Te Ngahere
Native Forest Management

Upper Te Auaunga Awa - Oakley Creek
Puketāpapa
Restoration Plan

Ecological Restoration and Consultancy

Upper Te Auaunga Awa - Oakley Creek
Puketāpapa
Restoration Plan

August 2016

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Te Ngahere

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Executive Summary

This restoration plan has been prepared for Auckland Council Puketāpapa Local Board and Sustainable Catchments with input from mana whenua and Friends of Oakley Creek. The plan covers a section of the Te Auaunga Awa / Oakley Creek Catchment that runs through the Puketāpapa Local Board area. This includes Keith Hay Park, stormwater reserves, War Memorial Park, John Moore Reserve, Molley Green Reserve, Arkles Reserve and Freeland Reserve.

These areas are highly urbanised with little vegetation cover over the awa and weed species scattered throughout with occasional native species. The stream channels have been straightened and in places concrete lined or piped. The area contains no known sites of value or significance to mana whenua or significant ecological areas. However, the awa flows into ecologically significant areas and improving the Puketāpapa section will have benefits both locally and to the lower awa.

Te Aranga principles have been outlined for a restoration approach that provides positive outcomes to both the cultural and natural landscape for both mana whenua and the wider community.

It is recommended that weed control is undertaken in a staged approach adhering to a lowest toxicity policy. It is preferable that wherever possible the local community is involved with volunteer opportunities such as manual weed control, planting and monitoring.

Restoration planting is recommended through all areas and timing will be dependent upon whether modifications such as naturalisation of the awa are likely to take place. Species chosen for planting should be appropriate to position to the stream and soil type (alluvial or volcanic) and eco-sourced.

1 Introduction

1.1 Vision

The vision of this restoration plan is to provide a tool for achieving the outcomes of the Te Auaunga Awa / Oakley Creek He Rautaki Whakaora mō ngā o Vision and Restoration Strategy for the Upper Catchment:

"*Aiming to integrate mātauranga Māori and environmentally sustainable practices to restore Te Auaunga Awa so that is becomes an alive, flowing awa in a green corridor that is treasured and respected for generations to come*" (Auckland Council, 2016)

1.2 Te Aranga Principles and the Auckland Design Manual

The ecological restoration of Te Auaunga / Oakley Creek awa (river) within Puketāpapa Local Board area has been recognised as an opportunity to use the Te Aranga principles to provide positive outcomes for the cultural and natural landscape for both mana whenua and the wider community.

The principles taken from the Auckland Design Manual (Auckland Council, 2016b) are outlined below with opportunities for implementation within this project.

1. **Mana – Rangatiratanga (Authority).** ***The status of iwi and hapū as mana whenua is recognised and respected.***

Identification and involvement of any primary mana whenua groups and wider interests including but not limited to consultation of the proposed plan and the wider vision and restoration strategy for the upper catchment. Iwi require high level Treaty based relationships with all key stakeholders, including Auckland Council as well as Council-Controlled Organisations (CCOs) which recognise their tangata whenua status in order to fulfil their roles as kaitiaki (guardians). These relationships can then inform Iwi participation in collaborative design and development processes and are a precursor to actualising the other six principles.

2. **Whakapapa - Names and naming.** ***Māori names are celebrated.***

Wherever possible the inclusion of appropriate traditional place names and names for fauna and flora will be used within the restoration plan and recommended for future information signage etc.

3. **Taiao – The natural environment.** ***The natural environment is protected, restored and / or enhanced.***

A key goal of the restoration of Te Auaunga Awa both in Puketāpapa and Albert-Eden Local Board areas is to enhance and connect the natural environment through removal of invasive vegetation and restoration of indigenous habitats. This provides opportunities for planting eco-sourced native species and widening available habitat for native wildlife. In addition to in-stream benefits improving the awa and the Waitemata Harbour.

There is also potential to improve current and create new future harvesting opportunities of traditional mahinga kai (food gathering areas) and cultural resource areas to bring natural landscape elements back into modified urban environments allowing for active kaitiakitanga. See Section 5 for more details on restoration.

4. **Mauri tu – Environmental health.** ***Environmental health is protected, maintained and / or enhanced.***

Consideration is given to methodology for protecting, maintaining and enhancing mauri. This includes the use of eco-sourced plants from the Tāmaki ecological district, a preference for manual weed control where possible, following a lowest toxicity policy for herbicide use and a preference for naturalising the stream wherever possible. There are also opportunities for volunteers to actively participate including restoration activities such as weed control, planting and monitoring of the wai, whenua, ngāhere and air. See Sections 4 and 5

5. **Mahi toi – Creative expression.** ***Iwi /hapū narratives are captured and expressed creatively and appropriately.***

The focus of this restoration plan is on the physical aspects of restoring Te Auaunga Awa. However, future interpretative signage, artwork and design work through these areas is recommended to give consideration to mahi toi utilising names and local tohu to creatively incorporate iwi narratives.

6. **Tohu – The wider cultural landscape.** ***Mana whenua significant sites and cultural landmarks are acknowledged.***

Sites of significance are to be visually connected, preserved and enhanced with opportunities for markers and interpretation. This includes acknowledgment of cultural significance of Te Auaunga awa (see Section 2.3) as recognised in the strategy (Auckland Council, 2016) and other tohu such as wāhi tapu (sacred sites), maunga (mountains), awa (river), puna (spring) and ancestral kāinga (home). If new sites of significance are identified consideration must be given to these. To protect potentially unknown sites of significance the accidental discovery protocol must be followed (see example in Appendix 1).

7. **Ahi kā – Living presence.** ***Iwi /hapū have a living and enduring presence and are secure and valued within their rohe.***

This could be incorporated through maintaining and enhancing access to natural resources, and developing opportunities such as participation in restoration activities and monitoring (see Section 6). Outside the scope of this plan, there should be consideration of interpretation opportunities and art.

2 Site Overview

2.1 Location

The upper reaches of Te Auaunga Awa - Oakley Creek are located within Auckland Council's Puketāpapa Local Board. Downstream the awa flows through Albert-Eden and Whau Local Boards. Within Puketāpapa the creek runs through public open space including Keith Hay Park, stormwater reserves, John Moore Reserve, War Memorial Park, Walmsley and Underwood Reserves, Freeland Reserve, Molley Green Reserve and Arkles Reserve. This plan does not cover sections through land transport land around SH20 and the tributary that runs behind private land on Olsen Ave. Walmsley and Underwood Reserves are not covered as they have pre-existing restoration plans.

2.2 Public and private land and site designations

The area covered in this restoration plan is shown in Figure 1. This includes two types of Open Space:

- Informal recreation: Narrow stormwater reserves often only encompassing the stream area.
- Sport and recreation: These areas include public parks.

Through the upper catchment, private land is in close proximity of the creek. Private land includes Housing and Special Purpose, which are highlighted in Figure 1 where the zone occurs within approximately 10m of the creek.

The restoration area is outlined below within the context of the Proposed Auckland Unitary Plan (PAUP) (Auckland Council, 2013).

1. **Keith Hay Park**

This section is Public Open Space (Sport and Recreation) including Akarana Golf Course to the west. This reserve also contains a Natural heritage volcanic view shaft for Maungakiekie (One Tree Hill). Private land bordering the stream area includes Single House Zone along with Strategic Transport Corridor land to the north.

2. **Stormwater reserves beside Mt Roskill Intermediate School and Mt Roskill Grammar School**

This section is Public Open Space (informal recreation). This reserve also resides above an Aquifer and is listed as containing a notable tree, London Plane (495) (actually located on 1 James Preston Avenue). The area lies within the natural heritage volcanic view shafts for Puketāpapa (Mt Roskill). Private land bordering this area includes Single House Zone and Special Purpose Zone (Schools) with Historic heritage, pre-1944 building demolition control and on the western side, a Natural Resource: Aquifer (Auckland Isthmus Volcanic).

3. **Winstone Road to Dominion Road**

This section is Public Open Space (informal recreation). Natural resources include indicative stream and Auckland Isthmus Volcanic aquifer. Private property neighbouring this area includes Single House and Mixed Housing Suburban Zones, with the aquifer and some with pre-1944 building demolition controls.

4. John Moore Reserve

This section is Public Open Space (Informal Recreation). Neighbouring properties include Single House and Special Purpose (school) zones

5. Stormwater reserve from Dominion Road to May Road

This section is Public Open Space (Informal Recreation) with an indicative stream. The area contains a volcanic view shaft for Puketāpapa (Mt Roskill) and the Auckland Isthmus Volcanic aquifer. Neighbouring properties include Single House and Mixed Urban Zones.

6. War Memorial Park

This section is Public Open Space (Sport and Recreation). The area also contains volcanic view shafts for Owairaka (Mt Albert). This includes part of the stream area where there are currently scattered tall amenity trees. Historic heritage includes The War Memorial Hall and Memorial. Natural resources include an indicative stream and Auckland Isthmus Volcanic aquifer. Neighbouring properties bordering the stream area consist of Terrace Housing and Apartment Buildings Zone.

7. Freeland, Molley Green and Arkles Reserves

These reserves are all Public Open Space (Informal Recreation) surrounded by Mixed housing suburban. These reserves include volcanic view shafts height sensitive areas Puketāpapa (Freeland Reserve) and Maungakiekie (Molley Green Reserve). Natural resources include the Auckland Isthmus Volcanic Aquifer at Freeland Reserve.

Figure 1 Map of simplified Unitary Plan designations of restoration area and within approximately 20m of stream edge

2.3 Areas of significance

Te Auaunga Awa - Oakley Creek is highly significant to local iwi for the mauri / environmental and historic values.

Tangata whenua continue as kaitiaki of Te Auaunga Awa and a vital part of identity and their story as a people. The cultural landscape is discussed in the Te Auaunga Awa strategy document (Auckland Council, 2016). It describes the awa as a *"greatly significant awa in the west of Tāmaki Isthmus, flowing from between Te Tātua a Riukiuta and Puketāpapa in the south, to Te Wai o Te Matā in the north west. Te Auaunga Awa means swirling waters or whirlpool. .....a site of great cultural significance to Māori. Its waters weave together a vast cultural landscape of diverse sites including mahinga kai, pā taua, papakāinga, wāhi nohoanga and wāhi tapu".*

The strategy also discusses descriptions and uses of the area prior to modification from traditional kōrero including that it:

- Was navigable inland for access to papakāinga and pā taua and an important food (tuna and īnanga) and material resources.
- Provided habitat native fauna and flora including building / weaving materials raupō and harakeke, medicines and dyes.
- Te Wai a Rakataura (the waters of Rakataura) wāhi tapu with several sites of spiritual significance and prized for fish, water-fowl, building materials, and rongoā.
- Te Auaunga Awa also carries the cultural concept mauri and if healthy can sustain ecosystems, support cultural uses and mahinga kai, and be a source of pride and identity to mana whenua.

A number of cultural sites are known to be present from previous Māori occupation, including middens, food storage pits and potential terraces in the lower section of the awa outside of this restoration plan. Along with more recent archaeological sites these are covered in the existing restoration plan, Authority to Modify and Cultural Monitoring Plan / Tikanga Protocols for the lower part of the awa (Te Ngahere, 2015 and Druskovich, 2016).

The PAUP (Auckland Council, 2013) does not identify any areas of cultural or ecological significance within the restoration area for this plan. However, features of significance are present within the wider area including:

2.3.1 Sites of significance / value to Mana whenua

The restoration area flows through a hugely modified environment. Unlike the lower Te Auaunga Awa - Oakley Creek where there are a number of known sites of value to Mana whenua (Druskovich, 2016) the upper section does not contain any listed sites.

Within the wider area three sites and places of value to Mana whenua are listed in the PAUP (Auckland Council, 2013) recorded within the Open Space Reserves 1300m< and >300m from the restoration area (ID 2116, 2124, 2102, archaeology of Māori origin). These are located on the maunga Puketāpapa / Mt Roskill (ID113), Te Tatua-a- Riukiuta / Three Kings (ID222) and Owairaka / Mt Albert (ID1576). The outer circle of the site on the PAUP is located less than 290m from the nearest tributary of Te Auaunga Awa - Oakley Creek at Freeland Reserve and 400m from Keith Hay Park (see Figure 2). These maunga are also listed as outstanding natural features. The closest is Puketāpapa / Mt Roskill.

If archaeological / cultural sites are discovered in the future, an Accidental Discovery Protocol needs to be adhered to during ecological restoration tasks. Whereby if any suspected archaeological material is discovered all work must stop immediately and the appropriate authorities and consultant archaeologist must be informed. In addition, if any koiwi (human remains) are uncovered, work should cease immediately and the tangata whenua and police should be contacted so that appropriate arrangements can be made (See Appendix 3 Accidental Discovery Protocols from 4Sight Consulting (2016) an example developed for the lower Te Auaunga Awa - Oakley Creek. This is a guide and contact details will vary).

2.3.2 Significant Ecological Areas

Due to the highly modified environment no Significant Ecological Areas are located within the restoration area. Within the wider area, significant sites include the Waikōwhai network of reserves along the Manukau Coastline (SEA_T_5334) and a site at Te tatua-a-Riukiuta (Three Kings volcano).

Lower in the catchment the awa flows through ecologically significant areas including Alan Wood Reserve (SEA_T_6097) and the lower Oakley Creek (SEA_T_6008), the awa then flows into the significant marine environment of the Waitemata Harbour (including SEA_M1_53 and 53w1) this area contains significant habitat for foraging, roosting and nesting sites for shorebirds and waders. This includes Motu Mānawa / Pollen and Traherne / Te Kou Islands, which contain significant vegetation and bird habitat and are considered of national importance (Auckland Council, 2013).

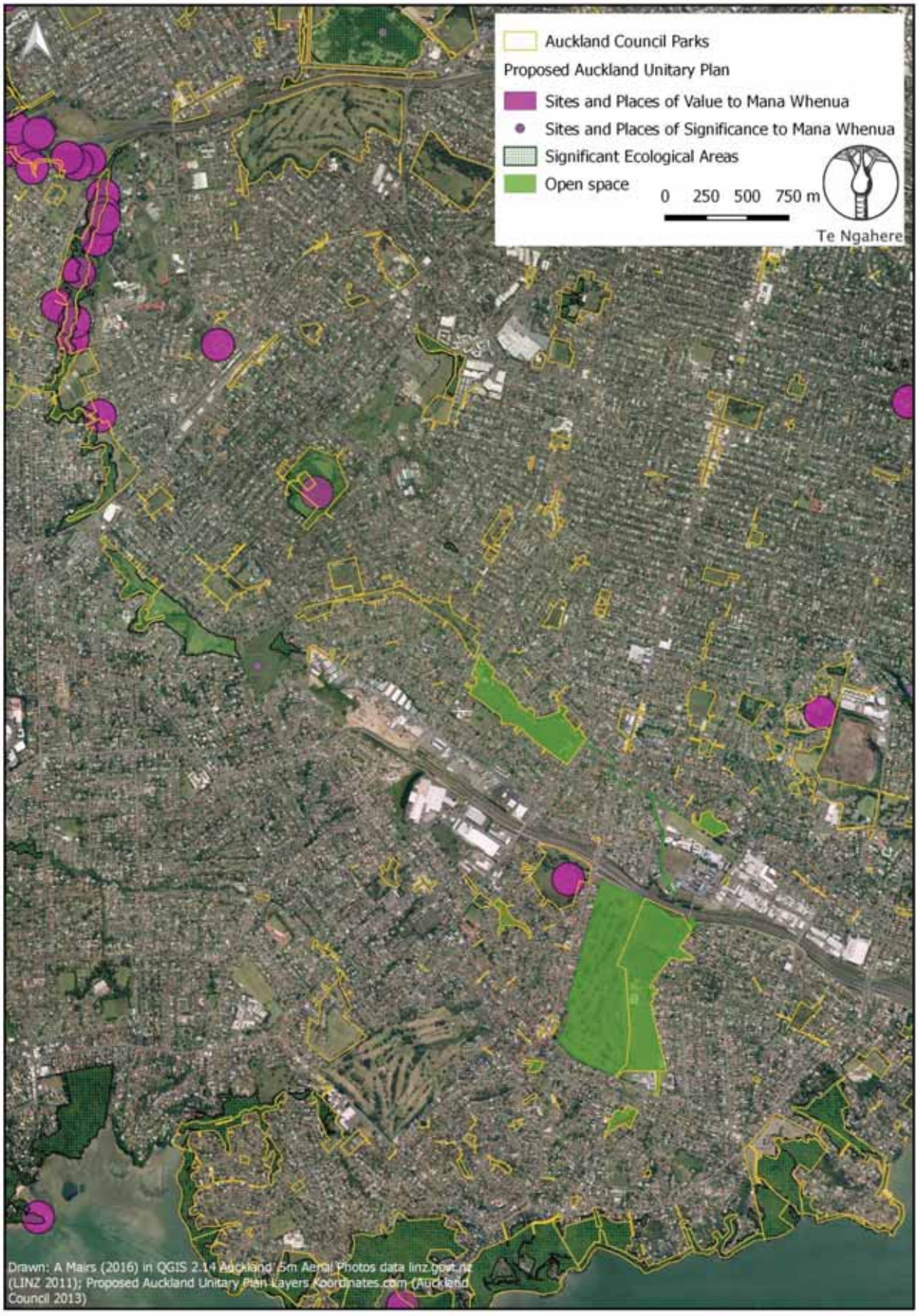

Figure 2 Map of areas of significance or value to Mana whenua and Significant Ecological Areas

2.4 Existing projects

Existing restoration projects along Te Auaunga Awa - Oakley Creek include Walmsley and Underwood Reserves in Puketāpapa, and within Albert-Eden / Whau the Alan Wood Reserve and the Lower Te Auaunga Awa - Oakley Creek. These areas are not included within this restoration plan.

