

Burnham Quarry

Ecological Impact Assessment Report
Prepared for Burnham 2020 Ltd



2 August 2023





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<p>Bibliographic reference for citation: Boffa Miskell Limited 2023. <i>Burnham Quarry: Ecological Impact Assessment Report</i>. Report prepared by Boffa Miskell Limited for Burnham 2020 Ltd.</p>		
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Status: FINAL	Revision / version: 2	Issue date: 2 August 2023
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Template revision: 20210624 0000

File ref: BM19954_009b_Ecology_Assessment_Report_Final_20230801.docx

Cover photograph: Proposed Burnham Quarry Site © Boffa Miskell, 2022

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Appendix 1: Assessing Ecological Value and Ecological Effects

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1.0 Introduction

Burnham 2020 Ltd are seeking approval for a new quarry and aggregate extraction activity at a 362 ha dairy farm located near Burnham, Canterbury (Figure 1). The site is intended to be excavated and rehabilitated in stages, with a maximum of 40 ha being operational at any one time. Extraction activity is expected to extend over a period of approximately 60 years.

Winstones have engaged Boffa Miskell Limited to undertake ecological investigations and prepare an Ecological Impact Assessment Report (EclA) as part of the resource consent application for the project.

1.1 Scope and Purpose

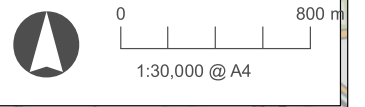
This EclA has been prepared to:

- Describe the existing ecological environment at the proposed quarry site;
- Assess the ecological significance and ecological value of the existing environment;
- Assess the actual or potential ecological effects of the construction and operation of the proposed quarry on the identified ecology values; and
- Develop recommendations to manage actual or potential adverse effects of the construction and operation of the proposed quarry on ecology values.

1.2 Report Structure

This report:

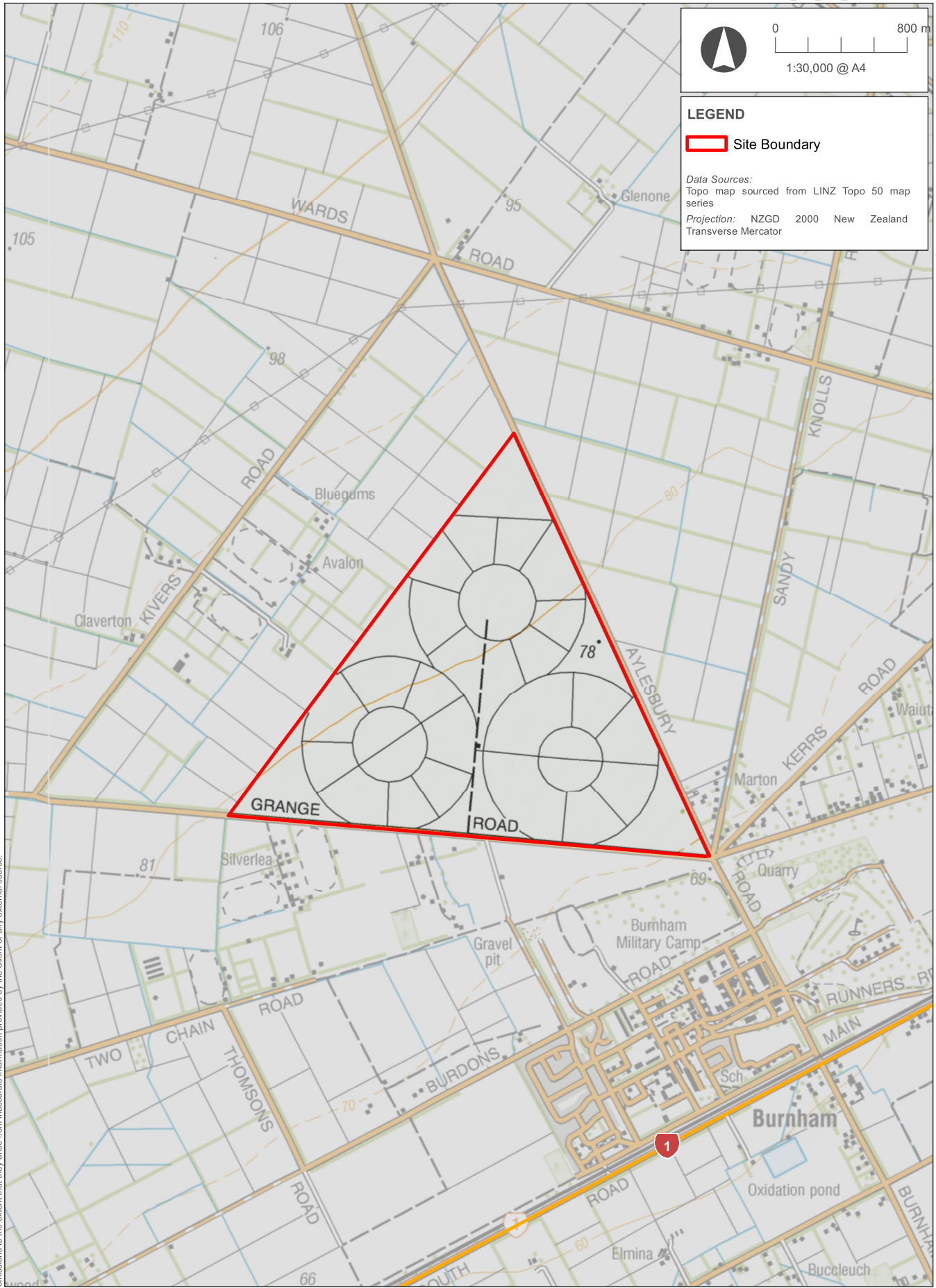
- Describes the project (Section 2.0);
- Outlines the methods used to undertake the site investigations and assessment (Section 3.0);
- Describes the existing ecological environment (Section 4.0);
- Assesses the ecological significance and ecological value of the existing environment (Section 5.0);
- Assesses the ecological effects of the project (Section 6.0);
- Provides impact management recommendations (Section 7.0); and
- Provides conclusions (Section 8.0).



LEGEND

Site Boundary

Data Sources:
 Topo map sourced from LINZ Topo 50 map series
 Projection: NZGD 2000 New Zealand Transverse Mercator



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2.0 Project Description

The proposal is to establish and operate an aggregate quarry on the Canterbury Plains near Burnham, Canterbury. The proposal includes an approximate extraction area of 360 ha.

Throughout the life of the quarry the Site will be quarried and rehabilitated in stages. The proposed quarry will require initial construction (Phase 1) and aggregate extraction (Phase 2) to enable the setup of the site access, offices, amenities, stockyard ramp, and processing area. Access to the Site will be from Aylesbury Road near the mid-point of the eastern boundary.

After Phase 1 and 2 are completed (1 - 6 years), the remaining six phases will be carried out in approximately 5-year increments depending on demand. This will occur progressively and include the extraction of aggregate, followed by the rehabilitation of the area before moving onto the next phase. Throughout the operation of the quarry the total active area of the Site will be limited to no more than 40 ha. The depth of the pit will vary depending on depth to the water table, with an approximate depth of 10 m below the existing ground level. During extraction, the Site will continue to be accessed for farming operations from Grange Road.

