

# Draft Pest Mammal Management Plan for Nova Energy, Twizel

Contract Report No. 6905

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# Pest Mammal Management Plan for Nova Energy Proposed Solar Farm, Twizel

**Contract Report No. 6905**

March 2026

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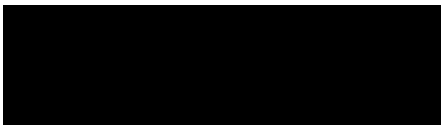
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## 1.0 Introduction

Nova Energy is proposing to develop a solar energy farm (**the project**) on an 866-hectare property (**the site**) east of Twizel. Wildland Consultants (2026, 2024, 2024a) have previously undertaken ecological surveys at the proposed solar farm site and prepared an assessment of ecological effects (Wildland Consultants, 2026) and several management plans (Wildland Consultants, 2026a-d). Evidence of pest mammals was recorded during these initial assessments. Indigenous plants and fauna that are vulnerable to damage or predation by pest mammals are present at the site. The AEE and management plans recommend a pest mammal management plan as part of effects management for the solar farm.

Currently, no formal pest monitoring is carried out on site, so the guild of pest species present and their abundance are not fully understood. This pest mammal management plan incorporates measures for surveying and monitoring pest mammals. After surveying to confirm the suite of pest mammals present on site, this plan may need to be adjusted. Data from pest mammal monitoring will be used to guide a control programme that is suitable for the site and monitor its efficacy.

## 2.0 Existing Ecological Values

### 2.1 Overview

The Mackenzie Basin, including land surrounding the site, is important habitat for indigenous plants and wildlife. The solar farm site is in Pukaki Ecological District, which provides a unique inland environment with semi-arid alluvial terraces and outwash plains crisscrossed by braided rivers (McEwen 1987). As a result, its flora and fauna assemblages are unlike any others in Aotearoa New Zealand, and many species are endemic to the Mackenzie (Wakelin *et al.* 2023). Heavy modification of the local environment due to farming and hydrological power schemes has resulted in the decline of many species and habitats. Introduced weeds and pest mammals, such as rabbits (*Oryctolagus cuniculus cuniculus*), hares (*Lepus europaeus*), brushtail possums (possum, *Trichosurus vulpecula*), mustelids (*Mustela* spp.), hedgehogs (*Erinaceus europaeus*), rodents (*Rattus* spp. and *Mus musculus*), and feral cats (*Felis catus*), thrive in the Mackenzie and pose various threats to its ecological values.

### 2.2 Vegetation and flora

The site is part of a highly modified agricultural operation with many non-indigenous vegetation types including weeds and large tracts of exotic pasture. Wildland Consultants (2023) mapped 15 habitat types at the site. Most of the site comprises exotic browntop-sweet vernal-clover grassland and haresfoot trefoil herbfield. Other important habitat types are present in smaller areas, including an old river terrace which is valuable lizard habitat, and herbfields with low-stature vegetation and bare stony ground which is important for nationally threatened invertebrates.

Some nationally Threatened and At Risk plant species are present, including *Carex kaloides* (At Risk – Declining), desert broom (*Carmichaelia petriei*) and dwarf broom (*C. vexillata*) (both At Risk – Declining), *Convolvulus verecundus f. verecundus* (At Risk – Declining), and common mat daisy (*Raoulia australis*; At Risk – Declining).



## 2.3 Indigenous wildlife

Twenty-one indigenous bird species have been recorded on site (Wildland Consultants 2023), including several Threatened and At Risk species. Tōrea/South Island pied oystercatcher (*Haematopus finschi*; At Risk – Declining) may use the site for breeding.

Several lizard species were found during the 2023 survey, including Southern Alps gecko (*Woodworthia* “Southern Alps”) and southern grass skink (*Oligosoma* aff. *polychroma* Clade5), both At Risk – Declining. Lakes skink (*Oligosoma* aff. *chloronoton* “West Otago”; Threatened – Nationally Vulnerable) has been found nearby. Lizard habitat was identified in several areas on site, particularly along fence lines and in rocky scrub areas along an old river terrace at the southern perimeter.

Herbfield habitats on site are important for terrestrial invertebrates (Wildland Consultants 2023). Minute grasshopper (*Sigaus minutus*; Threatened – Nationally Vulnerable Trewick *et al.*, 2012), Otago short-horned grasshopper (*Phaulacridium otagoense*; At Risk – declining), Tekapo ground wētā (*Hemiandrus* “furoviarius”; Threatened – Nationally Endangered) and New Zealand blue butterfly (*Zizina oxleyi*), which is considered to be declining (Patrick and Patrick 2012), were found there along with other insect species, primarily moths.

## 3.0 Pest Mammals

During the flora and fauna surveys, rabbit and hare sign was noted. Rabbits and hares are abundant throughout the Mackenzie area and cause extensive damage to indigenous vegetation and habitat. Other pest mammal sign was not seen, but feral cats, ferrets (*Mustela furo*), stoats (*Mustela erminea*), least weasels (weasel, *Mustela nivalis*), rodents, hedgehogs, and brushtail possums are all likely to be present (Table 1).

**Table 1** – Pest mammals present or potentially present at the proposed solar farm.

| Common Name      | Scientific Name              | Ecological Impacts                                                                                                                                   | Likelihood of Presence at the Site |
|------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Norway rat       | <i>Rattus norvegicus</i>     | Prey on birds, eggs, and chicks, and also eat seeds, lizards, and invertebrates.                                                                     | Likely                             |
| Ship rat         | <i>Rattus rattus</i>         | Excellent climbers, so can prey upon roosting birds and tree nests. Like Norway rats, they also eat eggs, chicks, seeds, invertebrates, and lizards. | Almost certain                     |
| Mouse            | <i>Mus musculus</i>          | Mice eat eggs, seeds, invertebrates, and lizards.                                                                                                    | Almost certain                     |
| Brushtail possum | <i>Trichosurus vulpecula</i> | Possoms destroy and consume indigenous vegetation, and opportunistically eat indigenous fauna including bird eggs and chicks.                        | Almost certain                     |



| Common Name     | Scientific Name                 | Ecological Impacts                                                                                       | Likelihood of Presence at the Site |
|-----------------|---------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------|
| Weasel          | <i>Mustela nivalis vulgaris</i> | Weasels primarily eat mice, but will often take birds, eggs, invertebrates, and lizards.                 | Likely                             |
| Ferret          | <i>Mustela furo</i>             | Primarily eat rabbits, but will often take birds, eggs, and lizards. A food source for feral cats.       | Almost certain                     |
| Stoat           | <i>Mustela erminea</i>          | Prey on birds, eggs, chicks, lizards, and invertebrates, and will take prey much larger than themselves. | Almost certain                     |
| Feral cat       | <i>Felis catus</i>              | Prey on birds, eggs, chicks, lizards, and invertebrates.                                                 | Almost certain                     |
| European rabbit | <i>Oryctolagus cuniculus</i>    | Consume indigenous vegetation. Provides food for other introduced predators.                             | Present                            |
| Brown hare      | <i>Lepus europaeus</i>          | Consume and damage indigenous vegetation and limit the growth of woody vegetation.                       | Present                            |

## 4.0 Pest mammal management goals

The goal of pest mammal management at the site of the proposed Twizel Solar Farm is to reduce the abundance of pest mammals on site as part of effects management as outlined in the AEE (Wildlands 2026).

