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Herpetofauna and Significant Vegetation Management 2017

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1. Introduction

This report updates copper skink, Geranium "Te Auaunga", and *Doodia squarrosa* (Significant vegetation) translocation and management activities undertaken before and during construction of the Waterview Connection Project, from the beginning of the programme in late 2011 until present (30 June 2017) following project completion.

In June 2011, the New Zealand Transport Agency (NZTA) received designation and resource consent approvals from a Board of Inquiry to complete the Waterview Connection Project (the Project). The Project is being implemented by the Well-Connected Alliance (WCA) and will complete the Western Ring Route identified by the Government as a 'road of national significance' (RoNS).

Adverse environmental effects associated with the Project include the clearance of native and exotic vegetation that supports native copper skinks (*Oligosoma aeneum*). Although not threatened (Hitchmough et al. 2010[1]), copper skinks are legally protected under the National Wildlife Act (1953).

The project also involved construction works in the locality of a taxonomically indeterminate Geranium species (*Geranium* aff. *retrorsum* "Oakley Creek" referred to in this report as Geranium "Te Auaunga") discovered in 2004 and *Doodia squarrosa* (recently re-named *Blechnum zeelandicum*; for consistency with previous reports and plans *D. squarrosa* will continue to be used in this report), an "At Risk: Naturally uncommon" fern species[2]. Geranium "Te Auaunga" is a tap-rooted perennial that is known only from the margins of Oakley Creek Te Auaunga in Hendon Park and Alan Wood Reserve. The geranium could potentially have arrived through natural means, assigning it as a threatened species due to the confined distribution and small population numbers. However, human vectors could also be the cause for the introduction which would classify the geranium as an exotic species. The designation and resource consent conditions require a conservative approach to its management by assuming it is a threatened species.

Specific consent conditions relevant to Geranium "Te Auaunga", *D. squarrosa* and herpetofauna include: V1, V2, V3, V5, V7, V9 and V16 (Geranium "Te Auaunga" and *Doodia squarrosa*), V12 and V13 (Geranium "Te Auaunga") and H1 (Herpetofauna). As required by consent conditions, a Lizard Management Plan (LMP), Geranium "Te Auaunga" Management Plan and *Doodia squarrosa* Management Plan, were prepared by the WCA in December 2011 (ref: 025-Y019-3466-LMP), April 2012 (ref: 025-Y022-3466) and November 2013 (ref: 025-MGP-01411) respectively. The Plans have been developed in accordance with the Ecological Management Plan (ECOMP), which fulfils consent requirements associated with the Project, and were updated periodically. Each plan requires the production of an annual report to update the number of lizards salvaged and the results of annual post-release monitoring, as well as, the replanting of significant vegetation within remediated sites and the health of translocated plants.

Enabling Works commenced on 9 January 2012 in Sector 9 of the Waterview Connection Project and further works have since started in Sectors 5 and 7. As of 26 June 2017, work

[1] Hitchmough RA, Hoare JM, Jamieson H, Newman D, Tocher MD, Anderson PJ, Lettink M, Whitaker AH 2010. Conservation status of New Zealand reptiles 2009. New Zealand Journal of Zoology 37(3): 203-224.

[2] de Lange PJ, Norton DA, Courtney SP, Heenan PB, Barkla JW, Cameron EK, Hitchmough R, Townsend AJ 2009. Threatened and uncommon plants of New Zealand (2008 Revision). New Zealand Journal of Botany 47: 61-96.

associated with translocating skinks, Geranium "Te Auaunga" and *D. squarrosa* has occurred at Hendon Park, Alan Wood Reserve, Maioro Street interchange, the North Western Motorway Waterview onramp, the Point Chevalier Motorway off-ramp, and the Oakley Inlet heritage area (there are two areas within the Oakley Inlet heritage area, the heritage area and the rock forest management area).

This report provides an updated annual overview of the relocation and monitoring efforts associated with native skinks, geranium "Te Auaunga" and *Doodia squarrosa*, as required by the respective management plans.

