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Terrestrial Invertebrate Management Plan for Southland Wind Farm

Contract Report No. 6656g

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Wildlands

Terrestrial Invertebrate Management Plan for Southland Wind Farm

Contract Report No. 6656g

August 2025

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PART A: OVERALL TERRESTRIAL INVERTEBRATE MANAGEMENT PLAN

1.0 Introduction

Contact Energy Ltd (Contact) is proposing to construct a wind farm across the site ('Southland Wind Farm Site'), which includes Jedburgh Station, Matariki (Venlaw) Forests, and Glencoe Station. Up to 55 wind turbines will be located over an area of approximately 5,972 hectares. Contact engaged Wildland Consultants Ltd (Wildlands) to undertake general invertebrate field surveys on-site. After Helms' stag beetle was confirmed present on-site, and carnivorous land snail habitat was identified, further surveying was undertaken. Four terrestrial invertebrate surveys have been conducted on-site so far:

- A preliminary general terrestrial invertebrate survey.
- A comprehensive general terrestrial invertebrate survey.
- A carnivorous land snail survey.
- A targeted Helms' stag beetle survey and general invertebrate pitfall trapping.

This Terrestrial Invertebrate Management Plan (TIMP) adheres to the legislation and principles outlined by the Resource Management Act 1991. These policies and principles are integrated to prescribe successful management of effects of the Project on invertebrate biodiversity.

Helms' stag beetle (*Geodorcus helmsi*) is mentioned in the main body of this overall TIMP. A separate sub-plan, the Stag Beetle Management Plan (SBMP), is included as **Part B** of the TIMP, while monitoring and reporting requirements for all terrestrial invertebrates are included in **Part C** of the TIMP.

Table 1 summarises the purpose, objectives, and performance measures outlined in this TIMP.

Table 1 – Purpose, specific objectives, performance measures and monitoring relevant to this TIMP.

Purpose	This TIMP describes how measures to reduce potential effects to notable indigenous invertebrates will meet the requirements of conditions EC19 to EC26 of the proposed resource consent conditions. *Note that the Helms' Stag Beetle Management Plan (Part B of this TIMP) also addresses the requirements of the Wildlife approval for the Project.*
Specific Objectives	The objective of this TIMP is to describe measures to be implemented to avoid, remedy, mitigate, and where necessary compensate, for adverse effects on notable indigenous invertebrates within the Project Site from the construction and operation of the Southland Wind Farm.
Content	This TIMP has been prepared to address the matters and achieve the standards set out in proposed consent conditions EC19 – EC26. This TIMP has been prepared by a suitably-qualified ecologist and includes: (a) Identification of known or likely habitat of notable indigenous invertebrate species within the Project Footprint; and (b) A description of the measures to be taken by the Consent Holder during vegetation clearance to avoid, remedy, mitigate or where necessary compensate for adverse effects on notable indigenous invertebrates, including supervision requirements and relocation of cleared vegetation; and (c) A description of monitoring and reporting requirements; and (d) An incidental discovery protocol; and (e) The compensation requirements for residual adverse effects of vegetation clearance and earthworks activities required for the construction of the Southland Wind Farm on notable indigenous invertebrates.
Monitoring	• Monitoring of invertebrates will be carried out according to Part C (see also the HREP) in areas where minimisation and habitat enhancement and restoration has been applied. • Surveys and monitoring will focus on species diversity and abundance.
Reporting	• A pre-construction terrestrial invertebrate survey report, containing the results of the terrestrial invertebrate survey has been completed. This report will be provided to the Southland District Council prior to the construction commencement date. • A compliance monitoring report will be submitted annually during the construction period to Southland District Council by 30 September each year.

The Limitations of a Species-Centric Approach to Invertebrate Management

Invertebrate communities make up a large part of every terrestrial ecosystem (Bar-On *et al.* 2018) and are essential for maintaining biodiversity and ecological properties and function (Kim 1993; Cardoso *et al.* 2011); however, their importance is often overlooked. Less than 9% of arthropods (invertebrates with hard exoskeletons) have had their threat statuses evaluated under the New Zealand Threat Classification System (NZTCS; Townsend *et al.* 2008; Landcare Research 2023). Less than 0.2% of arthropods are protected under the Wildlife Act (1953).

Due to the lack of current knowledge and understanding regarding invertebrate taxonomy and the threat statuses of individual species (Lester *et al.* 2014), we cannot rely on threat lists and legal protection to decide which species require consideration in the TIMP. To maintain biodiversity, attributes of the entire invertebrate community must be considered. Invertebrate values considered in the TIMP are based on their value in supporting indigenous biodiversity.

Notable Invertebrates

This TIMP sets out the methods that will be used to avoid or minimise potential adverse effects on invertebrate biodiversity, but particularly notable invertebrates. This TIMP defines 'notable invertebrates' as any species that meets at least one of the following criteria:

- Protected under the Wildlife Act; or
- Threatened or At Risk, having been assessed under the New Zealand Threat Classification System; or
- Locally endemic; or
- Large-bodied and reliant on a specific indigenous habitat type; or
- Taonga species for Ngāi Tahu.

2.0 Consent Condition Scope

This TIMP has been developed in accordance with the proposed consent conditions EC19-26 for the Southland Wind Farm.

The requirements of these consent conditions will be addressed through the implementation, monitoring, and reporting procedures described in this TIMP and the following management plans. Further measures to address effects on invertebrates are detailed in the following plans:

- **The Vegetation Management Plan (VMP) -** which includes detail on how adverse effects on terrestrial ecology associated with vegetation clearance (including effects on invertebrates) will be minimised through vegetation clearance protocols.
- **Habitat Restoration and Enhancement Management Plan (HREP) -** which includes detail on the location, magnitude and type of indigenous habitat restoration and enhancement measures that are proposed to offset or compensate for significant residual effects on ecological values.

Delivery of, and compliance with, the TIMP will be the responsibility of the Environmental Manager who will liaise with the Site Manager, site engineer(s), Project Ecologists, and vegetation clearance and earthworks contractors as required.

3.0 Invertebrate Values

3.1 Desktop assessment

A desktop survey of terrestrial invertebrates involved searching the online database iNaturalist for invertebrate records within five kilometres of the Southland Wind Farm Site. iNaturalist is a citizen science-based initiative which is limited in usefulness due to bias in observer ability, expertise, and interests.

To find any invertebrate research or lists from the local area, Google and Google Scholar searches were conducted using the terms invertebrates NZ Catlins OR Slopedown OR Redan. The first three pages of results were scanned for invertebrate records from the area surrounding the proposed development. Invertebrate records were used to provide context for invertebrate fauna recorded within the site, and to inform an assessment of ecological values for Southland Wind Farm.

3.2 Desktop survey results

Only three records were found on iNaturalist within five kilometres of the proposed development. Records of two non-notable species were found: an endemic ground wētā species, *Hemiandrus maia* (Not Threatened), and *Hinewaia embolica* (Not Threatened), an endemic jumping spider.

No invertebrate lists or observations were found in the Google or Google Scholar searches.

The nearby Catlins Forest is home to notable ground beetles (Carabidae) including *Neoferonia* sp. and *Megadromus* sp. These large-bodied beetles are often dispersal-limited, and susceptible to habitat loss and introduced predators. The Catlins also has its own probable species of ngaokeoke/peripatus, *Peripatoides* "Catlins".

An entomological survey of the summit of Mokoreta to the northeast of the Project Site recorded three notable beetles and diverse beetle and moth assemblages that had affinities with the Awarua wetlands, Longwood Range, and Fiordland (Patrick *et al.* 1986).

Other notable species that were identified as possibly present on-site include trapdoor spiders (*Cantuaria* spp.) and short-range endemic moths.

3.3 Field surveys

3.3.1 Overview

All notable invertebrate locations were recorded during surveying. Notable invertebrates were identified to recognisable taxa units (RTUs) either in the field, or in the laboratory. Suspected distributions of notable invertebrates are outlined in Table 3, based on where they have been found and habitat values on-site.

3.3.2 Preliminary surveys (April 2023)

As detailed in the Ecology Report prepared by Wildland Consultants (2025), preliminary invertebrate surveys were undertaken in April 2023, using similar search locations as the lizard survey. Options for night searching and hand-searching some areas of the Wind Farm Site were limited, but the general state of the habitat and invertebrate biodiversity was assessed.

During these surveys, several notable invertebrates were discovered (ngaokeoke/peripatus, short-horned grasshopper, Helms' stag beetle, ground beetle and red and black millipede; Table 3), triggering further surveys which were undertaken in early 2024.

3.3.3 General invertebrate survey (February 2024)

Further general invertebrate surveying was undertaken in the invertebrate active season of early 2024. Full details of survey locations and methods are detailed in the Ecology Report prepared by Wildland Consultants (2025), and the survey area is summarised in Figures TIMP-1a and 1b.

The understorey of much of the mānuka forest was absent or sparse in some areas (primarily between JED-11 and JED-14), probably due to the high numbers of red deer (*Cervus elaphus*) and pigs (*Sus scrofa*). Deer, pig, and possum (*Trichosurus vulpecula*) sign was prevalent throughout the survey in most locations, which may explain the lack of forest understorey in parts. Moisture, rotting wood and a healthy and diverse understorey are important in supporting invertebrate biodiversity, so forest with little or no understorey and plant diversity are of lower value to invertebrates than diverse forests with a healthy understorey. Deer, pigs and possums may also cause disturbance to invertebrates in rotting wood and leaf litter, and pigs and possums will eat larvae and possibly adults.

An undescribed, locally endemic species of leaf-veined slug was found during this survey.

3.3.4 Carnivorous land snail survey (March 2024)

The carnivorous land snail survey was undertaken on the 20-21 March 2024. The Jedburgh Plateau (Figure TIMP-1a) was searched thoroughly for shells and live snails hiding in roost plants or leaf litter during the day, and for any active live snails at night. The methods used to search for snails were also suitable for other terrestrial invertebrates on the surface of the ground or vegetation. Conditions were good for invertebrate activity, being warm during the day and with recent rain and damp ground. Carnivorous land snails were not found during this survey, although leaf-veined slugs and more short-horned grasshoppers were detected.

3.3.5 Targeted Helms' stag beetle surveys (November 2024 & January 2025)

The findings from the general invertebrate surveys confirmed the presence of Helms' stag beetle at the Southland Wind Farm Site.

Subsequent surveys were conducted using spotlit searches at night combined with pitfall trapping. The surveys consisted of two rounds. Although the surveys chiefly targeted Helms' stag beetles and their habitat, other invertebrates were also recorded if they had not previously been found, or if they were notable. A more detailed description of these surveys is included in Wildlands (2025).

The first round of surveying occurred from 6 until 11 November 2024, with the second round occurring from 21 to 27 January 2025. Weather during night searches for both 2024 and 2025 survey periods was generally warm and damp, with some cool nights and mildly rainy weather.

Wildlands deployed 28 trap grids (each comprised of five live-capture pitfall traps) throughout the site (Table 2); 20 were deployed within Jedburgh Station (Figure TIMP-1a) and eight were deployed within the Matariki Forest (Figure TIMP-1b). No targeted surveys were conducted in the Glencoe Station as no suitable habitat was available for Helms' stag beetle.

Traps were initially checked two days after deployment. Traps ran for a minimum of four fine nights, after which they were removed, any captured animals recorded if necessary and released, and the holes filled in.

These surveys discovered giant springtail and trapdoor spider populations.

3.3.6 Survey locations

Live-capture pitfall trapping protocols followed Sherley & Stringer (2016), using clusters of cup-based pitfall traps. The cups used were empty one-litre buckets, with holes drilled in the bottom to prevent harm to captured animals and to drain water. Wooden lids were used to keep rain and sun from harming captured animals. The lids were propped up on legs and each set was checked to ensure enough room for large invertebrates to pass easily underneath.

The potential Helms' stag beetle habitat (which has values important for a variety of other invertebrates) on-site was split into six areas (see Table 2 and Figures TIMP-1a and 1b below). Traps were set and retrieved in groups by area, so that trapping periods in different areas of the site were staggered to make the most efficient use of resources. Pitfall traps were deployed in clusters of five traps, with each cluster at least 20 metres apart, depending on habitat, time, and area constraints. Trap locations are reported here for use in future monitoring (Part C; refer also to the HREP).

Wildlands deployed 28 trap grids (each comprised of five live-capture pitfall traps) throughout the site (Table 2); eight were deployed within the Matariki Forest and 20 within Jedburgh Station. Pitfall traps were out for at least four fine nights before being retrieved. No targeted surveys for Helms' stag beetles were conducted in the Glencoe Station as no suitable habitat was available.

Traps were initially checked two days after deployment. Any Helms' stag beetles found in traps were recorded before being released into suitable habitat at the location they were caught. Any other invertebrates caught were also recorded if they had not previously been recorded at the site, or if they were notable species. Traps ran for a minimum of four nights, after which they were removed, any captured animals recorded if necessary and released, and the holes filled in.

Table 2 – Areas of potential Helms' stag beetle habitat and effort to search for Helms' stag beetles at the Southland Wind Farm.

Area Number	Turbines	Number of Pitfall Traps Deployed	Number of Hours of Night Searching
1	JED-6, 15	15	2
2	JED-1, 11-14, 24	30	3
3	JED-20, 21	15	3
4	JED-25-29, 16, 17	25	5
5	JED-31-34	15	2
6	MAT-14-16, 9-10	40	2

3.3.7 Night-Time Hand Searching

Helms' stag beetle habitat was searched at night by two people for two hours each, using headlamps. Each area was subject to one night search. Areas 4 and 6 (Table 2) were previously searched at night during the general invertebrate surveys (Area 6) and the targeted giant land snail survey (Area 4). Therefore, there was no need to search for them again. Beetles were searched for under logs, on tree trunks, and on the ground. Habitat was handled carefully so that it was not damaged.

