Caversham Highway Improvements :
Stage 2 - Caversham Valley Safety Improvements

ECOLOGICAL ASSESSMENT

Caversham Highway Improvements :
Stage 2 - Caversham Valley Safety Improvements

ECOLOGICAL ASSESSMENT

Prepared By .....
Roger MacGibbon
Principal Ecologist

Reviewed By .....
Nicola Etheridge
Senior Ecologist

Opus International Consultants Limited
Environmental
Opus House, Princes Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone: +64 7 838 9344
Facsimile: +64 7 838 9324

Date: 21 April 2011
Reference: 6CM015.02
Status: Final

Contents

1 Executive Summary 1

2 Introduction 3
2.1 Purpose of the Report 3
2.2 Context and Scope of Assessment 3
2.3 Methodology 4

3 Description of Site and Ecology 5
3.1 General site description 5
3.2 Historical flora and fauna 5
3.3 Current terrestrial vegetation 6
3.4 Current terrestrial and avian fauna 14

4 Assessment of Ecological Values 17
4.1 Significant indigenous vegetation 17
4.2 Fauna of ecological significance 17
4.3 Significant habitat for indigenous fauna 18
4.4 Sites of recognised ecological significance 18

5 Assessment and Management of Ecological Effects 19
5.1 Threat of peripatus mortality 19
5.2 Loss of habitat 20
5.3 Removal of vegetation 21

6 Conclusions and Recommendations 21

7 References 22

1 Executive Summary

Stage two of the Caversham Highway Improvements Project in Dunedin has a focus on improving the route efficiency and safety of State Highway 1 between Barnes Drive and Lookout Point. The consequence of this proposal is that a strip of land up to 40 metres wide will be added to the road corridor on the north side of the existing highway. This land is currently a mixture of vacant sections, residential housing, property accessways and public reserve land. Land on the south side of the existing highway will also be added that is almost entirely residential housing.

This report is an assessment of the likely effects of the proposed highway improvements on the ecology of the highway footprint and adjacent areas, and provides additional information related to changes made to the proposed highway footprint that were not able to be evaluated in the original assessment undertaken by Alice Bradley. It has been prepared as part of an Assessment of Environmental Effects, to support the Notice of Requirement and resource consent applications for the Project.

The existing Caversham Valley Road (SH1) corridor is a highly modified, urbanised environment. The vegetation growing along the roadside and in residential sections consists largely of planted shrubs and small trees. Two Dunedin City Council reserves exist on the north side of the highway. Lookout Point Reserve is a small (approximately 0.5 hectare) reserve at the upper (western end) of the highway corridor, near to the Mornington Road intersection. It has a canopy dominated by mature sycamore, pine and eucalypt trees with an understorey of introduced shrubs, regenerating sycamore and naturally regenerating native subcanopy and forest margin species.

Caversham Valley Forest Reserve is larger (approximately 3.4 ha) and occurs further down the valley. More than 50% of the reserve has been cleared of all vegetation and woody material and replanted in native seedlings. The land between these two reserves, mostly owned by the Walsh family and Dave Randle, has significant pine, eucalypt and sycamore tree cover with substantial native plant regeneration under the canopy. This land, plus sections of the larger reserve where trees still form a canopy, is the home of a population of peripatus, an ancient animal sometimes referred to as the link between worms and arthropods. The tree covered south-facing aspect of this site creates cool, constantly moist conditions and an abundance of rotting logs and stumps on the forest floor that is ideal habitat for peripatus and an array of other native invertebrates. The area is also well frequented by a variety of native forest bird species.

The proposed highway improvements will remove approximately 0.5 ha of tree covered reserve land. The impact of removal of the existing vegetation on this land is considered to be no more than minor in terms of the quality of the vegetation and the value of the habitat to native birds, however, the land to be cleared is possibly occupied by peripatus. While the peripatus population is currently known as *Peripitoides novaezealandiae,* a species not classified as threatened, there is a reasonable likelihood that the population found in the Caversham Valley is a unique species or genus not found beyond Dunedin City. The removal of the reserve vegetation will not, in itself, threaten the immediate existence of the peripatus population, or any other indigenous plant or animal species, however habitat removal could reduce the resilience of the peripatus population to withstand future disturbances, whether natural or human-induced. Consequently, it is considered that the removal of vegetation from the proposed highway footprint could have a potentially significant effect on the peripatus population and will require mitigation to offset this effect. For this reason it is recommended that the following mitigation measures be undertaken:

(i) Replacement of the reserve land lost by:

- protection of an equivalent area of appropriate habitat connected to the site currently occupied by peripatus, or
- procurement of an equivalent area of appropriate habitat connected to the site currently occupied by peripatus, or
- investment in the enhancement of an area connected to the existing peripatus area that has a tree canopy and could be improved as peripatus habitat reasonably quickly.

(ii) Contract the services of a person experienced in the habitat requirements and translocation of peripatus to produce a peripatus Translocation Plan prior to the commencement of highway construction.

(iii) Undertake a search, capture and translocation exercise along the length of the proposed highway footprint on the north side of the highway from Lookout Point Reserve to Caversham Valley Forest Reserve immediately prior to the commencement of vegetation removal to translocate as many peripatus as can be found from the site.

(iv) Commission the production of a Peripatus Management Plan as a reference document to be available for the Dunedin City Council, to assist in their management of the reserve areas, with the purpose of safeguarding the future of the peripatus population.

(v) Plant the highway fringes adjacent to the Caversham Valley Forest Reserve and Lookout Point Reserve in a natural assemblage of ecosourced native tree and shrub species appropriate for south facing Caversham slopes and link these to existing mature vegetation on both Council reserves to provide future habitat for native birds and invertebrates and long-term future habitat for peripatus.

2 Introduction

2.1 Purpose of the Report

Stage two of the Caversham Highway Improvements Project in Dunedin has a focus on improving the route efficiency and safety of State Highway 1 between Barnes Drive and Lookout Point (fig. 1). Specific changes proposed to improve route safety include:

- The highway will be widened to include a kerbed central median.
- The roadside shoulders will be widened.
- The road alignment will be eased.
- Houses will be removed and land acquired on both sides of the highway to accommodate the road widening.
- Some land from two Dunedin City Council reserves located on the north side of the highway, the Caversham Valley Forest Reserve and the Lookout Point Reserve, will be acquired to enable the improvements to take place.

The consequence of this proposal is that a strip of land up to 40 metres wide will be added to the road corridor on the north side of the existing highway. This land is currently a mixture of vacant sections, residential housing, property access ways and public reserve land. Land on the south side of the existing highway will also be added that is almost entirely residential housing.

