Te Ngahere
Native Forest Management

Review of Oakley Creek Restoration Plan (2005 – 2015)

Final - June 2015

Ecological Restoration and Consultancy

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Prepared on behalf of:
Auckland Council (Biodiversity Team & Local and Sports Parks Team)

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Te Ngahere

Table of Contents

Table Index

Figure Index

1 Introduction

1.1 Background

Significant progress has been made towards enhancing and restoring the landscape and stream values of Oakley Creek over the last 10+ years, with noticeable changes in vegetation cover apparent along the creek.

While some weed control was undertaken between 2001-2004 (by Te Ngahere), ecological restoration work along Oakley Creek started in earnest in 2004/2005 after the formation of Friends of Oakley Creek (FOOC). The key to the success of this restoration project has been effective collaboration between the local community (mainly through Friends of Oakley Creek), Auckland City Council (now various Auckland Council departments) and contractors (including ecological restoration contractors Te Ngahere and the previous Metrowater contractors).

In 2005 the *Environmental Weed Control and Native Revegetation Programme for Oakley (Te Auaunga) Creek*, known as the 'Oakley Creek Restoration Plan', was prepared by Te Ngahere for Auckland City Council. The purpose of this document was to outline a restoration programme to provide co-ordinated management of the site with a long-term vision, focusing on weed management and revegetation. This would take into account social and cultural values of the area and activities of different community groups involved. The project area covers Oakley Creek from Great North Road, Waterview, to the northern half of Harbutt Reserve, Mt Albert, which was identified as Management Units (MUs) 1-9. This area is also known as the Oakley Creek Walkway.

In 2011/2012 the Albert-Eden Local Board funded a report to assess of the remnant mahoe rock forest areas along Oakley Creek Walkway (Te Ngahere, August 2013). This report identified management priorities and a programme of restoration work. From 2012 weed control was begun in the identified remnant Mahoe Rock Forest areas (MRF areas A-F) and the Management Units were extended to the southern extent of Harbutt Reserve, with the addition of MUs 10 & 11.

Refer to maps in **Figure 1** and 2 showing the restoration work area at Oakley Creek. The location of distance markers, spaced at 50m, used by Friends of Oakley Creek is shown in Figure 3.

A review of the planting programme progress from 2005-2007 was carried out to ensure planting was meeting the objectives of the restoration plan (Te Ngahere, January 2007). In 2009 the 'Oakley Creek Restoration Plan' was reviewed and revised by Te Ngahere, including incorporating a section on archaeological sites (following the archaeological assessment by consultant archaeologist Brent Druskovich in 2009) and updating the management unit recommendations.

Due to the presence of archaeological features, especially in the lower stretches of Oakley Creek, an Authority to Modify was applied for and granted by the NZ Historic Places Trust to Auckland City Council in November 2009[1]. This allowed restoration work (including rubbish

and vegetation removal, erosion control and planting) to proceed as long as archaeological conditions were adhered to.

Management planning for the Oakley Creek Walkway (as outlined in the 'Oakley Creek Restoration Plan') was forecast until Summer 2013 and as the project reaches its tenth year, now is an appropriate time to review work completed, assess successes and look at effectiveness of methodologies.

[1]It should be noted that the 'Authority to Modify' for Oakley Creek MU 1-9 expired in November 2014 and the application process to renew and extend this (from MU 1 – MU 11) has been started.

1.2 Scope

The scope of this report is to review and summarise the work which has been completed between 2005-2015 as part of the 'Oakley Creek Restoration Plan'.

This will involve:

- Recording work completed in each Management Unit
- Mapping where different stakeholders have been involved along the creek
- Review of the restoration timeline in the 2009 revised plan
- Compile and brief analysis of monitoring results that have been collected
- Review the restoration methodology – including approaches, successes and recommendations for future restoration

Figure 1. Oakley Creek Management Units 1-6

Figure 2. Oakley Creek Management Units 7-11

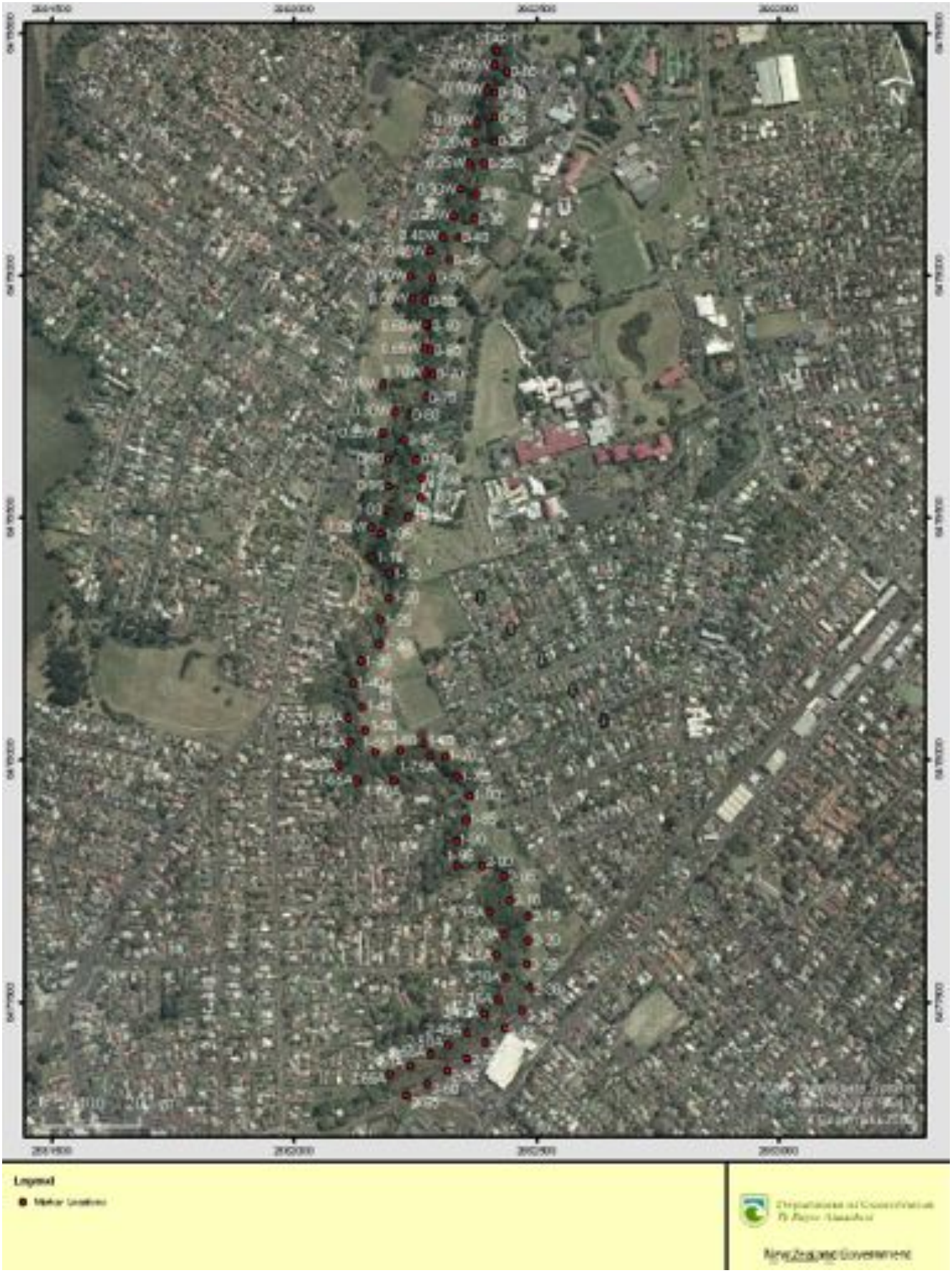


Figure 3. Location of distance markers used by Friends of Oakley Creek

2 Work completed

Significant progress has been made at achieving the identified management tasks in the Oakley Creek restoration area, as outlined in the Revised Oakley Creek Restoration Plan (Te Ngahere, 2009). The following section reviews progress made over 10 years in terms of weed control, planting and animal pest control.

2.1 Review of Management Units

Text shown in blue is from the 'Oakley Creek Restoration Plan', pages 20 & 21, with review comments underneath in black.

2.1.1 Management Unit One

2005- 2013 Description and workplan

Management Unit One (Priority One) is divided into three different units 1a, 1b and 1c. 1a-1c are all partially planted and bordered by the creek on the west and the Mason Clinic on the east. 1a is the most Northern end of the site. 1b covers the flood plain and 1c covers the area under tree privet canopy. The canopy should be retained until funds are available to revegetate the entire area. At this stage ⅔of mature privet should be removed within 1c. The remaining ⅓could be removed once plantings have established a ground cover (i.e. at least 3 years after planting).
To date the majority of contracting work has been carried out within this management unit. In order to maintain the weed infestations at a low level, the site needs to be visited regularly. This area is therefore a priority.

Current condition and work completed as of April 2015

Weed issues have been significantly reduced in MU 1, with tradescantia continuing to reappear along the stream and a few known 'hotspots' for Madeira vine. The majority of MU 1 has been planted with a few areas remaining for infill planting.

Progressive thinning of large tree privet has been carried out in MU 1 over a number of years. Friends of Oakley Creek have undertaken planting under the remaining privets in 1c between the path and stream. Privet removal has been funded by the Well-Connected Alliance (WCA) as part of the Waterview Connection project and by Auckland Council Parks.

The restoration plan has allowed for mature pines to be retained, unless they are causing a hazard near to the path. Mature pine trees continue to be removed as they die by trained arborists (organised by Parks contract manager). Mature flame trees have generally been retained, with a few drilled and poisoned.

Some of the tall macrocarpa have been removed along the boundary with Unitec in MU 1c. The remaining trees between the path and eastern boundary of MU 1c have become wind damaged and continue to fall apart.

Future work required

- Ongoing weed control of site to treat weed seedbank sources and re-invasion, including tradescantia along the stream and a few known 'hotspots' for Madeira vine.
- Pines, macrocarpa and flame trees will continue to be managed as they become a hazard to park users. As Flame trees are considered an environmental weed a plan for long-term removal of remaining flame trees should be developed as part of future management work.
- Privet, an environmental weed tree species, should continue to be removed in the long-term with staggered felling and some drilling, followed by infill planting. The group of privet at the back of the wetland towards eastern boundary in MU 1b and clump of privet at northern end of MU 1c could be targeted next.
- Infill planting required for the following sites:
  - Either side of the path from the walkway entrance to 0.05 marker, with a mix of plants, but allowing for good visibility.
  - Open rocky patch on east side of path near 0.10 marker.

2.1.2 Management Unit Two

2005- 2013 Description and workplan

Management Unit Two (Priority 4) covers the western side of the creek through to the level of the privet canopy in management unit 1c. Large exotic trees (6m+), with the exception of willows and privets, should not be controlled. As in MU 4, weed control efforts seem to have been concentrated on the eastern banks of Oakley Creek. MU 2 is given a priority of 4 as it is partially planted and will complement the work in MU 1.

Current condition and work completed as of April 2015

Weed control has progressed in MU2 and planting has been carried out throughout the unit. Large willows along the stream were drilled by Te Ngahere in 2009. Privet has been thinned but large exotic trees have been retained (e.g. white poplar, alder, Yunnan poplar, eucalyptus sp.). There is some privet and mature acmena remaining at northern end of MU 2 by Great North Road.

Future work required

Ongoing weed control is required to maintain weeds at low levels. There is some privet and mature acmena remaining at northern end of MU 2 by Great North Road. Removal of these mature weed trees should be managed and staged over the coming years.

The Well Connected Alliance (WCA) will be working in collaboration with Friends of Oakley Creek to carry out planting and weed control along the floodplain in MU 2 and MU 4a in winter 2015 and through MU 1 & MU 3 in 2016, as mitigation for an upstream pollution incident.

2.1.3 Management Unit Three

2005- 2013 Description and workplan

Management Unit Three (Priority 2) is divided into two sections, a and b. This management unit has a large open component and needs to be revegetated in a manner that maintains open recreational areas. The northern and southern ends of this unit are bordered by tree privet and oak canopy respectively, while the stream borders the western boundary. Planting was carried out recently (August 2005) in a section of this area, therefore will require maintenance weed control and releasing to ensure their survival. It is also adjacent to MU 1, the focus of much of the current weed control operations.

Current condition and work completed as of April 2015

Early plantings at the southern end of MU 3a are maturing well. Regrowth of bindweed throughout the area is an issue. Otherwise weed issues are now relatively minor, with emergence from the seedbank occurring.

In 2012 the WCA funded planting preparation and plants, and assisted with planting of 1000 plants in the open grass area above the path (MU 3a Lizard Management Area). This work was part of habitat enhancement for the relocation of native skinks from the Waterview Connection / SH20 works.

From 2012-2015 the WCA funded rodent control (set-up by Te Ngahere, carried out by volunteers), annual rodent monitoring (by Te Ngahere) and lizard monitoring (by Tonkin & Taylor ecologist). FOOC is continuing a quarterly rodent control programme throughout the area. Additional planting by FOOC has included *Muehlenbeckia complexa* below the mown path, to create suitable habitat and food sources for native lizards (and potentially copper butterflies). *NB: part of this open area MU 3a is Auckland Council land, with the remainder owned by Unitec.*

Bamboo covers a very large area at the northern end of MU 3b (eastern side of creek). It has been controlled at the edges historically by Te Ngahere to stop it spreading, but is not currently covered in the ERC contract.

Future work required

In MU 3a the two large willows by the stream could be controlled. The adjacent area is being kept open as an amenity area (access to stream) and to protect an archaeological site. Infill planting could be undertaken along the stream in northern part of MU 3a.

A long-term management approach is needed for the Bamboo in MU 3b as it will be complex to remove, management of regrowth will be needed and there is probable presence of archaeology underneath. In the immediate future bamboo needs be pushed back from the stream banks. Also there is a large flame tree next to the bamboo, which should be controlled.

The steep slopes and floodplain, including the potential old mill site, in MU 3b currently has limited weed control, mainly removal of woody weed saplings. This area needs an archaeological assessment to establish future management.

A new at-grade bridge is to be built across the valley between MU 3b and MU 5 (Waterview Glades), just downstream from the 'Troll Bridge', as part of the Waterview Connection shared path. Two years of planting and planting maintenance will be required in this area as part of consent conditions. The large pine on the western bank will also be removed.

2.1.4 Management Unit Four

2005- 2013 Description and workplan

Management Unit Four (Priority 5) is also divided into two sections. 4a runs from management unit 2 up to Great North Rd. Continuing from here 4b is a predominantly pine canopy along a steep slope. The amount of work carried out in this management unit is low; therefore its priority ranking is low.

Current condition and work completed as of April 2015

Thinning of Chinese privet and hawthorn has been undertaken in MU 4a historically. Friends of Oakley Creek (FOOC) have carried out planting along the stream in MU 4a and Te Ngahere planted the steep bank below the pine trees in MU 4b. Limited weed tree control has been undertaken in MU 4b and MU 5 by Te Ngahere since 2013, as the WCA had plans to undertake restoration work in this area and there was uncertainty as to when this work would take place.

Future work required

The WCA now plan to undertake the restoration works for 2015-2016, along a 20m esplanade strip of the western bank of the stream, from MU 5 by the Unitec Bridge to the northern boundary of MU 4a.

WCA now have planned restoration works for 2015-2017 from MU 5 by Unitec Bridge to northern boundary of MU 4a. The works will include planting (winter 2015 and 2016) and selected weed tree removal of C. privet, hawthorn and 2 x sycamore. The WCA will also take out any young pines on the edge of MU 4b, as part of the enhancement works. The planting will be done in collaboration with FOOC, with volunteers carrying out some of the planting. As mentioned above (in Section 2.1.2), the WCA will also be undertaking drilling of weed trees and planting in MU 4a below the path, as part of mitigation for the upstream pollution incident.

The remaining large pines in MU 4b should be removed in future as they become unsafe and / or die.

2.1.5 Management Unit Five

2005- 2013 Description and workplan

Management Unit 5 (Priority 6) encompasses both the west and eastern banks of the creek from the bridge at the northern end of the oak canopy, through to the bridge that runs through to the Unitec accommodation. The density of weeds is relatively low in this unit, hence a higher priority. The Gladstone Primary School 'Nature Force' group has planted an area on the western side of Oakley Creek in this unit. The Unitec student residents may focus on areas within MU5 as well, so it is important to control the weeds if the group intends to revegetate some areas. It may be necessary to concentrate on these revegetation areas as an earlier priority than other management units.

Current condition and work completed as of April 2015

See comments above regarding WCA work in MU 5.

MU 5a was added at the start of the ERC contract in 2012/2013 as this area had seemed to have received no previous control and had a range of weeds present, which are steadily being reduced but there is ongoing regrowth.

Enhancement planting has taken place at the 'Cabbage Tree Swamp' in MU5 and the plan is to keep some of this area relatively open, as it provides amenity value.

Future work required

There is still some hawthorn and willow on the western edge of the bend in MU 5 below Waterview Glades, which will be controlled as part of the WCA works. Weed maintenance should be continued throughout the whole unit.

Some infill planting could be carried out along the riparian zone in MU 5.

2.1.6 Management Unit Six

2005- 2013 Description and workplan

Management Unit 6 (Priority 7) runs along both sides of the creek from the main bridge leading to the Unitec accommodation until the next minor bridge. It encompasses the waterfall and some open grass spaces but is otherwise dominated by regenerating native shrubland. MU 6 is still significantly infested with weeds (particularly the western bank), therefore remains a low priority.

Current condition and work completed as of April 2015

MU 6 weed issues have been significantly reduced, including around the waterfall slopes. Planting has occurred throughout this unit including the upper slopes, which are outside the Auckland Council Parks boundary.

Pine tree felling on Hebron leased land (NZTA owned) and de-limbing/felling on Council land has occurred on western side of creek (at southern end of MU 6) in summer 2014/15. Initial planting was carried out under the pines (on Council reserve land) in winter 2014 and more planting is planned for this area in winter 2015.

Future work required

The bracken / gorse dominated area to north of pines and west of the path requires some weed control and further planting in future.

It was noted that weeds were present in 1m corridor along stream edge above waterfall, particularly on the eastern side (streamside weed control contracted to Downer), which will need further control. This area should also be monitored for bamboo regrowth (from an old bamboo clump). Infill planting could also be carried out along the stream edge above the waterfall, as it is rather open.

2.1.7 Management Unit Seven

2005- 2013 Description and workplan

Management Unit Seven (Priority 8) is the narrowest portion of the site. Following south from management unit six it encompasses both sides of the creek and the area surrounding the Waterview Downs Bridge and walkway leading to New North Road. Within MU 7 is the planting above the retaining wall of the old rubbish dumpsite. Control of this unit should be straightforward as weed densities are relatively low. The biggest concern for this unit is the adjacent land where weeds are not being controlled. The low priority ranking is mainly due to the fact that no plantings have been carried out in this area recently and its location i.e. it is upstream from current work and adjacent to bad weed infestations (MU 8 and 9).

Current condition and work completed as of April 2015

Weed issues have been reduced significantly over time, but there are still some areas of regrowth (e.g. around Phoenix palm / Waterview Downs area on western bank). Arundo / giant reed grass control has occurred in two areas, with replanting planned on the western bank in 2015.

Understorey planting has been carried out by Te Ngahere under half of planted area on the eastern slope (old landfill – above the gabion wall). The steep slope below 2/10 Blockhouse Bay Road was very open and had serious weed issues, including vines. Weed control has commenced and the slope will be replanted by Te Ngahere in winter 2015.

Future work required

On the western bank, north of the bridge (at the southern end of MU 7) further weed control is needed to tackle regrowth of weeds on the slope (e.g. Chinese privet and blue morning glory).

On western side, downstream of the Waterview Downs houses, the banks are very steep and access is tricky – some more weed control is required here and possible planting. The esplanade reserve (AC land), upstream of Waterview Downs, on the western bank, also requires further weed control and planting.

The northern area on the eastern side of the creek adjacent to MU7 is Ngati Whatua land, which has had limited weed control. Weed control in this area should be encouraged.

Part of the Council land below the units at #34 Waterview Downs is mown by one of the owners. Some planting is needed along the stream bank here to give more shade, but to ensure minimal loss of visibility of the creek by the tenants / owners.

2.1.8 Management Unit Eight

2005- 2013 Description and workplan

Management Unit Eight (Priority 10) follows the eastern side of the creek. (Through MU 8 and MU 9 the western banks are not within the projects focal area.) It has large-scale weed infestations, with blue morning glory smothering the majority of trees, native and exotic, within the area so it is recommended to control this management unit once all other units are at manageable 'maintenance' levels.

Current condition and work completed as of April 2015

MU 8 remained a lower priority for many years, as it was not included in the AC weed control maintenance contracts and restoration efforts were focused in the northern half of Oakley Creek. In 2011/2012 SLIPs funding was used to carry out plant preparation by Te Ngahere in an area below the path up to the large willow, with volunteers carrying out planting in winter 2012. Planting has also been undertaken around the Phyllis Reserve path junction and towards the bridge.

In 2011/2012 an assessment of potential remnant mahoe rock forest habitat was funded by Auckland Council and undertaken by Te Ngahere (August 2013 report), which identified three areas of remnant mahoe rock forest (MRF) in MU 8, which were called MRF Areas A, B and C. Area A is to the south of the rubbish dumping area and contains an old rock quarry.

Weed control has progressed well in MRF Areas A-C since it was started in March 2012, with climbing asparagus reduced to small amounts of regrowth now. Natural regeneration is starting to occur and understorey planting was undertaken in Area C in winter 2013, including along the stream, which has been very successful. A weed infested open slope remains between Area B and Area C, with hemlock and vines dominating.