The purpose of this pest mammal management plan is to outline methods for:

- A survey to detect which pest mammal species are present on site.
- Monitoring activity of rodents, rabbits, hares, mustelids, possums, hedgehogs, and feral cats throughout the site.
- Reducing introduced pest mammal numbers to alleviate pressure on indigenous plants and fauna and meet performance standards described in Section 11.
- Reducing hare and rabbit numbers, and if present possum numbers, to alleviate herbivory on indigenous vegetation.
- Adaptive management, so that control is adjusted as needed in response to monitoring.

This plan prescribes a standard level of pest mammal control, based on best practice, intended to benefit indigenous plants and fauna. Control methods are presented here as a series of options which should be selected and adjusted as needed by a suitably-qualified ecologist after the baseline pest mammal survey has been completed. After control has begun, it should be increased or adapted as necessary in response to monitoring.



## 5.0 Grazing

Short-stature vegetation present at the site must be maintained as habitat for indigenous fauna and flora, such as minute grasshoppers. Removing herbivores such as rabbits, hares, and possums will reduce grazing pressure on the plants, and may allow exotic vegetation to become taller and out-compete short-stature vegetation. Managed seasonal grazing, as outlined in the AEE (Wildlands 2026), should be implemented in response to the threat from exotic vegetation.

## 6.0 Pest Mammal Survey and Monitoring

### 6.1 Overview

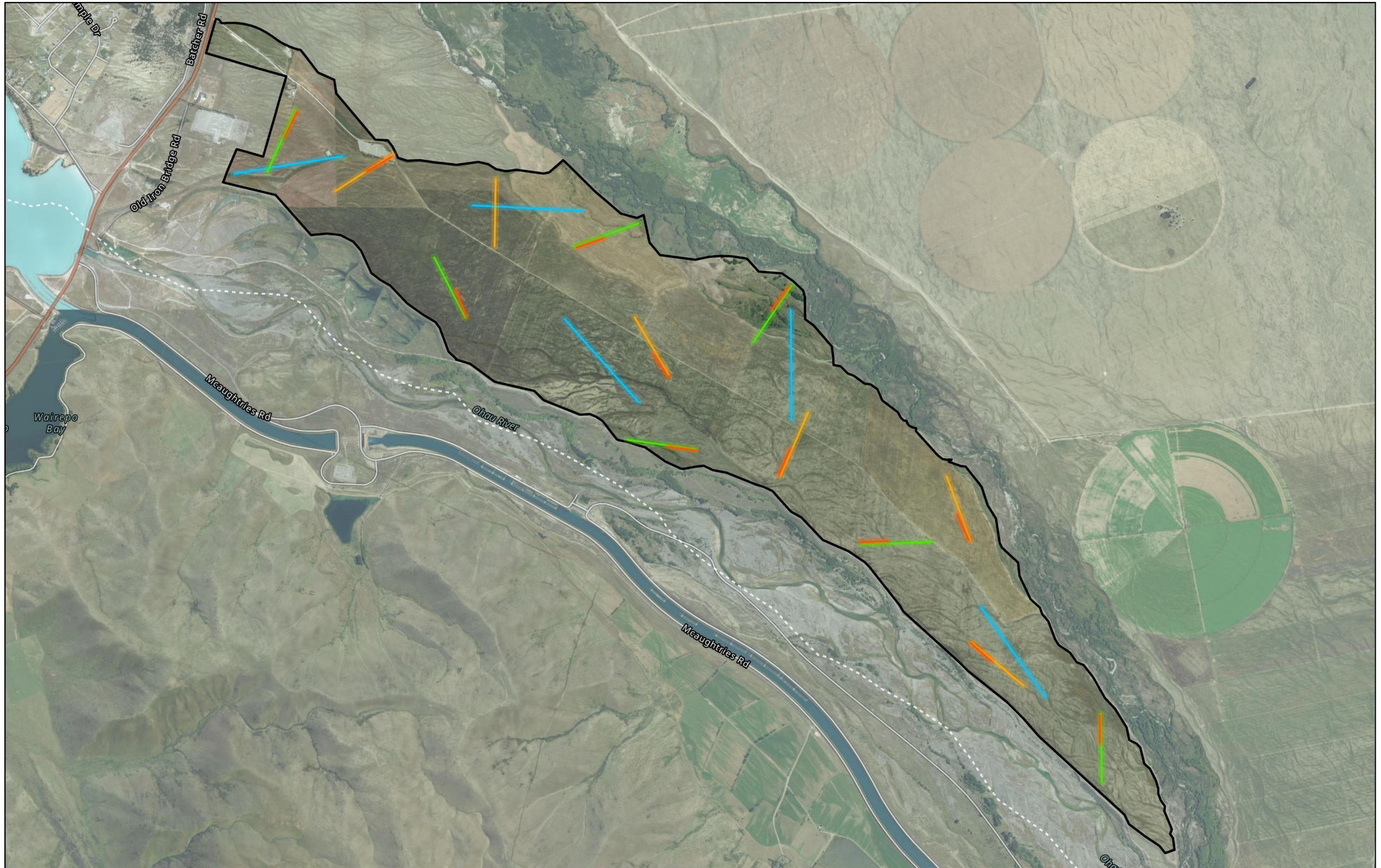
A baseline pest mammal survey should be completed during the year before construction begins to estimate the relative abundance of each pest mammal species present on site to inform which control methods to implement. The baseline survey will take a year to complete, as it needs to investigate activity and abundance of pest mammals in different seasons. During the year there will be:

- Four tracking tunnel surveys (one per season).
- Four wax tag surveys (one per season, concurrent with tracking tunnel surveys).
- Two night counts for feral cats, rabbits, and hares (one each in spring and autumn).

Building on the methods used in the baseline survey, pest mammal monitoring should be repeated after trapping and toxic baiting has begun, to monitor the regime's efficacy and if any adjustments are needed as part of adaptive management. Performance standards are discussed in Section 11.

Monitoring should continue yearly for the first five years of the project, after which it should be reviewed (alongside pest mammal control reviews). If pest mammal numbers have been relatively stable or trending downwards over at least two years, and are meeting targets outlined in Section 11, when compared to the baseline survey, frequency of monitoring may be reduced to once every 2-4 years. The monitoring programme should be reviewed once every five years throughout the life of the solar farm, in consultation with a suitably-qualified ecologist.

A layout for the proposed baseline survey and pest mammal monitoring is provided in Figure 1. Various monitoring methods are outlined below.



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- Site boundary
- Rodent-only tracking tunnels
- Rabbit, hare, and feral cat night counts
- Rodent and mustelid tracking tunnels
- Wax tags

**Figure 1. Pest mammal monitoring plan at the site of the proposed solar farm.**



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## 6.2 Tracking tunnels for mustelids and rodents

Tracking tunnels use a tunnel, ink, and card setup, with bait to encourage animals to run through the tunnel and leave ink footprints on the card. They are effective for monitoring rodent and mustelid activity, though not abundance, in time and space. Tracking tunnel surveys should be run once per season, so four times per year, using the protocol in Gillies and Williams (2013).

Thirteen permanent lines of 10 tracking tunnels each (a total of 130 tunnels) should be established for the initial survey, baited with peanut butter, and left for rodent monitoring over one fine night. Then, five tunnels (every second tunnel) on seven of the lines (indicated in Figure 1 as rodent and mustelid lines) should be baited with fresh rabbit (which could be shot on site) and left for mustelid monitoring over three fine nights. The difference in methodology between rodents and mustelids is designed to account for differences in their behaviour (Gillies and Williams 2013).

A Tracking Tunnel Index (TTI) should be calculated to allow comparison of rodent and mustelid activity between years, and to inform adaptive management (Gillies and Williams 2013).

