TRANSMISSION GULLY PROJECT

TECHNICAL REPORT #7

Herpetofauna and terrestrial macro - invertebrates:
Description & Values
August 2011

Front Cover Photo:

Peripatoides novaezealandiae (peripatus or velvet worm) found beneath logs in pasture and boulderfields at Wainui Saddle and in the headwaters of Te Puka Stream.

Bibliographic reference:

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Contents

List of Tables

List of Figures

INTRODUCTION

This technical report is one of a series that report on ecological investigations being undertaken as part of the Transmission Gully project (the "Project"), specifically in relation to NZTA 345PN Phase II Investigations, E&EA; work package "WS-08 Ecological Assessment, Survey, Modelling and Management" (BML, 2009). The purpose of Work Package 08 is to comprehensively map and describe the values of ecological systems that occur along this route, and to describe the distribution and abundance of native flora and fauna within or in close proximity to the Project footprint. From this work the potential environmental effects of both the construction and ongoing operation of the proposed Transmission Gully highway will be assessed in a subsequent report (Technical Report 11: Ecological Impact Assessment (EIA)), and measures to mitigate potential or actual adverse effects be developed.

The Transmission Gully Main Alignment (the "Main Alignment") is 27 km in length, running north between Wellington (Linden) and the Kapiti Coast (MacKays crossing). The Main Alignment traverses a wide range of habitats from improved pasture, plantation forestry, shrublands, and scrub to forest remnants (Figure 7-1). It ranges from sea level to 280m in altitude and crosses eight catchments, most of which discharge to Pauatahanui Inlet, a nationally significant estuary and wildlife refuge.

This report describes the results of the terrestrial fauna investigations undertaken along sections of the Main Alignment from January to March 2010. These studies covered herpetofauna and terrestrial invertebrates. These two taxonomic groups are dealt with separately in this report, with each having its own methods, results, discussion, and conclusion sections.

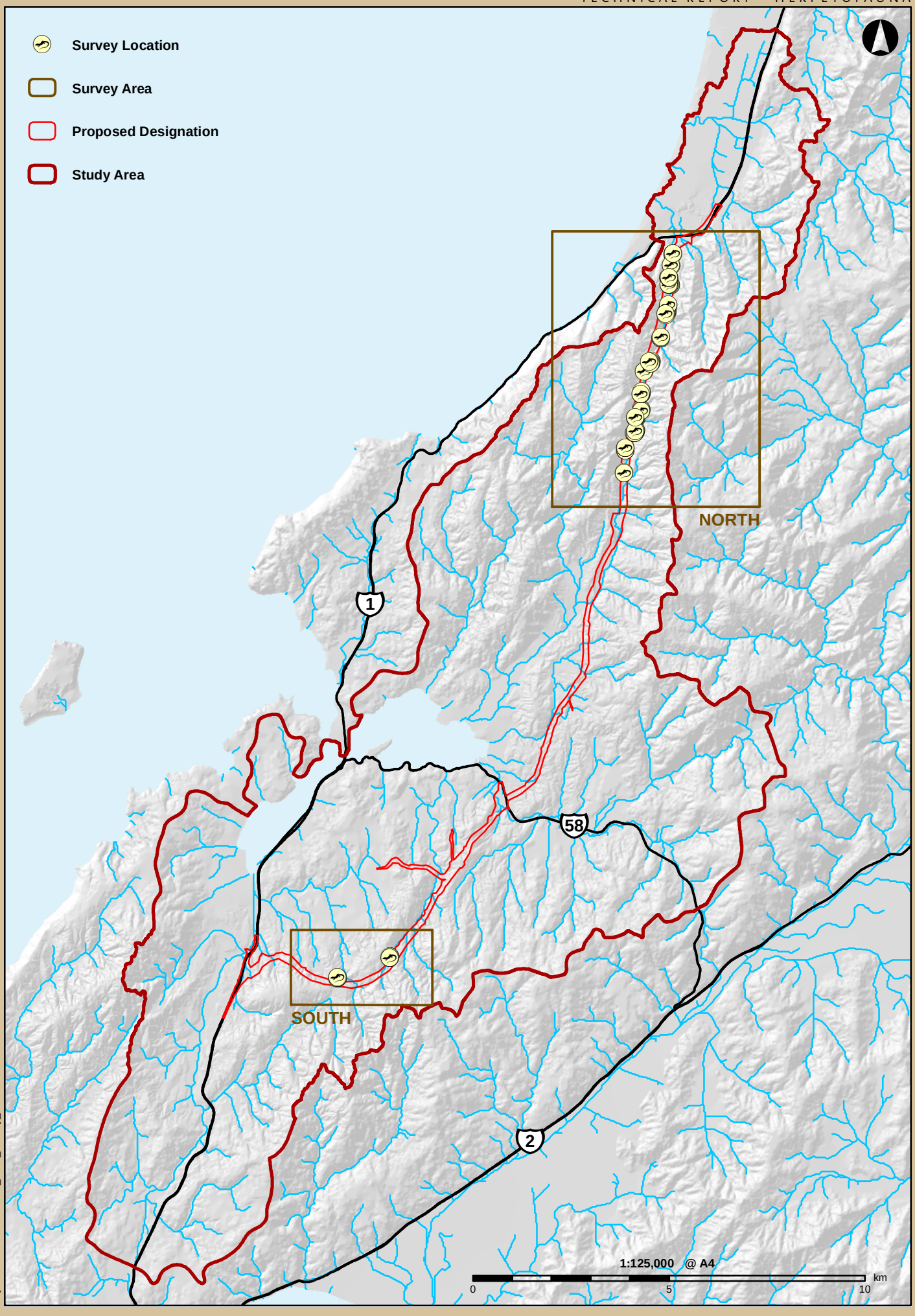
An assessment of potential adverse effects and a discussion of mitigation measures will be reported in a separate Ecological Impact Report.