Between MRF Area A and B there was a weed infested steep slope, which is being restored with funding from the AC Sustainable Catchments Programme, with weed control and planting undertaken in 2013/2014.

Future work required

To the south of the large willow tree an area of initial control remains, which has a broad range of environmental weeds from the top of the slope down to the floodplain. This is one of the last areas of initial control remaining on the creek.

To the south of the initial control area (south of large willow), is a steep bank with serious historic rubbish dumping issues including extensive amounts of old bottles and metal. In 2014 contractors removed many truck loads of surface rubbish, but it is unknown how deep

this rubbish persists for in the soil. It is suspected that the slope may be unstable. No weed control has occurred in this area and volunteer activity should be avoided here, at this stage.

Ongoing weed control is needed to continue to reduce weed regrowth and maintain plantings in the MRF areas. Sustainable Catchments have a maintenance programme scheduled for the plantings on the steep slope between MRF A & B until autumn 2016.

2.1.9 Management Unit Nine

2005- 2013 Description and workplan

The remaining southern portion to be restored is contained within MU 9 (Priority 3/9). Weed infestations are relatively large in places with species such as climbing asparagus at high densities. Community groups have carried out a number of plantings in this unit so it is recommended that these planting sites only, be given a priority 3, while the remaining section is given priority number 9.

Current condition and work completed as of April 2015

As part of the proposed Waterview Connection shared path project the land behind numbers 6, 8 and 10 Phyllis Street (between MU 8 & 9) will pass into the management of Auckland Council Parks, following handover maintenance conditions. Weed control will be required in this area, but the benefit will be a wider section of stream corridor and buffering to the adjacent MRF Area C.

Weed control / bamboo removal has been taking place on the slope at the north end of MU 9, but planting is on hold until the shared path has been completed and further archaeological investigation has been done.

Weed control and planting have been undertaken on the Harbutt steep slope (south of the tortured willow) and the floodplain peninsula towards the northern end of MU 9 over the last five years. Large specimen trees including kahikatea, have been planted on this peninsula and along the floodplain in the southern half of MU 9.

Dying willows were cut to about 1m above the base, along the streamside downstream of the Craddock Street bridge, but are now resprouting. Planting is planned along this open stream edge once stream bank erosion remediation works have been undertaken by the AC Stormwater team (which are currently on hold until upstream works in Alan Wood Reserve are completed).

Since 2013 plantings have taken place in Restoration Opportunities 8 and 11 along the streamside, which are starting to establish well. Regular volunteer weeding sessions run by FOOC have helped to control weeds along the edges of MU 9 and within planting areas.

As part of the remnant mahoe rock forest assessment, two MRF Areas were identified in MU 9 – MRF Area D and E (some of the latter extends into MU 10). Initial weed control began in

2013 in these two areas, with understorey planting carried out in Area D in winter 2014. Climbing asparagus was a major issue but this has been reduced considerably. Area E is more open and there has been continued regrowth from the seedbank, such as wattle seedlings. Planting is planned at the southern end of MRF Area E in winter 2015.

In 2014 the southern part of MU 9 (from the southern end of MRF Area D) and MU 10 were added to the ERC contract, with initial control undertaken. In MU 9 there were large infestations of ginger on the eastern bank above the path, below the willows. Te Ngahere carried out some planting on this slope in winter 2014.

Future work required

Ongoing weed control is needed across the unit, with the focus on maintaining progress made in MRF areas and controlling regrowth of weeds in the ERC managed area. Planting maintenance needs to be continued to ensure the survival of plantings. Future planting areas need to be assessed, taking into account the amount of natural regeneration.

2.1.10 Management Unit Ten

2005- 2013 Description and workplan

The Oakley Creek Restoration Plan area only extended to MU 9, so did not include a work programme for the southern part of Harbutt Reserve.

Current condition and work completed as of April 2015

Following on from the mahoe rock forest assessment, MU 10 and MU 11 were established as management units to cover the remainder of Harbutt Reserve. The ERC work area excludes the MRF Areas.

ERC initial weed control focused on dense ginger in the floodplain area and abundant vines on the slopes. The weedy gully before the railway line was sprayed out and planted in 2014. Planting was also carried out on the floodplain area in winter 2014.

The canopy to the south of the weed gully is predominantly tree privet and this is being selectively drilled annually as a staged process, to ensure that large light wells are not created. Emergence of weed seedlings in the understorey in MU 10 continues to be an issue but this will be reduced over time.

Some volunteer streamside planting is planned in winter 2015, funded by AC Stormwater and coordinated by FOOC, in the floodplain area to the south of the stormwater outlet.

Future work required

Vigorous regrowth of weeds has been an issue in the weedy gully before the railway line, and the adjacent more open area to the south (next to the start of the tree privet canopy). Regular weed control and maintenance of plantings in this area should be targeted.

Ongoing weed control is required throughout the unit to control regrowth of a variety of weeds, including vines on the slopes and ginger near the floodplain.

A large stand of bamboo exists on the southern boundary of MU 10, which should be controlled in future, if resources are available and archaeological assessments were carried out.

2.1.11 Management Unit Eleven

2005- 2013 Description and workplan

The Oakley Creek Restoration Plan area only extended to MU 9, so did not include a work programme for the southern part of Harbutt Reserve.

Current condition and work completed as of April 2015

MU 11 starts to the south of the large area of bamboo, which has not been targeted yet. Initially the canopy is tree privet dominated with some mahoe and ponga. The area between marker 2.5 and 2.55 is identified as Mahoe Rock Forest Area F, with mature mahoe being dominant.

Climbing asparagus was dense throughout the understorey when initial control started in MU 11. Weed issues are now less serious but require ongoing management to treat regrowth.

MU 11 has been in the ERC contract area since 2014, with regular weed visits undertaken. Staged thinning of tree privet will be undertaken over time by drilling selected trees. Weed control has been undertaken in MRF Area F in MU 11 since June 2013.

Below the complex of stone walls (an archaeological site) in MRF Area F, willows were removed from the stream edge by AC Stormwater. The cut stumps were placed very near to or against the stone walls and unfortunately are resprouting, which is of concern for the protection of the archaeological feature.

Future work required

Ongoing weed control is needed to maintain the MRF Areas and to continue weed control in the adjacent areas of mixed bush. Future planting areas need to be considered, taking into account the amount of natural regeneration and archaeological assessments.

In the long-term willows, an environmental weed tree, need be removed along the stream banks in both MU 10 and MU 11.

2.2 Restoration Timeline review

In the Oakley Creek Restoration Plan (Te Ngahere, 2009) an outline of a suggested work programme over time was provided (referred to as the 'restoration timeline'). We have reviewed the objectives of this timeline to understand what actions took place and which objectives were achieved. Those objectives not achieved may need further work or development in the next restoration phase (2015-2025). Overall, weed control and planting at Oakley Creek has progressed further than expected in the timeline (2005-2013), with weed control occurring into MU10 - 11 and planting begun in MU 10.

One of the requirements for successful environmental weed control is having a long-term approach to the programme. A phased programme of weed control was set-out in the restoration timeline for Oakley Creek, moving into new Management Units and following up existing areas of weed control. The timeline was dependant on the availability of labour and funds. The timeline was also compiled with the assumption that contractors, such as Te Ngahere, would have continued involvement with this project.

It should be noted that the priority a management unit was given does not necessarily reflect the entire unit. Some units will have a small area that requires a higher priority than the rest of the management unit. These areas were noted in the 'specific targets'.

Text shown in blue is from the Revised Oakley Creek Restoration Plan (Te Ngahere, 2009), pages 49-54, with review comments in black showing progress made in completing objectives and specific targets. The 'status' in the tables below refers to current status of the MU as of April 2015.

2.2.1 Stage 1

Season	Objective Stage 1	Status
Spring 2005	Control all high and medium priority weed species within management unit (MU) 1.	Met – all high and medium priority weeds controlled in MU 1. Ongoing weed control has occurred from 2004-2015, MU 1 is now in Seedbank Control. Ongoing maintenance is needed and few hotspots remain (e.g. Madeira vine).
Season	**Specific targets Stage 1**	**Status**
Spring 2005	FS wandering Jew, periwinkle, nasturtium and other ground covering species in order to maintain current revegetation sites.	Achieved – revegetation sites established. Ongoing control of tradescantia and other groundcovers needed within MU 1.
	CS ⅔ tree privet and any other exotic tree species below 5m.	Ongoing – control of tree privet has occurred in a staged process. Mature tree privet remain in MU 1c and will continue to be steadily removed in future. Other weed trees to be controlled in future.
	Control and remove all willows below 6m as funds allow.	Achieved – all willows controlled in MU 1.

2.2.2 Stage 2

Season	Objective Stage 2	Status
Summer 2005/2006	Control all high and medium priority weed species within MU 3. Maintain weeds species within MU 1.	Met – all high and medium priority weeds controlled in MUs 1 & 3. Ongoing weed control has occurred from 2004-2015, MUs 1 & 3 are now in Seedbank Control. Ongoing maintenance is needed.
Season	**Specific targets Stage 2**	**Status**
Summer 2005/2006	Control and remove regrowing flame tree and any other ground covering and woody (<6m) tree weed species.	Achieved – flame tree has been controlled. Ongoing control of ground cover and woody weed species undertaken. Tree privet is main weed tree that has continued to be controlled in a staged approach.
	Revisit MU 1 in late summer and control remaining weed infestations.	Achieved – revisits carried out. Weed infestations controlled.

2.2.3 Stage 3

Season	Objective Stage 3	Status
Winter 2006	Follow up control of all high and medium priority weed species within management units 1 and 3. Revegetate the remainder of MU 1a and 1b.	Met – all high and medium priority weeds controlled in MUs 1 & 3. Ongoing weed control has occurred from 2004-2015, MU 1 & 3 are now in Seedbank Control. Ongoing maintenance is needed. Met - Planting has been carried out through MU 1a and 1b, with only some infill areas remaining now.
Season	**Specific targets Stage 3**	**Status**
Winter 2006	Prepare MU 1 for planting.	Achieved – Planting preparation undertaken.
	The revegetation priority should be the stream bank throughout MU 1.	Achieved – MU 1 planting has been carried out.

2.2.4 Stage 4

Season	Objective Stage 4	Status
Spring 2006	Control all high and medium priority weed species within MU 9. Follow up control of weed infestations within MU 1 and 3.	Ongoing – all high and medium priority weeds significantly reduced in MU 9 (control of whole unit only started in 2013). Met - Ongoing weed control has occurred from 2004-2015 in MUs 1 & 3 - they are now in Seedbank Control. Ongoing maintenance is needed.

Season	Specific targets Stage 4	Status
Spring 2006	Revisit MU 1 and 3 to control previous infestations.	Achieved – weed controlled in MU 1 & 3 to Seedbank Control level.
	Control should focus on areas recently revegetated within MU 9 only. Hand releasing plantings of all vine and ground covering species and controlling with herbicide.	Achieved – MU 9 early plantings now well established.

2.2.5 Stage 5

Season	Objective Stage 5	Status
Summer 2006/2007	Control all high and medium priority weed species within MU 2 and MU 5. Follow up weed control of MU 1, 3 and sections of 9.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1, 2, 3 & 5 - they are now in Seedbank Control. MU 9 weed control is progressing well, with weeds significantly reduced. Ongoing maintenance is needed.
Season	**Specific targets Stage 5**	**Status**
Summer 2006/2007	Focus on vine and ground covering species, with manual methods where possible and foliar spraying.	Achieved – vines and ground cover weeds have been reduced to only small amounts of regrowth.
	Focus weed control within MU 5 within areas revegetated by Gladstone Primary School only.	Achieved – MU 5 early plantings now well established.
	Follow up weed infestations within MU 1, 3 and revegetation sites within 9.	Achieved - Ongoing weed control has occurred from 2004-2015 in MUs 1 & 3- they are now in Seedbank Control. Met - MU 9 early plantings established and weed control has progressed to the whole unit. Further planting has occurred.

2.2.6 Stage 6

Season	Objective Stage 6	Status
Winter 2007	Control all high and medium priority tree species within MU 2. Follow up weed control of MU 1, 3 and sections of 9.	Met – Majority of weed trees in MU 2 have been controlled (exotic amenity species retained). A few weed trees remain at northern end of MU 2, near the road. Met - Ongoing weed control has occurred from 2004-2015 in MUs 1 & 3 - they are now in Seedbank Control. MU 9 weed control is progressing well, with weeds significantly reduced.

	Revegetate the remaining areas in MU 1 and MU 3.	Ongoing maintenance is needed. Ongoing – planting has been undertaken regularly in MU 1 & 3, only a few small infill areas remain to plant.
Season	**Specific targets Stage 6**	**Status**
Winter 2007	Focus on completing initial control of vine and ground covering species, with manual methods where possible and foliar spraying, within MU2.	Achieved – Initial control completed early in project programme. MU 2 is now in Seedbank Control.
	Cut and stump all tree species <6m. Targets will include tree and Chinese privet within MU 2.	Achieved – MU 2 smaller weed trees have been targeted.
	Follow up weed infestations within MU 1, 3 and revegetation sites within 9 and 5.	Achieved - Ongoing weed control has occurred from 2004-2015 in MUs 1 & 3- they are now in Seedbank Control. Achieved -MU 9 and MU 5 early plantings established. Further planting has occurred.
	Revegetate any remaining areas in MU 1 and revegetate the stream bank and flood plain of MU 3a and 3b.	Ongoing - Planting has been undertaken in MU 1 & MU 3, with only a few small infill areas remaining and some more stream bank planting needed in MU 3.

2.2.7 Stage 7

Season	**Objective Stage 7**	**Status**
Spring 2007	Control all high and medium priority species within MU 4. Follow up weed control of MU 1, 2, 3 and sections of 9.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1, 2, 3 & 4 - they are now in Seedbank Control. MU 9 weed control is progressing well, with weeds significantly reduced.
Season	**Specific targets Stage 7**	**Status**
Spring 2007	Infestations are relatively small within MU 4 therefore manual methods could be used for a number of small infestations, however herbicide foliar spraying and cut and stump methods will be required. The pine canopy within 4b is to be maintained.	Achieved – Weed infestations further reduced in MU 4. Ongoing focus on weed tree control as part of WCA planned restoration works in MU 4a and MU 4b. Pine canopy in MU 4b still remains, but will be managed as dies.
	Follow up on spring growth in MU 1, 3 5 and 9.	Achieved.
	Follow up control on weed infestations within MU 2.	Achieved.

2.2.8 Stage 8

Season	Objective Stage 8	Status
Summer 2007/2008	Ensure weed infestations within MU 1, 2, 3 and 4 are controlled to maintenance levels.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1, 2, 3 & 4 - they are now in Seedbank Control.
Season	**Specific targets Stage 8**	**Status**
Summer 2007/2008	Focus efforts on persisting weed populations within MU 1-4 including the removal of willows as funding allows.	Achieved – Willows along stream MU 1-4 controlled in 2009 (few remain in MU 3). Other weeds reduced to small amounts of regrowth. Large bamboo stand in MU3 remains.
	Follow up on spring growth in MU 1, 3 5 and 9.	Achieved.
	Follow up control on weed infestations within MU 2	Achieved.

2.2.9 Stage 9

Season	Objective Stage 9	Status
Winter 2008	Control all high and medium priority weed species within MU 5. Revegetate MU 2 and 3.	Met - Ongoing weed control has occurred from 2004-2015 in MU 5 – it is now in Seedbank Control. Further focus on weed tree control as part of WCA planned restoration works in MU 5, including Chinese privet. Met - Revegetation has been carried out in MU 2 and 3. Some areas remain to infill plant.
Season	**Specific targets Stage 9**	**Status**
Winter 2008	Target weed species on the MU 5s western bank only.	Ongoing – WCA work planned for 2015-2016.
	Follow up control of MU 2, 4 and revegetated sections of 9.	Achieved.
	Revegetate MU 2 and any remaining areas of MU 3, ensuring some grassed areas are left open and plants are grouped to form pockets of vegetation that facilitate the recreational use of the reserve.	Achieved - Planting has been undertaken in MU 2 & 3, most recently in MU 3a. Access areas along stream edge have been left open in places.

2.2.10 Stage 10

Season	Objective Stage 10	Status
Spring 2008	Control all high and medium priority weed species within MU 5. Follow up weed control on MU 1-4.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1-5 – they are now in Seedbank Control. Further focus on weed tree control as part of WCA planned restoration works in MU 5, including Chinese privet. Met - Revegetation has been carried out in MU 2 and 3. Some areas remain to infill plant.
Season	**Specific targets Stage 10**	**Status**
Spring 2008	Complete initial control on the western bank of MU 5 and target high priority environmental weeds only on the eastern banks of MU 5.	Achieved - Initial control completed and high priority targets controlled in MU 5. Ongoing maintenance and weed tree control required. WCA work planned for 2015-2016 in MU 5 to target weed trees.
	Continue the control and removal of willows throughout MU 1-4 as funding allows.	Achieved - Willows along stream controlled in 2009 (few remain in MU 3).
	Follow up control of MU 1-4 and revegetated sections of MU 5 and 9.	Achieved.

2.2.11 Stage 11

Season	Objective Stage 11	Status
Summer 2008/2009	Control all high and medium priority weed species within MU 5. Follow up weed control on MU 2-4.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1-5 – they are now in Seedbank Control. Further focus on weed tree control as part of WCA planned restoration works in MU 5, including Chinese privet.
Season	**Specific targets Stage 11**	**Status**
Summer 2008/2009	Complete all initial weed control in MU 5.	Achieved – Initial control completed in early stages of the project and high priority targets controlled in MU 5. Ongoing maintenance and weed tree control required. WCA work planned for 2015-2016 in MU 5 to target weed trees.
	Continue the control and removal of willows throughout MU 1-4 as funding allows.	Achieved - Willows along stream controlled in 2009 (few remain in MU 3).
	Follow up control of MU 2 and 4.	Achieved.

2.2.12 Stage 12

Season	Objective Stage 12	Status
Winter 2009	Control all high and medium priority weed species within MU 6. Follow up weed control on MU 1, 3 and 5. Revegetate MU 4.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1-6 – they are now in Seedbank Control. Ongoing - Revegetation has been carried out in MU 4, particularly in areas along the stream bank.
Season	**Specific targets Stage 12**	**Status**
Winter 2009	Focus on the Eastern banks of MU 6 using foliar spraying and cut and stump methodology to control high and medium priority environmental weeds.	Achieved – All high and medium priority weeds controlled in MU 6.
	Follow up weed control of MU 1, 3 and 5.	Achieved.
	If funding is limited, target revegetation efforts on the stream bank and flood plain of MU 4.	Achieved - MU 4 planting has mainly focused on stream edges due to density of weed trees further upslope.

2.2.13 Stage 13

Season	Objective Stage 13	Status
Spring 2009	Control all high and medium priority weed species within MU 6. Follow up weed control on MU 2, 4 and 9.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 2, 4 & 6 – they are now in Seedbank Control. Weed control was started in 2013 in MU 9 and is progressing well.
Season	**Specific targets Stage 13**	**Status**
Spring 2009	Control all high and medium priority environmental weeds within MU 6.	Achieved.
	Follow up weed control of MU 2, 4 and revegetated sections of 9.	Achieved.

2.2.14 Stage 14

Season	Objective Stage 14	Status
Summer 2009/2010	Control all high and medium priority weed species within MU 6. Follow up weed control on MU 1, 3 and 5.	Met - Ongoing weed control has occurred from 2004-2015 in MUs 1, 3, 5 & 6 – they are now in Seedbank Control.
Season	**Specific targets Stage 14**	**Status**
Summer 2009/2010	None	

2.2.15 Stage 15

Season	Objective Stage 15	Status
Winter 2010	Control all high and medium priority weed species within MU 7. Follow up weed control on MU 2, 4, 6 and 9. Revegetate the remainder of MU 4, and focus on the stream banks of MU 5.	Met - Ongoing weed control from 2004-2015, MU 1-7 now in Seedbank Control. All of MU7 included in ERC from 2012. MU 9 in ERC contract since 2013 and covered by SLIPs/Local Board projects. Ongoing - Planting has occurred in MU 4 & 5, with more planned.
Season	**Specific targets Stage 15**	**Status**
Winter 2010	None	

2.2.16 Stage 16

Season	Objective Stage 16	Status
Spring-Summer 2010/2011	Control all high and medium priority weed species within MU 7. Follow up weed control on MU 1 3, 5, and 6. Continue willow control as funding is available.	Met - Ongoing weed control from 2004-2015, MU 1-7 now in Seedbank Control. All of MU7 included in ERC from 2012. Met - Only few willows remain in MU 3.
Season	**Specific targets Stage 16**	**Status**
Spring-Summer 2010/2011	None	

2.2.17 Stage 17

Season	Objective Stage 17	Status
Winter 2011	Control all high and medium priority weed species within MU 8.	Ongoing - Parts of MU 8 managed as Mahoe Rock Forest areas since 2012, part of MU 8 has been a Sustainable Catchments project site and part has been restored through SLIPs funding. Two areas still remain in MU 8 that are in initial control (south of willow and open weedy slope between MRF Areas B & C).
	Follow up weed control on MU 2, 4, 7 and 9.	Met - Ongoing weed control from 2004-2015, MU 1-5 & 6 now in Seedbank Control. All of MU7 included in ERC from 2012 and MU 9 in ERC since 2013 and SLIPs/Local Board projects.
Season	**Specific targets Stage 17**	**Status**
Winter 2011	Complete revegetation of MU 5 if necessary and revegetate MU 6 where appropriate.	Ongoing - Planting has been undertaken in MU 5 & 6, but is ongoing.