2. Herpetofauna

2.1. Methods

Methods used to search for, capture, and process skinks are detailed in the Lizard Management Plan Revision 6 dated 18 September 2015 (Appendix E of the Ecological Management Plan[3]), and are based on generally accepted best practice. Summarised methods are provided below. Field work started on 31 of October 2011 and continued on a periodic basis until 17 February 2017.

2.1.1. Selection of salvage release site

Due to the extent of habitat removal in some areas of the footprint, it was not appropriate to release skinks into immediately adjacent habitats. Skinks rescued in advance of the Enabling Works were released into an area referred to as Management Area 3a within the Oakley Creek Management Area (Te Ngahere 2009[4]) (Appendix A) and herein referred to as the Lizard Relocation Management Area.

The Lizard Relocation Management Area is a mosaic of rank grass and native plantings that is approximately 6000 m^2 and lies adjacent to Oakley Creek. Habitat enhancement undertaken at Oakley Creek has included staged native plantings, provision of refugia using logs, weed control and pest (animal) control.

2.1.2. Capture and relocation of skinks

Skinks were searched for in the following areas; Hendon Park, Alan Wood Reserve, Maioro Street interchange, the North Western Motorway Waterview onramp, the Point Chevalier Motorway offramp, Unitec, and the Oakley Inlet heritage area (heritage area and rock forest management area).

Salvage areas were identified based on the known and likely presence of native skinks from an assessment of the construction footprint in 2010[5] and further assessments by Project herpetologists. Salvaging was undertaken before, during and immediately after vegetation

[3] The Ecological Management Plan (Revision 5) is found in Appendix I of the Contractors Environmental Management Plan.
[4] Te Ngahere 2009. Environmental Weed Control and Native Revegetation Programme for Oakley (Te Auaunga) Creek.
[5] Bioresearches 2010. Western Ring Route – Waterview Connection: Assessment of herpetofauna Ecological Effects.

clearance. Skinks were not salvaged from the site at the end of Parr Road South during construction as a pre-construction manual search found no native skinks, with the site comprised of a maintained grass verge, native plantings and little to no skink habitat.

Pre-construction searching was undertaken at Hendon Park and Alan Wood Reserve using Artificial Cover Objects (ACOs: 500 x 450 mm sheets of onduline), which were laid out approximately 5 weeks before the initial search. Manual habitat searching was also carried out during the pre-construction phase, and involved searching for skinks under logs, in the exotic pampas and other native or exotic habitats deemed to be high quality. ACOs were not deployed at the Maioro Street interchange, Point Chevalier offramp or the Oakley Inlet heritage area due to timing constraints, or at the Waterview onramp due to the relatively poor quality of habitat for skinks.

Skink searching during construction activities involved working directly with vegetation clearance contractors to remove habitat. Excavators carefully removed vegetation and large coarse woody debris and dismantled rock walls in the presence of and under the supervision of the WCA's herpetologists. Habitat reduction was also used during construction activities in an attempt to "herd" skinks into reduced habitat to allow more efficient capture.

Once caught, the location, size (Snout Vent Length, SVL), tail condition (regenerating or not regenerating) and breeding condition (gravid or not gravid) was recorded onto data sheets. The skink was placed into a terrarium (temporary holding facility) for release at the end of the day's search effort.

2.2. Results

2.2.1. Search of lizard habitat

In total, 204 native copper skinks were captured across seven sites during salvage efforts before and during construction. All skinks were processed and relocated to the release site. Table 2-1 provides an overview of the number of skinks caught from each location. Photographs of some salvaged skinks are included in Appendix B. No other native lizard species were found.

Table 2-1: Total number of copper skinks caught across the seven sites.

Site	No. of copper skinks caught
Hendon Park	92
Alan Wood Reserve	34
Maioro Street Interchange	65
North Western Motorway Waterview onramp	0

North Western Motorway Pt Chevalier offramp	1
Oakley Inlet heritage area	10
Unitec rock wall	2

The purpose of the translocation programme was to establish a viable population at the release site, and the translocation of 204 copper skinks, including a number of gravid females is considered to be more than adequate for establishment of a viable population.