HERPETOFAUNA

The objectives of the herpetofauna investigations were to:

- To determine which species of indigenous herpetofauna are present within the project footprint.
- To identify herpetofauna habitats present within the project footprint
- To determine the significance of affected habitats for native herpetofauna, particularly Threatened and At Risk species.

While the presence of Threatened and/or At Risk animals is taken into consideration when determining an ecological assessment, it is important to note that all native animals are protected under the Wildlife Act (1953), other than those outlined in Schedules 1-5 of the Act. The following herpetofauna species (all introduced) are listed in Schedule 5 (wildlife not protected) of the Act: green and golden bell frog (*Litoria aurea*), Southern bell frog (*Litoria raniformis*), whistling frog (*Litoria ewingii*), rainbow skink (*Lampropholis delicata*) and red-eared slider turtle (*Trachemys scripta elegans*).



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SURVEY AREAS & SITES 7.1

1. METHODS AND SEARCH/SAMPLING EFFORT

A combination of desktop investigations and four field-based methods was used to assess the ecological value of herpetofauna communities and habitats within the Main Alignment and in suitable habitat immediately adjacent. Details of the individual methodologies are provided below.

1.1 Desktop Investigations

The first phase of investigations of the Project's herpetofauna communities involved querying the Department of Conservation's Herpetofauna database for all records of herpetofauna detected within 10 km of the alignment since 1980 (arbitrarily selected to represent criteria for 'relevant' records).

Additional desktop studies included a review of high resolution aerial imagery and preliminary vegetation maps to assist in determining where field-based investigations should be targeted (subsequently verified during the on-site habitat assessment).

1.2 Habitat Assessment

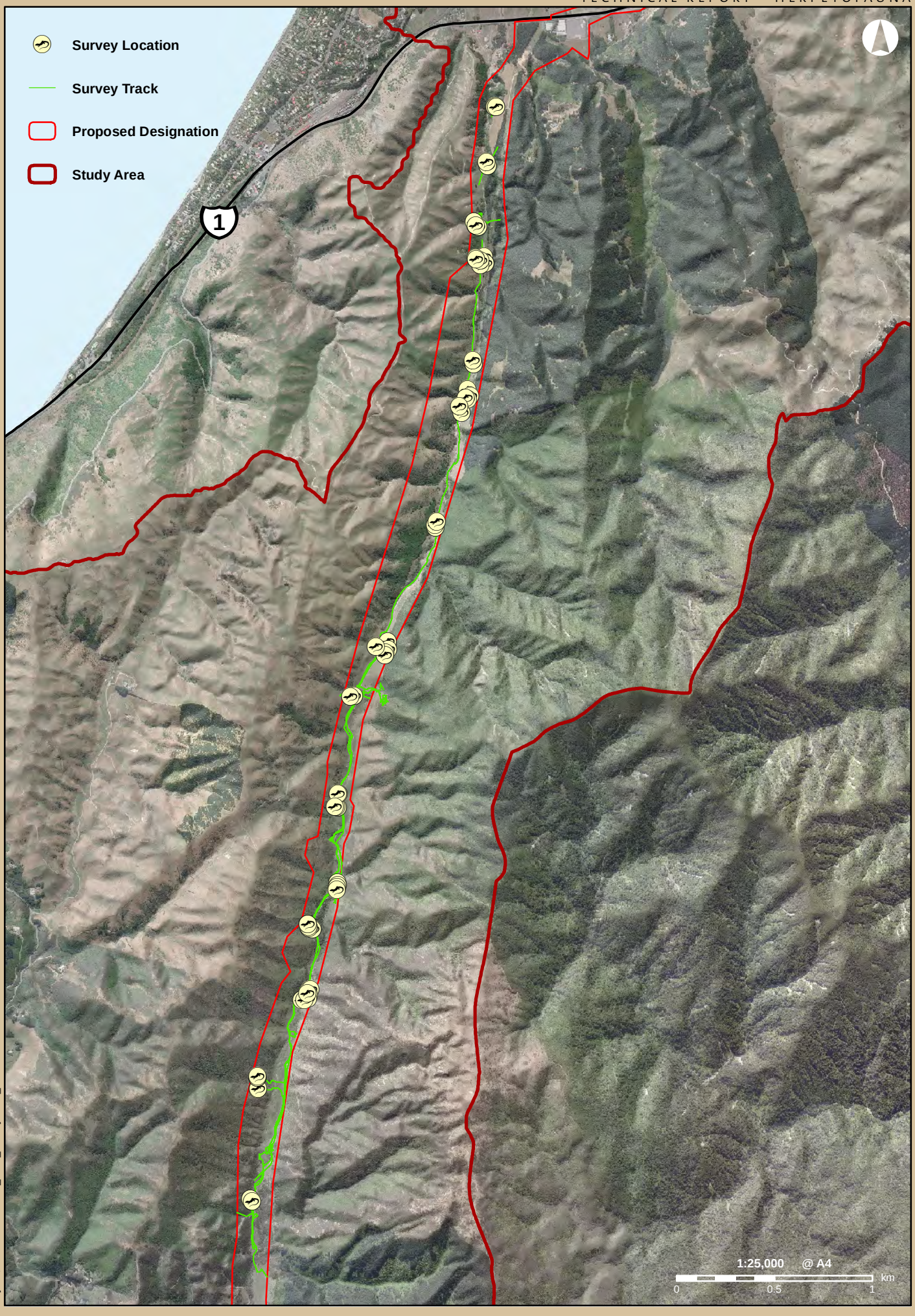
Initial on-site investigations commenced by driving/walking the Main Alignment to assess herpetofauna habitat quality. Areas considered to represent marginal or better herpetofauna habitat were subsequently targeted with the herpetofauna sampling methodologies described below (sections 1.3, 1.4 and 1.5).