Prior to aggregate extraction, a long-term bund will be constructed from the proposed Aylesbury site access approximately 1 km southwards down the Site boundary. This will be present throughout the life of the quarry and will be encompassed within a 24.5 m setback from the road boundary. For the remainder of the Site, a temporary linear topsoil stockpile will be constructed along a 17.5 m setback prior to extraction. This will be to store overburden from the initial scraping of the soil during extraction and will be removed as part of rehabilitation upon the completion of each extraction phase.

During the rehabilitation of each phase, the base of the pit will be resurfaced with a minimum of 400 mm of suitable materials including at least 200 mm of topsoil and sown with grass seed. The slopes of the pit edge will be regraded to an approximate 1:2 gradient and fenced to exclude stock.

As part of site rehabilitation, over the life of the project, the following areas will be progressively planted with indigenous plantings, which when completed, will total more than 29.3 ha (Figure 2 shows the completed rehabilitation planting):

- On the permanent bund within the 24.5 m extraction set-back along Aylesbury Road during the construction phase (1.2 ha);
- As part of rehabilitation the slopes of the pit edge will be regraded to an approximate 1:2 gradient and rehabilitated with native planting as aggregate extraction progresses around the Site (20.2 ha).
- Within the 100 m setback from neighbouring dwellings in the south-eastern corner along Aylesbury Road during Phase 3 at between 6 - 10 years (4 ha) and Grange Road during Phase 5 at between 16 - 20 years (3.9 ha). It is proposed that these areas will be planted to create a buffer between dwellings adjacent to this area of the Site, and to develop amenity and ecological value.
- At the Aylesbury Road Site entrance.

A more detailed description of the proposal can be found in the Assessment of Effects.



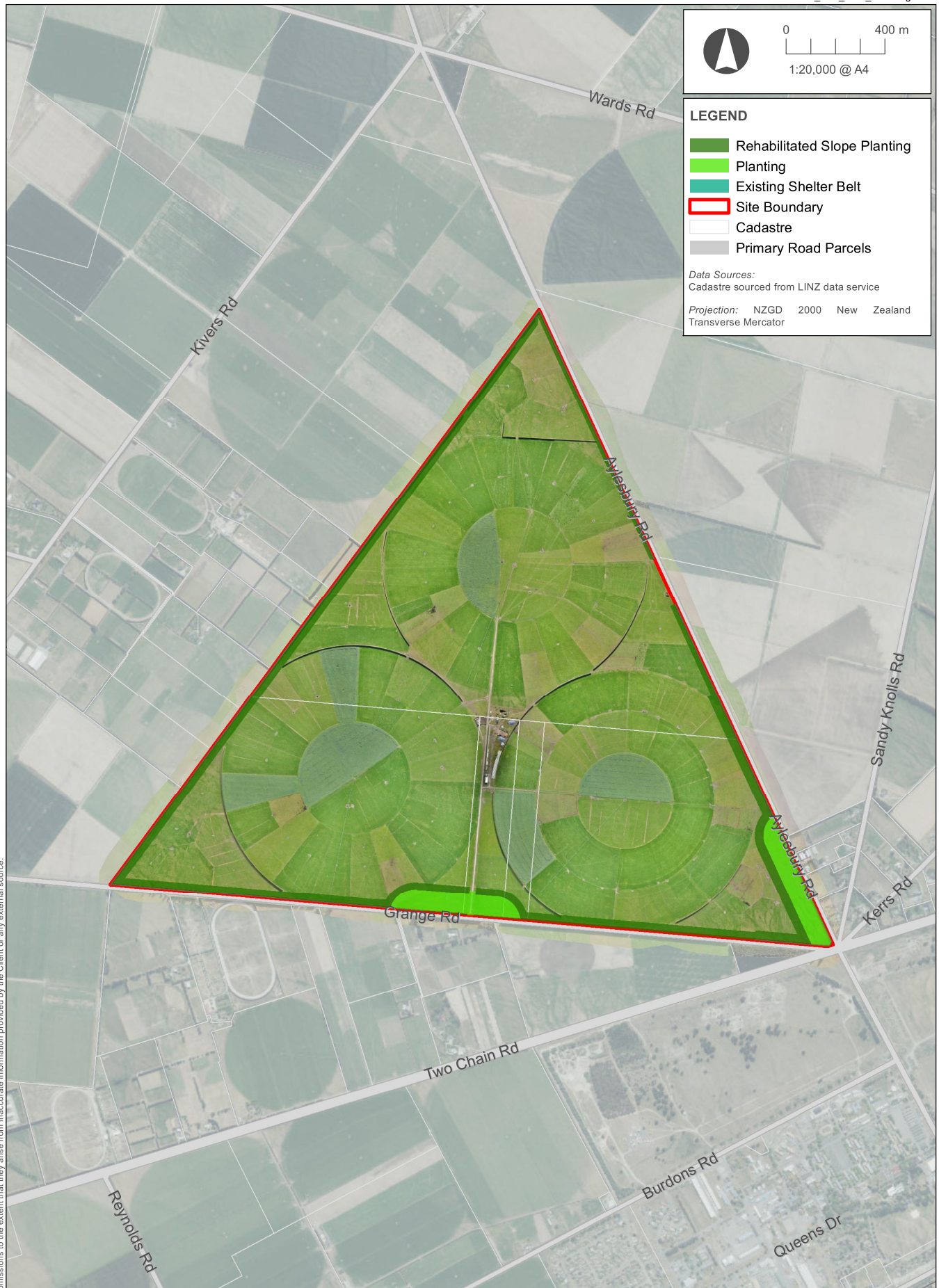
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- Rehabilitated Slope Planting
- Planting
- Existing Shelter Belt
- Site Boundary
- Cadastre
- Primary Road Parcels

Data Sources:
Cadastre sourced from LINZ data service

Projection: NZGD 2000 New Zealand
Transverse Mercator



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3.0 Methods

3.1 Desktop Review and Information Gathering

A desktop review was undertaken to gather information on the existing ecological values within and adjacent to the property. The desktop review included reviewing:

Recent aerial imagery, including Google Earth;

GIS (Geographic Information System) databases including:

- Topographical (Topo50) data (Land Information New Zealand);
- Threatened Environment Classification (Walker et al. 2015);
- Ecological region and ecological district GIS layers;
- Environment Canterbury 'Canterbury Wetlands' and 'Canterbury Regional Wetlands' GIS layers (no longer publicly available, downloaded May 2019).

Ecological databases including:

- DOC Herpetofauna database records;
- Bird records for the general area on the New Zealand Bird Atlas¹; and
- The NIWA-administered New Zealand Freshwater Fish database (NZFFD)².
- The Operative and Proposed Selwyn District Plans.