2.2.18 Stage 18

Season	Objective Stage 18	Status
Spring 2011	Control all high and medium priority weed species within MU 8.	Ongoing - Parts of MU 8 managed as Mahoe Rock Forest areas since 2012, part of MU 8 has been a Sustainable Catchments project site and part has been restored through SLIPs funding. Two areas still remain in MU 8 that are in initial control (south of willow and open weedy slope between MRF Areas B & C).
	Follow up weed control on MU 1, 3, 5 and 6.	Met - Ongoing weed control from 2004-2015, MU 1-5 & 6 now in Seedbank Control.
Season	**Specific targets Stage 18**	**Status**
Spring 2011	None	

2.2.19 Stage 19

Season	Objective Stage 19	Status
Summer 2011 – Spring 2012	Control all high and medium priority weed species within MU 8	Ongoing - Parts of MU 8 managed as Mahoe Rock Forest areas since 2012, part of MU 8 has been a Sustainable Catchments project site and part has been restored through SLIPs funding. Two areas still remain in MU 8 that are in initial control (south of willow

		and open weedy slope between MRF Areas B & C).
	Removal of remaining ⅓ of tree privet canopy within MU 1c.	Ongoing - Staged removal of tree privet in MU 1c has been ongoing and should be continued.
	Follow up weed control on MU 1-7	Met - Ongoing weed control from 2004-2015, MU 1-7 now in Seedbank Control.
	(Winter) Infill planting where necessary through MU 1-6	Met - Planting has been undertaken in MU 1-6. Some infill opportunities in future.
	Commence revegetation of stream bank within MU 7.	Ongoing - Planting planned in 2015 in two areas on western bank of MU 7. Area opposite to gabion wall by stream to be kept open.
Season	**Specific targets Stage 19**	**Status**
Summer 2011 – Spring 2012	None	

2.2.20 Stage 20

Season	**Objective Stage 20**	**Status**
Summer 2012 – Spring 2013	Control all high and medium priority weed species within MU 9.	Met - MU 9 has been included in the ERC work area since 2014 and parts were in SLIPs/Local Board projects previously. All high and medium priority weeds controlled, yet ongoing regrowth.
	Follow up weed control on MU 1-8.	Met - Ongoing weed control from 2004-2015, MU 1-7 now in Seedbank Control. Parts of MU 8 managed as Mahoe Rock Forest areas since 2012, part of MU 8 has been a Sustainable Catchments project site and part has been restored through SLIPs funding. An area still remains in MU 8 that is in initial control.
	(Winter) Revegetate remaining areas within MU 7 (including infill planting if necessary within the retaining wall).	Ongoing - Eastern slope above gabion wall in MU 7 (approx half of area) has had understorey planting.
Season	**Specific targets Stage 19**	**Status**
Summer 2012 – Spring 2013	None	

2.2.21 Stage 21

Season	Objective Stage 20	Status
Summer 2013-ongoing.	Complete initial weed control within MU 9.	Met - Initial control was completed in MU9 by end of 2014. Since 2014 weed control is also being undertaken in all of MU 10 and MU 11.
	Follow up maintenance weed control on all management units.	Met (apart from part of MU 8) - Ongoing weed control from 2004-2015, including MUs 1-11. The exception is an area of initial control that still remains in part of MU 8 (south of willow tree and weedy slope between MRF B & C). Ongoing maintenance in all MUs is needed to reduce weeds to low levels.
	(Winter) Revegetate MU 8 and 9 as time and funding allows.	Ongoing – revegetation has continued in MUs 8 & 9, particularly since winter 2010 on an annual basis.
Season	**Specific targets Stage 19**	**Status**
Summer 2013-ongoing.	None	

2.3 Weed control

2.3.1 Restoration contracts (long-term)

Weed control along Oakley Creek has been under Auckland City Council / Auckland Council restoration contracts since 2002, which has ensured regular visits are carried out and weed issues are followed up, thus reducing the prevalence and diversity of weeds along the stream corridor. This has supported the efforts of volunteers and allowed restoration to progress at a faster and more sustained rate.

A site-led weed control approach has been followed using the Forest Restoration Framework, developed by Te Ngahere. This has allowed phased progression from initial control to follow-up control, with now the majority of the management units being in seedbank control.

Te Ngahere has carried out all three of the restoration contracts along Oakley Creek, so have developed an in-depth knowledge of the weed issues and restoration history of the reserve. The work area of these weed control contracts is restricted to the Council owned land.

From 2002-2006, the Oakley Creek Walkway from MU 1 - 6 was part of the WCBNA (Weed Control in Bush and Natural Areas) contract which included a number of central city parks owned by Auckland City Council.

Te Ngahere carried out weed control under the ERBNA (Ecological Restoration of Bush and Natural Areas) contract, from December 2007- June 2012. The work area extended from MU 1 - 6, including a small part of MU 7 on the western side of the creek.

From July 2012 onwards this was replaced by the ERC (Ecological Restoration Contract) for the central parks sector managed by the Auckland Council Local and Sports Parks team. Initially the work area covered MU 1 - 7 (including the eastern and western sides of the creek) with weed control starting from December 2012. MU 5a sections were added at the start of this contract, to take in extensions on the western side of the creek. In 2014 the ERC work area was further extended to include the southern part of MU 9 (from end of MRF Area D), plus MU 10 and MU 11.

Weed control visits have been undertaken 3 times per year (spring, summer and autumn visits), targeting environmental weeds through appropriate hand pulling, cut stump or foliar spray methods, following Te Ngahere's lowest toxicity herbicide policy.

In addition, Weed Canopy Control work has been undertaken by Te Ngahere as required. This is where selected environmental weed trees are drilled and poisoned, where an existing understorey exists. Refer to the maps in Figure 20 - Figure 22, showing weed canopy control carried out between 2013-2015.

The following number of weed species have been controlled by contract / project at Oakley Creek, shown in Table 1. For a list of weed and exotic species controlled refer to the Appendix (Section 6).

Table 1. Number of environmental weed species controlled by project 2007- April 2015

Project/ contract	Oakley MU1-7 (ERC)	Harbutt MU 9-11 (ERC)	Mahoe Rock Forest MU 8-11	ERBNA 2007-2012 (MU 1-part7)
Number of weed species controlled	63	30	53	38

2.3.2 Volunteer weeding

Volunteers managed by Friends of Oakley Creek (FOOC), have also been active in carrying out weed control using manual and cut and paste methods, since the start of the project. FOOC carry out regular weed control working bees and also undertake planting maintenance. FOOC works closely with adjacent neighbours and landowners (such as Unitec, Ngati Whatua, private residents, Kodesh Community and Sustainable Neighbourhood groups) to encourage weed control and restoration planting on areas adjacent to Oakley Creek. Refer to Section 2.4 for details of planting and Section 3 for monitoring activities undertaken by FOOC.

2.4 Planting

A major focus of the Oakley Creek restoration project has been revegetation, as there was a general lack of established native cover present along many parts of the stream corridor at the start of the project and hence limited food sources for native birds. Significant achievements have been made in establishing native vegetation in the riparian area and wider stream corridor.

This has led to:

- an enhanced natural character,
- terrestrial and in-stream biodiversity benefits (such as increased shelter and food sources for native wildlife, reduced number of animal pests, more shading of the stream resulting in more stable stream temperatures and shelter for fish and macro invertebrates),
- increased amenity value, and
- improved ecosystem services (improving water quality, reducing flows, providing fish and wildlife habitat).

The first planting was carried out by FOOC in 2004 (with some earlier plantings organised by Auckland City Council). Initial planting was mainly focused on the northern half of the Oakley Creek walkway, and since 2009 the number of plantings undertaken in MU 7-9 has increased. In 2014, the first plantings were carried out in MU 10 by Te Ngahere. No planting has been undertaken in MU 11, as restoration was only recently begun in this unit and archaeological assessment is required.

The majority of plantings have been carried out by the community (involving various local

groups and the occasional business/corporate group) and co-ordinated by FOOC. Annual planting at a selected site(s) has also been carried out by Te Ngahere since 2006, as part of the restoration contracts.

The planting activity from 2004-2014 is summarised in the table below, Table 2. A total of 45,543 plants have been planted in the Oakley Creek restoration plan management area since 2004, with at least 28 different groups involved in planting.

Table 2. Summary of planting carried out at Oakley Creek between 2004-2014

Year	Groups involved in planting	Number of plants *	Management Units
2004	Friends of Oakley Creek (FOOC)	200	9
2005	FOOC, Buchanan Rehab Centre, Metrowater, Gladstone Primary School, Wai Care	4129	1a, 1b, 1c, 2, 3a, 4a, 5, 7 & 9
2006	FOOC, Te Ngahere, Buchanan Rehab, Unitec, Corrections Department, Gladstone Primary School	6081	1a, 1b, 1c, 2, 3a, 3b, 5, 6
2007	FOOC, Envirotech, Buchanan Rehab, Conservation Volunteers NZ (CVNZ), Gladstone Primary School, Sustainable Business Network (SBN), Te Ngahere, Unitec, Metrowater	4348	1a, 1b, 1c, 2, 3a, 3b, 5, 6, 7 & 9
2008	FOOC, SBN, Buchanan Rehab, Te Ngahere, CVNZ, Gladstone Primary School	3730	1a, 1b, 2, 3a, 3b, 4a, 5, 6, 7 & 9
2009	FOOC, SBN, Buchanan Rehab, Te Ngahere	2724	1a, 1b, 1c, 2, 3a, 3b, 4, 5 & 7
2010	FOOC, Te Ngahere, CVNZ, Alldrains, Buchanan Rehab, Kodesh Community, A Rocha, Gladstone Primary School	4097	1a, 1b, 1c, 2, 3a, 3b, 4b, 5, 6, 7, 8 & 9
2011	FOOC, Buchanan Rehab, Waterview Primary School, A Rocha, Te Ngahere, Cadburys, Collectively Kids	2935	1a, 1b, 1c, 2, 3a 4a, 5, 6, 7, 8 & 9
2012	FOOC, BNZ, Envirotech, Auckland Council, A Rocha, Buchanan Rehab, Well-Connected Alliance (WCA), Auckland Council, Telecom/Vector, Open Polytechnic, CVNZ, World Wildlife Fund for Nature (WWF), Gladstone Primary School	5243	1a, 1c, 2, 3a, 4a, 5, 6, 7, 8 & 9
2013	FOOC, Gladstone Primary School, Buchanan Rehab, Collectively Kids, A Rocha, CVNZ, Chorus, Open Polytechnic, Te Ngahere, BNZ, HSBC	5839	1a, 1b, 1c, 2, 3a, 4a, 5, 6, 7, 8 & 9

Year	Groups involved in planting	Number of plants *	Management Units
2014	FOOC, Buchanan Rehab, Open Polytechnic, Te Ngahere, A Rocha, Wildlands, Manukau Institute of Technology (MIT), BNZ, HSBC	6217	1a, 1b, 2, 3a, 3b, 4a, 4b, 5, 6, 7, 8, 9 & 10
Total		45,543	

* NB: Does not include plants planted in areas outside Oakley Creek management area.

2.5 Other Restoration Projects

A variety of funders / contributors and stakeholders have been involved in the restoration of Oakley Creek since the project commenced in 2004, and several of these continue to do so. Refer to Figure 4 for maps showing location of the specific project areas and contributors. Friends of Oakley Creek is involved in the co-ordination of and / or the liaison with the key contacts for all restoration efforts on the Oakley Creek Walkway (MU 1-11). The various projects are described below.

2.5.1 Albert-Eden Local Board SLIPs (Small Local Improvements Projects)

Small Local Improvement Projects (SLIPs) - Local Board funding secured by the Auckland Council Parks Volunteer & Biodiversity Co-ordinator and managed by the Auckland Council SLIPs team or previously Beca - have funded restoration works along Oakley Creek since 2005 (pers. comm. Wendy John). Te Ngahere have been involved with planning and carrying out restoration tasks for SLIPs projects along Oakley Creek since at least 2007.

The main focus areas for SLIPS work have been in MU1-MU7 and part of MU 8, covering work which has fallen outside the scope of ecological restoration contracts. Work has included planting site preparation, weed tree removal (such as privets and willows), planting maintenance of previously planted areas, plant supply and additional weed control, carried out or managed by Te Ngahere. This has supported Friends of Oakley Creek to carry out volunteer planting days and plan future planting.

2.5.2 Mahoe Rock Forest Restoration

Further to the completion of an ecological assessment of Oakley Creek, as part of the proposed Waterview Connection (SH20 extension), a "remnant of a rare rock forest ecosystem type, around 700 m^2", was identified in Phyllis Reserve. FOOC, knowing that there were other similar areas along the creek, approached the Albert-Eden Local Board for funding. This resulted in an assessment of remnant mahoe rock forest covering MU 8-11 being carried out in 2012 (Te Ngahere, Aug 2013). Further funding was allocated under the Auckland Council Long-term Plan (LTP) for a special project to restore remnant mahoe rock forest habitat along Oakley Creek.

Restoration works started with weed control in 2012. Weed control has continued annually (undertaken by Te Ngahere) with planting carried out in 2013 and 2014 (by Friends of Oakley Creek). Weed issues in Mahoe Rock Forest Areas A-F have been significantly reduced and all areas are now in seedbank control. This project was initially managed by the SLIPs team, but in 2014/2015 was included in the Local Board work programme for the ERC contract.

2.5.3 AELB Stream Restoration (Local Board discretionary funding for community projects)

This Local Board fund (managed by the Auckland Council Biodiversity Team) has contributed to streamside restoration in MU 9 Restoration Opportunity (RO) areas 8, 9 and 11 (refer to Oakley Creek Watercourse Management Plan) in 2012-2015. It has included site preparation, follow up plant maintenance, weed control and plant supply, with planting being carried out by FOOC.

2.5.4 Biosecurity – Chinese Knotweed

Chinese knotweed (*Persicaria chinensis*) was discovered along Oakley Creek in MU 8 (on east bank south of the bridge) by Te Ngahere. In February 2014 the Auckland Council Biosecurity Team engaged Te Ngahere to carry out a streamside survey and both sides of the stream plus floodplain areas were searched from MU 6-11. Only the initial patch of Chinese knotweed was found and this was controlled, with plant material removed. Another contractor now checks this site three times per year and if required re-sprays.

2.5.5 Well Connected Alliance (WCA) Lizard Enhancement Area

As part of the Waterview Connection works (SH 20 to SH16 link) lizard capture and relocation was required, due to vegetation clearance and stream re-alignment. Skinks were searched for and captured within Hendon Park, Alan Wood Reserve, Maioro Street interchange, the North Western Motorway Waterview onramp and the Point Chevalier Motorway offramp before, during and immediately after vegetation clearance.

WCA moved approximately 192 native copper skinks to suitable habitat in MU 3a in 2012 (referred to as the Lizard Relocation Management Area), prior to commencement of construction of the motorway. The Lizard Relocation Management Area is a mosaic of rank grass and native plantings that is approximately 6000 m2 and lies adjacent to Oakley Creek.This open area was also enhanced, with the support of the WCA, with the placement of large logs (from tree privet felled in MU 1c) and planting of native plants, with some areas being kept open, with low-growing species / open grassland. Lizard monitoring and rodent monitoring were undertaken for three years (until Dec 2014).

Control of introduced mammalian predators has been undertaken since 2012 to reduce predation pressures on native skinks and is ongoing. Bait stations have been set up and Friends of Oakley Creek are continuing to bait four times a year. Rodent control monitoring was conducted once a year during December for 3 years until December 2014 (details from WCA /Tonkin & Taylor report, October 2014).

2.5.6 WCA Riparian Restoration

The Waterview Connection Project (run by the Well-Connected Alliance) is creating a tunnel under Oakley Creek which links up SH 20 and SH 16. A ventilation stack will be located in the north-west corner of MU 4a, on the edge of Great North Road, Waterview. The WCA proposed work area covers a 20 metre riparian strip from MU 5, below the Unitec Bridge, down to the northern end of MU 4a. Restoration work will include weed control and planting, starting in 2015 and will be focused over a 2 year period.

As part of additional restoration works (due to a pollution incident in Alan Wood Reserve), control of weed trees and planting along the stream edge north of MU 4a (on both sides of the stream) will be undertaken in collaboration with FOOC, in 2015 and 2016.

2.5.7 NZ Transport Agency (NZTA) / Well Connected Alliance Shared Path

As part of the Waterview Connection project a walking and cycling (shared) path will be cconstructed in 2015-2016, along the top of the valley, parallel to Oakley Creek, from the Alan Wood Reserve, through to Great North Road, Waterview. This will include a new raised boardwalk between Harbutt & Phyllis Reserves, and an at-grade bridge crossing the stream close to the boundary of MU 3b & MU 5. Some positive outcomes from the project will be an expanded esplanade reserve behind properties 6-10 Phyllis Street, and more planting under the new bridge.

2.5.8 Sustainable Catchments Programme

The Sustainable Catchments Team at Auckland Council have produced an "Urban 10 Year Implementation Plan - South Waitematā (Sept 2014)" which covers the whole Oakley Creek catchment and is a strategic document. It sets out 'on-the-ground' catchment intervention options which link to Restoration Opportunities identified in the Water Course Management Plan for Oakley Creek (Morphum, Oct 2010). Progress towards achieving objectives for Restoration Opportunities RO 1-12 (which cover sections of Oakley Creek from MU 5-11) can be seen in Table 11 in the Appendix.

Restoration work has been undertaken in RO 7 by Sustainable Catchments in 2013/2014 on the weed dominated slope and floodplain between MRF Area A & B. Planting was carried out by contractors in winter 2014. Infill planting is planned in this area and maintenance will continue until 2016.

2.5.9 Western banks – Whau Local Board area

Restoration work has been undertaken in the Whau Local Board area along Oakley Creek by way of a partnership with the Friends of Oakley Creek and Local and Sports Parks West, with involvement from the Haven / A Rocha / Powell Street Sustainable Neighbourhood community. This has focussed on the area at the pedestrian access way from Cradock Street (MU9) and 100m north of the bridge from that access as it crosses the stream. The work

has been a mixture of contractor weed management on a steep scarp above the access way, including planting of 250-300 native plants and follow up weed control in the 2013/14 financial year. Planting site prep (weed control) is being carried out covering 100m on the west stream bank (downstream) of the pedestrian footbridge for the 2014/15 winter planting season.

2.5.10 Unitec

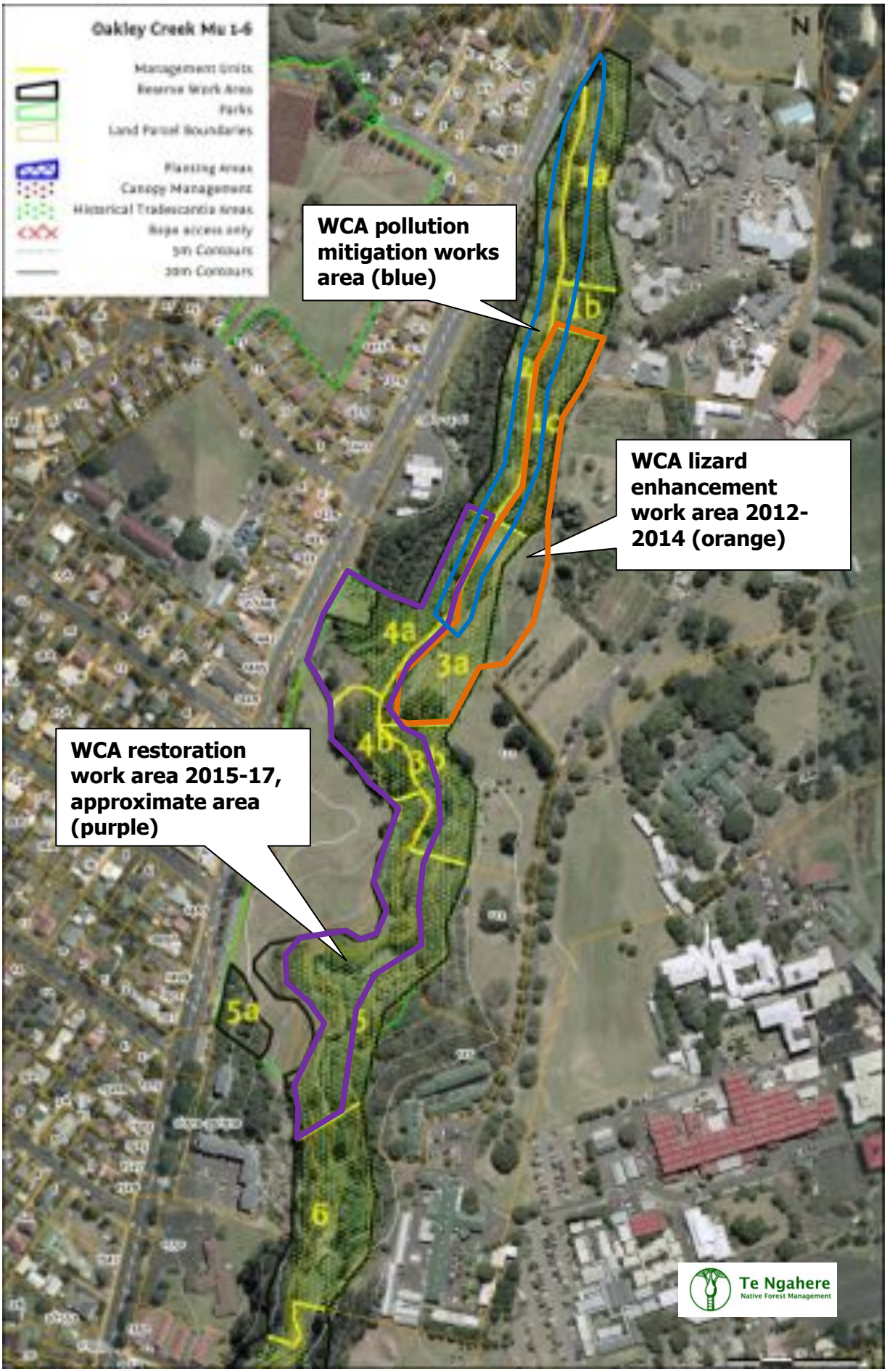
Unitec have been working with Friends of Oakley Creek to restore the Wairaka Stream channel that runs through Unitec grounds. A working group has been set-up and a *Unitec Biodiversity Strategy for Wairaka Stream Sub-precinct E* (undated, Unitec/Morphum) has been developed. This strategy sets out planting lists and management units for the Wairaka Stream, which flows into Oakley Creek.