This report is an assessment of the likely effects of the proposed highway improvements on the ecology of the highway footprint and adjacent areas. It has been prepared as part of an Assessment of Environmental Effects, to support the Notice of Requirement and resource consent applications for the Project.

An earlier report (February 2009) on the terrestrial ecology of the site was undertaken by Alice Bradley of Opus. Because the author of that report has since left Opus and the proposed configuration of the highway improvements have changed a fresh field survey and ecological assessment has been undertaken. This report discloses additional information to that provided in the first report, including an appraisal of the possible impact of the new proposed highway footprint on the population of peripatus that is known to exist on adjacent land.

2.2 Context and Scope of Assessment

This assessment includes the following:

- A description of the flora and fauna present along the proposed new line of the highway corridor.
- Description (where possible) of the flora and fauna areas adjacent and linked to the proposed new highway corridor.
- Assessment of the current ecological values within the proposed project foot print and areas adjacent and linked to the proposed footprint.

- Evaluation and description of the potential adverse effects (if any) of the Project on the ecological values along the project corridor and surrounding landscape, and the likely significance of those effects.
- Recommendations as to measures necessary to avoid, remedy or mitigate any effects (if more than minor) on the ecology along the project corridor.

Three separate references, O'Connor et al. (1990), Environment Waikato and Wildland Consultants (2002) and Norton and Roper-Lindsay (2004), have been used in this assessment as a guide for the determination of the ecological significance of any area of indigenous vegetation and any area of indigenous fauna habitat. The last two mentioned references specifically cover criteria for the determination of significance under section 6(c) of the Resource Management Act.

The New Zealand Threat Classification System (Hitchmough et al. 2007) has been used to determine the importance of any indigenous plant or animal species present in the project area.

2.3 Methodology

This ecological assessment was undertaken in the following way:

- Review of the current and historical documentation for this project and on the ecology of the surrounding landscape, including extraction of all information that may relate to the biology of the site and likely impact on the ecology, past and present. All documents reviewed are listed in the References section of this report.
- Identification of the project footprint on maps and aerial photographs supplied, and determination of the likely ecological links of the site to the surrounding landscape and especially any nearby areas of high ecological significance.
- Physical inspection of the proposed new highway designation/footprint from Caversham Valley Road.
- Walk-through site inspection of Lookout Point Reserve and Caversham Valley Forest Reserve to determine the location, state and composition of the flora and fauna along the corridor.
- Guided (and landowner approved) inspection of land owned by Mr Dave Randle (146 Caversham Valley Road) and by Walsh family (172 Caversham Valley Road).
- Drive-around physical inspection of the landscape surrounding the project site to determine any important ecological linkages.
- Meeting and subsequent communication with Otago Museum entomologist Tony Harris, and reference to notes compiled by Tony Harris on the Caversham Valley peripatus population.
- Meeting with affected landowner, Dave Randle, who has extensive "hands-on" experience with, and knowledge of, this population of peripatus.

3 Description of Site and Ecology

3.1 General site description

The section of highway under consideration drops down to the east through Caversham Valley from a high point at the Mornington Road intersection (Lookout Point) and extends towards the city as far as the Barnes Road intersection (fig. 1). The land required for the highway improvements and proposed for NZTA acquisition can be seen in figures 2 and 3.

The slopes to the north of the road corridor are moderately steep and, apart from a fringe of housing along State Highway 1 and on adjoining secondary roads, the area from Mornington Road to Aberfeldy Road is largely covered in mixed secondary exotic and indigenous forest, scrubland and rough pasture. This slope is south to south east facing and so remains damp and cool throughout the year.

The area east of Aberfeldy Road through to Barnes Drive is more heavily occupied by residential housing. Sidey Park, a large grass covered Council park, occupies the land at the junction of Barnes Drive and State Highway 1.

The land on the south side of State Highway 1 is less steep and is covered in residential housing from the Mornington Road intersection to the Barnes Road intersection.

Two Dunedin City Council reserves exist on the north side of the highway. Lookout Point Reserve is a small (approximately 0.5 hectare) reserve at the upper (western end) of the highway corridor, near to the Mornington Road intersection. Caversham Valley Forest Reserve is larger (approximately 3.4 ha) and occurs further down the valley (fig. 5).

3.2 Historical flora and fauna

In pre-human times the valley and south facing slopes would have been under a mixed podocarp / broad-leaved forest cover. Little of the original indigenous vegetation now remains in the Caversham Valley area. The valuable timber species, the podocarps: rimu (*Dacrydium cupressinum*), totara (*Podocarpus totara*), matai (*Prumnopitys taxifolia*) and kahikatea (*Dacrycarpus dacrydioides*), were all extracted through the mid 1800's but remnants of the broad-leaved component of the forest do exist on the northern face of Caversham Valley. Quite old specimens of tree fuchsia (*Fuchsia excorticata*), broadleaf (*Griselinia littoralis*) and cabbage tree (*Cordyline australis*) can be found in the bush remnants.

The moist cool nature of the south-facing Caversham slopes would have been home to an array of native birdlife. Early records refer to kereru (*Hemiphaga novaeseelandiae*), kakariki (*Cyanoramphus novaezelandiae*), kaka (*Nestor meridionalis*), bellbird (*Anthornis melanura*), saddleback (*Philesturnus carunculatus*), morepork (*Ninox novaeseelandiae*), robin (*Petroica australis*), tui (*Prosthemadera novaeseelandiae*), grey warbler (*Greygone igata*), fantail (*Rhipidura fuliginosa*) and tomtit (*Petroica macrocephala)* being present. Today, only kereru, fantail, grey warblers, tui and bell bird exist in any number.

South facing moist forest areas provide favourable habitat for moisture dependent groundcover plants such as mosses and filmy ferns, and for ground dwelling invertebrates

including peripatus (Phylum: Onychophora). No reference has been found to any peripatus population in Dunedin prior to 1990.

3.3 Current terrestrial vegetation

3.3.1 Caversham Valley Road Corridor

The existing Caversham Valley Road (SH1) corridor is a highly modified, urbanised environment. The vegetation growing along the roadside and in residential sections consists largely of planted shrubs and small trees. The roadside plantings, including both sides (north and south) of the Barnes Drive intersection and around the perimeter of Sidey Park consist of native flax (*Phormium tenax*), ngaio (*Myoporum laetum*), toetoe (*Cortaderia richardii*.), karamu (*Coprosma robusta*), mahoe (*Melicytus ramiflorus*), wineberry (*Aristotelia serrata*), cabbage tree (*Cordyline australis*), and introduced agapanthus (*Agapanthus praecox*). Self-established introduced tree species, especially sycamore, are common where reserve land adjoins the road corridor. Invasive weed species including gorse (*Ulex europeus*) and blackberry (*Rubus fructicosus* agg.) also occur along these margins.