3.3.8 Limitations of survey

Even intensive invertebrate surveys cannot detect all species on a site or all individuals within a population. Notable invertebrates can have low population densities, cryptic colouration, and unknown habitat requirements. Therefore, uncertainty is inevitable when estimating notable invertebrate distributions and every effort is made to ensure good practice is adhered to in order to ensure a fair representation across the site.

contact

LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Jedburgh Plateau
- Civil Works Design
- Wind Farm Site

Terrestrial Invertebrate Surveys

- Pitfall Traps

Invertebrates Recorded

- Giant Springtail
- Ground Beetle
- Helms' Stag Beetle
- Short-Horned Grasshopper
- Ngaokeoke
- Trapdoor Spider
- Terrestrial Invertebrate Night Search Area
- Terrestrial Invertebrate Day Search Area
- Jedburgh Station Ecological Enhancement Area (Terrestrial Invertebrate Release Site)

MAP SCALE	PRINT DATE
N Scale: 1:20,000	15/08/2025
	VERSION 1.0

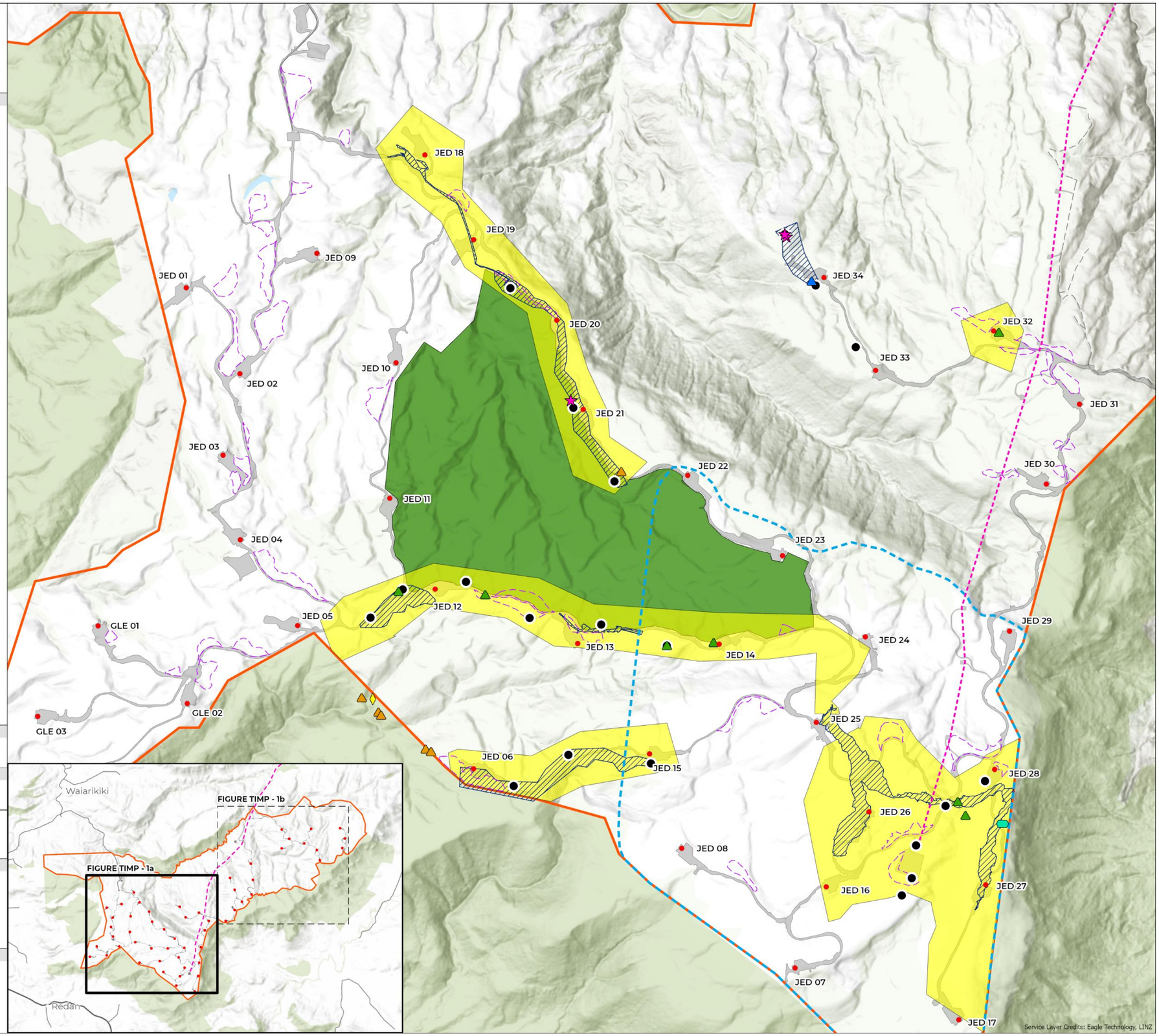
Kilometers
0 0.25 0.5 1

CREDITS:

Wildlands
Ecological data provided by Wildlands Consultants

TITLE

FIGURE TIMP - 1a
NOTABLE TERRESTRIAL INVERTEBRATE SURVEY AREAS AND SPECIES FOUND WIND FARM SITE - WEST



contact

LEGEND

Wind Farm

- Wind Turbines
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- Indicative Fill Disposal Sites
- Jedburgh Plateau
- Civil Works Design
- Wind Farm Site

Terrestrial Invertebrate Surveys

- Pitfall Traps

Invertebrates Recorded

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- Helms' Stag Beetle
- Ground Wētā
- Red and Black Millipede
- Trapdoor Spider
- Terrestrial Invertebrate Night Search Area
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MAP SCALE	PRINT DATE
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	VERSION
	1.0

Kilometers
0 0.25 0.5 1

CREDITS:

Wildlands
Ecological data provided by Wildlands Consultants

TITLE

FIGURE TIMP - 1b
NOTABLE TERRESTRIAL INVERTEBRATE SURVEY AREAS AND SPECIES FOUND WIND FARM SITE - EAST

MAT 01
MAT 02
MAT 03
MAT 04
MAT 05
MAT 06
MAT 07
MAT 08
MAT 09
MAT 10
MAT 11
MAT 12
MAT 13
MAT 14
MAT 15
MAT 16
MAT 17
MAT 18

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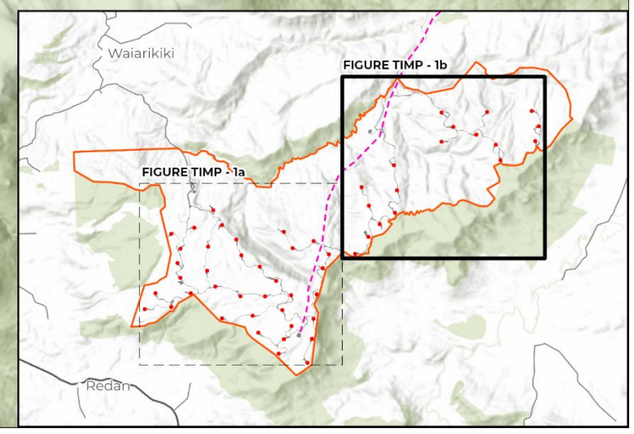


Table 3 – Notable invertebrate species recorded at the proposed Southland Wind Farm Site (April 2023 to January 2025).

Scientific Name	Common Name	Notability #	Habitat on-Site	Where Found	Projected Distribution
Megadromus meritus	Ground beetle	Local endemic	Living in soil and leaf litter, under logs and in rotting wood	Throughout site (except in pasture)	Throughout site (except in pasture)
Sigaus campestris	Short-horned grasshopper	At Risk - Declining	Wetland and grassland	Between JED-27 and JED-28; near JED-28	Throughout Jedburgh Plateau
Geodorcus helmsii	Helms' stag beetle	Protected under the Wildlife Act (1953)	Indigenous forest and areas with tussock plants that have not been impacted by introduced mammalian pests	Between JED-22 and JED-21; between JED-5 and JED-6; between MAT-15 and MAT-16	Some mānuka forest, tussock, possibly shrubland. Between JED-19 and JED-22; JED-6 and JED-15; near MAT-15 and MAT-16; possibly very low numbers in other areas of indigenous woody vegetation and tussock.
Peripatoides sp.	Ngaokeoke	Sensitive to habitat loss, little known about them and many species are undescribed. Often locally endemic.	Mānuka forest	Between JED-5 and JED-6	Throughout forested areas on-site.
Athoracophoridae	Leaf-veined slug	Sensitive to habitat loss, little known about them and many species are undescribed. Often locally endemic.	Found in high-altitude wetlands during surveys. Likely to be found in any areas with indigenous vegetation.	Near JED-28 and near MAT-16	Likely found throughout the forested and native vegetation areas on-site. At least two species present.
Platanurida sp.	Giant springtail	Poorly-studied dispersal-limited genus with locally endemic species that are likely vulnerable to habitat loss	In indigenous forest, under tree bark and in rotting wood.	Near JED-34	Likely to be found around JED-33 and JED-34.
Cantuaria sp.	Trapdoor spider	Often locally endemic, some species At Risk, many species Data Deficient	In sloping ground in indigenous vegetation with no history of landscaping. Prefers clay soil.	Near JED-34, between MAT-15 and MAT-16, near JED-21.	Likely to be found throughout indigenous vegetation on-site, particularly in forest and Matariki plateaux.
Holcaspis sp.	Ground beetle	Likely to be local endemic, may be vulnerable to predation and habitat loss	Living in soil and leaf litter, under logs and in rotting wood	Near JED-32	Throughout site (except in pasture)
Megadromus sp.	Ground beetle	Likely to be local endemic, may be vulnerable to predation and habitat loss	Living in soil and leaf litter, under logs and in rotting wood	Near JED-12	Throughout site (except in pasture)
?*Icosidesmus* sp.	Red and black millipede	Undescribed species. Locally endemic.	Moist vegetation, most habitats except pasture	Throughout site (except in pasture)	Throughout site (except in pasture)

3.4 Field survey results

3.4.1 Preliminary survey results

Results are shown in Table 3 and Figures TIMP-1a and 1b. Surveys involved hand searching, sweep netting, spotlighting at night to detect nocturnal invertebrates, and incidental observations of invertebrates found under ACOs during lizard surveys. Invertebrate habitat values were also recorded. Despite limitations due to weather and access conditions, we are confident that the surveys provided an overview of the taxa that may be present on the site, and enabled us to refine and target our efforts for the surveys undertaken in November 2024 and January 2025.

The Project Site supports important habitat for invertebrates, including moths, spiders, grasshoppers and wētā, and beetles. Several notable invertebrates are present (Table 3) and additional notable taxa are potentially present at the site. Key invertebrate habitats were identified for further surveying (see Section 3.4.2). Potential habitat for carnivorous land snails (family Rhytididae) was identified. Further survey effort was needed to determine whether carnivorous land snails are present, the likely extent of the stag beetle habitat, and other notable invertebrates present that may be affected by the project.

3.4.2 Key invertebrate habitats

All indigenous vegetation is potential habitat for indigenous invertebrates, which use plants as a source of food and shelter. Different species have different needs and sensitivity to factors such as pest presence. Indigenous forest, grassland, and wetland habitats are particularly valuable. Indigenous forest is also important for many other species, including ngaokeoke. Carnivorous land snails are unlikely to be present, but the most suitable habitat for them is at the Jedburgh Plateau. Short-horned grasshopper requires grassland habitat with tussock and herb species. Scrub and shrubland provide ground beetle habitat.

The following vegetation types, listed in Wildlands (2025) as being present on-site, may provide suitable invertebrate habitat:

- Southern rātā-kāmahi forest.
- Mānuka-haumakaroa-mountain holly forest.
- Pahautea/southern rātā-kāmahi forest.
- Mānuka forest and scrub.
- [Mānuka]/tauhinu-inaka-*Veronica odora*- scrub and shrubland.
- Mānuka-inaka-mountain holly-(gorse) scrub and shrubland.
- Inaka scrub.
- Wetlands.
- Copper tussock-dominant vegetation (including areas with occasional wilding conifers).

3.4.3 General invertebrate survey results

The general invertebrate survey found a lack of invertebrate diversity, despite the mostly suitable weather conditions and the high diversity found in less favourable conditions during the preliminary survey. However, the understorey of much of the mānuka forest was largely absent or sparse, probably due to the high numbers of deer and pigs. Deer, pig, and possum sign was prevalent throughout the survey in most locations, which may explain the lack of forest understorey and a lower-than-expected invertebrate biodiversity.

3.4.4 Carnivorous land snail survey results

Despite thorough searching under generally favourable conditions, carnivorous land snails and their sign were not found. The prevalence of possum and pig sign throughout the Jedburgh Plateau is likely to preclude the presence of carnivorous land snails.

3.4.5 Invertebrate values discussion and implications

Overview

The areas of the site with indigenous vegetation cover appear to be important for invertebrate biodiversity. The forest and shrub environments are important for beetles, spiders, and ngaokeoke/peripatus. Damp dead wood and mature trees in the southern rātā-kamahi forest provide habitat for giant springtails. The Jedburgh Plateau and tussockland at Matariki are important for grasshoppers and moths. Several notable invertebrates have been found, and there is a high percentage of indigenous invertebrate fauna. The pasture areas, exotic plantation forest, and gorse are of little value to indigenous invertebrate biodiversity.

Introduced pest mammals appear to be a major threat to invertebrates on-site, particularly in the mānuka forest between JED-11 and JED-14, which has little understorey and therefore less capacity to support invertebrates that live on ferns and small shrubs. Pest sign was found throughout the site's indigenous habitats, particularly pig, possum, and deer. Without these introduced pest mammals, the site's value to invertebrate biodiversity would likely be considerably higher.

Ground beetle

The ground beetles found on-site (*Megadromus meritus, Holcaspis* sp., *Megadromus* sp.) are not protected and have not yet had their threat statuses assessed. Ground beetles are notable due to the following reasons:

- The genera *Megadromus* and *Holcaspis* contain many At Risk species, mostly Relict or Naturally Uncommon.
- The large body size typical of *Megadromus* spp. and *Holcaspis* spp., combined with their limited dispersal ability and high degree of local endemicity, make them vulnerable to population declines.
- *Megadromus meritus* is endemic to Southland and parts of Otago. While there is no evidence that it is currently of conservation concern, *M. meritus* could decline in numbers if it lost too much habitat over its limited range. The other two ground beetle species are unknown, but many ground beetle species have limited ranges.

Megadromus meritus shows three colour variants (bronze, green, and black), all of which are found on-site. Little research has been undertaken into the species or its colour variation, which may be genetic. Ground beetles are common throughout the Southland Wind Farm Site wherever wooded habitat, rocks, and indigenous vegetation are present. Effects will mostly be due to vegetation clearance, which will cause death to individuals and removal of their habitat. Their population appears to be healthy and is unlikely to be greatly impacted by the proposed wind farm.

Short-horned grasshopper

The short-horned grasshopper is classified as 'At Risk-Declining' (Mahlfeld *et al.* 2012) under the Department of Conservation National Threat Classification System (NZTCS). It is found in herbfields and tussocks. The Jedburgh Plateau provides a relatively large, contiguous habitat for this species. It may possibly be found elsewhere on-site but populations are likely to be small and under high pressure from predation. Vegetation clearance on the Jedburgh Plateau could impact this species by removing habitat and causing mortality to individuals.

Helms' stag beetle

Helms' stag beetle is covered separately under the SBMP.

Ngaokeoke

Ngaokeoke are not protected under the Wildlife Act. In New Zealand, ngaokeoke taxonomy is in its infancy and there may be many undescribed species. The species found on-site is likely to be either *Peripatoides* "Catlins" (Not Threatened, Trewick *et al.* 2018) or an undescribed species that has not yet had its threat ranking assessed.

The phylum Onychophora, of which ngaokeoke are the only members, is listed in the IUCN Invertebrate Red Data Book as Vulnerable (Wells *et al.* 1983). The listing is mostly due to their small, patchy populations, and their reliance upon habitat types that are susceptible to disturbance. Individual species have different threat rankings, but in New Zealand so little is known about ngaokeoke taxonomy, conservation issues, and ecology that the threat to individual unknown species is difficult to quantify (New 1995), so caution must be used when considering their conservation issues. Ngaokeoke is therefore included in this TIMP because ngaokeoke species are often locally endemic, have strict habitat requirements and limited dispersal ability, and are sensitive to habitat loss (Wells *et al.* 1983, DOC 2014). Impacts on ngaokeoke are likely to be through vegetation clearance and disturbance from machinery, which will cause death to individuals, loss of habitat, and potentially reduced fitness due to stress in surviving individuals close to construction works and areas of long-term activity (such as roads).

Carnivorous land snails

Carnivorous land snails in the family Rhytididae are a large and diverse group, with species found throughout Aotearoa New Zealand. Rhytidid species tend to be range-restricted and are dependent upon the abundance of prey, particularly earthworms, to survive. They are often large-bodies, slow moving, and lacking any effective defence mechanism against predators such as possums and pigs. Many species have At Risk or Threatened threat statuses, and some are protected.

Carnivorous land snails have not been found on-site, but some of the smaller forest-dwelling species may be present in the southern rātā-kamahi forest. These species are not protected, but are often vulnerable to predation and habitat loss, and may be range-restricted. Due to the lack of these species appearing during surveys, they are assumed not to be present, but the Incidental Discovery Protocol must be followed if one is found.

Leaf-veined slug

Two species of leaf-veined slug are known on-site, and more may be present. They tend to be found in moist environments with indigenous vegetation, as they are thought to feed on fungi and algae on the surfaces of plants. They are likely to be found throughout areas of indigenous vegetation on-site. Leaf-veined slugs are sensitive to habitat loss and predation by pest mammals, but their conservation statuses and issues are poorly known. Impacts of the project on leaf-veined slugs are mainly due to vegetation clearance, resulting in the death of individuals and the loss of habitat. Dust and disturbance from the project that affects vegetation near construction sites and roads may cause minor impacts.