Friends of Oakley Creek has been working with Unitec and initially Wai Care, to restore the Wairaka Stream that flows into Oakley Creek. The *Wairaka Stream Restoration Plan Discussion Document* (Morphum 2012) provides a framework for the restoration work. It sets out the scope, objectives, management units and enhancement opportunities for the reaches of Wairaka Stream within the campus grounds. In 2014, a roopu / group, Nga Kaitaiki, of which FOOC is a part, was established to '*maintain and protect the mauri and integrity of the environment occupied by Unitec'*, which includes the Wairaka Stream.

2.5.11 Auckland Council Stormwater

The Stormwater Team at Auckland Council are responsible for ensuring that Oakley Creek stays clear of blockages that could result during flood periods. Contractors, Alldrains, and more recently Downer have carried out this work, and they are also responsible for managing the weeds and clearing debris along the 1.5m riparian edge of the stream.

The Stormwater team are also responsible for implementing the recommendations in the Oakley Creek Watercourse Management Plan (which covers engineering assets, erosion management, fish passage and enhancement opportunities). Stormwater are looking to undertake some major erosion control works along several sections of Oakley Creek. These works were identified as issues in the Watercourse Management Plan and in the *Lower Oakley Creek Erosion Assessment* (Morphum 2012). These works are currently on hold until upstream re-alignment works are completed. New erosion 'hotspots' have also been identified and priorities will be adjusted accordingly.


Oakley Creek Mu 1-6
Management Units
Reserve Work Area
Parks
Land Parcel Boundaries
Planting Areas
Canopy Management
Historical Tradescantia Areas
Rope access only
5m Contours
20m Contours
N
WCA pollution mitigation works area (blue)
WCA lizard enhancement work area 2012-2014 (orange)
WCA restoration work area 2015-17, approximate area (purple)
1a
1b
2
3a
4a
4b
5a
6
Te Ngahere
Native Forest Management

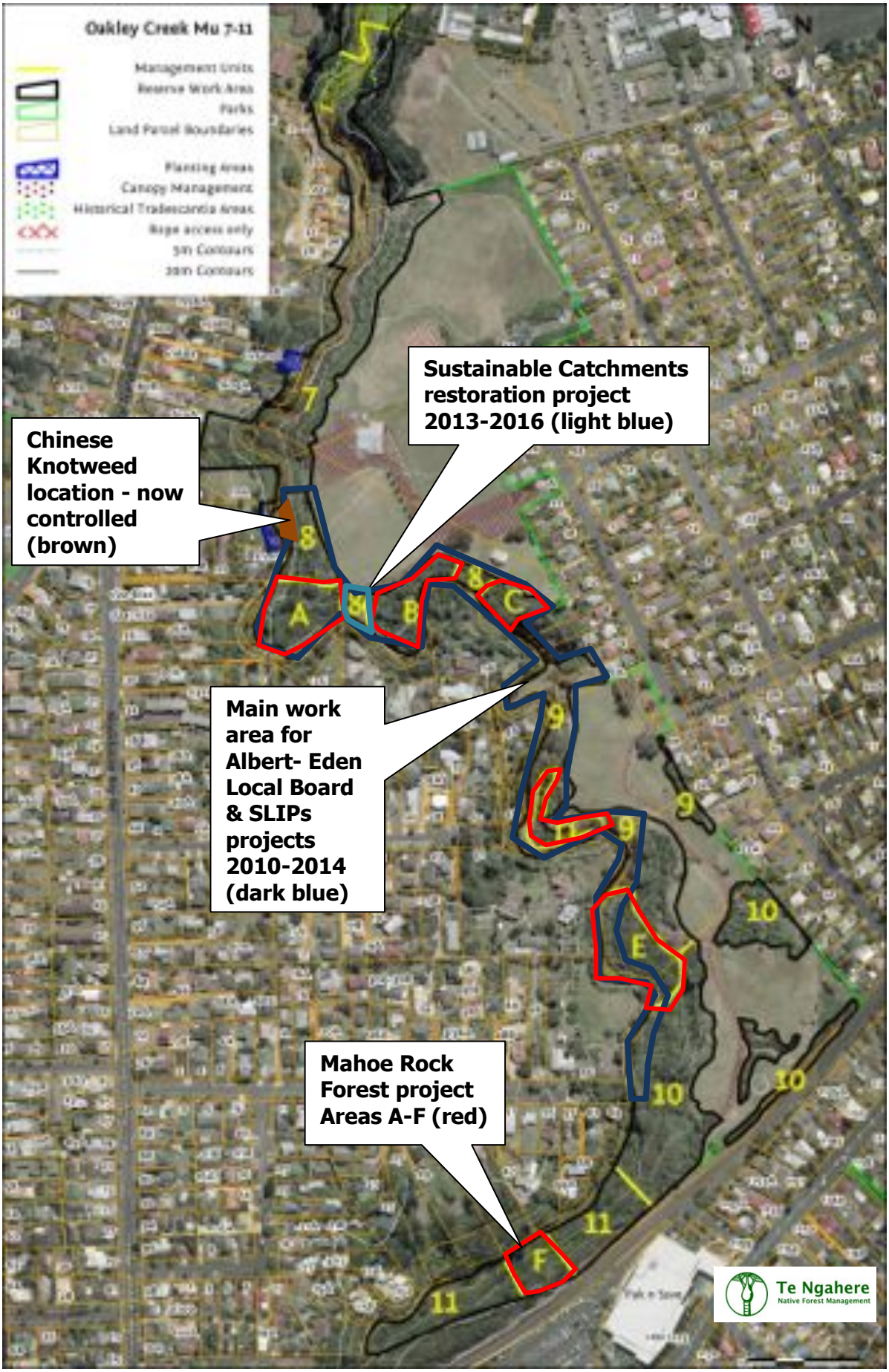


Figure 4. Restoration Project locations in MU 1 – 11 (two maps)

2.6 Animal Pest Control

Animal pest control has been undertaken in the lower part of Oakley Creek from MU 1 to MU 6 (referred to as the 'pest control area') since 2009 and is managed by Friends of Oakley Creek. For locations of bait stations and traps in the pest control area at Oakley Creek, refer to map in Figure 6.

Purpose: The purpose of pest control along Oakley Creek is to increase the abundance of native wildlife living there, to ensure native plants survive and reproduce, and generally to create a create a healthy and functioning native ecosystem (FOOC, 2010a) .

2.6.1 Rodent control

Rodent bait stations have been installed on both the east (27 stations) and west banks (24 stations) of Oakley Creek at 50 m spacings – total of 51 stations. Rats are the main target, but mice will also take bait.

Rodent baiting has been carried out 4 times per year since 2009 (approximately February, May, August, November). Ditrac (active ingredient Diphacinone), a first generation anti-coagulant bait has been mainly used for rodent control since 2009. From 2012 an annual Contrac (2^{nd} generation bait – active ingredient Bromadiolone) pulse has been used to prevent 'shyness' to a particular type of bait. In August and November 2014 Ratabate (active ingredient Diphacinone) and Ratabate/Ditrac were used. The amount of bait placed in stations is recorded and then at the end of the baiting period the amount remaining is recorded, hence bait consumed can be calculated.

Figure 5 shows the total amount of bait consumed in bait stations, which has decreased since 2010, with lower levels used between 2012-2014. It should be noted that the data for 2015 only covers up until the end February 2015. There appears to be slightly more bait take on the eastern bank, but this could be due to there being a few more bait stations on the eastern line.

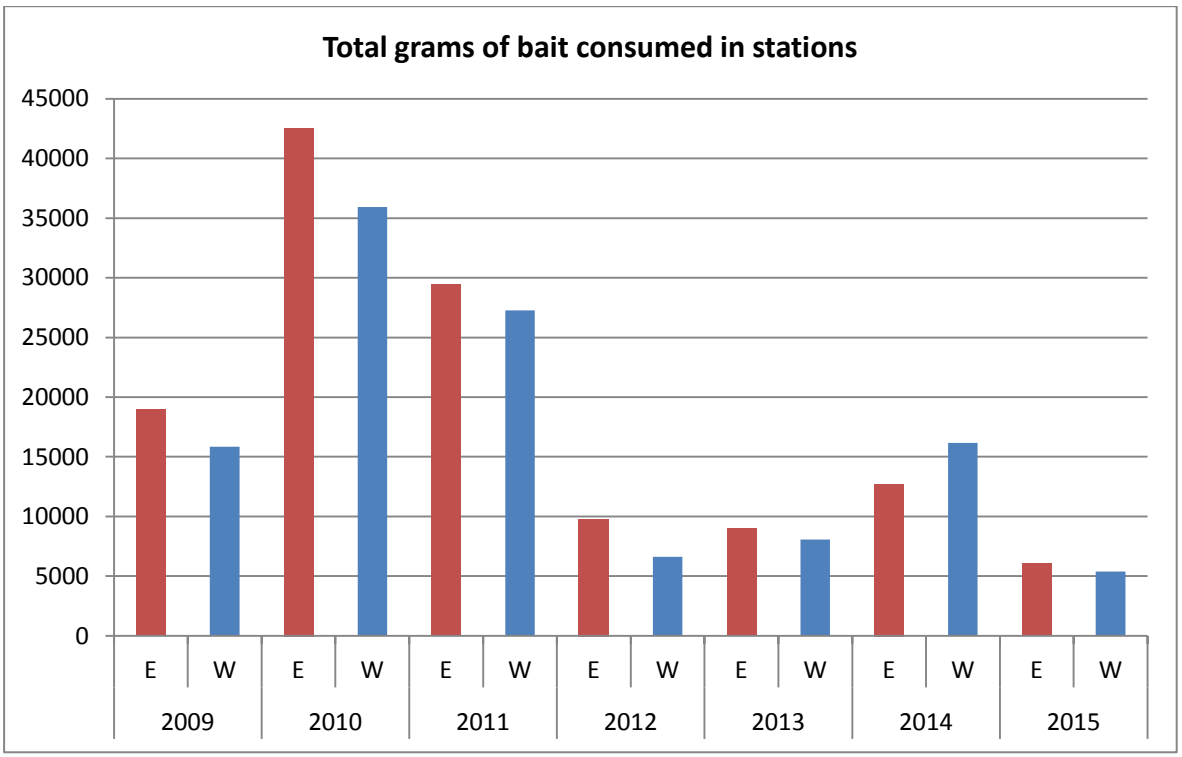


Figure 5. Summary of rodent control using bait 2009 – 2015

2.6.2 Possum control

FOOC

Friends of Oakley Creek volunteers began trapping possums in late 2009 on the east side of the creek, and in April 2010 on the west side of the creek. Before possum control started the possum numbers in the pest control area were consistently higher than the no pest control area. It took a year of trapping (up until August 2010) before monitoring showed fewer possums in the pest control area than the no pest control area (FOOC, 2012).

FOOC volunteers check and re-bait 11 Timms traps (at 100m spacings) on the east side of the creek weekly. In the first year of trapping a large number of possums were removed (111 possums from the east side in the first 8 months of trapping in only 637 corrected trap-nights) (FOOC, 2012). Since then numbers of possums caught on the east bank has reduced significantly, as can be seen in

Table 3, with data included for non-target pests where available (rats, hedgehogs and rabbits).

Table 3. Results from Timms traps on the east side of the creek checked by FOOC volunteers 2009 – 2015, showing numbers of pests caught

Number of possums caught	Number of rats caught	Number of hedgehogs caught	Number of rabbits caught	Period	Number of corrected trap nights	Comments
54				Nov 2009 - March 2010	-	Unknown number of trap nights. No data for rats, hedgehogs or rabbits.
33	-	-	-	April 2010 - June 2010	574.5	No data for rats, hedgehogs or rabbits
7	1	1	2	July 2010 - June2011	3533	
15	-	-	-	July 2011 - June 2012	2957.5	No data for rats, hedgehogs or rabbits
24	9	9	6	July 2012 - June 2013	3395	
24	13	1	6	July 2013 - June 2014	3339	
15	8	1	6	July 2014 - March 2015	3433.5	

St Judes Venturer Scouts

The St Judes Venturer Scouts have been checking the traps on the western side of Oakley Creek since 2010, on a less frequent basis than on the eastern side of the creek. No data was available at the time of this review.

Roskill Rovers

The Roskill Rovers setup a line of traps on the east side of Oakley Creek in Harbutt Reserve, from marker 1.70 by Mahoe Rock Forest Area C up to marker 2.65. This includes 10 DOC 200 traps and 10 Timms traps, which are checked weekly.

Results were only available for the August 2014 – February 2015 time period, as shown in Table 4 below.

Table 4. Combined results from Timms & DOC 200 traps (2014-2015) managed by Roskill Rovers

Number of possums caught	Number of rats caught	Number of hedgehogs caught	Number of rabbits caught	Period	Number of corrected trap nights
38	19	0	2	Aug 2014 - Feb 2015	3395

Sustainable Neighbourhood Group – Powell Street

This new group have recently installed 3 Goodnature self re-setting possum traps in their project area on the western side of the creek.

2.6.3 Hedgehogs and mustelids

Friends of Oakley Creek have set out 9 DOC 200 traps on the west side of the creek and 11 DOC 200s on the east side. They are baited with an egg or rabbit lure for control of hedgehogs and mustelids (ferrets, weasels and stoats) and are generally checked/cleared weekly, at the same time as the Timms traps, apart from a few weeks over the summer months.

No mustelids have been caught (pers comm. FOOC). Hedgehogs are caught occasionally. Full DOC 200 data records were not available at the time of this review.

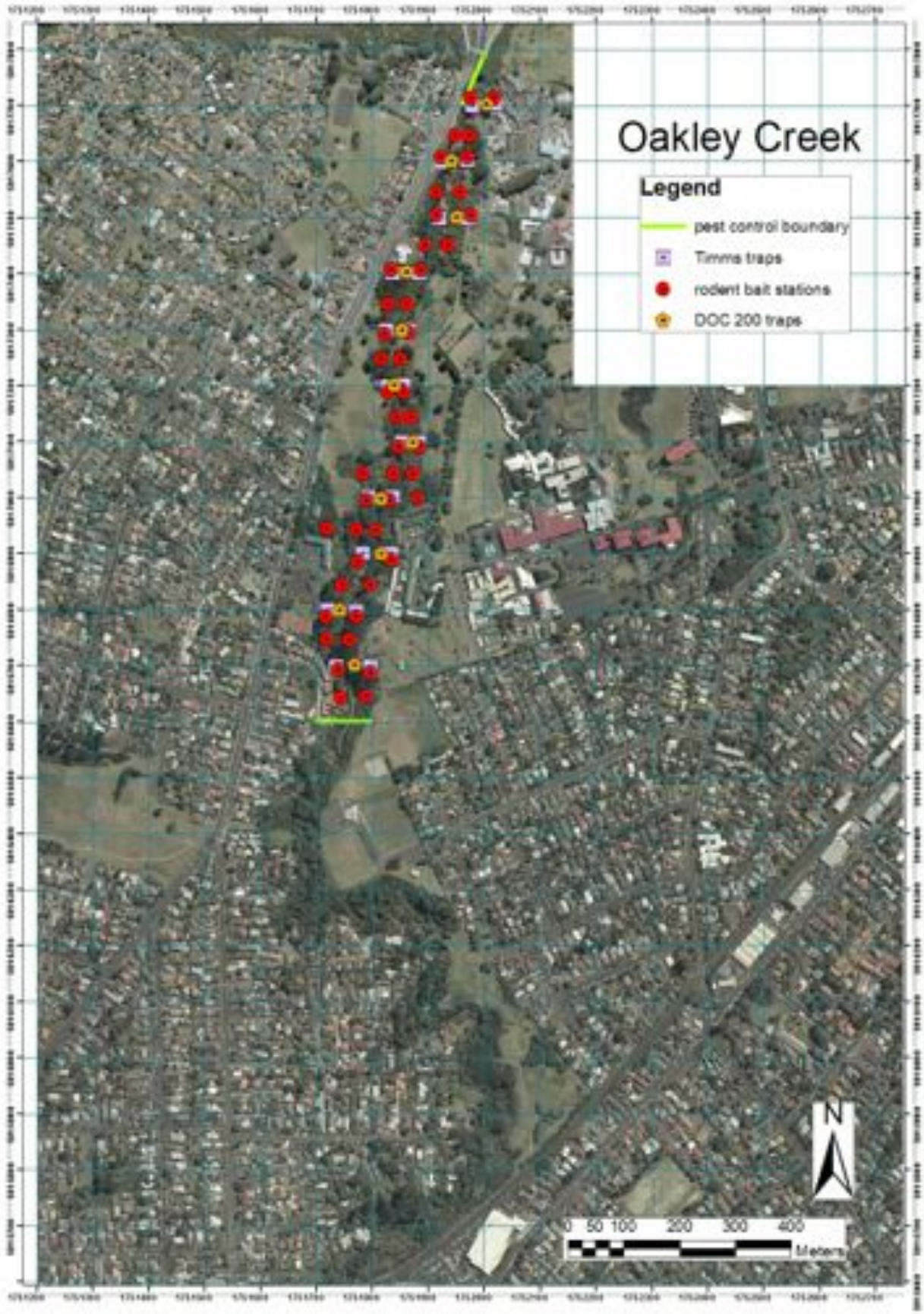


Figure 6. Location of bait stations and traps in 'pest control area' at Oakley Creek (FOOC)

3 Monitoring Results

3.1 Animal pest monitoring

Purpose: The purpose of the monitoring of pests along Oakley Creek is to see if pest control is effective in the pest control area.

Objective for rodents and possums: To control rodents and possums within the pest management area of Oakley Creek to achieve a result of less than 5% Bite Mark Index (BMI) for possums, or less than 5% tracking rate for rodents in order to increase the numbers of native birds, lizards and invertebrates, and to allow palatable native plant species to germinate and grow.

Objective for hedgehogs and mustelids: To control hedgehogs and mustelids within the pest management area of Oakley Creek to achieve a result of less than 5% tracking rate for hedgehogs and mustelids in order to increase the numbers of native birds, lizards and invertebrates (FOOC, 2010b).

3.1.1 Rodent monitoring

Three rodent monitoring lines, each containing 10 tracking tunnels, have been laid out in the rodent control area (northern half of creek) and the same in the no rodent control area (southern half of creek). Tracking tunnels were placed at 50 metres intervals along the line, with lines spaced 200 metres apart. Refer to the map in Figure 9.

Rodent monitoring has been undertaken since November 2008 by FOOC volunteers, 3 times per year. Rat tracking has reduced significantly since control started, but mice numbers rose considerably in 2014, as can be seen in

Table 5 and Figure 7.

The 5% rat tracking target is hard to reach in an urban area, especially where control is happening along a narrow corridor and there is constant reinvasion from adjacent land, such as Unitec grounds and residential gardens which support good rat breeding and feeding habitat.

An increase in mice numbers is common once rat levels are reduced. Mice numbers are particularly hard to decrease due to their small home ranges and rapid breeding (even with decreased spacing to 25m between bait stations). Increased numbers of mice are likely to have some detrimental effects on lizards (especially juveniles) and invertebrates, as well as the survival of seeds and seedlings.

Table 5. Summary of rodent monitoring data 2008 - 2014

Date	Mean % tracking in Pest Control Area	
	Rat	Mouse
Nov 2008	33.33	6.67
April 2009	55.65	39.07
Dec 2009	6.67	10.00
April 2010	10.00	43.33
Sept 2010	0.00	53.33
Dec 2010	0.00	30.00
April 2011	6.67	66.67
Sept 2011	0.00	10.00
Dec 2011	3.33	3.33
April 2012	0.00	43.33
Sept 2012	10.00	26.67
Dec 2012	16.67	20.00
March 2013	0.00	33.33
Sept 2013	6.67	20.00
Dec 2013	0.00	23.33
April 2014	6.67	50.00
Sept 2014	14.29	43.92
Dec 2014	13.69	48.81

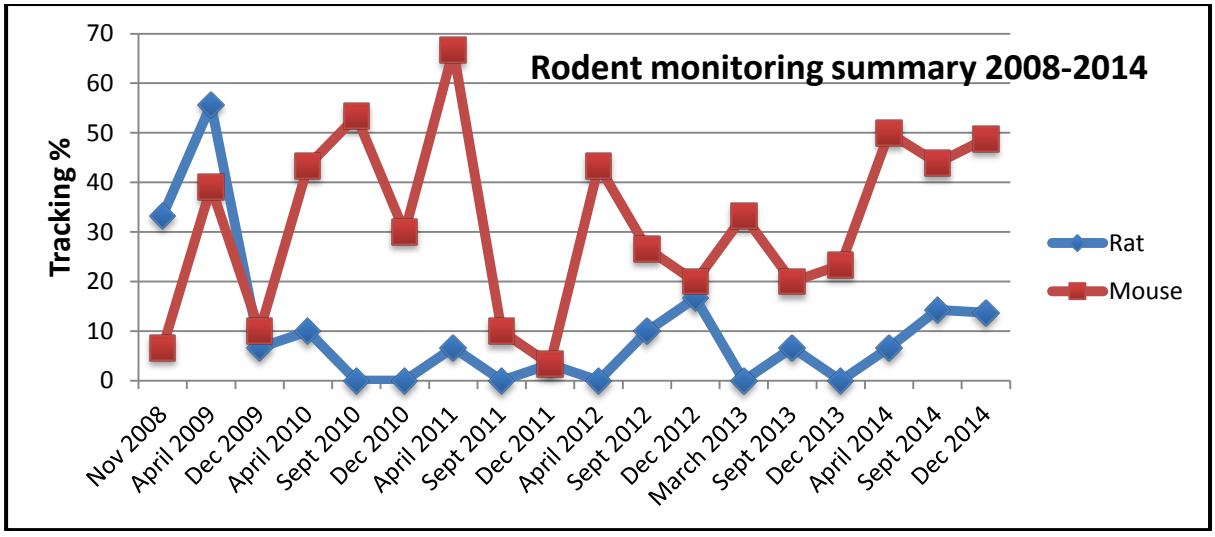


Figure 7. Graph of rodent monitoring tracking results 2008-2014

3.1.2 Possum monitoring

Possum monitoring initially involved putting out six lines of wax tags, with 20 wax tags per line at 10 m spacing (200m long lines). There are 3 lines each in the pest control and non pest control areas (each 200m apart), as can be seen in Figure 9. In the pest control area, two lines are on the west side of the creek and one line is on the east side of the creek. In the no-pest control area there were two lines in the valley and one along the top of the valley.

