29 June 2016

Waitaki District Council
Private Bag 50058
Oamaru 9444

For: Michelle Gardiner / Andrew Purves

Dunedin City Council
PO Box 5045
Moray Place
Dunedin 9058

For: Kirstyn Lindsay

Dear Michelle, Andrew and Kirstyn

Waitaki District Council (WDC) 201-2016-779 and Dunedin City Council (DCC) LUC-2016-230 and LUC-2013-225/A –Coronation North Mining Development – Request for further information

We refer to WDC and DCC's letters dated 21 June 2016 with requests for additional information concerning terrestrial ecology and respond below.

Questions 1 to 8 have been addressed in a letter from ERA Ecology NZ Limited, which is attached.

OceanaGold has the following further comment in respect of question 7, which asked us to provide an assessment of cumulative effects of the wider mining operation on indigenous vegetation, habitats, and relevant fauna/ species in the Macraes Environs and the Macraes Ecological District.

Question 8 asked us to provide further details on which projects at Macraes had used a method similar to a 'value of land approach' to mitigation. This approach has been successfully used for the Reefton Gold Project in Victoria Forest Park.

Question 9 asked us to provide a discussion of alternatives of the proposed Coal Creek water storage dam and on the location and footprint of the proposed waste rock stack in terms of loss of the indigenous vegetation, habitats and relevant faunal species. It was also asked "Could the height of the waste rock stack be increased and the footprint reduced, at least from a mining operation perspective?" We respond to the latter question first.

Coronation North Waste Rock Stack Alternatives
In short, no, from a mining operation perspective the Coronation North waste rock stack should not be elevated higher than the current design. Upon primary assessment of a waste rock stack design for Coronation North, engineering and aesthetic criteria have already been considered and implemented into the design.

From an engineering standpoint, elevating the waste rock stack will primarily result in a loss of efficiency which, in effect, manifests operationally as a higher cost per tonne moved. Generally speaking, the higher runs will utilise more trucks, and dozing requirements to maintain the dump area are higher with a less laterally

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extensive dump (i.e. smaller footprinted area). These higher equipment requirements result in higher maintenance costs per tonne moved as well as the environmental effect of more emissions per tonne moved. See attachment .

There are also amenity considerations. A study done on the visual impact of the Macraes mining operation (*OceanaGold: Macraes Phase III Landscape and Visual* Assessment) found that "*[t]he Macraes Ridge area, which forms the western or southern skyline for much of the Palmerston and Pigroot Land Units, is assessed as locally Significant landscape, for visual reasons;*". As such, the waste rock stack has been designed, aesthetically speaking, to "*visually integrate finished structures, landforms and vegetation into the surrounding landscape so they appear to be naturally occurring features*" (Condition 14(a) of the land use consent LRC 96/98 for the landscape rehabilitation of waste rock stacks). With this in mind, redesigning the waste rock stack to be any higher than its current design will cause it to be featured prominently on the skyline as a structure that sits above any other features that lie adjacent, causing it to stand out from its surroundings.

Section 4 of the Coronation Project land use consent (WDC Reference: 201.2013.360; DCC Reference: LUC-2013-225) controls rehabilitation, and in particular the visual impact of the Coronation WRS. WRS design is undertaken with input from a Landscape Architect and in consultation with Councils. OceanaGold proposes to adopt the same conditions in the Coronation North land use consent, as outlined below.

4 REHABILITATION

4.1 The rehabilitation objectives to be achieved by the consent holder are:-

(a) To ensure short and long term stability of all structures and works and their surrounds;

(b) To avoid maintenance after completion of rehabilitation requirements;

(c) To protect soil from erosion and to protect water from contaminants affected by mining operations;

(d) To stabilise and rehabilitate the banks and surrounds of any waterbodies;

(e) To return land as closely as possible to its original condition, including any exotic pastoral and indigenous species appropriate to the area; and

(f) To visually integrate finished structures, land-forms and vegetation into the surrounding landscape so they appear to be naturally occurring features; and,

(g) To control invasive environmental weeds, including wilding conifers, in the Disturbed Land for the Life of the Macraes Gold Project.

<u>Earth Shaping and Visual</u>

4.2 The consent holder shall locate, form and shape all earthworks so that their profiles, contours, skylines and transitions closely resemble and blend with the surrounding natural landforms. If earthworks cannot be fully naturalised, the consent holder shall minimise the extent of their visibility and maximise their integration into the surroundings.

4.3 The consent holder shall use a Landscape Architect in the planning and design of all permanent earthworks and structures.

<u>Waste Rock Stack</u>

4.4 The consent holder shall design and construct the waste rock stack in accordance with the following principles:

(a) Slopes shall be suitably concave or convex in cross-profile to match nearby natural slopes;

(b) Slope gradients shall be no steeper than nearby natural surfaces;

(c) Transitions between natural and formed surfaces shall be rounded and naturalised;

(d) Contours should be curvilinear in plan form, in keeping with original natural contours in that area;

(e) The skyline shall be variable and curved, simulating natural skylines;

(f) New landforms shall be aligned and located so they seem to continue, not cut across, existing landscape patterns; and

(g) Silt ponds shall be removed and the site rehabilitated or be converted to stock water drinking ponds following completion of mining operations and rehabilitation.

4.5 Where practicable the waste rock shall be backfilled into pits in order to minimise the size of waste rock stack.

4.6 Prior to the commencement of the Coronation waste rock stack, the consent holder shall in consultation with the Councils, design the shape and construction details of the stack. The final design and construction details shall be lodged with the Councils and include a report prepared by a Landscape Architect that includes, but is not limited to, the following:

(a) A detail description of the proposed waste rock stack;

(b) A detailed description of the adjoining landforms; including their slopes and transitions; and

(c) A detailed discussion on how the proposed waste rock stack meets the principles set out in condition 4.4 (a) – (f).

4.7 If after commencement of the construction of the Coronation waste rock stack, the consent holder wishes to change the design or construction details it shall design the changes in consultation with the Councils. The design or construction changes shall be lodged with the Councils. The change document shall include a report by a Landscape Architect that details the proposed changes and reassess whether the design changes
better meet the principles set out in condition 4.4 (a) – (f).

Alternatives to the location and footprint of the proposed waste rock stack in terms of lost values have already been considered during project development and consultation.However, the proposed waste rock stack has been conservatively designed to hold all waste generated by the project. There is real potential for waste to be opportunistically backfilled into pits, thereby reducing the footprint and area of ecological impact. Nevertheless, mitigation is being offered for the entire footprint area. It is noteworthy that on more than one occasion at the MGP mitigation has been provided for the entire project footprint and subsequently less than the entire footprint has been developed. Coronation WRS is an example of that.

Coal Creek Dam Alternatives
In determining the location of Coal Creek Dam OceanaGold did consider alternatives. However, the need to locate the dam on land owned by the company with sufficient catchment to supply the volume of water needed

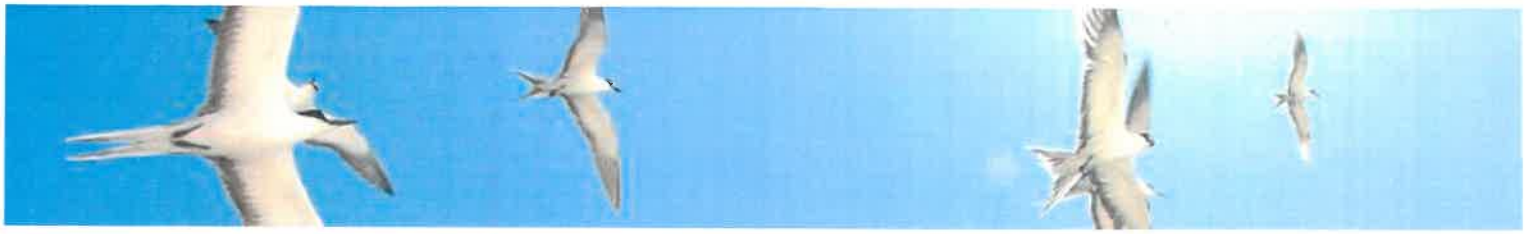
for dilution restricted the dam to this location. In addition, the site selected is geological suitable for construction of the embankment between two geological outcrops For the reasons expressed in section 15 of the AEE (page 111) the proposed location was preferred. See Attachment.

OceanaGold will not discount the possibility that if we were to acquire more land in proximity to the Coronation North waste rock stack in the future we could consider re-locating the dam to a site with lesser effects on ecology.

Yours Sincerely

Jackie St John/John Bywater

Land and Consenting Lawyer / Consenting Project Advisor



ERA ECOLOGY NZ LTD

Reference:

8 July 2016

Waitaki District Council
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For: Michelle Gardiner / Andrew Purves

Dunedin City Council
PO Box 5045
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Dunedin 9058

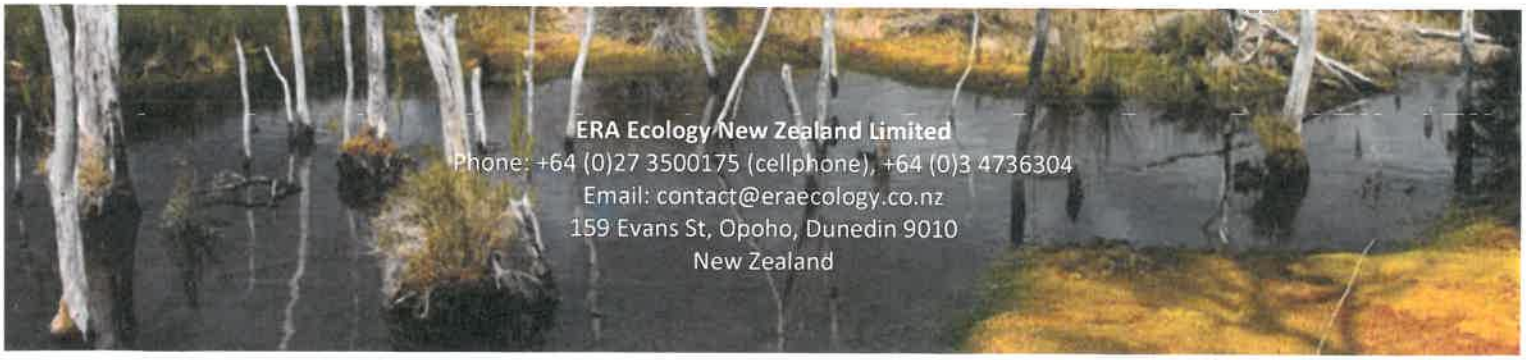
For: Kirstyn Lindsay

Re: Waitaki District Council (WDC) 201-2016-779 and Dunedin City Council (DCC) LUC-2016-230 and LUC-2013-225/A –Coronation North Mining Development – Request for further information

I refer to WDC and DCC's letters dated 21 June 2016 with requests for additional information concerning terrestrial ecology. I have been asked by OceanaGold to respond to questions 1 to 8, which I do below with the questions in bold and answers following.

1. **Vegetation Representativeness**

The ERA reports appear to assess representativeness in the context of the existing vegetation 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 and natural indigenous vegetation types are given higher rankings for representativeness.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It is unclear why the Canterbury guidelines have been used given the site resides within the Otago Region.

Please reassess the assessment of representative using an 1840 baseline and examine whether the Otago Region criteria change any evaluation or please alternatively explain why reassessment is unnecessary.

The Canterbury guidelines[1] were used in the ERA documents as, in the absence of Otago-specific detailed guidelines[2], they are the geographically-closest example of a Best Practice guiding document as recommended for use by the EIANZ Guidelines[3] developed with assistance from the Ecological Society of New Zealand. As the 2016 Wildlands Review does not support their use in Otago, they are removed from consideration, and Representativeness is here evaluated against the criteria in the WDC and DCC district plans and the ORC Regional Policy Statement.

Representativeness of the Coronation North PIA according to 1998 ORC Regional Policy Statement guidelines[4].

Wording in Regional Plan:
"(Policy) 10.5.2 To maintain and where practicable enhance the diversity of Otago's significant indigenous vegetation and the significant habitat of indigenous fauna, trout and salmon which are: ...

(d) Vegetation that contains a substantially intact, uninterrupted ecological sequence of indigenous species which are rare or representative regionally or nationally; ...

and to promote and encourage, where practicable, the retention, enhancement and re-establishment of indigenous ecosystems within Otago."

No definition of representative is given in the text or glossary. No guidance is given on whether Representative should be evaluated relative to a pre-human, pre-European, 1840, current, or other baseline.

As there are no available baselines for vegetation cover in the Otago region, except for that provided in the 2nd edition of the Land Cover Database (LCDBII)[5], analysis of vegetation representation could only be conducted relative to this baseline. This gives Representation in a recent (2012-2013) context, which can be applied both Locally and Regionally in reference to 33 land classifications which are derived from examination of aerial photographs. These 33 land classifications are broad categories, and the finer-detail mapping using ground survey used in the ERA reports results in more land classifications. Four land classifications are mapped within the PIA in LCDBII (high producing exotic grassland, low producing exotic grassland, matagouri shrubland, tall tussockland) in comparison with the eleven mapped and described in ERA. There are also differences in the boundaries of these communities, probably arising from the difference between mapping

[1] Guidelines for the application of ecological significance criteria for indigenous vegetation and habitats of indigenous fauna in Canterbury Region. Wildlands Consulting Ltd report 2289i to Environment Canterbury, 2008.

[2] Some broad guidance on Representativeness is provided in the WDC and DCC District Plans and the ORC Regional Policy Statement.

[3] Ecological Impact Assessment (EcIA): EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. EIANZ, Melbourne, March 2015.

[4] As expressed on p. 141 of Chapter 10: Biota.

[5] Ministry for the Environment. Database version v4.1.

vegetation based solely on aerial imagery and using automated techniques as at 2012/13 and mapping based on visual inspection of 2016 aerial photographs and pre-validated by ground survey. For these reasons, the assessment of Representativeness provided in the ERA reports is considered accurate.

Representativeness of the Coronation North PIA according to 2010 WDC District Plan guidelines[6].

Wording in District Plan:
"16.9.3 Policies
... 3 To use the following criteria to identify areas with significant indigenous vegetation or significant habitats of indigenous fauna:
i Representativeness
The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature; ..."