Giant springtail

Little is known about the genus *Platanurida* or their more recognisable sister genus *Holacanthella*. The common name "giant springtail" is more commonly used to refer to *Holacanthella* spp., which include the largest springtails in the world. However, *Platanurida* spp. are also conspicuously large for a springtail, and lack the ability to jump. They therefore cannot disperse or escape predators as well as typical smaller springtails, which are also capable of dispersing by wind or phoresy[1]. *Platanurida* spp. are under-studied and their habitat requirements and threats are not fully understood. Their distributions are patchy and each species tends to have a small range. They require dead wood and

[1] Phoresy is travelling on the back of a larger animal, such as a fly or bird.

mature indigenous forest (F. Ashwood, pers. comm). Damp conditions and diverse tree species also appear to be important habitat requirements. *Platanurida* spp. are threatened by habitat loss, climate change, and most likely also predation by introduced mammals and invertebrates such as wasps.

The giant springtail found on-site is an attractive animal, blue-purple in colour, with bright yellow-tipped lateral lobes on both sides of its body (Plate 1). It was approximately eight millimetres long. The principal impacts from development of this species are likely to be localised habitat loss and increased edge effects, due to turbine JED-34 being proposed to be built close to where the individual springtail was found. Felling mature trees, such as those close to the planned site of JED-34, and removing dead wood is likely to negatively impact springtails, noting that few (if any) mature indigenous trees will be felled during construction. Any increase in predation is also likely to affect the giant springtails, particularly from introduced wasp species.

Trapdoor spider

Aotearoa New Zealand has 42 described species of trapdoor spider, and approximately 10 known undescribed species (Smith 2016; V. Smith, unpublished data), all within the genus *Cantuaria*. The only Southland species that has been described is *C. orepukiensis* (At Risk – Naturally Uncommon), though *C. catlinensis* (Data Deficient) is also found nearby on the east coast of the Catlins. The trapdoor spiders found on-site could be either of these species, or a new species. Trapdoor spiders have been found in three locations on-site: near JED-34 and JED-21 on Jedburgh Station, and between MAT-15 and MAT-16 at Matariki Forest.

Trapdoor spiders are dispersal-limited due to their sedentary nature: after initially leaving their mother's burrow, the female only ever builds one burrow, and never leaves it. Only the adult males leave their burrows, to search for females. If removed from their burrows, females will die unless another burrow is made for them (pers. obs.). They take care of their spiderlings in their burrows, and take years to reach maturity. Trapdoor spiders are the longest-lived known of all spiders, with one female living 43 years (Mason *et al.* 2018). They form small, dense populations, so that landscaping and other activities that disturb the soil can wipe out large numbers of trapdoor spiders. The main impacts to trapdoor spiders from the Project will be direct mortality and disturbance. Unlike other invertebrates, trapdoor spiders do not appear to benefit from restoration or enhancement planting, but they will likely benefit from predator and wasp control.

Red and black millipede

Red and black millipedes are not protected under the Wildlife Act. Only a small proportion of New Zealand millipedes have been described, and therefore undescribed species are easily found. The red and black millipede found on-site has also been recorded in and around Papatowai in the Catlins. It appears to be primarily a forest species, but can be found in other areas with indigenous vegetation such as shrubland. It has not yet been recorded from pasture or exotic vegetation. On-site it is commonly found throughout areas with indigenous vegetation, though it has not yet been found on the Jedburgh Plateau.

This millipede species appears to be common at the Southland Wind Farm Site. It is notable due to its apparent local endemicity, but its threat status and conservation issues are unknown. A cautious approach to effects management for red and black millipedes will be used due to lack of knowledge concerning this species. Effects management has therefore been built into the TIMP. However, their population appears to be healthy and is unlikely to be greatly impacted by the proposed wind farm. Impacts are likely to be from vegetation clearance and earthworks, which will destroy individuals and habitat that may be present in those locations.

A summary of all notable invertebrate taxa recorded or surveyed from the Wind Farm Site is provided in Table 3. Number of individuals found from each species is not reported, as little indication of true abundance or population health can be gained from the survey methods used.

4.0 Effects on Invertebrates and Associated Management Actions

4.1 Invertebrate species groups

For the purposes of effects management, invertebrates present (or potentially present) on-site have been divided into five management groups, reflecting the many similarities in how they will be impacted by the project, and how effects should be managed.

1. **Carnivorous land snails** include any species within the family Rhytididae that may be found on-site.
2. **Widespread, common species** includes ground beetle and red and black millipede as well as many other invertebrates found throughout the site.
3. **Edge-sensitive species** includes species particularly prone to edge effects such as a drop in humidity. For example, ngaokeoke and giant springtail.
4. **Grasshoppers** include short-horned grasshopper.

Helms' stag beetle will be managed separately as per the SBMP.

4.2 Potential effects

The EcIA (Wildlands 2025) discusses potential effects of the Project on ecological values, and provides an overview of the management measures. The relatively small footprint (compared with the larger area of the site) of the Southland Wind Farm means that habitat throughout much of the site will remain unaffected. Vegetation clearance for turbine platforms and road construction are likely to have the greatest impacts on invertebrates, due to the resulting habitat loss and fragmentation. Without careful management, this could cause a localised decline in numbers and change in species composition. Table 4 is a summary of how invertebrates may be affected without management.

Table 4 – Potential effects of the development on different species management groups, assuming no effects management. *Note that carnivorous land snails are unlikely to be present so effects are likely to be nil. Effects in on carnivorous land snails only apply if they are found incidentally during development.*

Effects	Carnivorous Land Snails *Effects apply only if present*	Widespread, Common Species	Edge-Sensitive Species	Grasshoppers
Disturbance, death, injury, and displacement during development	Clearance of wetland vegetation at the Jedburgh Plateau, or vegetation within southern rātā-kamahi forest near JED-34, could kill or displace snails.	Vegetation clearance will cause the death, injury and displacement of many species, though populations will recover.	Vegetation clearance will open habitat up, increasing edge effects, as well as causing death, injury and displacement.	Vegetation clearance could cause the death, injury and displacement of grasshoppers.
Acute disturbance during development	Vibrations may cause stress to snails.	Dust and vibrations will particularly affect diurnal insects such as grasshoppers. Invertebrate populations are likely to recover relatively quickly from short-term disturbance.	Edge-sensitive species may be more susceptible to stress from vibration. Dust may aggravate desiccation issues and stick to moist cuticles, causing issues with respiration or movement.	Vibrations may interrupt grasshopper communication. Dust may cause injury and stress.
Fragmentation of indigenous invertebrate habitat	Fragmentation of habitat should carnivorous land snails be found could severely limit their movement and cause population fragmentation due to their limited dispersal ability.	Fragmentation of habitat can split up populations of dispersal-limited species. Effects will be increased for all invertebrates.	Fragmented habitat has greater edge effects. Fragmentation of habitat can split up populations of dispersal-limited species.	Grasshoppers may be more capable of crossing minor barriers between habitat patches, such as roads, than other management groups. However, fragmenting habitat reduces connectivity between populations.
Loss of indigenous invertebrate habitat	Loss of habitat will reduce the size of the population able to be supported on-site.	Loss of habitat will decrease indigenous invertebrate biodiversity.	Loss of habitat will reduce the size of the population able to be supported on-site.	Loss of habitat will reduce the size of the population able to be supported on-site.

Effects	Carnivorous Land Snails *Effects apply only if present*	Widespread, Common Species	Edge-Sensitive Species	Grasshoppers
Ongoing disturbance due to project operations – note that the relatively small number of traffic movements will limit any potential effects	Ongoing vibrations from machinery may reduce snail activity. Vehicle collisions are also likely to cause mortality.	Ongoing dust and vibrations may impact insect communication and may cause injury and illness due to blocked respiratory apparatus. Dust is likely to be detrimental to all invertebrates, but particularly diurnal insects and herbivores. Invertebrate biodiversity in disturbed areas is likely to be reduced. Vehicle collisions are also likely to cause mortality.	These species are likely to be more susceptible to stress from ongoing project operations, including vibration, human presence, and increased light and dust. Vehicle collisions are also likely to cause mortality.	Vehicle collisions may cause mortality. Ongoing vibrations may interrupt and affect grasshopper communication and behaviour.
Increased risk of predation (not taking into account the significant pest / predator control proposed as part of the Project)	Carnivorous land snails are particularly vulnerable to predation by pigs, possums, and hedgehogs.	Moths and butterflies will be at increased risk of predation by introduced wasps. Large-bodied invertebrates and those with limited defensive mechanisms are at greater risk of predation. Increases in introduced predators will drastically affect invertebrate assemblages, removing many large-bodied species from the ecosystem.	Soft-bodied, large invertebrates such as ngaokeoke and giant springtail may be prone to predation from invertebrates. Opening up the habitat reduces the amount of suitable habitat to shelter and avoid predation.	Grasshoppers are highly prone to predation, particularly by fast-moving mammals that prey on insects, such as cats and rats.

4.3 Effects management

4.3.1 Loss and fragmentation of indigenous invertebrate habitat

Avoidance/mitigation

Minimise road width: Roads have been kept as narrow as practicable in the wind farm design to minimise the barrier they present between habitat patches.

Avoid and minimise clearance of important habitat: Compared with the larger area of the site, the relatively small footprint of the wind turbines, roads, and substations means that habitat throughout much of the site will remain intact. Turbine locations and the overall wind farm layout have already been redesigned to avoid high-quality indigenous invertebrate habitat as much as practicable, such as by restricting much of the development to previously-existing farm tracks and thereby circumnavigating forest habitat instead of creating new tracks through it.

The wind farm infrastructure has been mapped by considering the least ecologically-damaging locations for structures wherever possible. During the design phase of the Project, an extensive exercise of project shaping was completed to ensure key ecological values were avoided as much as practicable (e.g. wetlands, southern rātā-kāmahi forest). Wildlands provided input into this process. However, avoidance is not always possible as many different factors have to be considered in wind turbine placement.

Restoration

Restoration of invertebrate habitat: Indigenous vegetation will be planted and stacks of rocks and logs will be created where possible around the turbine structures, at roadsides, and anywhere vegetation has been cleared but the ground would otherwise be left bare (refer to the HREP sections 4.2 and 5.0). Habitat directly adjacent to the footprint will also be enhanced with indigenous plantings of copper tussock, *Coprosma* spp., whaririki/mountain flax, and other eco-sourced species as detailed in the HREP. Rock stacks and log stacks will also be created in these areas, using rocks and indigenous woody vegetation salvaged from construction. This will replace some lost habitat values.

Habitat enhancement in and around infrastructure: Where vegetation has been cleared to build roads and other infrastructure, enhancement planting will take place, including copper tussock and woody species such as mānuka. Indigenous woody vegetation that has been cleared will also be stacked beside roads where they are adjacent to existing indigenous woody vegetation. This will enhance habitat right up to the edge of the development, maximising available habitat and minimising crossing distances.

Connecting existing habitat patches: Where possible, patches of indigenous woody vegetation and tussock that are currently isolated will be connected by planting appropriate species. This should increase connectivity of invertebrate habitat adjacent to the Wind Farm footprint and throughout the site.

Revegetation within the Jedburgh Station Ecological Enhancement Area: Approximately 8.7 hectares of farm tracks and fire breaks will be revegetated within ‘Mānuka forest and scrub’ inside the fenced Jedburgh Station Ecological Enhancement Area. This action will increase overall habitat for invertebrates as well as enhance connectivity between populations.

Avoid and minimise clearance of important habitat: Compared with the larger area of the site, the relatively small footprint of the wind turbines, roads, and substations means that habitat throughout much of the site will remain intact. Turbine locations and the overall wind farm layout have already been redesigned to avoid high-quality indigenous invertebrate habitat as much as practicable, such as by restricting much of the development to previously-existing farm tracks and thereby circumnavigating forest habitat instead of creating new tracks through it.

The wind farm infrastructure has been mapped by considering the least ecologically-damaging locations for structures wherever possible. During the design phase of the Project, an extensive exercise of project shaping was completed to ensure key ecological values were avoided as much as practicable (e.g. wetlands, southern rātā-kāmahi forest). Wildlands provided input into this process. However, avoidance is not always possible as many different factors have to be considered in wind turbine placement. Invertebrate habitat will be considered carefully when finalising the wind farm layout within the consented turbine 'envelopes' so that important connecting patches of habitat will be avoided where practicable. Roads should also be as short as possible to retain large patches of contiguous habitat. Existing farm tracks should be used where possible. Roads should be kept as narrow as practicable to minimise the barrier they present between habitat patches.

Restoration and enhancement

Restoration and enhancement of invertebrate habitat: As set out in conditions and the HREP, Contact will carry out assisted regeneration and enrichment planting of 8.7 hectares of existing tracks and firebreaks within the 245-hectare Jedburgh Station Ecological Enhancement Area; and will plant eight discrete areas (totaling approximately 1.6 hectares) on the Jedburgh Plateau. These actions will replace some lost habitat values, help address the residual effects of fragmentation, and help to maintain connectivity between shrubland and wetland habitats on the Jedburgh Plateau.

Enhancement planting of 5,000 indigenous plants will also be undertaken throughout the Jedburgh Station Ecological Enhancement Area to provide floristic diversity and habitat resources for indigenous fauna. These actions, combined with pest animal control, will benefit many forest and scrub invertebrate species.

Compensation

Establishment of ungulate exclusion area: An approximately 245-hectare area of mānuka forest and scrub (the 'Jedburgh Station Ecological Enhancement Area') will be fenced to exclude stock, deer, and pigs (as outlined in the HREP and shown in Figure TIMP-2a). Enhancement planting will be undertaken throughout the area to provide floristic diversity and habitat resources for indigenous fauna. These actions, combined with pest animal control, will benefit many forest and scrub invertebrate species.

Aerial pest animal control: Aerial control of predators such as rats and possums, together with feral deer, will be undertaken across *c*.1,400 hectares of indigenous habitats within the Jedburgh Station Pest Control Area. This will increase the carrying capacity of the habitat and will also reduce overall invertebrate mortality and injury from predation. Controlling deer and possums in the southern rātā-kāmahi forest, in particular, will enhance the habitat for many species, including giant springtails, ground beetles, and trapdoor spiders, which are currently likely limited by predator activity and browsing.

Targeted control of feral deer and pigs: The Jedburgh Plateau will, in addition to the Jedburgh Station Pest Control Area actions described above, be subject to targeted deer and pig control that will be undertaken on a six-monthly basis (May-June and February-March). This will enhance habitat for species such as ground beetles (including Helms' stag beetles) and short-horned grasshoppers.

4.3.2 Disturbance, death, injury, and displacement during development

Avoidance

Avoiding important habitat clearance: During the design phase of the project, extensive project-shaping was completed to ensure important invertebrate habitat was avoided as much as practicable (e.g. wetlands, southern rātā-kāmahi forest). For example, two new areas of wetlands identified during pre-construction surveys in February 2024 near MAT-12 and MAT-14 have been avoided by realigning the wind farm road. Wetlands and indigenous vegetation on the Jedburgh Plateau and tussockland at

Matariki should be avoided as much as practicable due to its importance for moths and grasshoppers, and difficulty in restoring or replacing it. However, avoidance is not always possible as many different factors must be considered in wind turbine placement. Some notable species (such as ground beetle and red and black millipede) are too widely-dispersed on the property to avoid.

Mitigation

Minimising habitat clearance: Where clearance of important invertebrate habitat cannot practicably be avoided, as much of it should be retained as practicable. This will be achieved through adhering to the vegetation clearance protocols set out in the Vegetation Management Plan. Habitat such as tussock, indigenous mosses and lichens, large rocks, and clay soils should be cleared as little as practicable.