No further lizards are expected to be salvaged and released into the LRMA due to project completion.

2.3. Post release monitoring and on-going management

In accordance with the Lizard Management Plan, post-release monitoring was undertaken because >20 copper skinks (i.e. 204 individuals) were salvaged.

The purpose of the post release monitoring programme was to determine if efforts to mitigate the impacts of the proposed development were successful and whether further management is required. Specifically, the objectives are to conclude if the copper skink population is stable, increasing, or decreasing over time and to verify that the mammalian pest control programme at the release site is effective at suppressing threats from key predators.

Post-release monitoring methods are described in detail in the Lizard Management Plan. In essence, monitoring involves the checking of 100 ACOs that have been laid out in a 10 x 10 m grid over the Lizard Relocation Management Area. During each annual monitoring event, ACOs were checked weekly over 3 consecutive weeks in March.

Post release monitoring results in March of 2012, 2013, 2014, 2015, 2016 and 2017 are provided in Table 2-2 below and the programme was completed in March 2017.

Results indicate that a population of copper skinks is breeding successfully at the Lizard Relocation Management Area due to the fact that the number of skinks caught has numerically increased, and juveniles and sub-adults (<40 mm SVL/<2 years old) are being detected five years after release (Table 2-2). The mammalian pest control programme appears to be effective at suppressing the threats from key predators of copper skinks.

Table 2-2: Overview of copper skinks caught during post–release monitoring at the Lizard Relocation Management Area.

Year	No. of skinks caught	Size range (mm)
2012	1	80
2013	7	37 – 93
2014	7	40 – 92

2015	9	50 - 78
2016	9	35 - 75
2017	16	35 - 85

Management within and around the Lizard Relocation Management Area has included habitat enhancement through the addition of log piles and native plantings as well as animal pest control. Approximately 75 log piles were constructed within the Lizard Relocation Management Area as well as the later addition of log piles created from several mature privet trees removed from the site. Log piles are intended to improve habitat, decreasing intra- and inter-specific competition. WCA and Friends of Oakley Creek will further improve general habitat quality (including for skinks) through planting native plants adjacent to the release site, to extend the amount of useable habitat. Control of introduced mammalian predators is also currently being undertaken by Friends of Oakley Creek to reduce predation pressures on native skinks. Bait stations have been set up and have been supplied with bait four times a year for the past four years, while pest control monitoring has also been conducted once a year during November.

Native skinks have been salvaged from all the areas where they are known to inhabit along the project designation[6]. No further vegetation will be cleared as the project construction has been completed.

3. Geranium "Te Auaunga"

3.1. Methods

Methods used to manage and translocate Geranium "Te Auaunga" are detailed in the Geranium "Te Auaunga" Management Plan, found in Appendix F of the Ecological Management Plan, and include a population survey, seed collection, immediate and temporary translocation and sod translocation. Field work started on 29 November 2011, planting is now completed and fortnightly monitoring continued until the end of June 2017.

3.1.1. Survey

A team of botanists/ecologists manually located Geranium "Te Auaunga" plants along Oakley Creek in Hendon Park and Alan Wood Reserve. Survey effort was concentrated in the core habitat where the plant is found in a significantly higher density, being the immediate 2-5 m of the stream bank, and a full census of plants was undertaken in these areas. Grassland areas adjacent to the stream were carefully searched to locate and count individual plants. A tally and GPS location of each plant was recorded. Geranium plants located further from the stream than the immediate margins of dense plants were also

[6] According to Bioresearches' (July 2010) Western ring route – Waterview Connection: Assessment of Herpetofauna Ecological Effects. Report prepared for New Zealand Transport Authority. 30 p.

surveyed, but less survey effort was expended here with the purpose of identifying the extent of the population rather than counting all individual plants. The total survey effort comprised approximately nine person-days.

A figure showing the distribution of Geranium "Te Auaunga" plants identified during the December 2011 survey is included in Appendix C (Drawing DG-EK-1055).

3.1.2. Seed collection

Seed collection was the primary method of management as it provided the most security for the population in terms of the potential number of individual plants and protection of genetic diversity.