After the first five-year review, if a downward trend in rodent and/or mustelid activity is detected, or performance targets in Section 11 are met, the frequency of tracking tunnel use for mustelid monitoring can be reduced so that tracking tunnel surveys are only carried out in February and November. This can be reviewed every five years in conjunction with other monitoring and control methods.

## 6.3 Night counts for feral cats, rabbits, and hares

Night counts for feral cats, rabbits, and hares provide useful information on relative abundance and distribution.

There is no best practice protocol for counting feral cats at night, but the same methods should be used as for rabbits and hares, as all three species can be counted concurrently.

In spring and autumn during the baseline survey, feral cats, rabbits, and hares should be counted along transects (David and Latham 2014; NPCA 2015a) over one fine night. Five 800 metre transects are shown in Figure 1. They can be navigated either on foot or by motorbike as long as the same method is used, moving quietly and at a constant pace, sweeping the area with a strong/ spotlight torch to count the number of feral cats, rabbits, and hares. Feral cats have green eyeshine (NPCA 2018) while rabbits and hares have red-pink eyeshine (NPCA 2015a). Weather conditions and other factors such as vegetation should be taken into account when planning a night count. Weather should preferably be consistent between counts, warm, and fine or slightly drizzly. For more comprehensive instructions, see the best practice standard (David and Latham 2014; NPCA 2015a). Where possible, use the same personnel consistently.

Night count data can be used to calculate the mean numbers of feral cats per kilometre, rabbits per kilometre, and hares per kilometre, for each transect and the entire site. Trends in abundance will become apparent over time, and can be used to track the efficacy of rabbit and hare control.

## 6.4 Wax tags for possums

Plain wax tags are useful for monitoring possums. They have an advantage over chew cards in that they are unlikely to attract the same possum twice due to the lack of palatable bait (NPCA 2015c); possums are instead attracted due to their natural curiosity. Wax tags have the added benefit of being



convenient to use in conjunction with tracking tunnels as they can be run adjacent to tracking tunnel lines (Figure 1) and at the same time as tracking tunnel surveys.

Ten wax tags should be placed 20 metres apart along each of the tracking tunnel lines illustrated in Figure 1 (130 wax tags). They should be fixed to shrubs, fence posts, or other upright surfaces where possible, or alternatively, a wooden stake can be used (NPCA 2015c). They should be left out for seven fine nights, preferably avoiding Te Rakanui (full moon). Wax tag surveys should be run at the same time as rodent and mustelid surveys, though after the first review period they can be reduced in frequency to twice per year (May and November) if possum numbers are declining or if possums have not been detected on site.

Monitoring possums using wax tags could be relaxed if numbers are low, with monitoring only happening when a build-up of possum sign is evident.

## 6.5 Trap catch rates

Pest mammal control should commence at least one month before any invertebrate is released after salvage, and before rock stacks have been created, as described in the AEE (Wildlands 2026), TIMP (Wildlands 2026a), and LMP (Wildlands 2026b). After the baseline survey of tracking tunnels, wax tags, and night counts, pest mammal control options from Section 7 below can be selected for implementation. Options include several different trap types, all of which provide additional monitoring data<sup>1</sup>.

All captures should be recorded, even if they are bycatch or non-target species, so that trapping protocols can be adjusted if necessary (for example if a non-target indigenous species is caught, the trap type may need to be modified with an exclusion device to prevent traps from capturing indigenous non-target species). If the trap is sprung but empty, that should also be recorded as if it happens repeatedly over consecutive checks it may indicate the need for repairs.

For ease of data collection and analysis, all trap catch data for pest mammal species being monitored (listed in Table 2) should be in the form of captures per 100 trap nights (C/100TN; one trap night = one trap set for one night).

To calculate trap catch per 100 trap nights, first calculate the number of trap nights:

**Trap nights = number of traps × number of nights they have been set minus half a night for every night they were recorded as sprung.**

**Then divide the number of captures by the number of trap nights, and multiply the result by 100.**

$$C/100TN = (\text{captures}/\text{trap nights}) \times 100$$

This calculation can be performed per line to pinpoint where more control may be needed (Section 12), but for monitoring general pest mammal populations at the site it should be calculated for the whole site. Different calculations should be made for each species.

<sup>1</sup> Automatic traps have a kill counter which measures the number of times the trap has gone off. Research shows that the kill counters accurately register kills, but the species killed is not recorded. Therefore, AT220 trap catch data can only be used to assess pest mammal numbers of unknown species caught by the traps.



## 6.6 Bait take

In the rodent control zone (Figure 2; Section 7.3), rodent activity can be monitored by the amount of bait that they have taken. Bait take can also be used to determine if the target pest mammal species are becoming bait shy, at which point the toxin being used should be changed (Section 12).

## 6.7 Summary of monitoring methods

Table 2 provides a summary of methods and timing for monitoring each pest mammal species at the site.

**Table 2 – Monitoring methods for pest mammals potentially present at the site.**

| Monitoring Method                    | Pest Species                                                                                          | Year 1 baseline survey                            | Timing                                            |                                                                                           |
|--------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------------|
|                                      |                                                                                                       |                                                   | Years 2-5 monitoring                              | Years 6+ monitoring post-review <sup>1</sup>                                              |
| Tracking tunnels                     | Norway rat, ship rat, mouse (baited with peanut butter).                                              | Feb, May, Aug, Nov.<br>Run for one fine night.    | Feb, May, Aug, Nov.<br>Run for one fine night.    | Can be reduced to May and Nov if rodent numbers reduced or absent.                        |
|                                      | Weasel, stoat, ferret (baited with rabbit).                                                           | Feb, May, Aug, Nov.<br>Run for three fine nights. | Feb, May, Aug, Nov.<br>Run for three fine nights. | Can be reduced to May and Nov if mustelid numbers reduced or absent.                      |
| Trap catch                           | Norway rat <sup>2</sup> , ship rat <sup>2</sup> , weasel, stoat, ferret, hedgehog, feral cat, possum. | None.                                             | Continuous.                                       | Increases or reduces with trapping effort if needed for adaptive management (Section 12). |
| Bait take (rodent control zone only) | Rodent <sup>3</sup> .                                                                                 | None.                                             | During poisoning pulses.                          | During poisoning pulses.                                                                  |
| Spotlight counts                     | Rabbit, hare, feral cat.                                                                              | Spring and autumn.                                | Spring and autumn.                                | Spring and autumn.                                                                        |
| Wax tags                             | Possum.                                                                                               | Feb, May, Aug, Nov.<br>Run for seven fine nights. | Feb, May, Aug, Nov.<br>Run for seven fine nights. | Can be reduced to May and Nov if possum numbers reduced or absent.                        |

<sup>1</sup> If control is successful in reducing pest mammal numbers of all species.

<sup>2</sup> DOC-series traps are not able to effectively control rat populations but are useful for monitoring them.

<sup>3</sup> The rodent species taking the bait will not be able to be reliably determined, so bait take can be used as a general proxy for rodent abundance.