1.3 Artificial Retreats

Seventy-four artificial retreats (ARs; approximately 50cm x 50cm sheets of Onduline roofing) were laid in clusters of 4-10 over the course of three field days (25-27 January 2010). The location of the ARs are shown in Figure 7-2 and Figure 7-3. GPS locations were recorded for each AR. The majority (66) of ARs were laid along the northern section of the route (Figure 7-2) as this area (particularly the Wainui Saddle) was considered to represent the best of the lizard habitat present within the alignment. This was due to the presence of rank grassland, forest/shrubland-grassland interfaces, stone fields within pasture, and scree slopes, all of which are ideal for lizards and as such were targeted with ARs (Table 7-1). AR's in the northern section were checked for herpetofauna occupancy and retrieved on 8 March 2010, whereas those in the southern section were checked and retrieved on 8 April 2010. All AR checks were undertaken during fine weather.

Table 7-1: Distribution of ARs in different habitats

HABITAT TYPE	No. ARs	
	Northern section	Southern section
Rank grassland	12	
Forest/shrubland-grassland interfaces	15	
Stone fields within pasture	25	8
Scree slopes	14	



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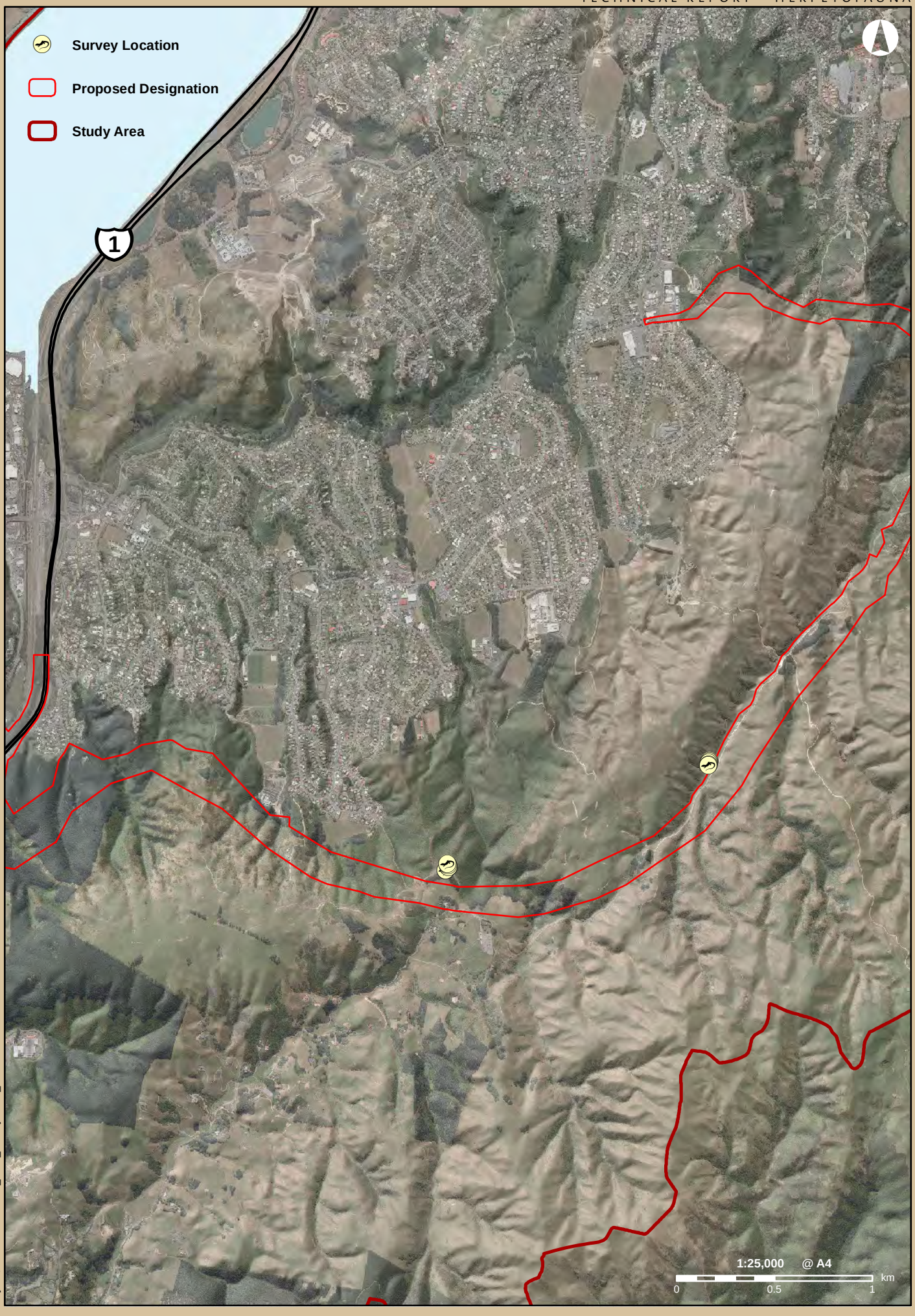
NORTHERN SURVEY AREA 7.2



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SOUTHERN SURVEY AREA 7.3

1.4 Manual Searching

Manual searches for herpetofauna were conducted during daylight hours on 25, 26 (northern section) and 27 January 2010 (southern section). The manual searching methodology followed that of Whitaker's (1994) 'searching by day' methodology. Search effort was targeted towards bush and shrubland edges, rocky areas, and debris such as logs and corrugated iron which could be lifted by hand. In accordance with the availability of suitable lizard habitat, searches were concentrated towards the northern end of the Main Alignment, and the Belmont area towards the southern end of the alignment (Figure 7-2and Figure 7-3). The total amount of time spent on manual searches was 20 person hours (one person for 16 hours with a second searcher assisting for four hours). Eighteen of the 20 person hours were spent on manual searches within the Northern Section and the other two person hours were spent within the southern section. Weather conditions were optimal for searching for herpetofauna: fine or slightly cloudy, calm or light winds, and mild to warm temperatures.