3.3.2 Lookout Point Reserve

Lookout Point Reserve is a 0.5 hectare gully reserve near the upper end of the project corridor. The reserve encompasses a small stream that carries surface runoff from the slopes above. It has a canopy of largely introduced tree species dominated by sycamores (*Acer pseudoplatanus***)** and including *Pinus radiata,* eucalypts (*Eucalyptus* spp.), and poplars (*Populus* spp.) (fig. 6). The reserve has a mixed understorey of introduced shrubs and naturally regenerating native small tree and shrub species including karamu (*Coprosma robusta*), pate (*Schefflera digitata*), lancewood (*Pseudopanax crassifolius*), broadleaf (*Griselinia littorlais*), lacebark (*Hoheria sexstylosa*) and kohuhu (*Pittosporum tenuifolium*). An upper section of the reserve is in rank grass and the margins contain a variety of introduced weed species including blackberry and bindweed (*Calystegia silvatica*). No mature trees of broadleaf species were observed in this reserve.

Lookout Point Reserve is not listed in the Dunedin City District Plan as an “Area of Significant Conservation Value”.

An estimated 0.15 hectares (30%) of the 0.5 ha reserve is likely to be cleared for use for the highway improvements (fig. 2).

Figure 1: Overview of the extent of stage 2 of the Caversham Highway Improvements Project : Caversham Valley Safety Improvements

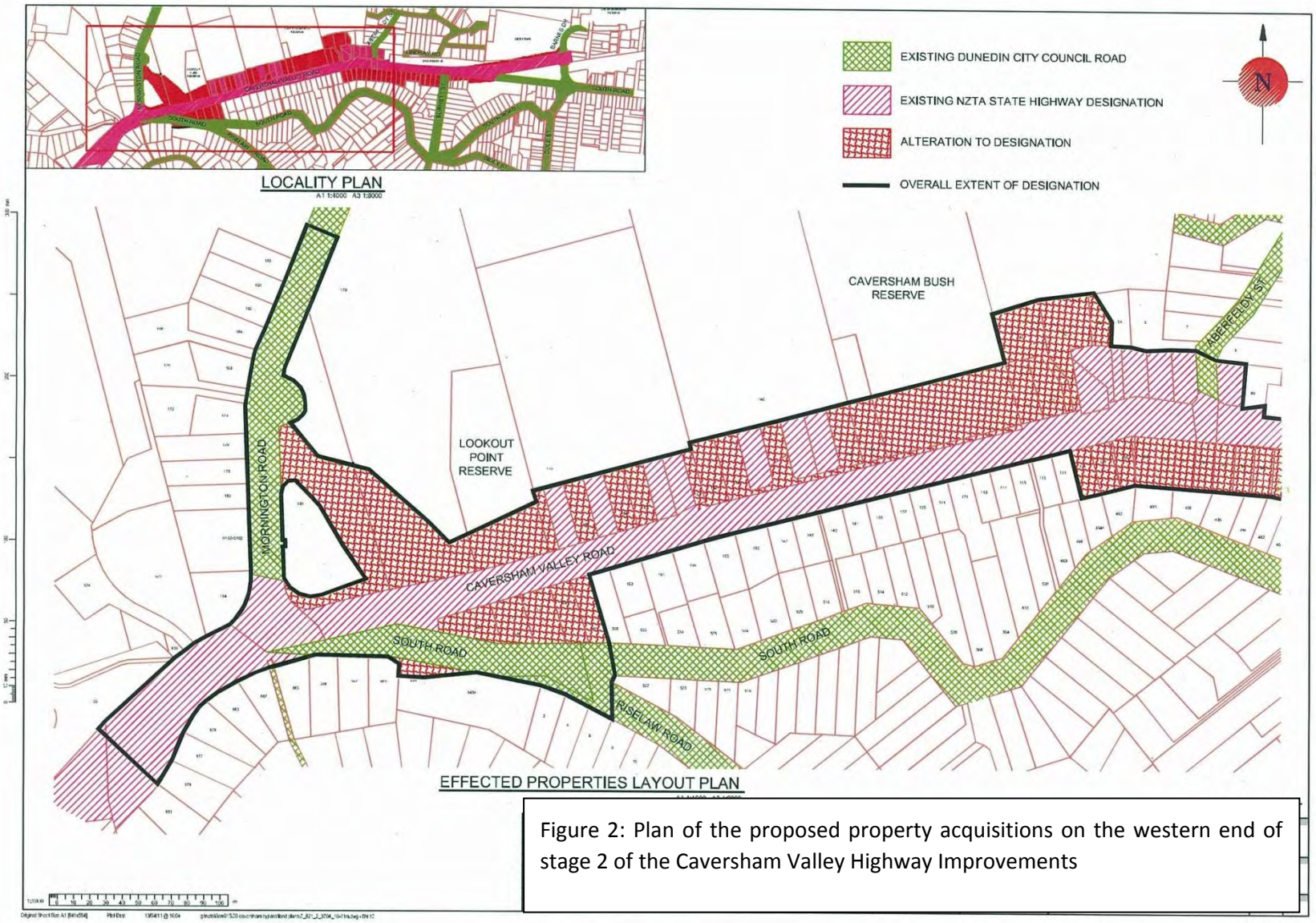

Figure 2: Plan of the proposed property acquisitions on the western end of stage 2 of the Caversham Valley Highway Improvements

