Yaldhurst Bush

# Ecological restoration plan

April 2025

Christchurch City Council

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# Introduction

## Vision

**Yaldhurst Bush will be valued as an important community asset that people of all ages and backgrounds will be actively involved in creating and nurturing. People will visit the reserve regularly for the enjoyment of nature, passive recreation, education, nature play and for social interaction. The bush and its associated dryland and freshwater environments will be representative of formerly widespread indigenous ecosystems that once occurred in Canterbury and will be used by native birds, lizards and other fauna as an important feeding and breeding resource in a city-wide forest patch and lizard habitat network.**

## Objectives

Establishing native forest and lizard habitat at Yaldhurst Bush will have the following ten key objectives:

- ✓ Continue to implement the Turning Point 2000 project to establish Yaldhurst Bush as a 'living museum'
- ✓ Increase tree canopy cover in the Yaldhurst area to help combat climate change
- ✓ Contribute to a target of 10% indigenous vegetation cover across the district[1]
- ✓ Provide important resources for native wildlife as part of a city-wide forest patch network
- ✓ Act as a 'lifeboat' for biodiversity by establishing threatened new populations of dryland species
- ✓ Meet a critical need to provide quality habitat for translocated lizard populations
- ✓ Provide manawhenua with opportunities to exercise Matauranga Māori and support mahinga kai
- ✓ Provide opportunities for people to experience and interact with urban wilderness
- ✓ Reduce ongoing operational costs and carbon emissions associated with managing mown turf
- ✓ Establish a significant and iconic landscape feature that contributes to community identity
- ✓ Optimise freshwater aquatic values of the naturalised water race and wetland

***Figure 1:*** *Photos of established native plantings at Yaldhurst Bush (Photographs: A. Shadbolt, 2024).*

[1] The National Policy Statement on Indigenous Biodiversity (2023) requires that all territorial local authorities (e.g., Christchurch City Council) achieve 10% indigenous cover across their urban and rural areas.

# Context

In 2023, we adopted the **Urban Forest Plan for Ōtautahi Christchurch[2],** focused on growing and managing public and private trees to increase urban tree canopy cover over the next 50 years. This plan supports climate action, neighbourhood livability, improved wellbeing, and better protection and maintenance of our precious indigenous flora and fauna. Native forests within our urban environments play a significant role in helping us achieve these goals.

Ōtautahi-Christchurch, a biodiversity hotspot within the plains ecological region[3], contains many important biodiversity sites, some of national or international importance. However, over the past 700 years Canterbury has suffered enormous loss in both the extent and quality of its indigenous biodiversity, particularly forests with Māori and European settlement. Pre-European fires meant that only a very small amount of native forest remained on the Canterbury Plains by the 1840s, and subsequent colonisation by European settlers in the 1850s brought further rapid habitat destruction to the Canterbury Plains and Port Hills.

The historic 'Black Maps' of Ōtautahi-Christchurch dating from the 19th Century show extensive areas of wetland with only limited areas of forest at Pūtagringamotu-Riccarton Bush (22 hectares) and Papanui Bush (30 hectares). Both patches of bush could be seen easily from the Bridle Path in a sea of tussock and toetoe. Unfortunately, Papanui Bush was completely felled by settlers within approximately five years, and Pūtagringamotu-Riccarton bush was reduced to around seven hectares.

But thanks to the foresight and visionary thinking of successive Councils and the community, the area of tree canopy cover in Ōtautahi-Christchurch is now almost a thousand times greater than it was in the mid 1800's when settlers had finished clearing the native forests. **However, less than 1% of this urban forest canopy cover is made up of native trees!**

While the other 99% of our urban forest is exotic trees numbering some 700 species, native forests have begun to have a renaissance in recent years, as have our native bush birds. Planted native forests in Ōtautahi-Christchurch now well-exceed the c.1840 extent but further restoration is essential for sustaining wildlife and providing high quality nature experiences for all.

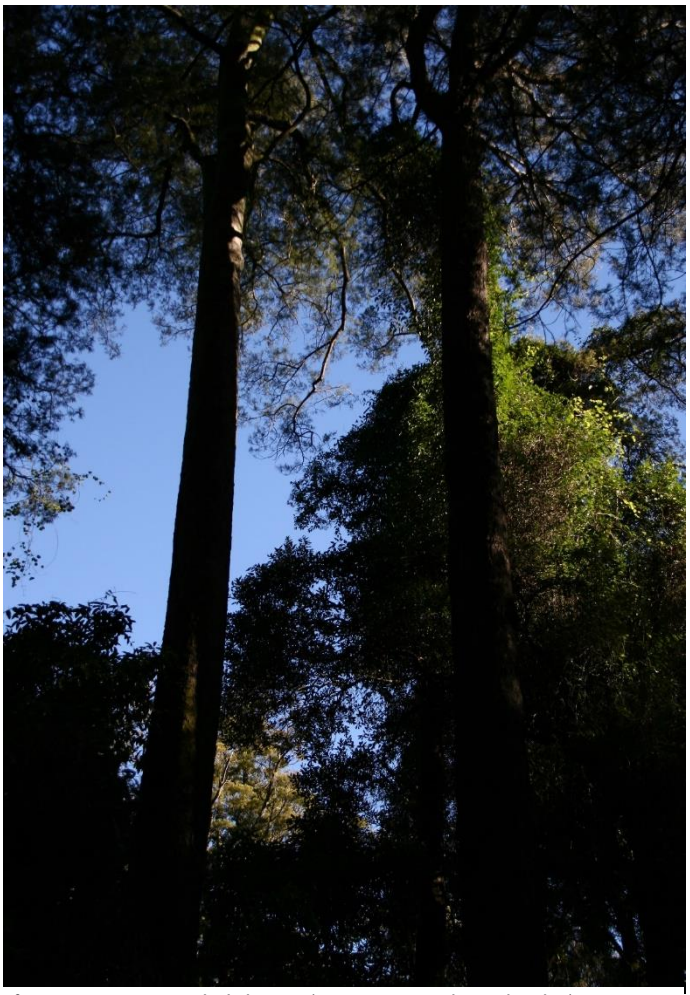

**Figure 2:** Emergent kahikatea *(Dacrycarpus dacrydioides)* at Pūtaringamotu – Riccarton Bush (Photograph: A. Shadbolt, 2019)

[2] www. ccc.govt.nz/assets/Documents/Consultation/2023/02-February/CUS5882-Urban-Forest-Plan-A4-WEB.pdf
[3] www.doc.govt.nz/documents/science-and-technical/ecoregions4.pdf

## Yaldhurst Bush in a network of forest patches

As well as the Urban Forest Plan, we are also developing the **Ōtautahi-Christchurch Native Forest Patch Network Plan**[4] to create a strategic network of native forests[5] across the city. This network aims to support viable populations of native bush birds and other wildlife, enhance ecosystem connectivity, and provide accessible natural areas aligning with the city's Biodiversity Strategy[6]. We hope it will also encourage community engagement in biodiversity conservation and foster a deeper understanding of ecological needs.

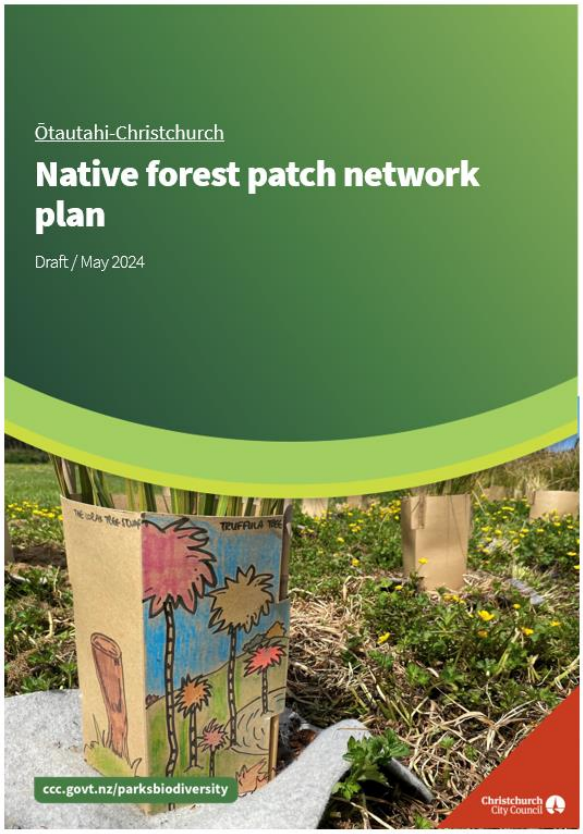


***Figure 3:*** Ōtautahi-Christchurch Native Forest Patch Network Plan (In preparation)

Many of the native forest plantings established in Ōtautahi - Christchurch have been relatively small compared to the few large blocks that have begun to be established since the early 2000s. As well as not supporting viable populations of wildlife in their own right, small plantings inevitably suffer from 'edge effects' like wind, heat, noise, weeds, pest animals, and artificial light. Some of these edge effects penetrate further than 50 metres inside habitats!

Our plan envisions 135 native forest patches averaging around six hectares each. 42 of these will be larger patches (>6.25 ha) that will provide core wildlife breeding habitat, and 93 will be smaller patches (1.50 ha – 6.25 ha) that act as food sources and stepping stones for wildlife.