In this instance reference is made to a pre-European baseline and defines Representative as typical to the district at the time of this baseline.
Again, there is no quantified pre-European baseline of the extent of vegetation communities in New Zealand. Instead, there have been scientific extrapolations based on current vegetation patterns (particularly those interpreted as remnants of previous vegetation communities) and palaeoecological investigations such as pollen profiles in the areas wetlands (and rare studies using subfossil coprolite studies, remnant logs, and geomorphological patterns such as up-root depressions). All these studies have limitations on how they can be interpreted. In the Central Otago (and particularly in the Macraes context), Bibby (1997), McGlone et al. (1995) and McGlone (2001) are viewed as the primary sources describing the extent of the vegetation in pre-human times. This is as described in the General Ecological Setting of the original ERA reports, though improved pasture probably covers 70% (rather than 50%) of the Ecological District, as mapped in LCDBII.
Using the vegetation description, as amended above, the following vegetation communities are considered Representative of Pre-European vegetation:

- Riparian herbfield and sedgeland.
- Basalt contact seepage wetlands.
- Ephemeral wetlands.
- Seepage and flush wetlands.
- Short tussock grassland.
- Shrubland.
- Narrow-leaved tussock grassland.
- Riparian herbfield and sedgeland.

The Coronation North PIA remains assessed as of **high** Representativeness.

Note that the relationship of these vegetation communities to the area's pre-human vegetation cannot be assessed as there have been massive changes in the vegetation of the area in pre-human, Maori and European times.

[6] As expressed on p. 141 of Section 16.9: Issue 8 – Nature Conservation Values

Representativeness of the Coronation North PIA according to 2006 DCC District Plan guidelines[7].

Wording in District Plan:
"Method 16.4.4 Schedule.
Identify areas of significant indigenous vegetation and significant habitats of indigenous fauna (Areas of Significant Conservation Value) for inclusion in Schedule 25.4 based on the following criteria:
(i) Criteria for identification of areas of significant conservation value:
...

(e) Representativeness: the degree to which vegetation is representative of that which formerly covered Dunedin City's ecological districts. Representativeness is defined by the percentage present of the native plant species that are known to have been in that vegetation type in the Dunedin district since European settlement (the 'characteristic' species), and the percentage contribution of native species to the plant cover.

..."

This District Plan interprets Representative in a similar fashion to that in the WDC District Plan, but with a later era of post-European colonisation. No date is indicated that could be used as a baseline. In this instance the 1840 baseline advocated by Wildlands could be appropriate. However no quantifiable baseline exists for this time. The vegetation immediately post European arrival is likely to have been very similar to that which existed as described in described in the General Ecological Setting of the original ERA reports and in the response to WDC (above), though improved pasture probably covers 70% (rather than 50%) of the Ecological District, as mapped in LCDBII.

Using the vegetation description, as amended above, the following vegetation communities are considered Representative of immediately post European vegetation:

- Riparian herbfield and sedgeland.
- Basalt contact seepage wetlands.
- Ephemeral wetlands.
- Seepage and flush wetlands.
- Short tussock grassland.
- Shrubland.
- Narrow-leaved tussock grassland.
- Riparian herbfield and sedgeland.

The Coronation North PIA remains assessed as of **high** Representativeness.

Note that the relationship of these vegetation communities to the area's pre-human vegetation cannot be assessed as there have been massive changes in the vegetation of the area in pre-human, Maori and European times.

Bibby, C.J. 1997. Macraes Ecological District, summary report for Protected Natural Areas Programme. Department of Conservation, Dunedin.

McGlone, M.S; Mark, A.F; Bell, D. 1995. Late Pleistocene and Holocene vegetation history, Central Otago, South Island, New Zealand. Journal of the Royal Society of New Zealand 25: 1-22.

[7] As expressed on p. 16:8 of Section 16 Indigenous Vegetation and Fauna.

McGlone, M.S. 2001. The origin of the indigenous grasslands of southeastern South Island in relation to pre-human woody ecosystems.

2. **Evaluation of Significance**

The ERA Reports assess the significance of the Indigenous vegetation communities against the ecological significance criteria in the Otago Regional Plan and in the Waitaki District Plan although no detail is provided in how that evaluation was completed. Significance criteria used in the Operative and Proposed Dunedin City District Plan are discussed In the report on the proposed Coal Creek Water Storage Dam but not in the Appendix 6a Report.

In terms of terrestrial ecology, it would be helpful to provide a systematic evaluation of significance under the various District Plan criteria to form the basis of the significance assessment.

Please provide further evaluation of significance against each of the individual District Plan criterion.

Significance of ecological features of the Coronation North PIA evaluated against the criteria in the 1998 ORC Regional Policy Statement guidelines[8]

Wording in the Regional Policy Statement:
"10.5.2 To maintain and where practicable enhance the diversity of Otago's significant indigenous vegetation and the significant habitat of indigenous fauna, trout and salmon which are:

(a) Covered under a statute or covenant for protection; or
(b) Habitat or vegetation that support the maintenance or recovery of indigenous species that are uncommon or threatened with extinction (rare, vulnerable or endangered) regionally or nationally; or
(c) Vegetation that contains associations of indigenous species which are rare or representative regionally or nationally; or
(d) Vegetation that contains a substantially intact, uninterrupted ecological sequence of indigenous species which are rare or representative regionally or nationally; or
(e) Important for soil and water values or have functions in natural hazard mitigation;

and to promote and encourage, where practicable, the retention, enhancement and re-establishment of indigenous ecosystems within Otago."

No areas within the Coronation North PIA meet criteria (a).

All of the natural vegetation communities within the Coronation North PIA meet criteria (b) in that they are known to provide habitat for indigenous species that are uncommon or threatened with extinction.

All of the natural vegetation communities within the Coronation North PIA meet criteria (c) as all natural vegetation communities are considered representative (see Question 1). The ephemeral wetland, seepage and basalt contact flush wetlands are rare vegetation communities which also meet criteria (c) as examples of rare associations of indigenous species.

None of the natural vegetation communities within the Coronation North PIA meet criteria (d) as none are an example of an ecological sequence.

[8] As expressed on p. 141 of Chapter 10: Biota.

None of the natural vegetation within the Coronation North PIA meet criteria (e) as none are considered important for soil or water values at a regional scale, though they are likely to have some value at a catchment scale.

The natural vegetation within the Coronation North project's PIA remains assessed as significant using the criteria within the ORC Regional Policy Statement.

Significance of ecological features of the Coronation North PIA evaluated against the criteria in the 2010 WDC District Plan guidelines[9].

Wording in the District Plan:
"To use the following criteria to identify areas with significant indigenous vegetation or significant habitats of indigenous fauna:

i Representativeness
The area supports an example of a particular vegetation type, habitat or ecological process that is typical of the ecological district relative to the pre-European baseline and contributes to maintaining the appropriate proportional representation of that feature;
or
ii Rarity and Distinctiveness
The area supports an indigenous species, habitat or community, which is rare and vulnerable within the ecological district or threatened nationally; or the area contains unusual features such as:

- Playing an important role in the life-cycle of protected or threatened indigenous fauna;
- The presence of species at their distribution limit;
- Containing an intact a sequence, or a substantial part of an intact sequence, of unusual ecological features or gradients;

or
iii Diversity and pattern
The area exhibits a high degree of biological diversity in terms of:

- Species (vegetation and fauna)
- Habitat types (i.e. "Seral" or "Climax" types)
- Ecological processes;

or
iv Ecological Context, Size and Shape
The area:

- Maintains connectivity between other significant areas or maintains the opportunity for better connectivity between existing significant sites;
- Provides a buffer for areas that are of significant value;
- Is of sufficient size to be viable and edge effects are not an important limitation;
- Important feeding/breeding areas for indigenous fauna."

The natural vegetation communities with the PIA are all considered as representative and therefore meet criteria (i).

[9] As expressed on p. 141 and 142 of Section 16.9: Issue 8 – Nature Conservation Values

The natural vegetation communities with the PIA all meet criteria (ii) as they support rare or vulnerable species. The ephemeral wetland, seepage and basalt contact flush wetlands are also rare vegetation communities and are also considered distinctive.

The natural vegetation communities with the PIA are all of high species meet criteria (iii) as they support a high diversity of indigenous plant species.

The narrow-leaved tussock grassland, short tussock grassland and gully mosaic vegetation communities meet criteria (iv) as they maintain connectivity with other natural vegetation communities in the area, are of sufficient size to be viable, and (together with the other natural vegetation communities at the site) provide important breeding and feeding areas for indigenous lizards and birds.

The natural vegetation within the Coronation North project's PIA remains assessed as significant using the criteria within the Waitaki District Plan.

Significance of ecological features of the Coronation North PIA evaluated against the criteria in the 2006 DCC District Plan guidelines[10].

Wording in the District Plan:
"Criteria for identification of areas of significant conservation value:
Any natural resource, or aggregation of such resources, will be considered to be an area of significant conservation value under one or more of the following criteria:

(a) Existing protected areas: habitat or indigenous vegetation that has been specially set aside by statute or covenant for protection and preservation.

(b) Wetlands: including wetlands that are listed in the WERI inventory by virtue of their ecological and representative importance or that are listed in the schedules of the Otago Regional Council's Regional Plan: Water.

(c) Sites within the Dunedin City boundaries that are listed in an Otago Regional Council Regional Plan as having significant conservation value. For sites listed in the Regional Plan: Coast, including the Marine Mammal and Bird Sites in Schedule 3.1, the Dunedin City Council will establish the extent to which these sites extend inland of the Coastal Marine Area.

(d) Rarity/distinctiveness: the degree to which vegetation and habitat types that were formerly common are now reduced in extent, or are naturally rare, or support native species (plants or animals) that are uncommon, in decline or threatened with extinction within an ecological district/subdistrict, ecological region or nationally, including those listed in Appendix 16A.

(e) Representativeness: the degree to which vegetation is representative of that which formerly covered Dunedin City's ecological districts. Representativeness is defined by the percentage present of the native plant species that are known to have been in that vegetation type in the Dunedin district since European settlement (the 'characteristic' species), and the percentage contribution of native species to the plant cover.

(f) Viability: the degree to which existing natural habitat or vegetation is capable of maintaining or recovering its structure and composition in the absence of additional management, or is subject to a formal restoration programme.

(g) Context in the Ecological Landscape: the degree to which an area of native habitat or

[10] As expressed on p. 16:7 and 16:8 of Section 16 Indigenous Vegetation and Fauna.

vegetation links other such areas or contributes to the ecological significance of the immediate vicinity. Such areas have a significant ecological function if they are within flying distance for the majority of native birds, a maximum of approximately 500m, or if they increase habitat suitability for terrestrial and aquatic flora and fauna by providing cover, shelter, food, nesting sites, a buffer from harmful influences, etc.

(h) Diversity/pattern: the number of species of native vascular plants and animals, and the number of vegetation/habitat types, contained in an area.

(i) Naturalness/intactness: the degree of absence of disturbance and damage by human activity and the activity of introduced animals.

(j) Size and shape: the size of an area of vegetation or habitat and the degree to which its shape influences the viability of the site."

No areas within the PIA meet criteria (a).

No wetlands in the PIA meet criteria (b).

No areas within the PIA are listed as significant by the ORC and meet criteria (c).

All the natural vegetation communities within the PIA meet criteria (d) as they are now reduced in extent (if compared with early European vegetation communities), provide habitat for that are uncommon, in decline or threatened with extinction. Several species are listed in Appendix 16a (see Section 5.3.4.3 of the EA reports). The ephemeral wetland, seepage and basalt contact flush wetlands are also rare vegetation communities.

All the natural vegetation communities are considered representative and meet criteria (e).

All the natural vegetation communities are considered to be viable under current land management practices and meet criteria (f), with the exception of the ephemeral wetland plant communities that are being smothered by exotic plants.

The narrow-leaved tussock grassland, short tussock grassland and gully mosaic vegetation communities meet criteria (g) as they maintain connectivity with other natural vegetation communities in the area, are of sufficient size to be viable, and (together with the other natural vegetation communities at the site) provide important breeding and feeding areas for indigenous lizards and birds.

All the natural vegetation communities meet criteria (h) as there are a variety of plant communities within the PIA and these contain a high diversity of plant species.

All the natural vegetation communities are currently moderately intact and meet criteria (i).

The narrow-leaved tussock grassland, short tussock grassland and gully mosaic vegetation communities meet criteria (j) as they are of respectable size.

The natural vegetation within the Coronation North project's PIA remains assessed as significant using the criteria within the current Dunedin City District Plan.

Significance of ecological features of the Coronation North PIA evaluated against the criteria in the draft DCC 2GP District Plan guidelines[11].

Wording in the draft plan:
"Identify areas of significant indigenous vegetation and/or significant habitats of indigenous fauna and promote the protection of these as Scheduled Areas of Significant Conservation Value (ASCVs) and/or through QEII covenants. Identify areas which have all or a number of the following criteria:

a. existing protected areas set aside by statute or covenant or listed in an operative Otago Regional Council Regional Plan as having significant indigenous biodiversity value;
b. habitats for indigenous species that are nationally threatened, at risk, or uncommon;
c. indigenous vegetation and/or fauna habitat types that are rare, acutely or chronically threatened;
d. indigenous vegetation or indigenous fauna that is distinctive or representative of the natural diversity of the ecological district;
e. areas important for their ecological context as an ecological buffer, connection or as a habitat for indigenous fauna;
f. areas with a relatively high indigenous diversity and pattern; and/or
g. areas that are of a size to make them significant.

No areas within the PIA meet criteria (a).

All the natural vegetation communities meet criteria (b) in that they provide habitat for threatened, at risk, or uncommon species.

The ephemeral wetland, seepage and basalt contact flush wetland vegetation communities are rare and acutely threatened and meet criteria (c).

All the natural vegetation communities are considered representative and meet criteria (d).

The narrow-leaved tussock grassland, short tussock grassland and gully mosaic vegetation communities meet criteria (e) as they maintain connectivity with other natural vegetation communities in the area and also provide habitat for lizards and birds.

All the natural vegetation communities have high indigenous plant diversity and meet criteria (f). It is unclear whether any meet the pattern criteria as pattern is currently undefined in the draft plan.

The narrow-leaved tussock grassland, short tussock grassland and gully mosaic vegetation communities may meet criteria (g) as they are of a size that could be considered significant, but there are no explanatory notes in the draft document that assist to make that assessment.

It is likely that all the natural vegetation communities within the PIA would be considered significant using the criteria in the draft 2GP plan.

[11] As expressed on p. 95 of Objective 2.2.3 Indigenous Biodiversity

3. **Threatened, At Risk, or rare plant species**
   Figure 5 of Appendix 6a ERA Report 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.

   The figures produced In Section 5.3 of the ERA Report show 'protected wetland' areas to the northeast of Macraes Flat, but it is unclear what the legal status is of this protection.

   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, it appears that the 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 the actual evaluation.

   Please confirm the legal protection status of the wetlands identified in Section 5.3.

