock stack, which would result in a smaller footprint, but would increase mining costs and conflict with landscape values. Criteria for the proposed Coal Creek water storage dam are also listed, and it is concluded that only the proposed site meets these criteria.

10.2 Lack of specificity

Appendix 22 describes a range of avoidance, remediation, and mitigation measures, but lacks specificity. For example, reconfiguring the waste rock stack margin is proposed to avoid 'some ecological features' and rock-fall barriers won't be created as 'the ecological feature is not of sufficient value'. Table 1 in the impact assessment report is more specific in documenting the ecological features that have been avoided by these changes. Ecological features along the proposed Coal Creek dam access road are proposed to be avoided, if possible, but these features are not mapped or described.

10.3 No mitigation for effects on birds

Appendix 22 does not mention birds. It therefore appears that the report's conclusion is that ecological effects on bird species do not exist, and therefore do not need to be mitigated. This is incorrect, particularly given that the assessment of effects concludes that there will be moderate local effects on bird populations.

The report needs to specifically address how the proposed mitigation will address the moderate local effects on bird populations. The report also needs to address how pipit and pipit nests will be avoided during habitat clearance, and potentially also eastern falcon and South Island pied oystercatcher. If the potential effects cannot be avoided, then the report needs to address how such potential effects will be mitigated.

The report is unconvincing in its assessment of the long-term effects of the project on pipit within the Macraes Ecological District, and appears to have concluded that any such effects do not need to be mitigated. This may be so, particularly in light of the possibility that pipit will use the mine site once operational. This could have been more thoroughly assessed by better surveys of the proposed mine and existing mine sites.

10.4 Mitigation for effects on lizards

A firm commitment should be provided by the Applicant on the measures they intend to implement in terms of mitigation to address adverse effects on each of the lizard species. This should be a mandatory addition to the AEE, to provide decision-makers

with robust information. In the case of OGL, this is especially important given the shortfall of mitigation measures taken over previous stages of the greater Macraes mining project for lizard habitat values (Annual Ecological Report 2015; Coronation Mine EMP 2016). In Section 5.4.3 of the Coronation Mine EMP (2016), "*a loss of 146 ha of moderate lizard habitat*" was expected to occur following completion of the Coronation Mine. Information provided within this same document, and the Annual Ecological Report (2015) shows this 146 ha loss (at ground level) has been offset by the creation of only *c*.0.1 ha of new rock habitat: 10 rock stacks each measuring 5 × 20 m on the ground (Annual Ecological Report 2015). The creation of *c*.0.1 ha of lizard habitat is favoured by the "not threatened" McCann's skink (Ecogecko, n.d.; Annual Ecological Report 2015) but the more important At Risk southern grass skink is currently rare within this human-constructed habitat. This is a predictable outcome given that this species was located "*in the more vegetated areas*" of the Coronation North project and the proposed Coal Creek Storage Dam footprints (Appendix 7 of the AEE). A single gecko skin was located in the 0.1 ha of habitat, which is promising in terms of potential habitat use by kōrero gecko.

Further to this point, Section 6.3 of the Coronation Mine EMP (2016) provides "Expected Outcomes from Consent Conditions". For lizards (all referred to as a single entity) this includes: "*A 10% increase in numbers or area occupied by lizards and rare plants over 95 ha*" and "*Creation of 1.2 ha of new rock pile lizard habitat and improved lizard habitat in the 120ha tussock area surrounding the Pit and WRS*". The 95 ha refers to the Cranky Jims wetland covenant, which is scheduled to have been covenanted by July 2016 (Section 6.6), but according to the Annual Ecological Report (2015), the covenant is being registered (Section 5.2.7). Creation of 1.2 ha of new rock pile habitat, however, seems to have failed to meet the end of 2015 deadline (Section 6.6). As noted above, only *c*.0.1 ha of habitat is available, and this habitat is not suitable for the two At Risk species present within the Coronation mine footprint.

The above summary raises various alarm bells: firstly, only *c*.6-7% of the promised lizard habitat has been created for the consented Coronation Mine, and the habitat that has been created primarily caters for the "not threatened" McCann's skink. Adverse effects of the Coronation Mine on the southern grass skink and the kōrero gecko have yet to be addressed. Other mitigation activities, such as planting to enhance lizard habitat values, may well have occurred yet description of these initiatives are spread throughout a convoluted set of documents and text that make it difficult to assess what has and has not occurred for the consented Coronation Mine (in particular see Section 5 of the Annual Ecological Report 2015 where land use consent conditions are addressed separately to Department of Conservation Wildlife Authority conditions).

Given the complexity and ongoing negotiation between Department of Conservation and OGL in relation to land use consent conditions versus Wildlife Act conditions (Page 47, Para 1, of the Annual Ecological Report 2015), it would be useful to have activities designed to avoid, remedy, or mitigate adverse effects on all lizard habitat values listed in a summary table that also sets out, for direct comparison, the scale and scope of the potential effects on these same values (species-by-species, as noted above). As it stands, limited activities are suggested throughout the AEE and the Coronation North Impact Management Plan 2.2 (IMP 2.2), and these are then somewhat condensed into Appendix 22 of the AEE and Appendix 1 of the IMP 2.2 to

refer to the creation of new lizard habitat around the WRS. It has been assumed that passive migration of lizards into this new habitat will occur, negating the need to undertake monitoring. Off-site compensation for lizard habitat values is implicit in the text of Appendix 22 but the scale and scope of this proposed initiative is not provided and is not referred to in Appendix 1 of the IMP 2.2.

Without the details of exactly what mitigation is proposed for lizards it is not possible to further evaluate whether or not the proposed action will result in residual effects on lizard habitat values requiring further mitigation, or compensation. Overall, the important lizards of the Macraes Ecological District are not well provided for, in terms of mitigation, based on the documents available for review.

10.5 Coal creek dam rehabilitation (2.2.1)

It is proposed to create seasonally-dry riparian sedgeland when the proposed pond is full, and ephemeral herbfield when the pond is drawn down, but the sedgeland is not however referred to in the impact assessment report. The ephemeral wetland would supposedly provide important habitat for several highly threatened plant species. It seems very unlikely that these objectives can be achieved. The primary use of the dam will be for supplementing stream flows, and the two wetland recreation objectives conflict: drawdown sufficient to maintain ephemeral wetland habitat will mean an empty dam and loss of wetland conditions for the sedgeland, whereas a full dam that supports the sedgeland would extinguish the ephemeral wetland. Water level regime is critical to persistence of ephemeral wetland vegetation, and the water level variation of the stream-fed proposed reservoir is likely to be quite different to that of precipitation-fed ephemeral wetlands. Furthermore, the main role of the proposed reservoir is to provide a residual stream flow during dry periods. To do this, the reservoir would need to hold significant reserves of water during summer, the very period that ephemeral wetlands tend to dry out. The proposal to create an ephemeral wetland in the proposed reservoir is untested, as the mitigation impact report (7.2.1) states, and in our opinion carries a significant risk of failure. The impact management plan expects no less than 12 rare plant species to benefit from the 'eco-engineered' dam, thus does not take account of this significant uncertainty.