1.5 Nocturnal Spotlighting

Nocturnal searches for arboreal geckos were conducted along the northern section of the route using spotlights on the evening (21:00-23:00 hrs) of the 25 and 26 January 2010 (i.e. with total nocturnal search effort being 4 hours spread over two sampling sessions). This effort was considered sufficient given the paucity of suitable habitat. Spotlighting was targeted towards areas where woody vegetation (especially native shrubland or forest) was present (i.e. the northern section). Where 4x4 vehicle access was possible, a high-powered spotlight was run from the vehicle's battery allowing much greater illumination of the habitat than was possible with normal hand-held torches. The vehicle was driven slowly along the route by an assistant while the herpetologist systematically scanned the visible vegetation. To ensure maximum coverage, the alignment was then surveyed again while travelling in the other direction. Within areas with no vehicle access, a hand-held torch (Eveready Dolphin) was used to search for herpetofauna while walking slowly through the following habitats: kohekohe and mahoe/pigeonwood forest edge and interior, scrub and scrub/pasture mix. A total of 2.5 hours were spent spotlighting from the vehicle and 1.5 hours were spent spotlighting on foot using hand-held torches.

2. SURVEY CONSTRAINTS

Survey methods for indigenous herpetofauna (especially lizards) have their limitations, and accordingly their results need to be interpreted with a degree of caution. For example, it is possible that seasonal and climatic changes may affect lizard survey results. Furthermore, results of lizard surveys are undoubtedly influenced to some degree by observer bias. Consequently, it is essential to consider the results of the field work (i.e. the sampling methodologies) in conjunction with the results of the database search and habitat assessment.

A site-specific factor that may have potentially affected the results of the herpetofauna surveys is that many of the scree slopes and stone fields present were too deep to excavate without destroying their habitat values. Destructive searches are only recommended if the animals are to be immediately relocated to suitable alternative habitat, and this was not the case. Given that comprehensive searches of these scree slopes were therefore not feasible, it was not possible to accurately determine either the presence or abundance of the lizard species that could be utilising such habitats.

Furthermore, New Zealand's arboreal lizards are particularly difficult to detect. They are typically well camouflaged, and they may occur anywhere within forest and shrubland habitats (e.g., canopy, tree cavities, beneath bark, etc.). Consequently, the absence of lizards from any location within the Main Alignment (especially where suitable habitat exists) may be more an artefact of the sampling constraints rather than any genuine absence. Thus, it will be important that when construction of the Project commences in areas of suitable lizard habitat an experienced herpetologist is on hand to undertake destructive searches prior to earthworks commencing.

3. RESULTS

3.1 Desktop Investigations

According to the DOC database, 24 species of herpetofauna have been recorded within the Wellington Region since 1980. Of the 24 species, three are marine turtles, two are introduced frogs, one is an introduced lizard, five are endemic lizard species confined to offshore islands, one is an endemic lizard (Whitaker's skink, *Oligosoma whitakeri*) confined to coastal habitat, and tuatara (*Sphenodon punctatus*) and Maud Island frogs (*Leiopelma pakeka*) have recently been reintroduced to the Karori Wildlife Sanctuary. The remaining 10 species (listed in Table 7-2) are all endemic lizards which could potentially occur within the Main Alignment (Table 7-2). Whitaker's skink (*O. whitakeri*) is a rare species which is confined to a small area of coastal habitat at Pukerua Bay approximately 4.5 km west of the Main Alignment at the nearest point; it will not be affected by construction works.

Aerial imagery and preliminary vegetation data indicated that the following potential lizard habitats are present within the Main Alignment: native forest, scrubland, stone field, scree and grassland. All of those habitats have the potential to support gecko and skink populations.

3.2 Habitat Assessment

From the site visit it was established that most of the habitat along the Main Alignment represents poor to marginal habitat for indigenous herpetofauna (see Appendix 7.A for photos of habitat occurring along and adjacent to the Main Alignment). Notable exceptions include the more mature indigenous forest and the larger/deeper stone fields and scree slopes towards the northern end of the alignment. Furthermore, the native shrubland (primarily tauhinu (*Ozothamnus leptophylla*)) within the northern section appeared to represent suitable habitat for Wellington green gecko. Consequently, these were targeted for the nocturnal survey (see Section 1.5). Grazed pasture lacking potential refugia such as rocks and logs was considered to represent poor habitat. Such habitat is the dominant vegetation community on the site.

Table 7-2: Conservation status and habitat preferences of herpetofauna potentially occurring along the Main Alignment.

Family	Common Name	Scientific Name	Conservation Status[1]	Habitat Preferences
Skink	Copper skink	*Oligosoma aeneum*	Not Threatened[PD]	Open and shaded areas where sufficient cover is available (e.g., rock piles, logs, dense vegetation, etc).
	Spotted skink	*O. lineoocellatum*	Relict[CD,PD]	Open grassland, scrub and stone fields.
	Common skink	*O. polychroma*	Not Threatened	Dry open areas with low vegetation or debris such as logs or stones for cover.
	Ornate skink	*O. ornatum*	Declining[CD,PD]	Open and shaded areas where sufficient cover is available (e.g., rock piles, logs, dense vegetation, etc).
	Brown skink	*O. zelandicum*	Not Threatened[Sp]	Forest or densely vegetated and damp areas in forest, scrub, grassland, gardens and coastlines.
Gecko	Common gecko	*Hoplodactylus maculatus*	Not Threatened[PD]	Forest, scrub, grassland and coastal areas
	Pacific gecko	*H. pacificus*	Relict[CD,PD]	Forest, scrub, grassland, coastal areas and creviced clay banks
	Marlborough mini gecko	*H.* aff. *maculatus* "Marlborough mini"	Not Threatened	Forest, scrub, grassland and coastal areas
	Southern forest gecko	*H.* aff. *Granulates* "southern North Island"	Not Threatened	Forest and scrub, especially kanuka / manuka, and creviced clay banks
	Wellington green gecko	*Naultinus elegans punctatus*	Declining	Forest and scrub, especially kanuka / manuka.