   It is presumed that the "actual evaluation' refers to the assessment of the ecological impact of the project on the ecological features (Section 6 of the ERA reports). We further explain here (in addition to the explanation in Section 4.7 of the ERA reports) that a number of factors were considered when assessing the impact of the project on the various species:
   - the mechanism of impact and its likely mode of operation.
   - the species' susceptibility to that impact.
   - the result on the species viability at a local and national level of the forecast impact which includes consideration on impacts on metapopulation dynamics, genetic pattern, species distribution, local and national population sizes together with the conservation status of the species.
   - the degree of certainty inherent in the evaluation.

   The 'protected wetlands' referred to in Section 5.3 of the ERA reports have no legal protection status. They are areas of ephemeral wetlands on freehold land around which OceanaGold have voluntarily placed a protective fence to prevent cattle damaging the wetlands.

4. **Avifauna**

It appears that the survey avifauna completed for the ERA (Section 5.4) was limited and other recordings completed at nearby locations previously included a range of species that would be expected at the subject location. The eastern falcon, the South Island pied oystercatcher and the New Zealand pipit for example are important species that could potentially be located within the proposed footprint.

The project area could be surveyed during the breeding season (e.g. October- November) with a focus on these species which would provide the basis for any necessary mitigation.

Please confirm whether a suitably qualified and experienced ornithologist could be engaged to survey the subject area during the breeding season (October to November 2016) and if so please propose conditions that would avoid, remedy or mitigate any adverse effects on avifauna species surveyed and assessed as being ecologically significant.

Alternatively, please prepare an assessment of actual or potential effects on avifauna; and, please also determine the appropriate level of mitigation for the loss avifauna, which recognises and takes into account the current uncertainty due to a lack of information.

A two-step process was undertaken to answer the second option above: a review of available information to identify which other bird species may occur in the vicinity, and analysis of these records to identify probable status of the species in the general area, and within the PIA in particular. The results of this process were then used to re-assess the project's effects on avifauna.

Literature Review

The review of available databases and literature was limited to information pertaining to the Taieri Ridge east to edge of the schist peneplain (a line roughly along from Mt Hellene to Little Peak via Lots Wife and Mt Royal) to limit observations to those in similar climatic and habitat conditions. Reference to observations made in previous studies was not included unless the information in that study could not be verified by viewing the original document. For information sources earlier than 2000 only records of species not already recorded from other data sources were included. No effort was made to locate unpublished field notes of other workers. Of equal importance to bird observations are observations when a species is not seen. This information is often not recorded, but there have been multiple visits to the Coronation area by several different ecologists from various organisations such as ERA Ecology NZ Ltd, Ryder Consulting Ltd and Wildlands Consulting Ltd where sightings of notable bird species are likely to have been recorded.

This review found 382 observations of 54 bird species comprising 34 indigenous bird species and 20 exotic bird species. These records are summarised in Table 1 and Table 2. Since 2012, twenty-three visits by eight ecologists totalling over 65 hours where sightings of rare birds are likely to have been recorded have been made to the Coronation area (Table 3).

Table 1. Bird records of the Taieri Ridge area. Records may be of more than one individual.
* Only species not recorded in subsequent information included.

Information Source	Date of Information	Total Observations	Number Indigenous Species	Number Exotic Species
Bull et al. (1985) OSNZ Bird Atlas1	pre-1985	1*	1[3]	0
Whitaker (1986) Deepdell survey	1985-1986	11*	9[12]	2
Bibby (1997) PNA Survey	pre-1997	3*,[13]	2[14]	1
eBird (www.ebird.org/content/newzealand/)	1998 onwards	139	12	15
Robertson et al. (2007) OSNZ Bird Atlas2 data from 10km^2 grid squares 2290 5530, 2290 5540, 2300 5530, 2300 5540, 2310 5530, 2310 5540.	1999-2004	174	25	14
Ryder Consulting Ltd OceanaGold Cranky Jims Shrubland Covenant monitoring	2012	10	3	7
Ryder (2013) Coronation Project ecological assessment	2012	9	3	6
NatureWatch (www.naturewatch.org.nz)	2013 onwards	4	4	0
ERA Ecology Ltd OceanaGold Cranky Jims Shrubland Covenant monitoring	2015	16	6	10
ERA (2016a,b) Coronation North and Coal Creek Dam Project ecological assessments	2016	11	5	6
ERA Ecology Ltd OceanaGold Island Block site survey	2016	1	1	0
OceanaGold file notes		3	3	0

[12] This figure includes an observation of eastern falcon, which, though was recorded in subsequent information, the record provides important historical information for this At Risk - Recovering species.
[13] Two of these observations are for unspecified sites within the Macraes Ecological District, which extends further than the area under consideration. Therefore it is not known whether the observation of exotic Canada geese and Threatened black-billed gull are pertinent.
[14] In addition to footnote 2: the observation of black-billed gull by these authors is retained as the record provides important historical information for this Threatened species.

Table 2. Bird species observed in Taieri Ridge area.

Common Name	Scientific Name	Threat Status	Number of observations
Grey duck	*Anas superciliosa*	Nationally Critical	2
Black-billed gull	*Larus bulleri*	Nationally Critical	2
Black-fronted tern	*Chlidonias albostriatus*	Nationally Endangered	1
Banded dotterel	*Charadrius bicinctus*	Nationally Vulnerable	1
NZ dotterel	*Charadrius obscurus*	Nationally Vulnerable	1
Crested grebe	*Podiceps cristatus*	Nationally Vulnerable	1
Red-billed Gull	*Larus novaehollandiae*	Nationally Vulnerable	1
Australasian Pipit	*Anthus novaeseelandiae*	Declining	17
South Island Oystercatcher	*Haematopus finschi*	Declining	11
Australasian Pied Stilt	*Himantopus himantopus*	Declining	2
Black shag	*Phalacrocorax carbo*	Naturally Uncommon	3
Marsh Crake	*Porzana pusilla*	Relict	1
Eastern falcon	*Falco novaeseelandiae*	Recovering	13
Tomtit	*Petroica macrocephala*	Locally Notable	2
Grey Teal	*Anas gracilis*	Not Threatened	4
Australasian shoveler	*Anas rhynchotis*	Not Threatened	2
Bellbird	*Anthornis melanura*	Not Threatened	4
New Zealand Scaup	*Aythya novaeseelandiae*	Not Threatened	2
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	1
Swamp Harrier	*Circus approximans*	Not Threatened	21
Black swan	*Cygnus atratus*	Not Threatened	2
White-faced heron	*Egretta novaehollandiae*	Not Threatened	4
Grey warbler	*Gerygone igata*	Not Threatened	16
Kingfisher	*Halcyon sancta*	Not Threatened	1
New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not Threatened	2
Welcome Swallow	*Hirundo neoxena*	Not Threatened	8
Southern Black-backed Gull	*Larus dominicanus*	Not Threatened	13
Brown Creeper	*Mohoua novaeseelandiae*	Not Threatened	1
Little Shag	*Phalacrocorax melanoleucos*	Not Threatened	2

Pukeko	*Porphyrio melanotus*	Not Threatened	3
Fantail	*Rhipidura fuliginosa*	Not Threatened	8
Paradise Shelduck	*Tadorna variegata*	Not Threatened	22
Spur-winged plover	*Vanellus miles*	Not Threatened	11
Silver-eye	*Zosterops lateralis*	Not Threatened	10
Sky Lark	*Alauda arvensis*	Exotic	14
Mallard	*Anas platyrhynchos*	Exotic	9
Greylag goose	*Anser anser*	Exotic	1
Little owl	*Athene noctua*	Exotic	1
Canada goose	*Branta canadensis*	Exotic	1
California Quail	*Callipepla californica*	Exotic	3
Goldfinch	*Carduelis carduelis*	Exotic	13
Redpoll	*Carduelis flammea*	Exotic	18
Greenfinch	*Chloris chloris*	Exotic	3
Rock Pigeon	*Columba livia*	Exotic	7
Yellowhammer	*Emberiza citrinella*	Exotic	21
Chaffinch	*Fringilla coelebs*	Exotic	11
Eurasian Coot	*Fulica atra*	Exotic	1
Australian Magpie	*Gymnorhina tibicen*	Exotic	18
Wild Turkey	*Meleagris gallopavo*	Exotic	2
Sparrow	*Passer domesticus*	Exotic	4
Dunnock	*Prunella modularis*	Exotic	24
Starling	*Sturnus vulgaris*	Exotic	12
Blackbird	*Turdus merula*	Exotic	13
Song Thrush	*Turdus philomelos*	Exotic	10

Table 3. Recent visits to the Coronation area by ecologists when observations of rare birds are likely to have been recorded.

Date	Name	Company	Visit duration (hours)	Area visited
2/11/12	Marcia Dale	Ryder Consulting Ltd	Unknown	Coronation project area
27/11/12	Marcia Dale	Ryder Consulting Ltd	Unknown	Coronation project area
15/8/13	John Barkla/Graeme Loh	Department of Conservation	Brief	Part Coronation project area
17/9/13	John Barkla	Department of Conservation	Unknown	Coronation project area
26/9/13	Kelvin Lloyd	Wildlands Consultants Ltd	5	Part Coronation project area
16/5/14	Mike Thorsen	ERA Ecology NZ Ltd	2	Coronation access route
30/6/14	Mike Thorsen, Jesse Bythell	ERA Ecology NZ Ltd	6	Coronation project area
July 2014	Mike Thorsen	ERA Ecology NZ Ltd	3	Coronation plant rescue

				sites
20/8/14	Mike Thorsen	ERA Ecology NZ Ltd	4	Coronation wetlands
27/8/14	Mike Thorsen	ERA Ecology NZ Ltd	4	Coronation wetlands
9/4/15	Mike Thorsen	ERA Ecology NZ Ltd	2	Coronation south drill sites
23/4/15	Mike Thorsen	ERA Ecology NZ Ltd	1	Coronation lizard rockpiles
16/7/15	Mike Thorsen	ERA Ecology NZ Ltd	1	Coronation rescued plant sites
26/8/15	Mike Thorsen	ERA Ecology NZ Ltd	2	Coronation south
26/8/15	Mike Thorsen	ERA Ecology NZ Ltd	2	Upper Coal Creek
16/12/15	Mike Thorsen	ERA Ecology NZ Ltd	7	Coronation North project area
7/1/16	Mike Thorsen	ERA Ecology NZ Ltd	6	Coronation North project area
7/1/16	Mike Thorsen, Richard Ewans	ERA Ecology NZ Ltd	6	Coronation North project area
14/1/16	Mike Thorsen	ERA Ecology NZ Ltd	6	Coronation south
20/1/16	Mike Thorsen	ERA Ecology NZ Ltd	2	Coronation south
21/1/16	Mike Thorsen	ERA Ecology NZ Ltd	6	Coronation North project area
6/4/16	Mike Thorsen	ERA Ecology NZ Ltd	4 (night)	Coal Creek dam
2016	Kelvin Lloyd	Wildlands Consultants Ltd	Unknown	Coronation North project area

Species Status

The status of the 54 species recorded in the literature review was assessed by considering the type of observation and the information contained within the observation together with analysis of the availability of both the species' breeding and feeding habitat in both the Taieri Ridge area and in the PIA. Feeding and breeding habitat was assigned using the information in NZ Birds Online (www.nzbirdsonline.org.nz) and the Author's personal observations of birds in the locality since 2003.

Only one of these observations concerns the breeding status of the species in the area: Paradise Shelduck was recorded with ducklings in the revised Coronation North Project impact area (PIA). A species status as breeding in other information sources appears to be inferred from season

of observation and observer's assessment of availability of suitable breeding habitat. Likewise, there is limited observation of a species feeding in the area, and their use of the area for foraging is inferred from the species presence. The status of bird species in the Taieri Ridge locality varies from probably locally extinct to common. Some species are likely only seasonal visitors to the area. It is apparent that several reports have perpetuated historic records of limited utility.

In comparison with the information provided in the original ecological assessments (ERA 2016a,b) of the five indigenous and six exotic bird species recorded from within the Coronation North PIA, the following additional three indigenous bird species and seven exotic bird species (of the previously unrecorded 26 indigenous and 14 exotic species known from the locality), are now considered to be likely present (at least temporarily) within the PIA:

- The Not Threatened welcome swallow is considered to possibly seasonally use the farm ponds for foraging.
- The Not Threatened silver-eye is considered to probably use shrubland habitats in the area for feeding and may nest in some of these.
- The Not Threatened southern black-backed gull is probably seasonally using cultivated areas and short tussock grassland for foraging.
- The Exotic mallard is likely to occasionally breed and feed in some farm ponds.
- The Exotic goldfinch may be breeding in the area in low numbers and flocks are considered to probably regularly use grassland habitats in the area for foraging.
- The Exotic greenfinch is considered to make infrequent use of grassland habitats by foraging flocks.
- The Exotic yellowhammer may be breeding in the area in low numbers and flocks are considered to probably regularly use grassland habitats for foraging.
- The Exotic Australian magpie is considered to likely be occasionally using open areas, particularly the cultivated area.
- The Exotic starling is likely to be nesting in the area and flocks are likely to be regularly foraging in open areas, particularly in the cultivated area of the PIA.
- Low numbers of the Exotic blackbird is likely to be nesting and feeding in some of the shrubland habitats.

The following three indigenous bird species and one exotic bird species are now considered unlikely to be present in the PIA, even temporarily, but there is a possibility of rare visits.

- The Recovering eastern falcon is considered to be possibly rarely using some of the area for foraging.
- The Declining South Island pied oystercatcher is considered to possibly rarely use some of the area for foraging, particularly in late summer when cultivation is occurring. The more open grassland areas on the ridge slope leading to Highlay Hill and on the lower slopes of Sister Peaks are also potential feeding areas.
- The Not Threatened white-faced heron is possibly a rare visitor to the PIA, where they may forage in freshly-cultivated land and along the margins of farm ponds.
- The Exotic Canada goose is possibly a rare visitor to the area.

It is probable that these species were not present in the PIA at the time of surveys. Contrary to Wildlands (2016), it is possible to survey flora and birds concurrently in dryland Central Otago, and this approach has been used by the Department of Conservation in Tenure Review surveys for several years. The observer in these surveys has extensive experience with birds in New Zealand and many places overseas dating from 1990.

The revised bird fauna of the PIA and the area of habitat potentially occupied is summarised in Table 5. It is important to note that most of the bird species in Table 5 would be using only part of the available habitat, or using it temporarily, and only one indigenous bird species (swamp harrier) and four exotic bird species (sky lark, yellowhammer, chaffinch, dunnock) are likely to be using the bulk of the available habitat.