Seed was collected from as many plants as possible to achieve the greatest genetic diversity. A particular focus was collecting from plants growing away from the core populations growing within the rank grass of the Valonia sports fields to preserve any genetic differences along the length of the creek.

Seed was collected by registered seed collectors and stored at numerous locations including Auckland Botanic Gardens, Oratia Native Plant Nursery, and will be deposited at the National Seed Bank. Auckland Botanic Gardens and Oratia Native Plant Nursery will on-grow the seed as required.

Representatives from local iwi (Ngati Whatua o Orakei and Ngati Paoa) were invited to be involved in the seed collection process. As a result of this, staff from Ngati Whatua o Orakei's Okahu Rakau Nursery helped with seed collection and geranium plant translocation.

3.1.3. Temporary, immediate and sod translocation

It was agreed with Council that at least 50% of the affected population (approximately 500) will be translocated. Translocation includes temporary translocation (plants are tended to at nurseries until suitable replanting sites are created), immediate translocation (plants are transferred immediately to a section of Oakley Creek that will be unaffected by the Waterview Connection works), and sod translocation (a form of immediate translocation, where large intact clumps of geranium plants are moved, along with surrounding ecosystem vegetation, to other sections of Oakley Creek that will not be affected by the works).

Similar to collecting seed, most translocating effort was put towards those plants found in areas outside the dense populations in the rank grass at Valonia sports field.

Plants were individually dug up using a spade to cautiously remove the intact taproot and other associated large roots from the ground. Most plants were transported to the two plant nurseries for temporary translocation (Oratia Native Plant Nursery and Auckland Botanic Gardens).

3.2. Results

3.2.1. Survey results

Approximately 700 individual Geranium "Te Auaunga" plants within or in close proximity to the works footprint were individually located and counted. It is estimated that approximately 50-70 % of plants in these areas were recorded in the tally and therefore probable that Hendon Park and Alan Wood Reserve contain at least 1,000 individual plants.

3.2.2. Seed collection

Geranium "Te Auaunga" seed was collected on four occasions from Hendon Park and Alan Wood Reserve, twice in late 2011 and twice in 2012, by staff from Oratia Plant Nursery and Okahu Rakau Nursery. Total quantity of seed is difficult to determine but it is estimated that approximately 4,500 seeds have been collected, of which 1,500 was held by Oratia Native Plant Nursery and 3,000 was given to Auckland Botanical Gardens.

Auckland Botanical Gardens have sowed and on-grown approximately 45 Geranium "Te Auaunga" seeds, which have since been planted, with a mixture of native plants, along the riparian margins of Oakley Creek stream diversion B.

3.2.3. Translocation

In early 2012, approximately 70 Geranium "Te Auaunga" plants were translocated to the planting area, south-west of Richardson Road. Plants responded well becoming established and producing flowers and seed. However, exotic and "weedy" vegetation out-competed the geraniums and approximately 5 to 10 plants were also lost due to works occurring in the area. Approximately 10 plants were still present at project completion.

A further 275 plants were immediately translocated in mid-2012 to the riparian margins of Oakley Creek along stream diversion C. Geranium "Te Auaunga" were planted in groups with native plantings over varying distances from the stream margin. Monitoring of the Geranium "Te Auaunga" areas has shown high survival and growth rates with many plants producing flowers and seed. Geranium "Te Auaunga" plants also began to establish outside the planting groups, indicating that the plants are successfully self-seeding along the stream banks.

In early 2012 Oratia Native Plant Nursery temporarily translocated approximately 400 plants to their nursery. Approximately 315 plants were planted in groups along diversion B in mid-2013. Similarly to diversion C, the geranium plants have shown high survival and growth rates, producing flowers and seed and also establishing new plants outside the planted areas.

On 8 February 2012, a sod translocation was trialled, removing a patch of approximately six-eight Geranium "Te Auaunga" plants with the surrounding vegetation cover from the Enabling Works area, and re-planting this in the planting area, south-west of Richardson Road. Approximately 10 m^2 of rank grass habitat was replanted in six digger loads. The plants initially suffered from "transplant shock" and desiccation. The area was watered on

several occasions, however the Geranium "Te Auaunga" have since died. Photographs of Geranium "Te Auaunga" and the different translocation methods used can be found in Appendix D.