10.6 WRS margin rehabilitation (2.2.2)

While Appendix 22 identifies an opportunity to rehabilitate the waste rock stack margin to provide habitat for lizards, birds, and rare plant species, there is no specific commitment or plan to do this, and evaluation of previous mitigation actions with regards to rehabilitation is insufficient.

For example, Page 87 of the AEE contains the phrase: "*Investigations have demonstrated that existing WRS at the MGP provide habitat for lizards and skinks. Historic surveys of lizards using habitat on the waste rock stacks showed lizard abundance, based on lizard per hour counts, was similar to or higher than comparative surveys at areas undisturbed by mining. This is despite the fact that the rehabilitation of the WRS's to date have not specifically targeted the establishment of lizard habitat*".

Although this sounds very positive in terms of the value of the waste rock stacks for lizards, as noted above in Section 10.4. Oceana Gold has only provided evidence that the not threatened McCann's skinks are using these habitats. To be reassured that this statement is correct in the context of the Coronation North project and Coal Creek Water Storage projects, we require evidence that the kōrero gecko and southern grass skink are also prospering within these constructed landscapes. The lack of such evidence represents a significant information gap in the AEE, and other ecological documents, and the validity of the rehabilitated landscape as habitat for all lizard species to be lost by mining activity has therefore not been adequately demonstrated.

10.7 Coronation North pit rehabilitation (2.2.3)

It is proposed to create a lake in the Coronation North pit after mine closure, and to create a permanently-wet riparian margin and lacustrine plant habitat. These proposals would depend on a good understanding of water level fluctuation in the proposed lake, and a gradually sloping shoreline with a mud or sand substrate suitable for the establishment of lacustrine plant species. As the mine pit will have steeply-sloping pit walls, it seems unlikely that such conditions could be created. Also, the AEE notes that the Coronation North pit is expected to take some 400 years to fill, which is a long time until a stable outcome could be expected. As such, this proposal appears fanciful, and it is not included in the impact management plan.

10.8 Rescue of ecological features (2.3.4)

Higher importance ecological features are proposed for 'rescue' by removing them or propagating seeds or cuttings and establishing them in new locations. The impact management plan identifies five Threatened, three At Risk-Declining, two At Risk-Naturally Uncommon, and two morphologically distinct plant species that would be 'rescued'. Suggested destination sites for this suite of species are Oceana Gold's existing QEII covenants or conservation land. These proposals are associated with significant uncertainty. There have been no trials to assess the effectiveness of these proposed rescues, and translocation of rare plants into natural habitats often fails. The required planting of common trees and shrubs in the Cranky Jims and Highlay Creek shrubland covenants has not yet been undertaken (OGL annual ecological report 2015), so even the success of these more straightforward plantings cannot be evaluated. Moreover, the proposed rescue destinations remove the targeted plants from the landscape that they currently occur in. The value of protecting adjacent, unaffected land is that the 'rescued' plants could be translocated to similar habitats in the same area, and thus potentially contribute to existing populations in this area. This approach would be much more consistent with the like-for-like principle.

The impact management plan (7.3.7) proposes to maintain the translocated plants for two years, and to monitor them for three years. This period of monitoring is too short for translocated rare plant populations. For example, the translocated population of *Carex inopinata* at the Orokonui Ecosanctuary is still slowly declining, continuing to lose individuals some six years after planting, with no evidence of regeneration of new individuals. At the same site, the longest-lived individual of translocated *Simplica laxa* died five years after planting. Monitoring timeframes need to be longer than three years. Monitoring for at least five years is necessary to detect whether establishment has occurred or whether declines are still evident. In addition,

contingency strategies need to be developed so that alternative mitigation can be provided in the event of translocation failure.

The impact management plan indicates that 'rescue' of the 12 Threatened, At Risk, and locally rare plant species will prevent total loss of these species from the area, and remove them to a safer environment. These putative benefits again ignore the significant uncertainty that these outcomes can be achieved.

10.9 Ecological compensation evaluation criteria (2.5.1)

Appendix 22 provides a number of criteria for assessing ecological compensation proposals. Most of these are supported, but some relate to Oceana Gold Ltd internal operations and community commercial endeavours, which are not ecological considerations and could result in inefficient and ineffective compensation if adhered to. The impact management plan repeats these criteria, which include choosing sites with similar ecological features, that the compensatory activities occur as close to the site where the impact occurs so as to provide local benefit, and that the compensatory activities are technically feasible with an acceptable chance of achieving the desired outcomes. Principles that are not included, but which are listed for biodiversity offsetting projects[1], include the compensation activities having to be additional to what would occur anyway, to be arrived at after effective stakeholder consultation, to have long term outcomes, and to be equitable,

The impact management plan[2] states that legal protection of land is not being pursued because of a lack of suitable sites containing equivalent ecological features, and to avoid constraining present or future commercial activities. Given that very similar habitats are present on OGL land directly adjacent to the proposed Coronation North development, similarity of habitats does not appear to be limiting, indicating that opportunity costs for future commercial activities are likely to be the prime reason for the non-pursuit of legal protection of habitat. The most similar habitats, in the unaffected part of the Trimbells Gully RAP directly adjacent to the proposed mine, have not had their ecological values assessed. Additional ecological assessments have been carried out on two dissimilar sites at lower elevation some 8-10 km east of the proposed mine, these being an area of unknown size in the lower part of Deepdell Creek (similar to that shown in Figure 1), and an unmapped 200 ha area described as 'Sailors Cutting' in OGL's response to the RFI.

The Deepdell Creek area is not described in the text of the OGL response to the RFI, but is reported on separately[3]. The table (Table 7 of the RFI response) that compares the values of the affected site and the two potential compensation sites is not complete. For example, the Lower Deepdell site contains at least one indigenous wetland, which is not referred to in the table. It also contains small populations of *Teucridium parvifolium* (At Risk-Declining), and fuchsia (*Fuchsia excorticata*), which are important plant species in Macraes Ecological District. However neither of these species are listed as being present in the Lower Deepdell site. There are inconsistencies between the tabulated values in the RFI response, and the report on

[1] Principles on biodiversity offsets. Business and Biodiversity Offsets Programme.
[2] ERA Ecology 2016: Coronation North project: impact management plan.
[3] ERA Ecology 2016: Island Block, Lower Deepdell catchment. Vegetation, avifauna, and herpetofauna.

the Lower Deepdell site, and the report itself is internally inconsistent. For example, the number of indigenous plant species is given as 53 in the RFI table, and 32 in the text of the site report, but Appendix 1 of the site report lists 76 indigenous plant species. A further twelve indigenous plant species (*Asplenium bulbiferum*, *A. richardii*, *Carex elegans*, *Coprosma rugosa*, *Coriaria sarmentosa*, *Fuchsia excorticata*, *F. perscandens*, *Oxalis magellanica*, *Pellaea calidiriupium*, and *Hebe salicifolia*) above and beyond those listed in the Lower Deepdell site report, were observed in this site during the brief site visit that was undertaken as part of the audit, meaning that at least 88 vascular plant species are present in the Lower Deepdell site, comparable with the number reported for the Sailors Cutting site. In addition, a number of locally uncommon plant species referred to in the Lower Deepdell site report are not referred to in Table 7 of the RFI response. Similarly, large bluffs suitable for falcon breeding are described in the Lower Deepdell site report, but its bluff communities are described as very limited in Table 7. These omissions all serve to reduce the value of the Lower Deepdell site compared to the Sailors Cutting site, but the reasons for this are unknown. Insufficient information is provided to fully assess the Sailors Cutting site, as no map of the site has been provided, or photographs showing representative features or site values, and its vegetation and habitat communities are not fully described.