2.4.1 Walmsley and Underwood Reserves

This section is being transformed to help reduce flooding and rehabilitate the stream running through these reserves. Works are due to take place between 2017 and 2019. This includes naturalising of the stream through removal of the concrete channel and providing a more natural environment where it meanders through the reserves. This also includes the creation of wetland areas and improving natural habitat. In addition to these works, there will be physical improvements to culverts, playgrounds, outdoor education zone, BMX track and construction of new bridges, cycleways and footpaths. A native nursery social enterprise is planned to be set up by Te Whangai Trust at Wesley Intermediate.

2.4.2 Alan Wood Reserve

The Alan Wood Reserve section is also being transformed through the State Highways 16 and 20 Waterview Connection Project (NZ Transport Agency) by the Well Connected Alliance. This includes the construction of stormwater ponds and wetland areas, extensive planting, re-location of copper skink and protection measures for a rare native geranium (*Geranium retrorsum "Oakley Creek"*).

2.4.3 Lower Te Auaunga Awa - Oakley Creek

In 2015 the restoration plan for the lower Te Auaunga Awa – Oakley Creek was renewed (Te Ngahere, 2015) and is now being implemented. The area includes Oakley Creek Cycleway, Phyllis Reserve and Harbutt Reserve (Albert- Eden Local Board) and some Esplanade Reserves (Whau Local Board). Projects within the catchment area, in addition to work by Friends of Oakley Creek, include the following:

Auckland Council Stormwater Projects
The Stormwater team at Auckland Council is responsible for ensuring that Te Auaunga Awa - Oakley Creek stays clear of blockages that could result during flood periods. Work includes:

- Managing the weeds and clearing debris along the 1.5m riparian edge of the stream.
- Implementing the recommendations in the *Oakley Creek Watercourse Management Plan* (Morphum, 2010), which covers engineering assets, erosion management, fish passage and enhancement opportunities.

Auckland Council Parks
Auckland Council's Local and Sports Parks Central team manages maintenance, community group liaison, Local Board Funded Projects and management of the Ecological Restoration Contract (ERC) for the Oakley Creek Walkway. Local Park's staff work closely with Friends of Oakley Creek (FOOC), mana whenua, Te Ngahere (Ecological Restoration contractors), the

consultant archaeologist, Auckland Council Stormwater and Biodiversity team members and other stakeholders to ensure restoration along the creek is carried out collaboratively.

Auckland Council Sustainable Catchments programme

The Sustainable Catchments team at Auckland Council has produced an "Urban 10 Year Implementation Plan - South Waitemata" (Auckland Council, 2014) which covers the whole Oakley Creek catchment. It is a strategic document that sets out 'on-the-ground' catchment intervention options which link to Restoration Opportunities identified in the *Watercourse Management Plan for Oakley Creek* (Morphum, 2010). Additionally a restoration plan for Restoration Opportunities at Stoddard Road (RO14), Mount Roskill Intermediate (RO18) and Keith Hay Park Tributary within Puketāpapa are outlined by Morphum (2013).

2.5 Stakeholders

2.5.1 Puketāpapa Local Board

The Puketāpapa Local Board have landowner responsibilities for the parks and reserves that the awa runs through in the upper catchment. They have been instrumental in developing the vision and restoration strategy in partnership with mana whenua and Friends of Oakley Creek Te Auaunga Awa.

The strategy reflects and is driven by the Local Board Plan and objectives for parks and the natural environment (Auckland Council, 2014). The board seeks to achieve:

- *Partnership with mana whenua as kaitiaki (guardians) that ensures our landscape is treasured and sustained.*
- *Our harbour and waterways are restored to greater health and ecological sustainability.*

2.5.2 Local iwi / mana whenua

Mana whenua have a cultural connection to Te Auaunga Awa - Oakley Creek as the original people of the land and an inherent responsibility for kaitiaki (guardianship). They are to continue to be given the opportunity to be informed and involved in future restoration work or activities of Te Auaunga Awa - Oakley Creek.

It is also recommended that iwi are kept informed on the progress of ecological restoration along the awa through summary reports and involvement with site meetings.

Through the development of the strategy (Auckland Council 2016) mana whenua have been involved in a series of hui during 2015 and 2016 for the Upper Te Auaunga Awa – Oakley Creek. The following iwi / hapū of Ngā Mana Whenua o Tāmaki Makaurau have been actively involved so far:

- Ngāi Tai Ki Tāmaki
- Ngāti Tamaoho
- Ngāti Te Ata Waiohua
- Ngāti Whātua Ōrākei
- Te Ākitai Waiohua
- Te Kawerau ā Maki

2.5.3 Friends of Oakley Creek Te Auaunga Awa

Friends of Oakley Creek (FOOC) have been an integral part of the success of restoration to date in the lower catchment of Te Auaunga Awa - Oakley Creek. The community group was set up in 2004 with the vision of having *"Te Auaunga Awa Oakley Creek and its environs restored and protected as a natural ecosystem, incorporating a range of wildlife habitats, indigenous species and recreational amenities, for present and future generations."*

Work undertaken by FOOC in the lower creek includes:

- Working closely with the Auckland Council Local and Sports Parks and Biodiversity teams to co-ordinate and encourage activities and community involvement on the creek.
- Engaging with the adjacent neighbours and landowners in the lower catchment (such as Unitec, Ngāti Whātua, private residents and Sustainable Neighbourhood groups) to encourage weed control and restoration planting on areas adjacent to Te Auaunga Awa - Oakley Creek.
- Coordinating a wide range of restoration activities for the project, including native plant propagation, planting, weed control, water quality monitoring and rubbish clean-ups.
- Undertaking monitoring and pest control since 2008. This includes animal pest monitoring and control of rodents, possums, hedgehogs and mustelids. Biodiversity monitoring tasks include annual bird counts, weta monitoring, vegetation plot and photo comparison monitoring.

FOOC takes an integrated approach to their work in the whole of the catchment, and has also been involved in a number of projects in the upper catchment, within the Puketāpapa Local Board. This includes the following (personal communication with Wendy John):

- Involvement in a MetroWater weed mat trial planting on the banks of Oakley Creek, adjacent to Mt Roskill Grammar, in 2005
- Working with schools in the area including Mt Roskill Intermediate School, Mt Roskill Grammar School, Mt Roskill Primary School, Waikōwhai Intermediate School, May Road School.
- Involvement in the restoration works of Molley Green and Freeland Reserves.
- Involvement in the preparation of the Puketāpapa Local Board upper catchment strategy, and in the Te Auaunga Awa: Underwood & Walmsley Reserves Project.

As with other areas along the awa / creek and throughout the catchment, FOOC acts as a key advocate for the protection of the creek. This includes preparing submissions on various projects or developments, monitoring various developments and advocating for resources for the protection and restoration.

2.5.4 Local Puketāpapa schools

A number of public schools reside within close proximity to the awa / creek and have been involved in previous restoration activities and could potentially be engaged with for future restoration and education opportunities. These include Wesley Intermediate School, Mt Roskill Grammar, Mt Roskill Intermediate School, Mt Roskill Primary School, May Road School and Waikōwhai Intermediate School.

Auckland Council is also working with Te Whāngai Trust, Project PETER organisations and the local community to establish a social enterprise nursery at Wesley Intermediate. This is to initially provide plants for the Walmsley and Underwood Reserves project developing life skills, training, work readiness, learning and employment opportunities to the local

community.

2.5.5 Wai Care

Wai Care is a programme for community and school groups that involves monitoring and education about water quality within the Auckland region. This programme is run by Wai Care coordinators in collaboration with FOOC and the local community. Monitoring sites in the upper catchment include Walmsley Park, Mt Roskill Intermediate and Mt Roskill Grammar School, along with the Olsen Ave tributary (Wai Care, 2016).

3 Site Description

3.1 Mātai aronuku / Geology

The geology of Te Auaunga Awa - Oakley Creek consists of three main distinct geological types, as can be seen in Figure 3.

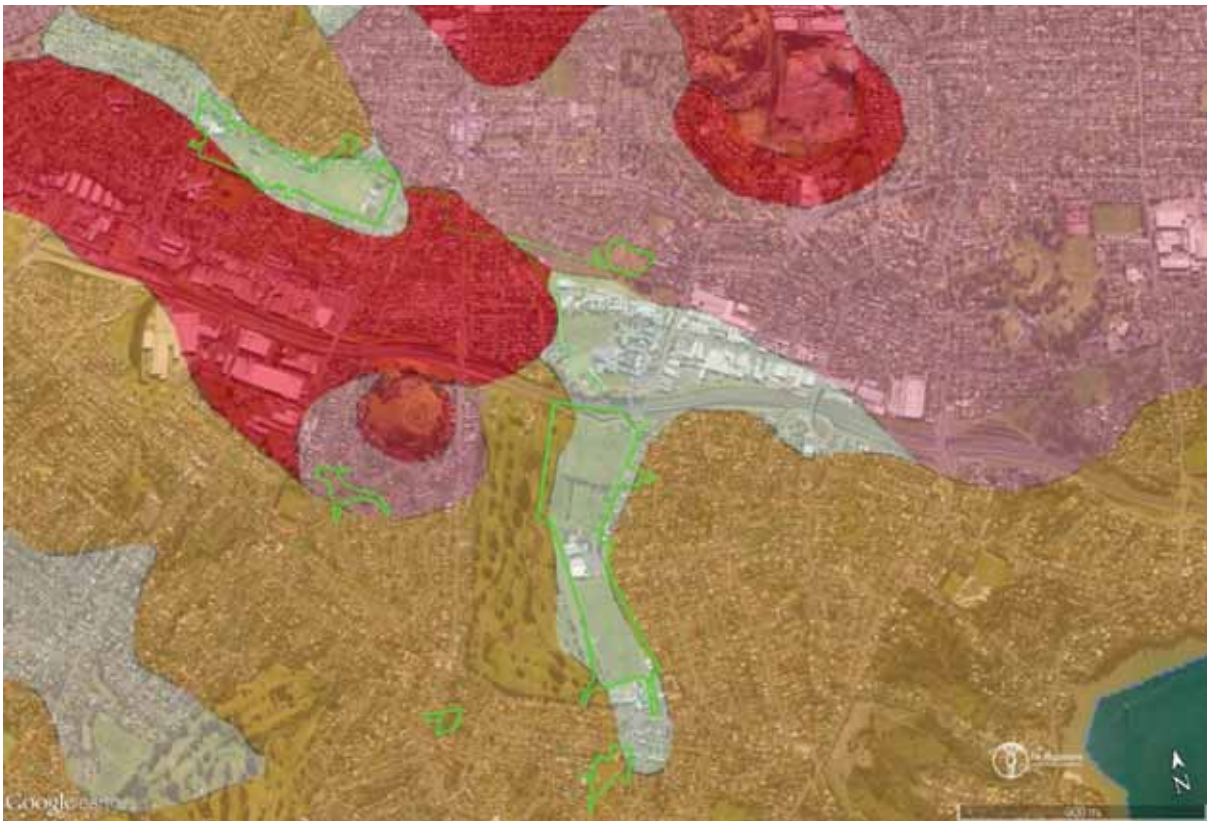

Figure 3 Map of the main geological types in the Puketāpapa area (source GNS science accessed June 2016). Areas covered by the plan are outlined in green

The three main geology types are described below, taken from GNS 2016:

- Alluvial (white areas) - Holocene river deposit. Described as sand, silt mud and clay with local gravel and peat beds. This includes War Memorial Park, Keith Hay Park (eastern side) and the stormwater reserve beside Mt Roskill Grammar School and part of Mt Roskill Intermediate School.
- Volcanic (red areas) - Auckland basalts tuff and lava, Kerikeri Volcanic Group of Auckland Volcanic field. This includes part of the stormwater reserve through Mt Roskill Intermediate School and John Moore Reserve.
    - tuff (pink areas): described as grey to very dark grey, dense, fine grained olivine basalt or basanite lava flows.
    - lava (red areas): lithic tuff, comprising reduced pre-volcanic materials with basaltic fragments to small particles / fragments, and unconsolidated ash and lapilli deposits.
- Sedimentary (orange areas) - East Coast Bays Formation of Warkworth Subgroup (Waitemata Group). Described as alternating sandstone and mudstone with variable volcanic content and interbedded volcanilastic grits. This includes the tributary on the western side of Keith Hay Park.

3.2 Ngāi kīrehe / Fauna

3.2.1 Birds

The area supports a range of fauna typical of urban environments including native birds such as native warau (welcome swallow), pūtangitangi (paradise shell-duck), riroriro (grey warbler), and exotic tiu (house sparrow) and rakiraki (mallard). Restoration of the stream area will increase available habitat for a range of native species likely to be in the area and provided a vegetated corridor to facilitate movement of species present in the lower reaches where 34 species have been recorded by FOOC (Te Ngahere Ltd, 2015).

3.2.2 Aquatic biota

Macroinvertebrates which have been recorded by Wai Care within the upper Te Auaunga Awa are typical of a degraded urban stream. These include mosquito, cranefly and midge larvae and Oligochaeta (segmented worms). There is more data available for Walmsley Park where moderately pollution sensitive woody-cased caddisflies were recorded. The remaining macroinvertebrate community is made up of pollution tolerant purse caddisflies (Hydroptilidae), damselflies, bugs (backswimmer, boatmen), crustaceans (amphipods, isopods), water flea, snails, flatworm, leeches, sandflies (*Austrosimulium* sp.), midges (sub-order: Nematocera), worms (order: Oligochaeta) and mosquito larvae (Culicidae) (Wai Care, 2016).

The fish which have been recorded are Gambusia (Waicare 2016) and tuna / unidentified eel species at Walmsley Park just downstream of the area covered in this plan (NatureWatch, 2016). This is reflective of the limited range of habitats present and absence of refugia from flood events.

Channel naturalisation and the provision of shade from riparian planting can improve in stream habitat through providing greater habitat diversity, refugia during high flow periods and decreased water temperature, increased dissolved oxygen, woody material, leaf litter and terrestrial invertebrates. This will allow for species present elsewhere in the catchment to recolonise the upper Te Auaunga - Oakley Creek. This includes fish such as īnanga, banded kokopu, redfin bully, pako (common bully) and ngaoire (common smelt) and macroinvertebrates such as smooth-cased, stony-cased and woody-cased caddisflies and spotty and tail gill stoneflies (Wai Care, 2016). Papamoko (torrentfish) which have been recorded in the lower catchment are unlikely to establish in these upper reaches due to lack of suitable habitat.

3.2.3 Animal pests

Some animal pest control work has been undertaken within the restoration area. This includes response based wasp control (Keith Hay Park) and temporary rat control where Auckland Council has received complaints. The area includes War Memorial Park along the stream in MU2 (2016) and Keith Hay Park behind the sports facilities in MU1 (2015). Other mammalian animal pests likely to be present include possums, mice, hedgehogs and rabbits.

3.3 Vegetation

3.3.1 Historic vegetation

The potential historic vegetation of the site is likely to have been Pūriri forest (WF7ii) from War Memorial Park to Mount Roskill Grammar School. While Keith Hay Park is listed as Kauri,

podocarp, broadleaf forest (WF11) (Singers et al, 2014 and Auckland Council GIS layer 2015). These classifications are part of the terrestrial and freshwater ecosystems that have been identified by Auckland Council as occurring in the Auckland Region. Historically the area would also have encompassed Te Wai o Rakataura which were wetlands that lay within the catchment of Te Auaunga Awa (Auckland Council, 2016). These would have provided important food and material along with habitat for native fauna and flora.

The vegetation can no longer be classified as these forest / wetland types due to human influences modifying the area over a long period. European settlement would have reduced vegetation through farming and urbanisation. The creek was straightened and deepened through this area in the 1930s to help drain the surrounding land (Auckland Council, 2016). Aerial photos from the 1940s show that the upper reaches were relatively open with scattered trees along the banks and the surrounding land use as farming with some residential housing see Figure 4.

Figure 4 1940s aerial photograph of area from Auckland Council (NZ Aerial Mapping, 1940; Auckland Council, 2016).

3.4 Reserves and Management Unit descriptions

Areas within the ecological restoration area are divided into management units to aid prioritisation of tasks and assist in reporting / planning. This also enables clear identification of particular locations and can accommodate the varying requirements for different areas within the restoration site.

In the case of the upper Te Auaunga Awa, the area is divided into management units depending on the morphology of the creek, open space type and size. It is important to keep units to a relatively small size so that they are more manageable for contractors and volunteers, and specific priorities can be targeted.

Management Units are depicted in Figures 7, 12, 14, 16 and 17. For details of restoration priorities, refer to the weed control priorities (Section 4 future planting sites 5.4).

For a full list of native and exotic species per reserve recorded please see Appendix 1 for exotic species and Appendix 2 for native plant species recorded.

3.4.1 Keith Hay Park

Keith Hay Park is comprised primarily of sports fields, tracks and footpaths including along side of the concrete lined section of Oakley Creek and a tributary that run along the east and western sides of the park respectively. The stream area has been split into three management units described below.

Keith Hay Park Management Unit 1
This management unit encompasses the streamside area along the eastern boundary from Noton Road Carpark to Arundel Street Carpark (Cameron Pools). It consists primarily of open grass with occasional large amenity trees. There is a small area of vegetation at the southern end that consists primarily of native canopy cover including puka, karamū, tarata, pōhutukawa, karo and tī kōuka. Exotic canopy includes woolly nightshade and Japanese spindle. Other weed species present include arum lilies, *Tradescantia*, cotoneaster, kikuyu, bamboo (cut with some re-growth) and small woolly nightshade. Other natives include harakeke. Large eucalyptus are also present as amenity trees.