Relocation of cleared habitat: Where indigenous woody vegetation, dead wood, or large rocks are to be cleared, they should be stacked next to a restored patch of similar habitat, as close as practicable to the location of removal, to enhance the restored habitat. This is a type of relocation, but entire communities are involved and moved together. Like all invertebrate relocation, this technique is experimental.

Salvage and relocation: Species-specific salvage and relocation protocols are outlined in Section 5.2. Salvage and relocation will take place under supervision by the Project entomologist.

Direct manual salvage will be carried out for grasshoppers, trapdoor spiders and Helms' stag beetle (refer to SBMP) in the locations shown in Figures TIMP-2a and 2b.

Ground beetles (all three species), red and black millipedes, and any other notable invertebrates caught in live-capture pitfall traps will be salvaged alongside Helms' stag beetles (refer to SBMP) and released, with the release location depending on the species and location found. Table 5 presents release locations for different species found in different locations within the Wind Farm Site.

Salvaging operations for red and black millipedes and leaf-veined slugs are not practicable due to these species' habits and difficulty finding them in large enough numbers to be worthwhile. However, if they, or other notable species are found during these salvages, they will also be relocated to one of the two relocation sites. Salvage and relocation are a last resort measure to save individuals from injury and mortality, as invertebrate relocations are under-researched and have variable success rates. The major issues with relocation include:

- Lack of data on success rates means that all invertebrate translocation is experimental.
- Stress while being handled and transported may affect survival rates.
- Salvaging only the notable species does not prevent biodiversity loss.
- Habitat requirements are not always understood sufficiently to gauge how many new individuals can be supported in enhanced habitat.
- Small juvenile ngaokeoke and grasshoppers are easily injured during handling.

Compensation

Aerial pest animal control: Aerial control of pest mammals such as rats and possums within the Jedburgh Station Pest Control Area (as outlined above) will significantly reduce predation pressure on indigenous invertebrates.

Ground-based control of rats: Intensive rat control in the 55-hectare Plateau Fauna Enhancement Area on the Jedburgh Plateau to address residual effects on terrestrial invertebrates.

Control of exotic social wasps: Wasp control will be carried out, as set out in the HREP.

Contribution towards research into invertebrate effects management: A Masters grant for $30,000 will be provided for research into invertebrate translocations, including for stag beetles and the other species mentioned in this plan. The research should include developing best practices for translocating invertebrate taxa, including habitat translocations such as stacking cleared vegetation, as well as direct salvage and translocation. This information would be of significant benefit to future invertebrate mitigation packages for other development projects as it will provide more certainty around the efficacy of undertaking salvage operations for invertebrates. This will lead to gains in invertebrate biodiversity throughout Aotearoa New Zealand, particularly concerning the species and habitats that are present on-site. Although it is compensation, it has the potential to achieve great biodiversity gains, as researching effects management for invertebrates is essential to understanding how invertebrates are affected by developments when effects management is applied.

4.3.3 Increased risk of predation

Avoidance

Avoid attracting pests to the site: When working on-site, take care not to leave litter or drop human food which may attract wasps, rodents, and other pest animals. Any dropped food or litter must be picked up immediately.

Mitigation

Control pest animals in and around infrastructure: In order to reduce predation pressure on indigenous invertebrates on the Jedburgh Plateau, DOC200 traps, DOC250 traps, and feral cat traps will be spaced evenly along the wind farm road network, targeting mustelids, rats, and feral cats.

5.0 Salvage and Relocation Protocol

5.1 Prior to any work commencing

Relevant contractors, the Environmental Manager and other authorised personnel will undertake an induction to be briefed on the following:

- Notable invertebrate species present on-site and what they look like.
- Where to look out for notable invertebrates.
- The Incidental Discovery Protocol and what to do if a notable species is found.
- Where any invertebrate management will be undertaken (including the release areas).
- The timeframe for associated works.

At each site with notable species (identified on Figures TIMP-2a and 2b), salvage will begin before vegetation clearance begins. Table 5 gives an overview of the species to be salvaged, salvage methods, and release areas. Figures TIMP-2a and 2b show salvage and release areas for different species on-site, and the areas where supervised vegetation clearance will be needed for trapdoor spiders.

Table 5 – Release locations for different species found in different locations within the wind farm site.

Species	Salvage method	Release area if found on Jedburgh	Release area if found at Matariki
Ground beetle (any species from Table 3)	Incidental salvage if discovered while salvaging other species	The nearest patch of vegetation that is at least 50 metres away from vegetation scheduled for clearance	The nearest patch of vegetation that is at least 50 metres away from vegetation scheduled for clearance
Short-horned grasshopper	Manual salvage (Section 5.4)	Grasshopper release areas marked on Figure TIMP-2a	The release site at Matariki Forest shown in Figure TIMP-2b, referred to in the Ecology Report and LMP as the 'Copper Tussock Enhancement and Skink Protection Area'
Helms' stag beetle	Refer to SBMP (Part B)	Refer to SBMP (Part B)	Refer to SBMP (Part B)
Ngaokeoke	Incidental salvage if discovered while salvaging other species, and incidental salvage while moving logs and other woody vegetation	The Jedburgh Station Ecological Enhancement Area	The release site at Matariki Forest shown in Figure TIMP-2b, referred to in the Ecology Report and LMP as the 'Copper Tussock Enhancement and Skink Protection Area'
Leaf-veined slug	Incidental salvage if discovered while salvaging other species	The nearest patch of vegetation that is at least 50 metres away from vegetation scheduled for clearance	The nearest patch of vegetation that is at least 50 metres away from vegetation scheduled for clearance
Giant springtail	Incidental salvage if discovered while salvaging other species, and incidental salvage while moving logs and other woody vegetation	The Jedburgh Station Ecological Enhancement Area	The release site at Matariki Forest shown in Figure TIMP-2b, referred to in the Ecology Report and LMP as the 'Copper Tussock Enhancement and Skink Protection Area'
Trapdoor spider	Manual salvage (Section 5.3)	The Jedburgh Station Ecological Enhancement Area	The release site at Matariki Forest shown in Figure TIMP-2b, referred to in the Ecology Report and LMP as the 'Copper Tussock Enhancement and Skink Protection Area'
Red and black millipede	Incidental salvage if discovered while salvaging other species	The Jedburgh Station Ecological Enhancement Area	The release site at Matariki Forest shown in Figure TIMP-2b, referred to in the Ecology Report and LMP as the 'Copper Tussock Enhancement and Skink Protection Area'

5.2 Salvage alongside Helms' stag beetles

Ground beetles, red and black millipedes, and any other notable invertebrates found will be salvaged alongside Helms' stag beetles in the Helms' stag beetle salvage areas (Figures TIMP-2a ; refer to SBMP). Helms' stag beetles will be salvaged using a combination of live-capture pitfall trapping and hand-searching (refer to the SBMP below for methods).

5.3 Trapdoor spider

Trapdoor spider salvage at Jedburgh Station will begin within one month before vegetation clearance begins. Areas for trapdoor spider salvage are shown on Figures TIMP-2a and 2b.

At Jedburgh Station, trapdoor spider burrows will be searched for during the day in areas where they have been found during the surveys. Burrows will be marked. Searching should take no more than five days for all Jedburgh populations. Over two or three nights, spiders will be extracted using beetling (Smith *et al.* 2015). Any juveniles found in burrows will be kept with their mothers. Males may be found on the surface of the ground at night and will be captured. Salvaged spiders will be taken to the Jedburgh Station Ecological Enhancement Area and each individual will be made a new hole by poking a pen into the ground and inserting the spider. Trapdoor spiders cannot make their own holes once they reach adulthood. Any juveniles will be put into the burrows with their mothers. Males will be released within 10 metres of the new population onto the surface of the ground.

At Matariki, trapdoor spider burrows will not be able to be found easily amongst the thick ground vegetation. Instead, supervised vegetation clearance will be necessary to spot and collect spiders as they are unearthed. The areas for supervised vegetation clearance are shown in Figure TIMP-2b Salvaged trapdoor spiders will be released at the release site at Matariki Forest shown in Figure TIMP-2b.

5.4 Short-horned grasshopper

Manual day-salvaging of short-horned grasshopper prior to vegetation clearance will be undertaken within two weeks before vegetation clearance is scheduled to begin within the salvage areas shown in Figure TIMP-2a, on the Jedburgh Plateau.

Manual day-salvaging methods will involve two people hand-searching on warm, sunny days, where practicable, using a sweep net to sweep vegetation and capture grasshoppers moving through the grass. The same areas will be searched for a minimum of five days. Since five consecutive sunny days are unlikely to occur, and grasshoppers are not likely to move much on non-sunny days, a break of up to three days can be taken between search days due to poor weather conditions. After day five, searching will cease.

Short-horned grasshoppers that have been salvaged will be released into the nearest scrub or grassland vegetation similar to that in which they were found, but at least 100 metres away from any vegetation scheduled to be cleared.

Short-horned grasshoppers are highly unlikely to be found outside of the Jedburgh Plateau, but if they are found elsewhere in Jedburgh Station they will be relocated to similar nearby habitat at least 100 metres from any vegetation scheduled for clearance. If found at Matariki, they will be released at the release site at Matariki shown on Figure TIMP-2b.

contact

LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Jedburgh Plateau
- Civil Works Design
- Wind Farm Site

Salvage and Release Sites

- Trapdoor Spider Salvage Areas
- Short Horned Grasshopper Salvage Areas
- Helms' Stag Beetle Salvage Areas
- Short Horned Grasshopper Release Areas
- Tautuku Gecko Soft Release Pen and Helms' Stag Beetle Relocation Site
- Important Invertebrate Habitat
- Jedburgh Station Ecological Enhancement Area (Terrestrial Invertebrate Release Site)

MAP SCALE	PRINT DATE
N Scale: 1:20,000	15/08/2025
	VERSION 1.0

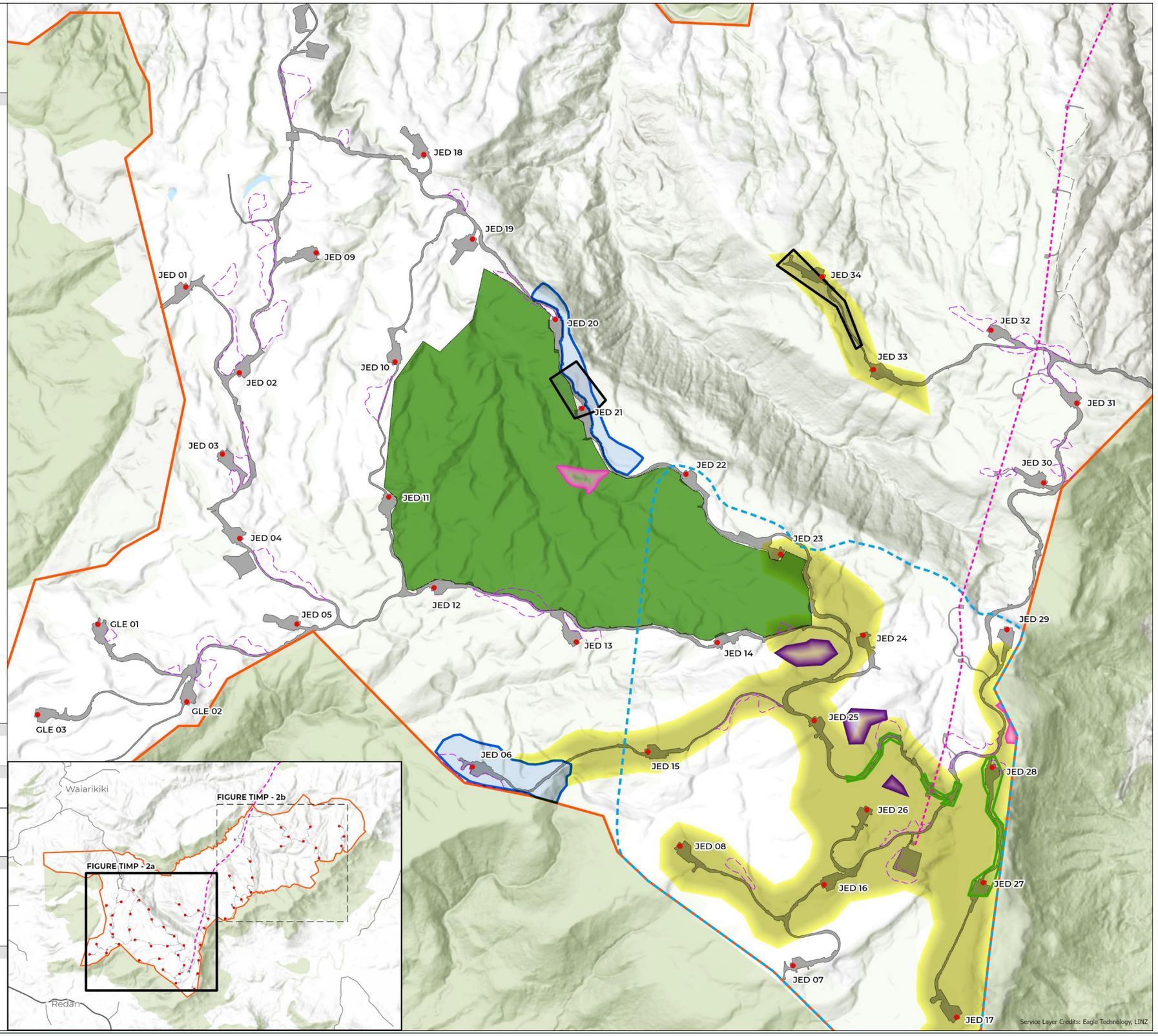
Kilometers
0 0.25 0.5 1

CREDITS:

Wildlands
Ecological data provided by Wildlands Consultants

TITLE

FIGURE TIMP - 2a
TERRESTRIAL INVERTEBRATE
SALVAGE AND RELEASE AREAS
WIND FARM SITE - WEST



contact

LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Civil Works Design
- Wind Farm Site

Salvage and Release Sites

- Supervised Vegetation Clearance for Trapdoor Spiders
- Helms' Stag Beetle Salvage Areas
- Copper Tussock Enhancement and Skink Protection Area
- Important Invertebrate Habitat

MAP SCALE	PRINT DATE
N Scale: 1:20,000	15/08/2025
	VERSION
	1.0

Kilometers
0 0.25 0.5 1

CREDITS:

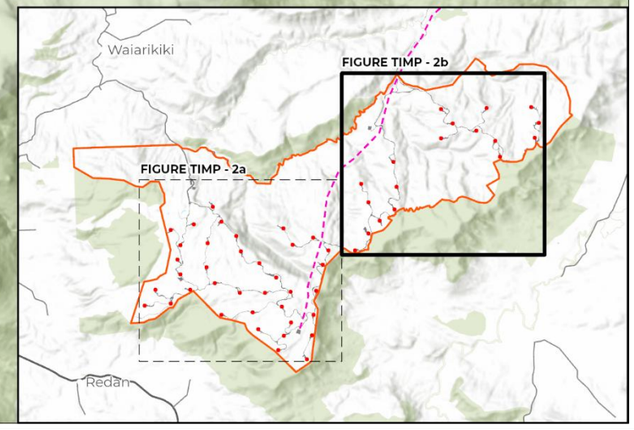
Wildlands
Ecological data provided by Wildlands Consultants

TITLE

FIGURE TIMP - 2b
TERRESTRIAL INVERTEBRATE SALVAGE AND RELEASE AREAS
WIND FARM SITE - EAST

MAT 01
MAT 02
MAT 03
MAT 04
MAT 05
MAT 06
MAT 07
MAT 08
MAT 09
MAT 10
MAT 11
MAT 12
MAT 13
MAT 14
MAT 15
MAT 16
MAT 17
MAT 18

Service Layer Credits: Eagle Technology, LINZ



5.5 Ngaokeoke and giant springtail habitat

Giant springtails and ngaokeoke have similar habitat requirements, inhabiting trees and rotting wood and preferring humid locations, although ngaokeoke can survive in exotic vegetation. If ngaokeoke and/or giant springtails are found during salvage operations for other species (particularly Helms' stag beetle), they will be salvaged directly. This will need to be done gently using a paint brush or similar soft tool to move the animals into suitable plastic containers. **No specific manual salvage is needed for giant springtails or ngaokeoke.**

Most ngaokeoke and giant springtail salvage will be undertaken via the uplift and repositioning of logs or stumps where they reside, as has been undertaken for ngaokeoke in Dunedin (New Zealand Transport Agency Waka Kotahi Caversham Highway widening project; Randle 2014). Only logs or stumps that are being cleared as part of vegetation clearance need to be removed. These logs can be stacked as log stacks in the release areas (the Jedburgh Station Ecological Enhancement Area and the Matariki Release Site, Figures TIMP-2a and 2b) as part of habitat restoration for lizards and invertebrates. They do not need to be placed only within the soft release pens.