3.2 Site Investigations

A site investigation was undertaken by Scott Hooson (Senior Ecologist / Senior Principal) and Cara-Lisa Schloots (Ecologist / Graduate) on 19 May 2022. The Site was surveyed by four wheel drive vehicle and on foot. Field assessments and surveys were carried out as described below.

3.2.1 Vegetation and Habitats

During the vegetation surveys:

- The plant communities within the Site were classified using the classification system and naming conventions developed by Atkinson (1985);
- Plant species, and their overall cover (using the 'DAFOR' scale) was recorded in each of the main vegetation communities;
- General notes were made on the condition of the plant communities and habitats present;

¹ NZ Bird Atlas grid square: <https://ebird.org/atlasnz/block/blkCY46> – accessed 18 November 2022.

² This database holds records of freshwater fish distributions and occurrences based on previous surveys.

- Habitat suitability for terrestrial indigenous fauna (lizards and terrestrial invertebrates) was assessed and incidental observations of other terrestrial fauna were recorded; and
- A handheld Garmin Global Positioning System (GPS) was also used to mark locations of interest, photographs were taken and field notes were recorded.

3.2.2 Birds

Birds were surveyed during the first site visit on 19 May 2022 as follows:

- Five-minute bird counts were conducted at six pre-determined locations (Figure 3). The counts followed the standard five-minute bird count methodology (Dawson & Bull 1975).
- A roaming inventory was also compiled of all bird species seen and heard during the field investigations outside of the formal five-minute count periods.

A second survey was undertaken for nesting birds on 11 October 2022 during the peak of the breeding season for most species. This survey involved:

- Carefully traversing the Site in a four wheel drive vehicle and stopping frequently to scope the paddocks within the Site with binoculars;
- Recording any breeding behaviour, or birds with nests or chicks;
- Completing five-minute bird counts at the same six pre-determined locations used during the last survey; and
- Completing a roaming inventory of all bird species seen and heard outside of the formal five-minute count periods.

3.2.3 Other Fauna

Due to lack of suitable habitat for lizards or indigenous terrestrial invertebrates of conservation value within the Site, formal surveys for lizards or terrestrial invertebrates were not considered necessary.

3.3 Assessing Ecological Significance

Section 6(c) of the RMA requires identification of sites of significant vegetation and significant habitats of indigenous fauna.

In Canterbury, Policy 9.3.1 of the Canterbury RPS provides the basis for use of the ecological significance criteria. Following Policy 9.3.1(1), significance, with respect to ecosystems and indigenous biodiversity, is to be determined by assessment of areas and habitats against four matters:

1. Representativeness
2. Rarity or distinctive features
3. Diversity and pattern
4. Ecological context

The Site was assessed against each matter using the criteria for determining significant indigenous vegetation and significant habitat of indigenous fauna listed in Appendix 3 of the CRPS (referring also to the Wildland Consultants (2013) non-statutory Guidelines). Following Policy 9.3.1(2), areas were considered to be significant if they met one or more of the criteria in Appendix 3.

Under Policy 9.3.1(3) of the CRPS, areas identified as significant are to be protected to ensure no net loss of indigenous biodiversity or indigenous biodiversity values as a result of land use activities.

3.4 Assessing Ecological Value and Ecological Effects

To determine the level of ecological effects associated with the proposal, we have followed the Environmental Institute of Australia and New Zealand's (EIANZ) Ecological Impact Assessment (EclA) Guidelines (Roper-Lindsay et al. 2018). In summary, the EclA method requires assessments of:

- The values of communities, habitats / ecosystems and species (Table 3, Table 4 and Table 5);
- The magnitude of impact (Table 6); and
- The level of ecological effect based on ecological value and magnitude of impact (Table 7).

3.5 Other

Where possible, common names for plants and animals have been used in this report. Where a species does not have a common name, or its common name cannot be used to identify the species without ambiguity, scientific names have been used.

The conservation status of nationally Threatened and At-Risk indigenous species used in this report are from the most current versions of their respective New Zealand Threat Classification System (conservation status) lists³.

³ <https://nztcs.org.nz/>



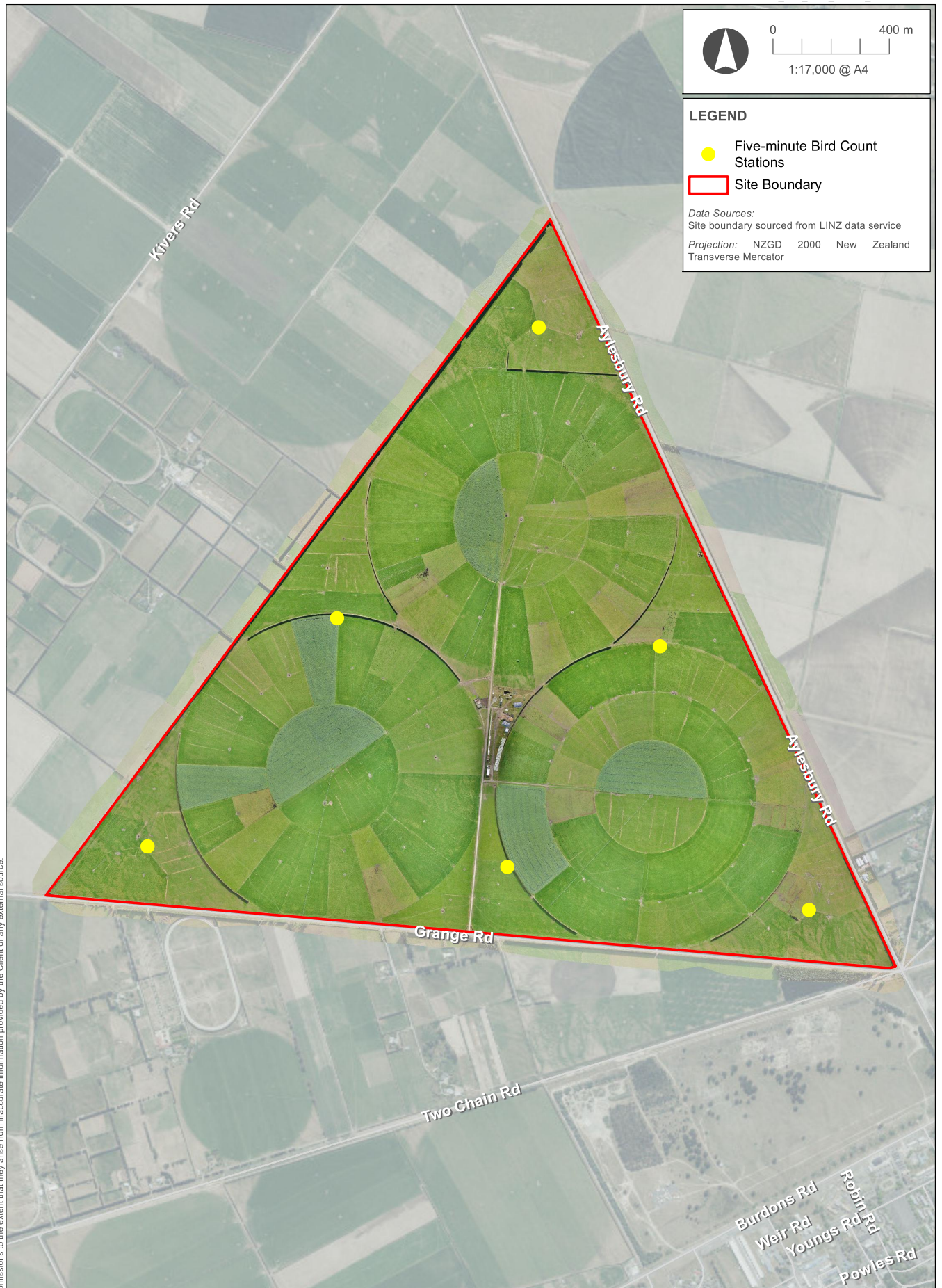
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LEGEND