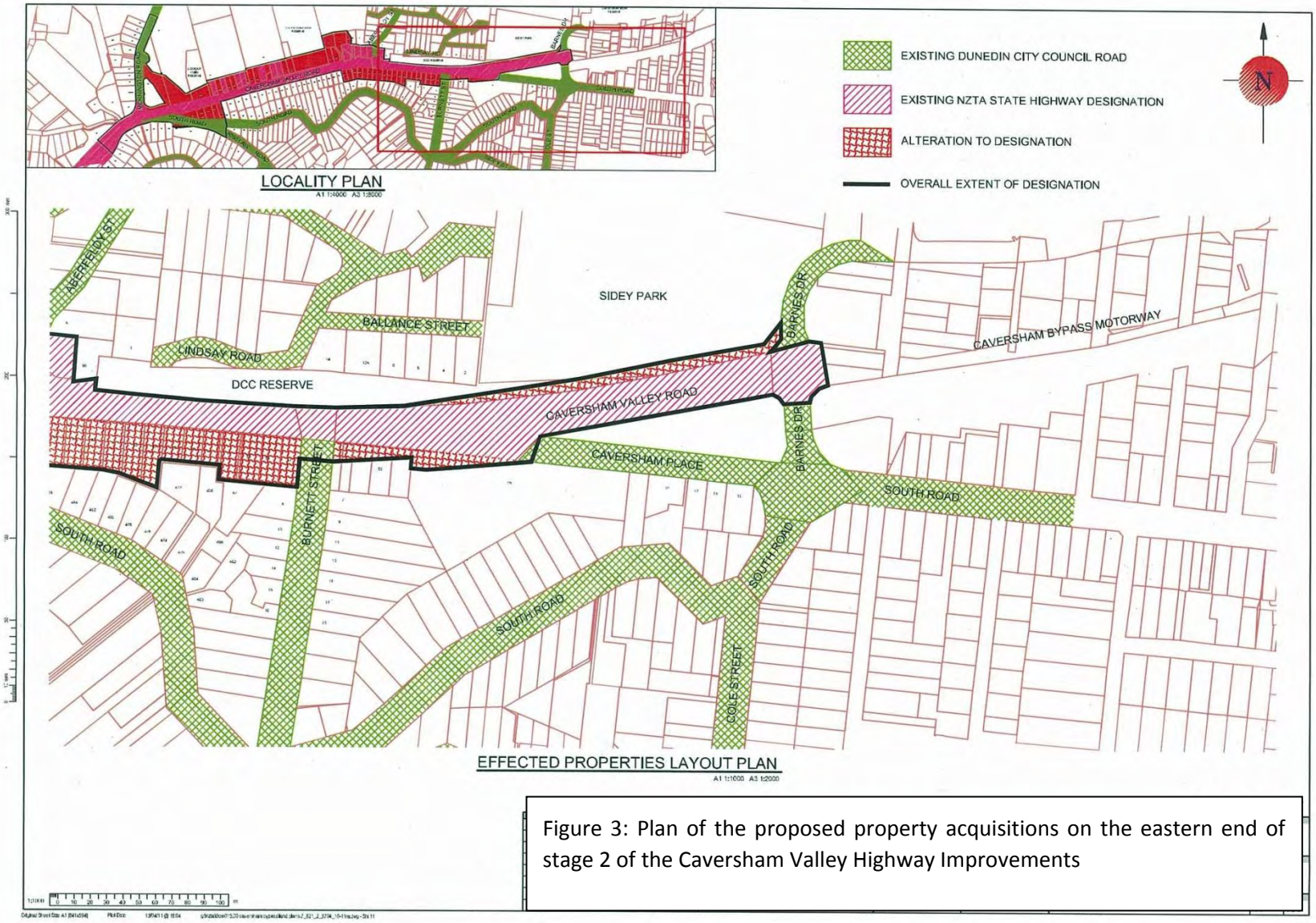

Figure 3: Plan of the proposed property acquisitions on the eastern end of stage 2 of the Caversham Valley Highway Improvements

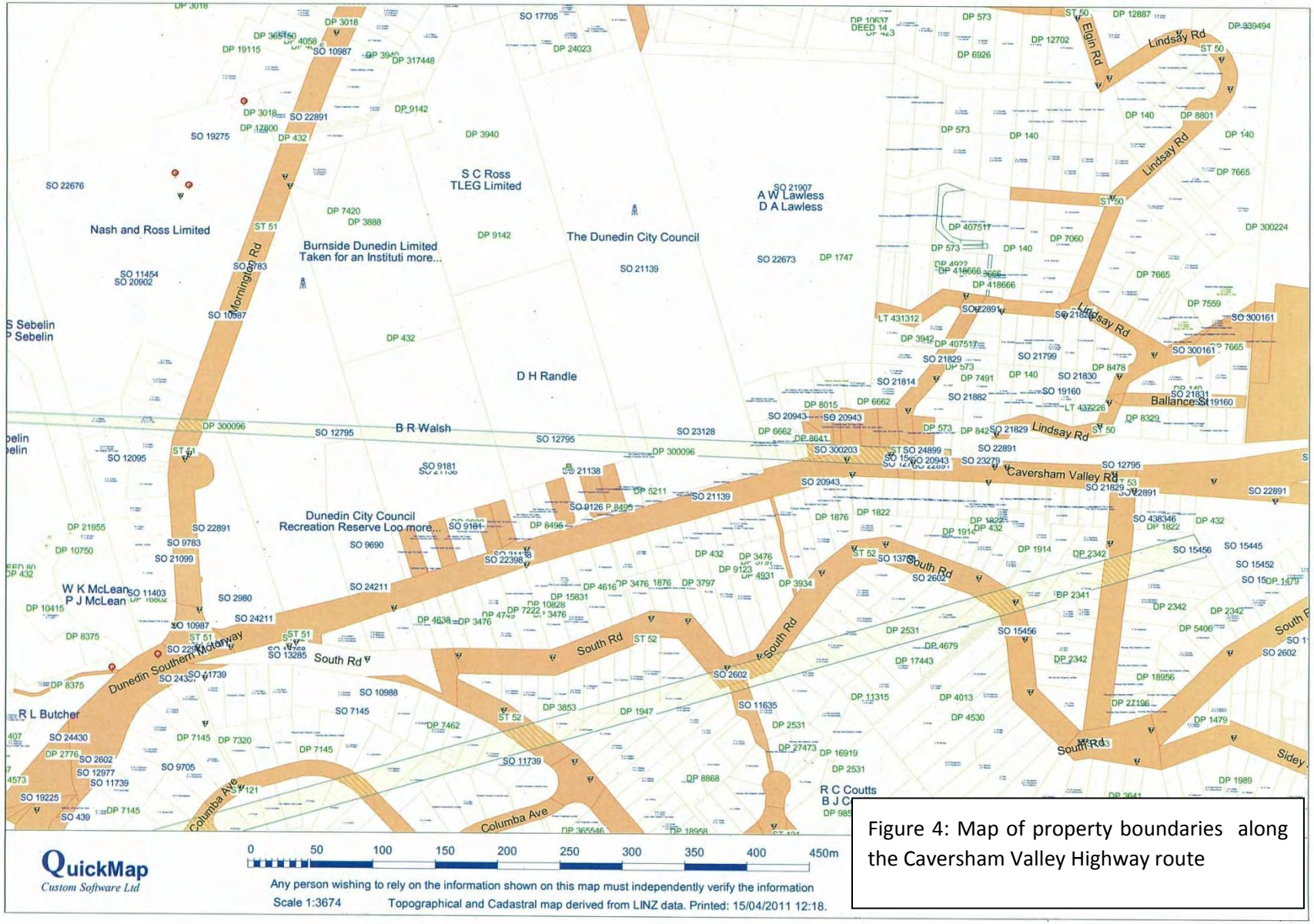

Figure 4: Map of property boundaries along the Caversham Valley Highway route

Figure 5: Aerial view of Caversham Valley Road and adjacent properties between the two reserves showing the proposed location of the realigned highway and access road. The red line shows the northern extent of the proposed designation.