## 7.0 Pest Mammal Control

### 7.1 Overview

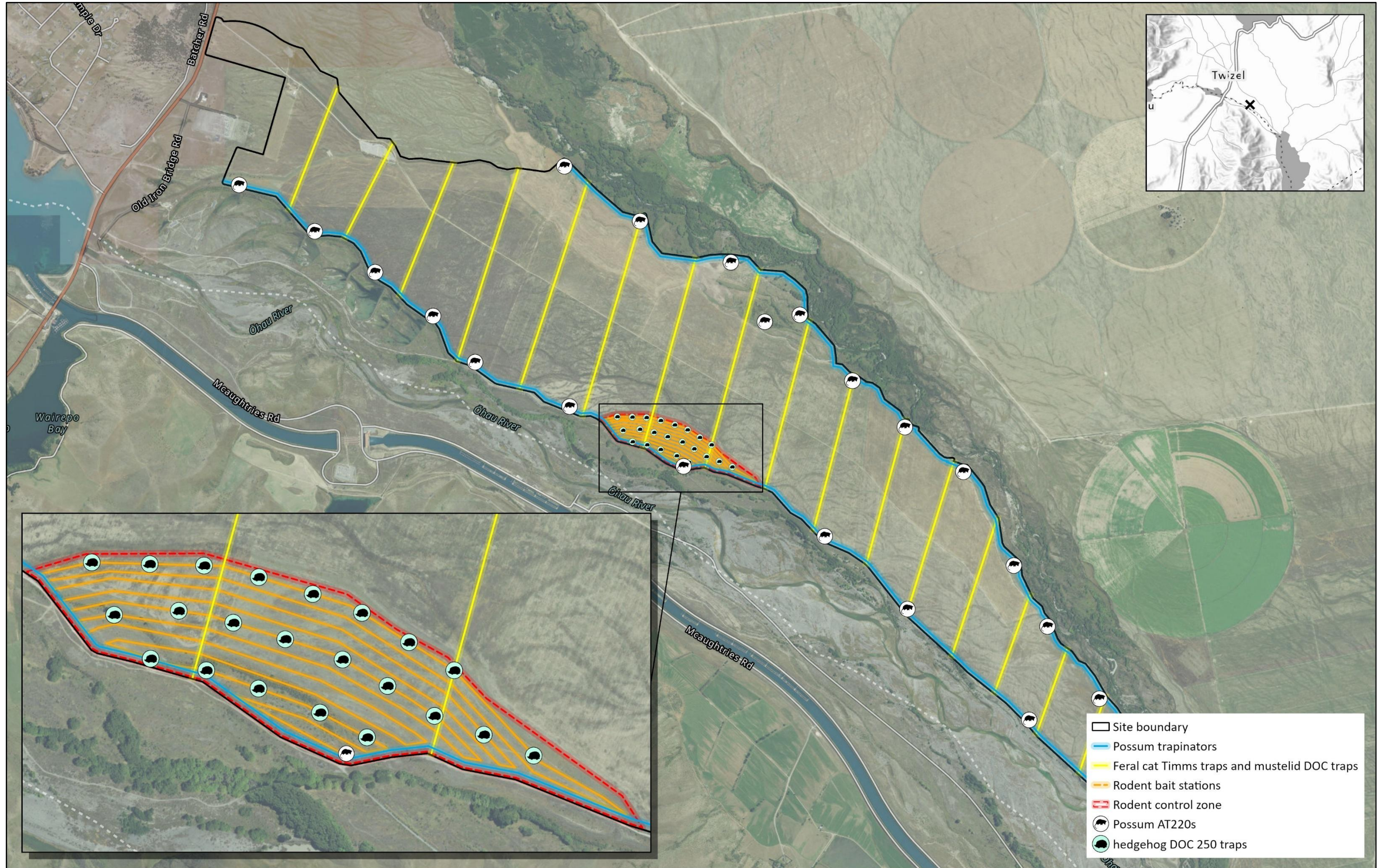
The following pest mammal control plan is designed to be implemented adaptively in conjunction with the monitoring plan set out above.

This pest mammal control plan uses traps, toxins, and shooting (for rabbits) to knock pest mammal numbers down and maintain them at low levels. A predator-proof fence would not be suitable for the site, due to the high financial cost to fence the property, maintain the fence, and eradicate pest mammals from within the fence.

The plan is flexible and should be implemented with consideration for terrain, safety, animal welfare, and other important factors that may not have been apparent during the site visit.

All kills of all species, including non-target species, must be recorded so that any issues with repeated non-target kills can be addressed as soon as possible. All relevant regulations must be followed regarding health and safety of trapping and poisoning operations. For a summary of devices and methods proposed in this plan, see Figure 2 and Table 4.

Pest mammal control should commence approximately one month before salvaged invertebrates are released in enhanced invertebrate habitat, and continued throughout the life of the project. Control and monitoring should be reviewed every five years in consultation with a suitably-qualified ecologist. The review should cover whether performance targets (Section 11) are being met or if adaptive management is needed (Section 12). Pest mammal control should continue for the life of the solar farm, but may be adjusted as required over time, and as long as performance targets are being met or exceeded then control intensity may be reduced gradually.



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Figure 2. Pest mammal control plan at the site of the proposed solar farm.



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**Table 4 – Summary of pest mammal control methods for the Nova Energy site at Twizel.**

| <b>Pest Species</b> | <b>Control Method</b>                         | <b>Line Spacing (metres)</b> | <b>Device Spacing Along Lines (metres)</b> | <b>Timing of Control</b>               | <b>Timing of Device Checks</b>                                          | <b>Trigger to Start Control</b>                                                           | <b>Trigger to Stop Control</b>             |
|---------------------|-----------------------------------------------|------------------------------|--------------------------------------------|----------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------|
| <b>Rodents</b>      | <b>Poisoning inside rodent control zone.</b>  | <b>50</b>                    | <b>50</b>                                  | <b>Four pulses per year (Table 3).</b> | <b>Three times per month during a pulse (Figure 3).</b>                 | <b>Rodents detected at the site.</b>                                                      | <b>N/A control is ongoing<sup>5</sup>.</b> |
|                     | <b>Poisoning outside rodent control zone.</b> | <b>50</b>                    | <b>50</b>                                  | <b>Four pulses per year (Table 3).</b> | <b>Three times per month during a pulse (Figure 3).</b>                 | <b>Important invertebrate and/or lizard population found outside rodent control zone.</b> | <b>N/A control is ongoing.</b>             |
| <b>Least weasel</b> | <b>Trapping with DOC-150s and DOC-200s.</b>   | <b>500</b>                   | <b>200</b>                                 | <b>Year-round.</b>                     | <b>Twice per month September-March; once per month March-September.</b> | <b>Weasels detected at the site.</b>                                                      | <b>N/A control is ongoing.</b>             |
| <b>Ferret</b>       | <b>Trapping with DOC-250s.</b>                | <b>500</b>                   | <b>200</b>                                 | <b>Year-round.</b>                     | <b>Twice per month September-March; once per month March-September.</b> | <b>Ferrets detected at the site.</b>                                                      | <b>N/A control is ongoing.</b>             |
| <b>Stoat</b>        | <b>Trapping with DOC-200s.</b>                | <b>500</b>                   | <b>200</b>                                 | <b>Year-round.</b>                     | <b>Twice per month September-March; once per month March-September.</b> | <b>Stoats detected at the site.</b>                                                       | <b>N/A control is ongoing.</b>             |
| <b>Feral cat</b>    | <b>Trapping with modified Timms traps.</b>    | <b>500</b>                   | <b>400</b>                                 | <b>Year-round.</b>                     | <b>Twice per month September-March; once per month March-September</b>  | <b>Cats detected at the site.</b>                                                         | <b>N/A control is ongoing.</b>             |

<sup>5</sup> If the control methods outlined in Section 7.8 are no longer safe to use in the rodent control zone, a new form of control must be devised.