- Five-minute Bird Count Stations
- Site Boundary

Data Sources:
 Site boundary sourced from LINZ data service
 Projection: NZGD 2000 New Zealand Transverse Mercator

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4.0 Existing Ecological Environment

The following sections summarise the known (and likely) values of the ecological environment within and adjacent to the proposed quarry site.

4.1 Ecological Context

The proposed quarry is within the Low Plains Ecological District (ED) in the Canterbury Plains Ecological Region (McEwen, 1987).

The original vegetation of the ED was likely to have been largely tōtara-matai forest on well-drained soils and kahikatea forest on poorly drained soils. Free-draining old and younger plains and terraces are thought to have supported kānuka forest and later successional tōtara-matai forest. Freshwater and saline wetlands of various types were also present, particularly nearest the coast (Steven & Meurk, 1996).

Nationally, the most significant losses of indigenous vegetation and habitats have occurred in lowland environments where development has been, and continues to be, most intensive. The Canterbury Plains Ecological Region is now among one of the most modified regions in New Zealand, with much of the natural, pre-Polynesian vegetation having been cleared (Leathwick et al., 2003; McEwen, 1987). The original vegetation of the Low Plains ED has been substantially depleted by human induced fire and land clearance for agriculture and settlement. Nearly all of the ED is intensively farmed or built (Harding 2009) and only 0.5% of the Low Plains ED is still covered in indigenous vegetation (Ecroyd & Brockerhoff, 2005).

4.1.1 Threatened Environment Classification

The Threatened Land Environments classification (Walker et al. 2015) shows how much indigenous vegetation remains within land environments and how much is legally protected. The classification system shows that all of the Canterbury Plains, including the proposed quarry site, are on land environments where less than 10% indigenous vegetation is left on these land environments nationally. The Site itself is located on land environment N1.1a where <10% indigenous vegetation remains on this land environment nationally (Cieraad et al., 2015; Walker et al., 2015).

4.2 Terrestrial Vegetation and Habitats

There are four main vegetation and habitats within the proposed quarry site:

- Exotic grassland (perennial ryegrass grassland);
- Fodder crops;
- Cultivated loamfield; and
- Shelterbelts (radiata pine treeland).

The location and extent of exotic grassland, fodder crops and cultivated loamfield changes depending on farm management activities. For example, at times, exotic grassland is ploughed and temporarily left as bare soil (loamfield) until it is replanted in pasture or fodder crops.

All of the vegetation and habitats on the Site are exotic. There is no naturally occurring indigenous vegetation on the Site.

4.2.1 Exotic grassland (perennial ryegrass grassland)

At the time of the site visit most of the Site was perennial ryegrass grassland (pasture) that is cultivated and irrigated by centre pivots and sprinklers and grazed by cattle and sheep (Appendix 1, Photo 1). The pasture was well maintained and there were few other species; white clover, annual meadow grass and shepherds purse are occasional throughout, and there were rare occurrences of other ubiquitous exotic pasture species such as cocksfoot, narrow-leaved plantain, broad-leaved dock, sheep's sorrel and dandelion. This exotic grassland is of **Negligible** ecological value.

4.2.2 Fodder crops

Paddocks are ploughed and sown in rotational fodder crops such as *Brassica* species for stock feed (Appendix 1, Photo 2). The location and extent of this cover type changes frequently depending on farm management activities. These rotational fodder crops are of **Negligible** ecological value.

4.2.3 Cultivated loamfield

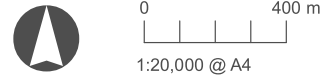
At times paddocks are ploughed and remain in bare soil (loamfield) until they are planted in pasture grass or fodder crops (as described above). Several paddocks with recently ploughed bare soil were present at the time of the site visits. The location and extent of this cover type changes frequently depending on farm management activities. This cultivated loamfield is of **Negligible** ecological value.

4.2.4 Shelterbelts (radiata pine treeland)

The Site is surrounded by radiata pine shelterbelts, with further shelterbelts present around part of the perimeter of each centre pivot (Figure 4, Photo 3, Appendix 1). These shelterbelts are approximately 4 – 5 m in height. In the few places where there is ground cover below the canopy this is dominated by cocksfoot. Gorse, scotch broom, yarrow and the exotic grasses Chewings fescue and sweet vernal are also occasionally present, as are numerous other herbaceous species such as black nightshade, narrow-leaved plantain, catsear and mouse-ear hawkweed. These shelterbelts are of **Negligible** ecological value.

4.2.5 Wetlands

There are no wetlands within the Site. The only periodically wet areas are limited to a small number of shallow depressions within improved pasture that are subject to temporary rain-derived water pooling or pooling from irrigation (Appendix 1, Photo 4). When dry they have a substrate of bare mud. These areas do not support wetland vegetation and are not 'wetlands' or 'natural inland wetlands' as defined by the RMA or National Policy Statement for Freshwater Management (NPS-FM; MfE 2020) respectively.