3.3.3 Caversham Valley Forest Reserve

Caversham Valley Forest Reserve is a 3.4 ha Dunedin City Council reserve located on the northern side of State Highway 1 approximately 200 metres to the east of Lookout Point Reserve. It has a 100 metre wide frontage onto SH1 and extends about 350 metres up the hill away from the highway.

The reserve was purchased by the Dunedin City Council, with assistance from the Royal Forest and Bird Protection Society, in 1994 for the purpose of protecting a variety of invertebrate species including peripatus, and protecting the habitat necessary for the survival of these species (Caversham Valley Forest Reserve Management Plan, 1996).

Caversham Valley Forest Reserve is identified in the District Plan as an Area of Significant Conservation Value. This designation was placed on the reserve when the existence of the ancient invertebrate known as peripatus or the velvet worm was discovered there.

Figure 6: View looking up (west) Caversham Valley Road (SH1) showing the edge of Lookout Point Reserve. All of this section will be removed for road widening under the proposed plan.

Figure 7: View looking up (north) Caversham Valley Forest Reserve showing the large area of recently planted native trees and shrubs. None of this part of the reserve will be affected by the highway improvements.

The reserve consists of a mixture of vegetation. A large part of the central section of the reserve (over half of the full reserve area) has been cleared of exotic trees (including all stumps and woody material) and recently replanted in native broadleaf tree and shrub species and a handful of podocarp forest canopy species (fig 6). Species planted include: cabbage tree, wineberry, kohuhu, lemonwood, kanuka (*Kunzea ericoides*), red matipo (*Mrysine australis*), broadleaf, horopito (*Pseudowintera colorata*), five-finger (*Pseudopanax arboreus*), kowhai (*Sophora microphylla*) and tree daisy (*Olearia avicenniaefolia*). Podocarps planted included totara and kahikatea. A wide unplanted grass strip provides access up the centre.

The outer margins of Caversham Valley Forest Reserve retain a scattering of mature introduced eucalypts, pines, Douglas fir (*Pseudotsuga menziesii*) and sycamores with a mixed understorey of regenerating natives, especially pate, mahoe, tree fuchsia, karamu, and kohuhu, as well as blackberry, broom, and sycamore seedlings and saplings.

The lower section of the reserve adjacent to SH1 has a scattered canopy made up largely of sycamore and willow (*Salix* spp.), with some elm (*Ulmus* spp.) and an understorey of regenerating karamu, cabbage tree, pate and mahoe, and planted ngaio (*Myoporum laetum*), lacebark, flax (*Phormium tenax*), korokio (*Corokia cotoneaster*), kowhai, miro (*Prumnopitys ferruginea*), *Hebe salicifolia*, and toetoe (fig. 8). Blackberry is common. An old, largely disused sealed car park area exists close to the highway and a stream channel runs through this area of vegetation, parallel to SH1. This channel begins above (west of) the entranceway to Dave Randle's property at 146 Caversham Valley Road and appears to be fed mostly from runoff from the slopes above and some stormwater flow, apparently, from the subdivision at the top of the face. All of this section of stream and vegetation, amounting to about 0.4 ha (12% of the reserve) will be required for the highway improvements.

Figure 8: View of the SH 1 frontage of Caversham Valley Forest Reserve. All of the vegetation in the foreground and middle ground will be removed to make way for the highway improvements.

3.3.4 Randle and Walsh properties

Dave Randle and the Walsh family own sizeable areas of tree and scrub covered land adjacent to each other that provide a contiguous ecological link between the two reserves. Both properties have significant ecological values that are relevant to this assessment.

The Walsh's own approximately 1.3 ha of land to the east of Lookout Point Reserve and Dave Randle owns 1.5 ha between the Walsh property and Caversham Valley Forest Reserve (fig. 4).

A significant portion of both properties have a mixed pine, eucalypt and sycamore tree cover with a recovering understorey of native seedlings and saplings. Pockets of sycamore saplings remain although Dave Randle has worked steadily over the past two decades to remove a significant portion of the sycamore regrowth and encourage native seedling regeneration. The method of restoration applied has been to selectively remove adult pine, sycamore, eucalypt and Douglas fir trees in order to create small light wells and minimise the amount of forest floor exposed to drying out. The natural regeneration is then managed to favour the natives. This approach also retains and enhances the habitat for the peripatus population resident at the site (see later discussion).

At the upper end of the Randle property and extending into the bush clad property to the north (owned by S.C. Ross) are some large mature specimens of broadleaf, mahoe, tree fuchsia and cabbage tree. The indigenous component of this section of bush is high and native seedling regeneration noticeable and significant.

The bush cover on the Walsh and Randle land and on the adjoining Ross property and Caversham Valley Forest Reserve provides a sizeable contiguous area of recovering native bush. Stands of trees at the northern end of the Walsh property also provide some link with Lookout Point Reserve.

Up to 40 metres of driveway on both the Randle and Walsh properties is proposed to be taken to enable the highway improvements to occur. Both driveways are bush lined, with a mix of exotic and native shrub species, but little else of their land will be required.

3.3.5 Northern bush boundaries of residential sections

The back (northern) boundaries of the residential sections between the Walsh driveway and the Caversham Valley Forest Reserve entrance on the northern side of the highway are joined by a contiguous bush thicket, much of which serves as riparian vegetation for the stream channel that flows to the east (fig 5). It is likely that most of this vegetation will be removed to widen the highway channel and the stream channel may be altered as a result of the fill that will need to be imported to elevate the land to the current road level. No construction cross-sections were available at the time of compiling this report.

3.4 Current terrestrial and avian fauna

3.4.1 Invertebrates

This area of Dunedin, especially the moist south-facing slopes under forest cover, is known for having an array of litter occupying invertebrates including several species of flightless beetle (part of the original fauna of this area), native land snails (confirmed by Dave Randle) and giant native springtails (Collembola) (source: Caversham Valley Forest Reserve Management Plan). These species will be confined to the bush areas where forest

floor moisture and organic humus levels are high, and are likely to be absent from the section of the reserve that has been cleared and planted in natives.

The invertebrate of most significance is a population of an ancient invertebrate animal called peripatus or velvet worm that is known to exist on the land owned by Walsh and Randle, and on the Caversham Valley Forest Reserve. This population was only officially discovered in the early 1990's although it is likely that this population has persisted since the time of forest clearance .