Around two-thirds of these patches, like Yaldhurst, simply build on existing native forest plantings in parks and stormwater sites. This approach serves to maintain the general character of our public spaces, whilst allowing the plantings to be extended and enriched to provide more optimum habitat and wilderness experiences.

[4] CCC (2024a & 2024b)
[5] Meurk and Hall (2006)
[6] CCC (2008)

## Providing for lizards

In early 2024, 38 sites across ten of Ōtautahi-Christchurch's city wards (Refer Appendix 1, and CCC 2024a) were identified as candidates for lizard release sites. Although Yaldhurst Bush was identified as a priority-2 site, because it is intended to be planted and restored as part of the native forest patch network, its potential for lizard habitat is included in this planning document too.

The greater Christchurch area provides habitat for up to five species of native lizard (E.g., Figure 4), all of which are 'absolutely protected' under the Wildlife Act (1953, s63 (1) (c)) and therefore they may not be harmed, disturbed or killed without a Wildlife Act Authority from the Department of Conservation (DoC). Loss and alteration of habitat has been a major cause of decline of many lizard species in Aotearoa-New Zealand[7], and in Ōtautahi-Christchurch lizards are present in many areas scheduled for development – including Council projects. However, one tool that we use to manage lizard populations in the face of such developments is salvage from the site and transfer to another suitable site where they are able to establish a new viable population. In some cases, these translocations may establish completely new lizard populations at the release sites, whereas in others they may supplement an existing but small population thereby improving its long-term population viability.

**Figure 4:** Southern grass skink (*Oligosoma aff. polychroma*, Clade 5) (Photograph: C. McClure 2023).

The current situation in Ōtautahi-Christchurch is that we have far more projects that are resulting in loss of lizard habitat than we have suitable release sites for. This places significant infrastructure projects at risk of not being able to be delivered until proposed release sites are at a stage that they are able to receive lizard translocations. This often means that Council will not meet its levels of service in terms of the delivery of the Annual and Long-Term Plans. Also, it means that we may not meet various consent conditions (e.g., the global stormwater discharge consent which requires us to manage stormwater quality through the establishment of large stormwater treatment facilities on sites that often support significant lizard populations). We are therefore in urgent need of a plan to establish a range of sites across the city that can be enhanced and managed in a state suitable for lizard translocations. The mid-aged plains ecosystem soils at Yaldhurst Bush would naturally support a broad suite of native plants that would in-turn support lizard populations.

While some areas of the reserve may be ready for lizard translocation immediately, there remains great potential to build on the existing plantings to both expand and enrich them with a suite of native plant species that more closely represent former Canterbury Plains ecosystems. This reserve could be completely restored to its former pre-human state by planting the remaining grass areas and managing the area as a predator-free sanctuary[8] - noting that its restored area would be approximately the same size as Pūtagringamotu-Riccarton Bush.

[7] (DoC 2019)

[8] While a predator proof fence could be considered for this reserve as part of habitat enhancement, more thought will be needed around how to protect the fence from vehicle accident damage, and also how to best construct and manage the fence along its interface with the private land to incorporate the required clear zone along the outside of the fence.

# Yaldhurst Bush

## Location

Yaldhurst Bush is an approximately six-hectare Local Community Park located at 35 Old West Coast Road in the rural north-western Christchurch area of Yaldhurst (Figure 5). The reserve has two major road frontages (West Coast Road/State Highway 73 and Old West Coast Road), however for safety reasons, the only access to Yaldhurst Bush for the public is from the less-busy Old West Coast Road on the north side of the reserve.

***Figure 5:*** *Location of Yaldhurst Bush (green polygon, right) at intersection of Old West Coast Road and West Coast Road (State Highway 73).*

# Brief history

Native forest and woodland planting began at Yaldhurst Bush in the mid-1990s to create a 'living museum' that recreated vegetation that would have occurred on the Canterbury Plains prior to the arrival of Europeans. Restoration was supported by the community, including Yaldhurst Primary School children who have had a long association with the park. Plantings now cover approximately 3.7 hectares (60%) of the reserve, and unplanted areas are currently maintained as mown grass and are used informally for passive recreation.

## Native Trees Please!

In 1998, Yaldhurst Bush was adopted as a **'Native Trees Please!'** project - one of 30 significant **'Turning Point 2000'** projects to celebrate and commemorate the year 2000 in Ōtautahi-Christchurch and Canterbury.

This project was based on the concept of re-establishing representative native Aotearoa-New Zealand plant species that existed originally on the various floodplain surfaces throughout Ōtautahi-Christchurch. At the time, each of the city's six community board areas was to establish one native tree grove that focussed on one dominant tree species and appropriate companion planting. The wider project aimed to provide valuable educational resources for schools as well as developing Christchurch's landscape heritage for present and future generations.

Yaldhurst Bush was favoured for native plantings in the Fendalton Waimairi Community Board area, as the site and soil type had its own distinct characteristics that were quite different from the northern, eastern and southern areas of the city. While the conditions were relatively harsh, it was believed that with good preparation and after care, it would be possible to establish a range of plants typical of those that originally grew on these soil types. Species suggested for the site included ti kouka/cabbage tree, kohuhu, kowhai, kanuka, kiokio, olearia and coprosma species.

The project emphasised that the primary aim was not to establish an attractive 'garden setting' (although it was thought that this may well occur eventually) but rather to develop a **'living museum'** of plant life and associated ecosystems that commemorated the past for the benefit of the present and future generations.

*On 8th June 2000, around 120 pupils from Yaldhurst Primary School planted several hundred trees in the reserve as part of this Turning Point 2000 project.*

# Landscape character

Yaldhurst Bush has two distinct landscape elements: 1) expansive open mown grass, and 2) areas of established native restoration plantings that provide a high degree of natural character and wilderness experience. Road noise from State Highway 73 on the south side of the reserve is partially mitigated by the native forest & woodland buffer along that edge, and also by the abundant birdsong, including bellbird and grey warbler, that the restoration plantings support.

Natural areas include open woodland dominated by lowland ribbonwood, clusters of kanuka, enclosed totara and matai dominated forest, silver tussock grassland and a naturalised ephemeral riparian corridor with permanent ponds dominated by raupo and spike sedge. Together, this mosaic of distinctive indigenous plant communities (Figure 6) creates a complex wilderness experience for visitors, and a valuable wildlife habitat for bush birds , invertebrates, lizards and aquatic biota which all add to the landscape and visitor experience.

***Figure 6:*** *A mosaic of distinctive plant communities adds to the natural character and wilderness experience of Yaldhurst Bush. Rows (left to tight), depict: (top) 1) expansive mown grass, 2) kanuka woodland flanked by mown grass, 3) open lacebark dominated woodland with mown understorey, (middle) 4) open ti kouka/cabbage tree woodland, 5) totara/matai dominated enclosed forest, 6) enclosed native woodland, (bottom) 7) silver tussock grassland, 8) ephemeral naturalised waterway, and 9) sedge dominated inline ponding along ephemeral waterway (Photographs: A. Shadbolt 2024).*

## Water race naturalisation

In the early 2000s, a water race that ran along State Highway 73 was re-routed through the Yaldhurst Bush Reserve and naturalised. This project involved restoring natural streambank profiles, adding cobbles/pebbles, creating a series of in-line ponding areas, adding woody debris, and establishing indigenous riparian planting along its length. A small pebbly/sandy beach area was also formed to provide access for children to the water for exploration and nature play.

Riparian planting (Figure 7) has met with mixed success. Although some areas remain well vegetated, throughout most of the waterway's length, planting is patchy (especially in dry/ephemeral areas), often narrow, and is being invaded by woody pest plants such as grey willow, crack willow and alder. Also, as plantings have failed, it appears that mowing has pushed further into the riparian margin and caused further damage. The wet margins are also being invaded by the large exotic umbrella sedge *(Cyperus eragrostis),* however natural colonisation of indigenous raupo and spike sedge has filled some areas where year-round soil moisture is high.

***Figure 7:*** *Naturalised water race passing through Yaldhurst Bush, showing (clockwise from top left): 1) inline ponding area with narrow riparian planting and grass mown to near water's edge, 2) natural colonisation of wet areas by raupo, 3) invasion of ephemeral section of drain by crack willow, 4) invasion of inline pond margin by grey willow, and 5) incorporation of woody debris in riparian plantings.*

# Management issues

The two main management issues that are evident at Yaldhurst Bush are 1) the presence of established biodiversity pest plants, and 2) mowing turf which is costly, has high carbon emissions, is damaging native woodland plantings, and preventing natural regeneration.

## Pest plants

Although the woodland and forest areas are mostly thriving under a low-level maintenance regime, exotic woody pest plants such as grey willow, crack willow, and alder are invading the naturalised waterway corridor. They are currently present to the extent that they now form the dominant vegetation along this important zone (Figure 8).

If left unchecked, these biodiversity pest plants will continue to dominate the established forest and spread into new planted areas where they will displace indigenous plant communities (both planted and naturally establishing) and the indigenous fauna those communities' support. Luckily, many of these pest plant species are both relatively sparse and young and able to be controlled cost effectively compared to if they are left to establish further.