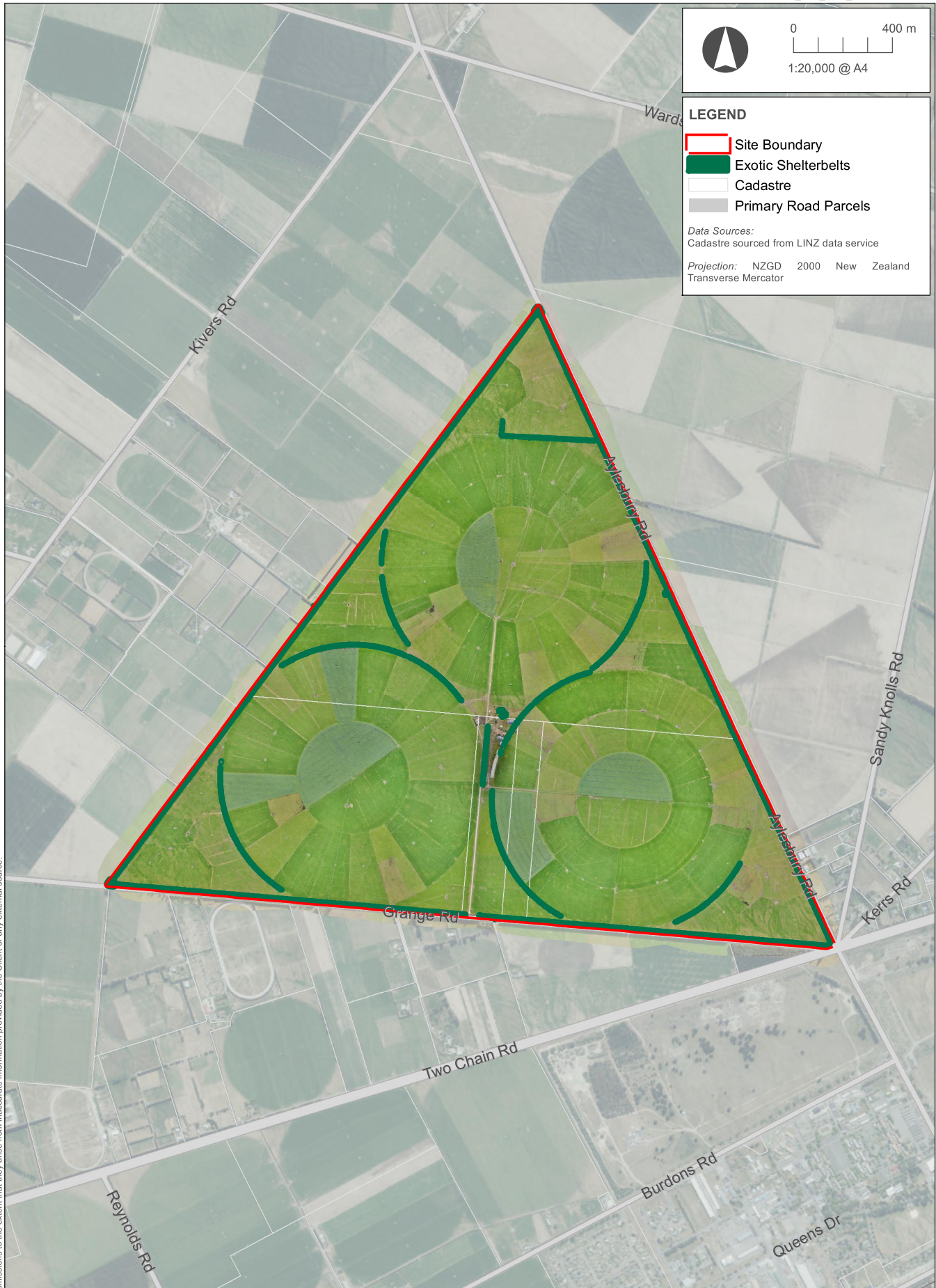


LEGEND

- Site Boundary
- Exotic Shelterbelts
- Cadastre
- Primary Road Parcels

Data Sources:
 Cadastre sourced from LINZ data service

Projection: NZGD 2000 New Zealand Transverse Mercator



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4.3 Freshwater Ecology

There are no waterways or permanent water bodies within the quarry site. There is an artificial water course (a water-race) adjacent to the southern boundary of the Site on the opposite (southern) side of Grange Road. Freshwater ecology values are not considered further in this assessment.

4.4 Birds

A list of the bird species recorded, or likely to occur within and adjacent to the proposed quarry site is provided in Table 1. Information on their conservation status and whether they were recorded during site visits is also included.

This list is derived from:

- The site investigation;
- The bird species recorded within the 10 x 10 km grid square of the Ornithological Society of New Zealand's Atlas of Bird Distribution in New Zealand (Robertson et al., 2007) that encompasses the project site.
- The bird species recorded within the relevant 10 x 10 km grid square on the eBird database;
- An assessment of the suitability of the habitat for these species; and
- The likelihood of them occurring in habitats within, or adjacent to, the project site.

Of the 32 bird species recorded, or considered likely to occur, in habitats within or adjacent to the proposed quarry site, approximately half (15 species) are indigenous, and half are introduced. Of the indigenous species, one is classified as Threatened – Nationally Endangered (black-fronted tern), three are classified as At Risk – Declining (black-billed gull, South Island pied oystercatcher and red-billed gull) and the remaining 10 species have a conservation status of Not Threatened.

Of the four Threatened and At Risk species potentially present, only one At Risk species, South Island pied oystercatcher, was recorded on the proposed quarry site. This species was observed foraging in pasture and recently cultivated loamfield and is likely to be using similar habitat in the wider area for feeding. No evidence of South Island pied oystercatcher breeding on the Site (breeding behaviour, nests or chicks) was recorded during the October site visit, but it is possible this species could breed within improved pasture or cultivated loamfield within the Site. Black-fronted tern, black-billed gull and red-billed gull are all likely to fly over the Site and may forage within pasture and cultivated loamfield, however these species are not expected to breed on the Site as it does not provide suitable habitat⁴.

Spur-winged plover chicks were observed on the Site, confirming this species breeds within the improved pasture or loamfield on the Site. One pair of paradise shelduck and one mallard duck were observed on the site with chicks during the October site visit. There is no breeding habitat for either waterfowl species on the Site, and it is considered most likely that they nested on suitable habitat on adjacent properties and have subsequently moved onto the Site with their chicks.

⁴ Black-fronted tern and black-billed gull typically breed on braided rivers and red-billed gull breed in coastal habitats such as on islands or rocky areas on the coast.

Table 1: Birds species recorded, or likely to occur within, or adjacent to, the proposed quarry site. Sorted by indigenous / introduced and by conservation status (Robertson et al., 2021). Superscript shows conservation status qualifiers and includes CD - Conservation Dependent, CI – Climate Impact, CR – Conservation Research Needed, Inc – Increasing, PD – Partial Decline, RF – Recruitment Failure, SO – Secure Overseas, and Sp – Sparse.