Peripatus are classified in a Phylum of their own – Onychophora. They are considered to be a possible ancient link between worms (Annelida) and insects, spiders and centipedes (Arthropoda). They have remained largely unchanged in form for 500 million years (compared to tuatara which are about 200 million years old).

In New Zealand, five peripatus species within two genera are currently recognised. However, very little work has been undertaken on the taxonomic status of the New Zealand peripatus. It is possible that there may be as many as 25 separate species amongst those currently classified as five species (Gleeson and Ruhberg, 2010).

The Caversham variety of peripatus is currently included in the species *Peripatoides novaezealandiae.* Gleeson and Ruhberg (2010) believe that this species is likely to be made up of a complex of species that have yet to be separated by taxonomists. Tait and Briscoe (1995) described the Caversham variety as having quite distinct morphological features from others in *P. novaezealandiae* and suggested that they may be a unique species and possibly a unique genus. Peripatus of the same or similar form as those at Caversham also occur in small numbers at Leith Hill and Saddle Hill in Dunedin (Tony Harris, pers comm).

The species complex *Peripatoides novaezealandiae* is not currently listed on the New Zealand Threat Classification System Lists as a threatened species, however, if the Caversham population was reclassified as a unique species or genus then that status would change.

A relatively large population of peripatus is believed to exist on the south facing slopes of Caversham Valley (Mark, A.F, 1994; Dave Randle and Tony Harris, pers com). The largest population would appear to occur on Mr. Dave Randle's property (Mark, A.F. 1994), with a smaller number also occurring under the tree canopy on the Walsh property. Some may remain on Caversham Valley Forest Reserve in the areas where mature tree cover has been retained, and it is likely that they also inhabit the Ross owned area of bush that lies to the north of the Randle property.

Peripatus require cool constantly moist conditions all year round to survive. They readily dehydrate when exposed to open areas and sunlight. Consequently, forest or bush covered south facing slopes that remain moist all year round provide ideal habitat. They are forest floor dwellers who occupy logs, tree stumps, rotting wood and leaf material on the forest floor. They will occupy the logs and stumps of a range of native and exotic species (including pines and eucalypts) but they do not inhabit sycamore wood. It has been noticed that wood stacks are highly favoured habitat as are other man made creations that provide

shelter, moisture and a cool micro-climate, such as stacks of bricks and sheets of iron on the forest floor (Dave Randle, pers comm).

The peripatus population on the Caversham Valley Forest Reserve is thought to be relatively small compared to that on the Randle and Walsh properties (Tony Harris and Dave Randle, pers comm). This is likely to be because a sizeable part of the reserve has been cleared of all introduced trees and all associated stumps and woody debris. While the cleared area has been replanted in natives trees and shrubs it will be many decades before there is sufficient canopy cover to produce the moist and cool conditions essential for peripatus survival.

It is not known whether peripatus occupy Lookout Point Reserve. The established tree canopy, cool, moist and relatively undisturbed conditions within the reserve would indicate ideal habitat however no surveys of this reserve appear to have been undertaken.

Peripatus are known to have been present in the past along the southern edge of the Randle and Walsh properties adjacent to the area to be disturbed for the construction of the highway improvements, and along the lower sections of Caversham Valley Reserve that will be acquired for road construction (Randle, pers comm).

3.4.2 Forest birds

Kereru, fantail, bellbird, tui, grey warbler, shining cuckoo (*Chalcites lucidus*), silver eye (*Zosterops lateralis*), and kingfisher (*Halcyon sancta*) occupy the bush areas on the north side of the highway in reasonable abundance. Tomtit and falcon (*Falco novaeseelandiae*) are seen occasionally but once common species such as brown creeper (*Finschia novaeseelandiae*) have not been seen for 10 years. Tui and bellbird numbers, in particular, occur in impressive numbers on Dave Randle's property and kereru are regularly seen flying above the tree canopy.

The mature pine and eucalypt trees provide good native bird roosting and nesting habitat and the increasing abundance of fruiting native species such as fuchsia, mahoe, pate, cabbage tree and broadleaf provide good seasonal food sources.

3.4.3 Reptiles

Common skinks (*Leiolopisma nigriplantare maccanni*) have been observed in the bush areas on the north side of the highway (Randle, pers comm).

3.4.4 Stream fauna

No survey of fish life or aquatic invertebrates was made in the small stream that runs along the northern edge of the proposed new road corridor. The stream would appear to be fed largely by surface runoff from the slopes above and is dry for periods of the summer. The stream channel peters out before the Walsh driveway at its upstream end, and is thought to feed into the city stormwater system downstream of Caversham Valley Forest Reserve and so is unlikely to sustain populations of any native migratory fish species.

4 Assessment of Ecological Values

4.1 Significant indigenous vegetation

The existing vegetation along the line of the proposed highway footprint contains no species or individual tree or shrub specimens that can be considered significant or will warrant any special attention. The majority of the vegetation that will need to be removed consists of introduced tree and shrub species with a scattering of naturally regenerating native species under the canopy and planted native and exotic trees and shrubs of variable age along the road fringe and in council park areas.

4.2 Fauna of ecological significance

While the population of peripatus found in the Caversham Valley area is currently referred to as *Peripatoides novaezealandiae* which is not listed as a threatened species, the view of invertebrate taxonomists and researchers would appear to be that the population is likely to be a unique species and possibly a unique genus. If it is reclassified as a new species or genus then the Caversham peripatus population would be considered to be of high ecological significance.

Email contact has been made with Landcare Research scientist Dianne Gleeson to determine whether there have been any recent advances in knowledge on the taxonomic status of this population. Dr Gleeson has undertaken DNA research on New Zealand peripatus in the past with Emeritus Professor Hilke Ruhberg, and while the research on the New Zealand peripatus is yet to be concluded, the view of both researchers is that the Caversham peripatus is unique taxonomically (D. Gleeson, pers comm). Dr Gleeson agrees that the Caversham population is possibly part of a new genus.

Given the paucity of study on New Zealand peripatus and the possibility that the Caversham population is a separate species, it is my view that this population should be considered to be ecologically significant and managed accordingly until such time that it has been proven otherwise. Every effort should be made to minimise the risk of causing peripatus mortality and to avoid any significant reduction in the extent of their habitat.

On the basis of the existence of a peripatus population on the Walsh, Randle and Council reserve properties adjacent to the highway it is likely that peripatus may be present in sections of the proposed highway footprint. The tree and bush covered areas that lie within the proposed highway footprint at the base of Caversham Valley Forest Reserve, along the driveways and southern boundaries of the Randle and Walsh properties, along the northern boundaries of the residential sections on the north side of the highway, and possibly along the southern edge of Lookout Point Reserve could all, potentially, have peripatus present in them at any one time. There is also a possibility that no peripatus occupy these areas, but only repeated peripatus surveys over a prolonged period of time could confirm this.