Wax tags are left out for 7 nights with lured luminescent markers and flour and icing sugar (5:1) mix with an orange or aniseed flavour. Possum monitoring is undertaken twice per year, in approximately February and August.

Monitoring of possums started in March 2009, both in the pest control area and in the no-pest-control area. This has allowed comparison of the trend in relative possum abundance over time where there is no control with the trend in possum abundance where there is control. After 2½ years of possum trapping (late 2009-March 2012), possum numbers were at moderate abundance in the pest control area (25-35% of waxtags have possum bites), slightly lower than in the no pest control area (38-45% of waxtags have possum bites) (FOOC, 2012). By February 2013 the BMI had decreased to 22% in the pest control area and 16% in the no pest control area. Refer to Figure 8 for a summary of possum monitoring results.

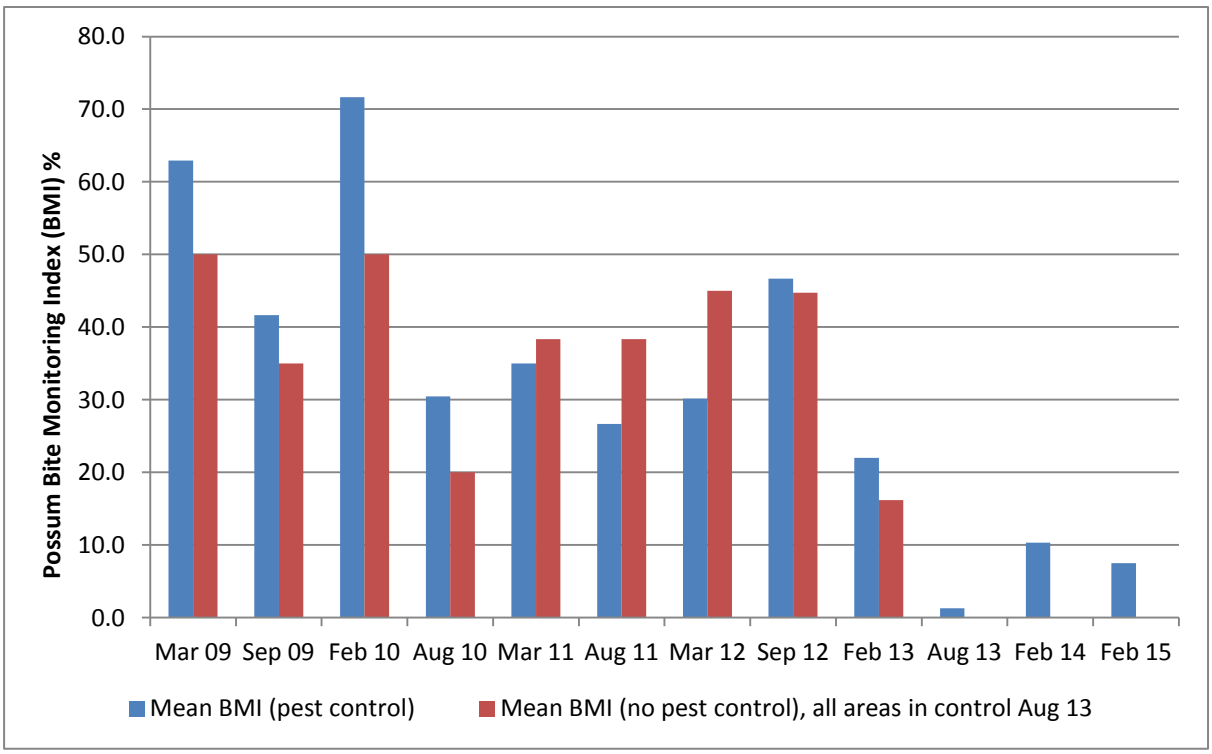


Figure 8. Summary of possum monitoring (BMI %) 2009 - 2015

After February 2013, a change was made to just monitoring possums in the pest control area, as the comparison monitoring results between no pest control and pest control area had to been collected over the last 4 years. This is why in the graph above (Figure 7) monitoring results are only shown for the pest control area (blue columns).

5 lines of 10 wax tags (50) on both the east and the west, at 20m spacings for possum monitoring was trialled. It was found that that this layout did not work (due to variable spacing and not providing useful monitoring information). So, in August 2013, possum monitoring was changed to 40 wax tags, with one at each distance marker (50m), and one, half way in between the markers (25m).

From February 2014 possum monitoring was only carried out annually, rather than twice per year.

3.1.3 Hedgehog and mustelid monitoring

Friends of Oakley Creek set out 2 lines of 10 tracking tunnels each for hedgehogs and mustelids (ferrets, weasels and stoats) in November 2008. Initially monitoring was carried out 3 times a year at set times (approximately January, April and October), but from 2014 this was reduced to once per year in February. Monitoring is undertaken for 3 fine nights using *Erayz* Rabbit paste or sardines as a lure. Results for monitoring are shown in the table below, Table 6. No mustelids have been recorded and hedgehogs are relatively frequently tracked but probably present in low numbers along the length of the creek.

Table 6. Results for Hedgehog and mustelid monitoring 2009 - 2014

Date	Area	Number of tunnels with Hedgehog tracks	% Hedgehog tracking	Number of tunnels with Mustelid tracks
Jan-09	Pest Control	0	0	0
	No pest control	0	0	0
Apr-09	Pest Control	0	0	0
	No pest control	0	0	0
Oct-09	Pest Control	0	0	0
	No pest control	1	10	0
Feb-10	Pest Control	0	0	0
	No pest control	1	10	0
Apr-10	Pest Control	0	0	0
	No pest control	1	10	0
Oct-10	Pest Control	3	30	0
	No pest control	4	40	0
Feb-11	Pest Control	0	0	0
	No pest control	0	0	0
Apr-11	Pest Control	0	0	0
	No pest control	0	0	0
Oct-11	Pest Control	6	60	0
	No pest control	1	10	0

Date	Area	Number of tunnels with Hedgehog tracks	% Hedgehog tracking	Number of tunnels with Mustelid tracks
Feb-12	Pest Control	4	40	0
	No pest control	1	10	0
Apr-12	Pest Control	6	60	0
	No pest control	2	20	0
Oct-12	Pest Control	0	0	0
	No pest control	0	0	0
Feb-13	Pest Control	4	40	0
	No pest control	1	10	0
Apr-13	Pest Control	5	50	0
	No pest control	1	10	0
Oct-13	Pest Control	1	10	0
	No pest control	0	0	0
Feb-14	Pest Control	2	20	0
	No pest control	2	20	0

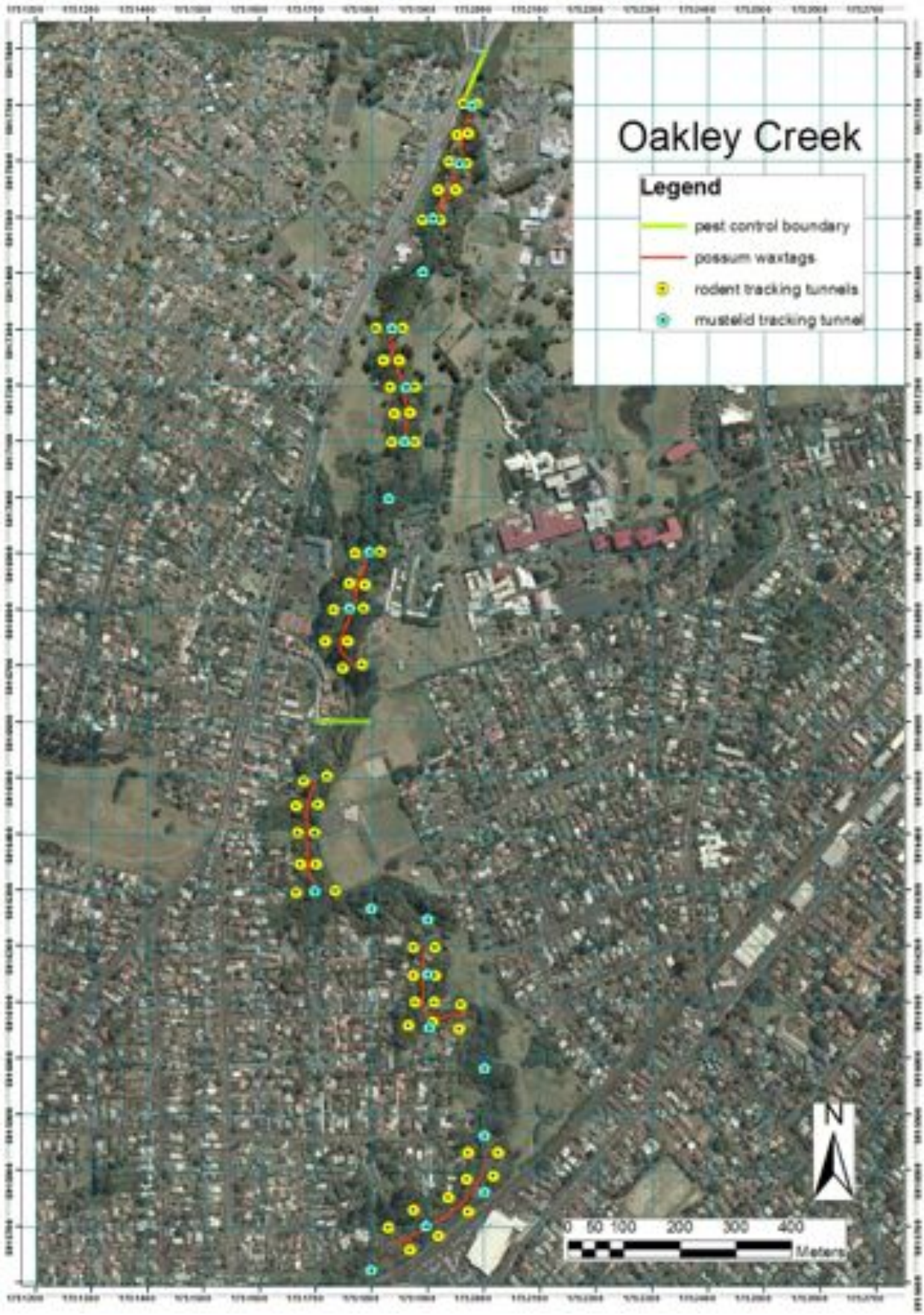


Figure 9. Location of animal pest monitoring stations (rodents, possums, mustelids)

3.2 Fauna monitoring

Purpose: The purpose of monitoring birds, lizards and weta is to see if the pest control is having the desired effect of reducing animal pests along Oakley Creek and encouraging native wildlife, although this may take time.

Objective: Control of major pests within Oakley Creek is intended to improve the native biodiversity within this Auckland City reserve and thereby enhance the natural environment experience for reserve users and local residents, and allow Oakley Creek to act more effectively as a wildlife corridor.

To see whether the native component of the environment is enhanced we need to measure some of the key components that make up the native biodiversity. The key components where we hope to measure a change are:

- increased numbers of native birds and lizards
- more terrestrial macro invertebrates.

(FOOC, 2010b).

3.2.1 Bird monitoring

Bird indicators:

- Species diversity of native species, and
- Abundance of the following indicator species: grey warbler, fantail, tui, kereru.

The presence of tui, kereru and morepork in the reserve will be a key milestone to success. Successful breeding of more vulnerable species such as tui, kereru or morepork will be the ultimate success (FOOC, 2010b).

The national garden bird survey method designed by Eric Spurr of Landcare Research is used for annual bird monitoring along Oakley Creek, and undertaken at the same time as the national survey (end June-early July). 2 transects have been set up along the creek each approximately 1 km long, with bird survey positions spaced at 200m. So a total of 10 bird monitoring sites exist along the creek, 5 in the pest control area and 5 in the no-pest-control area.

It should be noted that bird surveys are affected by the high amount of background noise along the creek, weather conditions and varying experience of surveyors.

Shining cuckoo do visit Oakley Creek, but have not been detected during the national garden bird survey as they are a summer migrant to New Zealand. Morepork are in residence along the creek but may are not spotted easily during the day, at time of the survey.

Refer to the graph (Figure 10) showing a summary of native bird species recorded by year, comparing the pest control and no pest control areas. A summary of number of birds by species over the total monitoring period (2008-2014) is shown in Figure 11. Refer to the Appendix for full bird monitoring results by year.

Overall, native bird counts were higher in the no pest control area, which is probably due to

the denser vegetation cover in the upper part of the Oakley Creek project area compared to the more open/parklike character in the downstream 'pest control area'.

Records of kereru have increased overall since 2010, with slightly higher numbers recorded in the no pest control area (especially in 2010, 2011 and 2012). Grey warbler records have increased since 2011. Tui records have generally increased, particularly in certain years, with higher numbers for the no pest control areas.

Fantail, welcome swallow and harrier hawk sightings seemed to have stayed relatively consistent across the survey period. It is encouraging to see shags, kingfisher and white faced heron using the creek. No bellbirds have been recorded but it is hoped that they may in future visit urban areas of Auckland, from the Hauraki Gulf Islands.