Common Name	Scientific Name	Conservation Status	Site Visit
Indigenous Species			
Black-fronted tern	<i>Chlidonias albostratus</i>	Threatened - Nationally Endangered ^{CI CD, PD, RF, Sp}	
Black-billed gull	<i>Larus bulleri</i>	At Risk - Declining ^{CI CR RF}	
SI pied oystercatcher	<i>Haematopus finschi</i>	At Risk - Declining ^{CI}	x
Red-billed gull	<i>Larus novaehollandiae scopulinus</i>	At Risk - Declining ^{CI}	
Black-backed gull	<i>Larus d. dominicanus</i>	Not Threatened ^{SO}	x
Grey warbler	<i>Gerygone igata</i>	Not Threatened	
Kingfisher	<i>Todiramphus sanctus vagans</i>	Not Threatened	
Paradise shelduck	<i>Tadorna variegata</i>	Not Threatened	x
Pied stilt	<i>Himantopus h. leucocephalus</i>	Not Threatened ^{SO}	x
Pūkeko	<i>Porphyrio m. melanotus</i>	Not Threatened ^{Inc SO}	x
Silveryeye	<i>Zosterops lateralis lateralis</i>	Not Threatened ^{SO}	
Spur-winged plover	<i>Vanellus miles novaehollandiae</i>	Not Threatened ^{SO}	x
Swamp harrier	<i>Circus approximans</i>	Not Threatened ^{SO}	x
Welcome swallow	<i>Hirundo n. neoxena</i>	Not Threatened ^{SO St}	x
White-faced heron	<i>Egretta novaehollandiae</i>	Not Threatened ^{SO}	x
Introduced and naturalised species			
Blackbird	<i>Turdus merula</i>	Introduced & Naturalised ^{SO}	x
California quail	<i>Callipepla californica</i>	Introduced & Naturalised ^{SO}	
Chaffinch	<i>Fringilla coelebs</i>	Introduced & Naturalised ^{SO}	
Dunnock	<i>Prunella modularis</i>	Introduced & Naturalised ^{SO}	x
Goldfinch	<i>Carduelis carduelis</i>	Introduced & Naturalised ^{SO}	x
Greenfinch	<i>Carduelis chloris</i>	Introduced & Naturalised ^{SO}	x
House sparrow	<i>Passer domesticus</i>	Introduced & Naturalised ^{SO}	x
Little owl	<i>Athene noctua</i>	Introduced & Naturalised ^{SO}	
Magpie	<i>Gymnorhina tibicen</i>	Introduced & Naturalised ^{SO}	x
Mallard	<i>Anas platyrhynchos</i>	Introduced & Naturalised ^{SO}	x
Pheasant	<i>Phasianus colchicus</i>	Introduced & Naturalised ^{SO}	x
Redpoll	<i>Carduelis flammea</i>	Introduced & Naturalised ^{SO}	
Rock pigeon	<i>Columba livia</i>	Introduced & Naturalised ^{SO}	x
Skylark	<i>Alauda arvensis</i>	Introduced & Naturalised ^{SO}	x
Song thrush	<i>Turdus philomelos</i>	Introduced & Naturalised ^{SO}	x
Starling	<i>Sturnus vulgaris</i>	Introduced & Naturalised ^{SO}	x
Yellowhammer	<i>Emberiza citrinella</i>	Introduced & Naturalised ^{SO}	x

In terms of the ecological value of these bird species (not of the Site as habitat for these species), following the EIANZ EclA Guidelines approach:

- The nationally Threatened black-fronted tern is of **Very High** ecological value;
- The three At Risk – Declining species (black-billed gull, South Island pied oystercatcher and red-billed gull) are of **High** ecological value;
- The 10 species that have a conservation status of Not Threatened and are nationally and locally common are of **Low** ecological value; and
- The introduced and naturalised (exotic) species are of **Negligible** ecological value.

4.5 Lizards

There are no records of lizards in areas within or adjacent to the Site in the DOC Bioweb Database. The closest records in the DOC Bioweb Database are of southern grass skinks, the closest of which is approximately 8.5 km from the Site.

In the context of the Site's historic uses (with the exception of a small area in the south-eastern corner the Site which was used for exotic plantation forestry up until at least December 2000⁵) and current land use, it is considered very unlikely that lizards occur within the Site. The intensively farmed, cultivated, grazed and cropped exotic habitats do not provide suitable habitat for lizards. Lizards are not considered further in this assessment.

⁵ <https://retrolens.co.nz>

5.0 Ecological Significance

The criteria for assessing whether a site is ecologically significant are listed in Appendix 3 of the CRPS (Environment Canterbury 2013). Table 2 evaluates the Site against each of these criteria. Italicised text is from Appendix 3 of the CRPS. The non-statutory guidelines for the application of the CRPS criteria (Wildland Consultants 2013) were used to assist interpretation of the criteria.

Table 2: Evaluation of the Site against the Canterbury Regional Policy Statement (Environment Canterbury 2013) criteria for determining significant indigenous vegetation and significant habitat of indigenous biodiversity

Criteria	Criteria met?	Explanation
Representativeness		
<i>1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type or represent all that remains of indigenous biodiversity in some areas.</i>	No	The Site does not support any indigenous vegetation or habitats.
<i>2. Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.</i>	No	The Site does not support any indigenous vegetation or habitats.
Rarity/Distinctiveness		
<i>3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.</i>	No	While the Site is situated on a land environment where there is <10% indigenous vegetation left nationally, there are no indigenous vegetation or habitats on the Site.
<i>4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within the relevant ecological district.</i>	No	The only indigenous species recorded on the Site that is threatened, at risk, or uncommon, nationally or within the relevant ecological district is South Island pied oystercatcher. The Site provides foraging habitat for this highly mobile species, but the Site is not significant for this reason. Intensively managed / grazed exotic pasture and ploughed fields that provide temporary foraging habitat South Island pied oystercatcher are not considered to be significant under this criterion.
<i>5. The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.</i>	No	The Site does not contain indigenous vegetation or indigenous species at their distribution limit within the Canterbury Region or nationally.
<i>6. Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an</i>	No	The Site does not support indigenous vegetation or an association of indigenous

<i>originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.</i>		species that is distinctive, naturally of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.
Diversity and Pattern		
<i>7. Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition reflecting the existence of diverse natural features or ecological gradients.</i>	No	The Site does not support indigenous vegetation. The diversity of indigenous birds and fauna at the Site is typical of intensively managed farms on the Canterbury Plains. This criterion is not met.
Ecological Context		
<i>8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.</i>	No	The Site does not have any important ecological linkages or networks and does not provide an important buffering function.
<i>9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.</i>	No	The Site is not a wetland and does not include any wetland habitats. It is not significant under this criterion.
<i>10. Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.</i>	No	The Site does not provide important habitat for indigenous species, either seasonally or permanently. Intensively managed / grazed exotic pasture and ploughed fields that provide temporary foraging habitat South Island pied oystercatcher are not considered to be significant under this criterion (refer to Wildland Consultants 2013).

In summary, the proposed quarry site is not ecologically significant under any of the criteria for determining ecological significance in Appendix 3 of the CRPS.

6.0 Assessment of Ecological Effects

This section assesses the actual and potential effects of the construction and operation of the proposed quarry on ecology values. The level of effect is assessed in this section **without** the impact management measures recommended in Section 7.0), but **with the** implementation of site management that is part of the project as outlined in Section 2.0.

6.1 Vegetation Clearance

The existing exotic vegetation within the quarry footprint will be progressively removed and rehabilitated in stages over the life of the quarry (as described in Section 2.0; Figure 2). For each stage, vegetation and topsoil will be stripped and directly reinstated into areas being rehabilitated (the area stripped will be determined by the volume of aggregate required between the stripping period). Following aggregate extraction for each stage, the quarry floor will be returned to a standard which allows farming to be re-established (likely similar to the vegetation removed)

All of the vegetation and habitats within the Site are intensively farmed and comprised entirely of exotic vegetation, and there is no naturally occurring indigenous vegetation. None of the vegetation and habitats within the Site are ecologically significant and all are of Negligible ecological value. The proposal will not affect any indigenous vegetation communities or habitats, and from an ecological effects assessment perspective, no impact management measures are required for vegetation removal.