4.3 Significant habitat for indigenous fauna

The proposed highway will remove a little over 0.5 hectares of reserve vegetation (0.4 ha from Caversham Valley Forest Reserve and 0.15 ha from Lookout Point Reserve). In addition, there will be small areas of trees / bush removed from properties on the north side of the highway between the two reserves. The majority of this vegetation consists of introduced tree species with mixed native and introduced species forming the undergrowth. As such it is not unique but this vegetation type is habitat occupied by peripatus and its removal will reduce the area of habitat available to peripatus. It is estimated that greater than 75% of the 0.4 ha to be cleared from Caversham Valley Forest Reserve and 100% of the 0.15 ha of Lookout Point Reserve is possible habitat for peripatus and moderate quality habitat for native birds.

The non-native tree cover and native regeneration under the protection of the tree cover is proving to be favourable habitat for several native bird species (listed in sections above). The native bird song and level of bird activity, especially of tui and bellbird, witnessed on the Randle property and the margins of the Caversham Valley Forest Reserve is considered to be high for an urban area. Larger contiguous patches of favourable habitat will generally sustain native forest bird populations better than an equivalent area of smaller, disconnected habitat. Removal of half a hectare of vegetation from the edges of the preferred habitat in this area will reduce the available feeding and roosting habitat and so can be expected to have some negative effect on the existing native bird populations.

Sizeable areas under a forest canopy on relatively undisturbed south facing slopes, as the Caversham bush area is, are uncommon in urban areas generally and certainly in Dunedin. The retention of moisture and organic humus in this bush area provides ideal habitat for ground dwelling organisms including beetles, springtails, snails and peripatus. These conditions cannot be easily nor rapidly replicated in areas where the tree canopy has been removed. The central portion of the Caversham Valley Forest Reserve is an example of this; the removal of the exotic tree cover and all of the woody organic material from the centre of the reserve has altered the conditions substantially to the point where the habitat is no longer suitable for any of the ground dwelling organisms previously present. It will be many decades before conditions suitable for peripatus, springtails, ground-dwelling beetles and native snails return.

4.4 Sites of recognised ecological significance

The land on which Caversham Valley Forest Reserve now sits was purchased in 1994 by Dunedin City Council to provide protection to the newly discovered peripatus and their preferred habitat. The reserve has been classified as an Area of Significant Conservation Value in recognition of the importance of the peripatus population.

5 Assessment and Management of Ecological Effects

5.1 Threat of peripatus mortality

The clearance of vegetation from the proposed highway footprint and subsequent earthworks will create some threat of peripatus mortality. While the area to be cleared is not high quality habitat for peripatus, at any given time it is likely that some individual animals will be present in this zone.

The recommended procedure to minimise peripatus mortality would be to undertake a thorough walk-through seek, capture and translocation exercise along the proposed highway footprint on the north side of the highway from Lookout Point Reserve to Caversham Valley Forest Reserve immediately prior to the commencement of vegetation clearance and earthworks. This should only be lead by personnel with considerable experience in the location, capture and translocation of peripatus, and all workers assisting in this task should be well trained before the exercise begins. There is no point undertaking this capture and translocation at any earlier stage as new peripatus may move back into the clearance zone prior to the commencement of earthworks; nor is there any value in undertaking a survey for peripatus in the interim because an absence of detections now does not mean there won't be any peripatus there at the start of earthworks.

To be successful, the translocation of peripatus must also only be undertaken by personnel experienced in this task. Peripatus will die if they are not released into prepared habitat that is known to be favoured by the species, and success is not guaranteed if new animals are released into habitat already fully occupied by peripatus. Decisions will need to be made prior to translocation as to where the animals are to be translocated to and woody material will need to be established at the new sites ready to receive the animals.

The production of a Peripatus Translocation Plan by an experienced person prior to the commencement of highway construction is recommended. This plan should include:

- Nomination of a person to lead the translocation who is experienced in the detection, capture and translocation of peripatus;
- Identification of sites that will provide suitable habitat for the translocated animals and that is likely to remain safe habitat into the future;
- Detailed peripatus detection, capture and translocation methodology including steps and timing for the creation of suitable receiving sites for the translocated animals in advance of capture;
- Training programme for personnel who will assist in the translocation effort;
- Monitoring programme to evaluate the success of the translocation.

It is unrealistic to expect that all peripatus in the footprint zone will be found and captured so some mortality is probably inevitable. However, the development of a translocation plan and leadership by a peripatus expert will minimise the likelihood of mortality as much as possible.

The peripatus search and capture effort will also probably enable skinks, geckos and snails that may be resident in the clearance zone to be detected, captured and relocated.

5.2 Loss of habitat

Approximately half a hectare of reserve land that is possible habitat for peripatus, several resident native bird species, and a selection of indigenous invertebrates will be lost when the highway is improved.

It is estimated (from information supplied by Dave Randle and Tony Harris) that peripatus may occupy a core area of approximately 4 ha (made up of 0.4 ha on the Walsh property, 1.0 ha on the Randle property, 1.2 ha on the Caversham Valley Forest Reserve, and possibly 1.4 ha on the Ross block immediately north of the Randle property). Note that no survey of peripatus has been undertaken on the Ross property but the habitat there is thought to be suitable and is contiguous with the reserve and the Randle property. Note also that the Lookout Point Reserve has not been included in this core area nor has the block of bush-covered land to the east of Caversham Valley Forest Reserve. It is not known whether peripatus are utilising these areas.

While the removal of this habitat will not, in itself, threaten the existence of the peripatus population or any other indigenous plant or animal species, its removal will add to the cumulative reduction of available habitat that has occurred in this area over the past several decades. This could, in turn, reduce the resilience of the peripatus population to withstand future disturbances, whether natural or human-induced. Consequently, it is my view that the removal of vegetation from the proposed highway footprint could have a potentially significant effect on the peripatus population and will require mitigation to offset this effect.

It is recommended that the appropriate mitigation for this loss of habitat would be one, or a combination, of the following:

- The protection of the equivalent amount of suitable connected bush land to be managed as peripatus habitat. This land would need to be existing habitat suitable for peripatus and not currently heavily populated by peripatus. Protection may be achieved on private land by the placement of a covenant, such as a QEII covenant, on that land, or on public land the establishment of a conservation reserve designation.