3.3 Artificial Retreats

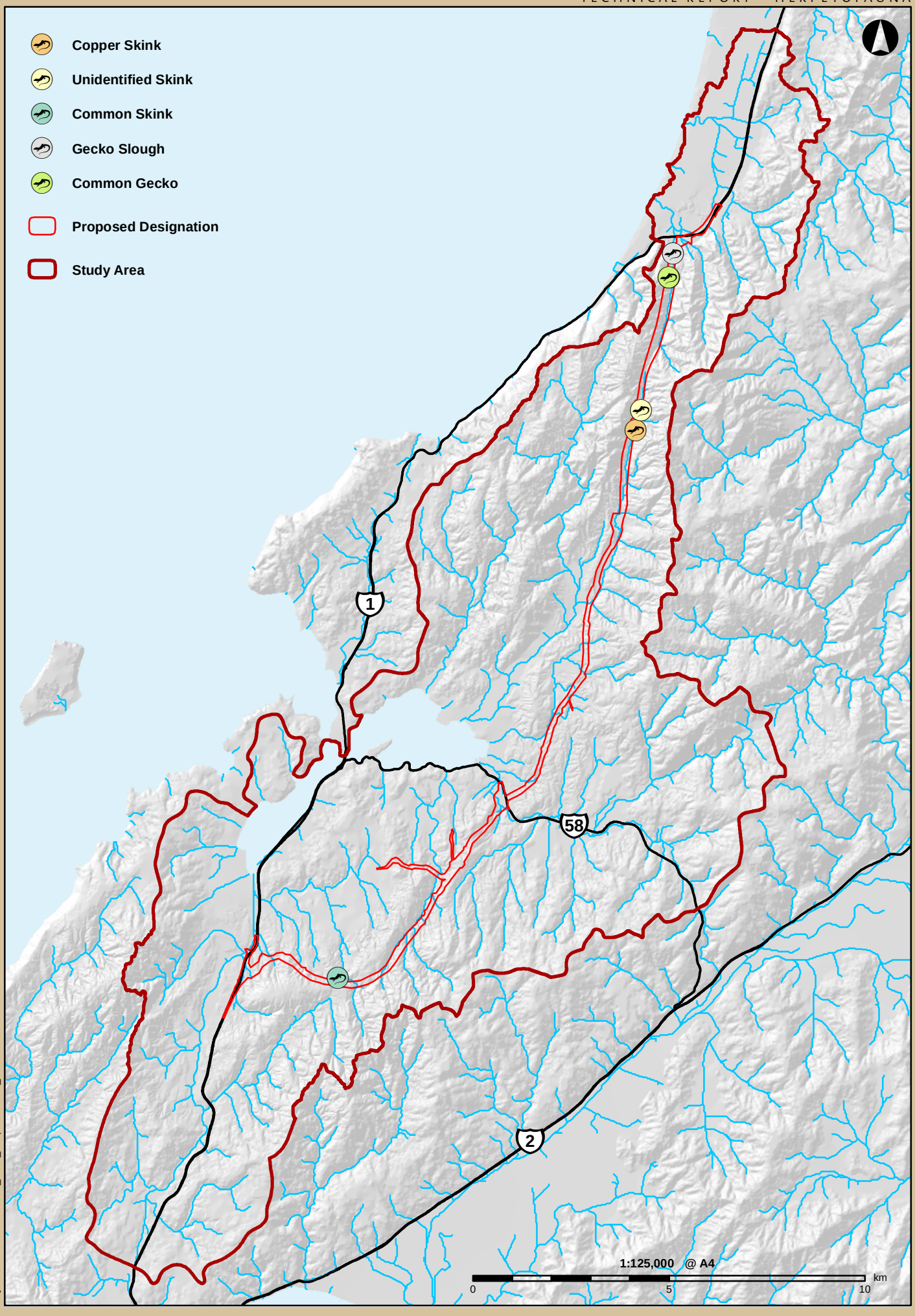
Only 64 of the 74 ARs that were originally laid were re-located when checking for the presence of herpetofauna at least six weeks later. Given that the location of each AR had been fixed by way of GPS, the 10 missing ARs were most likely blown away by strong winds that occurred in February. From the 64 ARs re-located, only four individual lizards were detected, being two common skink and two copper skink (see Figure 7-4). The two common skink were located under a single AR (121) at the southern end of the alignment in ungrazed pasture (see Figure 7-4). In comparison, the two copper skink were found under different ARs (62 and 72) in stone fields within the northern section (see Figure 7-4). Following the check for herpetofauna, all ARs that were re-located were retrieved from the field.

3.4 Manual Searching

A juvenile and two female individual common gecko were the only lizards observed during manual searching (see Figure 7-4). All were found beneath rocks within a stone field in grazed pasture near the northern end of the alignment.

Nine gecko (probably common gecko) skink sloughs were found among the scree at the very northern end of the alignment (see Figure 7-4).

[1] According to Hitchmough *et al.* (2010) with qualifiers: CD=Conservation Dependent; PD=Partial Decline; Sp=Sparse.



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HERPETOFAUNA LOCATIONS 7.4

3.5 Nocturnal Spotlighting

Despite the presence of apparently suitable habitat (i.e. mature indigenous forest, larger/deeper stone/boulder fields, tauhinu shrublands), no herpetofauna was detected during the nocturnal spotlighting surveys.

4. DISCUSSION

4.1 Species

The three herpetofauna species (common gecko, common and copper skink) detected within or adjacent to the Main Alignment are among the North Island's most common indigenous lizards, all being classified as Not Threatened (Hitchmough *et al*. 2010). While no uncommon or threatened species were detected, this suite of three common native lizard species present has ecological value; it is most probably representative of the lizard communities occurring across much of the inland Wellington Region – especially in agricultural landscapes with remnants/patches of forest and shrubland and/or deep scree slopes. The poor to marginal quality of much of the lizard habitat along the Main Alignment, together with the presence of a wide variety of introduced mammalian predators (i.e. rodents, mustelids and cats) indicates that the Project's lizard community represents a relict (as opposed to a thriving) population.