Table 1 lists biodiversity pest plants that threaten ecological values and restoration success at Yaldhurst Bush. Luckily, although dense, these pest plants are relatively young and able to be controlled cost effectively compared to if they are left to establish further.

***Figure 8:*** *Woody pest plants invading the riparian corridor include (clockwise from top left): 1) grey willow (Salix cinerea), 2) crack willow (S. fragilis), 3) alder (Alnus spp.), and 4) grey willow (showing female catkins) (Photographs: A. Shadbolt 2024).*

***Table 1:*** *Biodiversity pest plants occurring at Yaldhurst Bush and prioritised recommended control actions.*

| Species | Common name | Recommendation |
|---|---|---|
| *Salix fragilis* | crack willow | Completely eradicate from waterway corridor and progressive removal from eastern tip of reserve as. **HIGH PRIORITY** |
| *Salix cinerea* | grey willow | Completely eradicate from reserve and follow up control of new seedling growth. **HIGH PRIORITY** |
| *Alnus spp.* | alder | Completely eradicate from reserve – particularly waterway corridor and follow up control of new seedling growth. HIGH PRIORITY |
| *Maytenus boaria* | Chilean mayten | Completely eradicate the existing small number of trees from the reserve. **HIGH PRIORITY** |
| *Cyperus eragrostis* | umbrella sedge | Identify and control exotic umbrella sedge and replace with dense riparian plantings to limit its reinvasion. **HIGH PRIORITY** |
| *Rubus fruiticosa* | blackberry | Ongoing control of blackberry, particularly at eastern end of reserve, and control of new growth in other areas as it is identified. **MEDIUM PRIORITY** |
| *Vinca major* | periwinkle | Control of small patch of periwinkle at eastern end of reserve so that the patch does not expand. HIGH PRIORITY |
| *Hoheria sextylosa* | North Island lacebark | Survey for and eradicate adult trees of this invasive North Island species from reserve and control any seedlings **HIGH PRIORITY**. |
| *Cytisus scoparius* | European broom | Control and/or contain small, isolated patches of broom to prevent their spread. **MEDIUM PRIORITY** |
| *Cytisus proliferus* | tree lucerne | Remove tree lucerne from northern reserve boundary to allow established native plantings to thrive. **LOW PRIORITY** |
| | | |
| *Dodonaea viscosa* 'Purpurea' | purple akeake | Remove the small number of purple akeake to prevent spread, prevent cross pollination with local akeake species and maintain an authentic natural character for Yaldhurst Bush. **LOW PRIORITY** |
| *Olearia 'dartonii'* | twiggy tree daisy | Remove the small number of purple twiggy tree daisy to prevent cross pollination with local Olearia species and maintain an authentic natural character for Yaldhurst Bush. **LOW PRIORITY** |
| *Pittosporum tenuifolium* cultivar | variegated kohuhu | Remove the small number of variegated pittosporums to prevent cross pollination with local pittosporum species and maintain an authentic natural character for Yaldhurst Bush. **LOW PRIORITY** |
| *Phormium cookianum* | mountain flax | Remove the small number of mountain flax to prevent cross pollination with local harakeke/NZ flax and maintain an authentic natural character for Yaldhurst Bush. **LOW PRIORITY** |

## Mowing

Mown grass covers approximately three-hectares of the Yaldhurst Bush Reserve. These mown areas include the expansive grass areas to the north of the main restoration planting areas (Figure 9), but also extend along a narrow corridor within the planted areas too.

**Depending on the mowing frequency of existing grass areas at Yaldhurst Bush, at $0.06/m2, annual costs for mowing could be anywhere between $45,000 for 25 visits and $57,600 for 32 visits.**

***Figure 9:*** *Approximately three hectares of mown turf on the north side of restoration plantings at Yaldhurst Bush (Photograph: A. Shadbolt 2024)*

In places, ride-on mowers access the native woodland understorey where they have caused ongoing permanent damage to tree trunks of many native trees (Figure 10) which will eventually lead to their decline. This damage can be seen throughout the Yaldhurst Bush.

Once proposed restoration has been completed, we anticipate that mower access will be completely excluded from the woodland understorey areas south of the waterway where they are currently causing the most damage. Once further forest, woodland and lizard habitat has been established in the currently mown areas, mowing will be limited to well defined pathways and the two road frontages of the reserve.

***Figure 10:*** *Mower damage to native trees at Yaldhurst Bush (from top): 1) ti kouka/cabbage tree, 2)lowland ribbonwood, 3) totara, and 4) lowland ribbonwood (Photographs: A. Shadbolt 2024).*

# Ecological values

## Botanical values

Although no original remnant indigenous vegetation occurs at this site, and all plants have either been planted or have subsequently self-colonised, Yaldhurst Bush has value in terms of its original **'living museum'** role. If future restoration is planned and designed well, due to its size - which is comparable to Pūtaringamotu-Riccarton Bush - it has potential to act as another significant lifeboat for our increasingly threatened biodiversity.

The southern boundary of the park is dominated by lowland ribbonwood with an understorey of silver tussock. This zone also contains a good number of totara that are now beginning to naturally regenerate in the understorey. Several matai *(Figure 8)* are well established throughout this area, along with a representative range of other species including South Island kowhai, ti kouka/cabbage trees, kohuhu*, and* golden akeake*.*

At the centre of the reserve, groves of plains kanuka are well established, thriving, and serve as a good indicator for future planting (Figure 11). Nearby, large areas of planted silver tussock have been established and also thriving even though they persist amongst dense exotic grasses.

***Figure 11:*** *Left matai (Prumnopitys taxifolia) and right, kanuka (Kunzea serotina) at Yaldhurst Bush (Photograph: A. Shadbolt 2024)*

## Avifauna values

Twenty-six species have been recorded at Yaldhurst Bush (Table 2) during Council's programmed slow walk bush bird transect surveys (20 species) and from eBird[9] and/or iNaturalist[10] records (six species). Of these, 12 species are indigenous species.

***Table 2:*** *Monthly bush bird counts at Yaldhurst Bush using the slow walk transect method over two monitoring periods (2011-2012 / 2020-2021) and eBird/iNatuarlist records (bottom). Species shown in bold type indicate indigenous species.*

| Species | A | M | J | J | A | S | O | N | D | J | F | M | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Welcome Swallow** | 0/- | 0/0 | 0/0 | -/- | 0/0 | 0/- | 0/0 | 0/0 | 0/1 | 0/0 | 0/0 | 0/0 | 0/1 |
| **Grey Warbler** | 2/- | 0/0 | 0/0 | -/- | 0/1 | 1/- | 0/1 | 0/1 | 1/1 | 0/3 | 0/1 | 0/0 | 4/8 |
| **Fantail** | 3/- | 1/4 | 2/1 | -/- | 0/1 | 0/- | 0/0 | 0/0 | 0/0 | 0/0 | 0/7 | 0/0 | 6/13 |
| **Silvereye** | 3/- | 9/4 | 5/22 | -/- | 4/12 | 8/- | 4/7 | 7/5 | 5/0 | 3/11 | 7/21 | 11/5 | 66/87 |
| **Bellbird** | 0/- | 0/2 | 0/0 | -/- | 0/0 | 0/- | 0/0 | 0/2 | 0/0 | 0/0 | 0/1 | 0/0 | 0/5 |
| **Shining Cuckoo** | 0/- | 0/0 | 0/0 | -/- | 0/0 | 0/- | 0/0 | 0/1 | 0/0 | 0/0 | 0/0 | 0/0 | 0/1 |
| Chaffinch | 1/- | 0/0 | 1/0 | -/- | 1/0 | 0/- | 0/1 | 0/2 | 0/4 | 0/0 | 0/3 | 0/2 | 3/12 |
| Greenfinch | 1/- | 0/2 | 0/3 | -/- | 0/0 | 4/- | 3/1 | 1/5 | 1/2 | 3/8 | 3/0 | 1/1 | 17/22 |
| Goldfinch | 0/- | 1/2 | 1/2 | -/- | 5/1 | 11/- | 14/16 | 12/9 | 6/11 | 2/2 | 5/2 | 7/1 | 64/46 |
| Redpoll | 0/- | 3/2 | 1/0 | -/- | 1/0 | 2/- | 6/2 | 9/6 | 3/7 | 8/10 | 4/3 | 0/0 | 37/30 |
| House Sparrow | 7/- | 1/0 | 0/1 | -/- | 13/1 | 17/- | 25/ | 29/ | 20/ | 26/ | 29/ | 38/ | 205/53 |
| Dunnock | 1/- | 2/1 | 0/2 | -/- | 2/0 | 4/- | 0/4 | 0/13 | 0/7 | 0/10 | 0/8 | 0/9 | 9/8 |
| Blackbird | 2/- | 3/3 | 1/5 | -/- | 4/5 | 2/- | 6/3 | 4/1 | 2/1 | 2/7 | 6/4 | 8/5 | 40/27 |
| Song Thrush | 0/- | 0/3 | 1/2 | -/- | 1/0 | 2/- | 2/4 | 6/0 | 1/2 | 0/0 | 1/1 | 1/1 | 11/13 |
| Starling | 1/- | 0/8 | 8/12 | -/- | 4/7 | 5/- | 6/3 | 5/4 | 5/0 | 1/0 | 14/0 | 45/9 | 94/43 |
| Magpie | 0/- | 0/0 | 1/0 | -/- | 0/0 | 0/- | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 1/0 |
| Yellowhammer | 0/- | 0/2 | 0/0 | -/- | 1/0 | 2/- | 0/ | 0/ | 0/ | 0/ | 0/ | 0/ | 3/4 |
| Skylark | 0/- | 0/0 | 1/0 | -/- | 1/0 | 1/- | 0/0 | 1/1 | 2/0 | 2/0 | 1/0 | 0/1 | 9/1 |
| **Harrier** | 0/1 | 0/1 | 0/0 | -/- | 0/0 | 0/- | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/1 |
| Feral Pigeon | 1/- | 0/6 | 4/0 | -/- | 2/2 | 5/- | 5/0 | 2/0 | 0/0 | 4/1 | 4/0 | 1/0 | 28/9 |
| | | | | | | | | | | | | | |
| **Additional species recorded on iNaturalist and eBird websites** | | | | | | | | | | | | | |
| **Spur winged plover** | | | | | | | | | | | | | |
| **Southern black backed gull** | | | | | | | | | | | | | |
| **White faced heron** | | | | | | | | | | | | | |
| **Sacred kingfisher** | | | | | | | | | | | | | |
| Mallard | | | | | | | | | | | | | |
| **South Island pied oystercatcher** (fly-over) | | | | | | | | | | | | | |