- The procurement (purchase) of the equivalent amount of suitable connected bush land to be managed as peripatus habitat. As stated in the option above, this land would need to be existing habitat suitable for peripatus and not currently heavily populated.

- The identification of potential peripatus habitat on either the Caversham Valley Forest Reserve or the Lookout Point Reserve that is connected to habitat presently occupied by peripatus, and the enhancement of this habitat to make it more suitable for peripatus. Suitable potential habitat would need to have an existing tree canopy and be able to be enhanced relatively quickly. Investment in improving the quality of

more habitat for peripatus will also benefit the forest floor dwelling invertebrates that are characteristic of the area and the native bird populations that inhabit this zone.

The location of this additional area of habitat will need to be determined well in advance of translocation so that the option of translocating peripatus captured along the highway footprint to this new site can be evaluated.

5.3 Removal of vegetation

The vegetation to be removed from the highway footprint is common with low to moderate ecological value. Landscape planting along the new highway fringe using ecosourced native tree and shrub species naturally found on the south facing slopes in this area of Dunedin will provide suitable mitigation for the removal of the existing vegetation.

The highway fringe plantings on the new boundaries between the highway and the two Council reserves should be designed so that they link with existing mature vegetation in the reserves. While these new plantings will not provide suitable habitat for peripatus for several decades, if a natural assemblage of species is planted, including those that can form a tree canopy, in time this will evolve into suitable peripatus habitat.

6 Conclusions and Recommendations

The tree covered slope on the northern side of Caversham Valley Highway between Mornington Road and Aberfeldy Street is home to a population of ancient invertebrates known as peripatus or velvet worms. The site is reasonably steep, south-facing and parts are well covered by a canopy of mostly introduced tree species. This has created cool, constantly moist conditions that provide ideal habitat for peripatus and other indigenous forest invertebrates that persist in this area. The site is also well utilised by several native bird species.

DNA research suggests that the peripatus population that exists on the south-facing slope adjacent to Caversham Valley Highway is likely to be a unique species or genus not found outside the Dunedin area. While the removal of up to 0.5ha of habitat will not, in itself, threaten the existence of the peripatus population, or any other indigenous plant or animal species, its removal could reduce the resilience of the peripatus population to withstand future disturbances, whether natural or human-induced. Consequently, it is considered that the removal of vegetation from the proposed highway footprint could have a potentially significant effect on the peripatus population and will require mitigation to offset this effect.

To minimise the impact of the proposed highway improvements on the peripatus population and other indigenous species occupying this area the following mitigation is recommended:

(i) Replacement of the reserve land lost by:

- protection of an equivalent area of appropriate habitat connected to the site currently occupied by peripatus, or
- procurement of an equivalent area of appropriate habitat connected to the site currently occupied by peripatus, or
- investment in the enhancement of an area connected to the existing peripatus area that has a tree canopy and could be improved as peripatus habitat reasonably quickly.

(ii) Contract the services of a person experienced in the habitat requirements and translocation of peripatus to produce a peripatus Translocation Plan prior to the commencement of highway construction.

(iii) Undertake a search, capture and translocation exercise along the length of the proposed highway footprint on the north side of the highway from Lookout Point Reserve to Caversham Valley Forest Reserve immediately prior to the commencement of vegetation removal to translocate as many peripatus as can be found from the site. This translocation exercise should be lead by a person experienced in the habitat requirements and translocation of peripatus.

(iv) Commission the production of a Peripatus Management Plan as a reference document to be available for the Dunedin City Council, to assist in their management of the reserve areas, with a purpose of safeguarding the future of the peripatus population.

(v) Plant the highway fringes adjacent to the Caversham Valley Forest Reserve and Lookout Point Reserve in a natural assemblage of ecosourced native tree and shrub species appropriate for south facing Caversham slopes and link these to existing mature vegetation on both Council reserves to provide future habitat for native birds and invertebrates and long-term future habitat for peripatus.

7 References

Bradley, A. 2009. SH1 Caversham Valley Four-Laning. Terrestrial Ecology. Opus International Consultants.

Dunedin City Council. 1996. Caversham Valley Forest Reserve Management Plan.

Environment Waikato, Wildland Consultants Ltd. 2002. *Areas of Significant Indigenous Vegetation and Habitats of Indigenous Fauna in the Waikato Region: Guidelines to apply Regional Criteria and Determine Level of Significance*. Environment Waikato Technical Report TR 2002/15.

Gleeson, D.M. 1996. Onychophora of New Zealand: past, present and future. New Zealand Entomologist, 19: 51-55.

Gleeson, D.M. and Ruhberg, H. 2010. Chapter 3. Phylum Onychophora: velvet worms, peripatus. Pp. 36-39 in : Ed. Gordon, D.P. New Zealand Inventory of Biodiversity Volume Two Kingdom Animalia, Chaetognatha, Ecdysozoa, Ichnofossils. Canterbury University Press.

Hitchmough, R., Bull, L., Cromarty, P. 2007. *New Zealand Threat Classification System Lists – 2005*. Department of Conservation, Wellington 194p.

Mark, A.F. 1994. Letter written by A.F. Mark, Professor of Botany, University of Otago and Chairman of the Otago Conservation Board, to Murray Douglas, General Manager of Dunedin City Council.

Norton, D.A. and Roper-Lindsay, J.R. 2004. Assessing significance for biodiversity conservation on private land in New Zealand. NZ Journal of Ecology 28(2): 295-305.

NZ Transport Agency. 2011. Caversham Valley Safety Improvements: Overview.

NZ Transport Agency . 2009. TNZ 00/161 Caversham Highway Improvements. I & R Phase Stage 2. Interim Scheme Assessment Report. Prepared by Opus International Consultants.

O'Connor, K.F.; Overmars, F.B.; Ralston, M.M. 1990. Land evaluation for nature conservation. A scientific review compiled for application in New Zealand. Conservation Science publication no. 3, Department of Conservation, Wellington.

Randle, D.H. 1994. Submission on 132 Caversham Valley Road, Dunedin (aka Caversham Bush Project).

Tait, N.N. and Briscoe, D.A. 1995. Genetic differentiation within New Zealand Onychophora and their relationships to the Australian fauna. In: *Onychophora: past and present.* Eds: Wallker, M.H. and Norman, D.B. Zoological Journal of the Linnean Society 114: 103-113.

Trewick, S.A. 1999. Molecular diversity of Dunedin peripatus (Onychophora: Peripatopsidae). New Zealanmd Journal of Zoology 26: 381-393.

Townsend, A.J., de Lange, P.J., Duffy, C.A.J., Miskelly, C.M., Molloy, J., Norton, D.A. 2008. New Zealand Threat Classification System Manual. Department of Conservation, Wellington.