Table 4. Current status of bird species observed within the Taieri Ridge locality and within the Coronation North PIA.

Common Name	Scientific Name	Threat Status	Number of observations	Breeding habitat present in locality?	Breeding habitat present in PIA?	Feeding habitat present in locality?	Feeding habitat present in PIA?	Likely current status of species in locality	Likely current status of species in PIA	Justification for assessment
Grey duck	*Anas superciliosa*	Nationally Critical	2	Yes	Yes	Yes	Yes	Extinct as full species?	Likely not present	Records likely to be of hybrids with mallard
Black-billed gull	*Larus bulleri*	Nationally Critical	2	No	No	Yes	Yes	Rare visitor?	Likely not present	1 recent (1999-2004) sighting of 1 bird in Spring. Species known to roam widely outside breeding season and is attracted to ploughing
Black-fronted tern	*Chlidonias albostriatus*	Nationally Endangered	1	No	No	Yes	Yes	Rare foraging	Likely not present	1 historic (1986) 'possibly present' record (Whitaker 1986)
Banded dotterel	*Charadrius bicinctus*	Nationally Vulnerable	1	Yes	Yes	Yes	Yes	No longer present?	Likely not present	1 historic (1986) record where noted as probably breeding at Macraes ponds and foraging on improved pasture near Deepdell Creek. Appears to have disappeared from locality. Still present on Rock & Pillar Range (Pers. obs.). Conspicuous when breeding, but can be difficult to detect outside of breeding season. Likely to have seasonal movements in this area and vacating in Autumn and Winter (Robertson et al. 2007).
NZ dotterel	*Charadrius obscurus*	Nationally Vulnerable	1	No	No	Yes	Yes	Rare visitor	Likely not present	1 sighting in 2000 at Frasers West.
Crested grebe	*Podiceps cristatus*	Nationally Vulnerable	1	No	No	Limited	No	Rare visitor	Not present	1 sighting at Lone Pine in 1996
Red-billed Gull	*Larus novaehollandiae*	Nationally Vulnerable	1	No	No	Yes	Yes	Rare visitor?	Likely not present	1 historic (pre-1997) record, from an unknown site within Macraes E.D. (Bibby 1997). Species known to roam widely and inhabit cultivated areas and pursue artificial foods in urban areas.
Australasian Pipit	*Anthus novaeseelandiae*	Declining	17	Yes	Yes	Yes	Yes	Breeding	Breeding & feeding	Regularly recorded from a variety of habitats within locality, including pastoral and reported from mine tailings. Most commonly observed in grazed short-tussock grassland. Can be confused with the more common sky lark.

Common Name	Scientific Name	Threat Status	Number of observations	Breeding habitat present in locality?	Breeding habitat present in PIA?	Feeding habitat present in locality?	Feeding habitat present in PIA?	Likely current status of species in locality	Likely current status of species in PIA	Justification for assessment
South Island Oystercatcher	*Haematopus finschi*	Declining	11	Yes	Limited	Yes	Yes	Breeding	Possible rare seasonal feeding?	Conspicuous when present, and even more so in breeding season. Requires nesting sites with long sight-lines and low disturbance and there are few sites with these characters in the PIA. Likely to have seasonal movements in this area and vacating in Autumn and Winter (Robertson et al. 2007). Not recorded during23 visits by eight ecologists over 65+ hours. Nearest record is of 1 individual 2.8km away in Camp Creek in 2010.
Australasian Pied Stilt	*Himantopus himantopus*	Declining	2	No	No	Limited	No	Occasional visitor?	Likely not present	Both records of this species are of up to 3 individuals from water habitats. In the vicinity of the PIA this habitat is restricted to small farm ponds which are unlikely to be attractive to this species.
Black shag	*Phalacrocorax carbo*	Naturally Uncommon	3	No	Yes	No	No	Rare breeding?	Likely not present	Reported by Whitaker (1986) as requiring larger order streams to forage and therefore the seasonally-flowing streams in the vicinity of the PIA are unlikely to be attractive to this species.
Marsh Crake	*Porzana pusilla*	Relict	1	Limited	No	Limited	No	Rare visitor	Not present	1 sighting in 1995
Eastern falcon	*Falco novaeseelandiae*	Recovering	13	Yes	Limited	Yes	Yes	Small breeding population	Possible rare feeding	Recorded from several sites nearby, usually as single birds. Not believed to be nesting in PIA as conspicuous when breeding and fiercely territorial and potential nesting habitat limited to Coal Creek dam area. Species not observed in PIA. Ranges widely when foraging and therefore likely to be making occasional use of the PIA for foraging. Not recorded during23 visits by eight ecologists over 65+ hours. Only definite recent records from near PIA from 2.8km away in Camp Creek (1 bird) in 2010 and 7.5km away in Island Block (1-2 birds) in 2016. Most records of species in locality from Redbank/Nenthorn area
Tomtit	*Petroica macrocephala*	Locally Notable	2	Limited	No	Limited	No	Local breeding	Likely not present	1 historic (1986) and 1 recent (2015) record of 1 immature individual 8.5km away in regenerating forest in Cranky Jims shrubland covenant
Grey Teal	*Anas gracilis*	Not Threatened	4	Limited	No	Yes	No	Rare breeding	Likely not present	Records of this species are of up to 2 individuals from water habitats. In the vicinity of the PIA this habitat is restricted to small farm ponds which are unlikely to be attractive to this species as they lack dense bankside vegetation or nearby tree cavities.

Common Name	Scientific Name	Threat Status	Number of observations	Breeding habitat present in locality?	Breeding habitat present in PIA?	Feeding habitat present in locality?	Feeding habitat present in PIA?	Likely current status of species in locality	Likely current status of species in PIA	Justification for assessment
Australasian shoveler	*Anas rhynchotis*	Not Threatened	2	Limited	Limited	Limited	Limited	Rare breeding	Likely not present	Both records of this species are of up to 4 individuals from water habitats. In the vicinity of the PIA this habitat is restricted to small farm ponds which are unlikely to be attractive to this species.
Bellbird	*Anthornis melanura*	Not Threatened	4	Limited	No	Limited	No	Local breeding	Likely not present	Species only known from regenerating forest in this area and this habitat is not present within the vicinity of the PIA
New Zealand Scaup	*Aythya novaeseelandiae*	Not Threatened	2	No	No	Limited	No	Visitor	Likely not present	Both records from Macraes Ponds which provide open-water habitat not available in the vicinity of the PIA
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	1	Limited	Limited	Limited	Limited	Rare breeding	Likely not present	1 individual seen in exotic habit in 1999-2004. Requires tall trees or forest, neither present in the vicinity of PIA.
Swamp Harrier	*Circus approximans*	Not Threatened	21	Yes	Yes	Yes	Yes	Breeding	Foraging, may breed in low numbers	Reported by all observers in area. Likely to be foraging over all areas. Breeding sites are rarely seen in this area, but are well hidden.
Black swan	*Cygnus atratus*	Not Threatened	2	Limited	No	Limited	No	Occasional visitor?	Likely not present	Both records of this species are of up to 2 individuals from water habitats. In the vicinity of the PIA this habitat is restricted to small farm ponds which are unlikely to be attractive to this species.
White-faced heron	*Egretta novaehollandiae*	Not Threatened	4	Limited	No	Limited	Limited	Rare breeding	Rare visitor?	Records of this species are from farmland and wetland habitats. Farmland is well represented in the vicinity of the PIA. This species is conspicuous when present.
Grey warbler	*Gerygone igata*	Not Threatened	16	Limited	Limited	Limited	Limited	Breeding	Breeding & feeding	Frequently reported by observers in the area. Likely to be inhabiting gardens, exotic forest and small shrubland remnants throughout.
Kingfisher	*Halcyon sancta*	Not Threatened	1	Yes	Yes	Yes	Limited	Rare visitor?	Likely not present	Single historic (1986) record of 1 individual. Despite presence of apparently suitable habitat in this locality it is rare in Central Otago (Robertson et al. 2007), possibly because of climate.
New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not Threatened	2	No	No	Limited	No	Garden visitor?	Likely not present	Both records are of single birds in farmland habitat in winter. Recorded as visiting gardens in area by Whitaker (1996).
Welcome Swallow	*Hirundo neoxena*	Not Threatened	8	Yes	Yes	Yes	Yes	Breeding	Occasional seasonal foraging?	Conspicuous when present. No nests found in PIA and feeding habitat limited to small farm ponds in the vicinity.

Common Name	Scientific Name	Threat Status	Number of observations	Breeding habitat present in locality?	Breeding habitat present in PIA?	Feeding habitat present in locality?	Feeding habitat present in PIA?	Likely current status of species in locality	Likely current status of species in PIA	Justification for assessment
Southern Black-backed Gull	*Larus dominicanus*	Not Threatened	13	Limited	Limited	Yes	Yes	Breeding	Occasional seasonal foraging	Species known to roam widely and inhabit cultivated areas and pursue artificial foods in urban areas. Records in this locality are primarily from farmland in Spring.
Brown Creeper	*Mohoua novaeseelandiae*	Not Threatened	1	No	No	Yes	No	Rare visitor?	Not present	Only record is now dated (pre 1997) and likely to be from outside the area under consideration
Little Shag	*Phalacrocorax melanoleucos*	Not Threatened	2	Limited	No	Yes	No	Rare breeding?	Likely not present	Both records of this species are of up to 2 individuals from water habitats. In the vicinity of the PIA this habitat is restricted to small farm ponds which are unlikely to be attractive to this species.
Pukeko	*Porphyrio melanotus*	Not Threatened	3	Limited	Limited	Yes	Yes	Local breeding	Likely not present	Records are of up to 2 individuals in farmland and wetland habitats, including Macraes Ponds. Probably restricted by the lack of densely vegetated wet areas in this locality. This species is rare in Central Otago (Robertson et al. 2007).
Fantail	*Rhipidura fuliginosa*	Not Threatened	8	Limited	Limited	Limited	Limited	Rare breeding	Likely not present	Species usually conspicuous when present.
Paradise Shelduck	*Tadorna variegata*	Not Threatened	22	Yes	Yes	Yes	Yes	Breeding	Breeding & feeding	Conspicuous at all times, particularly when breeding
Spur-winged plover	*Vanellus miles*	Not Threatened	11	Yes	Yes	Yes	Yes	Breeding	Breeding & feeding	Conspicuous at all times, particularly when breeding
Silver-eye	*Zosterops lateralis*	Not Threatened	10	Limited	Limited	Limited	Limited	Local breeding	Local breeding and feeding	Seasonal movements of this species in the area?
Sky Lark	*Alauda arvensis*	Exotic	14	Yes	Yes	Yes	Yes	Breeding	Breeding & feeding	Common throughout area
Mallard	*Anas platyrhynchos*	Exotic	9	Yes	Yes	Yes	Yes	Breeding	Limited breeding, occasional foraging	Common on ponds in area
Greylag goose	*Anser anser*	Exotic	1	Yes	No	Yes	No	Semi wild population	Not present	1 historic (1986) record.
Little owl	*Athene noctua*	Exotic	1	Yes	Yes	Yes	Yes	Rare breeding	Possibly present?	Possibly still present in area but not detected in the daytime surveys? Presence requires confirmation as species rarely recorded in locality (Robertson et al. 2007).
Canada goose	*Branta canadensis*	Exotic	1	Yes	Yes	Yes	Yes	Visitor	Rare visitor?	1 historic (pre-1987) record. While increasingly a common pest in high country farmland, this species is still locally distributed in Central Otago (Robertson et al. 2007. Pers. Obs.)

Common Name	Scientific Name	Threat Status	Number of observations	Breeding habitat present in locality?	Breeding habitat present in PIA?	Feeding habitat present in locality?	Feeding habitat present in PIA?	Likely current status of species in locality	Likely current status of species in PIA	Justification for assessment
California Quail	*Callipepla californica*	Exotic	3	Yes	Yes	Yes	Yes	Visitor? Rare breeder?	Likely not present	Very few records for this locality, and those not consistent through year (Robertson et al. 2007) so likely a visitor to the area.
Goldfinch	*Carduelis carduelis*	Exotic	13	Yes	Limited	Yes	Yes	Breeding	Limited breeding, regular use by foraging flocks	Frequently seen in locality
Redpoll	*Carduelis flammea*	Exotic	18	Yes	Limited	Yes	Yes	Breeding	Limited breeding, regular use by foraging flocks	Frequently seen in locality
Greenfinch	*Chloris chloris*	Exotic	3	Yes	Limited	Yes	Yes	Breeding	Infrequent use by foraging flocks	Infrequently seen and usage of PIA likely to also be infrequent.
Rock Pigeon	*Columba livia*	Exotic	7	Limited	Limited	Limited	Limited	Local breeding	Likely not present	Conspicuous when present. Numbers in area appear limited by farming practices and harsh winter climate
Yellowhammer	*Emberiza citrinella*	Exotic	21	Yes	Limited	Yes	Yes	Breeding	Limited breeding, regular use by foraging flocks	One of the commonest species in the locality.
Chaffinch	*Fringilla coelebs*	Exotic	11	Yes	Limited	Yes	Yes	Breeding	Limited breeding, regular use by foraging birds, sometimes in flocks	
Eurasian Coot	*Fulica atra*	Exotic	1	No	No	Limited	Limited	Visitor	Likely not present	1 bird seen in 2012 at Macraes Ponds. Farm ponds in vicinity of PIA not likely to be attractive to tis species.
Australian Magpie	*Gymnorhina tibicen*	Exotic	18	Yes	Limited	Yes	Yes	Breeding	Likely occasionally feeding	Common throughout locality
Wild Turkey	*Meleagris gallopavo*	Exotic	2	Yes	Yes	Yes	Yes	Rare breeding	Likely not present	Conspicuous when present, though retiring. Field sign conspicuous at roost sites
Sparrow	*Passer domesticus*	Exotic	4	Limited	Limited	Yes	Yes	Breeding	Breeding & feeding	Numbers in locality very low compared with warmer areas
Dunnock	*Prunella modularis*	Exotic	24	Yes	Limited	Yes	Yes	Breeding	Breeding & feeding	One of most common species in locality
Starling	*Sturnus vulgaris*	Exotic	12	Yes	Yes	Yes	Yes	Breeding	Breeding & feeding	Numerically one of the most common species in the locality
Blackbird	*Turdus merula*	Exotic	13	Limited	Limited	Limited	Limited	Local breeding	Local breeding and feeding	Present in most shrubland habitats in the locality
Song Thrush	*Turdus philomelos*	Exotic	10	Limited	Limited	Limited	Limited	Local breeding	Local breeding and feeding	Present in many of the shrubland habitats in the locality

Table 5. Revised bird fauna of the PIA and quantity of species' potential habitat. Species in **bold** text are likely to be using most of the available habitat listed and could be considered common at the site.