On its own, Yaldhurst Bush would not support viable bush bird population in the long term. However, despite being one of the more isolated native forest patches planned for Ōtautahi-Christchurch, it will be a significant contributor to a city-wide bush bird **meta-population** - a population of populations that allows for some dispersal between patches (see also Meurk & Hall 2006). Because six native bush birds have already been recorded at Yaldhurst Bush indicates that native avian species can be expected to increase in both diversity and abundance as more habitat restoration is carried out.

[9] eBird website: https://ebird.org/home
[10] iNaturalist website: https://www.inaturalist.org/

## Herpetofauna values

The greater Ōtautahi-Christchurch area provides habitat for up to five species of native lizard (Table 1.), all of which are 'absolutely protected' under the Wildlife Act 1953, s63 (1) (c), and lizard habitats are protected by the Resource Management Act (1991). At any site where lizards and/or their habitat has been identified, we are required to adhere to legislation outlined in the Wildlife Act, and the Christchurch City Councils Biodiversity Strategy to protect rare and threatened native biodiversity; understanding that it is unlawful to disturb or destroy protected wildlife or any protected game species.

***Table 3:*** *Five indigenous lizard species occurring on the greater Ōtautahi-Christchurch area.*

| Common Name | Scientific Name | Conservation Status |
|---|---|---|
| Southern grass skink | *Oligosoma aff. polychroma*, Clade 5 | At Risk - Declining |
| McCann's skink | *Oligosoma maccanni* | Not Threatened |
| Canterbury spotted skink | *Oligosoma aff. lineoocellatum* | Threatened - Nationally critical |
| Waitaha gecko | *Woodworthia cf. brunnea* | At Risk - Declining |
| Jewelled gecko | *Naultinus gemmeus* | At Risk - Declining |

Indigenous lizard species often occupy habitats of otherwise low ecological value (i.e., weedy vegetation and vegetation margins) and are very cryptic species, making them difficult to detect and identify. Areas of vegetation such as exotic grasses, vines, shrubs, trees, and dense vegetation such as toetoe, pampas and harakeke often provide suitable habitat for indigenous lizards. Animals may also be found sheltering beneath objects (natural or manmade) that provide cover, such as pieces of wood, rocks, bricks etc. To date, no lizard surveys have been done in Yaldhurst Bush. However, we can assume that lizards are likely to be present given the age of the plantings that also that they are interspersed with areas of rough grass and other habitat features such as large woody debris and areas of open pebbles/gravels.

Species that expected to be present at Yaldhurst Bush – and/or could be released there include Southern grass skink (*Oligosoma aff. polychroma*, Clade 5) and McCann's skink *(Oligosoma maccanni)* which have conservation treat rankings of 'At Risk – Declining' and 'Not Threatened' respectively. A list of other lizard species occurring in the Ōtautahi-Christchurch area is included in Appendix 3, and these species could be considered for reintroduction once suitable habitat establishes.

As part of further planning for lizard translocations to Yaldhurst Bush, a lizard survey will be completed. This survey will determine the size of the existing population which will in-turn inform how many animals we will be able to release so that we do not exceed the sites carrying capacity. **This section of the report will be updated once this survey has been completed.**

## Freshwater aquatic values

Although no aquatic surveys have been done in this waterway, aquatic values may be limited due to its poor downstream connectivity. It appears that the waterway discharges to ground through gravels to re-emerge again downstream of the State Highway 73 intersection with the Old West Coast Road. We recommend than an aquatic survey be done at this site, and further investigation into the implications of its isolated nature, and whether conditions - including its isolation - may be suitable for the introduction of the nationally critically threatened Canterbury mudfish – kōwaro.

**Council's ecologists will work closely with staff from Selwyn District Council's Natural Environment Team to ensure that any proposals to (E.g.) alter flows in Selwyn water races will not adversely affect the section of waterway that passes through Yaldhurst Bush.**

## Invertebrate values

Although no formal invertebrate surveys have been carried out at Yaldhurst Bush, several species – including eight indigenous species have been recorded on iNaturalist (Refer Table 4).

***Table 4:*** *Invertebrate species recorded at Yaldhurst Bush as listed in iNaturalist website.*

| Species | Common name | Indigenous |
|---|---|---|
| *Uresiphita maorialis* | Kowhai moth | ✓ |
| *Strepsicrates ejectana* | Guava bud moth | ✓ |
| *Newzealandia graffii* | Flatworm | ✓ |
| *Trigonospila brevifacies* | Australian leafroller tachinid | |
| *Gymnobathra parca* | Endemic moth | ✓ |
| *Orthodera novaezealandiae* | NZ mantis | ✓ |
| *Armadillidium vulgare* | Common pill woodlouse | |
| *Pantomorus cervinus* | Fuller's rose weevil | |
| *Megangyna novaezelandiae* | Large hover fly | ✓ |
| *Zelandotipula novarae* | Swamp crane fly | ✓ |
| *Glyphipteriginae spp.* | Sedge moth | |
| *Orocrambus flexuosellus* | Common grass moth | ✓ |
| *Parentia spp.* | Fly species | |

There may opportunities to conduct formal invertebrate surveys to collect baseline species composition and population data either though engaging a specialist entomologist, supporting student research programmes or by including the site in annual city-wide bio-blitz events. Furthermore, as new plantings at Yaldhurst Bush establish and begin to provide appropriate habitat, re-introductions/translocations of appropriate invertebrate species – e.g., boulder copper butterfly (Figure 13) - could be carried out.

***Figure 13:*** *Boulder copper butterfly (Photograph: J. Sullivan, 2013)*

# Proposal

## Restoration

Successful restoration of Yaldhurst Bush sees the entire site restored as an indigenous woodland, shrubland and grassland ecosystem (Figure 14). This will involve:

- ✓ Eradication of pest plant species and exotic woody vegetation including willows that currently dominate the wetland at the eastern corner of the site.
- ✓ In-filling of existing planted areas with locally eco-sourced trees, shrubs, scramblers, and climbers.
- ✓ Under-planting of existing planted areas with understory groundcovers and ferns.
- ✓ Planting new kanuka & kowhai dominated native forest and woodland into mown grass areas at the western and eastern ends of the reserve.
- ✓ Managing open areas on the north side of the reserve as lizard habitat through managing exotic grass, establishing suitable groundcover and shrub species, and providing lizard refuge areas of woody debris and rock/stone.
- ✓ Continuing to enhance the corridor along the naturalised water race through riparian planting, and - if needed – by incorporating instream habitat diversity with pools, riffles, boulders, and/or woody debris.

**Figure 9:** Landscape development plan for Yaldhurst Bush showing a range of proposed ecological enhancements, new circulation routes, interpretation features and picnic tables/seating areas.

## Paths

We will retain all existing pathways in the park and create a series of informal nature loop trails through the native forest areas. A main route will be maintained through the proposed forest areas on the park's eastern side, with additional loop trails emerging naturally as the forest matures. These secondary loops will follow established desire lines or logical routes through natural clearings in the forest, creating the impression that the trails were organically integrated within the forest rather than the forest being shaped around them. This approach aims to enhance the sense of wilderness and natural character within the park.

We also propose constructing a new path along the western edge of the planned forest to create an open walking loop around the grass playing field. This path will offer an alternative route to the existing main path, which will eventually be surrounded by the mature forest.

## Other features

We propose creating a series of small spaces within the site that can be used for picnicking, quiet contemplation, or as small outdoor classrooms. The surfacing of these areas may be either be the in-situ natural surfaces or compacted crusher dust path surfaces.