It is possible that additional lizard species occur along the Main Alignment but were not detected as a result of the survey constraints discussed earlier (Section 2). However, given the variety and intensity of the surveys, if any species were missed they are unlikely to be present in any abundance. The restriction to three species within and adjacent to the Main Alignment (from the 10 potential species listed in Table 7-2) suggests both a lack of suitable habitat for the majority of these additional species together with high predation pressure from introduced mammals. Evidence from islands from which introduced predators have been eradicated suggests that some lizard species are able to persist at such low numbers as to be undetectable in the presence of predators, and this may possibly be the case in relation to the Project. However, on balance (and with regard to the data set collected) the herpetofauna communities within the Project footprint appear to be dominated by three common species that are all present only in low numbers.

4.2 Habitats

Much of the Main Alignment represents poor to marginal herpetofauna habitat. Grazed pasture is the dominant vegetation community. While lizards are sometimes resident in such habitat they are usually only found sheltering beneath rocks, logs and debris (e.g. corrugated iron). Conversely, ungrazed pasture (i.e. rank grassland) represents potentially better (even good) lizard habitat, and indeed the two common skinks that were detected were found under an AR located within rank grass at the southern end of the Main Alignment. However, this type of vegetation cover is rare within the Alignment.

The highest quality herpetofauna habitat within the Main Alignment appears to be the stone fields and scree slopes located towards the northern end of the alignment. The two deep scree slopes located here probably represent the best habitat for common gecko within the Main Alignment. However, this could not be confirmed as destructive surveys would have been required (refer to Section 2). Nevertheless, the

observation of several sloughed (probably common) gecko skins in these scree slopes suggests that this species is present here, and given this it is concluded that these northern scree slopes represent significant herpetofauna habitat.

In addition to the above, it is noteworthy that the stone fields that are also found in the northern end of the footprint supported the three common geckos, the copper skink and the unidentified skink). This supports the conclusion that the Project's northern stone fields and scree slopes represent the site's most important herpetofauna habitat.

The native forest in the Wainui Saddle area (also located within the northern end of the Project footprint) may provide habitat for arboreal gecko species such as forest gecko and Wellington green gecko. However, the survey programme revealed no herpetofauna occurring within the native forest habitats. They may be present but undetected due to the inherent difficulties in surveying for gecko (see Section 2) and/or low population densities. Regardless, given that the vast majority of forest habitat in the area lies outside the Main Alignment, the small areas of native forest that are located within it are unlikely to represent significant herpetofauna habitat.

5. CONCLUSIONS

- The Main Alignment provides habitat for at least three endemic lizard species: common gecko, copper skink and common skink.
- The alignment is dominated by grazed pasture which represents poor habitat for native herpetofauna.
- No herpetofauna were located within native forest and/or shrublands within the Project footprint. However, these habitats may nevertheless possibly contain native herpetofauna in low numbers. Notwithstanding this, little of this habitat type is present within the Project footprint.
- One skink species (common skink) was identified in an area of rank pasture in the southern end of the Project. This habitat type is uncommon within the Project footprint.
- The scree slopes and stone fields towards the northern end of the Main Alignment provide habitat for common gecko and copper skink and are therefore of some ecological significance for their herpetofauna habitat values.

6. RECOMMENDATIONS

- The EIA report and detailed design of the Project must consider and address all issues that could potentially impact (both directly and indirectly) upon native lizards known to occur within the footprint and within the wider surrounding area.
- Addressing these issues is likely to necessitate the capture and relocation of native herpetofauna present within the footprint by way of comprehensive and destructive searches of all good or better potential habitats immediately prior to Project works commencing.

TERRESTRIAL MACROINVERTEBRATES

Despite contributing substantially to biodiversity, terrestrial macroinvertebrates are often overlooked. In the case of agricultural landscapes such as the grazed pasture which dominates the Main Alignment, the terrestrial macroinvertebrate communities are typically dominated by introduced and ubiquitous taxonomic groups. Regardless, it is possible that At Risk or Threatened species may occur along the Main Alignment and as such a habitat assessment and survey was undertaken. The objectives of the terrestrial macroinvertebrate investigations were:

- To determine whether significant terrestrial macroinvertebrate communities or habitats occur within the Main Alignment.
- To determine whether the application of additional sampling methodologies is warranted.

With regards to the Wildlife Act (1953), the definition of an animal includes any terrestrial or freshwater invertebrate declared to be an animal under Schedule 7 of the Act. As such, all those invertebrate species listed in Schedule 7 are protected under the Wildlife Act.

7. METHODS AND SEARCH/SAMPLING EFFORT

Targeted searches for indigenous snails and other potentially significant invertebrate species were undertaken by way of searching *in situ* a total of 13 50 x 50 cm leaf litter quadrats, located within native forest at the northern end of the Project. Eight of the quadrats were within kohekohe forest and five were within mahoe/pigeonwood forest. The remainder of the other habitat types present within the Project footprint were considered to constitute habitat that would not be suitable for any uncommon native invertebrate species and/or communities.

Observations of terrestrial macroinvertebrate communities/habitats were also recorded opportunistically during other fieldwork – especially the herpetofauna habitat assessment and surveys on 25-27 January 2010 (see Figure 7-1, Figure 7-2 & Figure 7-3). In particular, rocks, logs and other debris were searched for any fauna present.

8. SURVEY CONSTRAINTS

It is recognised that the invertebrate surveys were somewhat limited in terms of areal extent, targeted only the one habitat type, were non-intensive and non-replicated, and used only a single sampling methodology (to the exclusion of other commonly accepted techniques such as pit-fall traps and malaise nets). However, given the overwhelming predominance of grazed pasture habitat within the Project footprint, the application of additional methodologies and sampling sites was not considered necessary; as such habitat generally supports only common invertebrate communities dominated by introduced taxa (including many pest species). The sampling approach that was undertaken was considered appropriate to the objective of identifying the presence of any significant terrestrial macroinvertebrate communities or species.