Common Name	Scientific Name	Threat Status	Likely current status of species in PIA	Quantity of available habitat within PIA
Eastern falcon	*Falco novaeseelandiae*	Recovering	Possible rare feeding	429.2ha (3.9ha basalt contact flush wetlands, 8.7ha bluff, 1.5ha ephemeral wetlands, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8.6ha pine, 8ha riparian herbfield & sedgeland, 0.2ha seepage, 87.2ha short tussock grassland, 9.2ha shrubland)
Australasian Pipit	*Anthus novaeseelandiae*	Declining	Breeding & feeding	303.7ha (216.5ha narrow-leaved tussock grassland, 87.2ha short tussock grassland)
South Island Oystercatcher	*Haematopus finschi*	Declining	Possible rare seasonal feeding?	370.6ha (65.2ha cultivated, 1.5ha ephemeral wetlands, 216.5ha narrow-leaved tussock grassland, 0.2ha seepage, 87.2ha short tussock grassland)
Swamp Harrier	*Circus approximans*	Not Threatened	Foraging, may breed in low numbers	494.4ha (3.9ha basalt contact flush wetlands, 8.7ha bluff, 65.2ha cultivated, 1.5ha ephemeral wetlands, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8.6ha pine, 8ha riparian herbfield & sedgeland, 0.2ha seepage, 87.2ha short tussock grassland, 9.2ha shrubland)
White-faced heron	*Egretta novaehollandiae*	Not Threatened	Rare visitor?	Farm pond habitats (not mapped)
Grey warbler	*Gerygone igata*	Not Threatened	Breeding & feeding	102.8ha (8.7ha bluff, 85.5ha gully slope mosaic, 8.6ha pine)
Welcome Swallow	*Hirundo neoxena*	Not Threatened	Occasional seasonal foraging?	Farm pond habitats (not mapped)
Southern Black-backed Gull	*Larus dominicanus*	Not Threatened	Occasional seasonal foraging	152.4ha (65.2ha cultivated, 87.2ha short tussock grassland)
Paradise Shelduck	*Tadorna variegata*	Not Threatened	Breeding & feeding	411.5ha (3.9ha basalt contact flush wetlands, 8.7ha bluff, 1.5ha ephemeral wetlands, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8ha riparian herbfield & sedgeland, 0.2ha seepage, 87.2ha short tussock grassland)
Spur-winged plover	*Vanellus miles*	Not Threatened	Breeding & feeding	152.4ha (65.2ha cultivated, 87.2ha short tussock grassland)
Silver-eye	*Zosterops lateralis*	Not Threatened	Local breeding and feeding	112ha (8.7ha bluff, 85.5ha gully slope mosaic, 8.6ha pine, 9.2ha shrubland)
Sky Lark	*Alauda arvensis*	Exotic	Breeding & feeding	469.1ha (3.9ha basalt contact flush wetlands, 65.2ha cultivated, 1.5ha ephemeral wetlands, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 0.2ha seepage, 87.2ha short tussock grassland, 9.2ha shrubland)
Mallard	*Anas platyrhynchos*	Exotic	Limited breeding, occasional foraging	Farm pond habitats (not mapped)
Canada goose	*Branta canadensis*	Exotic	Rare visitor?	158ha (3.9ha basalt contact flush wetlands, 65.2ha cultivated, 1.5ha ephemeral wetlands, 0.2ha seepage, 87.2ha short tussock grassland)

Goldfinch	*Carduelis carduelis*	Exotic	Limited breeding, regular use by foraging flocks	480.2ha (65.2ha cultivated, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8.6ha pine, 8ha riparian herbfield & sedgeland, 87.2ha short tussock grassland, 9.2ha shrubland)
Redpoll	*Carduelis flammea*	Exotic	Limited breeding, regular use by foraging flocks	480.2ha (65.2ha cultivated, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8.6ha pine, 8ha riparian herbfield & sedgeland, 87.2ha short tussock grassland, 9.2ha shrubland)
Greenfinch	*Chloris chloris*	Exotic	Infrequent use by foraging flocks	480.2ha (65.2ha cultivated, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8.6ha pine, 8ha riparian herbfield & sedgeland, 87.2ha short tussock grassland, 9.2ha shrubland)
Yellowhammer	*Emberiza citrinella*	Exotic	Limited breeding, regular use by foraging flocks	480.2ha (65.2ha cultivated, 85.5ha gully slope mosaic, 216.5ha narrow-leaved tussock grassland, 8.6ha pine, 8ha riparian herbfield & sedgeland, 87.2ha short tussock grassland, 9.2ha shrubland)
Chaffinch	*Fringilla coelebs*	Exotic	Limited breeding, regular use by foraging birds, sometimes in flocks	26.5ha (8.7ha bluff, 8.6ha pine, 9.2ha shrubland)
Australian Magpie	*Gymnorhina tibicen*	Exotic	Likely occasionally feeding	152.4ha (65.2ha cultivated, 87.2ha short tussock grassland)
Sparrow	*Passer domesticus*	Exotic	Breeding & feeding	83.1ha (8.7ha bluff, 65.2ha cultivated, 9.2ha shrubland)
Dunnock	*Prunella modularis*	Exotic	Breeding & feeding	112ha (8.7ha bluff, 85.5ha gully slope mosaic, 8.6ha pine, 9.2ha shrubland)
Starling	*Sturnus vulgaris*	Exotic	Breeding & feeding	152.4ha (65.2ha cultivated, 87.2ha short tussock grassland)
Blackbird	*Turdus merula*	Exotic	Local breeding and feeding	112ha (8.7ha bluff, 85.5ha gully slope mosaic, 8.6ha pine, 9.2ha shrubland)
Song Thrush	*Turdus philomelos*	Exotic	Local breeding and feeding	102.8ha (8.7ha bluff, 85.5ha gully slope mosaic, 8.6ha pine)

Effect of project on revised avifauna features.

Inclusion of these species changes the original ecological assessment (based on the Project as described in the AEE) to the following:

Ecological function

Of the eleven bird species recorded from within the PIA, six are exotic species. A further three indigenous species and seven exotic species are likely to be foraging within habitats within the PIA in low numbers and usually in a temporary or seasonal fashion. The Not Threatened silver-eye and the Exotic mallard, goldfinch, yellowhammer, starling and blackbird may be breeding in the area. The Recovering eastern falcon and Declining South Island pied oystercatcher may rarely forage within the PIA. There is a possibility that the site is visited rarely by Canada geese.

Four of these species: skylark, chaffinch, redpoll, house sparrow, goldfinch, mallard, greenfinch, yellowhammer, white-faced heron, welcome swallow, South Island pied oystercatcher, eastern falcon and Canada goose are considered of little positive ecological significance, being either insectivores or grass-seed eaters, predominantly occurring in exotic habitats, and/or in very low numbers, and several of these species are likely to be competing with native species. If numbers of Canada goose increase this could result in heavily browsed pasture and pond margins. The exotic song thrush and blackbird have some positive ecological significance due to their role in dispersing fruit of native shrubs. The exotic Australian magpie and starling may be having some effect on indigenous invertebrates, and starlings are also known to spread seeds of both native and weed plants.

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

Species diversity

Dryland Central Otago is depauperate in indigenous bird species due to its aridity and lack of forest and wetland habitats (Wilson et al. 2014). The five indigenous and six exotic bird species observed within the PIA during site inventory is the normal diversity expected for this site and similar to the diversity sighted in the adjacent Coronation Project (Ryder 2013).

Threatened, At Risk, or rare bird species

One of the five indigenous bird species known to occur within the PIA is classified as At Risk, the Declining pipit, and 2 of the indigenous bird species that are possibly present are also classified as At Risk, the Declining South Island pied oystercatcher and the Recovering eastern form of the New Zealand falcon.

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

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

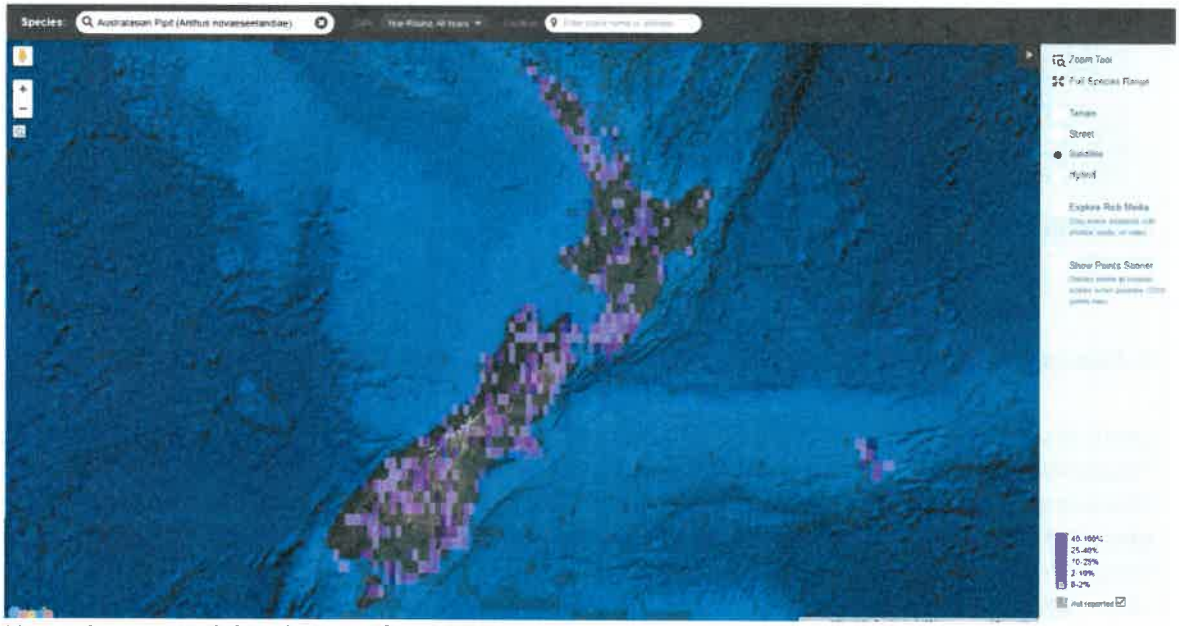

Figure 6a. National distribution of pipit and density of sightings, from: http://ebird.org/ebird/newzealand/map/auspip1?neg=true&env.minX=156.24755859375&env.minY=-47.82790816919327&env.maxX=-166.83837890625&env.maxY=-33.99802726234875&zh=true&gp=false&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2016 accessed 25 April 2016.

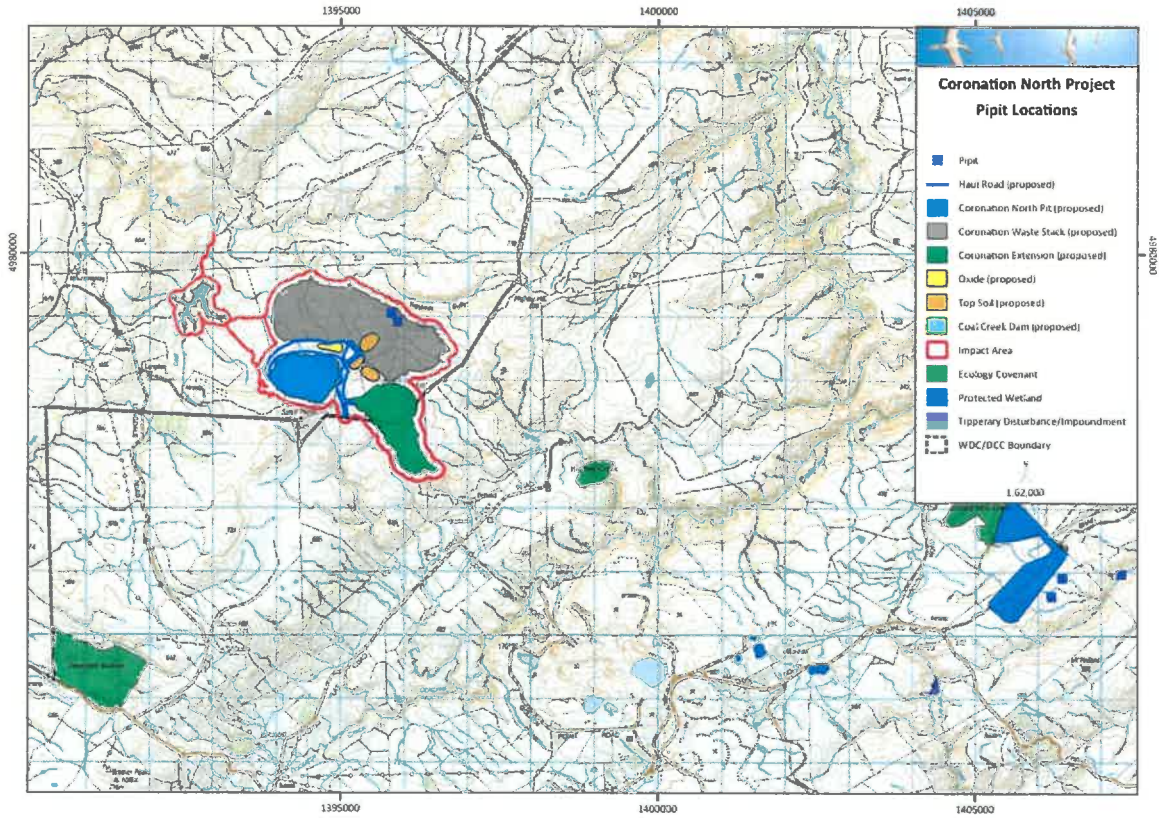

Figure 6b. Locations where pipit were recorded in the PIA. Note, records in Deepdell Covenant not shown.

2. *Haematopus finschi* Martins, 1897 (South Island pied oystercatcher, Haematopodidae).

South island pied oystercatcher are currently classified as Declining on the basis of the estimated population size being 20 000–100 000 mature individuals with a predicted decline 10–50% (Robertson et al. 2012). The reasons for this classification appears to be mainly based on an observed reduced distribution in Robertson et al. (2007), though New Zealand oystercatchers are known to experience reduced breeding success due to both disturbance and exotic predators (Sagar et al. 2002). South island pied oystercatchers are distributed throughout much of the eastern South Island and in place along the West Coast and were recorded in 39% of the 10km^2 grids examined during the Ornithological Societies bird mapping project (Robertson et al. 2007). Within the Macraes area South Island pied oystercatcher are sparsely distributed and apparently more common in the vicinity of Redbank and Nenthorn, possibly due to a long-running predator control programme there. South Island pied oystercatcher exodus the area between mid-December to mid-January, when they move to coastal areas (Robertson et al. 2007). No South Island pied oystercatcher have been recorded from the immediate vicinity of the PIA despite 23 visits totalling over 65 hours by eight different ecologists since 2012. However, the possibility that South Island pied oystercatcher use some of the PIA very rarely for foraging cannot be excluded.