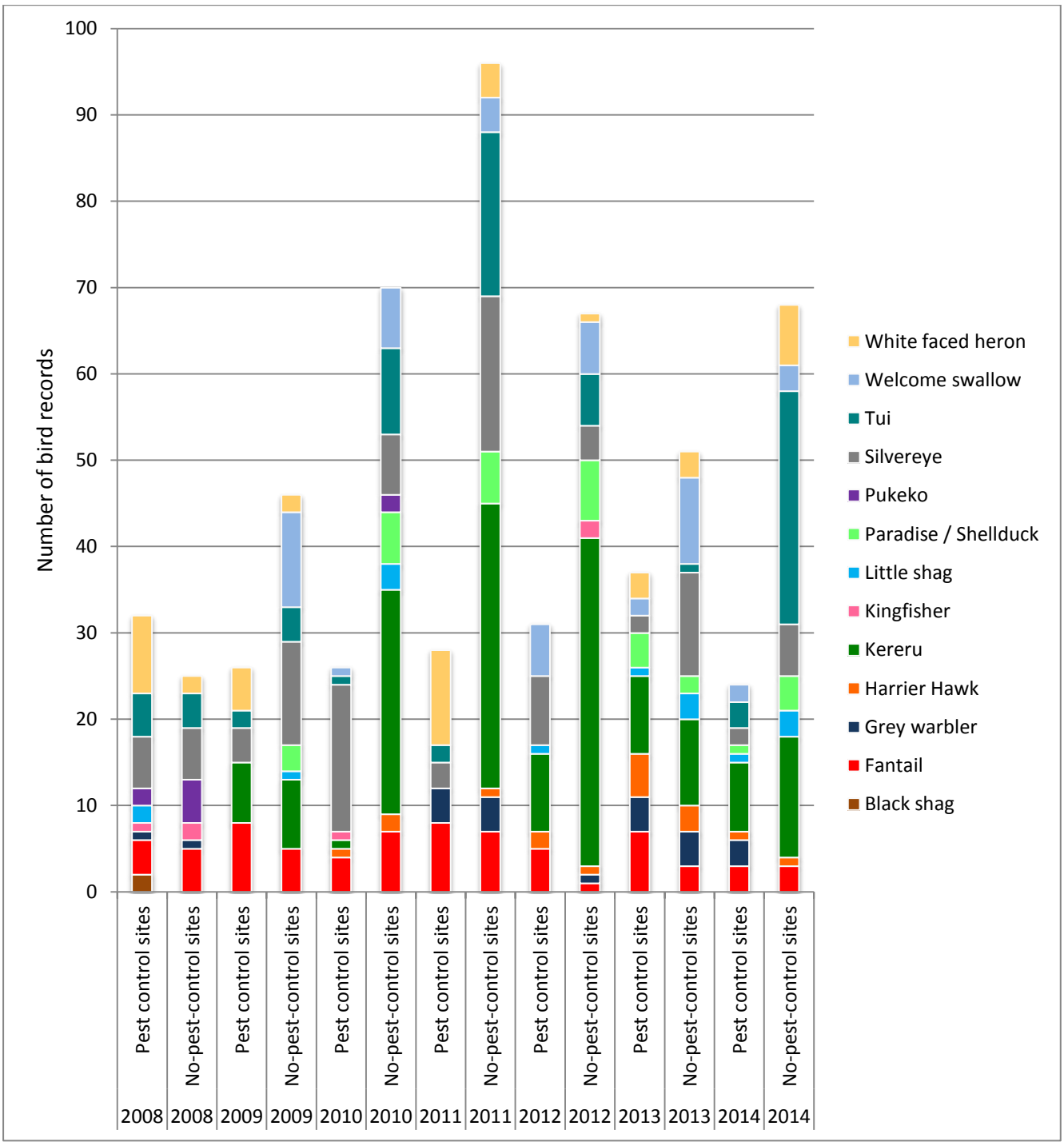


Figure 10. Native bird monitoring records 2008 - 2014

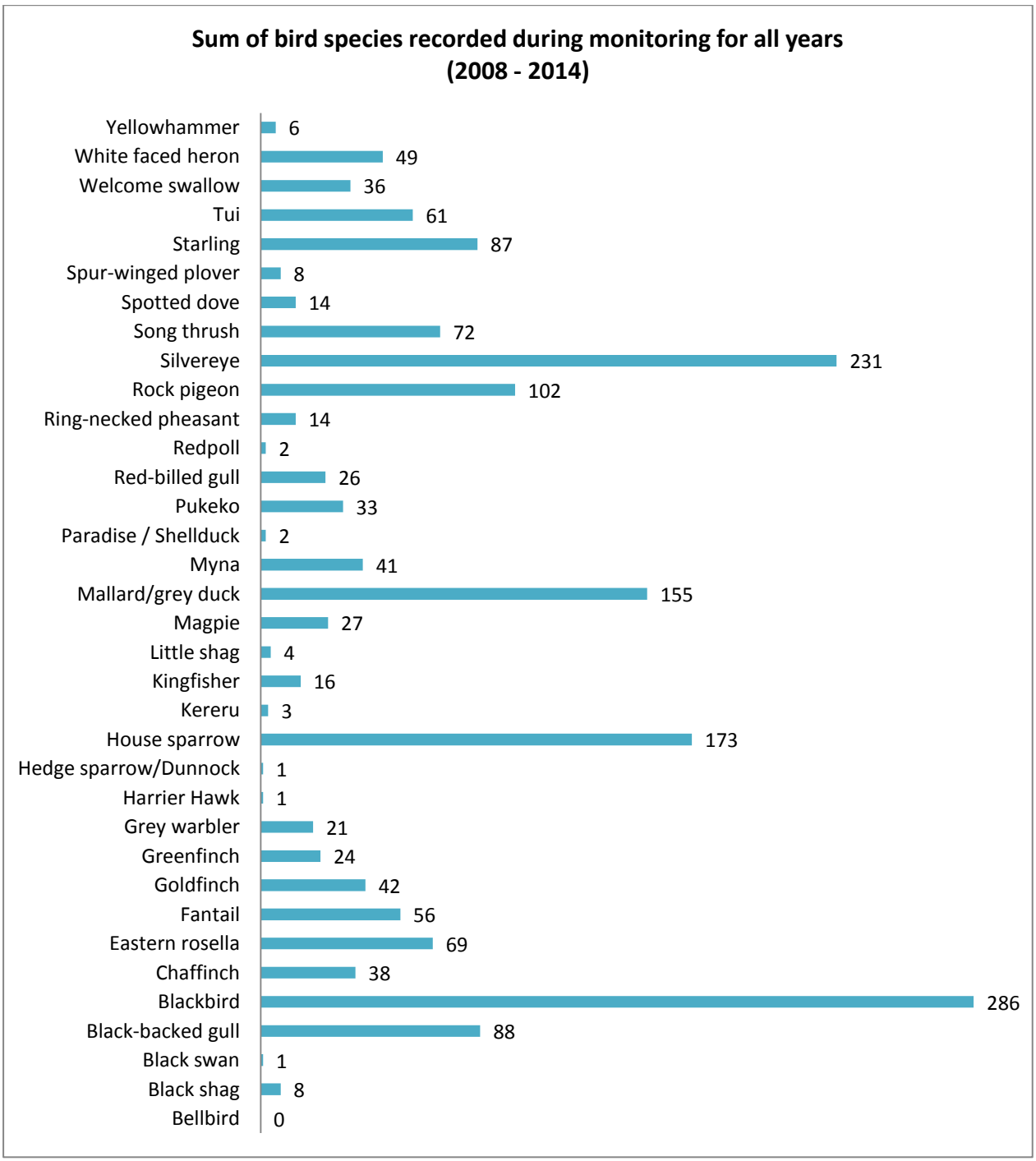


Figure 11. Total number of records per bird species 2008 - 2014

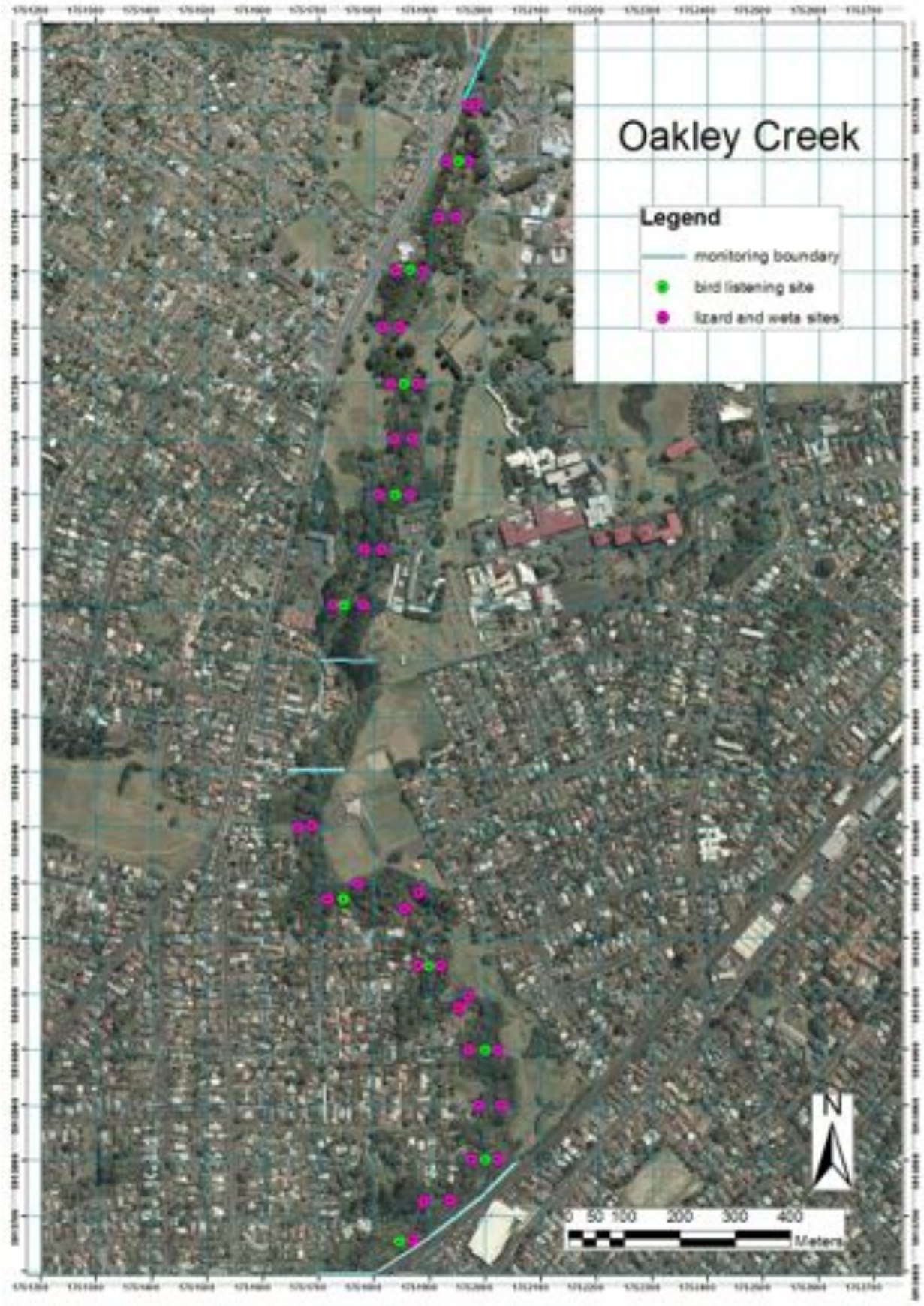


Figure 12. Location of bird listening, lizard and weta monitoring sites

3.2.2 Weta monitoring

Indicator: Large invertebrates are preyed upon by rodents, hedgehogs and other pest mammals. Weta make a good indicator species for large invertebrates and are easier to monitor than many other invertebrates. The use of artificial refuges is a useful way of detecting changes in weta abundance (FOOC, 2010b).

The artificial weta homes are bamboo tubes fastened to tree trunks, approx. 10 cm long x 14-18m internal diameter. There are 8 sites each with 5 weta homes in the pest control area and the same in the no-pest-control area, to total of 80 artificial refuges. They were installed in autumn 2009 and are checked annually in winter (June/July).

Weta numbers recorded in the artificial refuges have increased generally over the 5 year period in the pest control area. It is hard to tell whether this can be attributed to the effectiveness of the animal pest control, as numbers of weta recorded in the no pest control area have also increased (but levelled since 2011). Refer to the table and graph below showing weta monitoring results (Table 7 and Figure 13).

Table 7. Table showing number of weta records 2009 - 2014

Number of bamboo tubes that contained 1 or more weta						
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
pest control area	22.2	38.5	47.2	47.5	35	51.3
no pest control area	7.5	12.5	33.3	30.8	32.5	27.5

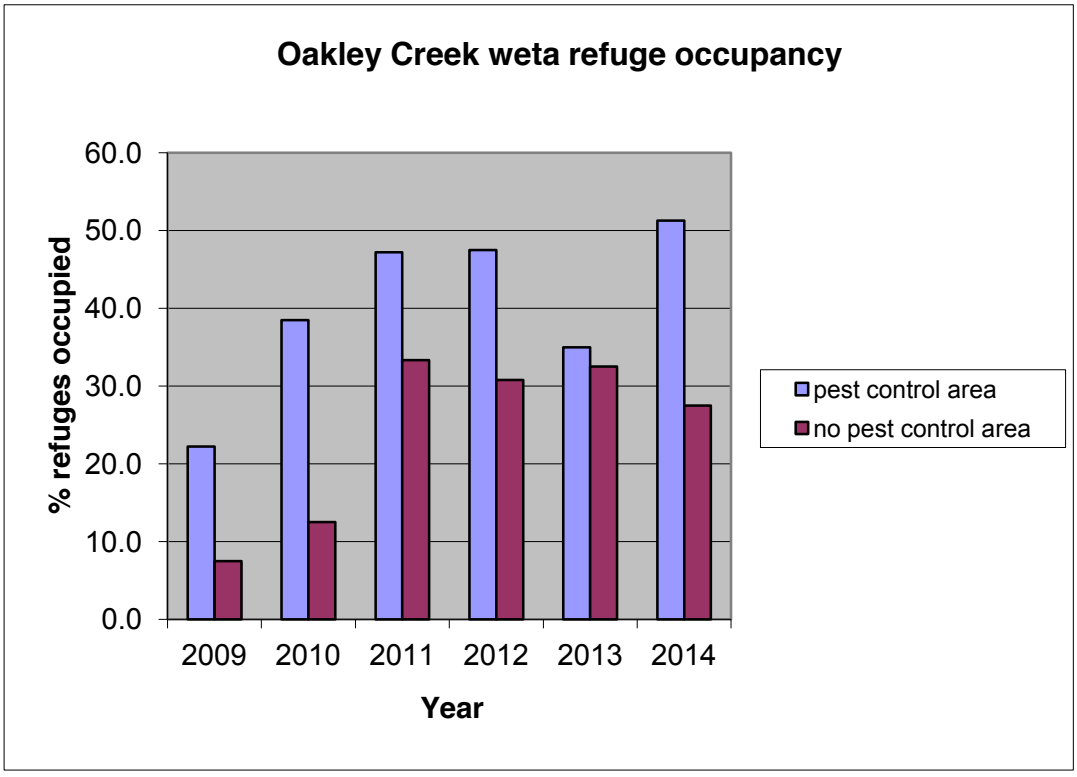


Figure 13. Summary of weta monitoring data 2009 – 2014

3.2.3 Lizard monitoring

FOOC

Native skinks are eaten by cats, mustelids, hedgehogs, rats, mice, magpies, kingfishers, and even blackbirds. Native skinks eat fruits and invertebrates. If pest control is effective, and consistently maintained, juvenile native skinks should increase in number. The simplest monitoring technique for ground dwelling lizards is to provide permanent artificial cover objects (ACOs) made of 3 stacked Onduline tiles (with spacers between) on the ground and to check these periodically (FOOC, 2010b).

Native copper skinks are known to be present along Oakley Creek (and have also been re-located to MU 3a, as part of the Waterview Connection works). The introduced rainbow (plague) skink is also present in the reserve.

In February 2009, 40 lizard refuges made of Onduline tiles were set out, with half of the refuges in the pest control area and half in the no-pest-control area. The refuges were first checked for lizards in June 2009, and checked for the second time in July 2010.

In 2009 two refuges in the pest area and two refuges in the no-pest-control area were found to have lizards. In 2010, 36 of the 40 lizard refuges were judged to be in a condition to offer refuge to lizards, and 3 of these had lizards in them. All of these were in the no-pest-control area. No lizards were found in refuges in the pest control area. Two ACOs were not found, one was flooded and silted up, and another was disturbed.

Lizard monitoring by FOOC was stopped after 2010, as the number of lizard sightings were low, and while the ACOs had been placed at appropriate spacings (as per the plan), with the reserve being long and narrow, a number of the sites had proven inappropriate, being too damp and shady. Thus, for the continuation of the monitoring, the plan requires a review, including the relocation of the ACOs in more appropriate, warmer locations, before it it could be recommenced. The amount of volunteer effort and lizard handling skills also needs to be considered (a lizard handling licence is needed if picking up and measuring native lizards).

WCA Lizard Enhancement Area

In total 192 native copper skinks were released into the Lizard Relocation Management Area in MU 3a.

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

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 are checked weekly over 3 consecutive weeks in March/April.

Post release monitoring results in 2012, 2013 and 2014 are provided in Table below and the programme is scheduled to run until 2017.

In 2012 only one copper skink was captured, while seven copper skinks were caught during each monitoring exercise in 2013 and 2014 (Table 8). The 2013 and 2014 results suggest that a population of copper skinks is present at the Lizard Relocation Management Area. The size range also indicated that both adult and juvenile copper skinks are present. It is not possible to determine if the skinks caught during post release monitoring were individuals salvaged from the Waterview Connection Project or were already present onsite. Continued monitoring over the next 3 years will work to determine the dynamics of the native copper skink population present at the Lizard Relocation Management Area (WCA/Tonkin & Taylor report, October 2014).

Table 8. WCA lizard enhancement area monitoring results

Year	**No. of skinks caught**	**Size range (mm)**
2012	1	80
2013	7	37 – 93
2014	7	40 – 92
2015	9	50 - 78

3.3 Aquatic monitoring

3.3.1 Water quality

Water quality monitoring has been undertaken by Wai Care in conjunction with Friends of Oakley Creek and a number of different groups. A number of sites along the full length of Oakley Creek have been monitored at various times, as can be seen in table below. Sites highlighted in blue are within the Oakley Creek Walkway restoration area.

Wai Care raw water quality monitoring data (for air temperature, water temperature, water clarity, turbidity, pH, dissolved oxygen, nitrate, nitrite, phosphorous and phosphate) is shown in the Appendix in Table 12.

Site Name	Monitoring Group	Site Location		Monitoring period
		Easting	Northing	
Wairaka Stream, Unitec Nursery	Wairaka Stream Care Group	1751981.739	5917529.764	2005-2014
Oakley Creek, upstream of Wairaka Stream	Wairaka Stream Care Group	1751979.565	5917639.548	2006-2012
Oakley Creek, Hendon Ave	Unitech Biological Sciences	1752983.392	5914879.501	Feb 2008
Oakley Tributary, Stoddard Rd	Unitech Biological Sciences	1753016.793	5914851.668	Feb 2008
Wairaka Stream, Unitec Fish Ladder	Unitech Biological Sciences	1752195.787	5917263.064	Oct 2014
Oakley Creek, Keith Hay Park North	Mt Roskill Grammar	1755368.82	5913503.79	2008
Oakley Creek, Behind Scout Den	St Judes Scouts	1751732.853	5915431.549	2010-2015
Oakley Creek, St Judes Scouts below SW drain	St Judes Scouts	1751746.34	5915474.94	2012-2013
Oakley Creek, End of Craddock St	Craddock Street Bridge Group	1751909.984	5916104.127	2010-2014
Oakley Creek, Unitec Bridge	Unitec Bridge Group	1751780.14	5916941.72	2011-2014
Oakley Creek, Walmsley Park	Wesley Intermediate	1754226.02	5914858.33	July 2012
Oakley Creek, Mt Roskill Intermediate	Mt Roskill Intermediate	1755319.13	5913878.23	Sept 2013
Oakley Creek, 80 Olsen Ave	Olsen Ave Community Group	1756079.84	5912843.39	2013-2014

The following native fish species have been recorded during water quality monitoring:

Oakley Creek, Unitec Bridge – inanga, banded kokopu, shortfin eel

Oakley Creek, upstream of Wairaka Stream – inanga

Wairaka Stream, Unitec Nursery – inanga, common smelt, inanga, banded kokopu

An interesting discovery during Morphum surveys in 2011 was the presence of torrentfish (*Cheimarrichthys fosteri*) below the waterfall.

Stephen Moore also recorded common bullies (*Gobiomorphus cotidianus)* and triplefin /cockabully (*Grahamina nigripenne).* Longfin eel and redfin bullies have also been recorded.

Water Monitoring – apart from the regular community monitoring, under the Wai Care programme, other monitoring / surveys have been done by Stephen Moore in 2006 (see attached) and Morphum / Mahurangi Institute of Technology in 2011. The Auckland Council Research and Monitoring Team have regional aquatic monitoring sites at Oakley Creek.

FOOC are also involved in the NIWA national research project, whereby a number of community groups around the country are undertaking water quality and macroinvertebrate monitoring, on a monthly basis, over an 18 month period, at the same time / location as their local / regional councils. The project started early in 2014 and goes until the middle of 2015.

3.3.2 Inanga spawning

Investigations have been carried out by Matt Bloxham, Regional Specialist – Freshwater at Auckland Council and Wai Care into the saltwater wedge extent and potential inanga spawning habitat along Oakley Creek.

Method: This method involves modelling a stream reach, undertaking saline surveys and where possible by completing a spawning survey (looking either for signs of spawning activity or preferably eggs).

1. **Saline modelling:** The modelling predicts how far upstream the saline wedge extends on a spring tide and the upstream toe (of the wedge) is normally where the inanga spawn.

2. **Saline survey:** This modelling information provides a pointer on how far upstream we should go to begin our saline wedge survey (required because the modelling uses LIDAR data only and does not correct for flows and water levels which can modify the wedge i.e. the freshwater lens pushes down on the saltwater wedge below it and forces the wedge downstream).

3. **Spawning survey:** Once the salt wedge is mapped, the site can be revisited in autumn to look for spawning activity.

Findings: For Oakely Creek, both modelling (using LIDAR) and saline surveys have been completed in 2012, but no actual spawning surveys. The survey indicated that the spawning area lies somewhere just upstream of the water control structure where there is also a waste-water pipe spanning the creek (in MU 1a, by the service road turn around area).

The map in Figure 14 shows the survey results with the actual saline survey readings (square boxes) overlaid over modelled polygons (yellow green and red).

The probable spawning zone is the area shown as the circle purple on the map. Specific spawning surveys have not been undertaken yet, but inanga have been recorded in the creek up to the waterfall.

Inanga habitat requirements: Inanga rely strongly on rank / long vegetation in the spawning zone to both protect their eggs from harmful UV rays and to keep the eggs moist for the month long period they spend out of water. Relative humidity has to be maintained up at around 99%. Appropriate plantings should be undertaken that provide vegetation for inanga spawning, such as sedges, along the stream edges in this identified potential spawning area and in the Wairaka Wetland.

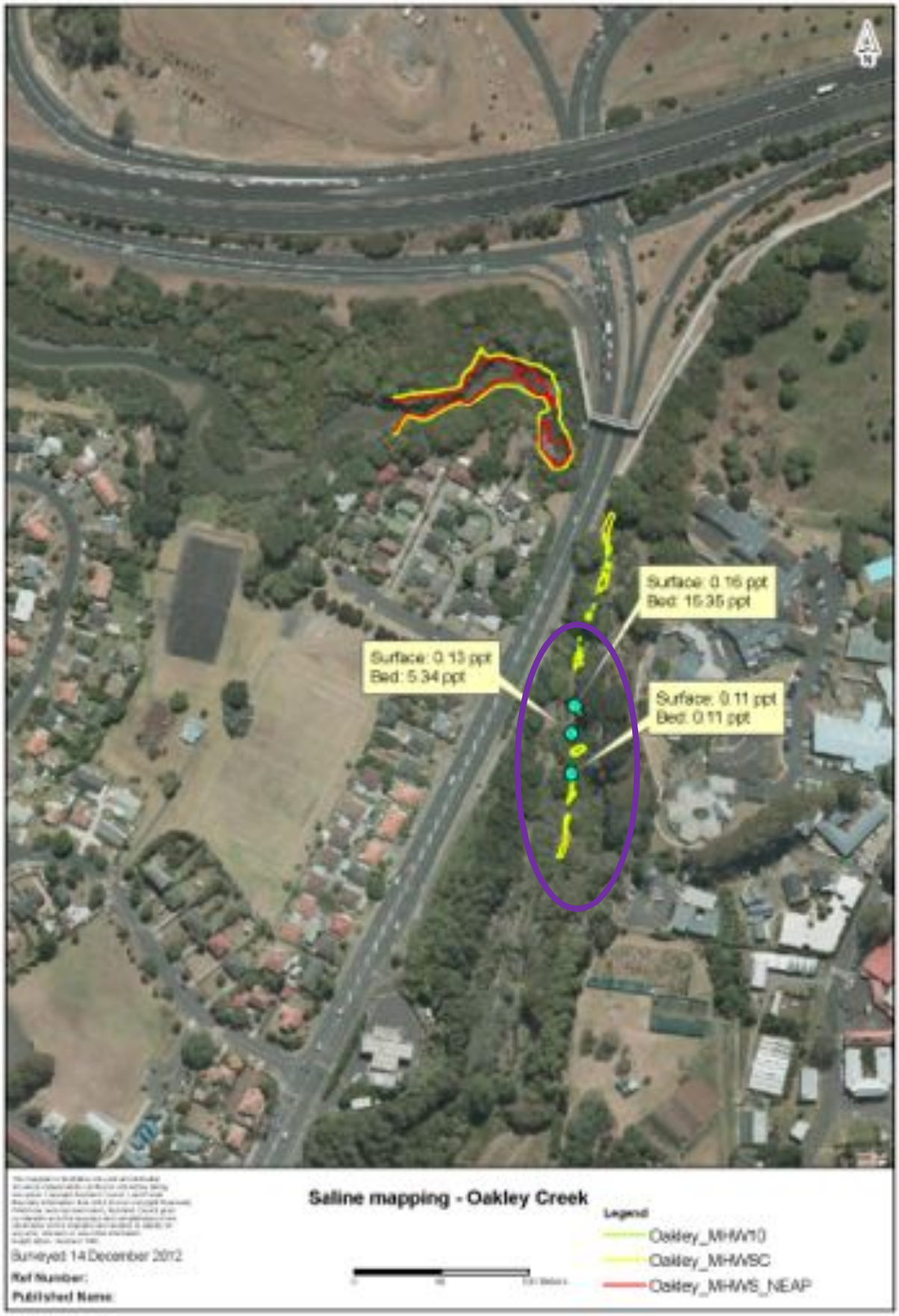


Figure 14. Map showing results of saline modelling and saline survey for potential inanga spawning location, with purple circle showing probable spawning area

3.4 Vegetation monitoring

3.4.1 Botanical survey

The Auckland Botanical Society carried out a site visit to the lower stretches of Oakley Creek Walkway (up until the start of Phyllis Reserve) on Saturday 16th May 2009 and recorded plants, mosses, liverworts, fungi and algae observed. A full list of species recorded can be found in the Auckland Botanical Society Journal, Volume 64 (2), December 2009.

http://oakleycreek.org.nz/wp-content/uploads/2013/11/Oakley-Creek-Plant-Species-List-AklBotSoc-December-2009.pdf

It should be noted that these records are the species observed at time of site visit and that many of these have been planted (natives and exotics), so do not represent what the natural character of the site would have been historically. Therefore, this survey cannot be used as a baseline record of what species should be present along Oakley Creek or planted in future.

3.4.2 Vegetation plots

FOOC

5 long-term vegetation monitoring plot sites have been installed by FOOC along Oakley Creek, with the intention of extending this to 8-10 sites over time. None of the sites have been revisited so far, as the intention is to look at long-term changes in vegetation character as the restoration programme progresses. The ongoing monitoring approach will have to be assessed, taking into account changes due to plantings and animal pest control.

The location for the 5 FOOC vegetation plots (2 x 5m) are:
Plots 1 & 2 – St Judes Scouts Den restoration area adjacent to Oakley Creek. Plot 1 in Area C and Plot 2 in Area D. *NB: This is outside of the restoration work area.*

Plots 3 & 4 – North and south side of Cradock Street Bridge (west side of bridge), mid-slope below the steep slope on the north, and below the Kodesh path on the south. This would be about half way between distance markers 1.90 and 1.95 (which are on the east side of the creek).

Plot 5 - Plot 5 is 10m upstream of the 2.0 distance marker in Harbutt Reserve, on the slope above the path, in RMRF Area D.

Over time, we are aiming to do the monitoring in a range of environs, including the rock forest, where there has been planting, and where there may / will be natural regeneration, e.g. In MU11.