6.2 Birds

There are four potential effects on birds that are considered relevant in relation to the construction and operation of the proposed quarry:

- Habitat modification and displacement;
- Temporary displacement resulting from construction disturbance;
- Impacts on nesting birds; and
- Loss of habitat connectivity.

6.2.1 Habitat Loss and Modification

The construction and operation of the quarry will result in the loss of existing habitat for birds where quarry infrastructure is established and temporary habitat loss where active quarrying is occurring. Because the proposal is to progressively excavate and rehabilitate the Site, returning quarried areas to a standard that will enable it to be used for farming, throughout the life of the quarry, much of the Site will continue to provide the same or similar habitat for birds. At any one time the active area of the quarry will be no more than 40 ha.

The habitats within the Site (exotic grassland, loamfield, fodder crops and exotic shelterbelts) are entirely intensively managed farmland. These habitats do not provide important habitat for the nationally Threatened and At Risk species recorded within, or likely to occur within, the proposed quarry site (black-fronted tern, South Island pied oystercatcher, black-billed gull, red-

billed gull). While South Island pied oystercatcher were observed foraging in pasture and recently cultivated loamfield within the Site, black-fronted tern, black-billed gull and red-billed gull likely only use the Site infrequently and irregularly for foraging (if at all). Because similar intensively managed farmland habitats are widespread in the surrounding area, and across the Canterbury Plains the magnitude of the loss and modification of habitat on birds is Negligible and the Level of effect is considered to be Very Low.

6.2.2 Disturbance and Displacement

Quarry construction and operation activities, including the use of heavy machinery and increased vehicle / people movements have the potential to disturb and displace birds that may be interrupted in their normal foraging and other behaviours. However, the bird species that have been recorded at the Site, or that could be expected to use habitats within the Site, are all mobile species that are able to disperse into similar habitats that are widespread in the surrounding area, in the Low Plains ED and across the Canterbury Plains. Further, because the proposal is to progressively excavate the Site in stages, disturbance effects will be limited to a relatively small portion of the Site. In this context, the magnitude of the effect of disturbance due to quarry construction noise and activity is Very Low and level of effect is expected to be Very Low.

6.2.3 Nesting Birds

Potentially, there is a risk to nesting bird species if works for quarry establishment or expansion for extraction occurs during the breeding season (generally September to February). This could arise either through works to clear new ground damaging nests or via disruption of nesting behaviours due to noise and other disturbance.

The intensively farmed habitats within the Site provide limited breeding habitat for indigenous bird species. However, the exotic grassland and bare loamfield habitat provides potential nesting habitat for three indigenous bird species: South Island pied oystercatcher (At Risk – Declining), pied stilt and spur-winged plover (both Not Threatened).

- Spur-winged plover, which nest in improved pasture or loamfield were confirmed to be breeding on the site during the October site visit.
- No evidence of South Island pied oystercatcher breeding (breeding behaviour, nests or chicks) was recorded during the October site visit, but it is possible this species could nest within improved pasture or cultivated loamfield.
- No evidence of pied stilt breeding was recorded during the October site visit, but this species could nest in shallow depressions within improved pasture that are subject to rain-derived water pooling or pooling from irrigation.

There is the potential for works undertaken for quarry construction and expansion to damage or disturb a small number of nests of species such as South Island pied oystercatcher, pied stilt and spur-winged plover if construction is undertaken during the breeding season. This could lead to nest failure, but due the small number of nests potentially affected (if any) effects on the local populations of these species are unlikely and the magnitude of this effect, at worst would be Low. The level of effect on the Not Threatened spur-winged plover and pied stilt would be Very Low, but because South Island pied oystercatcher are of High ecological value (i.e. classified as At Risk – Declining), the level of effect on this species is considered to be Low.

Most indigenous bird species (but excluding spur-winged plover⁶) are either absolutely or partially protected under the Wildlife Act (1953) and it is unlawful to disturb the nesting of these species. To manage effects on any nesting indigenous bird species during quarry establishment or expansion, pre-construction nesting bird surveys are recommended (refer to Section 7.0).

6.2.4 Habitat Connectivity

The existing exotic shelterbelts within the quarry site (and those in the wider landscape) may have a minor role as ecological corridors assisting the movement and dispersal of indigenous fauna, including common indigenous forest bird species (such as South Island fantail, grey warbler and silvereye), across this part of the Canterbury Plains. However, these shelterbelts are not considered ecologically significant in this context.

6.3 Lizards

There is no suitable habitat for lizards within the Site. No effects on lizards are anticipated and no impact management measures are required.

6.4 Freshwater Ecology

There are no waterways or permanent water bodies within the Site. An artificial water course (a water-race) outside of the Site (adjacent to the southern boundary of the site on the opposite (southern) side of Grange Road is not expected to be affected by the proposed quarry. No impact management measures are required for freshwater ecology.

7.0 Recommendations

The following impact management measures are recommended to manage the effects of the proposed quarry.

- If works for quarry establishment or expansion that involve removal of vegetation occur during the bird breeding season (August to February) a pre-construction survey of the proposed works area, and unquarried habitat within a 200 m buffer area of the works area, should be undertaken by a suitably qualified ecologist / ornithologist to locate nests, or chicks of any indigenous bird species that are absolutely or partially protected under the Wildlife Act (1953).
 - The survey should be undertaken no earlier than eight working days prior to the works being carried out.
 - If nests or chicks of indigenous birds that are absolutely or partially protected under the Wildlife Act (1953) are found, measures to avoid, minimise or mitigate potential adverse impacts should be included in a pre-works survey report. At a minimum, mitigation measures should include maintaining an appropriate exclusion zone

⁶ Spur-winged plover is listed on Schedule 5 of the Wildlife Act as 'Wildlife Not Protected'.

between breeding or nest sites and sources of continuous disturbance (but reduced minimum exclusion distances for intermittent, short-duration disturbance caused by work activities may be adopted where provided for by the bird survey report recommendations).

- Any person carrying out works must be informed of any bird breeding or nesting sites.
- A suitably qualified ecologist should provide input into the Rehabilitation Plans for each stage of extraction activity to ensure that plantings are ecologically appropriate and achieve the best outcomes for indigenous biodiversity.

8.0 Summary and Conclusions

- This assessment has identified that:
 - All of the vegetation and habitats at the proposed quarry site are exotic and of Negligible ecological value. There are no naturally occurring indigenous vegetation or habitats within the Site.
 - There are no waterways, permanent water bodies or wetlands within the proposed quarry site.
 - The habitats within the Site generally do not provide important habitat for indigenous birds, including nationally Threatened and At Risk species which, except for South Island pied oystercatcher, likely only use the Site infrequently and irregularly for foraging. Similar intensively managed farmland habitats are widespread in the surrounding area.
 - A moderate diversity of indigenous birds is likely to use the intensively managed farmland within the Site, at least from time to time, but generally the Site does not provide important habitat for indigenous birds and these habitat types are widespread in the surrounding area, and across the Canterbury Plains. Of the four Threatened and At Risk species known, or likely to occur in the wider area, only South Island pied oystercatcher (At Risk - Declining) were recorded at the Site.
 - We consider that there is no suitable habitat for lizards, or indigenous terrestrial invertebrates of conservation importance, within the Site.
 - The proposed quarry site is not ecologically significant under any of the criteria for determining ecological significance in Appendix 3 of the Canterbury Regional Policy Statement.
- Because the Site is entirely intensively managed farmland, the potential ecological effects of the proposed quarry are limited.
- Although the intensively farmed habitats within the Site provide limited breeding habitat for indigenous bird species, if quarry construction and expansion is undertaken during the bird breeding season there is the potential for works to damage or disturb the nests of a small number of indigenous bird species including South Island pied oystercatcher. Pre-construction surveys for nesting birds are recommended to avoid this effect.