Figure 5 Typical streamside environment of Keith Hay Park MU1 including area of existing vegetation

Keith Hay Park Management Unit 2
This management unit encompasses the streamside area from Arundel Street carpark (Cameron Pools) along the eastern boundary to the south-western motorway land and northern boundary. The area consists primarily of open grass with occasional large amenity trees. A small amount of vegetation exists at the Cameron Pools end including a range of the weeds Taiwan cherry, Queen of the night, woolly nightshade, agapanthus, tree privet, kikuyu, black nightshade, willow, Japanese spindle, oleander, arum lily and flame vine over grown from the boundary. Native species within this area include harakeke (including variegated cultivars) and coprosma hybrids. Other weed species beside the park boundary include phoenix and windmill palms. Amenity trees include she-oak, London plane, eucalyptus and native pōhutukawa.

Figure 6 Typical streamside environment of Keith Hay Park MU2

Keith Hay Park Management Unit 3 (tributary)

This management unit encompasses the tributary from the north-western corner of the reserve to behind the Cameron Pools along the boundary with Akarana Golf Course. This area consists primarily of open banks with a mix of scattered weeds and natives, and a dense native planting at the southern end. Key weed species include agapanthus, Chinese privet, tree privet, three cornered garlic, *Tradescantia*, gorse, alligator weed, German ivy (abundant), nasturtium, woolly nightshade and arum lilies. Some scattered native canopy exists on stream edge with a dense planting at the southern end including tītoki, kānuka, tarata, Coprosma hybrids, māpou, māhoe, tī kōuka, *Olearia solandri, Olearia lineata,* pōhutukawa, tarata, whau and tawapou. Other exotic trees include oak, she-oak, tulepo and macrocarpa.

Figure 7 Keith Hay Park including Management Units 1-3

3.4.2 John Moore Reserve and surrounding area

This includes public open space bordering schools and John Moore Reserve bordering a section of Te Auaunga Awa - Oakley Creek and a tributary with steep banks and a mix of open and covered vegetation. The stream area has been split into four management units described below.

John Moore Reserve Management Unit 1 (tributary)

This management unit comprises the stream area within John Moore Reserve. The reserve has a range of amenity trees including some providing shade to the stream such as tarata, pōhutukawa, ginkgo and liquidambar. Dense harakeke has been planted to the east of the bridge with the west being open and grassed with steep banks. This tributary is not concrete lined. Other occasional native species include karamū, turawera and rautahi. The area has scattered weeds including moth plant, woolly nightshade, alligator weed, Taiwanese cherry, agapanthus, queen of the night and *Tradescantia*.

Figure 8 Riparian edge at John Moore Reserve MU1

Mount Roskill Intermediate School Management Unit 2 (tributary)

This section of the esplanade runs along the northern side of Mount Roskill Intermediate School and comprises a tributary of Oakley Creek that is not concrete lined. This section contains steep sided banks mostly vegetated on the northern side with a mix of native and exotic species providing a good amount of shade to the stream. The area had a large number of weed species for a full list see Appendix 1. Key weeds include moth plant, blue morning glory, arum, Taiwan cherry, *Tradescantia*, woolly nightshade, climbing dock, blackberry, alligator weed, privets, evergreen buckthorn, Japanese spindle, Japanese honeysuckle, mile a minute and brush cherry. Native canopy has also established through this area including pūriri, taupata, harakeke, karamū, turawera, māhoe, pūrei, karo, tī kōuka, mamaku, kōwhai, kōhūhū, tarata and pohuehue. The southern side also consists of a steep bank that levels off for around 1m before the boundary fence consisting primarily of exotic lawn grasses.

Figure 9 Typical streamside environment of Mt Roskill Intermediate School MU2

Mount Roskill Intermediate School Management Unit 3

This section of the stormwater reserve runs along the western side of Mount Roskill Intermediate School. It includes a moderately to steeply sloped bank with open areas of rank kikuyu, native plantings and scattered weeds. A large section has been planted by the school and has established well including tī kōuka, karamū, harakeke, putaputawētā, pūrei, upokotangata, kānuka, toetoe, pūriri, tarata, pūkio, karaka and whau. Key weed species include arum lily, bamboo, queen of the night, castor oil plant, blue morning glory, crack willow, loquat, agapanthus, elephant's ear, nasturtium, alligator weed (some controlled), moth plant, windmill palm and woolly nightshade. Other exotic species include squash, Leyland cypress, yucca, liquidambar, cherry and Chinese toon.

Some subsidence of the stream bank was noted within this management unit.

Figure 10 Typical streamside environment of Mt Roskill Intermediate School MU3

Mount Roskill Grammar School Management Unit 4

This section comprised the esplanade reserve running along the western boundary of Mount Roskill Grammar School. The section consists of steep banks with a narrow 1-3m strip of flat ground next to the boundary fence. The majority of the area is open with scattered vegetation. Key weed species include jasmine, madeira, nasturtium*, Tradescantia*, queen of the night, castor oil, German ivy, woolly nightshade, Mexican daisy, cotoneaster, bindweed, moth plant, Chinese privet, papyrus and alligator weed. Native species are scattered and include karamū, pūriri, māhoe, turawera, karo, pūrei, tarata, taupata, tōtara (boundary), harakeke, toetoe and rasp fern. Some large exotic trees providing shade to the stream including redwood, hawthorn, oak and poplars.

Figure 11 Typical streamside environment of Mt Roskill Grammar School MU4

Figure 12 John Moore Reserve and surrounding area. Management Units 1-4

3.4.3 Stormwater reserves / deep channels

Sites were checked from roadsides through this section and tended to contain very little canopy and a mix of naturally established exotic and native species growing out of the rock or from adjoining boundaries. The rock channels are very deeply cut with boundary fences built close to the stream edge and no walk able access through these sections.

Winstone Road to Dominion Road

Winstone Road east includes canopy trees from neighbouring properties including feijoa, puka and exotic bangalow palm. The only environmental weed noted was German ivy. Other species include mallow, choko and native houpara.

Winstone Road west canopy includes kānuka, karamū, pōhutukawa, tī kōuka along with exotic species such as banana, phoenix palm and Queensland poplar. Key weed species present include moth plant, Chinese privet, evergreen buckthorn, agapanthus, tuber ladder fern, smilax and *Tradescantia.* Other species present include rosemary, osteospermum, cress along with native willow weed and puka.

Dominion Road east has very little shade and contains grass, black nightshade, rēmana / lemon and āporo / apple (overhanging from a neighbouring property), Chinese toon, mallow and native pōhutukawa canopy. Weed species include moth plant and ginger on neighbouring properties.

Dominion Road to May Road

Dominion Road (western side) canopy includes Chinese privet and native tarata and tanekaha. Environmental weed species include pitted crassula, agapanthus, tree privet seedlings, smilax and tuber ladder fern. A stag fern was also noted growing on the rock lined channel.

Memorial Road entrances include canopy cover from pōhutukawa, houpara and exotic paperbark. Weed species include moth plant, woolly nightshade and *Tradescantia*. Tōtara is also present. On the southern side of the road weed species include agapanthus, cotoneaster, woolly nightshade, tree privet (canopy), German ivy, smilax and moth plant. Other species include wisteria, and native tōtara and pōhutukawa canopy.

At Mt Roskill Road entrances weeds species include palm grass, bushy asparagus, English ivy, moth plant and tree privet canopy. Other species include exotic hibiscus along with native tōtara, karamū, karo and pōhutukawa.

May Road entrance weed species include woolly nightshade, Chinese privet, three-cornered garlic and nasturtium. Other species include exotic osteospermum, grasses, cleavers, black nightshade, along with native tītoki (over boundary), huruhuruwhenua (shinning spleenwort) and kōhūhū.

Figure 13 Typical streamside vegetation of the Stormwater Reserves

Figure 14 Stormwater Reserves / deep channels

3.4.4 War Memorial Park

War Memorial Park is comprised primarily of sports fields, running tracks and footpaths, including along side of the concrete lined section of Te Auaunga Awa - Oakley Creek that runs along the northern boundary of the reserve. The stream area has been split into two management units described below. See Figure 15 for typical streamside habitat in War Memorial Park.

War Memorial Park Management Unit 1.
This management unit encompasses the stream area from Sandringham Road Extension end to the bridge below 43 Gifford Ave. Key features of this management unit include open grass areas beside the concrete channel with large golden weeping willows at the western end and a patch of swamp cypresses. Other occasional large tree species include eucalyptus, poplar, tortured willow, she-oak and oak. Weed species are largely confined to existing small patches of exotic vegetation and are sparsely distributed including Queensland poplar, *Tradescantia*, climbing rose, moth plant seedlings, woolly nightshade, nasturtium, tuber ladder fern (below cypress), kikuyu (main grass, abundant) and alligator weed. Native species in the area include occasional pūriri, rewarewa, pōhutukawa, kōwhai, variegated harakeke, karo, kahikatea (groups planted into pasture), kōhūhū and karamū.

Figure 15 Typical streamside environment of War Memorial Park

War Memorial Park Management Unit 2
This management unit encompasses the stream area from the bridge below 43 Gifford Ave to May Road end. Key features of this management unit include open grass areas beside the concrete channel with scattered large exotic amenity trees such as magnolia, she-oak, pine, golden weeping willow, poplar and ginkgo along with the shrub escallonia. Weed species area largely confined to boundary properties and to existing small patches of native or exotic vegetation including Taiwan cherry, *Tradescantia,* English ivy, tree privet, agapanthus, moth plant, woolly nightshade, nasturtium, three cornered garlic, kikuyu (main grass, abundant) and black nightshade. Weed species noted beyond the boundary include monkey apple, woolly nightshade, tree privet and bamboo. Native vegetation primarily consists of patches of streamside plantings with dense harakeke and occasional tī kōuka, karamū, houpara, porokaiwhiri, tītoki, karaka, karo and kahikatea.

Figure 16 War Memorial Park including Management Units 1-2

3.4.5 Freeland Reserve

This reserve encompasses a tributary that is partially piped and partially channelled through the reserve, including an area of raupō and harakeke wetland. Some riparian planting has already taken place in 2015 and 2016 including harakeke and mānuka. In addition, there are some specimen kahikatea and taraire. Large trees in the reserve include exotic sheoaks. Key weed species include alligator weed, kikuyu, *Tradescantia* and woolly nightshade.

3.4.6 Molley Green Reserve

This reserve encompasses a tributary that is partially piped and partially channelled through the reserve including an area of riparian planting. This includes harakeke, toetoe, pūrei and tī kōuka. Large trees in the reserve include exotic sheoaks, eucalyptus, golden weeping willows along with native pūriri and tōtara. Key weed species include alligator weed, bindweed, kikuyu, *Tradescantia* and woolly nightshade.

3.4.7 Arkles Reserve

This reserve encompasses a tributary channelled through the reserve without concrete lining. The stream area consist of open grass and an area of will cover with mixed native karamū, tī kōuka and kawakawa along with exotic arum lilies, carpet *Tradescantia* and busy lizzy. Large trees in the reserve include exotic swamp and river sheoaks, Monterey pine, golden weeping willows and liquidambar. Other natives in the reserve include taupata, pōhutukawa, kāpuka and pūriri. Key weed species include kikuyu, *Tradescantia*, Montbretia, moth plant, three cornered garlic, agapanthus and woolly nightshade within the reserve and climbing asparagus, arum lilies and bamboo on neighbouring properties.

4 Weed Control

4.1 Environmental weed control approach

An ongoing programme of weed control is needed to:

- tackle weed regrowth (from on-site seed sources and existing weed populations).
- target weed re-invasion (from neighbouring land, upstream, and dispersal by birds and wind).
- protect establishing plantings and existing native habitat.
- prevent spread of weeds to adjoining sites, surrounding area or downstream.

4.1.1 Forest Restoration Framework

It is recommended that the 'Forest Restoration Framework', which was developed by Te Ngahere, is used to address a site-led weed control approach at Te Auaunga Awa - Oakley Creek. This framework is necessary to achieve a targeted approach that focuses efforts in an effective and efficient manner, and can be applied to wetland and riparian habitats, as well as forests.

The framework aims to restore native habitats by controlling invasive weeds in a manner which minimises the use of herbicides and ultimately creates an ecologically viable and self sustaining system. Worksites will progress under this framework from Initial Weed Control through to the Seedbank Control or Forest Protection phase to limit re-invasion of weeds from neighbouring seed sources. Major weed sources, such as nearby fruiting weed trees, path edges, stream edges and site boundaries need to be checked regularly as part of this weed approach.

Supplementary phases are needed for *Tradescantia* control and where gradual removal of weeds is required (Long-term Control), for example if there is an erosion risk. The table below summarises the main phases of the 'Forest Restoration Framework' (Table 1).

In addition, Weed Canopy Control (part of Long-term Control) needs to be undertaken. This is where selected environmental weed trees are drilled and poisoned, where an existing understorey exists and there are no safety issues to park users.

This restoration approach has been used very effectively by Te Ngahere at lower Te Auaunga - Oakley Creek since 2002, through the ecological restoration contracts. This has allowed phased progression from Initial Control to Follow Up Control, now with the majority of the management units being in Seedbank Control, with some Long-term Control in specific areas.

Table 1 Description of Restoration Framework Phases

Framework phase	Description
Initial Control	Initial control targets all plants and aims to eliminate plant pest reproduction within the site. This is achieved by cut stump application and following with an initial foliar spray application.
Follow Up Control	Follow up control targets all plants that were missed or failed to die due to numerous factors. If this phase is implemented in spring and autumn, usually only one calendar year is required to achieve this objective.
Seedbank Control	The seedbank control phase begins when all existing weeds have been eliminated. Seedbank control targets the remaining seed in the soil layer. Ideally at least three visits with one to be implemented prior to mid-summer to target weeds before setting seed to be effective. Implementation at this time allows for spring germination and enough biomass production for effective control. The duration of this phase is dependent on the seed viability of the targeted plant. It is commonly 2-4 years, depending on site situations and amount of cover.
Forest (Wetland / Stream) Protection	The protection phase is achieved when all seeds and seed sources are eliminated from the area. This phase is focussed on the prevention of plants establishing from incoming seed from adjacent areas and the stream. This is required to prevent a site from slipping back to the start of the process.
Long-term Control	The planned gradual removal of pest plants where complete removal would promote adverse environmental conditions e.g. erosion, removal of all structural habitat. This will involve cut stump, ring bark, drill or foliar spray of selected plant pests in selected areas over time once sufficient native cover is achieved. This is a long-term process.
Tradescantia Control	Control of *Tradescantia fluminensis* within a designated area is ongoing and requires a unique methodology. Foliar spray application of tradescantia three times a year, until fewer applications are necessary. Vigilance is required to reduce tradescantia to low levels and re-invasion may occur from infestations adjacent or upstream from the site. Ideally alligator weed could also be targeted during this phase.

Upper Te Auaunga Awa - Oakley Creek will require an ongoing weed control programme to ensure weeds do not re-establish or re-invade. Weed control efforts will be required annually to control the extensive seedbank that will be present in the soil for a number of years and species which will re-establish from upstream (*Tradescantia* and alligator weed).

Plantings will also require regular maintenance until a canopy or substantial native ground cover is achieved. Once plantings have reached an age where the risk of being smothered by weeds is reduced, shade tolerant weeds are then likely to be the main threat in these planted areas.

If restoration efforts are coordinated to allow for long-term weed maintenance, the cost, labour and herbicide requirements will steadily decrease over time and should eventually be reduced to a minimum level.

Regular reviews of the outcomes and methods implemented will help to determine the success of restoration efforts. This will also provide a means of identifying areas that may require further control or alternative applications and methods as a consequence of previous control efforts.

4.1.2 Open areas

The majority of the restoration area comprises mowed kikuyu grass and does not require extensive weed control prior to planting, just two to three pre-planting spray visits with non-residual herbicide approved for use around waterways. Once these areas are planted it is important that a sufficient programme of plant maintenance is carried out (primarily hand releasing) to allow for successful establishment of plants and reduce both weed numbers and minimise herbicide requirements.

4.1.3 Timing

Weed control visits should be undertaken two to three times per year (depending on species and restoration phase), targeting environmental weeds through appropriate hand pulling, cut stump or foliar spray methods, following a lowest toxicity herbicide policy. Weed control is usually targeted during times of active growth for a number of species, when herbicide will be most effective (often spring and autumn).

4.1.4 Environmental weed tree control

Environmental weed trees are those that:

- are listed in the Auckland Regional Pest Management strategy 2007-2012 (currently being updated), and / or
- are known to be invasive and impact significantly on the integrity of remnant native ecosystems by altering plant community structure and habitat, and by displacing native plant and animal populations.

The presence of individual mature environmental weed trees is undesirable as they provide weed seed sources that are spread into the surrounding areas of native vegetation, which are being restored. This exacerbates the efforts of weed control (and restoration) and leads to weed seed sources being present on site for longer.

In the short term, certain weed trees do provide habitat and some food sources (such as berries or nectar) for native birds such as tui and kereru. As restoration progresses with plantings becoming established, there should be sufficient habitat and native food sources along Te Auaunga Awa - Oakley Creek and in the surrounding area. Further native plantings will replace exotics such as tree privet as native food sources for fauna become available.

The remaining individual environmental weed trees are controlled and or removed using professional contractors or arborists where they are not currently contributing to shade over the stream. Priority environmental weed tree species to be removed / poisoned include evergreen buckthorn, willows, Japanese spindle, privet, wattle and brush cherry.

Other mature exotic trees that are present along such as swamp cypress, eucalyptus, pine sp., pedunculate oak and poplar sp. are less of a priority for removal and control as they are amenity trees and not spreading through the area. However, exotic tree seedlings, saplings and spreading suckers should be hand pulled or controlled as part of weed maintenance visits.