On 21 August 2015, 250 Geranium "Te Auaunga" plants grown from seed by the Oratia Nursery were infill planted into existing planting sites (diversion B and C). At the time of planting some of the existing planting sites had become weed dominant with few Geranium "Te Auaunga" remaining. Other sites were Geranium "Te Auaunga" dominated. The 250 Geranium "Te Auaunga" were distributed between planting sites based on the replacement requirements of each site. Plantings in one area in Diversion C with high flood flows and low Geranium "Te Auaunga" survival were not replaced.

Geranium "Te Auaunga" planted sites became heavily weed infested during the summer of 2015/16, particularly kikuyu grass which smothered some plantings. In response to this, Geranium "Te Auaunga" planted sites were reviewed and reconfigured to prioritise fewer larger sites. The purpose of this was to include areas where geranium growth is most prolific, to incorporate self-seeded colonies and exclude areas where geranium survival has been low.

During the week ending September 18 2016, 450 Geranium "Te Auaunga" sourced from Oratia Nursery were planted into Diversions B and C. Approximately 250 Geranium "Te Auaunga" were allocated to infill plant the reconfigured geranium management areas and the remaining 200 created two new planted sites. The new planting sites are located on the eastern side of Diversion B and C, in or near to areas where geraniums had begun to self-colonise.

A total of 1368 Geranium "Te Aunaunga" have been planted over the southern works site of the Waterview Connection Project. Table 3-1 below provides an overview of the planting between 2012 and 2016. Although the sod translocation plantings have failed, the growth of plants south of Richardson Road is unknown, and some planted sites along Diversion B and C have been decommissioned due to flood waters or kikuyu grass, the total plant numbers are likely to be higher due to the establishment of self-seeding plants. We expect the overall number of Geranium "Te Auaunga" plants now exceeds 1000 individual plants.

Table 3-1: Summary of Geranium "Te Auaunga" planted across the Waterview Connection Project.

Method	Site	Date planted	Current status	No. of Geranium "Te Auaunga" planted (survived)
Immediate translocation	Oakley Creek South West of Richardson	Early 2012	Survival rate unknown due to over-grown	70 (10)

	Road		surrounding vegetation.	
Sod translocation	Oakley Creek South West of Richardson Road	Early 2012	Low survival rate. All plants failed to establish.	8 (0)
Immediate translocation	Oakley Creek diversion C	Mid 2012	High survival rate. Flowering and producing seed.	275*
Temporary translocation	Oakley Creek diversion B	Mid 2013	High survival rate. Flowering and producing seed.	270*
On-grown from seed	Oakley Creek diversion B	Mid 2013	High survival rate. Flowering and producing seed.	45*
On-grown from seed	infill planting - Oakley Creek diversion C and B	August 2015	Good survival rate. Flowering and producing seed.	250
On-grown from seed	Infill planting - Oakley Creek diversion B and C	September 2016	Establishing.	250
On-grown from seed	Oakley Creek diversion B	September 2016	Establishing.	80
On grown from seed	Oakley Creek diversion C	September 2016	Establishing.	120
Total no. of Geranium "Te Auaunga" planted				**1368**

* Denotes that plant numbers are likely to be higher due to the establishment of self-seed plants.

3.3. Ongoing management and monitoring

We consider consent condition V12 (c) to replace Geranium "Te Auaunga" with an equal extent of replacement planting of the same species to have been met and plant propagation is no longer being undertaken.

Geranium "Te Auaunga" planted sites have been monitored every 2 weeks for the duration of construction. These plants have been fenced to protect them from the nearby works. Monitoring included identifying any changes in the condition and health of plants in relation to baseline monitoring results.