In areas where ngaokeoke and/or giant springtails have been found, logs or stumps that are most likely to contain ngaokeoke are as follows:

- Logs or stumps that can be broken by a hard blow, but not by a soft blow; and
- Logs or stumps at least 60 centimetres in diameter.

Such logs will be prioritised for stacking in the Jedburgh Station Ecological Enhancement Area (Figure TIMP-2a). In addition, if any mature indigenous trees (i.e. >25 cm diameter) are felled anywhere on-site they will be sliced into logs and relocated in stacks to the Jedburgh Station Ecological Enhancement Area (if found on Jedburgh, Figure TIMP-2a) or the Matariki Release Site (if found on Matariki; Figure TIMP-2b). They do not need to be confined to soft release pens within the release areas.

Logs and stumps will be moved during the day, when ngaokeoke and giant springtails are least active.

Machinery assistance will most likely be required.

Relocation of salvaged stumps and logs that may contain ngaokeoke and/or giant springtails should be undertaken on the same day during daylight hours, ideally no more than four hours following extraction.

5.6 Supervised vegetation clearance

Vegetation clearance may commence within the Project footprint immediately following salvage. Throughout most of the site, vegetation clearance does not need to be supervised unless vegetation to be cleared is not to be stacked in suitable habitat (Sections 4.3, 5.5; refer also to the LMP).

Supervision will include suitably-qualified ecologists checking any felled tree branches, trunks, leaf litter, topsoil and foliage for notable invertebrates. Any notable invertebrates found during supervised vegetation clearance will be salvaged and moved to a suitable location (Table 5).

The only area where vegetation clearance needs to be supervised regardless of where the vegetation ends up is near the trapdoor spider sighting at Matariki (Figure TIMP-2b). When vegetation is to be cleared within the area designated on Figure TIMP-2b for supervised vegetation clearance, topsoil will be searched by hand to find any trapdoor spiders which have been unearthed. These will then be released into the release site at Matariki (Figure TIMP-2b) using protocols described in Section 5.3.

If any populations of species that are protected under the Wildlife Act are detected during supervised vegetation clearance, and effects on these populations have not already been managed, works will cease and the Incidental Discovery Protocol will be followed.

5.7 Data collection

Data recorded upon capture will include species identity and age (adult or juvenile/larva). Each stage of salvage will be recorded, including start/stop date and time, GPS coordinates, and a habitat description for the capture location. Weather conditions will be recorded during and at the beginning and end of each salvage event.

5.8 Transportation of invertebrates

All captured invertebrates will be temporarily placed in clean individual containers, in cool, full shade. A small amount of damp leaf litter or vegetation from the capture site will be placed inside the containers with the invertebrates to provide cover and prevent dehydration. Any invertebrates captured will be handled and held carefully and as little as possible. All individuals salvaged will be released as soon as practicable (and within 12 hours) to the pre-selected species-specific release areas.

5.9 Relocation

Invertebrates that are salvaged will be relocated depending on their species and the location they were found, according to Table 5.

5.10 Other risks associated with proposed management

Potential risks to invertebrates from the proposed salvage, and management actions to reduce these risks, include:

- **Failure to capture all individuals at the salvage site**
  - Issue: Capture of all individuals present at the salvage site is unlikely due to the cryptic nature of invertebrates and the large numbers that may be present in the habitat. Even if an area is cleared of most individuals, more may move into the area from surrounding habitat.
  - Action: Vegetation clearance will commence within eight days after salvage to prevent more individuals from arriving into the salvaged habitat.
- **Injury/death**
  - Issue: Incorrect trapping or handling during salvage by untrained staff.
  - Action: All invertebrates will be captured or supervised by an appropriately qualified entomologist, following best practice and full hygiene protocols, minimising the risk of injury, death and disease transmission through inappropriate handling and capture.

- **Mixing of genetics between populations that would not naturally mix**
  - Issue: Notable species are often spot endemics or have heavily genetically-structured metapopulations. Releasing individuals from on-site into an off-site population may introduce genetic elements that were not previously present in that population, potentially causing harmful effects.
  - Action: Invertebrates will be released into suitable habitat within the same property.

6.0 Incidental Discovery Protocol

6.1 Overview

Incidental discovery protocols are set out below and are to be followed if any notable invertebrates are discovered during project activities.

6.2 Identifying notable species

Notable invertebrate species are variable in appearance, and invertebrates are highly abundant and diverse. Notable species tend to be cryptic and not brightly-coloured or striking in appearance. Therefore, distinguishing notable from non-notable species can be difficult. However, a few traits are common amongst most notable species, and can be used to discern whether a specimen requires further investigation (Table 6).

6.3 Where notable invertebrates might be found

Notable invertebrates are usually found in and around rock piles, rocky outcrops, piles of rotting plant debris, and rotting wood. They may also be found in herbfield, forest, and shrubland, but are unlikely to be noticed as easily. In most cases, a sighting of a notable invertebrate requires informing the Project Ecologist and providing a picture or sample of the specimen. However, there is a small chance that large (more than twenty millimetres) snail shells may be unearthed on or near the Jedburgh Plateau which may be protected carnivorous land snails. The only non-notable snail species of that size is likely to be the common garden snail (*Cornu aspersum*), which is distinguishable by the pattern on its shell. Any suspected carnivorous land snail should be reported immediately. Snails are likely to be sheltering in vegetation or litter during the day.

An incidental discovery protocol for Helms' stag beetles is provided separately as part of the SBMP.

Table 6 – Traits for identifying notable invertebrate species and recommended management actions.

Trait	Examples of notable invertebrates showing this trait	Action upon finding an invertebrate with this trait
Large (>3 cm across) snail.	Carnivorous land snail	Stop work in the immediate location, take a photograph or live-capture a sample, and seek advice from the Project ecologist or DOC. Do not resume work until advised by the Project Ecologist or DOC.
Flightless and slow-moving (except snails, which may only be notable if found on the Jedburgh Plateau)	Ground beetle Ngaokeoke/peripatus	Send a photograph (or live-capture a sample) to the Project ecologist and seek their advice.
Large body size for the type of animal (except stick insects, which are not notable)	Ground beetle Giant springtail	Send a photograph (or live-capture a sample) to the Project ecologist and seek their advice.

PART B: HELMS' STAG BEETLE MANAGEMENT PLAN

1.0 Introduction

Contact Energy Limited (Contact) is proposing to construct and operate the Southland Wind Farm (the Project).

This Stag Beetle Management Plan (SBMP) has been prepared to support the wildlife approvals sought in the substantive application made by Contact. It forms Part B of the Terrestrial Invertebrate Management Plan (TIMP) and the potential impacts that the construction phase of the Project will have on indigenous invertebrates will be managed in an integrated and holistic manner.

Contact is proposing to construct and operate the Project on Jedburgh Station, Matariki (Venlaw) Forests, and Glencoe Station. Up to 55 wind turbines will be located over an area of approximately 5,790 hectares. Contact engaged Wildland Consultants Ltd (Wildlands) to undertake general invertebrate field surveys on-site. After Helms' stag beetle (*Geodorcus helmsi*; threat classification not assessed) was confirmed present on-site, and carnivorous land snail habitat was identified, further surveying was undertaken. A total of four terrestrial invertebrate surveys have been conducted on-site:

- A preliminary general terrestrial invertebrate survey.
- A comprehensive general terrestrial invertebrate survey.
- A carnivorous land snail survey.
- A targeted Helms' stag beetle survey and general invertebrate pitfall trapping.

Helms' stag beetles are protected under the Wildlife Act (1953), meaning that collecting, killing, or possessing a Helms' stag beetle specimen is illegal.

This SBMP adheres to the legislation and principles outlined by the Wildlife Act 1953 (Wildlife Act) and the Resource Management Act 1991 (RMA). These policies and principles are integrated to prescribe successful management of invertebrate biodiversity. Table 1 summarises the purpose, objectives, and performance measures outlined in this SBMP.

The primary impact of the Project on Helms' stag beetle will occur during the construction phase, particularly vegetation clearance in areas that have been identified as potential Helms' stag beetle habitat. Geotechnical and enabling works will also impact Helms' stag beetles where they take place in stag beetle habitat.

Table 1 – Purpose, specific objectives, performance measures and monitoring relevant to this SBMP.

Purpose	This SBMP describes the measures that will be implemented to minimise the potential effects associated with the geotechnical and enabling works, and the construction phase of the Project on Helms' stag beetles, and to meet the requirements of the Wildlife Act and conditions EC19 to EC26 of the resource consent conditions in respect of Helms' stag beetles.
Specific Objectives	The objective of this SBMP is to describe measures to minimise potential adverse effects arising from the construction of the Southland Wind Farm on Helms' stag beetle.
Performance Outcomes	This SBMP has been prepared by a **suitably-qualified and experienced ecologist** and includes: (a) Summary of Helms' stag beetle surveys within suitable habitat in the Project footprint; (b) Timing of the works; (c) An overview of effects management; (d) A description of salvaging methodology; and (e) A description of relocation methodology, including transfer methods and relocation site(s) selection. Habitat enhancement measures are provided in the Habitat Restoration and Enhancement Plan (HREP) and referred to in this SBMP.
Monitoring (Part C, Section 1.0)	• The location of capture and release of any salvaged Helms' stag beetle will be recorded. • Helms' stag beetle monitoring will be carried out in areas enhanced for Helms' stag beetles, including the Jedburgh Station Ecological Enhancement Area and the Matariki Release Site. • Populations of Helms' stag beetle will be monitored within the release area(s), including salvaged individuals. • Helms' stag beetle monitoring should not require a WAA.
Reporting (Part C, Section 2.0)	• A compliance monitoring report will be submitted annually (covering the year 1 July to 30 June) during the construction phase of the Project to Southland District Council by 30 September each year. The compliance monitoring report may take the form of sections of a larger report including reporting on lizards and other ecological values. • Reporting requirements outlined in the Wildlife approval (once granted) will be adhered to in all reports where necessary. Contact's preference is for an annual (1 July to 30 June) report to be submitted by 30 September.

2.0 Wildlife Approval Requirements

2.1 Overview

Schedule 7 of the Wildlife Act declares some specific terrestrial invertebrates as animals, including Helms' stag beetle, which are therefore protected under the Act. Killing, harming, disturbing, capturing, or handling protected wildlife without a permit is prohibited under New Zealand law unless a WAA is obtained from DOC.

2.2 Responsibilities and competencies

The technical ecology lead role will be performed by the Project Ecologist in consultation with an entomologist where appropriate, and the Environmental Manager.

The responsibilities of the Environmental Manager(s) include but are not limited to:

- Reading and understanding the SBMP.
- Facilitating a Project start-up meeting with the site manager, Site Engineer(s), Project Ecologist and the vegetation clearance contractors before vegetation clearance commences for each construction stage. The purpose of this meeting is to establish the areas scheduled for clearance where Helms' stag beetle populations have been identified as the result of targeted surveys, to induct everyone working on-site to the incidental discovery protocol (Section 8.0) and to enable forward planning and avoid delays in the construction schedule.
- Contacting the Project Ecologist a minimum of 20 working days before any of the areas of potential stag beetle habitat (outlined in Table 2) are scheduled for clearance.
- Maintaining clear lines of communication with the Project Ecologist and the vegetation clearance contractors regarding changes in the works schedule.
- Brief new personnel about the vegetation clearance contractors' responsibilities under this plan.

The implementation of the SBMP will be supervised by the Project Ecologist. The Project Ecologist will, for the purposes of implementation of the SBMP, be suitably-qualified and experienced and hold a WAA for protected species found on the site. If the Project Ecologist does not have entomology qualifications or experience, they will work in consultation with an invertebrate ecologist/entomologist.

The Environmental Manager is responsible for reporting the discovery of 'Threatened' or 'At Risk' invertebrates to the Local Area Manager (DOC) and for maintaining a database with an incident register and file log of actions taken for each such discovery.

3.0 Helms' Stag Beetle

Helms' stag beetle is a large (1.7-4.4 centimetres long) black beetle in the stag beetle family Lucanidae. Like all species in the genus *Geodorcus*, Helms' stag beetle is legally protected under the Wildlife Act. Although they are widespread throughout the West Coast, Fiordland, and Southland, their threat status has not yet been assessed. Helms' stag beetle is flightless and slow-moving, and has little defence against introduced mammalian predators, particularly rodents, which are their main threat (Grey *et al.*, 2024).

Little is known about the habitat requirements of Helms' stag beetle. While they are mostly found in mature indigenous forest, particularly podocarp forest (Thomas, 2024), they are also found in tussock (Holloway, 2007). Rotting wood or other plant material, rich soil, and a layer of litter are all apparently important aspects of their habitat.

Three of the nine Helms' stag beetle specimens found at the Wind Farm Site were dead and partially eaten, indicating that introduced predators may be a limiting factor for the local population. The presence of introduced predators, including feral pigs (*Sus scrofa*), is likely to have significant adverse effects on the Helms' stag beetle population within the Wind Farm Site.

Some areas of the Wind Farm Site have been identified as potential Helms' stag beetle habitat (Figures SBMP-1a and 1b). While Helms' stag beetle presence has not been confirmed in these areas, the habitat appears to be suitable and undetected populations may still be present. As such, geotechnical and enabling works, and the construction of the wind farm, within these areas could cause habitat loss and fragmentation, and Helms' stag beetle mortalities if construction effects are not appropriately managed. Adverse effects on Helms' stag beetles will be managed through minimisation, habitat enhancement, and predator control, as outlined in the HREP and VMP.

4.0 Consent Condition and Wildlife Approval Scope

This SBMP has been developed in accordance with the requirements of the wildlife approval and consent conditions for the Project.

The requirements of consent conditions and the wildlife approval will be addressed through the implementation, monitoring, and reporting procedures described in this SBMP, and the management plans outlined below:

- **The Vegetation Management Plan (VMP)** - which includes detail on how adverse effects on terrestrial ecology associated with vegetation clearance (including effects on Helms' stag beetle and more broadly invertebrates) will be minimised through vegetation clearance protocols.
- **Habitat Restoration and Enhancement Management Plan (HREP)** - which includes detail on the location, magnitude and type of indigenous habitat restoration and enhancement measures that are proposed to mitigate, offset or compensate for significant residual effects on ecological values.

5.0 Summary of Survey Work

5.1 Preliminary surveys (April 2023)

As detailed in the Ecological Assessment (Wildlands 2025), preliminary invertebrate surveys were undertaken in April 2023, using approximately the same search locations as the lizard survey. Options for night searching and hand-searching some areas of the Wind Farm Site were limited, but the general state of the habitat and invertebrate biodiversity was assessed.