| <b>Pest Species</b> | <b>Control Method</b>                                   | <b>Line Spacing (metres)</b> | <b>Device Spacing Along Lines (metres)</b> | <b>Timing of Control</b> | <b>Timing of Device Checks</b>                                   | <b>Trigger to Start Control</b>           | <b>Trigger to Stop Control</b>                                    |
|---------------------|---------------------------------------------------------|------------------------------|--------------------------------------------|--------------------------|------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------|
| <b>Possum</b>       | Trapping with AT220s.                                   | N/A                          | 100                                        | Year-round.              | Once per month.                                                  | Possums detected at the site.             | N/A control is ongoing.                                           |
|                     | Trapping with Trapinators.                              | N/A                          | 100                                        | Year-round.              | Twice per month initially, then as needed.                       | Possums detected at the site.             | N/A control is ongoing.                                           |
| <b>Hedgehog</b>     | Trapping in DOC-series traps set for mustelids.         | 500                          | 400                                        | Continuous.              | Initially same as for mustelids; increase frequency if required. | Mustelids detected at the site.           | N/A control is ongoing.                                           |
|                     | Trapping with DOC 250 traps inside rodent control zone. | 100                          | 100                                        | Continuous.              | Twice per month initially, then as needed.                       | Hedgehogs detected at the site.           | N/A control is ongoing.                                           |
| <b>Rabbit</b>       | Night shoot.                                            | N/A                          | N/A                                        | Spring and autumn.       | Twice yearly.                                                    | Rabbits detected in previous night count. | Rabbits no longer detected or shoots no longer safe or effective. |
| <b>Hare</b>         | Night shoot.                                            | N/A                          | N/A                                        | Spring and autumn.       | Twice yearly.                                                    | Hares detected in previous night count.   | Hares no longer detected or shoots no longer safe or effective.   |



## 7.2 Mustelids

For weasels, ferrets, and stoats, DOC-series traps should be used (NPCA 2015b, 2018). All DOC-series traps can potentially catch any of the mustelid species, but DOC-150s may be more suited to catching weasels and DOC-250s may be more suited to catching ferrets. DOC-200s can catch all three species but are not suitable for stoats. Therefore, all three models should be used, and alternated along trap lines for multi-species control.

Mustelids have large home ranges, so trap spacings on a line can be far apart (Smith and Jamieson 2003). Mustelid traps should be spaced every 200 metres along the same lines used for feral cat traps (Figure 2). Some can be placed adjacent to feral cat traps for efficient checking. Mustelid trap sites should be grubbed up to remove plants, expose the soil, and provide a stable, flat surface for the trap. Weeds should be removed around the trap to provide a clear entrance and allow for air flow over the bait. Traps should be baited using hen eggs and fresh rabbit, with some meat dragged around the entrance to spread the scent. Pre-feeding unset traps with fresh meat for three weeks before setting them may increase catch rate by encouraging mustelids to interact with the traps.

Mustelid traps should be checked every two weeks from September to March, and every four weeks from March to September.

## 7.3 Rats and mice

### 7.3.1 Overview

Due to their small home ranges and high productivity, rats and mice are not usually controlled effectively using trapping. Rats and mice are highly mobile and are common throughout the Mackenzie area, so reinvasion potential is high. Rat and mouse control over the whole of the site is therefore likely to be high-cost and of limited efficacy. However, localised intensive rodent control targeted at small areas could be used to protect lizard and invertebrate populations present in those areas.

A rodent control zone is shown in Figure 2 and is discussed further below. The location of the rodent control zone is based on known important lizard and invertebrate habitat. In response to monitoring lizards and terrestrial invertebrates, additional rodent control could be established temporarily in small localised areas where high mouse numbers may be limiting lizard and invertebrate populations from meeting performance standards (Wildland Consultants 2026a, 2026b).

### 7.3.2 Rodent control zone

The rodent control zone (Figure 2) should have intensive rodent control so that rodent numbers will be lower than they are in the rest of the property. The rodent control zone contains important habitats for invertebrates and lizards, so controlling mice and rats should help to release invertebrates and lizards from predation pressure.

Run-Through bait stations should be used for mice and rats. They should be placed at 25 metre intervals along the bait station lines shown in Figure 2 (DOC, n.d.). Any rodent carcasses found within or adjacent to the rodent control zone should be buried or burned.

Rodents can rapidly develop bait aversion, so using more than one bait type is advised. Bromadiolone and diphacinone are among the least environmentally harmful, most cost-effective, and most readily-available toxins that affect mice as well as rats.



**For the first year, bromadiolone should be used under the pulsing regime to knock rodent numbers down and keep them low. In the rodent control zone, grazing may therefore not take place during the first year and other methods of weed control (such as hand-weeding or cut and paste) should be used instead to keep exotic vegetation down. In subsequent years, diphacinone should be used. If diphacinone bait is no longer being taken, yet tracking tunnel results suggest that rodent numbers are high, then diphacinone bait should be removed and replaced with bromadiolone pulses for a year before switching back to diphacinone.**

**A pre-feed is recommended prior to the first bromadiolone pulse to maximise uptake of toxic bait. During a pulse, bait stations should be filled on Days 1, 5, and 14 of the pulse (Auckland Council n.d). All bait should be removed on day 30. For example, for a January-February bromadiolone pulse, starting in the last week of January, bait stations should be filled on 24 and 28 January, and 7 February. All bait should be removed on 23 February. Removing bait prevents bait aversion from developing, as degraded bait is less palatable and may result in a sub-lethal dose.**

**Table 3 summarises baits for rodent control. Figure 3 summarises the timing of poison baiting depending on the poison to be used.**



**Table 3 – Toxins recommended for rodent control at the site.**

| Poison Type        | Example Products               | Advantages                                                                                                                                                                                                                                                       | Disadvantages                                                                                                                                                                                                                                                                                    | Usage Guidelines                                                                                                                                                                                                                                                                                             |
|--------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bromadiolone       | Contrac                        | Highly effective at rat and mouse control.                                                                                                                                                                                                                       | <p>Livestock must be removed before baiting. The treatment area cannot be restocked immediately after the bait has been removed<sup>1</sup>.</p> <p>Risk of secondary poisoning for wild and domestic animals.</p> <p>Residue remains in carcasses and the environment for months after use.</p> | <p>Initial treatment, and for use if rodent numbers remain high despite diphacinone baiting. Four pulses over one year in August, November, January-February, and March-April. The following August, switch back to diphacinone. A pre-feed is recommended before the first treatment with bromadiolone.</p> |
| Diphacinone blocks | D-Block <sup>2</sup><br>Ditrac | <p>Has resulted in mouse eradication (Shiels <i>et al.</i> 2018).</p> <p>Effective on both mice and rats.</p> <p>Little residue or risk of secondary poisoning.</p> <p>Bait aversion does not happen as quickly as with non-first-generation anticoagulants.</p> | <p>Variable effects on mice.</p>                                                                                                                                                                                                                                                                 | <p>Four pulses per year in August, November, January-February, and April. Continue use until bait take decreases but tracking tunnels show rodent activity to be high. Then switch to bromadiolone.</p>                                                                                                      |

<sup>1</sup> Before toxic baiting starts, check national and local legislation to confirm restocking rules after poison baiting.

<sup>2</sup> D-Block is more palatable to rodents than Ditrac, but Ditrac lasts longer. Preferably D-Block should be used.



**Figure 3 – Toxin application timeline for rodent control.**





## **7.4 Rabbits**

### **7.4.1 Night shoots**

Rabbit shooting should not take place beneath solar panels due to the risk from ricochet, the lack of clear visibility, and the potential to damage solar panels. However, night shooting may be carried out around the edges of the site.

Rabbit night shoots should take place following monitoring, if rabbits have been seen during night counts. Rabbit shooting protocols should follow best practice methods established by Bionet (2012) and BOPRC (2016). The police will need to be notified of night shoots when they are to occur, and local and national legislation followed to avoid risk to human life.