In terms of lizard habitat values, for which the Macraes Ecological District is renowned, Table 7 of the RFI response also fails to capture all available information pertaining to significant habitat of indigenous lizard fauna. As one example, the Deepdell Creek area was subject to a cursory winter survey in July 2016[1], whereby two lizard species were found: *Woodworthia* "Otago large" and McCanns skink. Survey methods described on Page 6 indicate that data were collected on sightings per unit effort (SPUE) yet these data are absent from Table 7 (for *Woodworthia* "Otago large, at least). Table 7 does, however, list reptile density and diversity over the Deepdell Creek area as "poor", and for Sailors Cutting as "poor?" without providing any supporting information to substantiate this claim, thereby limiting the usefulness of the Table to determine the relative lizard habitat values of the development site versus the two potential mitigation areas.

Further to the point made above, the Table 7 entries are grossly inconsistent with the text of the Applicant's RFI document, which states, in the context of comparing the two proposed mitigation sites with the development site: "*the reptile and bird communities appeared to be similar*" (Page 44). This comment, on the face of it, appears to be a deliberate down-playing of the importance of significant habitat for lizards, especially given that no lizard survey has been undertaken for Sailors Cutting and only a very short, poorly-timed, survey was completed for the Deepdell Creek area.

The Department of Conservation submission also expresses concerns relating to the quality of information provided by the Applicant on lizard habitat values and the resulting potential for minimisation of the perceived adverse effects on these values, e.g. the Department has the view that the development will result in the permanent

[1] ERA Ecology 2016: Island Block, Lower Deepdell catchment. Vegetation, avifauna, and herpetofauna.

loss of lizards and habitat for "*several thousand (possibly tens of thousands) of lizards*" (4(a) of Department of Conservation submission). The Department of Conservation submission also states in 4(f): "*Overall, the D-G would expect that as a minimum a lizard package that is set to achieve gains of equivalent numbers and species to those that are lost in the mine development, consistent with OGL environmental policy and NZ Biodiversity offsetting guidelines*". Given the evaluation of lizard habitat values available for review for the two proposed mitigation areas, it is not possible for the Councils to properly assess the value of the package being offered by the Applicant in terms of significant habitat for indigenous lizards. Both sites require survey by an independent herpetologist, to adequately complete Table 7 of the RFI response.

The impact management plan notes the presence of large protected areas elsewhere in Macraes Ecological District, but as Figure 1 of the impact report shows, these areas of public conservation land are not large in the context of Macraes Ecological District, and occur some distance (>15 km) to the south of the proposed Coronation North mine. The three existing QEII covenants on OGL land in the north of the Macraes Ecological District are the only legally protected areas in this part of the district. In our opinion, legal protection of habitats similar to those to be affected, in the same general area, would be the most appropriate and enduring form of mitigation or compensation for the significant adverse effects of the proposed mine extension, and would be most consistent with the suggested compensation criteria.

10.10 Valuing the loss (Section 5 of the impact management plan)

The impact report notes that 'like for like' measures are most frequently used to compare the exchange of biodiversity loss and gain in relation to development projects. The reason for this frequent use of the like for like principle is that positive activities consistent with it have the most certainty of addressing the adverse effects. It is agreed that expert consensus can be a useful tool to help evaluate such exchanges.

The impact report goes on to describe a land value approach, based on the per hectare cost of farmland. This approach strays a long way from the like-for-like principle, as it contains no measure to ensure that the loss of biodiversity is exchanged for a similar gain. In our opinion it is highly unsuitable approach that exchanges certain significant loss of indigenous biodiversity for very uncertain gain. For this reason, it is a rarely-used approach, but this is OGL's preferred approach to compensation.

10.11 Enhancing habitat (2.5.2)

Enhancement of habitat is referred to, but without any detail provided on what weed or pest animal control would be undertaken, where it would be undertaken, or what it would be undertaken to benefit. In the absence of this information the utility of such enhancement can't be assessed.

10.12 Protecting rare or important habitats (2.5.3)

Appendix 22 focusses on rare habitats with respect to protection, and states that without conservation attention these habitats will be lost. The same opinion is stated in the impact report. This begs the question of how the unprotected project area

supports so many high conservation values in the absence of conservation attention. Schist bluff communities, for example, have values that persist in the absence of conservation management. The most immediate threat for rare habitats and species in the local area is the proposed mining activity, not other land uses.

10.13 Environmental weed control (2.5.3.1)

The mitigation project describes 'some weeds' and 'other species' which could be targeted for eradication, but none of these weeds are identified. The impact management plan (7.4.1.1) identifies two weeds, the rush *Juncus subnodulosus* and grass *Nardus stricta*, that are proposed for control within the Deighton Creek Nature Reserve. Of these two exotic plants, only the short tussock grass *Nardus stricta* is recognised as an environmental weed[1], because of its ability to invade indigenous wetlands. Thus the proposal to control *Juncus subnodulosus* is unnecessary. Successful control of *Nardus stricta* would be beneficial, as it is an invader of ephemeral wetlands[2], which are an important feature of Macraes Ecological District. As such, control of this species within the Deighton Creek Nature Reserve is very likely to be undertaken by the Department of Conservation.

10.14 Restoring ephemeral wetlands (2.5.3.2)

Appendix 22 discusses restoration of ephemeral wetlands by removing weeds and reintroducing missing species, and suggests that this would result in a huge benefit to ephemeral wetlands. Further detail in the impact management report (7.4.1.2) shows that the restored wetlands would all be located within the Deighton Creek Nature Reserve, some 15 km from the area affected by the proposed Coronation North mine. Weeds are proposed to be removed from ephemeral wetlands in this area, and 'missing' species would be introduced. While weed control may be useful, it would need to be maintained in perpetuity to make these benefits permanent. Once weed control ceases, reinvasion of weeds is certain. In addition, the indigenous species composition of ephemeral wetlands is often very variable, so proposals to add 'missing' species need to be evaluated carefully and backed by strong evidence that those species were in fact once present. Of the twelve species proposed to benefit from the project, only the two Data Deficient species are known to be affected by the Coronation North mine. Thus the proposal to restore ephemeral wetlands may itself be ephemeral and have no lasting benefit for indigenous ephemeral wetland species. Additionally, as with other mitigation, weeding of ephemeral wetlands would take place away from the local area where the adverse effects of mining will occur, thus there would be a net loss of ephemeral wetland values locally.