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

Eastern falcons are currently classified as Recovering with the qualifiers Data Poor and Increasing on the basis of its ongoing increase and total population size is between 1000 and 5000 mature individuals or its area of occupancy is ≤100 ha (1 km^2) (Townsend et al. 2008, Robertson et al. 2012). The reasons for the increase and improvement in the conservation status of this species are unknown, and many of the reasons proposed by Bell and Lawrence (2009) do not appear to operate over sufficient scale. Eastern falcon are distributed throughout open areas of the eastern South Island (Fox 1988, Robertson et al. 2007, Bell and Lawrence 2009). Within the Macraes area eastern falcon are sparsely distributed and apparently more common in the vicinity of Redbank and Nenthorn. No eastern falcon have been recorded from the immediate vicinity of the PIA despite 23 visits totalling over 65 hours by eight different ecologists since 2012. However, the possibility that eastern falcon use some of the PIA very rarely for foraging cannot be excluded.

Species of biogeographic interest

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

Genetically or morphologically distinct forms

The population of falcon in the Macraes areas are representatives of an eastern form which differ from other forms of New Zealand falcon in its larger size, lighter colouration and distribution in the east of the South Island (Fox 1988).

Importance overall of avifauna

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

1. The presence of one At Risk species (and possible presence of a further two species);
2. role in ecosystem function;
3. low indigenous species diversity and abundance.

Impact on Avifauna Ecological Features

Eleven bird species were recorded from within the PIA, and a further ten species are likely to be present, and an additional four species are possibly present, ten of which are indigenous. The ecological importance of the birds within the PIA is categorised as **moderate-low** on the basis of the presence of one At Risk species (and possible presence of a further two species), the avifauna's role in ecosystem function and the low indigenous species diversity and abundance within the PIA.

Effect of construction of waste rock stack

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

Effect of removing rock material when excavating pit

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

Effect of sediment run-off
Nil effect as none of the bird species occur in watercourses in the PIA.

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

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

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

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

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

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

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

Changed hydrological regimes
Nil effect as no species occurs in this zone.

Construction of dam embankment
Major effect on bird species that would use this zone through destroying habitat.

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

At Risk black shag *Phalacrocorax carbo* would be attracted to this pond. The habitat created by pond run-down is likely to be utilised by many of these species, particularly the waterfowl.

The result of these project effects will be the displacement of most bird individuals from within the PIA, with a temporary increase in competition with neighbouring resident birds leading to the mortality of some individuals. Some adaptable species are likely to persist in the 100m buffer area of the PIA. Longer term there is likely to be avoidance of the area by harrier hawks (and falcon and South Island pied oystercatcher, if present) and there is likely to be attraction of waterfowl species to the pond site. The result of this is some disruption of local bird populations, most of which are common on a national scale. The loss of some habitat of the At Risk pipit, falcon (if present) and South Island pied oystercatcher (if present) is of minor importance on a national scale.

Therefore, the impact of this project is assessed as having an **adverse and beneficial, direct, permanent, irreversible, local impact** on these species.
The magnitude of the project's impact on these species at a local scale is assessed as **moderate**, and at a national level as **low**.
The overall degree of the project's effect on these species is **low**.
The confidence of this assessment is **moderate-low**, as the distribution and density of birds within the wider Macraes area is largely unknown.

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5. **Invertebrate Values and Effects**

The ERA does not address habitats or species occurrences for indigenous Invertebrates. Earlier work on the invertebrate fauna of Macraes Ecological District1 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.

The high diversity of plant species documented 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.

For a comprehensive assessment of actual or potential effects on invertebrates surveys would need to be completed both in spring and summer. Given such survey work Is now unlikely to be feasible then an alternative is to determine the appropriate mitigation for the impact on invertebrates, conservatively assuming the impact maybe high.

Please prepare an assessment of actual or potential effects on invertebrate fauna; and, please also determine the appropriate level mitigation needed for the loss of indigenous invertebrates, which recognises and takes into account any uncertainty due to a lack of information.

Assessing the invertebrate ecological features within any site is difficult, primarily because:

1) Information on invertebrate communities anywhere nationally is scarce and often limited in the taxonomic groups that are included.
2) The distribution of many invertebrate species is poorly known, and a number are only known from the original collection or a few other sites (see species distributions in McGuiness 2001).
3) The habitat requirements and food plants of many invertebrate species are poorly known. Most invertebrate taxonomic groups contain members that are 'generalistic' as well as 'specialists' in regards to the habitats that they occupy or the plants or other materials that they feed on. Species can also be polyphagous (feeding on many species), and this polyphagy can extend to also feeding on exotic plants. For example, the caterpillar of the Nationally Critical Central Otago moth *Australothis volatilis* is known to feed on both the native fuzzweed *Vittadinia australis* and the exotic fuzzweed *Vittadinia gracilis* (which is now much more common than the native species in Central Otago), though the relative suitability of the two hosts is not known (Matthews & Patrick 1998).
4) There are few experts with the skills and knowledge that can investigate invertebrate communities at a site.
5) The taxonomy of most invertebrate groups is usually incomplete in that a number of 'undescribed' species are postulated and species identification requires expert knowledge that is restricted to very few people, some of whom are based overseas. For example, within the conservation assessment of Coleoptera (beetles) (Leschen et al. 2012), one of the best known of New Zealand's invertebrate groups, of the 446 entities assessed, 51 (11%) are undescribed.
6) Identification of invertebrates requires expert skills that are not widely available, usually requires minute inspection of morphological features and dissected genitalia and therefore nearly all surveys identify specimens down to 'lowest recognisable taxonomic unit' which in many cases is to Order or Family level only.

7) Assessments of the conservation status of invertebrate species are based on often incomplete and patchy information. This is reflected in the number of invertebrate species assessed as Data Deficient or assigned the qualifier Data Poor in conservation status reviews (see Townsend et al. 2008 for definitions of these categories). In Leschen et al.'s conservation status review of Coleoptera, 52 entities were assessed as being Data Poor, and a further 28 entities were qualified as Data Poor, which represents 17% of the entities assessed.

While these issues are also considerations in flora and reptile surveys, it is particularly prevalent in the invertebrate fauna. It is for these reasons that assessments of a site's invertebrate fauna are often restricted to one or few taxonomic groups, most frequently Lepidoptera (moths), Coleoptera or Orthoptera (grasshoppers and weta) (e.g. Patrick et al. 1992), and an assumption made on the importance of the site for other invertebrate groups based on the observed importance to the invertebrate group(s) under investigation. This assumption of importance of a site to one invertebrate group being important to other invertebrate groups appears to be untested, though it is likely to be correct in a broad context, but dependent on the geographic, geological, biotic and abiotic characters of the site.

To assess the importance of the Coronation North project to invertebrates a review of the literature was conducted. This involved online searches for the phrase "Macraes Invertebrate/Insect" in Google (www.google.co.nz), Google Scholar (https://scholar.google.co.nz/), ResearchGate (www.researchgate.net) and Bugz (www.bugz.org.nz). Some of the references mentioned in these searches were not obtainable within the timeframe of this RFI. A large body of information is contained within the Department of Conservation's Conservation Resources Reports for Crown pastoral lease properties undertaking Tenure Review in Otago. But, as the invertebrate component of these reports usually involves survey over a much greater altitudinal range, some of the surveys do not extend down to elevations comparable to Macraes, they are often in very different landform and climatic areas and much of the information concerns species found at higher elevations than present at Macraes, these reports have not been considered further.

Of the references obtained, the following are particularly relevant, and are discussed further in respect to the Coronation North project.

- Terrestrial fauna of the Deepdell Catchment, North Otago (Whitaker 1986).
- Invertebrates of Macraes Ecological District (Patrick 1997).
- Lepidoptera of small-leaved divaricating *Olearia* in New Zealand and their conservation priority (Patrick 2000).
- The conservation requirements of New Zealand's nationally threatened invertebrates (McGuiness 2001).
- Conservation of New Zealand's tussock grassland moth fauna (Patrick 2004).

Whitaker (1986) surveyed the invertebrate fauna of the Deepdell area, which is c. 2km to the east of the Coronation North project. At the time of this survey, 20% of the vegetation was categorised as improved pasture, 59% as rough pasture and very little was categorised as natural vegetation (4.8% shrubland, 4.6% bluff vegetation, 1.3% narrow-leaved tussock grassland). Whitaker (1986) recorded 66 invertebrate species representing 19 orders from this area, none of which were considered rare. He emphasises the value of the more natural areas. After updating the names of species he records to current taxonomy, none of them

are currently considered of conservation significance. This may reflect the primarily pastoral setting of his study area.

Patrick (1997) provides a description of the invertebrates recorded at nine sites within the Macraes E.D. between 1984 and 1994. In total he recorded 367 mostly indigenous species in 12 orders, including some he considers as nationally or locally rare species. No species were found to be endemic to the Macraes E.D. The location of his Taieri Ridge survey site is not recorded, but this is likely to be the closest, and most similar, site to Coronation North which also is on the Taieri Ridge. He records 56 species from this location. One lepidopteran species, *Asterivora antigrapha* was only found at this site in his study and this is the only known southern New Zealand record for this species. It feeds on plants in the Asteraceae and is also known from the Wellington district (Dugdale 1979). Nationally it is classified as Not Threatened (Stringer et al. 2012), but the population on Taieri Ridge should be considered as locally rare and notable for biogeographic reasons. Patrick (1997) records other rare invertebrate species at his other study sites, some of which are now considered At Risk or Threatened, and there is a possibility that some of these species may occur within the Coronation North PIA if suitable habitat is present (though the presence of suitable habitat does not mean that the species is likely to be present). None of the host plants listed in Patrick (1997) which could be considered rare (such as the Naturally Uncommon *Gingidia grisea*) are present in the Coronation North PIA. Patrick (1997) emphasised the importance of wetlands, tors and rock faces, shrublands, native grasslands and streams as invertebrate habitats. All these habitats are present to various extents within the Coronation North PIA. Patrick (1997) also lists the tor areas, grasslands and shrublands of the Taieri Ridge as a key area for the protection of a representative insect fauna.

Patrick (2000) notes that New Zealand's eight species of endemic small-leaved divaricating tree daisies in the genus *Olearia* are host to 41 species of Lepidoptera, 17 of which are confined to this host. Of the host *Olearia* species, *O. bullata* is present at multiple sites within the Coronation North PIA, both *O. odorata* and a single tree of *O. fimbriata* are known within 500m of the PIA, and *O. lineata* is known to occur in the Cranky Jims area c. 10km to the east. *O. bullata* is recorded as hosting 10 lepidopteran species, *O. odorata* as hosting 27, *O. fimbriata* as hosting 15, and *O. lineata* as hosting 5 species. As the latter three of these species do not occur within the PIA they are excluded from further consideration. Of the species utilising *O. bullata* as a host, the noctuids *Graphania tetrachroa* is classified as Nationally Vulnerable and *Meterana exquisita* as Relict (Stringer et al. 2012). *M. exquisita* is known from between Auckland and Invercargill, with the bulk of the population in one region of Central Otago, and is not recorded from east Otago (Patrick 2000). It is a specialist, only feeding on *Olearia* species and has been recorded on at least ten species of *Olearia*. *G. tetrachroa* is distributed as fragmented small populations between the central North Island to Southland, as abundant in western Otago and eastern Fiordland, but is apparently absent from eastern Otago (Patrick 2000). It is recorded as a specialist on 5 species of *Olearia* by Patrick (2000).

McGuinness (2001) details the species then considered as possibly Nationally Threatened. Of the species he lists, 15 have distributions indicating they may occur within the Macraes E.D. (Table 6). Six of these 15 are now no longer considered as of national conservation significance (though they may still be of local conservation significance). The distribution of none of the remaining nine species is known to include the Coronation area or nearby, but the possibility exists that they could be present.

Patrick (2004) emphasises the rich moth fauna of tussock grasslands, particularly grasslands that are taller, in moist situations and with few exotic weeds. Species with specialised larvae, flightless females, or that are large-bodied are considered more prone to extinction. The 216.5ha of narrow-leaved tussock grassland, 87.2ha of short tussock grassland and 85.5ha of gully mosaic vegetation within the Coronation North PIA fit within

consideration of tussock grasslands as discussed in Patrick (2004). However, the grasslands within the Coronation PIA are variable in both stature and prevalence of exotic weeds due to past pastoral practices. The majority of narrow-leaved tussock grassland occurs in dry situations along spurs and north-facing gully slopes, though moisture content probably increases downslope and in south-facing areas. The copper tussock *Chionochloa rubra* subsp. *cuprea* on gully bottoms, the gully mosaic vegetation, and much of the short tussock grassland would be considered moist grasslands.

In summary, assessment of a site's importance to invertebrate species and communities is limited by many technical difficulties and scarcity of information. However, on the basis of the available information, the Coronation North PIA is likely to contain a diversity of invertebrate species probably commensurate with the number, naturalness and complexity of plant habitats that it contains, but the extent of this diversity at the site cannot be evaluated on the basis of existing information. It is unlikely that the 65.2ha of cultivated land within the Coronation North PIA has any value to indigenous invertebrates of interest. The Coronation North project is within a zone previously assessed as important for the conservation of invertebrate representativeness. The presence of a number of rare plant species within the PIA may indicate that a number of rare invertebrate species could be present, but there is little evidence for this. The lepidopteran *Asterivora antigrapha* which, though considered not threatened nationally, could be considered locally rare and of biogeographic interest and has been recorded from the Taieri Ridge area. No plant species that are known to host rare invertebrate species within the Macraes E.D. are known from within the Coronation PIA. Some plant species, notably the shrub *Olearia bullata*, within the Coronation North PIA may be host to specialist invertebrate species.

Table 6. Invertebrate species recorded as Nationally Threatened in McGuinness (2001) and NZTCS spreadsheets (from www.doc.govt.nz/nztcs) whose distribution could include the Macraes E.D. and their current conservation status. Black text as in McGuinness (2001), blue text additional information provided in latest cycle of NZTCS conservation review of group. For references refer to source publications.