During these surveys, two Helms' stag beetles were detected (one living female and one dead male; found at the southwestern stag beetle location indicated on Figures SBMP-1a and 1b), triggering further surveys, undertaken in early 2024.

5.2 General invertebrate survey (February 2024)

Further general invertebrate surveying (including Helms' stag beetle but not specifically targeting them) via pitfall trapping was undertaken in the invertebrate active season of early 2024. Full details

of survey locations and methods are detailed in the Ecology Addendum prepared by Wildland Consultants (2024), and the survey areas are illustrated in Figures SBMP-1a and 1b. A further two Helms' stag beetles were found during this survey (one living female and one mostly-eaten carcass that had probably been a male), one in the same location as the previous two and another in the northeastern location marked on Figure SBMP-1a, bringing the total to four.

The understorey of much of the mānuka forest was absent or sparse in some areas (primarily between JED-11 and JED-14), probably due to the high numbers of red deer (*Cervus elaphus*) and pigs. Deer, pig, and possum (*Trichosurus vulpecula*) sign was prevalent throughout the survey area, which may explain the lack of forest understorey in parts. Stag beetles require moisture and rotting plant material associated with a healthy understorey, so may only be present at low abundance, if at all, in forested areas with little understorey. Deer, pigs and possums may also cause disturbance to larvae in rotting wood and leaf litter, and pigs and possums will eat larvae and possibly adults.

5.3 Carnivorous land snail survey (March 2024)

The carnivorous land snail survey was undertaken on 20-21 March 2024. The Jedburgh Plateau (Figure SBMP-1a) was searched thoroughly for shells and live snails hiding in roost plants or leaf litter during the day, and for any active live snails at night. The methods used to search for snails would also have found Helms' stag beetles. Full details of the survey locations and methods are detailed in the Wildlands (2024) addendum. Conditions were good for invertebrate activity, being warm during the day and with recent rain and damp ground. Carnivorous land snails and Helms' stag beetles were not found during this survey.

5.4 Further targeted Helms' stag beetle surveys (November 2024 and January 2025)

The findings from the general invertebrate surveys confirmed the presence of Helms' stag beetle within the Wind Farm Site. Targeted surveys for Helms' stag beetles were then conducted to approximate their distribution on-site, using spotlit searches at night combined with pitfall trapping. Other invertebrates were also recorded during these surveys if they had not previously been found, or if they were notable. A more detailed description of these surveys is included in Wildlands (2025).

The targeted surveys consisted of two surveying rounds. The first round of surveying occurred from 6 to 11 November 2024, with the second round occurring from 21 to 27 January 2025.

5.4.1 Pitfall trapping

The potential Helms' stag beetle habitat on-site was split into six areas (see Table 2 and Figures SBMP-1a and 1b). Traps were set and retrieved in groups by area, so that trapping periods in different areas of the site were staggered to make the most efficient use of resources. Pitfall traps were deployed in clusters of five traps, with each cluster at least 20 metres apart, depending on habitat, time, and area constraints. Trap locations are reported here for use in future monitoring.

Wildlands deployed 28 trap grids, each of which comprised five live-capture pitfall traps throughout the site (Table 2), eight within the Matariki Forest and 20 within Jedburgh Station. No targeted surveys were conducted in the Glencoe Station as no suitable habitat was available for Helms' stag beetle. Weather during night searches for both the 2024 and 2025 survey periods was generally good for stag beetles. Traps were initially checked two days after deployment and remained open for a minimum of four fine nights, after which they were removed and the holes were filled in.

Table 2 – Areas of potential Helms' stag beetle habitat and search effort at the Southland Wind Farm

Area Number	Turbines	Number of Pitfall Traps Deployed	Number of Hours of Night Searching
1	JED-6, 15	15	2
2	JED-1, 11-14, 24	30	3
3	JED-20, 21	15	3
4	JED-25-29, 16, 17	25	5
5	JED-31-34	15	2
6	MAT-14-16, 9-10	40	2

5.4.2 Night-time hand searching

Helms' stag beetle habitat was searched at night by two people for two hours each, using headlamps. Each area was subject to one night search. Areas 4 and 6 (Table 2) were previously searched at night during the general invertebrate surveys (Area 6) and the targeted giant land snail survey (Area 4). Therefore, there was no need to search for them again. Beetles were searched for under logs, on tree trunks, and on the ground. Habitat was handled carefully so that it was not damaged.

5.5 Overall survey and habitat assessment results

Nine Helms' stag beetle within the Wind Farm Site have so far been found, in mānuka forest and scrub in two locations (Figure SBMP-1a) and in a boggy patch of flax, mountain holly, copper tussock and astelia in one location (Figure SBMP-1b). However, they may be found in other types of forest, scrub, tussock, and shrubland. Stag beetles require large areas with untreated rotting plant material and living indigenous tussock, forest or shrub habitat to survive (Thomas 2024; Holloway 2007). Copper tussock, scrub and shrubland may be important for Helms' stag beetle moving between habitat patches, where the shrubs form dense thickets.

Generalised invertebrate surveys and targeted Helms' stag beetle surveys have been carried out in all potential patches of suitable habitat. All accessible indigenous forest and tussock habitat has been searched. To obtain a more accurate understanding of Helms' stag beetle distribution and abundance, the Helms' stag beetle surveys have been targeted to specific areas of Helms' stag beetle habitat (Figures SBMP-1a and 1b). All indigenous forest, and some indigenous scrub and tussock, is considered potential Helms' stag beetle habitat where it covers large contiguous areas. Small, isolated patches of forest are not considered potential Helms' stag beetle habitat.

contact

LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Jedburgh Plateau
- Civil Works Design
- Wind Farm Site

Helms' Stag Beetle Surveys

- Helms' Stag Beetle Sighting
- Pitfall Traps
- Potential Stag Beetle Habitat
- Terrestrial Invertebrate Night Search Area
- Terrestrial Invertebrate Day Search Area
- Jedburgh Station Ecological Enhancement Area

MAP SCALE	PRINT DATE
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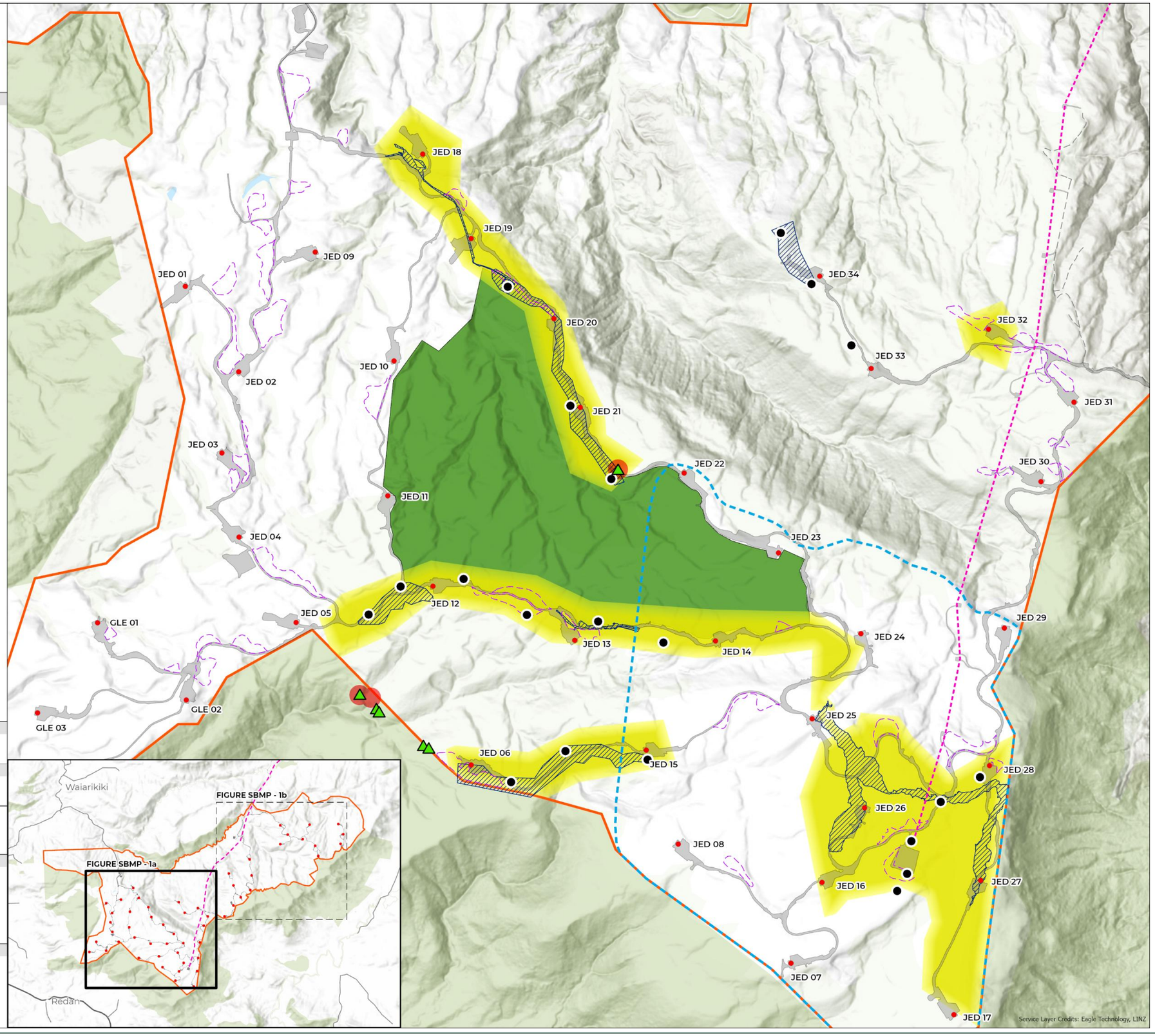
Kilometers
0 0.25 0.5 1

CREDITS:

Wildlands
Ecological data provided by Wildlands Consultants

TITLE

FIGURE SBMP - 1a
SURVEY AREAS AND RESULTS FOR
HELMS STAG BEETLE
WIND FARM SITE - WEST



contact

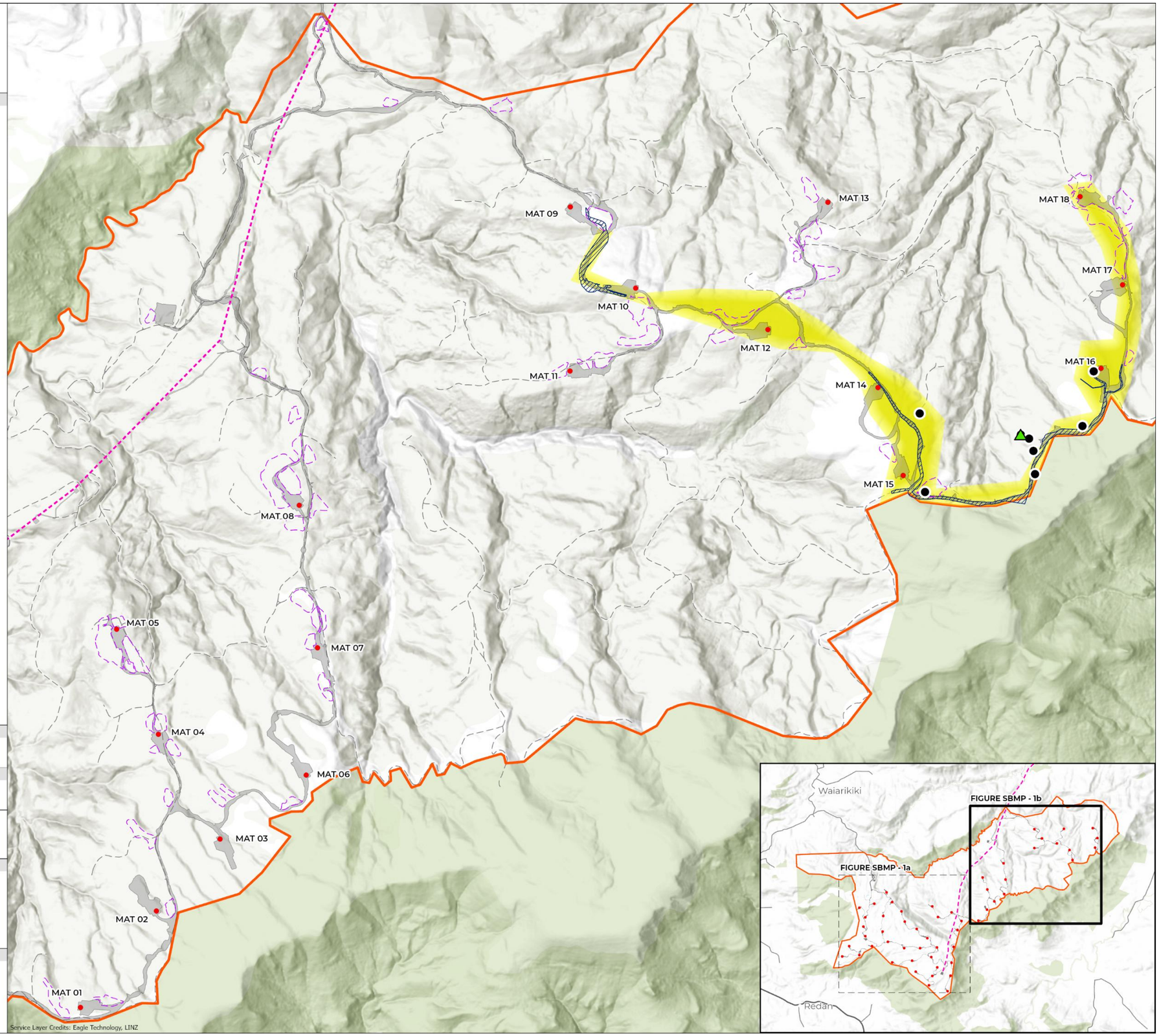
LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Civil Works Design
- Wind Farm Site

Helms' Stag Beetle Surveys

- Helms' Stag Beetle Sighting
- Pitfall Traps
- Terrestrial Invertebrate Night Search Area
- Terrestrial Invertebrate Day Search Area



MAP SCALE	PRINT DATE
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	VERSION
	1.0

Kilometers
0 0.25 0.5 1

CREDITS:

Wildlands

Ecological data provided by Wildlands Consultants

TITLE

FIGURE SBMP - 1b

SURVEY AREAS AND RESULTS FOR HELMS STAG BEETLE WIND FARM SITE - EAST

6.0 Effects on Helms' Stag Beetle and Associated Management Actions

6.1 Potential effects

6.1.1 Overview

The ecological assessment discusses potential effects of the Project on ecological values and provides an overview of the management measures, based on results of the invertebrate surveys that have been completed within the Wind Farm Site.

Vegetation clearance, for turbine platforms and road construction, is likely to have the greatest potential impact on Helms' stag beetle, through habitat loss and fragmentation. Without careful management, Helms' stag beetle will also be impacted by disturbance, direct injury and mortality, and increased impact from introduced predators. This could cause a localised decline in numbers and changes in distribution and gene flow across the site.

Potential effects of the Project in the absence of management are summarised below.

6.1.2 Loss of Helms' stag beetle habitat

Loss of habitat will, in the short term and without mitigation in place, reduce the size of the population able to be supported on-site (i.e. the site's carrying capacity for Helms' stag beetle will be lowered).

6.1.3 Fragmentation of Helms' stag beetle habitat

Fragmentation of habitat where Helms' stag beetle have been found will limit their movement and increase population fragmentation due to the limited dispersal ability of this flightless, slow-moving species. Fragmentation of habitat that current populations may have been expanding into will also limit or prevent population expansion.

6.1.4 Disturbance, death, injury, and displacement during development

Clearance of rotting wood, leaf litter, tussock and woody plants, primarily in the forest and tussock where Helms' stag beetle has been found, will kill, injure, and displace Helms' stag beetle larvae and adults. Stag beetles are also likely to be crushed by vehicles moving along roads at night or on rainy days.