## Crime prevention through environmental design (CPTED)

To manage Crime prevention Through Environmental Design (CPTED) principles, we have considered a range of responses:

- ✓ We will endeavour to provide clear sightlines along main pathways as much as practically possible within a natural forest environment. However, we recognise that this will not be achievable nor appropriate in all locations.
- ✓ Although paths in will be more secluded and with less passive surveillance and visibility than would normally be expected of a community park, it already has poor passive surveillance from outside the park due to the dense boundary planting on all sides. However, Yaldhurst Bush is not part of a walking or commuting route that is linked to other sites, and instead it is a 'destination park' that people will *choose* to visit (rather than *need* to transit though). To highlight the isolated wilderness nature of the park, design cues at key entry points to these paths will give a clear indication of the environment people will be entering into if they choose to.
- ✓ There will be multiple options for walking through and around the park. By creating loops and multiple entry and exit points to the paths, we will ensure there are no dead-ends or entrapment spots and/or that unobstructed escape routes are obvious and available should they be needed.

# Restoration method

## Species selection

As part of the Council's **Agenda 21** project undertaken by Lucas and Associates[11], the land surfaces of Ōtautahi-Christchurch were mapped for their approximate age, soil development, drainage, analogy with surviving remnants and historic accounts of the former natural mature vegetation/ecosystems. Each area was reconstructed as a model to be used as a guide for restoration, and plant lists were compiled for each of the ten original indigenous ecosystems including trees, shrubs, scramblers and ground covers.

The Lucas & Associates maps show Yaldhurst Bush located on moist & deep Waimakariri soils to the west of the Yaldhurst Bush site, and more droughty & shallower mid-aged Waimakariri soils in the east (Figure 15). In reality these soil types would likely merge seamlessly within the reserve, without any distinct separation. As-such, species suitable for planting within Yaldhurst Bush would be selected from Lucas and Associates **'Houhere/Piwakawaka – Kohuhu'** and **'Ti Kouka/Kotare – Kanuka'** plant lists.

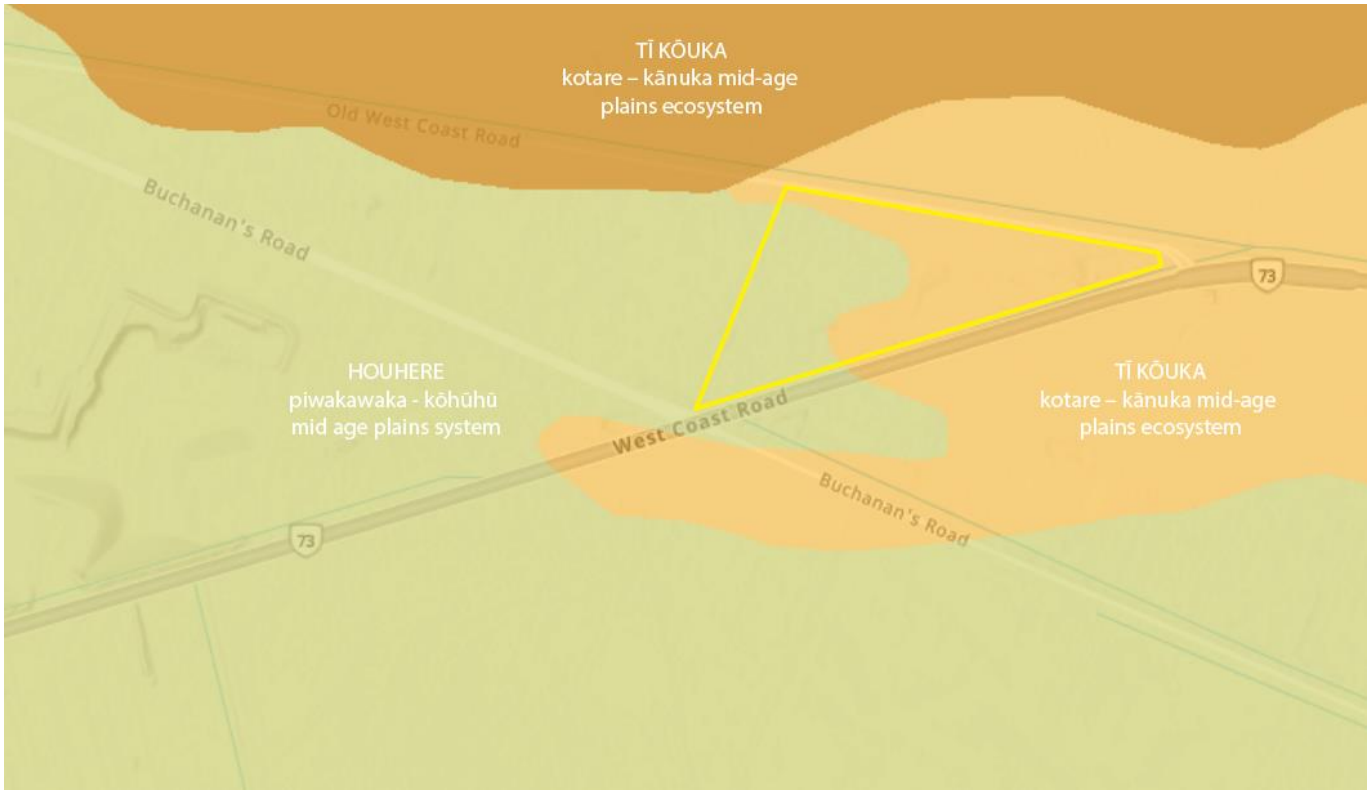


**Figure 15:** Location of Yaldhurst Bush (yellow polygon) in relation to various ecosystem types based on underlying soils (Source: Lucas and Associates Indigenous Ecosystems of Ōtautahi Christchurch).

**NOTE: All species used for forest restoration planting at Yaldhurst Bush shall be eco-sourced from naturally occurring vegetation remnants the Low Plains Ecological District or nearest appropriate location as approved by Council's parks ecologist.**

[11] https://www.lucas-associates.co.nz

# Restoration zoning

To aid planning of the forest, the proposed planted area has been separated into six distinct zones (Figure 16), based on how they will be integrated with park use, public safety and how they integrate with neighboring properties. These zones include:

1) **Dense boundary planting:** Dense native tree and shrub plantings along the western and northern reserve boundaries. Restoration limited to maintaining an effective buffer, weed control, staged replacement of non-local species & cultivars with appropriate eco-sourced species, and the establishment of native climbers and understorey plants.

2) **Open mixed plantings:** Sparse native forest/woodland plantings along southern boundary, and kanuka dominated central areas. Restoration activities include enrichment & infill planting to better buffer the southern reserve boundary, establishment of climbers and understorey species and ongoing weed control.

3) **Willow woodland:** Crack willow *(Salix fragilis)* dominated woodland with regenerating native tree & shrub understorey. Restoration activities include ongoing willow and woody weed eradication, preservation of natural landforms, wetland planting, establishment of a densely planted road buffer on the north, east and southern sides.

4) **Western and eastern mown grass areas:** Areas proposed to be planted in houhere-kanuka-kowhai dominated woodland to merge seamlessly with 1, 2 & 3.

5) **Northern open grass area:** Area proposed to be restored as open tussock grassland with scattered dryland shrubs, vines and naturalistic rock piles and other habitat features for optimum lizard habitat.

6) **Riparian corridor:** Restoration of waterway to include bolstering existing riparian planting, providing effective waterway shade, and the addition of woody debris and other in-stream habitat features.

**Figure 10:** Yaldhurst Bush restoration zoning map.

**Note:** Tables provided in Appendix 1 provide indicative species lists, numbers, and plant grades for the six planting zones. Note that final plant availability may change slightly due to plant availability.

# Establishing lizard habitat

Two key threats to skink species are habitat loss and predation. They are mostly found in grasslands (especially tall grass species or rank grass), scrublands and vinelands rather than forests (e.g., Figure 17). The southern grass skink requires sunny open areas for basking as well as habitat complexity to help avoid predation.

Some key points to enhancing lizard habitat for the southern grass skink at Yaldhurst Bush include:

- ✓ Habitat foundation should be tussock grassland. This maintains open and largely unshaded habitat. Grass should not be mown because this reduces cover and increases the risk of predation. For Yaldhurst Bush silver tussock is suitable.
- ✓ Include a scattered ground cover of native vines and prostrate shrubs. This creates habitat complexity and variable food resources. Species such as *Muehlenbeckia complexa* is suitable because it is low growing, provides complex cover and attracts a large range of insects (food).
- ✓ Include clusters of native shrubs. This improves the ecosystem, provides more complexity, diversity, and additional food resources by attracting insects and producing fruit. It is important to not uniformly plant shrubs in the landscape as this will result in a shaded shrubland which is not the desired outcome. Instead plant these shrubs in clusters.
- ✓ Coprosma species, porcupine shrub and prostrate kowhai, are good choices. Additional 'non-plant' habitat complexity should be incorporated. This can be achieved with stones piles or wood. It is recommended that additional complexity is based on what is natural in the environment. In the case of Yaldhurst Bush, logs, woody debris and small Waimakariri River stones are appropriate.
- ✓ It is important to undertake planting in a sensitive manner. For example, a manicured planting with mulched gaps between plants will result in too much space and not enough complexity. This would have a detrimental impact on the local lizard community. Habitat cover needs to remain even while plants are being established. Figure 18 (below) shows examples of a good and bad skink habitat plantings from Christchurch.