4.2 Weed Control Considerations

4.2.1 Lowest toxicity policy

Where time, cost and effectiveness allow. the preferred method of control is manual control especially around young plantings, beside waterways and under the drip line of sensitive trees (e.g. tree ferns).

A lowest toxicity policy should be used which aims to minimise risk to users and the environment, by using herbicide with the lowest toxicity that is effective for the weed species being targeted. Extra caution is required with use of agrichemicals in wetlands and near waterways and only appropriate herbicides approved for use over water shall be used.

4.2.2 Use of suitably qualified ecological restoration contractors

It is recommended that the majority of weed control is undertaken by qualified contractors where spraying or cut-stump control using specific chemicals is required for effective control. All contractor field staff should hold the Introductory Growsafe and EPA Approved Handlers test certificates, and be trained in chemical application for weed control. Agrichemical management and application must adhere to NZS 8409:2004 "Management of Agrichemicals" and policies in the Auckland Regional Air, Land and Water Plan. Throughout all stages of weed control it is important to consider public safety. Therefore the appropriate signage and precautions will be necessary. This may include temporary closure of walkways during any felling of large trees.

4.2.3 Volunteer weed control

Across the whole of Te Auaunga - Oakley Creek volunteers from Friends of Oakley Creek (FOOC) have been actively involved including weed control using manual and cut and paste methods. This includes planting maintenance, which focuses on manual methods and hand clearance. FOOC works closely with adjacent neighbours and landowners and they also co-ordinate other groups carrying out weed control tasks (e.g. CVNZ and corporate groups). It is important that volunteers are briefed at the start of tasks about any site hazards and that health and safety considerations are discussed. Tasks need to be suited to the age, fitness and ability of volunteers (as well as weather and site conditions) and volunteer groups should be supervised by an experienced volunteer supervisor. Suitable community tasks are discussed further in Section 6

4.2.4 Neighbouring properties

The private properties within 10m of the stream edge are highlighted in Figure 1. Some of these properties contain environmental weed species and invasive garden plants. These properties provide significant seed source threats for areas of restored habitat and contribute to downstream incursion. Neighbours should be encouraged and engaged with to carry out weed control through support from Auckland Council, to prevent continual reinvasion.

4.2.5 Stream bank stability and shade

It is important to acknowledge that the removal of vegetation along streams can increase the potential for stream bank erosion, subsidence along with reduced shade to the stream. The control of exotic grasses and herbaceous weeds should be avoided where possible, and stream banks should be revegetated as soon as environmental weeds have been controlled

to a low level. Low priority herbaceous weeds and grasses will be shaded out once a ground cover is achieved. If cover is lost due to weed removal, then 'living mulch', a rye-clover seed mix, can be spread to establish a quick and effective ground cover until planting is possible.

4.2.6 Sites of archaeological and cultural significance

No sites have been identified within this restoration area. However, the accidental discovery protocol adopted for the lower Te Auaunga - Oakley Creek should be use (see Appendix 3).

4.3 Environmental weed species control list

A site-led weed control approach should be followed at Upper Te Auaunga Awa - Oakley Creek. Table 2 highlights the key environmental weed species. The priority ranking relates to the impact of the weed on the site and RPMS status (Auckland Regional Council, 2007). Weed species and issues are likely to change over time as areas are taken out of mowing regimes and re-planted. This could provide more area for weed establishment. Bindweed and kikuyu grass are not included in the table as these species do not currently have a RPMS status. However, these species require a significant amount of volunteer / contractor effort to release manually from plantings in streamside areas to enable plantings to establish. This should be considered in future priorities. Species may also need to be reviewed when an updated Regional Pest Management Strategy is released. For a full list of relative abundance across the restoration area please refer to Appendix 1.

Table 2 Environmental weed species, RPMS status (2007) and priorities

Common Name	Botanical Name	RMPS 2007 STATUS	Priority
Acmena, monkey apple	*Syzygium smithii*	Surveilance	Low- control where not contributing to shade.
Agapanthus	*Agapanthus orientalis*	Surveillance	High- forms dense aeas suppressing native species
Alligator weed	*Alternanthera philoxeroides*	Surveillance	High- can spread through catchment
Arum lily	*Zantedeschia aethiopica*	Surveillance	High- can spread through catchment
Asparagus fern, bushy asparagus	*Asparagus aethiopicus*	Containment	High- can smother regenerating natives in shaded areas
Blue morning glory	*Ipomoea indica*	Surveillance	High- spreads quickly and can threaten plantings
Brush cherry	*Syzygium australe*	Surveillance- Hauraki Gulf Islands	Low- control where not contributing to shade.
Castor oil plant	*Ricinus communis*	Surveillance	Medium
Chinese privet	*Ligustrum sinense*	Surveillance	Low- control where not contributing to shade.
Chinese windmill palm	*Trachycarpus fortunei*	Research	Low
Climbing dock	*Rumex sagittatus*	Surveillance	Medium
Cotoneaster	*Cotoneaster glaucophyllus*	Surveillance	Low- control where not contributing to shade.
Crack willow	*Salix x fragilis*	Surveillance	Low- control where not contributing to shade.
Elephant's ear	*Alocasia brisbanensis*	Surveillance	High
English ivy	*Hedera helix*	Surveillance	Medium
Evergreen buckthorn	*Rhamnus alaternus*	Surveillance	Medium
German ivy	*Delairea odorata*	Surveillance	Medium
Gorse	*Ulex europaeus*	Surveillance/Community initiatives	Low
Hawthorn	*Crataegus monogyna*	Surveillance	Low
Hemlock	*Conium maculatum*	Surveillance	Low
Japanese honeysuckle	*Lonicera japonica*	Surveillance/Community initiatives	High
Japanese spindle tree	*Euonymus japonicus*	Surveillance	Medium- control where not contributing to stream shade
Jasmine	*Jasminum polyanthum*	Surveillance/Community initiatives	High
Kahili ginger	*Hedychium*	Containment	High
Madeira	*Anredera cordifolia*	Surveillance/Community initiatives	High
Mile-a-minute	*Dipogon lignosus*	Surveillance/Community initiatives	High- spreads quickly and can threaten plantings
Montbretia	*Crocosmia x*	Surveilance	Medium
Moth plant	*Araujia sericifera*	Containment	High- spreads quickly and can threaten plantings
Oxygen weed	*Lagarosiphon major, Egeria densa, Elodea canadensis, Hydrilla verticillata*	Surveillance (all except Elodea)	Low could be controlled by introducing shade
Palm grass	*Setaria palmifolia*	Surveillance/Community initiatives	High- can spread through catchment
Phoenix palm	*Phoenix canariensis*	Surveillance	Low- control where not contributing to shade.
Pitted crassula, fairy crassula	*Crassula multicava subsp. multicava*	Surveillance	Medium
Queen of the night	*Cestrum nocturnum*	Research	High- can spread through catchment
Queensland poplar	*Homalanthus*	Surveillance	Medium
Smilax	*Asparagus*	Containment	Low (introduced rust)
Tradescantia, wandering Jew	*Tradescantia fluminensis*	Surveillance	High
Tree privet	*Ligustrum lucidum*	Surveillance	Low- control where not contributing to shade.
Tuber ladder fern	*Nephrolepis cordifolia*	Surveillance	High- is in selected areas
Woolly nightshade	*Solanum mauritianum*	Containment	High - spreads quickly

5 Revegetation

5.1 Revegetation aims

Revegetation planting brings a number of positive outcomes for biodiversity, ecosystem function and amenity.

The aims of revegetation / restoration planting of Upper Te Auaunga Awa - Oakley Creek are outlined below to be consisted with the lower catchment. These aims are to:

- Assist and promote natural ecological processes.
- Provide buffering to wetland and riparian areas, which will help to filter out sediment and pollutants from runoff, therefore improving water quality.
- Restore the habitat structure and diversity of the existing vegetation which will provide more valuable food and habitat resources for native birds, reptiles and invertebrates, therefore attracting them into the area and maintaining their populations.
- Enhance the quality of habitat used by fauna within the stream and wetland areas (particularly macroinvertebrates and fish), including providing shading to help stabilise stream water temperatures.
- Augment natural regeneration, and act as a nurse crop to provide shelter for diversity and canopy species.
- Prevent the re-establishment of weeds.
- Help stabilise banks which will reduce erosion of the stream edge and decrease undercut banks from collapsing.
- Allow for unimpeded movement of flood waters by plants lying flat while flood water moves over them, which can help to reduce flows and mitigate high flow erosion.
- Protect the soil surface and enhance soil stability, decreasing sediment inputs into the stream.
- Link areas of existing riparian vegetation and regenerating forest habitats, to improve site connectivity and create continuous habitat.
- Create ecological connectivity to external sites through an enhanced wildlife corridor.
- Provide opportunities for mana whenua input and participation.
- Provide opportunities to engage the local community in restoration.
- Aesthetically enhance the area, thereby increasing the social and amenity value of the site and providing for recreational use of the stream corridor.
- Enhance the integrity of the creeks landscape and landforms.

Revegetation will take into account the need to maintain open areas for significant views of the landscape, recreation and public safety concerns. Any unknown archaeological sites will be protected through accidental discovery protocol.

5.2 Revegetation principles

Revegetation should follow best practice ecological restoration planting principles, including:

- Ensure plants are appropriate for the site and location considering substrate, correct zone of stream, and open, dry or steep slope. Alluvial soils are the main soil type of the restoration area with some possible volcanic influence around John Moore Reserve and Mt Roskill Intermediate School.
- Use predominantly pioneering / colonising species able to achieve canopy closure and sufficient ground cover.
- Use a small percentage of diversity species for later phase plantings considering natural seed availability within Te Auaunga Awa - Oakley Creek and the greater Tamaki Ecological District, natural niches, cost and success rates.
- Ensure all planting material is eco-sourced from naturally occurring indigenous stock growing within the Tamaki Ecological District or culturally appropriate (e.g. various harakeke varieties may be used for harakeke areas).
- Plant size should be appropriate to location. 1.5 L and 2L (PB3 equivalent) are recommended for revegetation projects. These allow for quick establishment minimising need for ongoing follow up. Smaller sizes such as 0.5L/ root trainer grade are appropriate for very rocky slopes and some grasses.
- Plant spacing of 1m on slopes and forest areas is ideal for achieving rapid establishment of native vegetation cover, which in turn reduces competition from weed species. Along the stream bank and wetland plantings are best carried out at .5 to .75m spacing.
- Planting should ideally take place during the months of May to August as long as soil conditions are suitable.
- Living mulch such as rye clover seed can be use around plantings if required to suppress weeds and cover the ground. Bark chip should be avoided where heavy rain events can wash this into the waterway.
- Planting maintenance is an important task to ensure establishment of plantings. This should be carried out for three years, ideally longer with 2-3 visits a year. Regular visits are required to prevent annual plants and weeds suppressing the establishment and growth of plantings.
- Accidental Discovery protocol for the lower catchment (see Appendix 3), this protocol should be followed although contacts for the upper catchment may differ.

5.2.1 Stream bank erosion / stability

Stream bank erosion and subsidence is a problem throughout the Te Auaunga Awa - Oakley Creek. The two main causes for this are likely to be: i) the lack of stream bank vegetation and ii) the rate at which the water flows through the stream. To reduce the occurrence of such erosion, banks should be revegetated with the appropriate plants. Plants need to be selected that will establish quickly and not get washed away or swamped by annual plants or weed re-growth.

5.2.2 Stormwater restoration opportunities

In the WMP and Upper Oakley Creek Restoration Plan (Morphum 2013) specific restoration opportunities have been identified and planned for through part of Mt Roskill Intermediate School (RO18) and a tributary on the western side of Keith Hay Park. This includes weed

control and planting recommendations. This plan should be used for restoration opportunities RO18 and Keith Hay Park tributary. However, it is not recommended that pūkio (*Carex secta*) or tarata (*Pittosporum eugenioides*) are planted. Appendix 4 includes maps from Morphum, 2013 outlining planting areas not covered by this plan.

5.2.3 Open spaces and view shafts

The restoration area holds significant recreational and amenity value for the community. It is important that sight lines and open spaces are maintained as much as possible. Within the planting recommendations, options have been given to some areas where either grass can be maintained or low vegetation planted to maintain sightlines along paths. Similarly, care should be taken with planting taller species within the identified view shafts from the Auckland Unitary Plan within War Memorial Park. It is important that revegetating does not compromise views of the awa / creek or any other landmarks.

5.2.4 Archaeological site revegetation

No archaeological sites have been identified within the proposed area for restoration. However, accidental discovery protocol should be followed. If archaeological sites are discovered and deemed appropriate for planting then species specified by Jones (2007) that have suitable root structure and form should be selected. Provided they are also suitable for the area / specific planting site for the re-vegetation of archaeological sites.

5.2.5 Living mulch

To assist in the regeneration of native vegetation, and to prevent the reinfestation of environmental weeds, rye-clover grass seed (known as living mulch) can be spread through the planted area, e.g. where there is bare soil, as this has been found to be very effective at other sites. It is likely that grass will gradually colonise bare ground naturally. However, spreading seed through areas prone to reinvasion and regrowth of weeds will speed up this process and reduce planting maintenance requirements.

5.2.6 Specimen tree planting

The planting of specimen trees should be limited to situations where amenity values / requirements are equal to ecological requirements. Otherwise, planting principles of dense coloniser plantings should be followed to achieve the ecological restoration goals of the project.

5.3 Specific planting lists by habitat / soil type

Planting units are based around a typical stream profile (see Figure 17) of regions starting from the stream edge, through to the slope above the floodplain along with seasonally wet areas for "swales" where wet depressions were identified. Within each management unit this stream-planting template can be used as the overall guideline for each area.

Original vegetation cover is likely to have been predominantly lowland broadleaf forest and wetlands in the lower reaches. Species chosen to revegetate a site are not necessarily those that would be found in these areas 'naturally'. For example a stream bank would naturally be occupied by a number of plant species that prefer damp conditions. The modified stream banks are hot and dry and, therefore, need to be initially planted with species that can tolerate these conditions. A number of species have been shown to establish well within modified stream banks and it is from these that the revegetation list has been predominantly chosen.

If there is a need to plant species not included in the below lists these should be chosen in consultation with Auckland Council Biodiversity team or Auckland Council Senior Regional Advisor (Flora).

It is not recommended that threatened species are planted through this area due to its highly modified state. Any threatened species to be introduced in the future will need to gain approval from the Auckland Council Senior Regional Advisor (Flora) and follow appropriate protocol.

Diversity planting needs to be appropriate to the distinct vegetation type / ecosystem that is appropriate for the location, so that homogenous or generic vegetation types are not created.

These vegetation types include:

- Lowland Broadleaf Forest of the creek on the slopes.
- Riparian vegetation and wetland vegetation along the stream banks and wetter areas.
- Alluvial Forest along the floodplain and lower slopes, where alluvial soils exist.

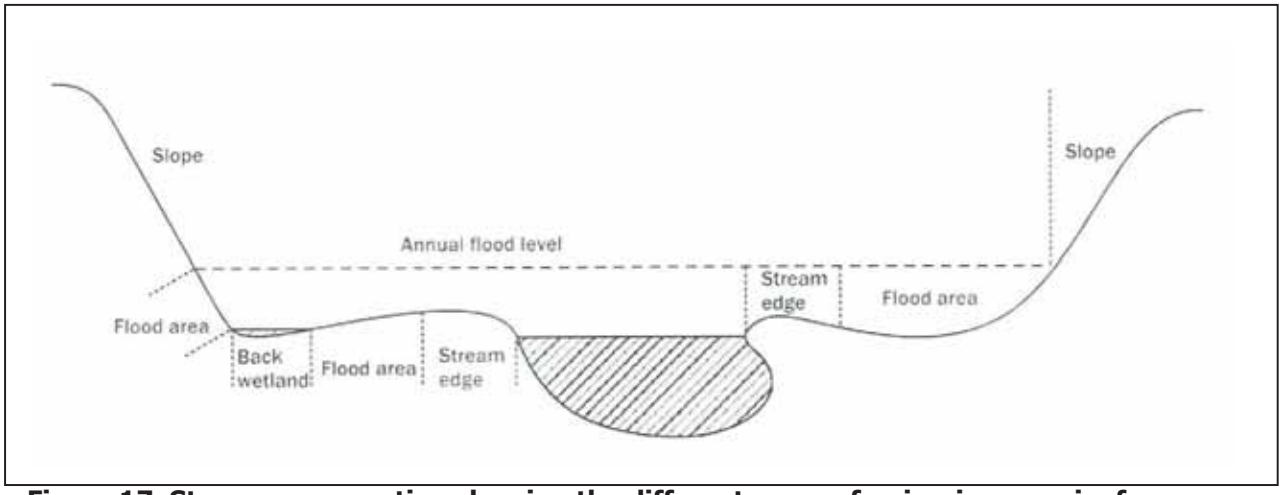

Figure 17. Stream cross section showing the different areas of a riparian margin, from TP148 Auckland Regional Council, June 2001

5.3.1 Stream edge

The stream edge is the most important area to revegetate to reduce stream bank erosion subsidence and provide shade. The stream bank should be a priority when revegetating all areas.

A stream edge is:

- The first 2-3m from the stream, including the lip of the bank.
- Frequently damp, but can be hot and dry during summer months.
- Water is likely to reach upper levels of the bank.
- Erosive forces are considerable.

Plants within the stream bank unit perform a number of important functions; therefore it is essential that species chosen are appropriate to this area (see Table 3 for recommended species).

Vegetation such as sedges and grasses in particular will:

- Prevent the establishment of some weeds that have been washed down from upper reaches of the stream.
- Stabilise banks i.e. reduce erosion of the stream edge.
- Enhance the quality of habitat used by fauna within the stream.
- Filter out sediment and pollutants from runoff.
- Allow for unimpeded movement of flood waters by plants lying flat while flood water moves over them.
- Provide ground cover to provide adequate habitat for native invertebrates and reptiles.