10.15 Dryland forest rehabilitation (2.5.3.3)

Appendix 22 has an incorrect section number for this section.

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[1] Howell C. 2008: Consolidated list of environmental weeds in New Zealand. DOC Research and Development Series 292. Department of Conservation, Wellington.

[2] Kissling W.D., Schnittler M., Sedon P.J., Dickonson K.J.M. and Lord J.M. 2005: Invasion ecology of the alien tussock grass *Nardus stricta* (Poaceae) at Lake Pukaki, Canterbury, New Zealand. *New Zealand Journal of Botany 43*: 601-622.

It is proposed to restore dryland forest and associated rare shrub, tree, understorey, and grass species. As with the other compensation proposals, there is no detail is provided on where this might occur, how much of it would be restored, what species would be included, and how long it would take. This proposal is not included in the impact management report. As such, more detail is needed to evaluate the utility of this proposal.

10.16 Protecting rare species (2.5.4)

Again, Appendix 22 proposes potentially useful activities but there are no details (apart from freshwater species) on the identity of the species that would benefit, the protection actions that would be undertaken, or the locations of the protection sites. The impact management report again shows that the Deighton Creek Nature Reserve would be the focal site for these actions, and that they would relate to seven high priority species. These species include four species - *Lagenophora montana*, *Uncinia strictissima*, *Carmichaelia kirkii*, and *Olearia fimbriata* - which will not be affected by the proposed Coronation North Mine. Conversely, no specific management is proposed for the Threatened *Pachycladon cheesmanii*, *Ranunculus ternatifolius*, and *Anogramma leptophylla*, the At Risk-Declining *Aciphylla subflabellata* and *Carmichaelia crassicaulis*, the At Risk-Naturally Uncommon *Cardamine bilobata*, *Anthosachne falcis*, *Dracophyllum uniflorum* var. *frondosum*, and *Lagenophora barkeri*, the locally rare *Olearia bullata*, the morphologically distinct red-fruited *Coprosma dumosa*, or the rare in Macraes Ecological District *Carex kaloides*, *Rumex flexuosus*, and *Veronica rakaiensis*. Thus the rare species protection proposals are not very consistent with the like-for-like principle, and would result in the net loss of populations for 14 Threatened, At Risk, locally uncommon, and morphologically distinct plant taxa.

10.17 Additionality

All of the projects aimed at compensating for adverse terrestrial ecological effects are located within the Deighton Creek Nature Reserve, managed by the Department of Conservation. This focus on land that is managed for conservation raises the issue of additionality. That is, all of the proposed actions may be carried out by the Department of Conservation, and thus would provide no additional benefit within Macraes Ecological District. As Nature Reserve is the highest classification of conservation land, it seems very likely that the biodiversity projects discussed are among those that have already been identified by the Department of Conservation for future action.

10.18 Mitigation for loss of habitat

The compensation proposals do not, in general, address loss of habitat. The direct loss of some 265 ha of indigenous vegetation and habitat, including extensive areas of narrow-leaved snow tussock grassland, gully shrublands and wetlands, rock outcrop habitats, and basalt contact flush wetlands, is not addressed. This is a significant deficiency of the compensation proposals.

10.19 Research (2.5.5)

Research is generally very costly and has a relatively narrow focus. Nevertheless, research by management could be an approach undertaken with restoration and protection actions if appropriate counts and measures are undertaken and reported on.

10.20 Supporting local biodiversity projects (2.5.7)

Appendix 22 lists two conservation groups, one based in Dunedin and one based in Alexandra. Other conservation groups that could potentially be supported include the Orokonui Ecosanctuary near Dunedin, which supports populations of rare indigenous flora and fauna, and River-Estuary Care: Waikouaiti-Karitane, which has a focus on the Waikouaiti River catchment.

10.21 Other matters

No photographs of the site, vegetation communities, rare plant species, or indigenous fauna are included in Appendix 6a, 6b, 7, or 22. Photographs would have been helpful in gaining and understanding of the site and its ecological features.

10.22 Conclusion

The proposed compensation for adverse effects on indigenous terrestrial biodiversity exchanges certain significant loss of important indigenous biodiversity, for uncertain gains of largely other types of biodiversity at a Nature Reserve some distance from the affected area. The proposals are only partially consistent with the like-for-like principle, and may not represent additional conservation activities over and above what might be undertaken by the Department of Conservation in any case. Adverse effects on many of the potentially affected important plant species are not mitigated at all, and there is practically no mitigation for adverse effects on indigenous vegetation and habitats. As such, the compensation proposals fall short of what is required to address the significant adverse effects that would be generated, and would result in a significant net loss of indigenous biodiversity values within the local area. Indigenous biodiversity would not be maintained.

With respect to indigenous vegetation, habitat, and plant species, legal protection and conservation management of habitat should be a major part of any compensation offered, because it would avert future loss of important habitat in the local area, provide similar habitats for a similar assemblage of species, and ideally be located within the same area and thus support local metapopulations of species. It would also be demonstrably additional to other conservation activities in the local area. Oceana Gold Ltd has a recent record of protecting areas of indigenous vegetation and habitat in the local area, and adding to this local protected area network would be potentially valuable. This would facilitate the operation of ecological processes such as seed dispersal, pollination, and gene flow between the protected sites.

The project area already contains one Recommended Area for Protection (RAP), and the remaining part of this area is one option for legal protection. Ideally, a protected area based on the remaining part of this RAP would also include the steep headwaters of Highlay Creek (Figure 1), where areas of dense narrow-leaved snow tussock

grassland, schist bluffs, and basalt contact seepages are present. The remaining part of the RAP and adjacent land would therefore have types of habitat that are similar to those within the area to be affected by mining, and be located in a similar location and on similar landforms to the proposed mine. It would also be close (*c.*1 km) to the