Regional Forest Monitoring

The Auckland Council Research and Evaluation Unit (RIMU) installed a Forest Monitoring Plot (ref C140a) in Harbutt Reserve in late 2012 as part of the Auckland Region Forest Monitoring Programme. This programme looks at changes across the region for forest habitats and is part of the long-term State of the Environment monitoring. The intention is to re-visit forest plot monitoring sites every 5 years. The location of this forest monitoring plot is in the tree privet dominated canopy towards the southern end of MU 10 (GPS grid ref E1752015 N5915802).

3.4.3 Photopoints

A simple way of monitoring revegetation and weed control success is by permanent photopoints. This involves returning to the same point each year and taking photos at the same bearing. Over time this will show growth of plantings and the success of weed control.

Ten photopoints were originally set-up by Te Ngahere in 2008 along Oakley Creek and monitored until 2012 – refer to the map showing the locations of these original photopoints (Figure 16).

Since 2012 the number of photo monitoring sites has been reduced to three, as it was found that ongoing changes were not being seen at all photopoints. Photos are taken annually at the remaining three photopoints by Te Ngahere, as part of the ecological restoration contract. The location of these Photopoints is shown in Figure 15. A summary of photos from these 3 monitoring points is shown from between 2008 to 2015.

Friends of Oakley Creek undertake photo comparison monitoring, particularly looking at changes that have occurred at revegetation sites over time.

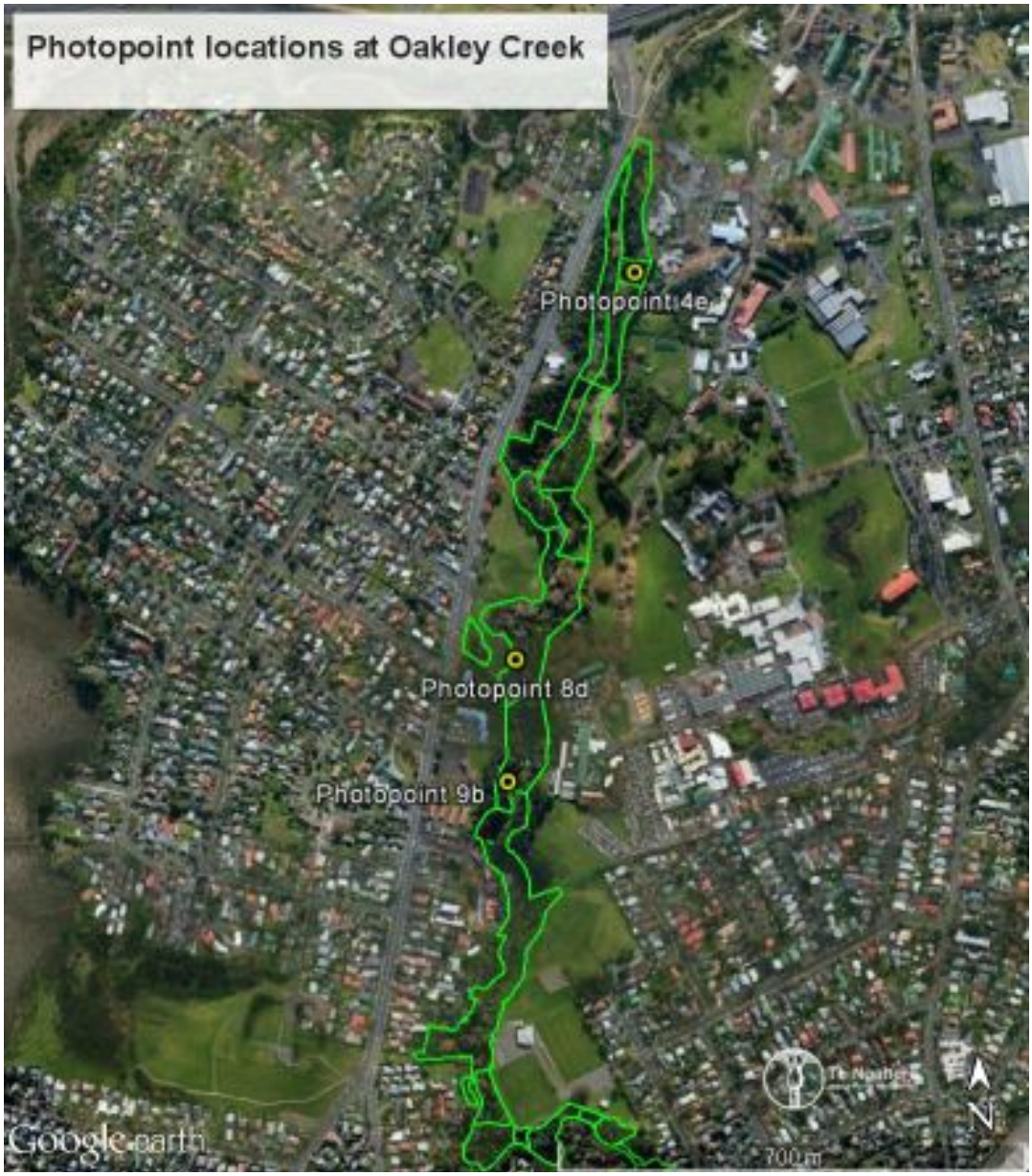


Figure 15 . Location of the three current photopoints along Oakley Creek

Figure 16. Location of the original 10 photopoints along Oakley Creek

Figure 17. Photopoint 4e - Top to bottom: 2008, 2010, 2015

Figure 18. Photopoint 8d - Top to bottom: Jan 2008, Sep 2008, 2014

Figure 19. Photopoint 9b - Top to bottom: 2008, 2013, 2015

4 Restoration Methodology/approach

The Oakley Creek restoration project has been successfully going for 10 years and major advances have been made in enhancing this stream corridor to a more natural character. The restoration approach has involved a collaborative approach between work undertaken by Friends of Oakley Creek, restoration contractors (mainly Te Ngahere), Auckland Council departments (Local Parks, Biodiversity, Stormwater and Sustainable Catchments) and local landowners / adjacent residents. As the project has progressed, lessons have been learnt and new approaches tried, to ensure the restoration methodology is effective and sustainable.

4.1 Planting

A large number of plants have been planted annually since 2004 as part of the Oakley Creek restoration programme. The focus initially was on planting open areas with colonising species (from species list recommendations in the Oakley Creek Restoration Plan), which have generally established well.

Along stream edges it was found that the smaller sedge/ carex species (such as *Carex virgata*, *Carex dissita*) and ferns (e.g. *Blechum novaezelandiae*) have generally not established well due to the periodic high flows experienced along Oakley Creek during winter months. In the last 2-3 years there have been some very successful stream edge plantings (e.g. below MRF Area C) using large more hardy sedges or sedge-like plants, including *Carex lessoniana*, toetoe *Austroderia fulvida* and *Cyperus ustulatus.* These have established to form dense plantings which will protect the stream banks from erosion.

Diversity plantings have increased in the last 5 years, as weed control has progressed in canopy areas and early plantings have established. The understorey, for example in mahoe rock forest areas, was previously weed dominated. As weeds have been controlled there is a lack of native understorey and sometimes limited natural regeneration, so diversity planting has been undertaken in selected areas. Also in areas of establishing plantings there is the opportunity to carry out infill planting in the understorey to enhance the diversity mix.

Diversity species have been selected according to alluvial or volcanic slope soil conditions, as well as some specific species recommended for mahoe rock forest remnants. The approach of introducing diversity species to appropriate locations where there is sufficient cover appears to be successful at Oakley Creek, as species are establishing well. Overtime the establishment rate and survival of diversity species should be looked at to determine appropriate long-term forest composition.

Colonising species (with a few common diversity species suited to open areas) should continue to be planted on open slopes and floodplain areas where there is a lack of canopy, as these have the highest chance of survival. A balance needs to be struck between following best practice ecological planting approaches and trying to accelerate restoration planting to create diverse forest in a short space of time.

Diversity species lists should be reviewed as part of the 2015-2025 restoration plan to ensure appropriate species are being selected for the Oakley Creek area, so that species lists

can be adjusted appropriately. It has also been suggested that some appropriate threatened species could be introduced to Oakley Creek and this will need to be assessed by the Auckland Council Flora advisor to ensure that this is a warranted approach where there is a good chance of long-term survival.

Planting of specimen trees, on floodplains and steep slopes (especially in MU 9) to establish some shade and tree cover initially, has been trialled at Oakley Creek. This has had varying success, with some plantings surviving well yet growing slowly (on floodplain) and other areas were there have been several losses and slow establishment due to trees being swamped by annual and more invasive weeds. The approach of planting appropriate native trees on stream banks is generally recommended to create shade over the stream. From experience at Oakley and Meola Creeks, it is also necessary to establish sedge /sedge-like vegetation underneath specimen trees along stream banks at the same time (with trees set-back from stream edge by 1-2m). For specimen trees to survive, thorough site preparation is needed, staking of trees and regular plant maintenance over a number of years - so overall requires more sustained effort to reach a good outcome.

Planting species lists for archaeological sites should be reviewed as part of the Restoration Plan update to ensure appropriate species to the Auckland region are included. Experiences from planting of archaeological sites at Oakley Creek should be looked at to determine which species have established well.

4.2 Weed Control

Weed control along Oakley Creek has made huge advances in the last 10 years, with weed populations being reduced in the main management area from MU 1-9 and now being extended into the new management areas in MU 10 and MU 11. The success of weed control is due to ongoing funding provided by Auckland Council to employ contractors to undertake a programme of regular weed control visits and provide other sources of funding for weed tree removal and additional weed control. FOOC and the local community have played an integral part in carrying out weed control to protect plantings and target specific areas.

The majority of the restoration area is now in Seedbank control. Ongoing maintenance is needed to control problem weeds, to prevent re-invasion from boundaries and to keep weeds at low levels. There are still some weed issues that will need a more comprehensive approach, such as two large patches of bamboo (in MU 3 and MU 11) and ongoing removal of weed tree species (such as tree privet and willow). The remaining area of initial control in MU 8 should also be targeted in future.

4.3 Animal Pest Control

A comprehensive pest control programme for rodents, possums, mustelids and hedgehogs has been in place since 2009 along the northern half of Oakley Creek. There have been significant decreases in possum catches and rat relative abundance over the last five years. No mustelids have been caught (even though stoats have been trapped on nearby Traherne Island) and hedgehogs are caught occasionally. Mice numbers have peaked in the last year

as rat numbers have decreased, which is a common trend. The 5% rodent tracking target and possum BMI target of 5% have been designed (by Department of Conservation) for large blocks of rural native forest and are generally not achievable in a small site in an urban environment. A <40% tracking target (ideally 20-30%) would be more achievable, yet Oakley Creek is a long corridor, with plenty of suitable adjacent habitat and food sources nearby for possums and rodents, so reinvasion will occur.

In future animal pest control should be extended to the southern part of the Oakley Creek restoration area (MU 7 – 11), as weed control and planting is now focused in this section of the creek. This will aid natural regeneration and enhance the integrity of the native canopy, yet will require an increased volunteer effort and time for collation of animal pest and monitoring data.

4.4 Other Recommendations

- Restoration Plan to be a useful document that outlines the management approach clearly, to ensure co-ordinated restoration along creek.
- State protocol/approach for environmental weed tree removal (including willows and tree privet) in revised Restoration Plan.
- Review planting species lists - state by habitat, soil type and diversity/colonising. Consider inclusion of other diversity species into planting lists.
- Review archaeological planting species list to ensure appropriate.
- Adjust boundaries to take into account – new WCA/ NZTA areas, western esplanades, southern boundary along railway line. Management requirements to be considered for new esplanade reserves.
- Take into account future effects including – climate change, increased flows due to urbanisation, Central Interceptor project, Unitec planned change of site use.
- Continue to engage in Authority to Modify process and incorporate archaeological assessment recommendations into Restoration Plan.
- Take into account contaminated land issues and Soil Handling Plan for future planting works (especially MU 8-11).

5 References

Auckland Botanical Society, December 2009, Field Trip Report: Oakley Creek Te Auaunga, Waterview – Saturday 16 May 2009, Auckland Botanical Society Journal, Volume 64 (2), pgs 123-133.

Auckland Council, Sustainable Catchments Programme, September 2014, Oakley Creek: Urban 10 Year Implementation Plan South Waitematā (Draft)

Auckland Council, Sustainable Catchments Programme (Morphum Environmental), April 2013, Phyllis Street Reserve Restoration Design Plan: Oakley Creek

Druskovich, Brent, March 2009, Revegetation programme - Oakley Creek Walkway archaeological assessment

Friends of Oakley Creek (Alicia Warren), 2010a, Oakley Creek Wildlife Monitoring and Pest Control Report (1 April 2009 to 31 March 2010) - Report to Friends of Oakley Creek AGM.

Friends of Oakley Creek (Alicia Warren), 2010b, Pest control and monitoring plan for Oakley Creek, April 2010 – updated

Friends of Oakley Creek (Alicia Warren), 2012, Review of Possum Control and Monitoring to 2012

Morphum Environmental Ltd, October 2010, Oakley Creek Watercourse Management Plan

Te Ngahere (Melinda Habgood), January 2007, Oakley Creek Planting Review (2005-2007)

Te Ngahere (Melinda Habgood), October 2005, Environmental Weed Control and Native Revegetation Programme for Oakley (Te Auaunga) Creek

Te Ngahere (revised by Samantha Happy), March 2009, Environmental Weed Control and Native Revegetation Programme for Oakley (Te Auaunga) Creek – Revised March 2009

Te Ngahere (Michelle Dublon), final version August 2013, Assessment of Mahoe Rock Forest at Phyllis and Harbutt Reserves, Oakley Creek.

Unitec Institute of Technology, (undated), Biodiversity Strategy for Wairaka Sub-Precinct (with maps and planting lists by Morphum Environmental Ltd)

Well-Connected Alliance (Kieran Miller & Brett Ogilvie, Tonkin & Taylor), October 2014, Herpetofauna and Significant Vegetation Management (revised March 2015) – Document # 025-RPT-03746

Further Reading

Stephen Moore, April 2006, Summary of freshwater biological sampling of Oakley Creek

Torrentfish in Oakley Creek, June 2011, Morphum Environmental Ltd – News article on http://www.morphum.com/news.asp?pageID=2145880545&RefID=2141740685

6 Appendix

Table 9. List of environmental weed species controlled at Oakley Creek by Te Ngahere from 2007 - 2015 by project

Common Name	Scientific Name	Auckland* RPMS Designation	Oakley MU1-7 (ERC)	Harbutt MU 9-11 (ERC)	Mahoe Rock Forest (MU 8-11)	ERBNA 2007-2012 (MU 1-part7)
African clubmoss	*Selaginella kraussiana*	Surveillance	Y	Y	Y	Y
agapanthus	*Agapanthus orientalis*	Surveillance	Y		Y	
alligator weed	*Alternanthera philoxeroides*	Surveillance	Y	Y	Y	Y
arum lily	*Zantedeschia aethiopica*	Surveillance	Y	Y	Y	Y
bamboo	*Bambusa sp.*		Y	Y	Y	Y
bangalow palm	*Archontophoenix cunninghamiana*				Y	
bears breeches	*Acanthus mollis*		Y	Y	Y	
blackberry (wild aggregates)	*Rubus fruiticosus agg.*	Surveillance	Y	Y	Y	Y
blue morning glory	*Ipomoea indica*	Surveillance	Y	Y	Y	Y
buddleia	*Buddleja davidii*	Surveillance	Y			
canna lily	*Canna indica*		Y		Y	Y
cape honeysuckle	*Tecomaria capensis*				Y	
castor oil plant	*Ricinus communis*	Surveillance	Y		Y	Y
climbing asparagus	*Asparagus scandens*	Surveillance	Y	Y	Y	Y
climbing dock	*Rumex sagittatus*	Surveillance	Y		Y	Y
coral tree	*Erythrina indica*		Y			Y
cotoneaster	*Cotoneaster glaucophyllus*	Surveillance	Y			Y
cretan brake fern	*Pteris cretica*					Y
elaeagnus	*Elaeagnus x reflexa*	Surveillance	Y	Y	Y	Y
elephant's ear	*Alocasia brisbanensis*	Surveillance	Y		Y	
English ivy	*Hedera helix*	Surveillance	Y		Y	
fruit salad plant	*Monstera deliciosa*		Y			
giant reed grass	*Arundo donax*	Surveillance	Y			

Common Name	Scientific Name	Auckland* RPMS Designation	Oakley MU1-7 (ERC)	Harbutt MU 9-11 (ERC)	Mahoe Rock Forest (MU 8-11)	ERBNA 2007-2012 (MU 1-part7)
ginger, kahili	*Hedychium gardnerianum*	Surveillance	Y	Y	Y	Y
ginger, yellow	*Hedychium flavescens*	Surveillance	Y			
gorse	*Ulex europaeus*	Surveillance	Y	Y	Y	Y
grey sedge	*Carex divulsa*	Surveillance	Y			
hawthorn	*Crataegus monogyna*	Surveillance	Y			Y
Himalayan honeysuckle	*Leycesteria formosa*	Surveillance	Y		Y	
ivy, German	*Delairea odorata*	Surveillance	Y	Y	Y	
Japanese honeysuckle	*Lonicera japonica*	Surveillance	Y	Y	Y	Y
Japanese spindle tree	*Euonymus japonicus*	Surveillance	Y	Y	Y	Y
jasmine	*Jasminum polyanthum*	Surveillance	Y	Y	Y	
Jerusalem cherry	*Solanum diflorum*		Y	Y	Y	Y
kikuyu grass	*Pennisetum clandestinum*		Y		Y	
lodgepole pine	*Pinus contorta*	Surveillance	Y			
loquat	*Eriobotrya japonica*		Y		Y	
madeira vine	*Anredera cordifolia*	Surveillance	Y	Y	Y	Y
Mexican daisy	*Erigeron karvinskianus*	Surveillance	Y			Y
Mexican devil	*Ageratina adenophora*	Surveillance	Y			
mile a minute	*Dipogon lignosus*	Surveillance			Y	
mistflower	*Ageratina riparia*	Surveillance	Y		Y	
monkey apple	*Syzygium smithii*	Surveillance	Y		Y	Y
montbretia	*Crocosmia x crocosmiiflora*	Surveillance	Y	Y	Y	
moth plant	*Araujia hortorum*	Surveillance	Y	Y	Y	Y
palm grass	*Setaria palmifolia*	Surveillance	Y		Y	Y
palm, Chinese windmill/ fan	*Trachycarpus fortunei*	Research			Y	
pampas, purple	*Cortaderia jubata*	Surveillance	Y		Y	Y
pampas, white	*Cortaderia selloana*	Surveillance	Y		Y	

Common Name	Scientific Name	Auckland* RPMS Designation	Oakley MU1-7 (ERC)	Harbutt MU 9-11 (ERC)	Mahoe Rock Forest (MU 8-11)	ERBNA 2007-2012 (MU 1-part7)
panic veld grass	*Ehrharta erecta*		Y		Y	
passionfruit, banana	*Passiflora tripartita*	Surveillance	Y		Y	
periwinkle	*Vinca major*	Surveillance	Y	Y	Y	Y
phoenix palm	*Phoenix canariensis*	Surveillance	Y		Y	
plectranthus	*Plectranthus ciliatus*	Surveillance			Y	
privet, Chinese	*Ligustrum sinense*	Surveillance	Y	Y	Y	Y
privet, tree	*Ligustrum lucidum*	Surveillance	Y	Y	Y	Y
queen of the night	*Cestrum nocturnum*	Research	Y	Y	Y	Y
queensland poplar	*Homalanthus populifolius*	Surveillance	Y	Y	Y	Y
smilax	*Asparagus asparagoides*	Surveillance	Y			Y
taiwan cherry	*Prunus campanulata*		Y	Y	Y	Y
Tasmanian blackwood	*Acacia melanoxyn*					
tree lupin	*Lupinis arboreus*		Y			
tuber ladder fern	*Nephrolepis cordifolia*	Surveillance	Y			
tutsan	*Hypericum androsaemum*	Surveillance	Y	Y	Y	Y
wandering jew	*Tradescantia fluminensis*	Surveillance	Y	Y	Y	Y
wattle, black	*Acacia mearnsii*		Y	Y	Y	
wattle, brush	*Paraserianthes lophantha*	Surveillance	Y	Y	Y	Y
wattle, sydney golden	*Acacia longifolia*	Research	Y			
willow, crack	*Salix fragilis*	Surveillance	Y		Y	Y
woolly nightshade	*Solanum mauritianum*	Containment	Y	Y	Y	Y
Total number of weeds controlled			**63**	**30**	**53**	**38**

* RPMS = Auckland Regional Pest Management Strategy 2007-2012 (extended)

Table 10. List of exotic species controlled at Oakley Creek by Te Ngahere from 2007 - 2015 by project

Common Name	Scientific Name	Auckland RPMS Designation	Oakley MU1-7 (ERC)	Harbutt MU 9-11 (ERC)	Mahoe Rock Forest (MU 8-11)	ERBNA 2007-2012 (MU 1-part7)
angels trumpet	*Brugmansia candida*					E
bindweeds	*Calystegia spp.*		E	E	E	
convolvulus	*Convolvulus arvense*		E	E	E	E
Eucalyptus sp.	*Eucalyptus sp.*		E			
fennel	*Foeniculum vulgare*		E			
hydrangea	*Hydrangea spp.*			E		
inkweed	*Phytolacca octandra*		E	E	E	E
nasturtium	*Tropaeolum majus*		E	E	E	E
pink head knotweed	*Persicaria capitatum*		E			
poplar	*Populus spp.*		E		E	E
she oak	*Casuarina cunninghamiana*		E			
stinking iris	*Iris foetidissima*					E
thistle sp.	*'All' spp.*				E	E
three cornered garlic	*Allium triquetum*		E			
umbrella sedge	*Cyperus eragrostis*		E		E	
watsonia	*Watsonia bulbillifera*					E
willow weed	*Persicaria maculosa*		E	E	E	E
Total number of exotic species controlled			**12**	**6**	**8**	**9**