Stream edge habitat exists in areas where the banks are low enough to the watercourse such as the esplanades beside the schools, John Moore Reserve. It could also include War Memorial Park and Keith Hay Park, where preferably the concrete lined stream would be removed and naturalised prior to planting.

Table 3 Appropriate stream edge planting species

Common name	Species	Composition in planting	Traditional Maori uses from Landcare (2016)	Planting notes
Coloniser species				
upokotangata/ giant umbrella sedge	*Cyperus ustulatus*	Common	Medicinal, weaving, construction and kites	Plant in groups.
rautahi	*Carex lessoniana*	Abundant		Plant in groups. Prefers wetter conditions.
purei/ small swamp sedge	*Carex virgata*	Common		Plant in groups. Can cope with wet or dryer conditions. Can be outcompeted by annuals.
toetoe	*Austroderia fulvida*	Abundant	Cooking, weaving, construction, hunting, ceremonies	Plant in groups
Diversity species				
purei/ flat-leaved sedge	*Carex dissita*	Common		This sedge is easily smothered by weeds therefore is ideal as an infill species once the majority of weeds have been controlled and shaded out.
putaputaweta	*Carpodetus serratus*	Sparingly		Tolerates sun and semi-shade. Prefers wetter conditions.
kiokio	*Blechnum novae-zelandiae*	Sparingly	Food (wrap for hangi)	Plant in shade where possible. May be difficult to source.
toetoe	*Austroderia fulvida*	Abundant	Cooking, weaving, construction, hunting, ceremonies	Plant in groups.
mahoe	*Melicytus ramiflorus*	Sparingly	Medicinal, dyes, domestic.	Plant to provide some shade.
manuka	*Leptospermum scoparium*	Sparingly	Medicinal, domestic, construction, fishing/hunting, gardens.	Plant to provide some shade.
mapou	*Myrsine australis*	Sparingly	Medicinal, domestic, fishing	Plant to provide some shade.
karamu	*Coprosma robusta*	Sparingly	Medicinal, food, fibre, dyes and ceremonies.	Plant to provide some shade.
Silver fern, ponga	*Cyathea dealbata*	Sparingly	Medicinal, food, fishing/ hunting	Plant in appropriate locations to create some shade.
mamaku	*Cyathea medularis*	Sparingly		Plant in appropriate locations to create some shade.

Note: *Carex secta* is commonly suggested as an appropriate plant for revegetating riparian areas. However, it is naturally only found in areas of standing water and not in flowing water (McKain, 2004), therefore, it is inappropriate for the riparian margins of Te Auaunga Awa - Oakley Creek.

* There is some discussion amongst botanists regarding the hybridisation / difference between *Carex lessoniana* and *Carex geminata*. There is some argument that *C. geminata* is more of a West Coast species in the Auckland Region whilst *C. lessoniana* is found more often in Auckland central areas. Others refer to *C. geminata agg.* as these two species are known to hybridise and are difficult to differentiate. For simplicity and as a preference *C. lessoniana* is used throughout this restoration plan.

5.3.2 Flood areas and floodplains

The flood area / floodplain is:

- Stream flat and toe of adjacent slope.
- The stream flat that is frequently subject to flooding.
- Generally high fertility and moisture levels.
- Low erosion forces.

Plants within the floodplain carry out important functions such as protecting the soil surface and enhancing the stability of the area. As with the stream bank plants should have low resistance to flood waters which in turn reduces the potential for erosion. It should be noted that plants such as harakeke, that have a high resistance to flood waters, should not be planted in the flood plain zone.

A small number of trees can be planted sparingly to add diversity, create shade and attract native fauna to the area. Table 4 below shows details of appropriate species to plant within floodplain areas.

This could potentially include an area in Molley Green Reserve or elsewhere where the stream channelling is naturalised / modified.

Table 4 Appropriate flood area / floodplain planting species

Common name	Species	Composition in planting	Taditional Maori uses from Landcare (2016)	Planting notes
Coloniser species				
upokotangata/ giant umbrella sedge	*Cyperus ustulatus*	Common	Medicinal, weaving, construction and kites	Plant within the floodplain, close to the stream bank region.
mahoe	*Melicytus ramiflorus*	Sparingly		
rautahi	*Carex lessoniana*	Common		Plant in groups along the stream flat. Prefers wetter conditions.
purei/ small swamp sedge	*Carex virgata*	Common		Plant in groups. Can cope with wet or dryer conditions. Can be outcompeted by annuals.
ti kouka, cabbage tree	*Cordyline australis*	Sparingly	Food, fibre, constructions, fishing/ hunting	Plant in clumps of 3-4 plants.
toetoe	*Austroderia fulvida*	Abundant	Cooking, weaving, construction, hunting, ceremonies	Plant along the toe of the slope and on the floodplain.
Diversity species				
purei/ flat-leaved sedge	*Carex dissita*	Common		This sedge is easily smothered by weeds therefore is ideal as an infill species once the majority of weeds have been controlled and shaded out.
kahikatea	*Dacrycarpus dacrydioides*	Sparingly	Medicinal, food, dyes, domestic, construction, fishing.	Plant on the toe of the slope and in floodplain.
pukatea	*Laurelia novae-zelandiae*	Sparingly	Domestic, construction, fishing.	Characteristic of wet sites, the trunk offers low resistance to flood waters.
putaputaweta	*Carpodetus serratus*	Sparingly		Plant along the toe of the slope and sparingly on floodplain.
mahoe	*Melicytus ramiflorus*	Sparingly	Medicinal, domestic, construction, fishing/hunting, gardens.	Plant along the toe of the slope and sparingly on floodplain.
manuka	*Leptospermum scoparium*	Sparingly	Medicinal, domestic, fishing	Plant along the toe of the slope and sparingly on floodplain.
ponga, silver fern	*Cyathea dealbata*	Sparingly	Medicinal, food, fishing/ hunting	Plant in appropriate locations to create some shade.
mamaku	*Cyathea medullaris*	Sparingly		Plant in appropriate locations to create some shade.

5.3.3 Swales, seasonally wet areas, back wetland or springs

The back wetland or spring is:

- Wet for some of the year.
- Arises when a stream changes course, springs emerge or stream banks have accreted.
- Has little or no erosion.

Plants in this region of the riparian margin need to be tolerant of permanently wet conditions (or in some cases seasonally wet conditions) as described in Table 5.

Swales of wet pasture were identified at War Memorial Park and John Moore Reserve where there are overland flow paths. There are no current back wetlands or springs identified but could possibly be incorporated into the area if naturalisation of the channel is undertaken at Keith Hay Park and War Memorial Park.

Table 5 Appropriate back wetland / spring or seasonally wet planting species

Common name	Species	Composition in planting	Taditional Maori uses from Landcare (2016)	Planting notes
Coloniser species				
upokotangata/ giant umbrella sedge	*Cyperus ustulatus*	Common	Medicinal, weaving, construction and kites	Plant on margin of wetland.
manuka	*Leptospermum scoparium*	Sparingly		Plant on margin of wetland.
rautahi	*Carex lessoniana*	Common		Plant in groups.
small swamp sedge	*Carex virgata*	Common		Plant in groups. Can be outcompeted by annuals.
ti kouka, cabbage tree	*Cordyline australis*	Common	Food, fibre, constructions, fishing/ hunting	Plant in groups of 3-4 plants.
flax / harakeke	*Phormium tenax*	Common	Medicinal, weaving, dyes, domestic, construction, fishing/ hunting, gardens, traditions.	Do not plant near stream edge.
Diversity species				
kahikatea	*Dacrycarpus dacrydioides*	Sparingly	Medicinal, food, dyes, domestic, construction, fishing.	Canopy. Plant on margin of wetland.
pukatea	*Laurelia novae-zelandiae*	Sparingly	Domestic, construction, fishing.	Canopy. Characteristic of wet sites, the trunk offers low resistance to flood waters.
kiokio	*Blechnum novae-zelandiae*	Sparingly	Food (wrap for hangi)	Plant on margin of wetland.
swamp maire	*Syzygium maire*	Sparingly	Medicinal, Dye and Food	Canopy. May be difficult to source.

When planting in the riparian zones and on alluvial forest slopes at Te Auaunga Awa - Oakley Creek the following three gahnia species could be considered, for diversity planting. The most appropriate species needs to be considered based on the suitability of the site and potential survival success rate / competition from other species (see Table 6).

Table 6 Gahnia to be considered for diversity planting

Common name	Species	Composition in planting	Taditional Maori uses from Landcare (2016)	Planting notes
cutty sedge	*Gahnia lacera*	Sparingly		Colonising a variety of substrates which may be seasonally waterlogged, though otherwise dry. Usually found in scrub or open forest.
mapere, giant Gahnia	*Gahnia setifolia*	Sparingly		Mostly in lowland areas in light forest, scrub and lining streams. Sometimes colonising the fringes of swamps.
mapere, giant Gahnia	*Gahnia xanthocarpa*	Sparingly		Not recorded in surveys at Oakley Creek. Occupying a diverse range of habitats, seems to prefer permanently damp situations within alluvial forest, swamp forest and the margins of waterways.

5.3.4 Slopes and open areas

Slopes of varying steepness generally arise from either the floodplain or back wetland. Slopes are drier than stream flats, however flooding can often extend to the toe of the slope. The substrate varies at Te Auaunga Awa - Oakley Creek (i.e. volcanic or alluvial) and the species composition of planting needs to vary accordingly, as described below.

Plant species on the slopes above the floodplain should primarily be chosen for their ability to establish and grow quickly to form a 'nursery crop' to form cover to prevent the re-establishment of environmental weeds. Later diversity and canopy species can be added to enhance the forest structure. On the upper slopes plants must be able to tolerate dry, hot conditions as opposed to the wet conditions on the flood plain and toe of the slope.

Alluvial slope (majority of areas excluding part of John Moore Reserve, Freeland Reserve and Mt Roskill Intermediate School)

The upper reaches of Te Auaunga Awa - Oakley Creek are more suited to species appropriate for alluvial slopes. Alluvial slope areas exist in Keith Hay Park and War Memorial Park. The following planting list should be used on these slopes (Table 7).

Table 7 Appropriate species for the alluvial slope planting

Common name	Species	Composition in planting	Taditional maori uses from Landcare (2016)	Planting notes
Coloniser species				
harakeke, flax	*Phormium tenax*	Abundant	Medicinal, weaving, food, dyes, domestic, construction, gardens.	Plant throughout the slope.
kanuka	*Kunzea robusta**	Common	Medicinal, construction, fishing.	Plant throughout the slope.
karamu	*Coprosma robusta*	Abundant	Medicinal, food, fibre, dyes and ceremonies.	Plant throughout slope.
mahoe	*Melicytus ramiflorus*	Common	Medicinal, dyes, domestic.	Plant throughout the slope.
manuka	*Leptospermum scoparium*	Common	Medicinal, domestic, construction, fishing/hunting, gardens.	Plant throughout the slope.
ti kouka, cabbage tree	*Cordyline australis*	Common	Food, fibre, constructions, fishing/ hunting	Plant in groups in the lower portions of the slope.
mapou	*Myrsine australis*	Common	Medicinal, domestic, fishing	Plant thoughout the slope.
toetoe	*Austroderia fulvida*	Abundant	Cooking, weaving, construction, hunting, ceremonies	Plant throughout the slope, especially in open areas.
Diversity species				
five-finger	*Pseudopanax arboreus*	Sparingly	Dyes, domestic, fishing.	Understorey.
karaka	*Corynocarpus laevigatus*	Sparingly	Food (toxic warning), gardens.	Canopy.
kawakawa	*Piper excelsum subsp. excelsum*	Sparingly	Medicinal, food, domestic, pesticide.	Understorey.
kohekohe	*Dysoxylum spectabile*	Sparingly	Medicinal, construction, fishing.	Canopy.
koromiko	*Hebe stricta var. stricta*	Sparingly	Medicinal, food, ceremonies.	Understorey.
kowhai, small-leaved	*Sophora microphylla*	Sparingly	Medicinal, dyes, domestic, construction, fishing/hunting.	Canopy. Plant at minimum of 2-3m spacing.
pate	*Schefflera digitata*	Sparingly	Medicinal, dyes and domestic.	Understorey. Requires shelter and shade.
puriri	*Vitex lucens*	Sparingly	Medicinal, food, dyes, domestic, construction.	Canopy. Plant throughout the slope, at minimum 3-5 m spacing.
taraire	*Beilschmiedia tarairi*	Sparingly	Food, domestic, construction and fishing.	Canopy.
titoki	*Alectryon excelsus*	Sparingly	Medicinal, food, domestic, construction.	Canopy and understorey. Plant throughout slope
totara	*Podocarpus totara*	Sparingly	Medicinal, food, domestic, construction, fishing/hunting, musical instruments.	Canopy.
rewarewa	*Knightia excelsa*	Sparingly	Medicinal, food, domestic, traditions.	Canopy.
gully fern	*Pneumatopteris pennigera*	Sparingly	Medicinal, food.	Plant in appropriate locations.

* Kānuka species (*Kunzea sp.*) in New Zealand have recently been re-classified by Peter de

Lange and he has recommended that the appropriate *Kunzea* species to be planted in the central Auckland area is *Kunzea robusta*.

In addition to this there is a clay influence within these areas and on dry open slopes the following colonising species which are adapted to these conditions could be planted:

- Whau (*Entelea arborescens*)
- Akepiro (*Olearia furfuracea*)
- Kūmarahou (*Pomaderris kumeraho*)
- Kānuka (*Kunzea robusta*)
- Tōtara (*Podocarpus totara var. totara*)
- Flax / harakeke (*Phormium tenax*)

Volcanic soils (John Moore Reserve, Freeland Reserve and Mt Roskill Intermediate School)

The esplanade beside Mt Roskill Intermediate School and John Moore Reserve area is classed as containing volcanic soils (see Figure 3). Therefore it is recommended to use plants suitable to volcanic soils in this area. These plants are best placed above the area that is likely to be subject to flooding. The following planting list is to be used for these areas (see Table 8).

Table 8 Appropriate species for volcanic slopes

Common name	Species	Composition in planting	Traditional Maori uses from Landcare (2016)	Planting notes
Coloniser species				
hangehange	*Geniostoma ligustrifolium var. ligustrifolium*	Common		Understorey.
karamu	*Coprosma robusta*	Common	Medicinal, food, fibre, dyes and ceremonies.	Understorey. Plant throughout slope.
mahoe	*Melicytus raimiflorus*	Common	Medicinal, dyes, domestic.	Canopy and understorey. Plant throughout slope.
mapou	*Myrsine australis*	Common	Medicinal, domestic, fishing	Understorey. Plant throughout slope.
shining karamu	*Coprosma lucida*	Sparingly	Medicinal, food, dyes, ceremonies.	Understorey. Plant throughout slope. Not noted in Mahoe rock forest areas at Oakley Creek (but may be present).
Diversity species				
karaka	*Corynocarpus laevigatus*	Sparingly	Food (toxic warning), gardens.	Canopy.
kawakawa	*Piper excelsum subsp. excelsum*	Sparingly	Medicinal, food, domestic, pesticide.	Understorey.
kohekohe	*Dysoxylum spectabile*	Sparingly	Medicinal, construction, fishing.	Canopy. Plant at minimum 2-3m spacing.
mangeao	*Litsea calicaris*	Sparingly	Medicinal, domestic, fishing.	Canopy. Difficult to source - use local rock forest sites. Plant sparingly as not dominant part of canopy.
pigeonwood	*Hedycarya arborea*	Common	Medicinal, domestic, musical instruments.	Understorey.
puriri	*Vitex lucens*	Sparingly	Medicinal, food, dyes, domestic, construction.	Canopy. Plant throughout the slope, at minimum 3-5m spacing. Only found rarely occurring naturally in Oakley Creek mahoe rock forest MU 8 areas.
titoki	*Alectryon excelsus*	Common	Medicinal, food, domestic, construction.	Canopy and understorey.

5.4 Restoration Programme

A flexible approach is needed when planning planting. As a number of factors may affect when a site is ready for planting, such as long term plans, weed levels being sufficiently controlled, availability of budget, soil factors (such as buried rubbish), availability of suitable plants, stormwater requirements and archaeological requirements. In the following sections are a list of restoration opportunities according to channel type and proposed planting areas.

Part of the stormwater reserves beside Mt Roskill Grammar School, Mt Roskill Intermediate School and the tributary on the western side of Keith Hay Park have been covered in a restoration plan by Morphum 2013. This document should be referred to for planting within these areas (see Appendix 4 for planting areas).

5.4.1 Restoration options

Within the restoration area, there are three main types of channel. These are discussed in the following sections**.**

1. Deep cut straightened channels

This includes the stormwater reserves from May Road to Mt Roskill Intermediate School.

These comprise of deep cut channels and some overhanging vegetation providing shade. The riparian edge consists of very narrow ledges between the stream and boundary fences. Restoration options below are in order of maximum benefit to the awa including:

1. Purchase of properties and naturalisation of creek area. A number of houses are constructed close to the stream edge and would require their removal.

2. Encourage, support and promote planting of boundaries on neighbouring properties with species that will provide shade to the creek and can replace weed canopy.

3. Undertake no planting, maintain a weed control programme. Support and educate neighbouring properties with weed control efforts

2. Straightened channels without concrete lining

This includes sections of John Moore Reserve, Keith Hay Park tributary, Freeland Reserve, Arkles Reserve and the stormwater reserve beside Mt Roskill Grammar School and Mt Roskill Intermediate School. Restoration options below are in order of maximum benefit to the awa including:

1. Continue planting programme within the reserve areas and support / encourage additional planting within school, Akarana Golf Club and Land Transport properties.