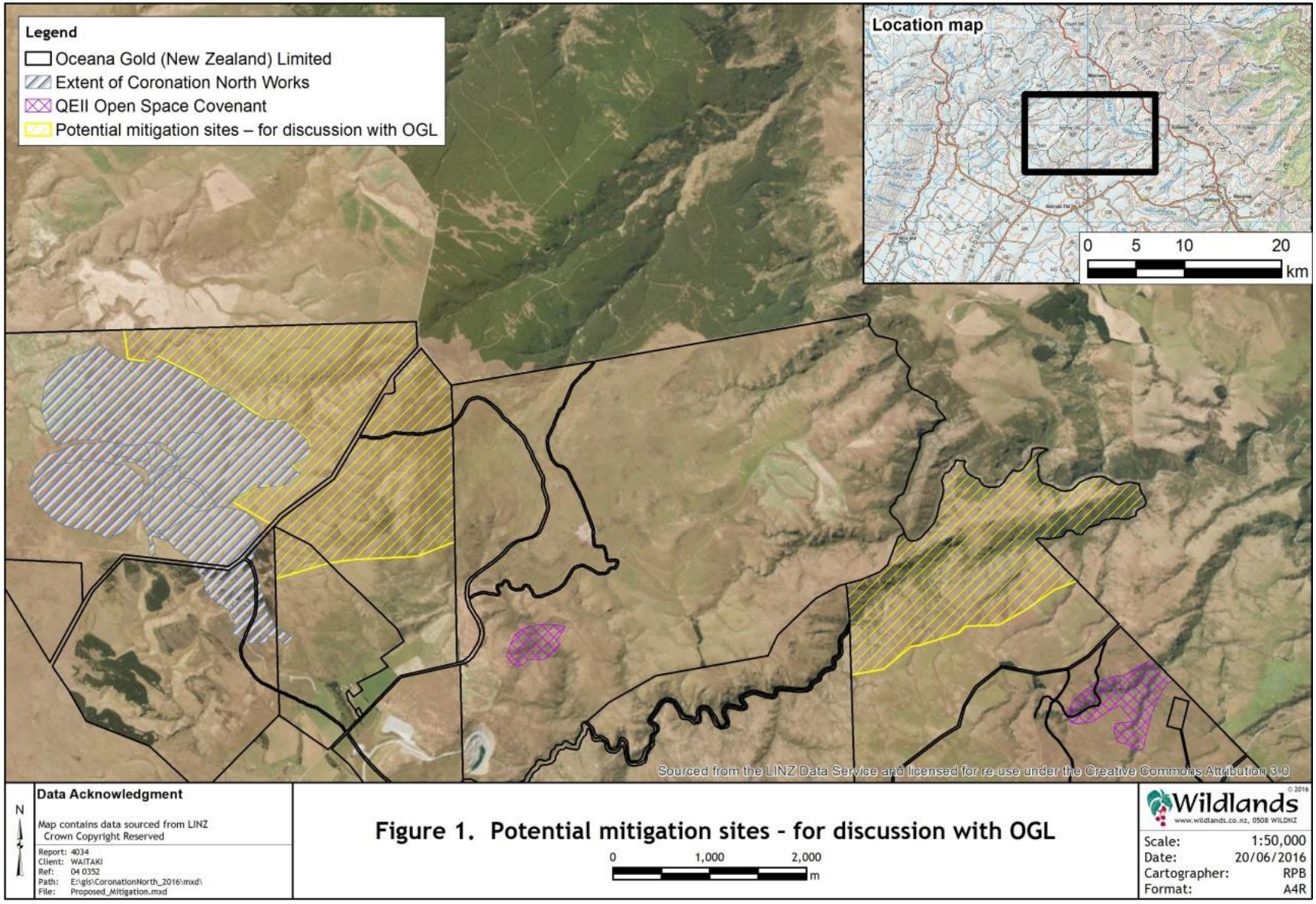

Figure 1. Potential mitigation sites - for discussion with OGL

Highlay Creek shrubland covenant, and approximately six kilometres from the Cranky Jims Creek shrubland and Deepdell tussock grassland covenants. A protected area based on the remaining part of the Trimbells Gully RAP would be consistent with the like-for-like principle.

Another site with current biodiversity values on land owned by OGL, some five kilometres from and at lower elevation to the affected area, is the lower part of Deepdell Creek and adjacent land adjacent to its confluence with the Shag River (Figure 1). While not as similar to the affected site, this area has abundant schist bluffs and areas of regenerating indigenous treeland and forest, and protection of this area would therefore complement the existing protection of indigenous forest in the nearby (about one kilometre distant) Cranky Jim's Creek. This would help to protect and enhance the extremely scarce remnants of indigenous forest within Macraes Ecological District, and would also provide extensive rock bluff habitat for potential 'rescue' of those species that depend on this habitat type.

An additional 'Sailors Cutting' site has also been proposed by the Applicant as a potential compensation site, but there is insufficient information to fully assess the merits of this site as compensation for adverse effects.

Legal protection of areas of indigenous vegetation and habitat within the northern part of Macraes Ecological District is an important objective because, aside from the three relatively small areas of indigenous habitat with existing legal (QEII covenant) protection on OGL land, no other areas have legal protection for conservation of indigenous biodiversity.

The other major component of mitigation or compensation for adverse effects on vegetation and flora should be 'rescue', restoration, or other enhancement of populations of each of the 18 Threatened, At Risk, Data Deficient, and locally rare plant species that are to be affected by the proposed mining operations. Current proposals do nothing to mitigate or compensate for adverse effects on many of these species. The two areas described above are likely to provide a sufficient diversity of habitats for these species.

Other mitigation options could include:

- Providing access for ecological assessment of potentially significant areas of indigenous vegetation and habitat on OGL land within Waitaki District and Dunedin City District.

- Providing for a review of all East Otago landholdings of OGL at the conclusion of mining, with the aim of legal protection and conservation management of the more important areas of indigenous vegetation and habitat that remain at this time.

11. COAL CREEK RESERVOIR (APPENDIX 7)

11.1 Project overview (4.0)

Most of the information in the project overview duplicates information in Appendix 6a, and as such, the information in that document could have been referred to rather than repeating it in Appendix 7.

11.2 Flora ecological communities (5.2)

This section again duplicates material included in Appendix 6a, but also includes significant new information, including two additional threatened plant species and other plant species of importance. The area to be affected lies almost wholly on Acutely Threatened land environments, with less than 10% of their original vegetation remaining.

11.3 Notable vegetation communities (5.2.7)

Appendix 7 states that the project area contains no vegetation communities that are a national priority for protection, yet in the description of vegetation communities (5.2.1), 2.5 ha of *Carex coriacea* sedgeland, an indigenous wetland vegetation type, is described. This indigenous wetland vegetation would meet National Priority 2, which covers indigenous vegetation associated with wetlands. Overall, the indigenous vegetation is assessed as being of very high ecological importance (5.2.1).

11.4 Sites or communities identified as significant in a regional plan (5.2.7.5)

Appendix 7 states that the indigenous vegetation in the project area would be significant based on criteria in the Otago Regional Plan, as they are representative and provide habitat for rare or threatened species.

11.5 Threatened, At Risk, or rare plant species (5.3)

Thirteen plant species within the Coal Creek reservoir project area are classified as Threatened, At Risk, or locally rare. Figure 5, which shows the distribution of species in these categories, conflicts with distribution information given in each species account. For example, only one Threatened plant species is shown within the reservoir footprint in Figure 5, but three occurrences of Threatened plant species are shown in the following two figures.

The occurrence of *Pachycladon cheesemanii* is significant, not only because of its Threatened-Nationally Vulnerable status, but because it is very uncommon in east Otago, and the Coal Creek record is the first from the Macraes Ecological District. We concur with Appendix 7 where it states that the importance of this population is very high, for the reasons given. Similarly, *Senecio dunedinensis*, also classified as Threatened-Nationally Vulnerable, is not only nationally rare, but is rarely found locally. We agree that the importance of the Coal Creek record is very high. As for Appendix 6a, Appendix 7 appears to base its importance ranking solely on the basis of threat category. Despite other factors being listed, these appear to have had no weighting in the importance assessment.