Figure 20. Weed canopy control carried out by Te Ngahere 2013-2015 (MU1-6)

NB: Green is marked & controlled, Red is marked and not controlled

Figure 21. Weed canopy control carried out by Te Ngahere 2013-2014 (MU7-11)

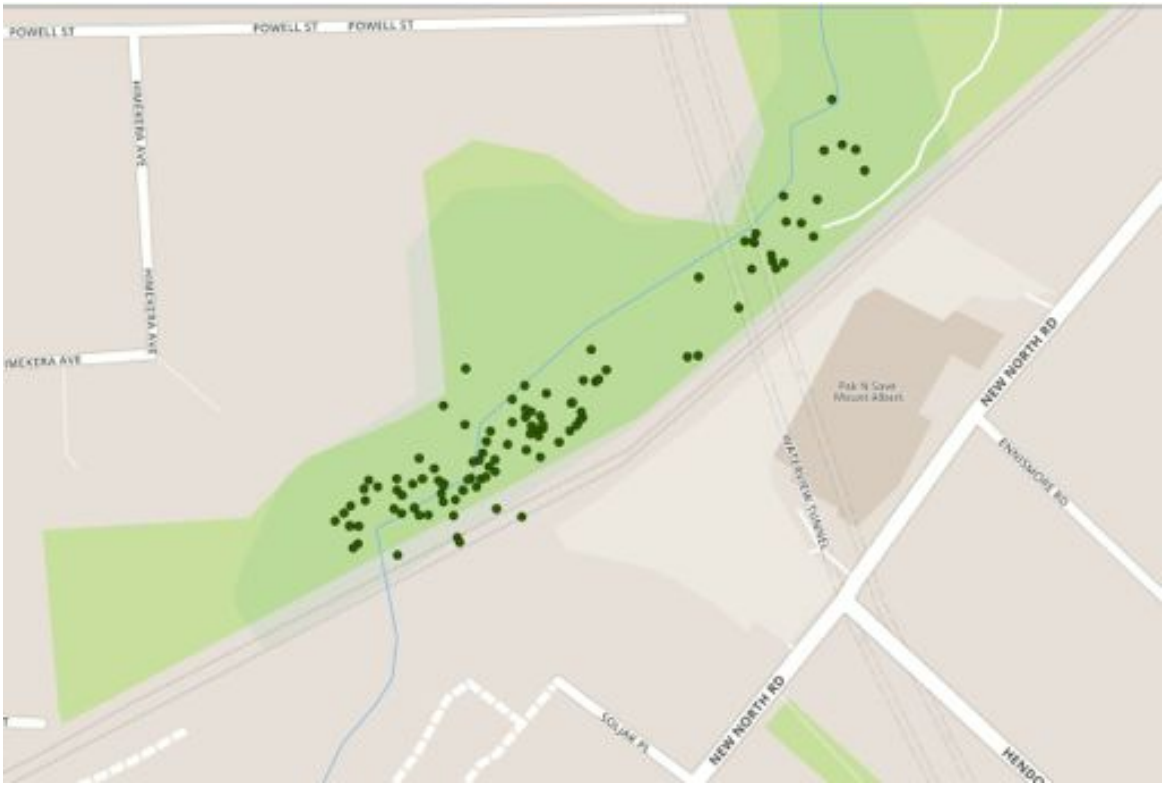


Figure 22. Close-up of Weed canopy control carried out by Te Ngahere in MU 11 2013-2015

Table 11. Restoration Opportunity Areas identified by Stormwater/Morphum - Restoration work progress

Intervention Type	Intervention Name	Location	Description	Outcomes	Progress
Naturalise Channel, Riparian Planting	RO1 – Engineered Channel	MU 5	Naturalise concrete lined channel and plant appropriately	Naturalise channel and improve amenity	Not undertaken. Future consideration.
Erosion Control, Riparian Restoration	RO2 – Waterview Glades	MU 5	Planting on true left bank and reinforce as necessary to improve bank stability	Erosion control and riparian restoration	Planting to be undertaken as part of WCA restoration works
Amenity, Facilitate Fish Passage	RO3 - Waterfall	MU 6	Conduct feasibility assessment for provision of wetted margin planting on side of waterfall to facilitate fish passage	Amenity improvement, fish passage	Not progressed.
Riparian Restoration, Amenity	RO4 – Waterview Downs	MU 7	Improve amenity by removing weeds and debris from both banks. Enhance riparian planting	Riparian Restoration, Amenity	Ongoing weed control as part of ERC. Planting on Arundo slope in winter 2015, otherwise limited recent planting
Riparian Restoration, Amenity	RO5 – Blockhouse Bay Access Way	MU7	Improve shading, stability and amenity by improving native vegetation density. Weed removal	Riparian Restoration, Amenity	Ongoing weed control (ERC). Planting near bridge by volunteers.
Weed Management, Erosion Protection	RO6 – Albie Turner Fields/Phyllis Reserve	MU8	Improve amenity by controlling weeds and enhance riparian planting	Weed Management, Erosion Protection	Serious weed issues. Initial weed control needed.
Weed Management, Amenity	RO7 – Phyllis Street Reserve	MU8	Improve amenity by removing weeds and debris from the site. Enhance riparian margin with native planting	Weed Management, Amenity	Restoration project organised by Sust Catchments. Contractor plant prep 2013 and planting 2014.
Amenity, Erosion Control	RO8 – Downstream of Harbutt Reserve	MU9	Improve amenity through the provision of a picnic area and installation of a defined pathway. Enhance bank stability and shading through the planting of flax and low growing grasses	Amenity, Erosion Control	Planting undertaken by volunteers on floodplain and some stream edge. Central area still mown.
Enhance Native Biodiversity, Weed Management	RO9 – Downstream of Cradock Street	MU9	Consider alternative maintenance methods to prevent the incidence of exotic groundcover being transported downstream. Consider planting on true right bank to improve amenity	Enhance Native Biodiversity, Weed Management	Large willows trimmed to low stumps but now resprouting. No planting undertaken on true right bank. Weed control and planting (winter 2015) to be carried out on west bank.
Erosion Protection, Weed Management	RO10 – Upstream of Cradock Street	MU10	Improve bank stability through bank reinforcement and planting as appropriate. Specimen tree planting to improve amenity	Erosion Protection, Weed Management	Future erosion control work planned. Specimen trees planted on eastern bank and some planting on west stream edge.

Intervention Type	Intervention Name	Location	Description	Outcomes	Progress
Weed Management, Erosion Protection	RO11 – Upstream Harbutt Reserve		Reinforcing and planting on both banks to mitigate erosion and bank instability	Weed Management, Erosion Protection	Plant prep and planting undertaken 2013-2015. Plus specimen trees planted previously.
Improve Stream Conveyance, Weed Management	RO12 – Cascades		Improve and maintenance conveyance through the reach by selected willow removal. Weed management on both banks and improve shading of channel to reduce occurrence of periphyton in stream	Improve Stream Conveyance, Weed Management	Stormwater undertook removal of a willow for clearance but resprouting on bank. Further willows to remove. Weed control ongoing on east bank (ERC/ Mahoe RF). Sustainable Neighbourhoods Grp working on west bank.

Oakley Creek Annual Bird Monitoring Summary - 2008-2014

Year	2008			2009			2010			2011			2012			2013			2014		
Bird name	Count of all sites	Pest control sites	No-pest-control sites	Count of all sites	Pest control sites	No-pest-control sites	Count of all sites	Pest control sites	No-pest-control sites	Count of all sites	Pest control sites	No-pest-control sites	Count of all sites	Pest control sites	No-pest-control sites	Count of all sites	Pest control sites	No-pest-control sites	Count of all sites	Pest control sites	No-pest-control sites
Bellbird																					
Black shag	2	2					1	1								2	2		3	3	
Black swan	1	1																			
Black-backed gull	13	8	5	16	7	9	13	2	11	10	2	8	14	2	12	10	3	7	12	3	9
Blackbird	13	7	6	29	10	19	89	10	79	43	6	37	19	7	12	73	11	62	20	8	12
Chaffinch	6	3	3	3		3	6	4	2	10	4	6	1	1		6	4	2	6	3	3
Eastern rosella	8	5	3	13	8	5	11	4	7	15	8	7	6	5	1	10	7	3	6	3	3
Fantail	9	4	5	5	1	4	9	3	6	13	3	10	8	6	2	7	5	2	5	2	3
Goldfinch	4	2	2				8	3	5	16	5	11	8	3	5	4	4		2	2	
Greenfinch	4	3	1							8	4	4	1		1	8	4	4	3	3	
Grey warbler	2	1	1				3	1	2	3	2	1	3	2	1	8	5	3	2	1	1
Harrier Hawk													1		1						
Hedge sparrow/Dunnock										1	1										
House sparrow	10	5	5	15	7	8	27	1	26	33		33	47	9	38	19	9	10	22	8	14
Kereru							1	1					2		2						
Kingfisher	3	1	2	1		1	3		3				1	1		4	1	3	4	1	3
Little shag	2	2								2	2										
Magpie	7	6	1	1		1	1	1		10	8	2	3	1	2	4	2	2	1		1
Mallard/grey duck	7	4	3	18	13	5	26	17	9	14	3	11	30	20	10	41	31	10	19	16	3
Myna	8	3	5	3		3	6		6	6		6	7		7	6	4	2	5	1	4
Paradise / Shellduck							2		2												
Pukeko	7	2	5	7		7	3		3	2		2	2	2		8	4	4	4		4
Red-billed gull				2	2		2	1	1	2		2	7	3	4	7	2	5	6	2	4
Redpoll										2	2										
Ring-necked pheasant	3	3								11	11										
Rock pigeon	7	5	2	16	4	12	24	17	7	21	3	18	12	8	4	14	2	12	8	2	6
Silvereye	12	6	6	41	2	39	58	6	52	34	3	31	29	11	18	32	14	18	25	12	13

Year	2008			2009			2010			2011			2012			2013			2014		
Song thrush	10	6	4	11	2	9	16	7	9	6	1	5	8	5	3	7	3	4	14	4	10
Spotted dove	2	1	1	5	2	3	2	1	1	1		1	2	1	1	2		2			
Spur-winged plover	2	1	1				1		1	3	2	1							2		2
Starling	12	7	5	6	2	4	11	1	10	21	2	19	6		6	1		1	30	3	27
Tui	9	5	4	11		11	8	1	7	4		4	12	6	6	12	2	10	5	2	3
Welcome swallow				7	5	2				15	11	4	1		1	6	3	3	7		7
White faced heron	11	9	2	13	12	1	12	6	6	2		2	6	4	2	1	1		4	3	1
Yellowhammer							1		1				1		1	4	4				
Totals	**174**	**102**	**72**	**223**	**77**	**146**	**344**	**88**	**256**	**308**	**83**	**225**	**237**	**97**	**140**	**296**	**127**	**169**	**215**	**82**	**133**

Table 12. Water quality monitoring data (collected by Wai Care) 2005 - 2014

Site	Sample Date	Air Temp	Water Temp	Water Clarity	Turb-idity	pH	Dissolved Oxygen	Nitrate	Nitrite	Phosph-orous	Phosphate
Oakley Creek, End of Craddock St	13/04/2010	21	17	80		6	9	0	0	0.05	0.154
Oakley Creek, End of Craddock St	28/05/2010	19	16	57		6	8	1	0.15		
Oakley Creek, End of Craddock St	28/05/2010										
Oakley Creek, End of Craddock St	23/06/2010	14	13	75		6	11	0.5	0.15		
Oakley Creek, End of Craddock St	30/08/2010	15	15	88		7	10.8	0.5	0.5		
Oakley Creek, End of Craddock St	6/10/2010										
Oakley Creek, End of Craddock St	6/10/2010	18	16	75		6.5	9	0.5	0.15		
Oakley Creek, End of Craddock St	17/11/2010	20	18	88		6.5	7	1	0.15		
Oakley Creek, End of Craddock St	17/12/2010	25	22	70		6	8	0.05	0.15		
Oakley Creek, End of Craddock St	22/02/2011	25	24	87		6.5	9.5	1	0.15		
Oakley Creek, End of Craddock St	24/03/2011	20	20	78		6.5	5.5				
Oakley Creek, End of Craddock St	13/05/2011	21	19	63		6	5.5			0	0
Oakley Creek, End of Craddock St	13/05/2011										
Oakley Creek, End of Craddock St	22/06/2011										
Oakley Creek, End of Craddock St	22/06/2011	15	15	80		6.5	9	2	0	0.025	0.077
Oakley Creek, End of Craddock St	24/09/2011	17	16	93		7	10			0.025	0.077
Oakley Creek, End of Craddock St	9/02/2012										
Oakley Creek, End of Craddock St	9/02/2012	20.5	20	97		7	6.8	0	0.15	0.05	0.154
Oakley Creek, End of Craddock St	21/05/2012	15.5	13.5	98		7	9.8	0	0	0.05	0.154
Oakley Creek, End of Craddock St	21/07/2012	12.5	13	73		7	9.2			0.05	0.154
Oakley Creek, End of Craddock St	22/09/2012	18.5	14.5	82		7	10	0	0	0.1	0.307
Oakley Creek, End of Craddock St	18/11/2012	18.5	17	70		6	9.3	1	0.15	0.1	0.307
Oakley Creek, End of Craddock St	26/02/2013	21	20.5	100		7	6.5	0	0	0.075	0.23
Oakley Creek, End of Craddock St	27/05/2013	18	15.5	76		7	10.1	0	0	0.038	0.115
Oakley Creek, End of Craddock St	24/08/2013	15	13.5	75		6	9.5	0	0	0.075	0.23

Site	Sample Date	Air Temp	Water Temp	Water Clarity	Turb-idity	pH	Dissolved Oxygen	Nitrate	Nitrite	Phosph-orous	Phosphate
Oakley Creek, End of Craddock St	25/11/2013	24	22	87		7	9.8	0	0	0.1	0.307
Oakley Creek, End of Craddock St	10/03/2014	25	20	100	3.9	7	5.5	0	0		
Oakley Creek, End of Craddock St	28/06/2014	16	14	46	12.5	6	10	0	0	0.025	0.077
Oakley Creek, Unitec Bridge	13/07/2011	18	14	57.5		6	9.5	0	0	0	0
Oakley Creek, Unitec Bridge	10/10/2011	18	15	47.5		7	8.5	0	1	0.05	0.154
Oakley Creek, Unitec Bridge	23/01/2012	22	19	78		7	8.6	0	0	0	0
Oakley Creek, Unitec Bridge	3/05/2012	10	11	85		7	8	2	0	0.15	0.461
Oakley Creek, Unitec Bridge	4/07/2012	12	12					1	1		
Oakley Creek, Unitec Bridge	21/07/2012	14	11	83		8	14	1	0	0	0
Oakley Creek, Unitec Bridge	29/10/2012	19	17	43	13.8	7	7.6	0	0	0.025	0.077
Oakley Creek, Unitec Bridge	29/10/2012	19	17	43		7	7.6	0	0	0.075	0.23
Oakley Creek, Unitec Bridge	21/01/2013	21	22	90		7.8	7.8	0	0	0.05	0.154
Oakley Creek, Unitec Bridge	24/01/2013	21	20	85		8	6.4	0	0	0.037	0.114
Oakley Creek, Unitec Bridge	24/04/2013	18.5	19	48		7	7.6	0.035	0	0.035	0.107
Oakley Creek, Unitec Bridge	26/08/2013	12	13	58		8	15	0	0	0.035	0.107
Oakley Creek, Unitec Bridge	19/03/2014	22	21	80	5.4	7	7.8	1	0	0	0
Oakley Creek, Unitec Bridge	22/06/2014	15	14	76	5.8	7	8.1	0	0.3	0.05	0.154
Oakley Creek, Unitec Bridge	29/09/2014	20	16	57	9	8	8.4	0	0	0.05	0.154
Oakley Creek, Unitec Bridge	18/12/2014	21	21	52	10.4	8	8	0	0.3	0.05	0.154
Oakley Creek, upstream of Wairaka Stream	3/04/2006	26	22	50		7	7	1	0	0.025	0.077
Oakley Creek, upstream of Wairaka Stream	3/07/2006	8	11	100		7	7.5	1.5	0	0.1	0.307
Oakley Creek, upstream of Wairaka Stream	2/10/2007	19	14	25		7	7	2	0	0.05	0.154
Oakley Creek, upstream of Wairaka Stream	25/02/2008	23	22	55		7	5.5	2	0	0.05	0.154
Oakley Creek, upstream of Wairaka Stream	2/09/2008	16	15	75		7	6.9	2	0	0.1	0.307

Site	Sample Date	Air Temp	Water Temp	Water Clarity	Turb-idity	pH	Dissolved Oxygen	Nitrate	Nitrite	Phosph-orous	Phosphate
Oakley Creek, upstream of Wairaka Stream	18/11/2008	16	17	30		8	6.5	0	0	0.05	0.154
Oakley Creek, upstream of Wairaka Stream	23/03/2009	20	18	70		7	6	0	0	0.025	0.077
Oakley Creek, upstream of Wairaka Stream	7/09/2009	14	12	70		7		1	0	0.025	0.077
Oakley Creek, upstream of Wairaka Stream	21/07/2010	15	13	70		7	7			0.05	0.154
Oakley Creek, upstream of Wairaka Stream	22/08/2011	11	10	75	6	7	8	2	0	0.05	0.154
Oakley Creek, upstream of Wairaka Stream	29/10/2012	15	16	90	4.5	7	6.5	2	0	0.1	0.307
Wairaka Stream, Unitec Nursery	7/03/2005	20	18	100		7	7.4			0.14	0.43
Wairaka Stream, Unitec Nursery	4/04/2005	23	18	100		7	8	5	0	0.05	0.154
Wairaka Stream, Unitec Nursery	2/05/2005	19	19	100		7	6.5	1	0	0.2	0.614
Wairaka Stream, Unitec Nursery	7/06/2005	11	15	100		6	7	2	0	0.025	0.077
Wairaka Stream, Unitec Nursery	11/07/2005	15.5	17	80		6	7	2	0	0.025	0.077
Wairaka Stream, Unitec Nursery	1/08/2005	17	15.5	100		6	15	1	0	0.025	0.077
Wairaka Stream, Unitec Nursery	5/09/2005	20	16	100		7	7.2	2	0	0.1	0.307
Wairaka Stream, Unitec Nursery	10/10/2005	25	19	70		7	7	2	0	0.025	0.077
Wairaka Stream, Unitec Nursery	7/11/2005	22	19	100		7	7	2	0	0.025	0.077
Wairaka Stream, Unitec Nursery	7/03/2006	22	19	100		7	15	2	0	0.05	0.154
Wairaka Stream, Unitec Nursery	1/05/2006	19	18	100		7	6.8	1	0	0.2	0.614
Wairaka Stream, Unitec Nursery	3/07/2006	8	11	100		7	7.5	1.5	0	0.1	0.307
Wairaka Stream, Unitec Nursery	4/09/2006	16	16	100		7	5	2	0	0.4	1.228
Wairaka Stream, Unitec Nursery	21/11/2006	19	18	100		7	6	0	2	0.05	0.154
Wairaka Stream, Unitec Nursery	3/04/2007	20	19	95		7	6.5	0	2	0.1	0.307
Wairaka Stream, Unitec Nursery	7/05/2007	18	18	100		7	6.5	2	0	0.05	0.154
Wairaka Stream, Unitec Nursery	14/08/2007	14	16	100		7	7	2	0	0.05	0.154

Site	Sample Date	Air Temp	Water Temp	Water Clarity	Turb-idity	pH	Dissolved Oxygen	Nitrate	Nitrite	Phosph-orous	Phosphate
Wairaka Stream, Unitec Nursery	25/03/2008	24	18	100		7	6.5			0.05	0.154
Wairaka Stream, Unitec Nursery	15/07/2008	14	16	100		7	6.5	2	0		
Wairaka Stream, Unitec Nursery	13/10/2008	17	16	100		7	7.1	2	0	0.05	0.154
Wairaka Stream, Unitec Nursery	23/02/2009	20	20	85		7	7	2	0	0.1	0.307
Wairaka Stream, Unitec Nursery	17/06/2009	10	15	100		7		2	0	0.025	0.077
Wairaka Stream, Unitec Nursery	10/08/2009	16	15	100		7		2	0	0.1	0.307
Wairaka Stream, Unitec Nursery	10/02/2010	22	18	80		7		2	0	0.1	0.307
Wairaka Stream, Unitec Nursery	10/03/2010	22	19	100		7		2	0	0.2	0.614
Wairaka Stream, Unitec Nursery	20/09/2010										
Wairaka Stream, Unitec Nursery	20/09/2010	15	17	100		6	6			0.1	0.307
Wairaka Stream, Unitec Nursery	7/03/2011	16	15	100	3.9	6	6.25			0	0
Wairaka Stream, Unitec Nursery	20/02/2013	21	19	100	3.9	7	6.5	5	0	0.1	0.307
Wairaka Stream, Unitec Nursery	20/05/2013	18	17	95	4.2	7	6	1	0	0.05	0.154
Wairaka Stream, Unitec Nursery	19/08/2013	18	17	100	3.9	7	6.5	2	0	0.05	0.154
Wairaka Stream, Unitec Nursery	25/11/2013	23	18			7	6.9	1	0	0.1	0.307
Wairaka Stream, Unitec Nursery	24/03/2014	20	19	100	3.9	7	6	1	0	0.025	0.077
Wairaka Stream, Unitec Nursery	23/06/2014	14	15	115	3.1	7	6.5	2	0	0.05	0.154
Wairaka Stream, Unitec Nursery	15/12/2014	18	17	95	4.2	7	7	1	0	0.025	0.077