Rabbit meat can be used as bait for feral cat and mustelid traps, and for mustelid tracking tunnels.

### **7.4.2 Hunting with dogs**

Dogs can be used on site as a non-standard method to hunt and capture rabbits where rabbit burrows are not present. Dogs may only be used during autumn and winter, unless a bird survey confirms no nesting birds on site. Lurchers (sighthound crosses) are likely to be most effective at quickly finding, chasing and capturing rabbits, though other fast-moving breeds such as field-bred spaniels may also be effective. Dogs should be kept away from bait stations and only stock-proofed dogs may be used in paddocks where stock is present. Dogs must be discouraged from mouse or rat-hunting behaviour as it is difficult to distinguish from lizard-hunting behaviour.

### **7.4.3 Fumigation**

If rabbit burrows are found on site, they should be fumigated using MagToxin, which releases toxic phosphine gas when it comes into contact with water. One to two Magtoxin pellets, plus a squirt of water from a bottle or a moist paper towel, should be placed deep inside one burrow entrance after all other entrances have been thoroughly blocked with earth and/or rocks. The last entrance should be blocked immediately upon placing the pellets.

Fumigation should not occur less than three months either side of a night shoot.

## **7.5 Hares**

Hares should also be shot during rabbit shoots around the periphery of the site. Hare shooting protocols are similar to rabbit shooting protocols and should follow NPCA (2015a). If hare numbers increase under solar panels, hunting with sighthounds or lurchers may be effective at controlling them, following the precautions listed in Section 7.4.2.

## **7.6 Brushtail possums**

Possum control using best practice involves placing traps or bait stations in 100 metre square grids. This is a greater intensity than is likely to be necessary at the site, and would be labour-intensive, especially due to the lack of trees or fence posts over most of the property. Therefore, the possum protocol outlined below and in Figure 2 has been adapted to reflect the likely low-density population of possums at the site. If possums are grazing on enhancement plantings, however, intensity may need to be stepped up (Section 12).



Any possums that are present are likely to be living in the bush near the northeast and southwest perimeters of the property, and may come onto the property at dusk to feed. Possum movements may therefore be intercepted by placing traps along the perimeter fence. Fence posts and trees can be used to hang traps.

Near bush habitat and tracks, where most possums are likely to be caught, automatic traps (AT220s) should be set along the perimeter (Figure 2). These traps require little maintenance, although a monthly check is recommended to ensure that they are functioning well. Lure will need to be replaced and batteries will need to be recharged approximately once every six months.

Trapinators should also be placed along the perimeter, interspersed with the AT220s, so that there is one of either type of trap per 100 metres of fence line. Trapinators should be baited with possum dough and lured with a possum flour blaze (four parts flour to one part icing sugar). They should be checked once every two weeks initially, then as needed to ensure that at least 50% of Trapinators are always set.

## 7.7 Feral cats

Feral cats should be trapped using Timms traps, modified by widening the entrance hole by 25 mm all around. Lines of Timms traps 400 metres apart have been marked on Figure 2 (NPCA 2015b, 2018). They should be baited using fresh rabbit or hare meat, dragging the meat around the entrance of the trap to spread the scent. Prior to first setting the traps, they should be left unset but baited with fresh meat to encourage feral cats to interact with them. After three weeks of pre-feeding the traps should be baited and set. Feral cat traps should be checked every two weeks from September to March, and every four weeks from March to September.

## 7.8 Hedgehogs

There is currently no standard best practice methodology that exists for hedgehog control. Hedgehog home ranges vary widely depending on the sex of the hedgehog, food availability, and the time of year (Hamilton 1999). They are frequently caught in DOC-series traps baited with rabbit, which are proposed for mustelid control in Section 7.2. If hedgehog catch rate increases so that 50% or more of traps have caught hedgehogs when the DOC-series traps are checked, trap check frequency should be doubled until catch rate decreases so that at least 50% of traps are always open to catch mustelids and hedgehogs.

Within the rodent control zone (Figure 1), hedgehogs should be controlled using DOC 250 traps at 100 metre grid spacings (Paterson 2024), baited with hen eggs or fresh rabbit.

## 8.0 Limitations of Pest Mammal Control

The large size of the site and its easily-navigable terrain are conducive to cost-effective pest mammal control operations. However, the long, thin shape of the site may mean continuous reinvasion of pest mammals from the surrounding properties through the extensive perimeter. This issue may be exacerbated by the presence of optimal pest mammal habitat in the form of bush and tree-lined waterways along both long sides of the site. Pest reinvasion can be curtailed if neighbouring landowners were willing to collaborate with pest control on their properties (Section 10).

Rabbits and hares are extremely abundant in substantial populations throughout the Mackenzie. Controlling them at the site may produce a sink effect, whereby rabbits and hares continuously move



in from outside the property. This could result in rabbit and hare populations remaining the same, or even increasing, on the property despite control. If rabbit and hare control as outlined in this PMMP is insufficient to meet performance standards (Section 11), adaptive management will be triggered (Section 12).

## 9.0 Record Keeping

Data collected from device checks is of fundamental importance for monitoring pest mammal populations at the site, and for assessment of the efficacy of the control methods for adaptive management (Section 1). The data may be useful for research into pest biology and control methods. Data must be collected and stored separately for every device check. Digital copies of data must be made and backed up securely to prevent data loss. Databases should be set up in Microsoft Excel, with different workbooks for monitoring and control, and different worksheets for each device type. Data recorded should include:

### Traps

- Date of device check.
- Weather.
- Device identification number.
- Device type.
- Device status (AT220s: functioning, not functioning; traps: set, sprung but empty, or sprung with animal).
- Kill count (AT220s only).
- Species caught.
- Notes (e.g., trap broken needing maintenance; trap missing).

### Bait stations

- Date of device check.
- Weather.
- Device identification number.
- Device type.
- Device status (full, partially full, empty).
- Any kills nearby.
- Comments (e.g., bait removed in preparation for toxin change).

### Monitoring devices

- Date device set.
- Date device checked.
- Weather.
- Device identification number.



- Device type.
- Device status (animal detected, no detections).
- Species detected.
- Comments (e.g., tracks look like possum but may be hedgehog).

Uploading data onto Trap.nz is recommended to help manage the project and enable multiple device checkers to work together.

## 10.0 Liaison with neighbouring landowners

Due to the shape of the site, reinvasion of pest mammals across the borders of the site is likely to be continuous. Reinvasion could be curtailed if neighbouring landowners control pest mammals on their land and thereby provide a buffer. Some adjoining land is managed by the Department of Conservation (DOC), offering potential opportunity for integrated pest management and sharing of information and monitoring data. Collaboration with DOC is recommended if possible.

A potential solar farm which is currently under application under the FTAA, The Point Solar Farm, could be collaborated with for mutual benefit by undertaking pest mammal control and monitoring on both properties, which are adjacent to one another and separated by the Twizel River. Controlling pest mammals on both properties (including the land north of the planned The Point Solar Farm, which is on the same property as the solar farm) could significantly reduce reinvasion and benefit ecological values (such as braided river birds) on the riverbed. However, pest mammals are likely to use the Twizel River as a corridor, which may reduce the potential benefits to be gained from collaboration, unless pest mammal control is also carried out on the Twizel River between the two properties, possibly by DOC or Project River Recovery.

## 11.0 Performance Standards

### 11.1 Overview

Performance standards should be biodiversity-based and adaptive, with baseline surveys of pest mammals and ecological values informing targets and regular auditing to ensure best practice.