6.1.5 Acute disturbance during development

Any work that continues after dark may disturb active adult Helms' stag beetle. Vibrations and dust may cause stress and decreased fitness in adults and larvae. Dust and vibration from construction may affect behaviour and communication and increase disease and mortality.

Ongoing disturbance may cause stress to larvae and adults and has the potential to reduce adult activity. Vehicle movement along roads after dark and on rainy days may cause mortality of adults. Dust and vibration from traffic may affect behaviour and communication, and cause disease and mortality.

6.1.6 Increased risk of predation

Stag beetles are highly vulnerable to predation by a range of pest mammals, primarily rats, and predation by introduced mammals is likely having a significant impact on the Helms' stag beetle population. The construction of roads at the site has the potential to increase mammal movement and therefore increase predation pressure on Helms' stag beetle.

6.2 Effects management

6.2.1 Overview

Effects management associated with the loss and fragmentation of habitats and increased predation on Helms' stag beetle is covered in the Vegetation Management Plan (VMP) and Habitat Restoration and Enhancement Management Plan (HREP). Enhancement of forest and shrubland habitat, pest plant management, and pest animal management will all contribute towards managing effects for Helms' stag beetle.

To manage residual effects, such as disturbance and mortality, further management is prescribed below. All effects management for Helms' stag beetle should be restricted to Helms' stag beetle habitat, which is primarily tussock, forest or other indigenous woody vegetation.

6.2.2 Loss of indigenous invertebrate habitat

Avoidance/minimisation

Avoid and minimise clearance of important habitat: Compared with the larger area of the site, the relatively small footprint of the wind turbines, roads, and substations means that habitat throughout much of the site will remain intact. Turbine locations and the overall wind farm layout have been redesigned to avoid high-quality Helms' stag beetle habitat to the extent practicable, such as by restricting much of the development to previously-existing farm tracks and thereby circumnavigating forest habitat instead of creating new tracks through it.

The wind farm infrastructure has been mapped by considering the least ecologically-damaging locations for structures wherever possible. During the design phase of the Project, an extensive exercise of Project shaping was completed to ensure key ecological values were avoided as much as practicable (e.g. wetlands, southern rātā-kāmahi forest). Wildlands provided input into this process. However, avoidance is not always possible as many different factors have to be considered in wind turbine placement.

Habitat enhancement

Helms' stag beetle habitat will be enhanced as part of habitat restoration and enhancement (see the HREP for details). Enhancement actions within, or adjacent to, the Wind Farm footprint (including roadside restoration) that will specifically benefit Helms' stag beetle includes:

- Controlling ungulates, possums and rats in the southern rātā-kāmahi forest within the Jedburgh Station Pest Control Area (as mapped in the HREP). Although Helms' stag beetle was not found here, controlling ungulates and possums will enhance the habitat to allow expansion of Helms' stag beetle populations, which are currently likely limited by predator activity.
- Targeted control of feral ungulates in mixed indigenous shrubland and wetlands on the Jedburgh Plateau.
- Planting small-leaved coprosma species, whaririki/mountain flax, and copper tussock at Jedburgh Station and in the Copper Tussock Enhancement and Skink Protection Area at Matariki Forest (as per the HREP).
- Stacking woody vegetation in appropriate roadside habitat on-site.

Compensation

Establishment of the 245-hectare Jedburgh Station Ecological Enhancement Area: A 245-hectare area of mānuka forest and scrub at Jedburgh Station will be fenced to exclude stock, deer, and pigs (Figure SBMP-2a; outlined in the HREP). Enhancement planting and aerial pest control will be undertaken throughout the area to provide floristic diversity and habitat resources for indigenous fauna. These actions, combined with pest animal control, will benefit many notable species including Helms' stag beetle.

Pest animal control: Ungulate and rodent control within the *c*.1,400-hectare Jedburgh Station Pest Control Area will also enable habitat to support more Helms' stag beetle as it increases in complexity.

6.2.3 Fragmentation of indigenous invertebrate habitat

Avoidance/minimisation

Considerate layout: Turbine locations and access roads are largely positioned on, or adjacent to, existing farm and forestry tracks, reducing the amount of vegetation that will need to be cleared, and the resulting habitat fragmentation. Furthermore, stag beetle habitat has been considered carefully when finalising the wind farm layout within the consented turbine 'envelopes' so that important connecting patches of habitat will be avoided where practicable.

Minimise road width: Roads within the Wind Farm Site will be as short and narrow as practicable to retain large patches of contiguous habitat.

Remediation and enhancement

Habitat enhancement in and around fill sites and temporary construction areas: Where indigenous vegetation has been cleared to construct fill disposal sites, sites will be rehabilitated including revegetation planting where appropriate, with indigenous species including copper tussock, whaririki/mountain flax, and woody species such as mānuka (refer to the HREP). This also applies to other areas that will be temporarily disturbed during the construction process, such as temporary laydown areas.

Indigenous woody vegetation that has been cleared will also be stacked beside roads where they are adjacent to existing indigenous woody vegetation. This will enhance habitat right up to the edge of the development, maximising available habitat and minimising crossing distances.

Connecting existing habitat patches: To help compensate for the residual loss of invertebrate habitat on the Jedburgh Plateau, approximately eight discrete areas (totalling 1.6 hectares) will be planted adjacent to the wind farm infrastructure and fill disposal sites (Figure 5 in the HREP). The aim of the planting is to provide improved structural habitat for invertebrates as well as enhance connectivity between existing habitats where infrastructure would otherwise act as an obstacle.

Revegetation within the Ecological Enhancement Area: Approximately 8.7 hectares of farm tracks and fire breaks will be revegetated within 'mānuka forest and scrub' inside the fenced Jedburgh Station Ecological Enhancement Area. This action will increase overall habitat for invertebrates as well as enhance connectivity between populations.

6.2.4 Disturbance, death, injury, and displacement during development

Avoidance

Avoiding important habitat clearance: As detailed in Section 7.3, important Helms' stag beetle habitat will be avoided where practicable.

Minimisation

Minimising habitat clearance: Where clearance of habitat where a Helms' stag beetle population has been confirmed cannot be avoided, as much of it should be retained as possible. This will be achieved through adhering to the vegetation clearance protocols set out in the VMP.

Relocation of cleared habitat: Where woody vegetation or fallen wood is to be cleared within an area identified in Figures SBMP-2a and 2b as being Important Invertebrate Habitat, the debris should be stacked within the two proposed stag beetle release sites (distributed throughout accessible areas of the Jedburgh Station Ecological Enhancement Area and the Copper Tussock Enhancement and Skink Protection Area at Matariki; Figures SBMP-2a and 2b). This is a type of relocation, but entire micro-communities associated with the vegetation are involved and moved together, so theoretically it should have a greater success rate than translocating individuals. Like all invertebrate relocation, this technique is experimental and should involve monitoring to gauge success (see Part C).

Salvage and relocation: The person authorised by the wildlife approval should make reasonable efforts to salvage adult Helms' stag beetles from areas where populations have been identified and where vegetation is scheduled to be cleared. These salvage areas are identified in Figures SBMP-2a and 2b. Salvage should be undertaken prior to clearance and salvaged Helms' stag beetles should be relocated to suitable habitat within the release areas shown on Figures SBMP-2a and 2b. Other individuals from notable species found during these salvages will also be relocated. This is a last resort measure to save individuals from injury and mortality, in addition to relocation of cleared vegetation, as Helms' stag beetle relocations have not previously been attempted.

Note: Salvage and relocation protocols are outlined in Section 7.0. Salvage and relocation will take place under supervision by the Project Entomologist.

Compensation

Aerial and ground-based predator control: Aerial control of predators such as rats and possums will be undertaken across *c*.1,400 hectares of indigenous habitats at Jedburgh Station, together with predator trapping along the wind farm roads within this area (described in the HREP). This will increase the carrying capacity of the habitat to manage the effects of the reduced amount of habitat available for on-site Helms' stag beetle populations. Reducing predator numbers will also reduce overall invertebrate mortality and injury from predation.

contact

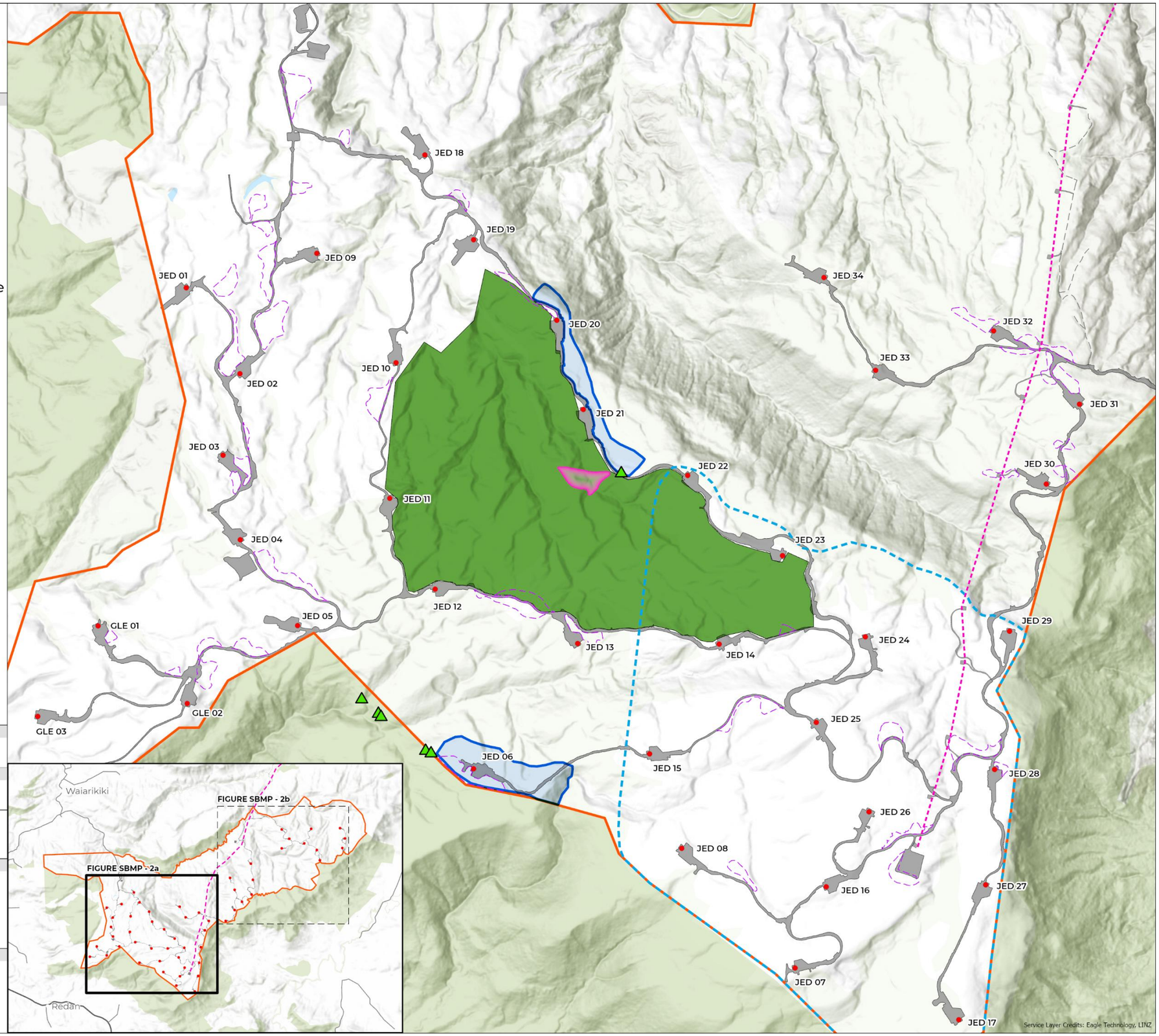
LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Jedburgh Plateau
- Civil Works Design
- Wind Farm Site

Helms' Stag Beetle Salvage & Release

- Helms' Stag Beetle Sighting
- Helms' Stag Beetle Salvage Areas
- Tautuku Gecko Soft Release Pen and Stag Beetle Relocation Site
- Jedburgh Station Ecological Enhancement Area



MAP SCALE	PRINT DATE
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	VERSION
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Kilometers
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CREDITS:

Wildlands
Ecological data provided by Wildlands Consultants

TITLE

FIGURE SBMP - 2a
SALVAGE AND RELEASE AREAS FOR HELMS STAG BEETLE
WIND FARM SITE - WEST

contact

LEGEND

Wind Farm

- Wind Turbines
- Transmission Line Route
- Indicative Fill Disposal Sites
- Civil Works Design
- Wind Farm Site

Helms' Stag Beetle Salvage & Release

- Helms' Stag Beetle Sighting
- Helms' Stag Beetle Salvage Areas
- Copper Tussock Enhancement and Skink Protection Area

MAP SCALE	PRINT DATE
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	VERSION
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Kilometers
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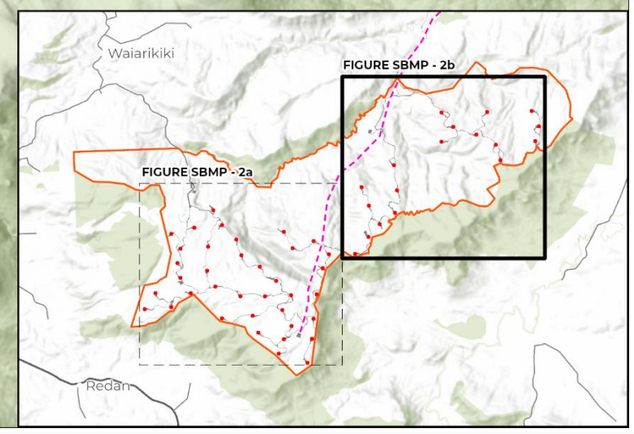
TITLE

FIGURE SBMP - 2b
SALVAGE AND RELEASE AREAS FOR HELMS STAG BEETLE WINDFARM SITE - EAST

MAT 01
MAT 02
MAT 03
MAT 04
MAT 05
MAT 06
MAT 07
MAT 08
MAT 09
MAT 10
MAT 11
MAT 12
MAT 13
MAT 14
MAT 15
MAT 16
MAT 17
MAT 18

Service Layer Credits: Eagle Technology, LINZ



Contribution towards research on translocating invertebrates: A student grant will be offered for research into effects management for invertebrates, including stag beetles (*Geodorcus* spp.) in accordance with Condition EC26. The research should focus on translocation (including vegetation stacking within the release area), but explore other effects management as appropriate, depending on the student's interests and salvage results.

The student grant will be for $30,000. The funding should preferably be made available prior to construction, or within six months of the commencement of construction. Results from the Project salvage, translocation, and monitoring should be made available to the student and the student should be invited to be involved with ongoing monitoring.

If no student claims the student research grant in the first year of its being made available, it should be offered to the Entomological Society of New Zealand for the explicit use of researching effects mitigation, including salvage and translocation of Helms' stag beetle, ngaokeoke, grasshoppers (Acrididae), and/or ground beetles (Carabidae). This research need not be connected to the Project.

The current gap in understanding for invertebrate effects management (including Helms' stag beetle effects management) severely hinders the ability of development projects to manage effects on invertebrates. The results of this research will therefore be of significant benefit to conserving Helms' stag beetle as it will provide more certainty around the efficacy and appropriate methods for effects management for invertebrates.

6.2.5 Increased risk of predation

Avoidance

Avoid attracting pests to the site: When working on-site, care will be taken not to leave litter or drop human food which may attract rodents and other pest animals. Any dropped food or litter must be picked up immediately.

Mitigation

Control pest animals in and around infrastructure: Roads and structures are ideal locations for predator traps and bait stations. Placing control along the roads within the Jedburgh Station Pest Control Area will enable capture of any pest animals moving along the human infrastructure. Mustelids, possums, and rodents will be of particular focus as localised control of these species is likely to have the greatest impact. Pest animal monitoring and control plan requirements are outlined in the HREP.