2. Continue planting programme through these sections within the reserve areas.

3. Straightened channels with concrete lining

This includes concrete lined channels at Keith Hay Park and War Memorial Park. Restoration options below are in order of maximum benefit to the awa including:

1. Naturalisation of the stream bed and channel. This could include a process similar to what is being undertaken in Walmsley and Underwood Reserves.

2. Retain concrete lined channel and plant riparian areas to increase shade of the awa.

4. Underground pipes

This includes areas within Molley Green Reserve, Freeland Reserve and Keith Hay Park. Restoration options below are in order of maximum benefit to the awa including:

1. Daylighting and naturalisation of the stream bed and channel. Including planting of riparian species and creating a natural habitat.

2. Keep the area as an underground pipe.

5.4.2 Keith Hay Park planting areas

Figure 18 Keith Hay Park MU1 planting areas

Figure 19 Keith Hay Park MU2 planting areas

5.4.3 Public Open Space beside Mt Roskill Intermediate and Mt Roskill Grammar Schools and John Moore Reserve planting areas

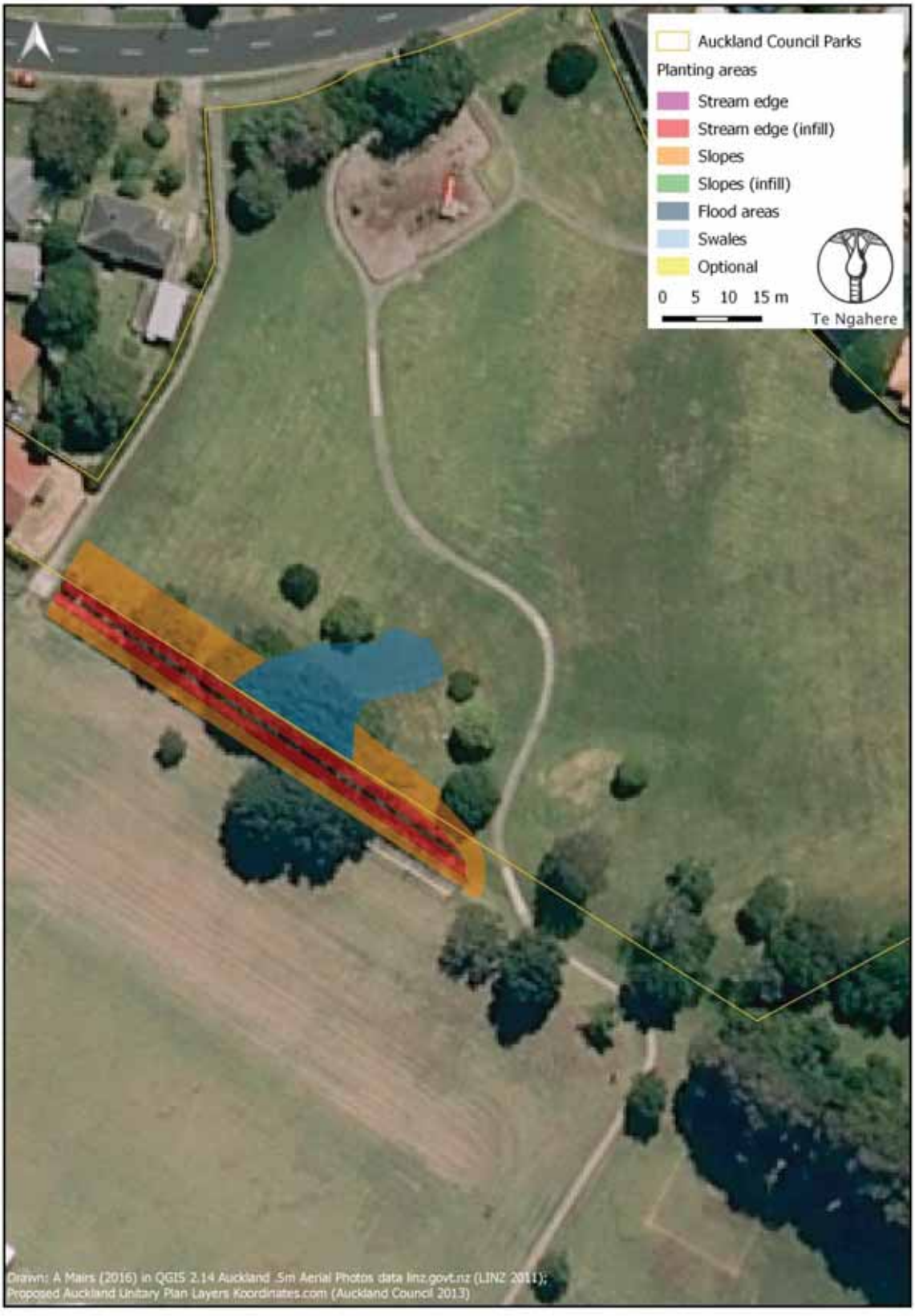

Figure 20 John Moore Reserve MU1 planting areas

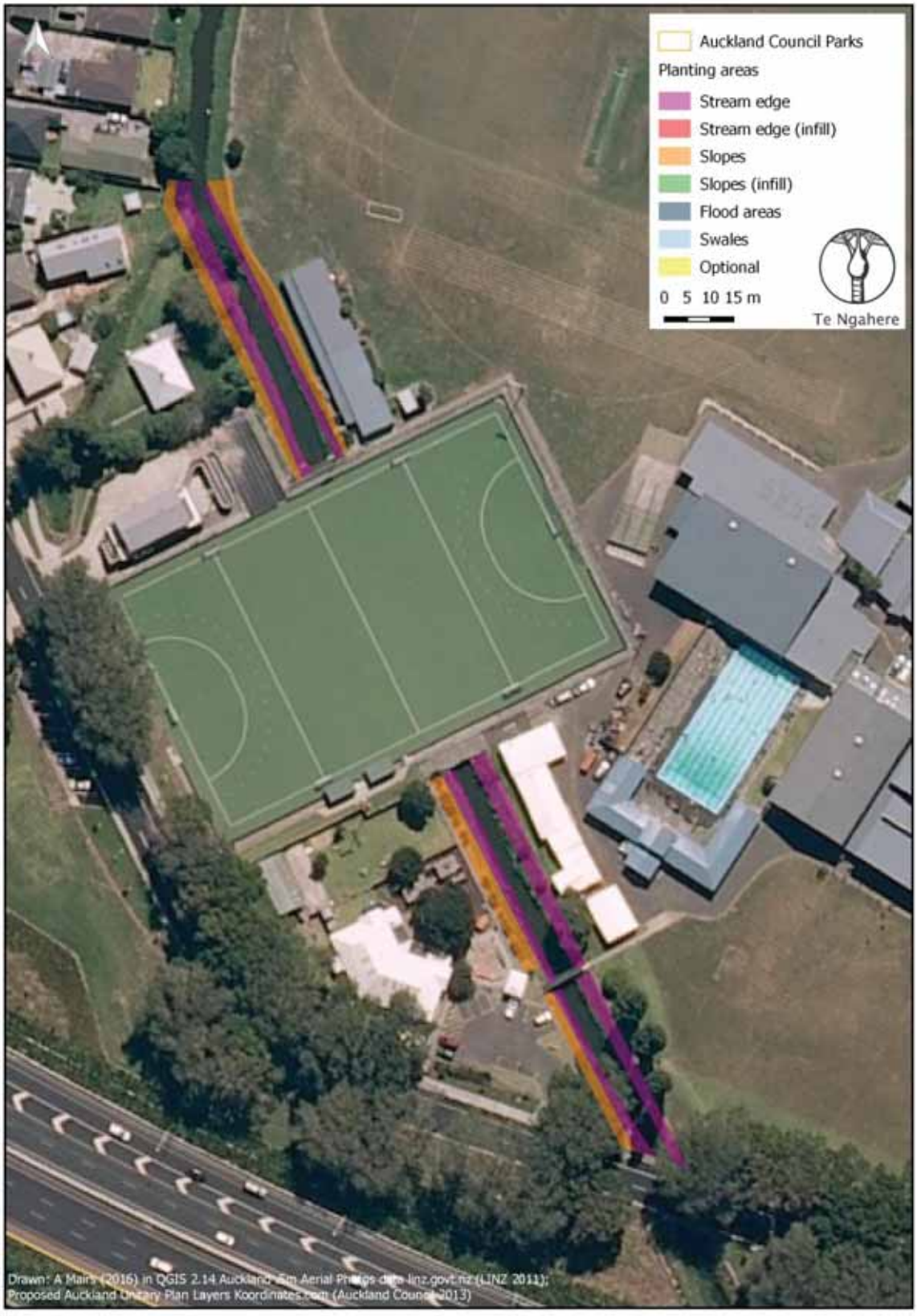

Figure 21 Mount Roskill Grammar School MU 4 planting areas

5.4.4 War Memorial Park planting areas

Figure 22 War Memorial Park MU1 planting areas

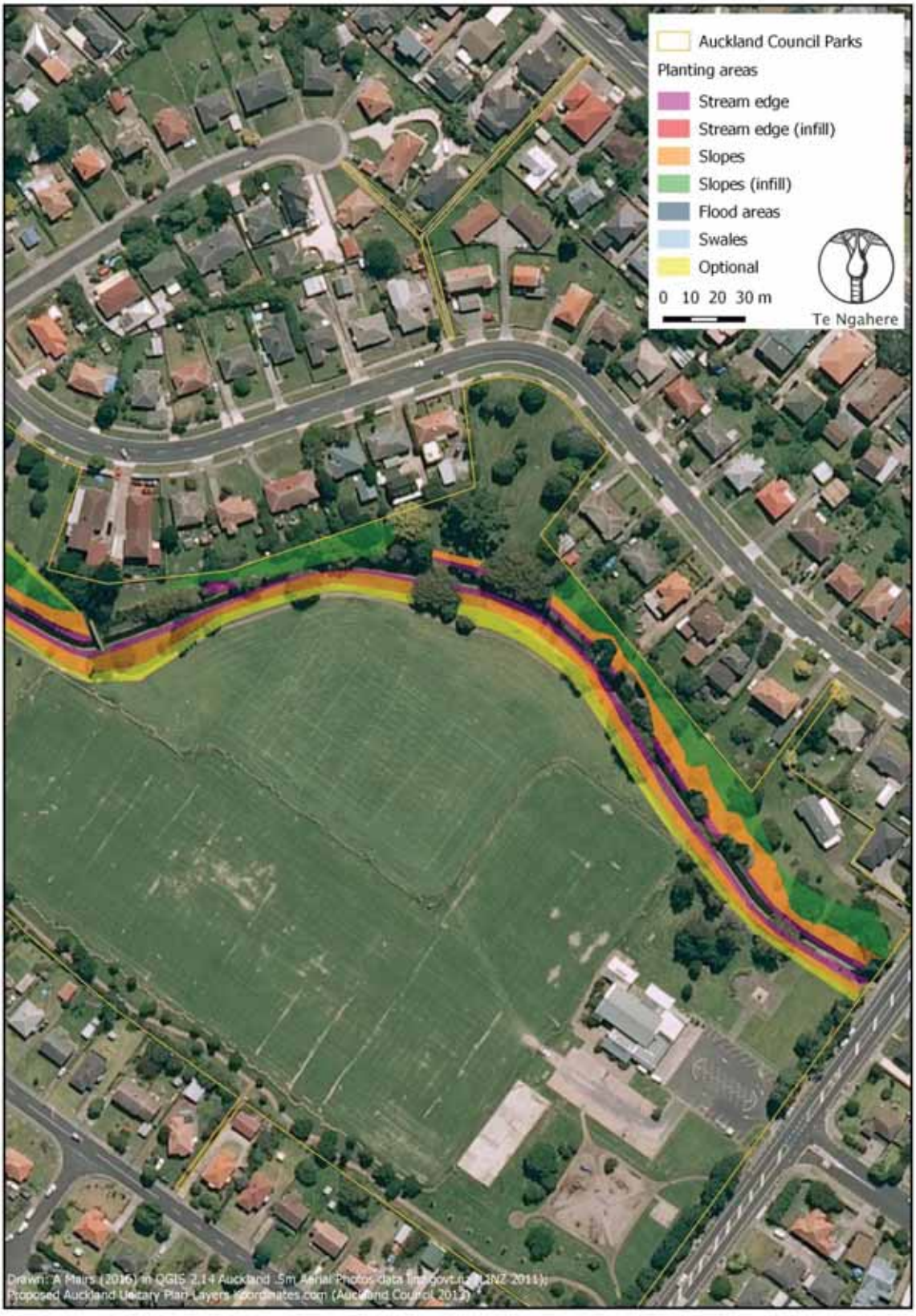

Figure 23 War Memorial Park MU2 planting areas

5.4.5 Freeland Reserve planting areas

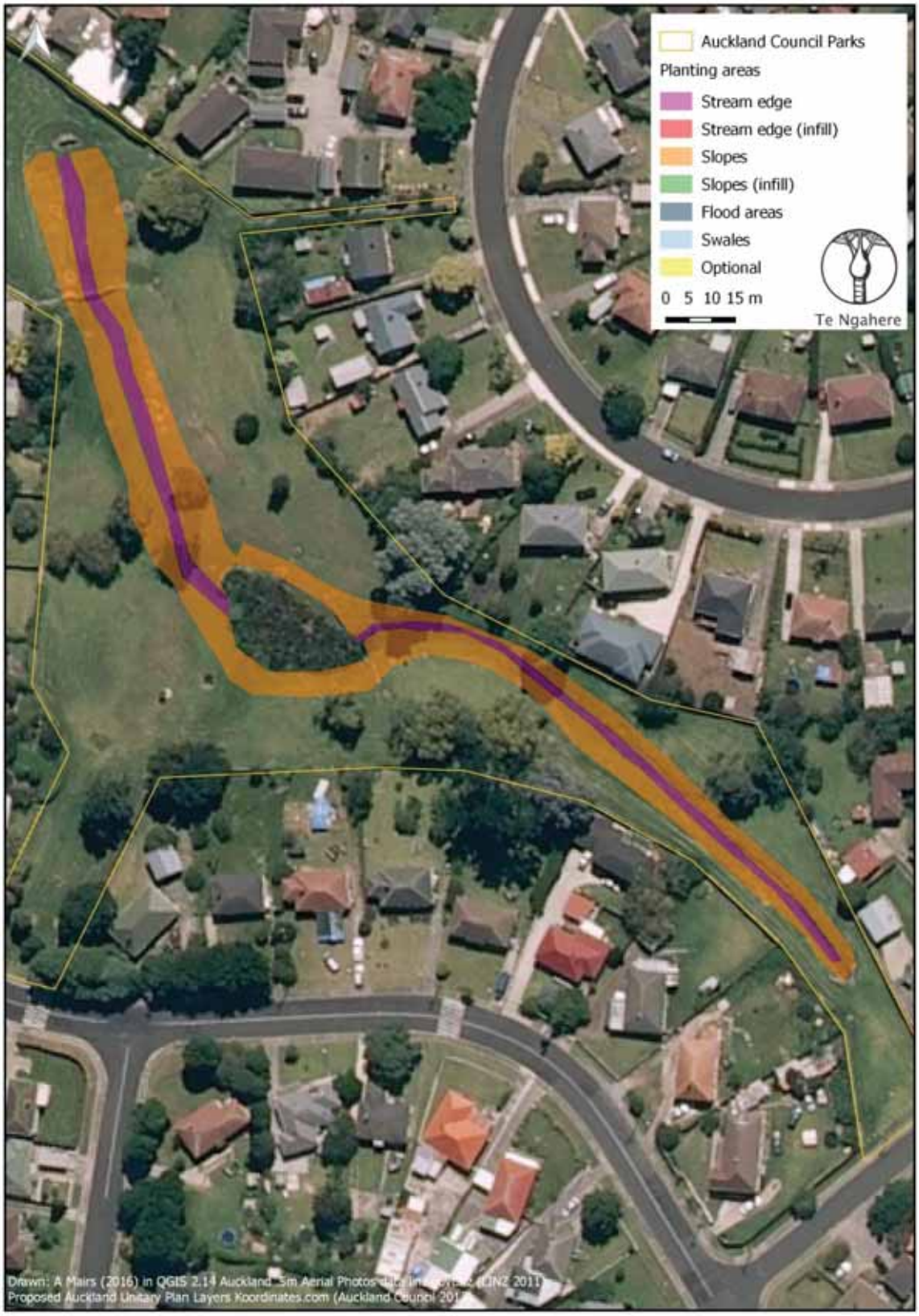

Figure 24 Freeland Reserve planting areas

5.4.6 Arkles Reserve planting areas

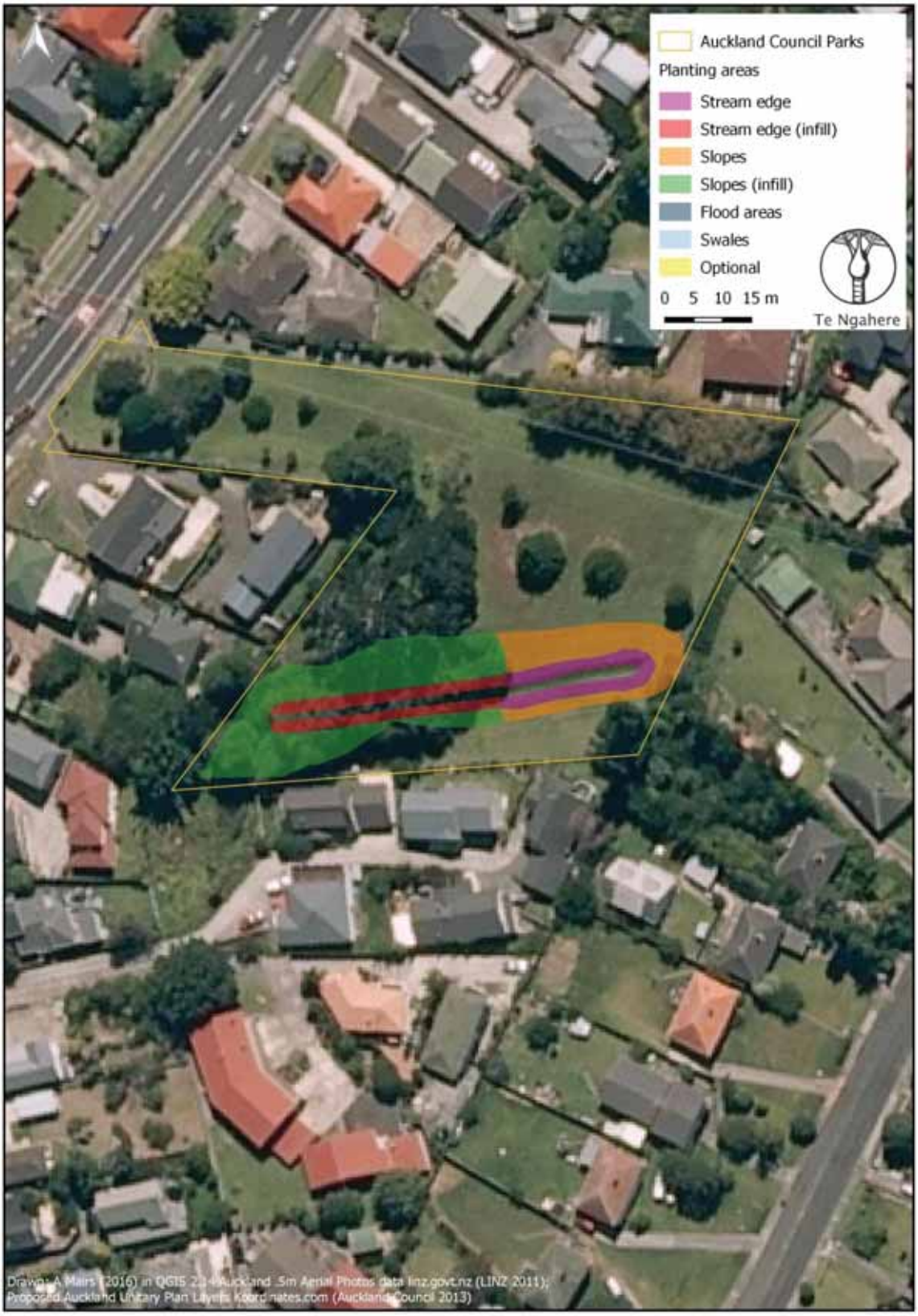

Figure 25 Arkles Reserve planting areas

5.4.7 Molley Green Reserve planting areas

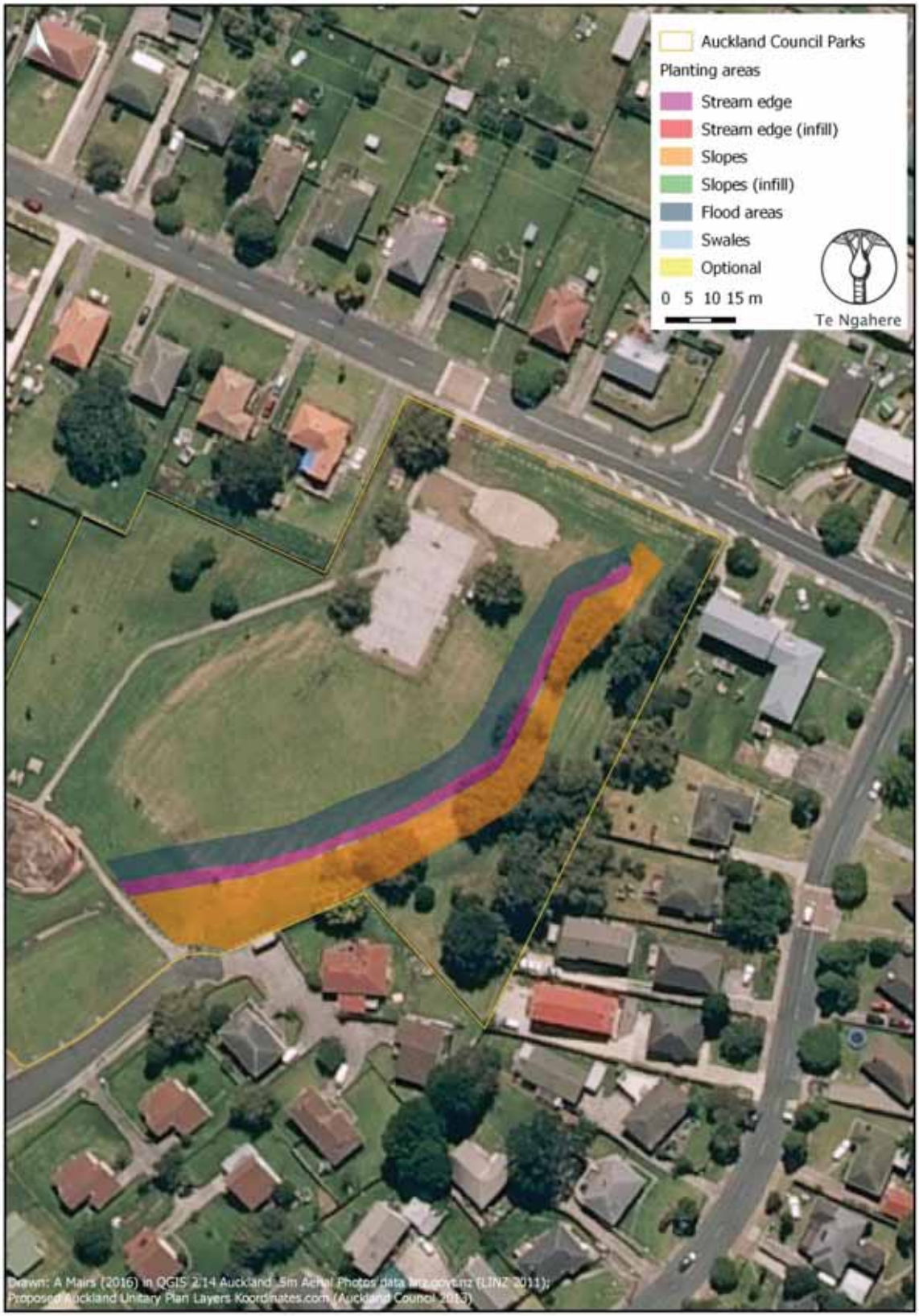

Figure 26 Molley Green Reserve planting areas

6 Community Involvement

Community engagement is encouraged and vitally important to ensure a long-term focus and the success of this project. This has been vital to the success of restoration of the lower Te Auaunga Awa - Oakley Creek being initiated and driven by an active volunteer group (Friends of Oakley Creek Te Auaunga Awa).

Co-operation and communication between FOOC, neighbouring landowners, schools, Auckland Council, Iwi and contractors working in the area is vital to ensure all efforts are combined and focused towards achieving a common goal. Through engagement in this restoration programme locals can develop a sense of community stewardship and ownership. It also increases awareness of environmental, archaeological, cultural and stream restoration issues (such as the impacts of environmental weeds and the impacts of urbanisation on stream quality).

Suitable community restoration tasks on Te Auaunga Awa - Oakley Creek include:

- Planting
- Planting maintenance - it is recommended that volunteers be involved in plant maintenance of new / young plantings, as this can be more cost effective than using contractors and reduce use of herbicides.
- Manual weed control (such as cutting of vines including bindweed).
- Animal pest control e.g. rodents and possums (once there is sufficient habitat for hiding traps).
- Monitoring e.g. birds, weta, aquatic fauna and water quality.

6.1 Weed control

It is recommended that a comprehensive programme of weed control continue to be undertaken by qualified contractors due to the variety and extent of weed issues that exist across Oakley Creek, which requires spraying to be managed effectively. The weed control focus of volunteers should be on manual methods that do not require herbicide, or managing weeds that can be effectively controlled through cut and paste. This can involve:

- Hand releasing of exotic vines from trees and shrubs.
- Pulling out weed seedlings.
- Digging out small areas of weed infestation, where feasible, (note that care must be taken to ensure the entire root system is removed).

Where appropriate, some weeds such as bindweed and *Tradescantia* can be put into weed bags, and left to compost down. The control of any species that can regrow from small fragments (e.g. *Tradescantia*) should be carried out with extreme care. In most cases it is likely that foliar spraying the weed on site would prove more beneficial. This should be undertaken by contractors. However, small areas of these weeds can be dealt with effectively by volunteers, to prevent them spreading.

6.2 Community plantings

Community plantings, co-ordinated by Friends of Oakley Creek, have made a significant contribution to the restoration of Te Auaunga Awa - Oakley Creek. Volunteers, schools, iwi and local community groups should continue to be engaged in planting opportunities wherever possible.

6.3 Monitoring

It is important to undertake some form of monitoring to gauge the effectiveness and success of the ecological restoration programme, including the weed and animal pest control operations and revegetation plantings.

Monitoring could include:

- Fauna monitoring for birds, weta and lizards.
- Aquatic / water quality monitoring.
- Vegetation monitoring.
- Animal pest monitoring if control is undertaken.
- Photo point monitoring to assess change over time for weed control and plantings.

Ideally monitoring data, if collected by various groups, would be collated to a central location for future reference and analysis.

7 Summary of restoration options

Table 9 Summary of restoration options for the Upper Te Auaunga Awa - Oakley Creek

Summary of Restoration Options					
Management Unit	Environmental Weed Control	Comments	Planting Programme	Comments	Could be planted by community
Keith Hay Park					
MU1	High	Good accessibility, number of environmental weeds that can disperse downstream.	Medium-long term	Will require a decision on whether to keep the concrete channel or not.	Yes
MU2	High	Good accessibility, number of environmental weeds that can disperse downstream.	Medium-long term	Will require a decision on whether to keep the concrete channel or not.	Yes