Biodiversity outcomes will be monitored as described in each management plan (Wildland Consultants, 2026b-d). To link biodiversity outcomes to pest mammal control, the absence of evidence of impacts from introduced pest mammals on indigenous flora or fauna will be taken as a sign that the pest mammal control is working as intended (Section 11.2).

Declines in the abundance and/or activity of pest mammals on site will be taken as evidence that pest mammal control is effective at reducing pest mammal abundance on site and therefore meeting performance standards (Section 11.3).

### 11.2 Biodiversity performance standards

Monitoring of fauna as outlined in the attached Management Plans (Wildland Consultants, 2025d, 2025c, 2025b), including bird carcass monitoring, should show negligible or no signs of predation by



pest mammals being controlled under this programme on lizards, adult birds, chicks, or bird eggs. No predation of lizards or invertebrates should be apparent in the rodent control zone.

Indigenous plants should be monitored as outlined in the AEE (Wildland Consultants, 2026) and Biosecurity and Vegetation Management Plan (Wildland Consultants, 2026d). Plants should show negligible or no possum feeding sign, and little to no rabbit or hare feeding sign. Plant growth should not be prevented by hare or rabbit damage. If hare or rabbit damage appears to be limiting plant growth (apparent from the lack of plant growth combined with extensive rabbit or hare damage on plants that are not growing), rabbit and hare adaptive management will be triggered (Section 12).

### 11.3 Pest mammal performance standards

Pest mammal monitoring should show general declines in pest mammal activity and abundance across the site, comparing between the same seasons across different years. Absolute targets in the form of percentage trap catch or TTI are unlikely to be helpful, as without research into the pest ecology specific to the site the thresholds at which indigenous flora and fauna will begin to recover after pest mammal control cannot be known. However, declines in pest mammal abundance or activity should be compared with biodiversity outcome monitoring at the site to see if the abundance of Threatened or At Risk species is improving.

### 11.4 Auditing

An audit of pest mammal control and monitoring practices should be undertaken once every five years (before each control and monitoring review) to ensure that best practice is followed correctly. Records (Section 9) should be examined and a site visit conducted to assess the quality of pest mammal control. The audit also presents an opportunity to gather data and views from pest control operators for consideration during the review. Auditing should be carried out by an independent pest control specialist. Any changes in practice recommended as a result of each audit should be considered in the context of this plan, relevant research, and the views of the pest control operator before any decisions are made regarding changes of practice.

## 12.0 Adaptive Management

Pest mammal control measures should be guided by monitoring, and adjusted if necessary. Continuous increase in mammal activity and/or abundance is a sign that control may need to be intensified to bring mammal numbers down. Monitoring results will fluctuate seasonally and in response to food availability. To track trends in mammal activity which may be due to abundance, monitoring results should be compared between the same seasons across multiple years. Monitoring results that depict an increase in predator abundance or activity will only trigger adaptive management if the increase occurs over two of the same seasons (e.g. if the increase is first detected in summer, monitoring results the following summer will trigger adaptive management if they show a further increase), or if they are linked to an unfavourable biodiversity outcome such as predation on indigenous fauna.

### 12.1 Pest overabundance

If pest mammal control does not appear to be decreasing pest mammal activity (i.e. tracking tunnel and/or wax tag indices are remaining the same or increasing between years), but trap catches and bait take have not declined, then pest mammal control devices are killing pest mammals but there are not enough devices to control the high numbers present. If necessary, pest control intensity can then be



increased by reducing the distances between devices, checking devices more frequently, and adding more devices where pest mammal numbers are not declining. Typically, device spacings along each line should be halved. Alternatively, trap checks can be doubled in frequency if this is more practicable than adding more devices.

For example, if mustelid tracking tunnel indices are remaining the same or increasing between years, and trap catches remain consistent or are increasing between years, mustelid trap spacings can be reduced to 100 metres along lines, or alternatively checked once every week (if between September and March) or once every two weeks (if between March And September).

The possum control outlined in this PMMP is less intensive than best practice, but should be sufficient to control anticipated low possum numbers. However, if possums are impacting enhancement plantings, Timms traps<sup>1</sup> should be deployed in grids throughout the property, with trap spacings not exceeding 100 metres.

Rabbits and hares are common in the Mackenzie Basin and standard control methods may be insufficient to keep their numbers down sufficiently to meet performance standards (Section 11). Rabbit and hare control on neighbouring properties would help to minimise the risk of this happening (Section 10). If monitoring shows that performance standards are not met, other options shall be considered, such as pindone poisoning, or rabbit-proof fencing around indigenous vegetation (including enhancement plantings) to exclude rabbits and hares from important plants and habitat.

## 12.2 Bait aversion by rodents

If bait take declines or remains low, but monitoring devices show no drop in rodent activity, rodents may have developed bait aversion, or poisoning methods may not have used best practice.

In the first instance, check that all bait stations are functioning fully, referring to the manufacturer's guidelines. If bait is not being taken, but rodent numbers are high near the rodent control area, check that the bait has not expired or gone mouldy in the bait stations.

Baiting methods need to be reviewed if aversion develops in pest mammal populations. All operators must be coordinated in their efforts and using best practice as described in Section 0 and in the best practice documents in the references list below. Common causes of bait aversion include:

- Use of expired or mouldy bait.
- Mixing of bait with a non-toxic substance to make it more palatable.
- Leaving bait in bait stations at the end of a pulse.
- Not filling bait stations at the correct time during the pulse.

Bait should be switched when aversion is detected. Initially, bait should be switched from diphacinone to bromadiolone (Section 7.3). After a year of baiting with bromadiolone, diphacinone should be used again. All poison baiting should follow the pulsing protocol (Figure 3).

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<sup>1</sup> Timms traps set for possums should not have their entrance holes widened. They should be baited with apple halves and lured with a possum flour blaze containing four parts flour mixed with one part icing sugar.



## 13.0 Conclusions

The proposed solar farm site is large with important values for indigenous plants and fauna. Ecological values on site may be enhanced using a suite of pest mammal control methods, guided by monitoring. The main challenges to pest mammal control at the site are its shape and the likely high abundance of some species such as rabbits and rats. However, the monitoring proposed will provide more information about the abundance of each pest species at the site and enable appropriate control to be implemented in a timely manner.

## References

- Auckland Council. (n.d.). *Pest animal control guidelines for the Auckland region*. Available at: <https://www.bionet.nz/assets/Uploads/pest-animal-control-guide-Auckland-Council-2016.pdf>. Accessed 28 March 2023.
- Bay of Plenty Regional Council (BOPRC). (2016). *Rabbit control options. Pest animal control report*. Available at: <https://www.boprc.govt.nz/media/395489/rabbit-control-options-a4-booklet-web-.pdf>. Accessed 9 November 2022.
- Bionet and National Pest Control Agencies (NPCA). (2012, revised 2020). *Pest rabbits monitoring and control good practice guidelines*. ISBN: 978-1-877474-53-8. Available at: [www.bionet.nz](http://www.bionet.nz). Accessed 27 March 2023.
- David, A., & Latham, M. (2014). *Animal pests: Night counts for rabbits*. Version 1.0. Department of Conservation, Science and Capability Group, Hamilton, New Zealand. DOC DM-1417897 [www.doc.govt.nz](http://www.doc.govt.nz)
- de Lange P.J., Gosden J., Courtney S.P., Fergus A.J., Barkla J.W., Beadel S.M, Champion P.D., Hindmarsh-Walls R., Mekan T., and Michel P. (2024). *Conservation status of vascular plants in Aotearoa New Zealand, 2023*.
- Department of Conservation (DOC). (n.d). *Choose traps and toxins*. <https://www.doc.govt.nz/nature/pests-and-threats/predator-free-2050/community-trapping/trapping-and-poisoning/choose-traps-and-toxins/> Accessed 20 April 2022
- Department of Conservation (DOC). (n.d.). *Where to put trap and bait lines*. <https://www.doc.govt.nz/nature/pests-and-threats/predator-free-2050/community-trapping/trapping-and-poisoning/where-to-put-trap-and-bait-lines/> Accessed 20 April 2022
- Gillies, C. A., & Williams, D. (2013). *DOC tracking tunnel guide v2.5.2: Using tracking tunnels to monitor rodents and mustelids*. Science and Capability Group, Department of Conservation.
- Hamilton, W. J. (1999). *Potential threat of hedgehogs to invertebrates with a restricted range, Otago region*. Department of Conservation, Dunedin, New Zealand.
- McEwen, M. (1987). *Ecological regions and districts of New Zealand*. Department of Conservation.
- National Pest Control Agencies (NPCA). (2015a). *Pest hares: Monitoring and control*. NPCA, Wellington. ISBN 978-1-877474-39-2
- National Pest Control Agencies (NPCA). (2015b). *Kill traps: A guideline to trap possums, ferrets, stoats and feral cats using kill traps*. NPCA, Wellington. ISBN 978-1-877474-65-1