Compensation

Control pest mammals at Jedburgh Station. Pest mammals will be controlled by aerial and ground-based baiting operations across *c.*1,400 hectares of indigenous habitats at Jedburgh Station (the Jedburgh Station Pest Control Area), including in the release areas[1]. Monitoring will also be carried out to assess the efficacy and inform control, as outlined in the HREP.

[1] Ground-based control only will be undertaken in the Matariki Release Site.

7.0 Salvage and Relocation Protocol

7.1 Prior to any work commencing

Relevant contractors, the Environmental Manager and other authorised personnel will undertake an induction to be briefed on the following:

- Where to look out for Helms' stag beetle, and what they look like.
- The Incidental Discovery Protocol (Section 8.0).
- Where Helms' stag beetle management will be undertaken.
- The timeframe for associated works.

At each salvage area where Helms' stag beetle have been detected during the surveys (as shown on Figures SBMP-1a and 1b), salvage will begin before vegetation clearance commences (see Appendix 1 for decision tree).

7.2 Pre-clearance salvage

7.2.1 Pitfall trapping

Pitfall traps consist of a plastic cup dug into the ground, which invertebrates may fall into and be unable to exit. They will be covered with a lid with a gap between the lid and the cup so that large beetles may enter. Holes drilled into the bottoms of the cups allow rainwater to drain away. To prevent harm to Helms' stag beetle and lizards, pitfall traps will be closed when not in use and checked every 24 hours when in use. Pitfall traps will have a damp sponge or piece of vegetation inside to prevent desiccation of animals within the trap.

Live-capture pitfall trap grids will be set to capture Helms' stag beetle in advance of vegetation clearance work commencing. Each grid will have four traps arranged in a five-metre by five-metre square, with a fifth trap in the centre of the square (Sherley and Stringer 2016). Grids will be placed in the stag beetle salvage areas marked on Figures SBMP-2a and 2b, no closer together than 10 metres, with grid locations and spacings determined by the Project Entomologist based on their knowledge of Helms' stag beetle habitat use.

Once active, live-capture traps will be checked daily for a minimum of seven consecutive days. If trapping reveals trends of decreasing numbers of Helm's stag beetles over the course of seven days, with $\leq$1 Helm's stag beetle captured on day seven, trapping will cease.

If live capture traps continue to get the same or high numbers of Helm's stag beetles over these seven days, with >3 individuals caught on the final day, trapping will continue for another three days, or until no more Helms' stag beetle are caught, at the discretion of the Project Entomologist.

7.2.2 Night searching

Night searches will be conducted in each salvage area during fine, or slightly damp, weather. Each salvage area will be walked through after dusk, using headlamps to spot and salvage any active Helms' stag beetles. Due to safety considerations, some areas may not be entirely accessible after dark (particularly at Matariki), but as much of the area should be examined as possible. The amount of time spent on salvage will depend on the size of the area and how many Helms' stag beetles are found during the search, but is expected to be 1-2 hours per salvage area.

7.3 Supervised vegetation clearance

Vegetation clearance may commence immediately following salvage, or up to ten working days after salvage has been completed. Further salvage may be required if this time is exceeded.

Supervision of vegetation clearance is only required where:

1. Cleared vegetation is removed from areas where stag beetle populations have been confirmed; and
2. The vegetation is not to be stacked in other suitable Helms' stag beetle habitat (such as the Jedburgh Station Ecological Enhancement Area or the Matariki Release Site; Figures SBMP-2a and 2b).

In these instances, a suitably qualified ecologist(s) will check any felled tree branches, trunks, and foliage for Helms' stag beetle.

Where woody vegetation is proposed to be stacked in suitable Helms' stag beetle habitat (such as the Jedburgh Station Ecological Enhancement Area or the Matariki Release Site; Figures SBMP-2a and 2b), no supervision by a suitably qualified ecologist is required.

See Appendix 1 for a decision tree regarding vegetation clearance supervision, and Section 6.2.4 for the description of vegetation stacking.

7.4 Data collection

Data recorded upon capture will include species identity (Helms' stag beetle) and age (adult or juvenile/larva). Each stage of salvage will be recorded, including start/stop date and time, GPS coordinates, and a habitat description for the capture location. Weather conditions will be recorded during and at the beginning and end of each salvage event. Data collected will be included in the annual and three-year monitoring reports described in Part C (if applicable), and shared with the researcher.

7.5 Transportation of Helms' stag beetle

All captured Helms' stag beetle will be temporarily placed in clean individual containers, in cool, full shade. A small amount of damp leaf litter or vegetation from the capture site will be placed inside the containers with the beetles to provide cover and prevent dehydration. Any beetles captured will be handled and held carefully and as little as possible. All individuals salvaged will be released as soon as practicable (and within 12 hours) to the pre-selected species-specific release area.

7.6 Relocation site(s)

The stag beetle release sites (Figures SBMP-2a and 2b) will be enhanced so that their carrying capacity for Helms' stag beetle will be increased (primarily predator control, ungulate exclusion, and planting to restore indigenous forest diversity). The soft release pen within the Jedburgh Station Ecological Enhancement Area will need to be constructed at least three months prior to the stag beetle salvage takes place, noting also that predator control within the soft release pen and at the Matariki Release Site will need to commence at least one month before the salvage. Construction of the ungulate exclusion fences around the two release sites is scheduled to commence following the completion of all wind turbines within 150 metres of the release sites.

7.7 Other risks associated with proposed salvage

Potential risks to Helms' stag beetle from the proposed salvage, and management actions to reduce these risks, include:

- Overcrowding
  - **Risk:** Any population of Helms' stag beetle within the habitat at the proposed relocation site is under some pressure from predation and has limited resources and is therefore at the Wind Farm Site's current carrying capacity for that species.
  - **Action:** Helms' stag beetle will be released into the two release areas (Figures SBMP-2a and 2b). The habitat will be enhanced by predator control and habitat creation (enhancement planting) shortly before release. Salvaged Helms' stag beetles will be released into whichever of the two release areas is nearest the location of salvage.
- Failure to capture all individuals at the salvage site
  - **Risk:** Capture of all individuals present at the salvage site is unlikely due to the cryptic nature of Helms' stag beetle and the large numbers that may be present in the habitat. Even if an area is cleared of most individuals, more may move into the area from surrounding habitat.
  - **Action:** Surveys will attempt to capture most individuals from the salvage site and best efforts will be made to capture all of them. Vegetation clearance will commence immediately, or up to ten working days after salvage to prevent more individuals from arriving into the salvaged habitat.
- Injury/death
  - **Risk:** Incorrect trapping or handling during salvage by untrained staff.
  - **Action:** Capture of Helms' stag beetles will be carried out or supervised by an appropriately qualified entomologist, in accordance with the Wildlife approval, and will follow best practice and full hygiene protocols, minimising the risk of injury, death and disease transmission through inappropriate handling and capture.
- Failing to thrive in relocation site, or movement away from the relocation site
  - **Risk:** Released Helms' stag beetle may die or leave after relocation. All invertebrate salvage and relocation operations are experimental (including for Helms' stag beetle), and success rates are unknown and likely to be variable.
  - **Action:** Helms' stag beetle will be released into appropriate habitat, protected by localised mouse control at both release sites. Monitoring, combined with compensation through funding research, will enable the development of improved salvage and relocation protocols for future projects.
- Mixing of genetics between populations that would not naturally mix
  - **Risk:** Releasing Helms' stag beetle from on-site into an off-site population may introduce genetic elements that were not previously present in that population, potentially causing harmful effects.
  - **Action:** Helms' stag beetle will be released into suitable habitat that is as close as possible to the salvage site within the Wind Farm Site.

8.0 Incidental Discovery Protocol

8.1 Overview

Incidental discovery protocols are set out below and are to be followed if any Helms' stag beetle are discovered during vegetation clearance of any area at the Wind Farm Site.

8.2 Identifying Helms' stag beetle

Helms' stag beetle are large, slow-moving black beetles (Plate 1). Females are 16.5-27.5 millimetres long, while the larger males are 17.5-44 millimetres long, including the large mandibles (Holloway, 2007). The nine (six live and three dead) Helms' stag beetle found at the Wind Farm Site have been towards the larger end of the size spectrum.

Plate 1 – Female (left) and male (right) Helms' stag beetles. The male was approximately 40 millimetres long.

Stag beetle larvae are cream-coloured, and have a brown head. They grow larger than most other beetle larvae. Their bodies are curled into a C- shape. However, they are difficult to distinguish from the larvae of other large beetles. All larvae that resemble Helms' stag beetle larvae should therefore be treated as though they are Helms' stag beetle.

8.3 Where Helms' stag beetle might be found

Helms' stag beetle are usually found in and around forest, but they can also be associated with tussock, scrubland and shrubland. Larvae are usually underground or in deep litter. They appear to feed on soil (Holloway 2007). Areas identified as potential Helms' stag beetle habitat are marked on Figures SBMP-2a and 2b.

8.4 Protocol upon discovering a stag beetle

If a suspected adult stag beetle is discovered:

1. Stop work in the immediate location. Send a photograph to the Project Ecologist and seek their advice.
2. Capture the beetle carefully in a hard plastic container such as a lunch box. Place some damp vegetation in with the beetle and put the container in a cool place, out of the sun. Ventilate the container by leaving the lid slightly ajar or creating airholes.
3. Await further instructions from the Project Ecologist. Salvage and relocation activities may need to be carried out in the immediate area.
4. Do not continue work until further instructions from the Project Ecologist have been received.

If a suspected stag beetle larva is discovered:

1. Stop work in the immediate location. Send a photograph (or live-capture a sample) to the Project Ecologist and seek their advice.
2. Carefully transfer the litter and/or soil containing the larva to the nearest release area (Figures SBMP-2a and 2b). Ensure the larva is protected on all sides by litter and/or soil.
3. Do not continue work until further instructions from the Project Ecologist have been received.

PART C: MONITORING AND REPORTING

1.0 Monitoring

1.1 Overview

The terrestrial invertebrate monitoring requirements set out here are the same as (and not additional to) those set out in the Habitat Restoration and Enhancement Management Plan.

Monitoring the success of mammalian predator control and habitat restoration combined with monitoring terrestrial invertebrates, lizards (see the LMP) and avifauna (see the AMP) will provide an integrated picture of the impact of the development and the results of effects management.

1.2 Enhanced habitat invertebrate surveys, including Helm's stag beetles

Invertebrate community monitoring, including light trapping, live-capture pitfall trapping[1], and hand-search transects by day and night, should be undertaken over approximately two weeks in summer once every three years after construction, for **ten** years (**three** surveys). Representative areas within enhanced terrestrial invertebrate habitat should be surveyed. This includes the eight restored habitat patches on Jedburgh Station (totalling 1.6ha in area), the Jedburgh Station Ecological Enhancement Area, and the Copper Tussock Enhancement and Skink Release Area.

Terrestrial invertebrate monitoring will aim to detect trends in the following:

- Abundance of terrestrial invertebrates.
- Species diversity of terrestrial invertebrates.
- Abundance of Helms' stag beetle.

1.3 Monitoring relocated Helms' stag beetles

If more than 20 Helms' stag beetles are salvaged and translocated, then monitoring relocated Helms' stag beetle is necessary. The monitoring programme should include:

- Hand-searching transects at night, with a total of four hours' effort in the Jedburgh Station Ecological Enhancement Area and two hours' effort at the Copper Tussock Enhancement and Skink Protection Area at Matariki Forest (the Matariki Release Site; as per the HREP) split between two fine nights.
- Searching the stacked relocated vegetation piles for signs they are being used by Helms' stag beetles.
- Mark-recapture of salvaged beetles, using a paint pen to number individuals as has previously been done for Canterbury knobbled weevils (Fountain *et al.* 2013).

Monitoring should take place once every three months (evenly spaced as far as practicable in light of weather constraints) for the twelve months following salvage and release (four monitoring periods). Seasonal variation in activity appears to be slight in Helms' stag beetles but should be accounted for in data analysis and interpretation.

[1] Live-capture pitfall trapping will use funnels in traps to prevent capture of lizards and Helms' stag beetles so that no WAA is required for monitoring. Funnels should have an opening of approximately 1.5 mm.

If a student is incorporating this monitoring into their research, using funds provided as part of compensation, then they may refine these methods in consultation with the Project Ecologist. However, any extra expenses caused by refining the methods should be taken out of the student's research funding.

The Helms' stag beetle monitoring will inform the research into salvage and relocation techniques, which will benefit Helms' stag beetle in relation to future projects (funded through compensation: Section 6.2.4). Monitoring results should be shared freely with the student conducting research into salvage and translocation methods. If no student is available to take the funding, results should be accessible by any researcher seeking to study effects management for Helms' stag beetles.

2.0 Reporting

2.1.1 General terrestrial invertebrates

A monitoring report of **general terrestrial invertebrates** will be submitted annually during the construction period to Southland District Council and the Department of Conservation by 30 September each year. The report can be combined with reporting requirements for other taxa.

This report shall include:

- Monitoring methods and locations;
- Monitoring results including a species list;
- Location and habitat in which invertebrates were captured;
- If salvage and relocation was required, summary of salvage methodologies and salvage effort.

A one-off report will be submitted to Southland District Council within two months of completion of vegetation clearance. The report can be combined with reporting requirements for other taxa.

This report shall include:

- Confirmation that effects on invertebrates were managed in accordance with this TIMP and associated consent conditions.
- If salvage and relocation was necessary, salvaging methods, numbers of invertebrates salvaged and successfully released, locations of release, and plans to monitor populations.

2.1.2 Helm's stag beetles

In order to comply with the WAA for **Helm's stag beetles**, a compliance monitoring report will be submitted to DOC annually (for the year 1 July to 30 June) by 30 September each year during the construction period. The report can be combined with reporting requirements for other taxa.

This report shall include:

- Monitoring methods and locations.
- Monitoring results.
- DOC Wildlife Act Authority number, Project name and location.
- A summary of the number and size of all Helms' stag beetle captured.
- Location and habitat in which Helms' stag beetle were captured.
- If salvage and relocation was required, summary of salvage methodologies and salvage effort.
- Any other WAA reporting requirements.

Stag beetle management decision tree

Targeted surveys

Pre-vegetation clearance targeted surveys to refine area(s) within the Wind Farm Site that will require Helms' Stag Beetle management during vegetation clearance.

[Completed]

Reporting on survey findings to the consent authority before vegetation clearance commences.

[Completed]

Establish predator control within relocation sites at both Jedburgh (Ecological Enhancement Area) and Matariki.

[Part B, Section 7.6]

Environment Manager to facilitate a start-up meeting and engage the Project Ecologist 20 working days prior to vegetation clearance activity.

[Part B, Section 2.0]

Pre-clearance salvage undertaken [maximum of 10 working days prior to vegetation clearance].

This is led by the Project Ecologist (who has a WAA) and involves pitfall traps being set in grids within the stag beetle salvage areas (Figures SBMP-2a and 2b).

Requirement to check traps for at least seven (7) consecutive days.

[Part B, Section 7.0]

Helms' stag beetle not found

Vegetation clearance can commence with no further management measures. Note Incidental Discovery Protocols will apply if a Helms' stag beetle is found during vegetation removal.

Helms' stag beetle is found and salvaged. Data collected on salvaged beetles.

Supervised vegetation clearance required if trees are not being stacked.

[Part B, Section 7.3]

Unsupervised vegetation clearance can occur where trees removed will be stacked (as opposed to mulched).

[Part B, Section 7.3]

Monitoring of stag beetles to inform research into salvage and relocation techniques **[Part C, Section 1.0]**.

Once every three months for one year post-full commissioning of turbines.

[Part C, Section 1.3]

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