***Figure17:*** *Examples of NZ grassland and shrubland ecosystems that provide good skink habitat (Photographs from top: C. McClure, N. Head, C. McClure, and N. Head).*

***Figure 18:*** *Examples of good (left) and bad (right) skink habitat (Photographs, Chris McClure).*

# Site preparation

## Herbicide application

- ✓ Spray all proposed forest/woodland areas with a broad-spectrum herbicide to achieve total kill of all grass and broadleaved weeds.
- ✓ Contractor to follow all best-practice agrichemical application procedures and council guidelines for working in parks.
- ✓ Where possible, use a **stale seedbed** methodology whereby two applications of herbicide are done, consisting of 1) an initial application to achieve total kill of existing weeds, and 2) a second follow-up application (e.g. 6 – 8 weeks later) to kill any new weed-cover that has established resulting from seeds that have germinated following the first herbicide application.

## Supply & spread mulch

- ✓ Where funding allows, arrange for the supply, delivery and spreading of 100 mm compacted/settled depth of arbor mulch across new forest/woodland areas within the site. Mulch will help suppress further weed growth and help retain soil moisture.
- ✓ Where available budget will not allow for the entire site to be mulched, recommend limiting mulch to a 5 – 10 m wide band around the edges of the planted areas, and particularly along pathways. Mulching these areas will help the site look tidy and cared-for, making the restoration plantings more acceptable to the public.

## Addition of woody debris

- ✓ Because natural forests and woodlands have a high proportion of standing deadwood and downed woody debris in their understories, it is desirable to arrange for the importation of logs and stumps. Supply of this type of material can normally be easily arranged with local arboricultural contractors who are working in the area, as dropping it at a convenient re-arranged locations often helps them avoid transportation and disposal costs.
- ✓ Placement of woody debris as lizard habitat features in lizard areas shall be directed by a suitably qualified/experienced herpetologist (refer to section on lizard habitat).

# Planting

## Plant collection and delivery

- ✓ Contractors, staff, and/or volunteers collecting plants from nurseries must contact the nursery ten working days prior to plant pick-up to allow for their planting stock to be sorted and weeded before dispatch.
- ✓ Where contractors, staff or volunteers are concerned about the size of nursery plants being too small (or of otherwise poor quality/health) to establish well, they should contact Council's parks ecologist for advice.
- ✓ Ensure that only the number of plants that can be planted on the day are collected unless the contractor, staff or volunteers have facilities to ensure plants are watered and remain in good health prior to planting.
- ✓ When transporting plants to the planting site, foliage should be covered with (e.g.) hessian or wind break material to reduce wind damage and excessive transpiration/water loss.

## Plant setout

- ✓ Contractor, staff, and/or volunteers shall contact Council's parks ecologist to meet on site at time of planting to assist with set-out and/or provide plant set-out advice.
- ✓ All plants to be laid out in natural/random patterns, avoiding straight lines.
- ✓ Shrubs such as harakeke/lowland flax *(Phormium tenax),* small-leafed coprosmas *(Coprosma propinqua & C. rubra)*, toetoe *(Austroderia richardii),* korimiko *(Hebe salicifolia)* and korikio *(Corokia cotoneaster)* shall be planted towards the edges of new plantings to achieve a natural forest edge ecosystem.
- ✓ Ensure that harakeke/lowland flax is planted no closer than 3 m from the edge of any path to maintain sightlines and avoid tripping hazards from their long strappy leaves.
- ✓ Climbers and scramblers, including NZ jasmine *(Parsonsia spp.)*, bush lawyer/tataramoa *(Rubus spp.)* and clematis *(Clematis paniculata)* will require mature plants to support them and will therefore need to be planted at the bases of existing trees and large shrubs that can offer them structural support to eventually climb.

## Planting

- ✓ Planting must follow industry best-practice for restoration plantings whereby holes are sufficiently wider than the plant container size, straight sided, deep enough and having broken though any sub-surface pans or compacted soils beneath the level of the pot.
- ✓ Where local schools with younger children (<10-year-olds) are involved with planting, recommend that holes are pre-dug by others prior to the planting event, and that follow-up planting checks are carried out and any issues rectified immediately.
- ✓ Ideally, all plants (except for grasses) should have cardboard plant protectors installed, including bamboo stakes and wool mulch mats to assist their establishment and enable easier location line-trimming and/or follow-up herbicide application.

- ✓ Where cardboard plant guards are not used, each plant shall have a one-metre above-ground length bamboo cane installed to help contractors, staff and/or volunteers find plants amongst weeds. Suggest that all stakes are installed on the (e.g.) north side of each plant to further aid in plant location amongst weeds.
- ✓ Fertliser tabs shall be added to the base of each planting hole according to manufacturer's recommendations to help sustain healthy and vigorous plant growth.

# 24-month establishment period

## Weed control

- ✓ Contractors, staff, and/or volunteers shall ensure that weed growth at the site does not compromise native plant health and vigor, and that the site is maintained in a tidy state that is accepted by the community.
- ✓ Recommend site receives a minimum of four maintenance passes per year during the 24-month establishment period involving (where necessary) locating and hand releasing plants where they have become overrun with weeds, and an application of an approved systemic herbicide to control weeds throughout site.

## Watering

- ✓ Even given the dry nature of the reserve, based on experience at nearby sites (e.g., McLeans Island Grassland Park), it is not anticipated that plantings in Yaldhurst Bush will require watering. Instead, plants shall be selected based on their ability to withstand Canterbury's harsh and droughty conditions.

## Pruning

- ✓ Pruning shall <u>not</u> be carried out on any plantings during the 24-month maintenance period.

## Pest animals

- ✓ Often restoration plantings are impacted by pest animals such as rabbits, hares, possums and pūkeko. Given the rural nature of Yaldhurst Bush, it can be expected that such pest animals will be an ongoing treat to native plantings at the site, and control measures may need to be initiated as damage becomes evident.

## Rubbish removal

- ✓ In some situations, restoration plantings can trap rubbish (E.g., plastic bags, paper, or even plant guards) that is discarded or blows through sites. Although it is expected that this will be minimal at Yaldhurst Bush, any rubbish or other debris encountered during routine maintenance shall be collected and disposed of off-site appropriately.

# Ongoing management

Ongoing management of the site following the initial 24-month maintenance period shall be limited to the following activities.

- ✓ Once habitat is established and supporting wildlife populations (including lizards), mammalian predator control can be carried out as part of Council's Parks Operational Pest Animal Management Plan. Note that there will also likely be requirements for ongoing animal pest management as part of Lizard Management Plans associated with lizard translocations.
- ✓ Ongoing monitoring of lizard population as required by Lizard Management Plans.
- ✓ Control of woody weeds and vines throughout planted areas (E.g., grey willow, sycamore, Chilean mayten, cherry, North Island lacebark, old man's beard, ivy).
- ✓ Removal and disposal off-site - or re-use - of plant guards.
- ✓ Control of grass and herbaceous weeds around the periphery of the forest areas, and particularly along pathways for aesthetic reasons.
- ✓ Periodic removal and disposal off-site of rubbish and debris.
- ✓ Stripping and of dead cabbage tree leaves from trees alongside paths to reduce risk of arson. Cabbage tree leaves to be disposed of within plantings away from paths/high-use areas.

# Implementation plan

We intend to establish native restoration plantings at Yaldhurst Bush via Councils rolling programme of urban forest plantings and its programme of establishing habitat for translocated lizard populations. We also intend to partner with Trees for Canterbury[12] - a charitable trust that runs around 12 community planting days each year and has given away more than 1,400,000 trees to the community over the last 30+ years.

Partnership options with Trees for Canterbury will need to be confirmed, but could involve variations of (E.g.):

- ✓ For forest and woodland areas, Council funds the cost of site preparation, mulch, and trees from its rolling urban forest planting budget while Trees for Canterbury supplies and plants non-tree species to complete forest planting in one planting season, or
- ✓ Council covers cost of site preparation & mulch and Trees for Canterbury supplies and plants all species to complete forest planting over several seasons, or
- ✓ Other partnership arrangement.

All scenarios will likely involve plantings being handed over to Council for maintenance and establishment immediately following planting.

Pending Community Board approval, restoration activities at Yaldhurst Bush could commence in early 2025, with an indicative programme shown in Table 5 (below). Once forest, woodland and lizard habitat has been established and lizards have been translocated to the site, Yaldhurst Bush will be handed over to Council's Coastal Plains Regional Parks operational team for ongoing management of the site's significant ecological values.