4. *Doodia squarrosa*

4.1. Methods

Methods used to manage and translocate *D. squarrosa* are detailed in the *Doodia squarrosa* Management Plan, found in Appendix F of the Ecological Management Plan, and includes temporary translocation, population enhancement and potential spore collection. Field work started on November 2013 and continued through to June 2017. The objective of managing *D. squarrosa* is to maintain and enhance the population, through the methods discussed below.

4.1.1. Temporary translocation

Temporary translocation involved the two identified *D. squarrosa* plants being individually dug up from the basalt rock wall and translocated to a pot until suitable replanting sites become available (*D. squarrosa* were being tended to by the Project Botanist).

4.1.2. Population enhancement

When a suitable replanting site became available, the population was supplemented by eco-sourced *D. squarrosa* ferns from a reputable nursery. The aim was to increase the number of ferns to a population of at least 30, however this was dependent on the availability of plants.

4.1.3. Spore collection

Spores were to be collected from the two *D. squarrosa* ferns if a fertile frond was present. However growing the ferns from spores can be challenging and may not be the best method in terms of time and effort for which to enhance the population.

4.2. Results

4.2.1. Temporary translocation

In late 2013, remediation works started in the vicinity of the *D. squarrosa* ferns. The two ferns were collected and transferred to pots and were being tendered to by the Project Botanist. The ferns were growing well in the pots. The ferns were planted into a similar area from where they were removed in the 2015 planting season.

4.2.2. Population enhancement and spore collection

Approximately 10 to 15 *D. squarrosa* ferns from Oratia Native Plant Nursery were planted with the other temporary translocated ferns. The two translocated ferns have not produced any fertile fronds to collect spores from.

4.2.3. Permanent translocation

On 21 August 2015, 30 *D. squarrosa* from Oratia Nursery plus two held by the project botanist were planted into the south facing bank of Diversion B and Diversion C. The most suitable habitat for *D. squarrosa* was along the south facing bank beneath the most established riparian

plantings to provide shade and moisture retention. Suitable planting sites nearest to the stream were prioritised.

4.3. Ongoing management and monitoring

Population enhancement continued with the aim of establishing a population with at least 30 individual ferns.

D. squarrosa ferns were monitored every 2 weeks for the duration of construction. Monitoring included identifying any changes in the condition and health of plants in relation to baseline monitoring results.

As of June 2017, 24 *D. squarrosa* ferns have survived since planting. Flash flood events are the primary reason for the failure of the ferns, as flooding has led to bank erosion and deposition of large quantities of debris and silt. Of the remaining plants, 25% are considered to be thriving, and 75% are either maintaining but not thriving or appear in poor health. The poor health was due to flooding events and associated smothering by stream debris and silt. To minimize effects of flooding, ferns were checked fortnightly (in conjunction with geranium monitoring) throughout construction and released from stream debris (where required).

Appendix A

Lizard Relocation Management Area

Appendix B

Salvaged skink photographs

Copper skinks salvaged during construction works in Hendon Park.

Copper skinks in the temporary holding facility (terrarium) before being released.

Copper skink released into a log stack at the Lizard Relocation Management Area.

Copper skink caught during post-release monitoring at the Lizard Relocation Management Area in 2013.

Copper skink salvaged from rock wall at Unitec in 2017.

Copper skink caught during post-release monitoring at the Lizard Relocation Management Area in 2017.

Appendix C

Distribution of Geranium “Te Auaunga” plants prior to works

Appendix D

Photographs of Geranium “Te Auaunga” and the translocation methods

Geranium "Te Auaunga" in flower along the banks of Oakley Creek.

Geranium "Te Auaunga" in flower growing amongst rank grass.

Sod translocation of Geranium "Te Auaunga" along the banks of Oakley Creek.

Seed collection and translocation of Geranium "Te Auaunga".

Patch of Geranium "Te Auaunga" growing along diversion C in Oakley Creek. Note the Geranium plants that established outside of the planting area marked by the wooden post.

Two Geranium "Te Auaunga" plants that have self-seeded and established along the banks of Oakley Creek in diversion B.

Appendix E

Photographs of planted *Doodia squarrosa*

Doodia squarrosa planted beneath existing riparian plantings.

D. squarrosa partly smothered by debris post flood event.