Of the At Risk species identified, the occurrence of *Cardamine bilobata* is significant, as this species is rarely found in the eastern South Island, and the Coal Creek record is the first for the Macraes Ecological District. It appears that a sizeable population may be present, as 20 individuals were seen, and more plants are likely to be present elsewhere in its rock bluff habitat.

The presence of *Veronica rakaiensis* is also notable, as this species is rarely recorded in Macraes Ecological District, which is likely to represent its southeastern distribution limit.

11.6 Avifauna communities (5.4.1)

Description of the bird communities in Appendix 7 is largely a 'cut-and-paste' from Appendix 6a. This suggests that the individual avifauna communities of these two distinct areas (which have different habitat types) have not actually been individually surveyed. Some of the habitat present within the proposed dam site does not appear to have been mapped and may not have been characterised. Appendix 7 characterises the ecological importance of birds within the project area as low, but the absence of a rigorous bird survey means that there is very little evidence to support this conclusion.

11.7 Herpetofauna communities (5.5.1)

As for the avifauna description, the description of herpetofauna is largely a cut and paste from Appendix 6a.

11.8 Impact on vegetation communities (6.1)

Appendix 7 assesses the project impact on vegetation communities as being high at a local level, and moderate at a national level.

11.9 Threatened, At Risk, or rare plant species (6.2)

Effects on *Pachycladon cheesemanii* have been assessed as being high at a local scale, and moderate-low at a national level. As this species is not only Threatened but scarce in East Otago, the local effects are more appropriately very high, and the national scale effects are high. Similarly, the Threatened *Senecio dunedinensis* is also given a moderate-low national scale effects assessment, which should also be promoted to high. This would be more consistent with some of the other effects assessments. For example, it is concluded that national scale effects on the At Risk coral broom, *Cardamine bilobata*, and *Coprosma intertexta* are high, and it is hard to see how taxa with higher national threat status could have a lower national-scale effects assessment.

The national-scale effect of the project impact on *Veronica rakaiensis* is assessed as negligible, yet the loss of this small population near its apparent national distribution limit must comprise at least be a moderate scale national effect.

11.10 Impact on avifauna ecological features (6.3)

Assessment of effects for the Coal Creek dam assumes that the new waterbody has the potential to attract a significant diversity of waterbirds (being of a different community to the assemblage being displaced). This is a reasonable conclusion. Adverse effects of Coal Creek reservoir development on resident avifauna are difficult to determine in the absence of more comprehensive bird information.

11.11 Impact on herpetofauna ecological features (6.4)

As in Appendix 6a, the assessment of adverse effects on lizards considers all three taxa as a group, and does not take account of differences in life-history, behaviour and habitat. Also, as an example of the problems associated with subjective impact assessments: Page 105 of Appendix 7 assesses the project impact on lizards at a national level (all species combined) as "minor" in Paragraph 5 then "moderate' in Paragraph 7 on the same page.

Again, on Page 105 of Appendix 7, it is noted that "*the impact of this project is assessed as having an adverse and positive, direct, permanent, partially-reversible, local impact on these species*" yet no information is given on how flooding of habitat and implementing earthworks could provide a positive impact for the two At Risk lizard species found at the site, and the not threatened McCann's skink. We reiterate that significant habitats of indigenous fauna have not been assessed, thus necessitating the Applicant adopting a casual approach to determining the project's impacts on these species and subsequent mitigation.

11.12 Ecological features in surrounding area (7)

Additional ecological features noted in Appendix 7 from the area around the proposed Coal Creek reservoir site include the At Risk-Declining bidibid *Acaena buchananii* and the At Risk-Naturally Uncommon hookgrass *Carex subtilis*. Locations of these species, and the additional occurrences of other Threatened and At Risk species, need to be specified. No assessment of effects has been provided for the two newly-recorded At Risk species, and this should be rectified. For example, the occurrence of *Acaena buchananii* probably represents a new eastern distribution limit for this species.

12. INVERTEBRATE VALUES AND EFFECTS

The ERA Ecology report does not address habitats or species occurrences for indigenous invertebrates. Given the types of habitats known to be present, this is a major omission. For example a report on the invertebrate fauna of Macraes Ecological District[1] shows that at least eight Threatened, At Risk, and Data Deficient invertebrate species are known from the Ecological District. Key invertebrate habitats are semi-natural grasslands, remnant gully shrublands, and rocky tor-studded areas, all of which are present in the Coronation North project area. Key areas identified for the

[1] Patrick, B.H. 1997: Invertebrates of Macraes Ecological District. *Otago Conservancy Miscellaneous Series No. 30*. Department of Conservation, Dunedin.

protection of invertebrates in Macraes Ecological District include tors, grasslands, and shrublands on Taieri Ridge and the Shag River and its tributaries below 500 m above sea level. The project area is at the northern end of Taieri Ridge, within one of these key areas, while one of the potential mitigation areas identified above occurs below 500 m adjacent to the Shag River.

Table 1: Threatened, At Risk, and Data Deficient invertebrates known from the Macraes Ecological District (Patrick 1997).

Common Name	Species	Threat Classification
Sphagnum porina	*Heloxycanus patricki*	At Risk-Declining
Moth	*Glyphipterix euastera*	At Risk-Declining
Moth	*Dasyuris partheniata*	At Risk-Declining
Moth	*Gingidiobora nebulosa*	Threatened-Nationally Vulnerable
Stonefly	*Zelandobius uniramus*	Data Deficient
Stonefly	*Zelandobius takahe*	Data Deficient
Caddisfly	*Tiphobiosis cataractae*	At Risk-Naturally Uncommon
Caddisfly	*Neurochorema pilosum*	Data Deficient

Gingidiobora nebulosa (Table 1) and four other invertebrate species present in Macraes Ecological District have geographic importance due to the Macraes Ecological District being one of very few known locations of the species, or because their occurrence in the Macraes Ecological District represents a geographic distribution limit (Table 2).

Table 2: Invertebrate species of geographic importance within the Macraes Ecological District.

Common Name	Species	Geographic Importance
Jawed moth	*Sabatinca quadrijuga*	Northern limit in Macraes ED, found south to Foveaux Strait
Grasshopper	*Paprides dugali*	Northern limit in Macraes ED, found south to Foveaux Strait
Geometrid moth	*Gingidiobora nebulosi*	Only known occurrences are in Macraes ED and inland Marlborough
Choreutid moth	*Asterivora antigrapha*	Only known from Macraes ED (Taieri Ridge) and two locations in the Wellington Area
Clapping cicada	*Amphisalta strepitans*	Southern limit in Macraes ED

OGL's response to the request for further information on invertebrate values and effects is firstly to present a range of 'difficulties' for the assessment of invertebrate assemblages, and then to undertake a literature review to assess important invertebrates which may potentially be present within affected areas.