MU3	High	Good accessibility, number of environmental weeds that can disperse downstream.	Short term	No concrete, could be prepared quickly.	Yes
Public open space beside school and John Moore Reserve					
MU1	High	Mixed accessibility with very steep slopes in parts, number of environmental weeds that can disperse downstream.	Short term	No concrete, could be prepared quickly.	Yes
MU2	High	Mixed accessibility with very steep slopes in parts, number of environmental weeds that can disperse downstream.	Short term	No concrete, could be prepared quickly.	Not very steep in parts, however buffer plantings on School grounds could be planted by community.
MU3	High	Mixed accessibility with very steep slopes in parts, number of environmental weeds that can disperse downstream.	Short term	No concrete, could be prepared quickly.	Not very steep in parts, however buffer plantings on school grounds could be planted by community.
MU4	High	Mixed accessibility with very steep slopes in parts, number of environmental weeds that can disperse downstream.	Short term	No concrete, could be prepared quickly.	Not very steep in parts, however buffer plantings on school grounds could be planted by community.
Stormwater Reserves					
	Medium	Limited access to narrow ledge, some control could be undertaken from stream channel and road edges.	Long term	Would require purchase of private properties. Could support neighbouring properties with planting their boundaries.	TBC
War Memorial Park					
MU1	High	Good accessibility, number of environmental weeds that can disperse downstream.	Medium-long term	Will require a decision on whether to keep the concrete channel or not.	Yes
MU2	High	Good accessibility, number of environmental weeds that can disperse downstream.	Medium-long term	Will require a decision on whether to keep the concrete channel or not.	Yes
Molley Green Reserve					
	Medium	Good accessibility to existing plantings with currently low level of environmental weeds.	Medium-long term	Will require a decision on whether daylighting could take place.	Yes
Arkles Reserve					
	High	Good accessibility to existing areas with high levels of environmental weeds that can disperse downstream.	Short term	No concrete, could be prepared quickly.	Yes
Freeland Reserve					
	High	Good accessibility to existing plantings with currently low level of environmental weeds.	Short term	No concrete, could be prepared quickly.	Partial (steep slopes may require contractor planting)

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Appendix 1 Environmental weed species and exotic plants recorded and relative abundance

Common Name	Botanical Name	RMPS 2007 STATUS	War Memorial Park	Stormwater	John Moore	Keith Hay Park	Keith Hay Trib	MRGS	MRIS	MRIS Trib	Molley Green	Arkles	Freeland
Acmena, monkey apple	*Syzygium smithii*	Surveilance	Boundary										
Agapanthus	*Agapanthus orientalis*	Surveillance	Occasional	Moderate	Moderate	Moderate	Occasional		Occasional			Occasional	
Alligator weed	*Alternanthera philoxeroides*	Surveillance	Occasional		Moderate		Moderate	Moderate	Moderate		Occassional		Moderate
Apple	*Malus domestica*			Incidental									
Arum lily	*Zantedeschia aethiopica*	Surveillance	Occasional	Occasional	Moderate	Occasional	Moderate	Occasional		Moderate		Abundant	
Ash	*Fraxinus sp*												
Asparagus fern, bushy asparagus	*Asparagus aethiopicus*	Containment											
Australian fireweed	*Senecio bipinnatisectus*						Occasional						
Bamboo	*Various spp.*		Boundary			Incidental			Moderate			Boundary	
Bangalow palm	*Archontophoenix cunninghamiana*												
Bears breeches	*Acanthus mollis*									Occasional			
Beggars' tick	*Bidens frondosa*							Incidental					
Bindweed	*Calystegia sp./Convolvulus sp.*							Occasional			Occassional		
Black mustard	*Brassica nigra*				Incidental				Occasional				
Black nightshade	*Solanum nigrum*		Occasional		Moderate		Occasional	Occasional	Occasional	Moderate			
Blue morning glory	*Ipomoea indica*	Surveillance							Occasional	Abundant			
Broad-leaved dock	*Rumex obtusifolius*				Occasional			Moderate	Moderate				
Broad-leaved fleabane	*Erigeron sumatrensis*						Moderate	Moderate					
Brush cherry	*Syzygium australe*	Surveillance- Hauraki Gulf Islands						Incidental		Incidental			
Camellia	*Camellia japonica*									Amenity			
Canton lace	*Radermachera sinica*							Amenity					
Cape gooseberry	*Physalis peruviana*									Incidental			
Castor oil plant	*Ricinus communis*	Surveillance						Occasional	Occasional				
Cherry	*Prunus sp.*				Moderate								
Chinese privet	*Ligustrum sinense*	Surveillance	Moderate	Moderate			Occasional	Occasional		Occasional			
Chinese toon	*Toona sinensis*			Boundary					Incidental				
Chinese windmill palm	*Trachycarpus fortunei*	Research				Boundary			Incidental				
Choysia, Mexican orange blossom	*Choisya ternata*												
Cleavers	*Gallium aparine*				Occasional		Moderate		Occasional	Occasional			
Climbing asparagus	Asparagus scandens	Surveillance										Boundary	
Climbing dock	*Rumex sagittatus*	Surveillance								Occasional			
Coast redwood	*Sequoia sempervirens*						Amenity	Amenity					
Common alder	*Alnus glutinosa*												
Coral tree, flame tree	*Erythrina sp*							Boundary					
Cotoneaster	*Cotoneaster glaucophyllus*	Surveillance	Moderate	Moderate				Incidental		Incidental			
Cotton lavender	*Santolina chamaecyparissus*												
Crack willow	*Salix x fragilis*	Surveillance	Incidental						Moderate				
Creeping buttercup	*Ranunculus repens*						Abundant	Moderate	Moderate				
Cut-leaved geranium, cranesbill	*Geranium dissectum*				Occasional								
Cypress	*Cupressus sp*												
Doves foot cranesbill	*Geranium molle*				Occasional								
Elephant's ear	*Alocasia brisbanensis*	Surveillance							Occasional				
English ivy	*Hedera helix*	Surveillance	Occasional							Abundant			
English oak, pedunculate oak	*Quercus robur*						Amenity						
Escallonia	*Escallonia rubra*		Moderate										
Eucalyptus spp.	*Eucalyptus spp.*		Amenity										
Evergreen buckthorn	*Rhamnus alaternus*	Surveillance		Incidental						Moderate			