Order	Family	Taxonomic Name	Conservation Status	Type of Insect	Distribution	Habitat
Opisthopora	Megascolecidae	Octochaetus multiporus (Beddard, 1885)	Not Threatened (2010)	Worm	Very widely distributed in the southern end of the North Island districts, east of the main divide, Nelson, Stewart Island and a number of small off-shore islands (Lee 1959a). It has been found recently at AgResearch's Hill Country Research station, Ballantrae (Springett et al. 1998)	Usually found in the subsoil, sometimes in topsoil, under forest, scrub, tussock grassland and pasture (Lee 1959a). Lee (1959b) described it as being numerous in yellow-grey, yellow-brown, and brown-grey earth soils. Most numerous in soils of low to moderate fertility, and those that slope away from the sun. High fertility soils had a similar density to adjacent areas of native forest, indicating that exotic pasture environments can favour this worm in some circumstances. A deeper burrowing species (Springett et al. 1998), which creates a network of burrows that do not open to the surface. The burrows have a diameter of about 10mm. Several chambers 15 - 20mm wide are usually within the burrow network, and worms may be found curled up in these (Springett & Gray 1998).
Coleoptera	Caribidae	Mecodema laeviceps Broun, 1904	Nationally Critical (2010)	Carabid	Ida Valley (Barratt 1994b; Patrick 1994b); Old Man Range 1524m; Mt Ida, Wedderburn near Mt Ida; Mt Teviot, East Otago Plateau between Millers Flat and Lake Onslow, c. 450m (Barratt 1994b); Oturehua (Sherley 1990; Barratt 1994b). Not seen between 1964 and 1998, when similar taxon in Waikaia Bush (northern Southland) now considered conspecific and one specimen found at Kakanui Mountains 2001. (Notes 2004, NZTCS)	Found under big stones in tussock country (Sherley 1990). Altitude records available from only two specimens, found in tussock grassland, and under a rock in tussock and briar surrounding vegetation, at 450m and 479m (Barratt 1994b).
Coleoptera	Caribidae	Mecodema minax Britton, 1949	Not Threatened (2010)	Carabid	Blue Mountains South, 400m; Blue Mountains North, 900-950m; Umbrella Range, Mt Whitcoomb 1230m & 1450m (B. Barratt pers. comm. 1999); Mt Tabletop (MONZ); Rocklands 1981 (NZAC).	Subalpine tussock shrubland in the wetter more eastern areas of Otago (B. Barratt pers. comm. 1999).
Coleoptera	Caribidae	Mecodema morio (Castelnau, 1867)	Not Threatened (2010)	Carabid	Found in Otago and Southland (Tennyson 1998) at Lake Onslow, east of Roxborough, 680m (Townsend, J.I. 1995); Dunedin; Swampy; Logan Burn; Forest Hill Reserve; Invercargill (Patrick et al. 1987a); Slopedown Mokoreta number 2, 580-713m; Longwood Range 804m, Bald Hill; Waipori, East Otago, east of Lammerlaw Range near Lake Mihinerangi, 520m (B. Barratt pers. comm. 1999); Rocklands; Bradford, Dunedin; Ferntree Reserve, Taieri Rd; Coal Point, east of Katangata (J.I. Townsend pers. comm. 1999). There is also a specimen in MONZ labelled Stephens Island. However, no other specimens have been collected from this location (MONZ).	Found in both forest and tussock habitat (Townsend, J.I. 1995), generally lower altitude tussock shrubland. It is usually only present in low densities (B. Barratt pers. comm. 1999).

Coleoptera	Caribidae	Megadromus fultoni (Broun, 1882)	Naturally Uncommon (2010)	Carabid	Found in the north Taieri Hills, immediately inland from Dunedin (P. Johns pers. comm. 1999); at Taieri River mouth (J.I. Townsend pers. comm. 1999), the lower slopes of Mt Maungatua (J. Nunn pers. comm. 1999); and at various localities from Taieri through to Sutton (R. Hornabrook pers. comm. 2000). Confined to small area in the Taieri. (Notes 2004, NZTCS)	Appears to be restricted to the rock soils of the north Taieri Hills (P. Johns pers. comm. 1999).
Coleoptera	Caribidae	Megadromus haplopus (Broun, 1893)	Not Threatened (2010)	Carabid	Has been found at Trotters Gorge, Moeraki; Mt Dasher, South Canterbury, 915m (CMNZ). This species is sympatric (occurring in the same place) with M. virens (P. Johns pers. comm. 1999). The specimen in MONZ labelled Stephens Island is almost certainly incorrectly labelled (P. Johns pers. comm. 1999). Widespread northeastern Otago. (Notes 2004, NZTCS)	Found in lowland and montane broadleaf forest (A. Larochelle pers. comm. 1999), and has been collected from broadleaf kanuka (Kunzea ericoides) river terrace (CMNZ).
Coleoptera	Caribidae	Megadromus sp. 9 "Millers Flat"	Data Deficient (2010)	Carabid	Back of Miller's Flat near Roxborough (P. Johns pers. comm. 1999). No further data (Notes 2010, NZTCS). Highly modified site; Otago. (Notes 2004, NZTCS)	Possibly rocky ground (P. Johns pers. comm. 1999).
Coleoptera	Caribidae	Megadromus virens (Broun, 1886)	Not Threatened (2010)	Carabid	Has been found at Dansey Pass, 914m; Trotters Creek, Moeraki; Duntroon; Oamaru (CMNZ); and Waianakarua (R. Hornabrook pers. Comm. 2000). The Oamaru habitat is virtually gone (P. Johns pers. Comm. 1999). This species is sympatric (occurring in the same area) with M. haplopus. Oamaru Area (Notes 2004, NZTCS)	Inhabits lowland plain forest (P. Johns pers. Comm. 1999), and tussock grasslands (A. Larochelle pers. Comm. 1999). Has been collected from gardens under stones (CMNZ).
Lepidoptera	Geometridae	Asaphodes stinaria (Guenee, 1868)	Nationally Vulnerable (2009)	Moth	Formerly found from Hawkes Bay/Taupo to Invercargill (B. Patrick pers. comm. 1999). It has been collected from the foot of Mt Hutt (Meyrick 1884); Matukituki River, Wanaka (Philpott 1904); Lake Wanaka; Invercargill; Dunedin; Queenstown (Philpott 1917a); Waiouru; Puketiritiri, Napier; Mt Grey; Christchurch; Otira; Otatara, near Invercargill (Hudson 1928); Clinton River; Pompolona; slopes of Mackinnon Pass (Clarke 1933); Waiho Gorge; Niagara (Hudson 1939); Gorge Hill, Homer (Howes 1946); Upper Clutha, Kawarau Gorge (Patrick 1994f); Rongahere Gorge, base of Blue Mountains 1963 (Patrick 2000); Franz Joseph Glacier 1964; Beaumont State Forests (NZAC); Mohaka River, Kaweka Range, Hawkes Bay; Titahi; Eglington Valley; near Mossburn (MONZ); Maruia Springs (CMNZ). May possibly be extinct in the eastern areas (Patrick & Dugdale 2000). Since 1964, it has only been found at 10 sites: the eastern entrance to Kawarau Gorge, Five Mile Creek, Bobs Cove, The Gorge and Fernhill (Queenstown); Devils Staircase (Lake Wakatipu); Kidds Bush (Lake Hawea); junction of Muir Creek and Haast River, Teapot Flat (Jackson River) (Patrick 2000) and most recently at Trotters Gorge Scenic Reserve (B. Patrick pers. comm. 2001). Apparently stable after major decline. (Threat Assessment Notes Current, NZTCS). Burwood Bush SMU 100749. Larvae feed on wetland buttercups - protect from mammalian browsing. Trotters Gorge polygon 44353. Franz Joseph 44354,	Philpott (1917b) stated that it 'frequents rough herbage in the vicinity of forests', and it is believed that it is a forest edge or grassland species (Patrick 2000). It has been found associated with damp grassy openings in forested areas (Sherley 1990a). Larvae of the genus feed on forest floor, wetland, coastal and inter-tussock herbs (Patrick 2000). The host plant may possibly be a Ranunculus spp (Ranunculaceae) (Patrick & Dugdale 2000), however, this has not been ascertained yet (B. Patrick pers. comm. 1999). Other candidates, based on congeneric species that have been reared, include native daisy (Asteraceae), Hydrocotyle (Apiaceae), a native chickweed Stellaria (Caryophyllaceae), Plantago (Plantaginaceae), or Cardamine (Brassicaceae) (Patrick 2000).

					Cascades Plateau 44355 and edge of EMU 11. Cluden Stream 44356. Lake Wakatipu - Devil's Staircase polygon 44357 (Prioritisation Notes, NZTCS, 2009)	
Lepidoptera	Geometridae	Gingidiobora nebulosa (Philpott, 1917)	Nationally Vulnerable (2009)	Moth	Found in Marlborough and east Otago in the Macraes Ecological District (Patrick 1997a) at Coverham (Philpott 1917a); Kaikoura 1963 & 1975; Jacks Pass, Marlborough 1979 (NZAC); Clarence River at the Bluff (MONZ). EMUs 326, 1001, 327, 558. Rocky gorges where Gingidia (grisea) grows on steep faces away from mammal browsing - needs mammal control. (Prioritisation Notes, NZTCS, 2009)	Found at coastal to montane rock sites (B. Patrick pers. comm. 1999). The larvae feed at night on Gingidia species (Apiaceae) (Patrick & Dugdale 2000), including Gingidia montana (Craw 1987; Patrick 1997b). The herb host is now confined to cliff sites due to grazing pressure (B. Patrick pers. comm. 1999).
Lepidoptera	Geometridae	Xanthorhoe bulbulata (Guenee, 1868)	Nationally Critical (2009)	Moth	Formerly widespread in the grasslands of the eastern South Island (Sherley 1990a). It has been collected from Castle Hill, Christchurch 731m; Dunedin (Meyrick 1884); Mt Linton (Philpott 1901); New River (Philpott 1904); Invercargill; Ben Lomond; Takitimu Mountains (Philpott 1917b); Oreti River (Clarke 1933); Kekerengu; Christchurch; Lake Pukaki; Lake Wakatipu (Hudson 1928); Awapiri (Marlborough); Hyde; Ranfurly; Waipori (Hudson 1939); Upper Clutha, Kawarau Gorge; Maniototo (Patrick 1994f); Riverton; the Canterbury area including Hoon Hay, Governers Bay, Bottle Lake (Patrick 2000), Mt Grey (NZAC); Mt Karetu; Pukeatua; Queenstown (1979) (Patrick 2000); Greenhills; Wedderburn (NZAC); Obelisk; Otatara; Nevis (MONZ). No individuals have been seen since the Kawarau Gorge collection in 1991 (Patrick 2000). Documented decline to undetectable levels. (Threat Assessment Notes Current, NZTCS)	This species has been found occurring from sea level to elevations of about 914m (Hudson 1928). Philpott **(1917) states that it is found 'amongst rough herbage in open situations'. The host plant is unknown, but may** possibly be the cress Ischnocarpus novae-zelandiae. This cress is a threatened species with a stronghold in western Otago (Patrick & Dugdale 2000; B. Patrick pers. comm. 1999). New Zealand mint (Mentha cunninghamii) is another possible host (Patrick 2000).
Lepidoptera	Hepialidae	Heloxycanus patricki (Dugdale, 1994)	Declining (2009)	Moth	Known only from localities south of the Waitaki River (Dugdale 1994). Has been collected from Centre Hill; Rock and Pillar Range; Great Moss Swamp; Lammermoor Range; Lammerlaw Range; South Rough Ridge; Old Man Range, Fraser Basin; Danseys Pass; Swampy Hill; Mt Maungatua; Black Swamp Road; Longwood Range, Bald Hill; Pukerau Bog; Slopedown Range, Mokoreta No.2; Catlins-Cairn Road, Hokonui Hill Bog, Tussock Creek Mire, Ajax Bog; Seaward Moss; Manapouri, Home Creek Bog; Blue Mountains; and Scolloys Flat. Larvae also from Takahe Valley, Fiordland; Table Hill, Stewart Island; pupa from Mt Luxmore, Fiordland. Habitat destruction at Seaward Moss (Threat Assessment Notes Current, NZTCS)	A semiaquatic species found in coastal to alpine moss bogs (B. Patrick pers. comm. 1999) and mires, on flat ground or blanket bogs on sloping ground (Dugdale 1994). Their host plants are mosses, especially Sphagnum in and at the margins of bogs and seepages (Patrick & Dugdale 2000). Has been found from sea level to 1500m (B. Patrick pers. comm. 1999)
Orthoptera	Anostostomatid ae	Hemiandrus "Rocklands"	Data Deficient (2010)	Ground weta	Behind Dunedin (P. Johns pers. comm. 1992).	Not known.
Orthoptera	Anostostomatid ae	**Hemiandrus "Timaru"**	Not Threatened (2010)	Ground weta	Timaru township (P. Johns pers. Comm.1999). North Otago to Burkes Pass (Threat Assessment Notes Current, NZTCS)	Gardens and scrubland (P. Johns pers. Comm.1999).
Trichoptera	Conoesucidae	Olinga fumosa (Wise, 1958)	?	Caddisfly	Has been found at Gunns Bush Stream, Waimate, South Canterbury; Kelseys Bush, Waimate Creek and tributary 2; McQuilkans Creek below Swampy Summit, Dunedin 1; Waitati River 1, Dunedin, (1917) 2. All are recent records, apart from	Has been found in small bouldery streams at c. 300m, open or in forest (Ward 1997).

					Waitati (J. Ward pers. comm. 1999). 1 Patrick 1994a; 2 Ward & McKenzie 1997. Surveys have been undertaken, as has taxonomic work and research on life history (B. Patrick pers. comm. 2000).	

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6. **Herpetofauna**

The ERA Report assesses the impact of the three surveyed species collectively rather than individually (Section 6.4). It is considered important to understand what the likely numbers of each of the individual species are present and the habitat preference of each of the species. This is needed to ensure any commensurate mitigation is carried out. This is important for the Threatened species or At Risk species which do not appear to recolonise the waste rock stacks.

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

Estimating actual numbers of a species present at a site is difficult and requires considerable effort. For this reason index of abundance measures are frequently used in this type of work. These give a number of animals encountered per hour of search effort or per distance searched result and these are reported in Section 5.5. of the ERA reports and it is not considered necessary to undertake further work in relation to these figures.

The habitat requirements of the three lizard species do differ to some degree, but the habitat separation between the different species is not absolute and there is overlap in the distribution and habitats of the species in Central Otago (see Patterson 1992). The distribution within the PIA of all species in relation to habitat features is provided in Section 5.5 of the ERA reports and it is not considered necessary to elaborate further.