***Table 5:*** *An indicative implementation programme for Yaldhurst Bush.*

| Action | Lead | Timing |
|---|---|---|
| Confirm partnership between Council & Trees for Canterbury | Parks Panning | Nov 2024 |
| Confirm programming of Council funding | Parks Planning | Nov 2024 |
| Control woody weeds throughout | Community Parks | Jan/Feb2025 |
| Confirm options to safeguard waterway | Council 3-Waters | Jan/Feb 2025 |
| Consult on plan | Parks Planning | Feb 2025 |
| Plant Zone 5 (Lizard habitat) and install habitat features | Parks Planning | May/Jun 2025 |
| Plant Zone 4 (Eastern & western mown grass areas) | Trees for Canterbury | May/Jun 2025 |
| Plant Zone 6 (Riparian Corridor) | Council 3-Waters | May/Jun 2026 |
| Plant Zone 2 – (Open mixed plantings). | Trees for Canterbury | May/Jun 2026 |
| First lizard release | Technical Services & Design | Feb/Mar 2026 |
| Second lizard release | Technical Services & Design | Feb/Mar2026 |
| Hand over reserve from Community Parks to Regional Parks | Parks Planning | Jul 2027 |
| Control willows in Zone 3 (Willow woodland). | Regional Parks | Mar/Apr 2028 |
| Pant Zone 3 (Willow woodland) | Trees for Canterbury | May/Jun 2028 |
| Plant Zone 1 (Dense boundary planting) | Regional Parks | May/Jun 2028 |
| Begin reintroducing invertebrates locally extinct invertebrates | Parks Planning | October 2028 |

***Note:*** *All plantings and restoration activities will be subject to Council's Long-Term Plan (LTP) and Annual Plan budgets, and/or third-party support.*

[12] www.treesforcanterbury.org.nz

# References

CCC (2004a) *Ōtautahi-Christchurch proposed lizard translocation release sites.* Christchurch City Council, Christchurch, New Zealand

CCC (2024a) *Ōtautahi-Christchurch (excluding Port Hills) native forest network.* Christchurch City Council, Christchurch, New Zealand

CCC (2024b) *Waimaero Fendalton-Waimairi-Harewood community board native forest patch network.* Christchurch City Council, Christchurch, New Zealand

Meurk C., and Hall, G. M. J. (2006) *Options for enhancing forest biodiversity across New Zealand's managed landscapes based on modelling and spatial design.* New Zealand Journal of Ecology 30(1)

# Appendix 1: Lizard translocation release sites

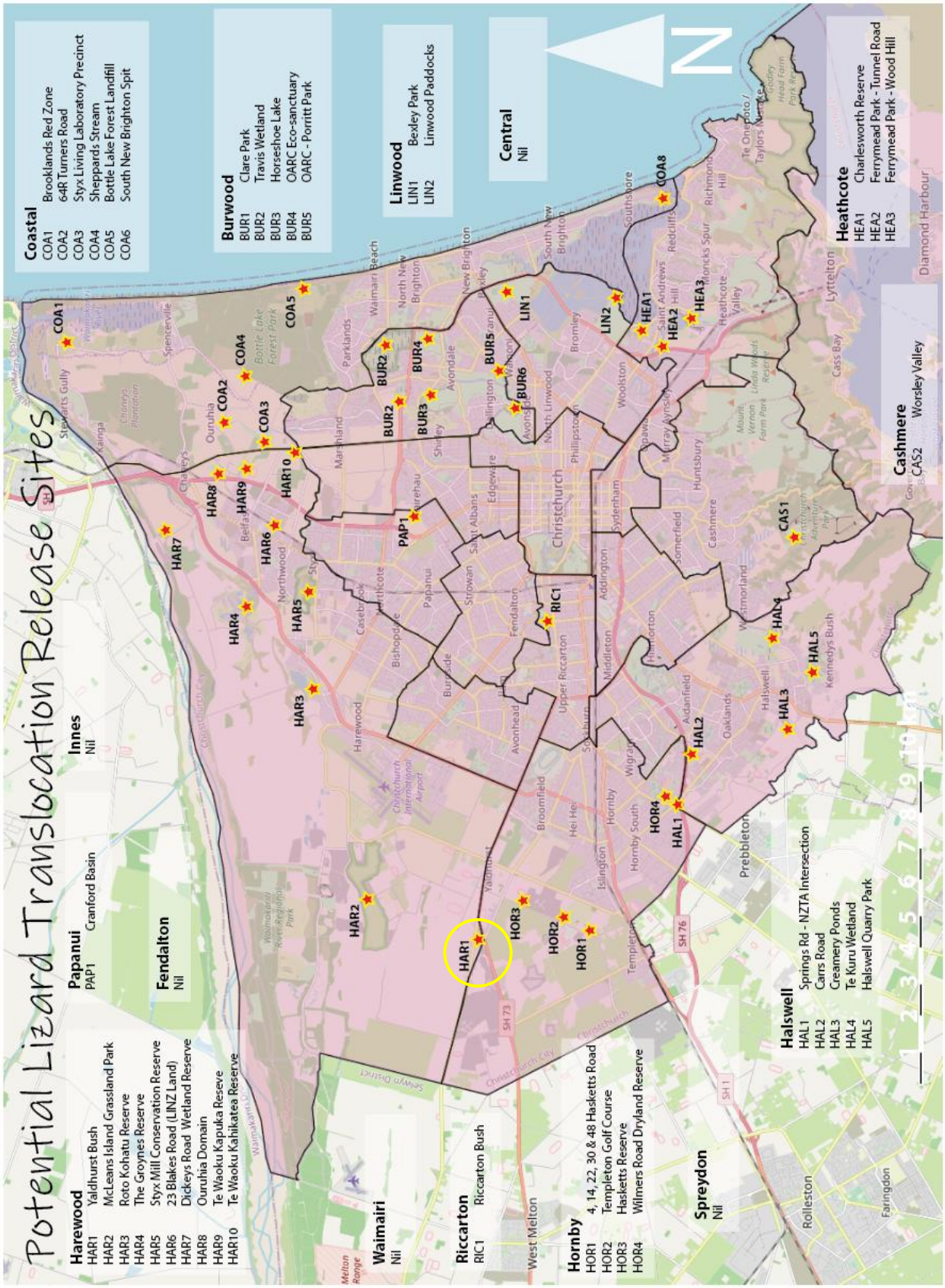


***Figure 19:*** *Proposed lizard release sites across Christchurch City Council Community Board area (Yaldhurst Bush circled)*

# Appendix 2: Restoration planting species lists

## Zone 1: Dense boundary planting - native forest/woodland (12,000 m$^2$)

**Table 6:** Indicative species list for Zone 1 (existing dense native forest/woodland) to be planted as infill/enrichment & understorey planting at (average) 5.00 m centres.

| Species | Common name | Number | Grade |
|---|---|---|---|
| *Clematis feotida* | yellow clematis | 20 | RX90 |
| *Clematis marata* | clematis | 20 | RX90 |
| *Clematis quadribracteolata* | clematis | 20 | RX90 |
| *Asplenium flabellifolium* | necklace fern | 20 | RX90 |
| *Asplenium terrestre* | ground spleenwort | 20 | RX90 |
| *Austroblechnum penna-maria* | kiokio/little hard fern | 20 | RX90 |
| *Hypolepis ambigua* | rough pig fern | 20 | RX90 |
| *Lophomyrtus obcordata* | rohutu/New Zealand myrtle | 10 | 2.5L |
| *Melicytus ramiflorus* | mahoe/whiteywood | 10 | RX1L |
| *Microsorum pustulatus* | maratata/hounds tongue fern | 20 | RX90 |
| *Myrsine australis* | red mapau | 10 | 2.5L |
| *Myrsine divaricata* | weeping mapau | 20 | 2.5L |
| *Parsonia capsularis* | kaiwhiria/New Zraland jasmine | 20 | RX90 |
| *Parsonia heterophylla* | kaiwhiria/New Zraland jasmine | 20 | RX90 |
| *Pellaea rotundifolia* | tarawera/butto fern | 20 | RX90 |
| *Pennantia corymbosa* | kaikomako | 10 | 2.5L |
| *Podocarpus totara* | totara | 10 | 2.5L |
| *Polystichum richardii* | pikopiko/tutoke/shield fern | 20 | RX90 |
| *Polystichum zelandica* | pikopiko/tutoke/shield fern | 20 | RX90 |
| *Prumnopitys taxifolia* | matai | 10 | 2.5L |
| *Pteridium esculentum* | rahurahu/bracken fern | 20 | RX90 |
| *Rubus schmidelioides* | taramoa/narrow-leaved lawyer | 20 | RX90 |
| *Rubus squarrosus* | leafless lawyer | 20 | RX90 |
| *Teucridium parvifolium* | New Zealand shrub verbena | 20 | 2.5L |
| **TOTAL** | | **420** | |

## Zone 2: Open mixed plantings - native forest/woodland (16,000 m$^2$)

**Table 7:** Indicative species list for Zone 2 (existing sparse native forest/woodland) to be planted as bulk infill planting of open areas and enrichment & understorey planting of denser areas at (average) 3.00 m centres.