- Planting of at least 29.4 ha of indigenous vegetation, which is proposed as part of the project, will result in a substantial Net Gain in indigenous vegetation and habitats within the Site.
- Ecological input into the Rehabilitation Plans for each stage of extraction activity is also recommended to ensure that plantings are ecologically appropriate and achieve the best outcomes for indigenous biodiversity.
- The level of effect of the construction and operation of the proposed quarry on ecological values, with implementation of impact management recommendations, is expected to be Very Low. Overall, and taking into account the indigenous plantings proposed as part of the project, the proposal is expected to result in a Net Gain in indigenous biodiversity at the Site.

9.0 References

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Appendix 1: Assessing Ecological Value and Level of Effects

Assessing Ecological Value

For communities, habitats and ecosystems we applied the four matters as described in the EIANZ guidance (Roper-Lindsay et al. 2018). Each of the four matters was assigned a score of “high”, “moderate”, “low” or “very low”, based on the relevant attributes (Table 3).

The four scores were then combined to provide a single site score which ranges from “Very High” to “Negligible” based on the following system (refer to Table 4).

For species, we applied Table 5 to assign value to species as described in the EIANZ guidance (Roper-Lindsay et al. 2018).

Tables 3 - 7 are reproduced from the EIANZ EclA Guidelines (Roper-Lindsay et al. 2018).

Table 3. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation / habitat / community for terrestrial ecosystems (from Roper-Lindsay et al. 2018).

MATTERS	ATTRIBUTES TO BE CONSIDERED
Representativeness	<p>Criteria for representative vegetation and aquatic habitats:</p> <ul style="list-style-type: none"> - Typical structure and composition - Indigenous species dominate - Expected species and tiers are present - Thresholds may need to be lowered where all examples of a type are strongly modified <p>Criteria for representative species and species assemblages:</p> <ul style="list-style-type: none"> - Species assemblages that are typical of the habitat - Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/distinctiveness	<p>Criteria for rare/distinctive vegetation and habitats:</p> <ul style="list-style-type: none"> - Naturally uncommon, or induced scarcity - Amount of habitat or vegetation remaining - Distinctive ecological features - National priority for protection <p>Criteria for rare/distinctive species or species assemblages:</p> <ul style="list-style-type: none"> - Habitat supporting nationally Threatened or At Risk species, or locally uncommon species - Regional or national distribution limits of species or communities - Unusual species or assemblages - Endemism
Diversity and pattern	<ul style="list-style-type: none"> - Level of natural diversity, abundance and distribution - Biodiversity reflecting underlying diversity - Biogeographical considerations – pattern, complexity - Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	<ul style="list-style-type: none"> - Site history, and local environmental conditions which have influenced the development of habitats and communities

MATTERS	ATTRIBUTES TO BE CONSIDERED
	<ul style="list-style-type: none"> - The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) - Size, shape and buffering - Condition and sensitivity to change - Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material - Species role in ecosystem functioning – high level, key species identification, habitat as proxy

Table 4. Assigning overall value to areas (refer to Table 3 for the matters to be considered for terrestrial communities) (Roper-Lindsay et al., 2018).

VALUE	DESCRIPTION
Negligible	Area rates Very Low for three matters and Moderate, Low or Very Low for remainder.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for two or more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder, or Area rates High for one of the assessment matters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Very High	Area rates High for three or all of the four assessment matters. Likely to be nationally important and recognised as such.

Table 5. Criteria for assigning ecological value to species (Roper-Lindsay et al., 2018).

ECOLOGICAL VALUE	SPECIES CLASSIFICATION
Negligible	Exotic species, including pests, species having recreational value.
Low	Nationally and locally common indigenous species.
Moderate	Species listed as any other category of <i>At Risk</i> (Recovering, Relict, Naturally Uncommon) found in the 'zone of influence' (ZOI) either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
High	Species listed as <i>At Risk – Declining</i> found in the ZOI either permanently or seasonally.
Very High	<i>Nationally Threatened</i> (Nationally Critical, Nationally Endangered, Nationally Vulnerable) species found in the ZOI either permanently or seasonally.

Assessing Magnitude of Impact

Once the value of the ecosystem components had been determined, the magnitude of the impact was assessed. Magnitude is determined by a combination of scale (temporal and spatial) of effect and degree of change that will be caused in or to the ecological component. A typical scale of magnitude ranges from "Very High" to "Negligible" as shown in Table 6.

Table 6. Criteria for describing magnitude of effect (Roper-Lindsay et al., 2018).

MAGNITUDE	DESCRIPTION
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element / feature.
High	Major loss or major alteration to key elements/ features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element / feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element / feature.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances/patterns; AND/OR Having a minor effect on the known population or range of the element / feature.
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the “no change” situation; AND/OR Having a negligible effect on the known population or range of the element / feature.

Assessing Level of Effect

The overall level of the effect on each ecological feature was determined by combining the ecological value of the vegetation communities, habitats, ecosystems and / or sites (Table 4) or species (Table 5) and the magnitude of the impact (Table 6) using the matrix in Table 7.

Table 7. Criteria for describing the level of effect (Roper-Lindsay et al., 2018).

		ECOLOGICAL VALUE				
		Very High	High	Moderate	Low	Negligible
MAGNITUDE	Very High	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

The EIANZ EclA guidelines (Roper-Lindsay et al. 2018) note that the level of effect can then be used as a guide to the extent and nature of the ecological management response required (including the need for biodiversity offsetting). For example:

- **‘Very High’** represents a level of effect that is unlikely to be acceptable on ecological grounds alone (even with compensation proposals). Activities having very high adverse effects should be avoided.

- **'High'** and **'Moderate'** represents a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be managed through avoidance, design, or extensive offset or compensation actions.
- **'Low'** and **'Very Low'** should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking impact management measures developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure low or very low-level effects.
- **'Very Low'** level effects can generally be classed as 'not more than minor' effects.

Appendix 2: Site Photographs



Photo 1: Typical pasture dominated by perennial ryegrass.



Photo 2: A paddock sown with a brassica fodder crop.



Photo 3: *A radiata pine shelterbelt on the property boundary.*



Photo 4: *An example of a wet depression within improved pasture where water pools after rainfall or irrigation.*

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Whangarei, Auckland, Hamilton, Tauranga, Wellington, Nelson, Christchurch, Dunedin, and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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