It is not considered necessary to change to change the planned mitigation as the information used in formulating that proposal is unchanged.

Patterson, G.B. 1992. The ecology of a New Zealand grassland lizard guild. Journal of the Royal Society of New Zealand 22: 91-106.

7. **Cumulative Effects**

There Is no discussion of cumulative effects of the mining operation on the ecology in the Macraes area and in the Macraes Ecological District. The ERA Report correctly refers to likely under-reporting of Threatened and At Risk plant species. However, at the same time the Indigenous vegetation and habitats and species populations are also declining in the Macraes area.

Cumulative effects of the wider mining operation on indigenous vegetation, habitats, and relevant faunal species needs to be assessed.

Please provide an assessment of cumulative effects of the wider mining operation on indigenous vegetation, habitats, and relevant fauna/ species in the Macraes Environs and the Macraes Ecological District

The Wildlands Review notes that there has been a reduction in the extent within the ecological district of land cover by natural vegetation communities between 2002 and 2012.

While this may be accurate (depending on the limitations of the analysis methodology), it is difficult to assess the extent of change as land cover is assigned to categories (e.g. 10-20% indigenous cover remaining). Therefore the percent change that has led to the shift by one category class to the district now being assessed as 10% indigenous cover remaining is unknown. It is likely given current land management practices in the area that loss of indigenous vegetation cover is real and ongoing, but the extent of change is unknown. Likewise the relative contribution that different commercial activities, including mining and pastoralism, and ecological processes such as weed invasion and pest proliferation have made to the cumulative loss of indigenous vegetation is unknown and not possible to calculate without further spatial information on land use throughout the district. Some insight into the relative contribution different land uses have made to loss of two indigenous grassland vegetation communities (short tussock and tall tussock grasslands) in the South Island has been made by Weeks et al. (2013). Between 1990 and 2008 Weeks et al. (2013) calculated that 3% (70,200ha) of the area mapped as indigenous grassland throughout the South Island was lost: 71% of the loss was attributed to agricultural practices, 25% to plantation forestry, and 3% to mining (various areas in the South Island, including at Macraes). Therefore mining at all the sites that occur within the area they mapped as grassland contributed 3% to a total calculated loss of 3% of this vegetation.

It is also important to recognise that rehabilitation of previous mine activity has been to productive farmland at the request of the local community. The impact of the mine on indigenous vegetation would have been less if rehabilitation had been to a more natural vegetation community (and acknowledging the technical difficulties in re-creating indigenous vegetation and their ecosystems).

Weeks, E.S; Walker, S; Dymond, J.R; Shepherd, J.D; 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.

8. **Impact Management Plan**

Section 4 of the Impact Management Plan states covenanting is a valuable tool to remediate a project's impacts. However, the Plan then states that, after assessment, a covenanting approach has not been pursued because of the lack of suitable sites containing equivalent ecological features and in order to avoid constraining present or future operational activities.

Please provide further details of the specific areas which were assessed as being unsuitable due to a lack of sites containing equivalent ecological features or due to constraints on present or future operational activities (or both).

Section 5 of the Plan states that a method similar to 'value of land approach' has been used in previous OceanaGold projects at Macraes.

Please provide further details on which projects at Macraes this approach has been used.

Two sites were inspected to assess their suitability for remediating the Coronation North project's ecological impacts: lower Deepdell Creek ('Island Block') in the vicinity of hill 345 (NZTM 1403951E 4977880N) surveyed by ERA Ecology on 2 February 2016, and 'Sailors

Cutting' in the upper Shag River (NZTM 1406938E 4974427N) surveyed by ERA Ecology on 3 February 2016. The ecological features that were found during the survey of these sites are provided in Table 7.

Neither site contained equivalent ecological features to those present in the PIA (Table 7), however the approximately 200ha Sailors Cutting site came the closest due to the presence of smaller areas of six of the eight vegetation communities (ephemeral wetlands[15] and basalt contact flush wetlands are missing), and the presence of one Threatened, three At Risk, and three rare plant species (although these were mostly different species than those present in the PIA). There are 73 fewer indigenous plant species at this site and it has a higher weed loading than in the PIA which would add to the complexity of management. The reptile and bird communities appeared to be similar. This site has good connectivity with an adjacent covenant, an additional vegetation community (remnant dryland forest). The value of many of these features could be increased through the creation of a covenant, fencing the site, weed control and species-specific management programmes.

Remnants of broadleaf (*Griselinia littoralis*) forest was observed further upstream from the area surveyed in Deepdell Creek, but this was not inspected as this forest has no similarity with any plant community that would be impacted within the PIA, and the canopy diversity is low in comparison with a nearby example in the Cranky Jims shrubland covenant.

I have been advised by OceanaGold that the 'value of land' approach has previously been used in their Reefton mine consent processes.

[15] One large and 2-3 smaller ephemeral wetlands are present nearby, and could be included in this option, but were not part of the initial site assessment.

Table 7. Comparison of notable ecological features identified in the lower Deepdell and Sailors Cutting potential remediation sites in comparison with those present in the Coronation North and/or Coal Creek PIA (brown shaded).

Ecological Importance	Type	Feature1	Feature2	FeatureName	Coronation North	Coal Creek dam	lower Deepdell	Sailors Cutting
Moderate-low	Bird	At Risk species	Declining	eastern Falcon			1 male	
Moderate-low	Bird	At Risk species	Declining	Pipit	Several sites, 5-10 pairs?	Visitor?		Few
Moderate	Bird	Community	Density		Low	low	Poor	Low
Moderate-low	Bird	Community	Diversity		5 indigenous species	low		
High	LENZ				Three Threatened LENZ (351.4ha + 1.7ha + 0.06ha)	Three threatened		
High	Plant	At Risk species	Declining	*Aciphylla subflabellata*	6 sites, c. 25 plants			
High	Plant	At Risk species	Declining	*Carex tenuiculmis*	1 site, 6 plants			
High	Plant	At Risk species	Declining	*Carmichaelia corrugata*	4 sites, c. 100 plants		-	-
High	Plant	At Risk species	Declining	*Carmichaelia crassicaulis*	Multiple sites, c 100-200 individuals	c. 100 plants		
High	Plant	At Risk species	Declining	*Coprosma intertexta*	1 site, c. 5 individuals	30-50 plants		
High	Plant	At Risk species	Declining	*Deschampsia cespitosa*	4 sites, 50100 plants			
High	Plant	At Risk species	Declining	*Olearia lineata*	-		-	2 sites, 2 plants
High	Plant	At Risk species	Naturally Uncommon	*Anthosachne falcis*	Multiple sites, 100s of plants			
High	Plant	At Risk species	Naturally Uncommon	*Cardamine bilobata*		c. 20		
High	Plant	At Risk species	Naturally Uncommon	*Celmisia hookeri*	Multiple sites, 100s of plants	c. 400 plants?		Few sites & few plants
High	Plant	At Risk species	Naturally Uncommon	*Dracophyllum uniflorum* var. *frondosum* G.Simpson		30-50 plants		
High	Plant	At Risk species	Naturally Uncommon	*Gingidea grisea*	-		1 site, c. 10 plants	Few sites & few plants
High	Plant	At Risk species	Naturally Uncommon	*Lagenophora barkeri*	2 sites, c. 10 plants	1 site		
Moderate	Plant	Biogeographic interest		*Pachycladon cheesemanii*		2 plants		
High	Plant	Community	Basalt contact flush wetlands		4.3ha		-	-
High	Plant	Community	Bluff		4.3ha	three large bluffs	Very limited	Limited moderate grade
Low	Plant	Community	Disused pine		22.8ha		-	-

Ecological Importance	Type	Feature1	Feature2	FeatureName	Coronation North	Coal Creek dam	lower Deepdell	Sailors Cutting
High	Plant	Community	Diversity		162 indigenous species		53 indigenous species	89 indigenous species
Very high	Plant	Community	Ephemeral wetlands		4ha			
Low	Plant	Community	Exotic pasture		170.7ha			
High	Plant	Community	Gully slope mosaic		49ha	present	Limited low grade	Moderate
High	Plant	Community	Gully wetlands		11.7ha	present, but more as riparian herbfield		Limited
Very high	Plant	Community	Historically rare ecosystems		Ephemeral wetland (Nationally Critical)			
High	Plant	Community	intactness		Moderate (0.60 naturalness index)	Moderate	Limited low grade	Moderate
High	Plant	Community	Narrow-leaved tussock grasslands		595.8ha & with moderate stature		Limited low grade	Limited moderate grade
Very High	Plant	Community	National Priorities for Protection		Wetlands			
Very high	Plant	Community	RAP		Part			
High	Plant	Community	Remnant dryland forest				very limited low diversity	Limited low diversity
High	Plant	Community	Short tussock grassland		153ha			Limited
Medium	Plant	Community	Shrubland		13ha with low diversity		Limited low grade	Common high diversity
Moderate	Plant	Data Deficient		*Epilobium insulare*	Multiple sites, 100-200 plants	c. 100 plants		
Moderate	Plant	Morphologically distinct		*Coprosma dumosa* red-fruit		1 grove		
Moderate	Plant	Morphologically distinct		*Carex testacea* brown		1 plant		
Moderate	Plant	Rare	DCC Threatened Plant	*Chionochloa rubra* subsp. *cuprea*	Multiple sites, 100s plants	c. 50 plants?		
Moderate	Plant	Rare	DCC Threatened Plant	*Olearia bullata*	Multiple sites, 100s plants	c. 200 plants?		Multiple sites, 100s plants
Moderate	Plant	Rare	Uncommon in Ecological District	*Brachyglottis southlandica*	1 site, 5-6 plants			

Ecological Importance	Type	Feature1	Feature2	FeatureName	Coronation North	Coal Creek dam	lower Deepdell	Sailors Cutting
Moderate	Plant	Rare	Uncommon in Ecological District	*Carex kaloides*	Multiple sites, 100-200 plants	Three sites to 5m x 3m		
Moderate	Plant	Rare	Uncommon in Ecological District	*Cordyline australis*			Several	Frequent
Moderate	Plant	Rare	Uncommon in Ecological District	*Fuchsia excorticata*				1 site, several plants
Moderate	Plant	Rare	Uncommon in Ecological District	*Pelargonium inodoratum*			3 sites, several plants	
Moderate	Plant	Rare	Uncommon in Ecological District	*Rumex flexuosus*	6 sites, c. 100 plants?			
Moderate	Plant	Rare	Uncommon in Ecological District	*Sophora microphylla*			Local	Occasional
Moderate	Plant	Rare	Uncommon in Ecological District	*Veronica rakaiensis*		c. 100 plants		
Very high	Plant	Threatened species	Nationally Critical	*Simplicia laxa*	2 populations			
Very high	Plant	Threatened species	Nationally Vulnerable	*Anogramma leptophylla*	1 site, 4 plants			
Very high	Plant	Threatened species	Nationally Vulnerable	*Carmichaelia kirkii*				1 site, 4 plants
Very high	Plant	Threatened species	Nationally Vulnerable	*Pachycladon cheesemanii*		2 plants		
Very high	Plant	Threatened species	Nationally Vulnerable	*Ranunculus ternatifolius*	3 sites, 3-7 plants		-	-
Very high	Plant	Threatened species	Nationally Vulnerable	*Senecio dunedinensis*		2 plants		
Very high	Plant	Threatened species	Nationally Vulnerable	*Sonchus* aff. *novaezelandiae*	1 site, 1 plant			
Moderate	Reptile	At Risk species	Declining	*Oligosoma polychroma*	Local	1.3 sightings/hour		?
Moderate	Reptile	At Risk species	Declining	*Woodworthia* Otago large	Local	4 individuals/hour		?
Moderate	Reptile	Community	Density		Low	Moderate	Poor	Poor?
Moderate	Reptile	Community	Diversity		3 species	low	Poor	Poor?

Ecological Importance	Type	Feature1	Feature2	FeatureName	Coronation North	Coal Creek dam	lower Deepdell	Sailors Cutting
Moderate	Reptile	Genetically distinct		*Oligosoma maccanni* Clade 4	Local	8.8 sightings/hour		Local
Moderate	Reptile	Genetically distinct		*Oligosoma polychroma* Clade 5	Local	1.3 sightings/hour		?
Moderate	Reptile	Genetically distinct		*Woodworthia* Otago large	Local	4 individuals/hour		?
High	Site	Connectivity					Connects to CJ Wetland & CJ Shrubland covenants through narrow border	connected to CJ Wetland & CJ Shrubland covenant through wide border
High	Site	Size					Smaller	Smaller
High	Site	Weed issues			Low	low	High	Moderate

Yours sincerely,

Dr Michael J. Thorsen
Director & Principal Ecologist
ERA Ecology NZ Ltd

9. consideration of alternatives

In short, no, the waste rock stack for Coronation North should not be elevated higher than the current design. Upon primary assessment of a waste rock stack design for Coronation North, engineering and aesthetic criteria have already been considered and implemented into the design.

From an engineering standpoint, elevating the waste rock stack will primarily result in a loss of efficiency which, in effect, manifests operationally as a higher cost per tonne moved. Generally speaking, the higher runs will utilise more trucks, and dozing requirements to maintain the dump area are higher with a less laterally extensive dump (i.e. smaller footprinted area). These higher equipment requirements result in higher maintenance costs per tonne moved as well as the environmental effect of more emissions per tonne moved.

A study done on the visual impact of the Macraes mining operation (*OceanaGold: Macraes Phase III Landscape and Visual* Assessment) found that *"[t]he Macraes Ridge area, which forms the western or southern skyline for much of the Palmerston and Pigroot Land Units, is assessed as locally Significant landscape, for visual reasons;"*. As such, the waste rock stack has been designed, aesthetically speaking, to *"visually integrate finished structures, landforms and vegetation into the surrounding landscape so they appear to be naturally occurring features"* (Condition 14(a) of the land use consent LRC 96/98 for the landscape rehabilitation of waste rock stacks). With this in mind, redesigning the waste rock stack to be any higher than its current design will cause it to be featured prominently on the skyline as a structure that sits above any other features that lie adjacent, causing it to stand out from its surroundings.

Question 9

Provide a discussion of alternatives of the Coal Creek Water Storage dam.

There are no alternatives for the location of the dam. The dam had to meet the following criteria .

1 It needed to be located on land owned by the company.
2 It needed to be located where its embankment could dam sufficient upstream catchment to supply the volume of water needed to provide the dilution volume for mitigation.
3 The site selected between two rock outcrops is geologically suitable to construct an embankment between. This minimizes the footprint of the embankment.

The proposed site is the only location that meets the three criteria.