| Species | Common name | Number | Grade |
|---|---|---|---|
| *Clematis feotida* | yellow clematis | 20 | RX90 |
| *Clematis marata* | clematis | 20 | RX90 |
| *Clematis quadribracteolata* | clematis | 20 | RX90 |
| *Cordyline australis* | ti kouka/cabbage tree | 300 | RX90 |
| Asplenium flabellifolium | necklace fern | 20 | RX90 |
| *Asplenium terrestre* | ground spleenwort | 20 | RX90 |
| *Austroblechnum penna-maria* | kiokio/little hard fern | 20 | RX90 |
| *Carpodetus serratus* | putaputaweta/marbleleaf | 30 | 2.5L |
| *Coprosma crassifolia* | thick-leaved mikimiki | 80 | RX1L |
| *Coprosma linariifolia* | linear-leafed coprosma/yellow-wood | 30 | RX1L |
| *Coprosma propinqua* | mikimiki | 160 | RX1L |
| *Coriaria arborea* | tree tutu | 20 | RX1L |
| *Hoheria angustifolia* | houhere/narrow-leafed lacebark | 80 | RT |
| *Hypolepis ambigua* | rough pig fern | 20 | RX90 |
| *Kunzea serotina* | kanuka | 300 | RT |
| *Leptospermum scoparium* | manuka | 80 | RT |
| *Lophomyrtus obcordata* | rohutu/New Zealand myrtle | 30 | 2.5L |
| *Melecope simplex* | poataniwha | 20 | RX1L |
| *Melicytus ramiflorus* | mahoe/whiteywood | 80 | RX1L |
| *Microsorum pustulatus* | maratata/hounds tongue fern | 20 | RX90 |
| *Myrsine australis* | red mapau | 30 | 2.5L |
| *Myrsine divaricata* | weeping mapau | 30 | 2.5L |
| *Parsonia capsularis* | kaiwhiria/New Zraland jasmine | 20 | RX90 |
| *Parsonia heterophylla* | kaiwhiria/New Zraland jasmine | 20 | RX90 |
| *Pellaea rotundifolia* | tarawera/butto fern | 20 | RX90 |
| *Pennantia corymbosa* | kaikomako | 30 | 2.5L |
| *Podocarpus totara* | totara | 80 | 2.5L |
| *Polystichum richardii* | pikopiko/tutoke/shield fern | 20 | RX90 |
| *Polystichum zelandica* | pikopiko/tutoke/shield fern | 20 | RX90 |
| *Prumnopitys taxifolia* | matai | 30 | 2.5L |
| *Pseudopanax arboreus* | whauwhaupaku/fivefinger | 30 | RX1L |
| *Pseudopanax crassifolius* | horoeka/lancewood | 30 | 2.5L |
| *Pteridium esculentum* | rahurahu/bracken fern | 30 | RX90 |
| *Rubus schmidelioides* | taramoa/narrow-leaved lawyer | 20 | RX90 |
| *Rubus squarrosus* | leafless lawyer | 30 | RX90 |
| *Sophora microphylla* | South Island kowhai | 80 | 2.5L |
| *Teucridium parvifolium* | New Zealand shrub verbena | 30 | 2.5L |
| **TOTAL** | | **1920** | |

## Zone 3: Willow woodland (4200 m²)

**Table 8:** Indicative species list for Zone 3 (mixed willow/native woodland) to be planted as bulk infill planting of open areas and enrichment & understorey planting of denser areas at (average) 1.80 m centres.

| Species | Common name | Number | Grade |
|---|---|---|---|
| *Astelia grandis* | kakaha/giant bush flax | 25 | 2.5L |
| *Austroderia richardii* | toetoe | 25 | RX90 |
| *Carex flagelifera* | sedge | 100 | RX90 |
| *Carex secta* | pukio sedge | 250 | RX90 |
| *Coprosma propinqua* | mikimiki | 100 | 2.5L |
| *Coprosma robusta* | karamu | 25 | RT |
| *Cordyline australis* | ti kouka/Cabbage tree | 500 | RT |
| *Cyperus ustulatus* | umbrella sedge | 25 | RX90 |
| *Dacrycarpus dacrydioides* | kahikatea | 25 | 2.5L |
| *Elaeocarpus dentatus* | pokaka | 5 | 2.5L |
| *Elaeocarpus hookerianus* | hinau | 10 | 2.5L |
| *Griselinea littoralis* | kapuka/broadleaf | 5 | RX1L |
| *Hebe salicifolia* | koromiko | 15 | RX90 |
| *Kunzea serotina* | kanuka | 50 | RT |
| *Leptospermum scoparium* | manuka | 150 | RT |
| *Pennantia corymbosa* | kaikomako | 25 | 2.5L |
| *Phormium tenax* | harakeke/New Zealand flax | 50 | RX1L |
| *Pseudopanax arboreus* | whauwhaupaku/fivevinger | 25 | RX1L |
| *Pseudopanax crassifolius* | horoeka/lancewood | 25 | 2.5L |
| *Podocarpus totara* | totara | 10 | 2.5L |
| *Prumnopitys taxifolia* | matai | 5 | 2.5L |
| *Sophora microphylla* | South Island kowhai | 50 | 2.5L |
| **TOTAL** | | **1500** | |

## Zone 4: Western & eastern mown grass areas - native forest/woodland (9,500 m²)

***Table 9:*** Indicative species list for Zone 1 (western & eastern mown grassed areas) to be planted as blanket planting of open areas and at (average) 1.50 m centres.

| Species | Common name | Number | Grade |
|---|---|---|---|
| Austroderia richardii | toetoe | 200 | RX90 |
| Coprosma propinqua | mikimiki | 500 | RX1L |
| Coprosma robusta | karamu | 200 | RT |
| Cordyline australis | ti kouka/Cabbage tree | 300 | RT |
| Griselinia littoralis | kapuka/broadleaf | 100 | RX1L |
| Hebe salicifolia | koromiko | 250 | RX90 |
| Hoheria angustifolia | Houhere/South Island lacebark | 500 | RT |
| Kunzea serotina | kanuka | 900 | RT |
| Leptospermum scoparium | manuka | 150 | RT |
| Phormium tenax | harakeke/New Zealand flax | 200 | RX1L |
| Pittosporum eugenioides | tarata/lemonwood | 50 | RT |
| Pittosporum tenuifolium | kohuhu/black matipo | 25 | RT |
| Pseudopanax crassifolius | horoeka/lancewood | 50 | 2.5L |
| Podocarpus totara | totara | 250 | 2.5L |
| Prumnopitys taxifolia | matai | 25 | 2.5L |
| Sophora microphylla | South Island kowhai | 300 | 2.5L |
| **TOTAL** | | **4000** | |

## Zone 5: Northern mown grass areas - proposed lizard habitat (7000 m$^2$)

***Table 10:*** Indicative species list for Zone 5 (northern mown grass areas – proposed lizard habitat) to be planted as directed by Councils herpetologist as blanket planting of tussocks with clusters of shrubs and creepers at (average) 0.80 m centres.

| Species | Common name | Number | Grade |
|---|---|---|---|
| Carmichaelia australis | NZ broom | 100 | RX1L |
| Coprosma crassifolia | thick leaved mikimki | 25 | RX1L |
| Coprosma intertexta | mikimiki | 25 | RX1L |
| Coprosma propinqua | mikimiki | 25 | RX1L |
| Coprosma rhamnoiodes | Mikimiki | 25 | RX1L |
| Discaria toumatu | matagouri | 150 | RX1L |
| Festuca novae-zelandiae | Hard tussock | 2000 | RX90 |
| Helichrysum lanceolatum | niniao | 50 | RX1L |
| Melicytus alpinus | porcupine shrub | 300 | RX1L |
| Muehlenbeckia axillaris | Mat pohuehue | 300 | RX90 |
| Muehlenbeckia complexa | pohuehue | 300 | RX90 |
| Poa cita | silver tussock | 8500 | RX90 |
| Sophora prostrata | prostrate kowhai | 75 | RX1L |
| Cyathodes juniperina | Prickly mingimingi | 100 | RX90 |
| Sophora microphylla | South Island kowhai | 25 | 2.5L |
| **TOTAL** | | **12,000** | |

## Zone 6: Riparian corridor (3500 m$^2$)

***Table 11:*** Indicative species list for Zone 1 (riparian corridor) to be planted infill planting of open areas and enrichment planting of denser areas at (average) 1.50 m centres.

| Species | Common name | Number | Grade |
|---|---|---|---|
| *Austroderia richardii* | toetoe | 75 | RX90 |
| *Carex secta* | pukio sedge | 250 | RX90 |
| *Coprosma propinqua* | mikimiki | 140 | RX1L |
| *Cordyline australis* | ti kouka/Cabbage tree | 100 | RT |
| *Dacrycarpus dacrydioides* | kahikatea | 25 | 2.5L |
| *Discaria toumatu* | matagouri | 90 | 2.5 L |
| *Griselinea littoralis* | kapuka/broadleaf | 10 | RX1L |
| *Hebe salicifolia* | koromiko | 80 | RX90 |
| *Kunzea serotina* | kanuka | 250 | RT |
| *Leptospermum scoparium* | manuka | 250 | RT |
| *Phormium tenax* | harakeke/New Zealand flax | 100 | RX1L |
| *Podocarpus totara* | totara | 50 | 2.5L |
| *Prumnopitys taxifolia* | matai | 30 | 2.5L |
| *Sophora microphylla* | South Island kowhai | 50 | 2.5L |
| **TOTAL** | | **1500** | |

## Summary (Zones 1 – 6)

***Table 12:*** *Summary of planting zones(1- 6) by area and number of plants.*

| Zone | Area | Number of plants |
|---|---|---|
| Zone 1 - Dense boundary planting - native forest/woodland | 12,000 m2 | 1300 |
| Zone 2 - Open mixed plantings - native forest/woodland | 16,000 m2 | 5750 |
| Zone 3 - Willow woodland | 4200 m2 | 1500 |
| Zone 4 - Western & eastern mown grass areas - native forest/woodland | 9500 m2 | 4000 |
| Zone 5 – Northern mown grass areas – lizard habitat | 7000 m2 | 12,000 |
| Zone 6 – Riparian corridor | 3500 m2 | 1500 |
| **TOTAL** | **52,200 m2** | **26,050** |

Christchurch City Council