- National Pest Control Agencies (NPCA). (2018). *A8 Pest mustelids: Monitoring and control*. National Pest Control Agencies, Wellington. Available at: <https://www.bionet.nz/assets/Uploads/A8-Pest-Mustelids-2018-04-LR.pdf>
- National Pest Control Agencies (NPCA). (2018, revised 2020). *A11 feral and stray cats: Monitoring and control, a preliminary guideline towards good practice*. National Pest Control Agencies, Wellington. Available at: <https://www.bionet.nz/assets/Uploads/A11-Feral-and-Stray-Cats-minor-revisions-2020.pdf>
- National Pest Control Agencies (NPCA). (2015). *Possum population monitoring using the trap-catch, waxtag and chew card methods*. NPCA, Wellington. ISBN 978-1-877474-57-6
- Paterson, E. G. (2024). *Enhancing conservation outcomes for New Zealand's coastal ecosystems through knowledge of hedgehog (*Erinaceus europaeus*) spatial ecology: A thesis presented in partial fulfilment of the requirements for the degree of Master of Science in Conservation Biology at Massey University, Albany, New Zealand* (Doctoral dissertation, Massey University).
- Patrick, B., & Patrick, H. (2012). *Butterflies of the South Pacific*. University of Otago Press.
- Shiels, A. B., Bogardus, T., Rohrer, J., & Kawelo, K. (2018). Effectiveness of Snap-trapping, Goodnature A24 Automated Traps, and Hand-broadcast of Diphacinone Anticoagulant Baits to Suppress Invasive Rats (*Rattus* spp.) and Mice (*Mus musculus*) in Hawaiian Forest. In *Proceedings of the Vertebrate Pest Conference* (Vol. 28, No. 28).
- Smith, D. H. V., & Jamieson, I. G. (2003). *Movement, diet, and relative abundance of stoats in an alpine habitat*. Department of Conservation. Available at: <https://www.doc.govt.nz/globalassets/documents/science-and-technical/dsis107.pdf>
- Wakelin, M., Tweed, J., Murray, T. (2023). A list of the invertebrates of the Mackenzie area, New Zealand. *New Zealand Journal of Zoology*. Jun 16: 1-63.
- Wildland Consultants. (2026). *Assessment of potential ecological effects of the proposed Nova Energy solar farm near Twizel*. Wildland Consultants Ltd Contract Report No. 6620. Prepared for Nova Energy. 67pp.
- Wildland Consultants (2026a). *Draft terrestrial Invertebrate Management Plan for Proposed Nova Energy Twizel Solar Farm*. Wildland Consultants Contract Report No. 7414a. Prepared for Nova Energy Ltd. 28pp.
- Wildland Consultants (2026b). *Draft Lizard Management Plan for Proposed Nova Energy Twizel Solar Farm*. Wildland Consultants Contract Report No. 7414b. Prepared for Nova Energy. 39pp.
- Wildland Consultants (2026c). *Draft Avifauna Management Plan for Proposed Nova Energy Solar Farm at Twizel, Canterbury*. Wildland Consultants Contract Report No. 7414c. Prepared for Nova Energy. 20pp.
- Wildland Consultants (2026d). *Draft Biosecurity and Vegetation Management Plan for Twizel Solar Farm*. Wildland Consultants Contract Report No. 7414d. Prepared for Nova Energy. 14pp.
- Wildland Consultants (2024). *Additional lizard, vegetation, and invertebrate surveys of a proposed Twizel solar farm*. Wildland Consultants Contract Report No. 6986. Prepared for Nova Energy. 36pp.
- Wildland Consultants (2024a). *Tekapo ground wētō tracking tunnel survey memorandum*. Wildland Consultants Contract Report No. 6986b. Prepared for Nova Energy. 4pp.



## Appendix 1 Year 1 Implementation Plan

Note: This is for the first year of control, after the baseline survey has been undertaken. This first year of control commences one month before any salvaged invertebrates are released, prior to construction. costs are estimated and do not include labour, transport, or other contractor fees.

| Month                                                                  | Task                                                                                                                                                                                                            | Estimated Hardware and Bait Costs (NZD) |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| February                                                               | Run tracking tunnel and wax tag surveys.                                                                                                                                                                        | 2,868                                   |
| March                                                                  | Set mustelid, hedgehog and possum traps (depending on survey results). Begin mustelid, hedgehog and possum trap checking regimes.                                                                               | 34,549                                  |
| April                                                                  | Perform spotlight checks for feral cats, rabbits, and hares. Begin trapping feral cats (depending on spotlight check results). Begin feral cat trap checking regime. Check mustelid, hedgehog and possum traps. | 3,930                                   |
| May                                                                    | Run tracking tunnel and wax tag surveys. Conduct rabbit and hare night shoots/fumigation. Check mustelid, hedgehog, feral cat, and possum traps.                                                                | 1,397                                   |
| June                                                                   | Check mustelid, hedgehog, feral cat, and possum traps.                                                                                                                                                          | 198                                     |
| July                                                                   | Deploy and pre-feed rodent bait stations within rodent control zone. Check mustelid, hedgehog, feral cat, and possum traps.                                                                                     | 918                                     |
| August                                                                 | Run tracking tunnel and wax tag surveys. Three-week pulse of bromadiolone. Check mustelid, hedgehog, feral cat, and possum traps. Refill AT220 lure.                                                            | 3,020                                   |
| September                                                              | Switch to checking mustelid and feral cat traps twice per month. Check mustelid, hedgehog, feral cat, and possum traps.                                                                                         | 331                                     |
| October                                                                | Perform spotlight checks for feral cats, rabbits, and hares. Check mustelid, hedgehog, feral cat, and possum traps.                                                                                             | 331                                     |
| November                                                               | Run tracking tunnel and wax tag surveys. Three-week pulse of bromadiolone. Check mustelid, hedgehog, feral cat, and possum traps.                                                                               | 2,948                                   |
| December                                                               | Check mustelid, hedgehog, feral cat, and possum traps.                                                                                                                                                          | 331                                     |
| January                                                                | Three-week pulse of bromadiolone (beginning end of January). Check mustelid, hedgehog, feral cat, and possum traps.                                                                                             | 2,948                                   |
| <b>Total estimated cost for Year 1 (hardware, lure, and bait only)</b> |                                                                                                                                                                                                                 | <b>\$53,767</b>                         |



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