In our opinion, the 'difficulties' in assessing invertebrate assemblages are overstated. Experts are available for the identification of invertebrates to species level in most invertebrate groups, and can be contracted to undertake field surveys if required. Assessment of invertebrate habitat values and effects remains a significant information gap which can only be rectified by engaging suitably-qualified and experienced invertebrate experts to survey for and/or identify invertebrates within the affected parts of the site. Given the known importance of Macraes Ecological District for invertebrates, it is surprising that this aspect of the AEE was neglected. It would be seasonally appropriate to undertake invertebrate surveys from mid-October on.

13. ASSESSMENT OF DEPARTMENT OF CONSERVATION SUBMISSION

13.1 Indigenous vegetation and flora

The Department of Conservation notes that the Applicant's reports do not adequately discuss the context of local vegetation types within a local and national context. In Section 2.8 of this report we share this view, and provided a breakdown of LCDB cover classes within the Macraes Ecological District to provide some additional context.

Another issue identified by the Department is that detail on creation of offset areas and/or offset protection of other areas is not clear, and needs to be more fully and clearly specified to assess the adequacy or value of the mitigation/compensation offered by the Applicant. This audit report has similar concerns, which are identified as a significant issue in the conclusion.

The Department also identifies that the ecological assessment does not cover some features (e.g. the haul road location) and has not assessed the adjacent part of the Trimbells Gully RAP and other areas of indigenous habitat that are closer to and more similar to the areas potentially affected by mining. This concern is also expressed in Section 10.9 of this report.

A key Department of Conservation concern is effects of the proposed mining activities on wetlands, and the Threatened and At Risk plant species they provide habitat for. The submission notes that the AEE lacks detail on wetland mitigation and compensation, and recommends further wetland and plant surveys on OGL land, with appropriate mitigation measures undertaken prior to mining earthworks commencing. This concern is valid, and echoes the general lack of specificity of proposed mitigation, and it lack of similarity to the affected areas.

13.2 Indigenous avifauna

The Department of Conservation notes that no assessment of falcon or pipit breeding habitat has been made. In Section 4.1.1 of this report we share this view. This has been somewhat rectified in the OGL response with a few statements in Table 5. However, the assessment is still cursory. The Department has also highlighted that the AEE does not identify the possible effects of disturbance or destruction of nest sites. This concern is also raised in Section 7.

14. SUMMARY OF ISSUES

Issues raised in this review are summarised in Table 2.

Table 2: Summary of issues identified within Appendices 6a, 6b, 7, and 22, and RFI responses to issues.

Matter	Section	Issue	Comment/action	Adequacy of RFI Response
Bird location databases	4.5.1	Ebird and Nature Watch databases are referred to, but no information form these databases is presented.	Information from these databases needs to be incorporated into the avifauna assessment.	Detailed information from a range of relevant sources has now been provided.
Avifauna survey	4.5.2.2	Non-expert avifauna survey undertaken in one season only.	Means that bird observations likely under-report the actual bird assemblage.	No specific avifauna surveys are planned. Rare species will likely be underrepresented in observations.
Assessment of significance	4.6	Significance justifications not fully provided.	It would be helpful to specify which values meet which criteria.	Evaluations of site values against significance criteria are generally adequate.
Extent of effects	4.7.2	Delineation of buffer.	The buffer should be distinguished separately so that direct vs indirect effects can be assessed.	
Representativeness assessment	5.2.2	Uses a baseline of current vegetation rather than historic vegetation.	Needs to interpret representativeness according to an historic baseline.	Conclusions on representative remain unreliable.
Representativeness assessment	5.2.2	Refers to guidelines for Canterbury Region.	The site is in Otago Region.	Canterbury guidelines no longer referred to.
Regional significance	5.2.7.5	Indigenous vegetation assessed as significant under Otago RPS criteria.	Significance justifications are not fully provided.	Justifications are now provided for each significance criterion.
District Plan significance	5.2.7.6	Indigenous vegetation assessed as significant under the Waitaki District Plan and Dunedin City District Plan.	Similarly, a more explicit explanation of the significant values held by different areas of vegetation, habitat, and species, would be helpful.	Justifications are now provided for each significance criterion.
Section 6(c) significance	5.2.7	Significance is only assessed with respect to significant areas of natural vegetation.	Significant habitats of indigenous fauna must also be assessed.	
Threatened and At Risk plant species	5.3	Too much detail in main body of report.	Summarise in body of report, put detail in an appendix.	
Threatened and At Risk plant species	5.3	Information sources listed but unable to determine which facts or conclusions they are associated with.	Cite sources of information in text and include list of references at end of report.	
Threatened and At Risk plant species	5.3	Personal communications are not dated, making it difficult to determine the relevance of the communication.	Provide dates for each personal communication.	
Status of 'protected	5.3	Protection status of the	Nature of protection would help to	Response clarifies that these

Matter	Section	Issue	Comment/action	Adequacy of RFI Response
wetland' polygons		'protected wetland' polygons in the figures in this section is not specified.	assess local status of Threatened and At Risk plants present in these wetlands.	areas have no legal protection, but ephemeral wetlands have been voluntarily fenced to exclude cattle
Ranking of importance	5.3	The rankings of importance for each taxon relate only to their threat status.	Other factors, such as other nearby occurrences, habitat dependence, and distribution limits should influence the assessment of importance for each taxon.	Response maintains other factors were considered but if so they had no additional relevance above threat status. This seems very unlikely.
Species of biogeographic interest	5.3.5	No species are assessed as being of biogeographic interest.	At least eight plant species are of biogeographic interest.	
Genetically or morphologically distinct forms	5.3.6	No species are assessed as being morphologically or genetically distinct.	At least two plant taxa within the project area are genetically or morphologically distinct, and both are Threatened taxa.	
Summary table	5.6	Distinctiveness of vegetation community, and species of biogeographic or genetic distinctiveness not identified.	The plant species assemblage at the site is very distinctive, including biogeographically and genetically distinct species.	
Avifauna communities	5.4.1	Eleven bird species are stated but only ten listed. This significantly under-represents the actual bird assemblage.	Nearby eBird records include an additional thirteen bird species, including one Threatened and one At Risk species.	Response adds another 10 species likely to be present, and another four species that may visit on rare occasions.
Bird species diversity	5.4.3	Conclusions of depauperate bird assemblage not supported.	At least twice as many bird species are likely to be using the site.	Response maintains conclusion of depauperate bird assemblage despite more than doubling the number of species likely or possibly present.
Invertebrates		No assessment of invertebrate fauna within the project area. Lack of invertebrate information from affected habitats is a major limitation of the AEE.	Threatened, At Risk, and locally uncommon invertebrate species could be present, and should be surveyed for. Mitigation for effects on indigenous invertebrate fauna should be provided.	A desktop assessment also concludes that significant invertebrates could be present. The difficulties of undertaking invertebrate surveys are overstated.
Effects on vegetation	6.1	Rare wetland types are assessed as being associated with national impacts.	Loss of all indigenous wetlands has a national impact, given the highly reduced status of wetlands nationally, and the habitat they provide for Threatened and At Risk plant species	