9. RESULTS

A wide variety of common terrestrial macroinvertebrates were detected (Table 7-3). No Threatened or At Risk species were observed (Hitchmough *et al.* 2007).

Table 7-3: Terrestrial macroinvertebrates detected adjacent and within the Main Alignment TG route.

Common name	Species / Taxonomic Group
Litterhopper	Amphipoda (Order)
Honeybee	*Apis mellifera*
Bumblebee	*Bombus* sp.
Sheetweb spider	*Cambridgea* sp.
Brown garden snail	*Cantareus aspersus*
Carabid beetle	Carabidae (Family)
Cockroach	*Celatoblatta* sp.
Midge	Chironomidae (Family)
Cicada	Cicadidae (Family)
Giant centipede	*Cormocephalus rubriceps*
Millipede	Diplopoda (Class)
Nurseryweb spider	*Dolomedes minor*
Fishing spider	*Dolomedes* sp.
Earwig	*Forficula auricularia*
Ant	Formicidae (Family)
Wellington tree weta	*Hemideina crassidens*
Silverfish	*Lepisma saccharina*
Earthworm	Lumbricina (Suborder)
Copper butterfly	*Lycaena salustius*
Garden slug	*Milax* sp.
Miturgid spider	Miturgidae (Family)
Magpie moth	*Nyctemera annulata*
Harvestman	Opiliones (Order)
Peripatus	*Peripatoides novaezealandiae*
White butterfly	*Pieris rapae rapae*
Mason wasp	*Pison spinolae*
Black cockroach	*Platyzosteria novaeseelandiae*
Slater	*Porcellio scaber*
Black tunnelweb spider	*Porrhothele antipodiana*
Huhu beetle	*Prionoplus reticularis*
Cave weta	Rhaphidophoridae (Family)
Passionvine hopper	*Scolypopa australis*
Flat worm	Seriata (Order)
False katipo spider	*Steatoda capensis*
Cinnabar moth	*Tyria jacobaeae*
Giant dragonfly	*Uropetala carovei*
Red admiral	*Vanessa gonerilla gonerilla*
Damselfly (red)	*Xanthocnemis zealandica*

10. DISCUSSION

10.1 Species

Investigations of terrestrial macroinvertebrate communities revealed that the Project footprint is a stronghold for *Peripatoides novaezealandiae* (see Figure 7-5 and Photos 7-7 & 7-8 in Appendix 7.A). Areas of native forest in the wider area are assumed to provide good peripatus habitat but they are difficult to detect within forest. While *P. novaezealandiae* is the most widespread of New Zealand's five currently recognised peripatus species, it is considered to represent a species complex rather than a single species, and it is currently undergoing taxonomic revision. Pending taxonomic divisions within the species complex, there are likely to be an increased number of distinct peripatus species deriving from *P. novaezealandiae*, each with fewer populations and overall national abundance, which would thereby increase the ecological significance of each peripatus population. It is not clear whether the taxonomic revision will lead to the threat classification of the peripatus found at this site being revised. Regardless of its eventual conservation status, peripatus are widely regarded as important in evolutionary biology due to their phylogenetic position, ancient history and Gondwanan distribution.

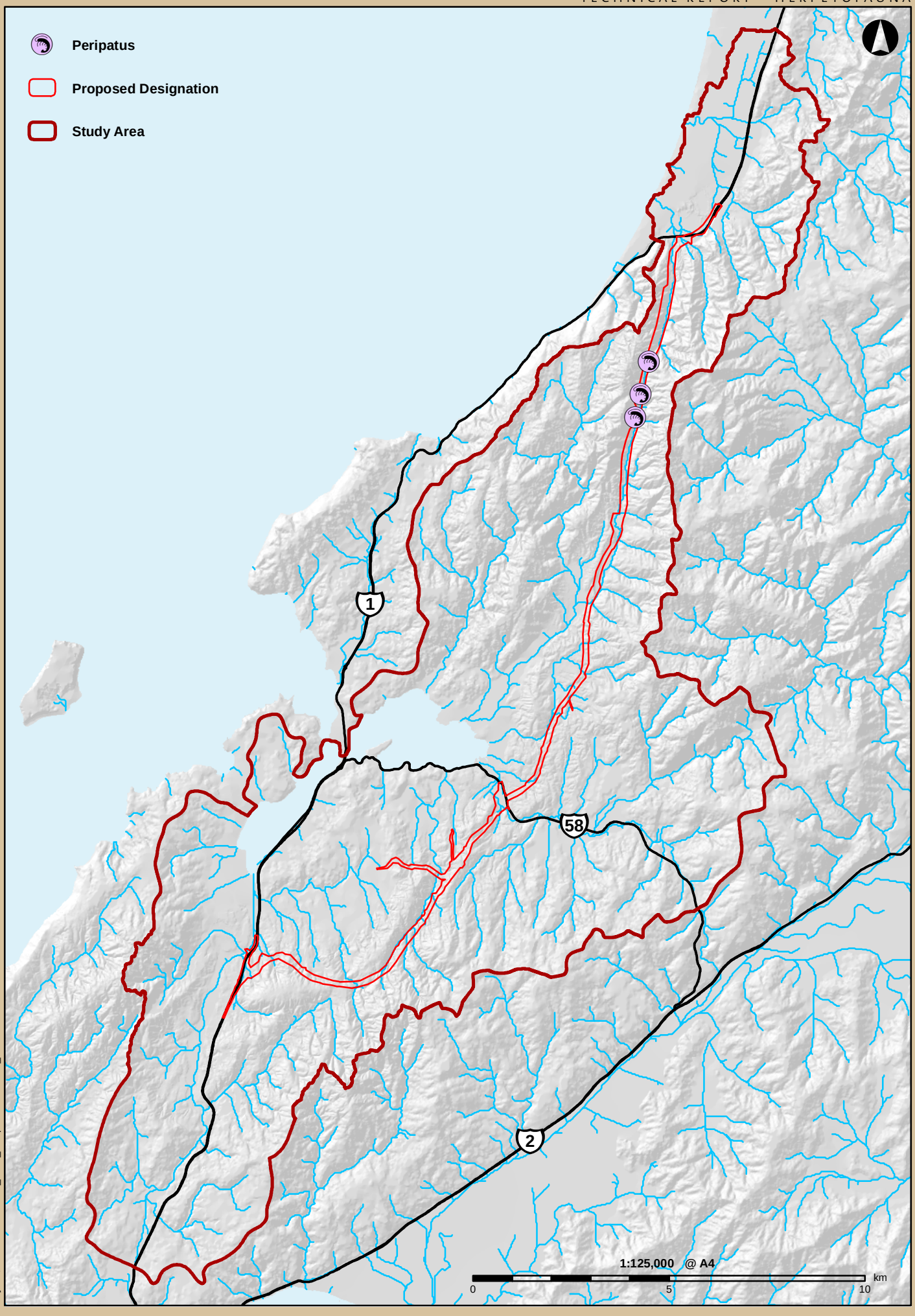
The other terrestrial macroinvertebrate species of note within the Project footprint is the red admiral butterfly (*Vanessa gonerilla gonerilla*), an endemic species that appears to be abundant here. The abundance of the red admiral butterfly can be explained by the abundance of ongaonga / tree nettle (*Urtica ferox*), the preferred food plant of its caterpillars. Ongaonga is particularly abundant in the lower tiers of the wider Project area's forest and shrubland areas, probably as a consequence of the reduction in more palatable species caused by introduced browsers such as the common brushtail possum (*Trichosurus vulpecula*).