Feijoa	*Acca sellowiana*												
Fennel	*Foeniculum vulgare*							Occasional	Occasional				
Flame vine	*Pyrostegia venusta*					Incidental							
Fumitory	*Fumaria spp.*									Occasional			
German ivy	*Delairea odorata*	Surveillance		Occasional			Abundant	Abundant					
Giant lily, spider lily	*Crinum asiaticum*									Incidental			
Ginkgo	*Ginkgo biloba*		Amenity		Amenity								
Golden weeping willow	*Salix x chrysocoma*		Amenity			Occasional					Moderate		
Gorse	*Ulex europaeus*	Surveillance/Community initiatives					Occasional						
Hawthorn	*Crataegus monogyna*	Surveillance						Incidental		Incidental			
Hemlock	*Conium maculatum*	Surveillance								Moderate			
Hibiscus	*Hibiscus syriaceus*			Incidental									
Inkweed	*Phytolacca octandra*								Occasional				
Japanese honeysuckle	*Lonicera japonica*	Surveillance/Community initiatives								Occasional			
Japanese spindle tree	*Euonymus japonicus*	Surveillance			Incidental					Incidental			
Jasmine	*Jasminum polyanthum*	Surveillance/Community initiatives						Abundant		Incidental			
Jointed rush	*Juncus articulatus*						Moderate						
Kahili ginger	*Hedychium gardnerianum*	Containment		Boundary						Incidental			
Kikuyu	*Cenchrus clandestinus*		Abundant		Abundant	Abundant		Abundant	Abundant		Abundant	Abundant	abundant
Korokio, wire-nettting bush	*Corokia cotoneaster*												
Leyland's cypress	*Cupressus x leylandii*								Amenity				
Lombardy poplar	*Populus nigra*		Amenity					Amenity					
Loquat	*Eriobotrya japonica*								Occasional				
Macrocarpa	*Cupressus macrocarpa*						Amenity						
Madeira	*Anredera cordifolia*	Surveillance/Community initiatives						Occasional					
Magnolia	*Magnolia grandiflora*		Amenity										
Mallow	*Malva sp*			Boundary				Occasional					
Mexican daisy	*Erigeron karvinskianus*							Occasional					
Mile-a-minute	*Dipogon lignosus*	Surveillance/Community initiatives								Boundary			
Milkweed	*Euphorbia peplus*				Occasional								
Montbretia	*Crocosmia x crocosmiifolia*	Surveilance										Moderate	
Moth plant	*Araujia sericifera*	Containment	Occasional	Occasional	Occasional			Occasional	Moderate	Abundant			
Narrow-leaved plantain	*Plantago lanceolata*				Occasional		Moderate	Moderate					
Nasturtium	*Tropaeolum majus*		Moderate	Moderate		Moderate	Occasional	Moderate	Moderate	Moderate			
Norfolk island hibiscus	*Lagunaria patersonia subsp. patersonia*												
Olive tree	*Olea spp.*							Amenity					
Osteospermum	*Osteospermum x*			Occasional									
Oxalis	*Oxalis spp.*									Occasional			
Oxtongue	*Helminthotheca echioides*						Occasional	Moderate					
Oxygen weed	*Lagarosiphon major, Egeria densa, Elodea canadensis, Hydrilla verticillata*	Surveillance (all except Elodea)						Occasional		Abundant			
Palm grass	*Setaria palmifolia*	Surveillance/Community initiatives								Occasional			
Panana, banana	*Musa x*			Boundary						Incidental			
Panic veldt grass	*Ehrharta erecta*				Moderate					Moderate			
Paperbark	*Melaleuca sp.*												
Papyrus	*Cyperus papyrus*							Incidental					
Paspalum	*Paspalum dilatatum*				Occasional		Moderate	Moderate	Moderate				
Phoenix palm	*Phoenix canariensis*	Surveillance		Boundary		Boundary							
Pin oak	*Quercus palustrus*												
Pine	*Pinus sp*												
Pitted crassula, fairy crassula	*Crassula multicava subsp. multicava*	Surveillance		Occasional									

Potato vine	*Solanum jasmanoides*												
Queen of the night	*Cestrum nocturnum*	Research			Occasional	Moderate		Occasional	Occasional				
Queensland poplar	*Homalanthus populifolius*	Surveillance	Occasional										
Red dead nettle	*Lamium purpureum*				Occasional								
Rēmana, lemon	*Citrus x lemon*		Amenity	Boundary									
Rose	*Rosa sp.*												
Rosemary	*Rosemary officinalis*												
Scambling speedwell	*Veronica persica*									Occasional			
She-oak	*Casuarina sp*		Amenity		Amenity	Amenity	Amenity						
Silver dollar gum	*Eucalyptus cinerea*		Amenity			Amenity							
Small herb Robert	*Geranium purpureum*												
Smilax	*Asparagus asparagoides*	Containment	Occasional	Occasional						Occasional			
Squash	*Cucurbita sp.*								Incidental				
Staghorn fern	*Platycerium sp.*												
Swamp Cypress	*Taxodium distichum*		Boundary										
Sweet gum, liquidambar	*Liquidambar styraciflua*				Amenity				Amenity				
Tahitian pohutukawa	*Metrosideros Tahiti*												
Taiwan cherry	*Prunus campanulata*		Occasional		Occasional	Moderate		Incidental	Occasional	Occasional			
Three-cornered garlic, onion weed	*Allium triquetum*			Occasional			Moderate	Moderate	Moderate			Moderate	
Tortured willow	*Salix matsudana*		Amenity										
Tradescantia, wandering Jew	*Tradescantia fluminensis*	Surveillance	Abundant	Moderate	Abundant	Moderate	Occasional	Occasional		Moderate	Occassional	Abundant	Moderate
Tree aloe	*Aloe arborescens*								Incidental				
Tree privet	*Ligustrum lucidum*	Surveillance	Occasional	Occasional		Occasional							
Tuber ladder fern	*Nephrolepis cordifolia*	Surveillance	Moderate	Moderate		Moderate							
Tulepo	*Nyssa sylvatica*					Amenity	Amenity						
Umbrella sedge, nut grass	*Cyperis congestus, C. eragrostis, C. rotundatus*				Moderate		Moderate	Moderate		Moderate			
Vetch	*Vicia sativa*							Occasional					
Violet	*Viola odorata*				Incidental								
Water celery	*Apium nodiflorum*								Occasional				
Watercress	*Nasturtium officinale*				Occasional								
Willow weed	*Persicaria maculosa*			Occasional	Occasional					Moderate			
Woolly nightshade	*Solanum mauritianum*	Containment	Occasional		Occasional	Moderate	Occasional	Occasional	Occasional	Moderate	Occassional	Moderate	Occasional
Yucca	*Yucca gloriosa*								Incidental				

Appendix 2 Native plant species recorded

Maori Name	Latin Name	Type	Notes
Akapuka	*Griselinia lucida*	Shrub	
Akiraho, golden akeake	*Olearia paniculata*	Tree	Planted
Coprosma hybrids	*Coprosma sp.*	Tree	
Harakeke	*Phormium tenax*	Flax	
Haupara, coastal five-finger	*Pseudopanax lessonii*	Tree	Planted
Huruhuruwhenua	*Asplenium oblongifolium*	Fern	
Kanuka (Auckland)	*Kunzea robusta*	Tree	
Karaka	*Corynocarpus laevigatus*	Tree	
Karamu	*Coprosma robusta*	Tree	
Karamu, shining karamu	*Coprosma lucida*	Tree	
Karo	*Pittosporum crassifolium*	Tree	
Kauri	*Agathis australis*	Tree	Planted
Kawakawa	*Piper excelsum subsp. excelsum*	Tree	
Kohekohe	*Dysoxylum spectabile*	Tree	
Kohuhu	*Pittosporum tenuifolium*	Tree	
Korokia	*Corokia macrocarpa*	Shrub	Planted
Koromiko	*Veronica stricta var. stricta (syn. Hebe stricta var. stricta)*	Shrub	
Kowhai (Coastal)	*Sophora chathamica*	Tree	Planted
Kowhai (Inland)	*Sophora microphylla*	Tree	Planted
Kowhai (Large-Leaved)	*Sophora tetraptera*	Tree	Planted
Kowhai (Prostrate)	*Sophora prostrata*	Shrub	Planted
Mahoe	*Melicytus ramiflorus*	Tree	
Mamaku	*Cyathea medullaris*	Tree fern	
Manuka	*Leptospermum scoparium var. scoparium*	Tree	
Mapou	*Myrsine australis*	Tree	
Maukoro	*Carmichaelia australis*	Shrub	Planted
Native willow weed	*Persicaria decipiens*	Herb	
Oioi	*Apodasmia similis*	Restiad	Planted
Pohuehue, large-leaved mue	*Muehlenbeckia australis*	Vine	
Pohutukawa	*Metrosideros excelsa*	Tree	Planted
Porokaiwhiri/ pigeonwood	*Hedycarya arborea*	Tree	
Pukio	*Carex secta*	Sedge	Planted
Purei	*Carex virgata*	Sedge	Planted
Puriri	*Vitex lucens*	Tree	
Putaputaweta / marbleleaf	*Carpodetus serratus*	Tree	Planted
Rasp Fern / pukupuku	*Blechnum parrisiae (syn Doodia australis)*	Fern	
Rautahi	*Carex lessoniana*	Sedge	Planted
Rewarewa	*Knightia excelsa*	Tree	

Tanekaha	*Phyllocladus trichamanoides*	Tree	Planted
Taraire	*Beilschmedia tarairi*	Tree	Planted
Tarata	*Pittosporum eugenioides*	Tree	
Taupata	*Coprosma repens*	Tree	
Ti Kouka	*Cordyline australis*	Tree	
Titoki	*Alectryon excelsus*	Tree	
Toatoa	*Haloragis erecta subsp. erecta*	Herb	
Toetoe	*Austroderia fulvida*	Grass	Planted
Totara	*Podocarpus totara*	Tree	
Turawera, shaking brake fe	*Pteris tremula*	Fern	
Upokotangata, giant umbrel	*Cyperus ustulatus*	Sedge	
Varigated flax	*Phormium tenax - cultivar*	Flax	Planted
Whaririki (mountain flax)	*Phormium cookianum*	Flax	Planted
Whau	*Entelea arborescens*	Shrub	
	Olearia lineata	Tree	Planted
	Olearia solandri	Tree	Planted

Appendix 3 Accidental Discovery Protocols for the Lower Oakley Creek, contacts may differ for the Upper Te Auaunga Awa - Oakley Creek.

4SIGHT CONSULTING

TE AUAUNGA OAKLEY CREEK – ARCHAEOLOGIST OFF-SITE DISCOVERY PROTOCOLS

Introduction

Auckland Council Parks, Sport & Recreation (AC PSR) are continuing with their programme of ecological restoration along the lower reaches of Oakley Creek, which involves native riparian planting, weed removal and canopy control. The programme will involve disturbance of the ground within or directly adjacent to recorded, and possibly unrecorded, archaeological sites.

For this reason, protocols for the discovery of archaeological evidence is required for the programme should the project archaeologist be off-site at the time of discovery. These protocols (which were previously known as Accidental Discovery Protocols) to be adopted during works are prescribed below.

This document is to be read in conjunction with the Cultural Monitoring / Tikanaga Protocols developed with Ngāi Tai Ki Tāmaki, Ngāti Whātua o Ōrākei and Te Kawerau a Maki.

Archaeologist Off-Site Discovery Protocols (AODPs)

1. Accidentally Encountering Archaeological Evidence

Should the contractor (or the employees, sub-contractors, volunteers or other associated persons) identify actual or suspected archaeological evidence they will, in the first instance:

- Stop work in the vicinity of the evidence and cordon off the subject site to provide full protection. A 5m minimum buffer is recommended. Work may continue elsewhere on the worksite. The original area cordoned off will be extended if there is sufficient reason to believe that the site extends beyond the restricted area.
- Contact the project archaeologist (or the designated assistants) so that they may assess as to whether the evidence is archaeological or not. If this is not possible then the Auckland Council Parks, Sport & Recreation Project Manager will be contacted.
- If the discovery is found to be archaeological evidence of Maori origin, then contact the representatives of Ngāi Tai Ki Tāmaki, Ngāti Whātua o Ōrākei, and Te Kawerau a Maki.
- If the discovery is found to be archaeological evidence, then the worksite will be omitted from the revegetation programme until the site is documented and the archaeologist is satisfied with the long term protection of the site.
- If the site cannot be adequately investigated to the satisfaction of the project archaeologist, given likely funding constraints, then the site will be recorded for future investigation and excluded from current works till such time as funding is available.

2. Accidentally Encountering Ko Iwi (human bones)

Should the contractor (or the employees, sub-contractors, volunteers or other associated persons) identify actual or suspected ko iwi evidence they will, in the first instance;

- Stop works in the vicinity of the evidence and cordon off the subject site to provide full protection. Work may continue elsewhere on the worksite. The original area cordoned off may be extended if there is sufficient reason to believe that the site extends beyond the restricted area.
- Contact the project archaeologist (or the designated assistants) and representatives of Ngāi Tai Ki Tāmaki, Ngāti Whātua o Ōrākei, and Te Kawerau a Maki so that they may assess as to whether the evidence is archaeological or not. If they are obviously human, notify the NZ Police first and the archaeologist second as it is likely that NZ Police will want an opinion as to whether the bones are recent or from the distant past.
- Notify Heritage New Zealand Pouhere Taonga (HNZPT).
- Work cannot recommence at the site until the go ahead is given by either the New Zealand Police if it is deemed to be a crime scene, or by HNZPT and iwi representatives if it is an older burial.

LAND. PEOPLE. WATER.

Level 2, 3 Vernon St, Freemans Bay, PO Box 911310, Victoria St West, Auckland 1142 09 303 0311 www.4sight.consulting

Contact Details

ORGANISATION	CONTACT	TELEPHONE / EMAIL
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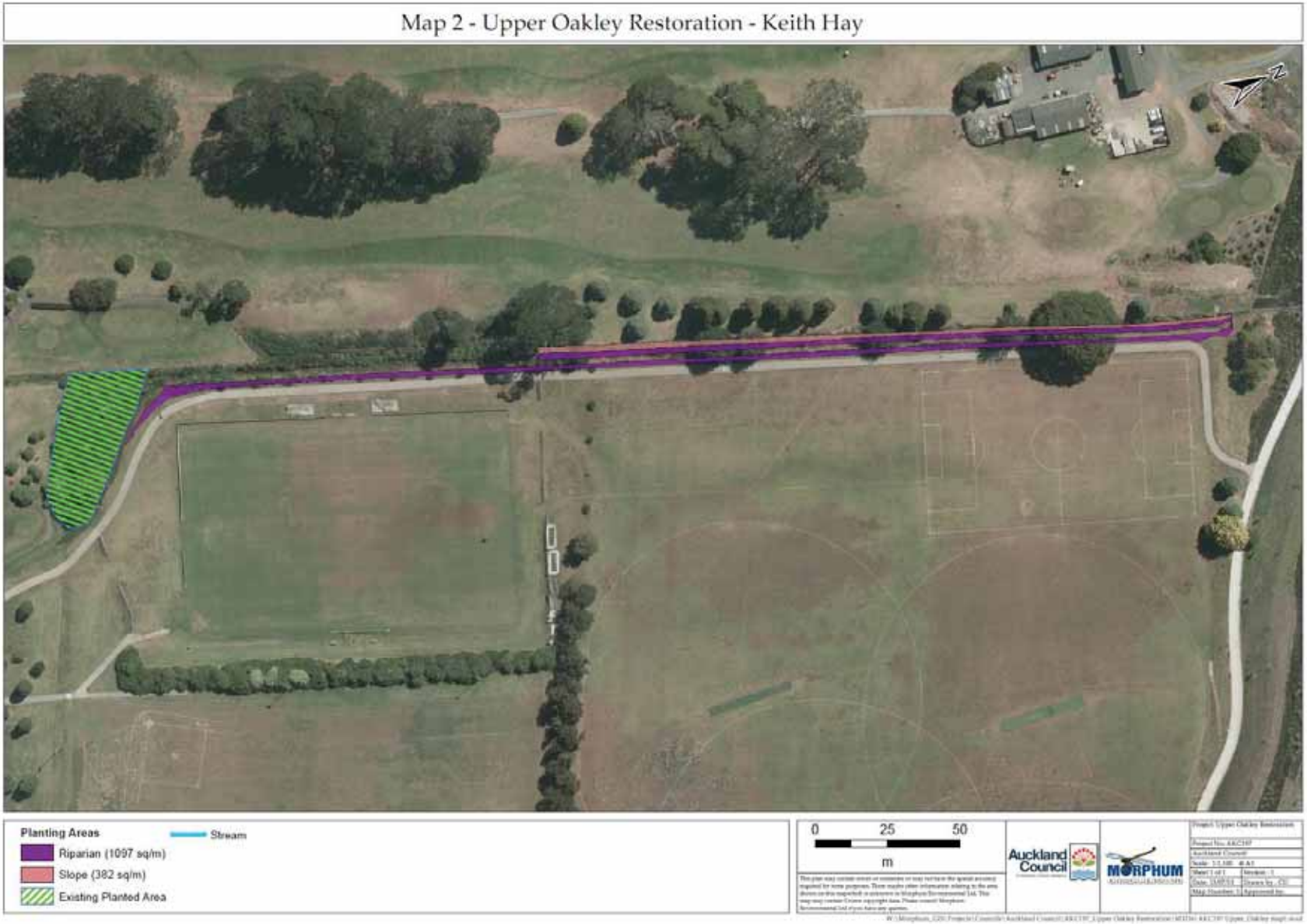
Ngāti Whātua o Ōrākei	Moana Waa	t: 021 617 749 e: moanaw@ngatiwhatuaorakei.com
Te Kawerau a Maki	Keith Williams	t: 021 243 1654 e: Keith.Williams@tekawerau.iwi.nz
Heritage New Zealand Pouhere Taonga		
HNZPT Auckland Conservancy	Bev Parslow Greg Walter	t: 09 307 9923 or 021 060 3424 e: ArchaeologistMN@heritage.org.nz t: 09 307 9924 e: AsstArchaeologistMN@heritage.org.nz
Project Archaeologist		
Brent Druskovich		t: 0274 905 336 e: druskovich@clear.net.nz
Other		
New Zealand Police		t: 111; or t: 09 820 5700 (Avondale Station)
Auckland Council – Parks, Sport & Recreation	David Stejskal – Project Manager	t: 021 842 678 e: David.Stejskal@aucklandcouncil.govt.nz

Appendix 4 Restoration Plan Maps from Morphum Environmental Ltd (2013)

Please refer to full restoration plan by Morphum Environmental Ltd, 2013 for further details on these areas.



Map 3 A - Upper Oakley Restoration - RO18A (South Arm)

Planted Areas
- Existing School Planting Area
- Riparian South Arm (1380 sq/m)
- Upper Slope South Arm (1324 sq/m)

- Planted Trees
- Stream

0 20 40
m

Auckland Council

MORPHUM

Map 3 B - Upper Oakley Restoration - RO18B (East Arm)