Matter	Section	Issue	Comment/action	Adequacy of RFI Response
Unnecessary information	6.2	Factors such as noise and project lighting are assessed for each species.	Project noise and lighting would have no or minimal effect on plants.	
Effects on plant species	6.2	Low national scale effects are given where nationally threatened plant species populations will be lost.	These effects are significant on a national scale.	
Effects on avifauna	6.3	Effects on only five indigenous birds have been evaluated, but additional species will almost certainly be affected.	Re-evaluate effects of the project on birds after further bird survey.	Description of effects on bird species generalised, and no assessment of direct effects such as destruction of nests or individuals during habitat clearance.
Effects on avifauna	6.3	AEE assessment of 'temporary, minor effect' conflicts with assessment of 'moderate, permanent, irreversible' effects in Appendix 6a.	Resolve conflict between these documents.	Response states local effects are adverse, permanent, irreversible, and of moderate magnitude.
Impact Assessment	6.4	All "reptiles" are lumped together in impact assessments, despite all three species having individual traits and characteristics which would have a considerable bearing on the severity of actual and potential affects of this project on each of them.	Separate effects assessments are required for all lizard species, for the entire footprint subject that is subject to application for consent.	Not provided and inappropriate use of Patterson (1992) indicates non-expert input into the commentary on lizard habitat values.
Cumulative effects		Cumulative effects are not addressed in Appendix 6a.	Cumulative effects on vegetation communities and plant species are occurring in the Macraes ED due to activities such as mining, afforestation, and pastoral intensification.	Cumulative effects are described at the South Island scale. What is needed is an assessment of cumulative effects in the local landscape.
Appendix 7		Repetition of information.	Much of the information in Appendix 7 has been cut and pasted from Appendix 6a.	
Appendix 7	5.2.7	Statement that National Priority 2 not met.	Indigenous vegetation in wetlands meets this priority.	
Appendix 7	5.3	Figure 5 conflicts with other figures showing rare plant distribution information.	Resolve these conflicts.	
Appendix 7	5.4.1	No separate assessment of avifauna in Coal Creek reservoir site.	A more comprehensive assessment is required.	

Matter	Section	Issue	Comment/action	Adequacy of RFI Response
Appendix 7	6.2	National scale effects for threatened species are not consistent with those for At Risk species.	National scale effects are higher than assessed.	
Appendix 7	6.2	National scale effect on loss of *Veronica rakaiensis* not recognised near national distribution limit.	Re-evaluate national scale effect.	
Appendix 7	7	Potential adverse effects on *Acaena buchananii* and *Carex subtilis* not assessed.	Assessment of these effects is required.	
Appendix 22		Alternatives not evaluated with respect to ecological values.	This is particularly relevant to the proposed Coal Creek reservoir.	
Appendix 22; Impact Assessment Report v2.2		Compensation does not adequately target the affected species, is located in a distant site with questionable additionality, and does not compensate for loss of extensive areas of indigenous vegetation and habitat, and does not adequately compensate for adverse effects on indigenous fauna.	Mitigation/compensation proposals need more development if they are to adequately mitigate or compensate for the residual adverse effects on indigenous species and habitats.	Two areas of dissimilar habitat are evaluated to compensate for the effects of the proposed mine. The Sailors Cutting area is not mapped and only briefly described, whereas a separate report describes the Lower Deepdell site. Neither area is very similar to the affected area, based on the tabulated values (Table 7). However the tabulated values are inconsistent with those in the Lower Deepdell site report, making conclusions based on Table 7 unreliable.

15. CONCLUSIONS

Overall, Appendices 6a, 6b, 7, and 22 are dominated by information on indigenous vegetation and plant species. This level of information is warranted with respect to the significant number of Threatened, At Risk, and locally rare plant species present within the footprint of the development activities. Appendix 6b lists five Threatened, nine At Risk, one Data Deficient, and six locally rare plant taxa that occur within the revised mine expansion, waste rock stack, and reservoir footprint. This is a very high concentration of rare plant species, and additional Threatened and At Risk taxa are known from the area and could be affected by roading and other similar developments, which have not been mapped within the development footprint. The potential loss of all of these occurrences of Threatened, At Risk, Data Deficient, and locally rare plant species would constitute a major adverse effect.

The plant-centric focus of the ecological information means that much more emphasis has been put on vegetation and flora than on indigenous fauna. As an example, copper tussock wetlands are noted as habitat for a Threatened plant, *Ranunculus ternatifolius*, but *Olearia bullata* shrublands are given low importance, despite them being important habitat for invertebrates, particularly Lepidoptera. In the 169 pages of Appendix 6, invertebrates are only mentioned three times, mainly as food for birds and lizards. The high diversity of plant species in the project area means that indigenous invertebrate diversity is also likely to be high, and Threatened, At Risk, and/or locally rare indigenous invertebrate species are likely to be present. As no invertebrate information has been collected, this important group may not be adequately accounted for in decision-making. Similarly, the avifauna information presented is limited, and conclusions on indigenous avifauna are therefore unreliable. While lizard information is comprehensive, significant habitats for lizards are not identified, and mitigation proposals for lizards are poorly developed.

Importantly, long-term effects and cumulative effects have not been adequately considered in the ecological appendices or in OGL's response to the RFI. Cumulative effects of mining undertaken to date have significantly reduced the extent of indigenous vegetation and habitat in Macraes Ecological District, and the long term effects of habitat changes caused by post-mining landforms will continue to affect resident populations of indigenous fauna.

The nature of a mining project means that avoidance and remediation of adverse effects on ecological values is largely impossible, leaving mitigation and compensation as the main methods of addressing adverse effects. Mitigation and compensation options are described only in a general way in Appendix 22, but more detail is provided in the impact assessment report. The significant potential adverse effects of the project warrant significant mitigation and/or compensation, but the compensation proposed is problematic because it only relates to some of the affected indigenous species, does not compensate for extensive loss of indigenous vegetation and habitats and adverse effects on indigenous fauna, has questionable additionality as it is primarily located in a Nature Reserve where Department of Conservation management is likely, and is located some distance from the landscape in which the adverse effects occur. Legal protection of large areas of similar habitat closer to the affected area could help to mitigate the adverse effects of mining, given the background rate of loss of indigenous habitat in Macraes Ecological District. OGL is

now considering this but the only options identified to date are not similar to the affected areas of indigenous vegetation and habitat, and suffer from incomplete and conflicting information on ecological values, thus making assessing of their adequacy difficult. 'Rescue' or other mitigation would also be needed to address adverse effects on each important, plant, lizard, and bird taxon, and if such mitigation was provided in new protected areas closer to the affected site, this could improve the adequacy of mitigation of adverse effects on these species.

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