10.2 Habitats

The most important habitats for indigenous terrestrial macroinvertebrates in the wider Project area are considered to be the native forest/shrublands, followed by the rocky areas such as scree slopes and stone fields. Within the Project footprint, peripatus abundance appeared to be highest beneath rotting logs in pasture, and where stone fields and scree slopes extend deep enough below ground level to provide sufficient shade and moisture during hot and dry periods. In contrast to the habitat of the other native terrestrial macroinvertebrates in the wider area, it appears that a substantial proportion of the local peripatus habitat occurs within the Project footprint.

11. CONCLUSIONS

- A wide variety of common terrestrial macroinvertebrates were observed adjacent and within the Main Alignment.
- The northern section of the Project passes through an area that appears to represent a peripatus stronghold. In particular, scree slopes, stone fields, rotting logs, and presumably native forest, provide excellent habitat for peripatus.
- While not currently classified as a threatened species, a pending taxonomic revision may have implications for the significance of the "Transmission Gully" peripatus population and habitats.



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PERIPATUS LOCATIONS 7.5

12. RECOMMENDATIONS

- The EIA report and detailed design of the Project must consider and address all issues that could potentially impact (both directly and indirectly) upon native fauna, such as peripatus, known to occur within the footprint and within the wider surrounding area.
- Addressing these issues is likely to necessitate the capture and relocation of the peripatus present within the footprint by way of comprehensive and destructive searches of all good or better potential habitats immediately prior to Project works commencing.

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Appendix 7.A: Habitat photos

Photo 7-1: Rough Pasture in the Horokiri

Photo 7-2: Forest – shrubland – pasture interface

Photo 7-3: Scree slopes in Te Puka

Photo 7-4: Boulder field in the Te Puka

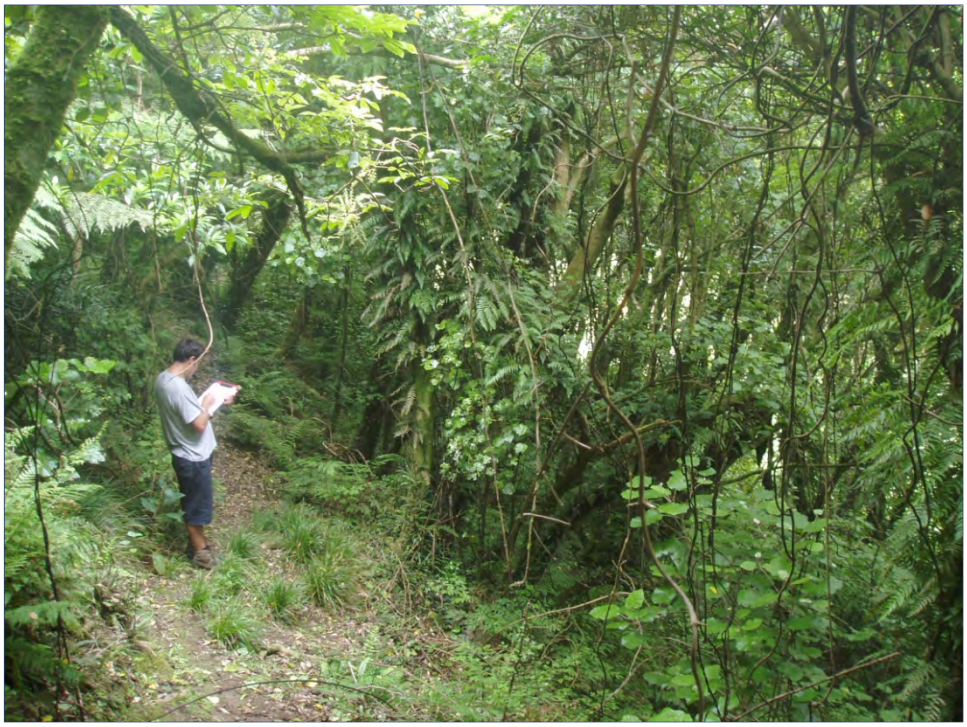

Photo 7-5: Forest interior, podocarp-broadleaf forest, Wainui Saddle

Photo 7-6: Forest interior – heavily browsed kohekohe coastal forest, Te Puka.

Photo 7-7: *Peripatus novaezealandiae* from Wainui Saddle

Photo 7-8: *Peripatus novaezealandiae* from Wainui Saddle