

ECOLOGICAL MANAGEMENT PLAN FOR THE PROPOSED REMOVAL OF PINES AT WESTERN SPRINGS PARK



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ECOLOGICAL MANAGEMENT PLAN FOR THE PROPOSED REMOVAL OF PINES AT WESTERN SPRINGS PARK

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1. INTRODUCTION

Auckland Council engaged Wildland Consultants Ltd to provide an ecological assessment and management plan for an existing area of mature pine (*Pinus radiata*) forest in Western Springs Park, Western Springs. The pine forest is part of a larger area of local vegetation that is scheduled as a Significant Ecological Area (SEA_T_5288) under the Auckland Unitary Plan (Figure 1). Western Springs/Zoo Forest is scheduled for its podocarp/broadleaved forest and coastal forest types, and its value as habitat for indigenous fauna (Roper 2008).

The pines were planted in 1923 and once comprised a densely stocked forest. Over time, however, the pines have thinned significantly; many trees are senescing and are becoming increasingly vulnerable to windfall. As such, the risk to public safety, particularly to adjoining properties in Westview Road, is an increasing concern. There is also the potential for pine trees to fall directly onto the zoo fence, which presents a significant security breach. Whilst the pines are exotic, it is likely that the process of pine removal will damage indigenous vegetation in the sub-canopy and understorey tiers. The clearance of indigenous vegetation in an SEA is a restricted discretionary activity; therefore resource consent is required prior to the removal of the pines.

Auckland Council has engaged Treescape to fell all the pine trees in one continuous operation. The works will take approximately 30-40 days to complete and is programmed to commence on 6 April 2021. Council intends to restore the affected area by undertaking pest plant control and indigenous planting based on the recommendations of this report. The team managing the pine removal is aware that areas of higher ecological value may need to be avoided or protected.

The purpose of this Ecological Management Plan is to provide guidance for the protection of watercourses and high value vegetation during the pine-felling operation and the restoration of the project area following the completion of the works. This aligns with the objectives of the Waitemata Local Board, which are to:

- Protect the existing and regenerating ecology in the forest; and
- Ensure the health and safety of forest users and workers.

2. OVERALL GOAL AND PROJECT OBJECTIVES

The overall goal of the EMP is to return exotic pine-dominated vegetation within a Significant Ecological Area to floristically diverse indigenous mixed podocarp-broadleaved species forest that will provide important protected habitat for indigenous fauna as well as significantly enhance the ecological and amenity values of Western Springs Park and surrounding areas.

The objectives of the EMP are to:

- Protect areas of high value indigenous vegetation during the pine-felling operation, including riparian vegetation buffering the intermittent stream.

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- Minimise adverse impacts on the wider area of indigenous understorey.
- Revegetate all bare ground, including the access track, following the pine-felling operation.
- Restore the true right floodplain of Motions Creek.
- Control all environmental pest plants.
- Control key pest animals within the project area to maintain low populations of these species and enhance the habitat value of the site for indigenous fauna.

These objectives will, over time, significantly improve the ecological values of the site through the planting of a diverse range of appropriate terrestrial and wetland plant species once all pine trees have been felled.

There is also an opportunity to engage with residents, including the Society for Protection of Western Springs Forest (the Society), during the restoration phase of the project area. This could involve community assistance with planting and pest plant control.

3. METHODS

3.1 Vegetation and pine management

Preliminary site visits were undertaken on 29 April 2014 and 5 May 2014 together with the client, Simon Ferrick, and two arborists, David Stejskal and Simon Cook. A general description of the vegetation was recorded, and representative site photographs were taken (Appendix 1). The location and abundance of environmental pest plants was also recorded during the survey. A subsequent visit was undertaken on 15 April 2016 with Greenscene NZ Ltd to discuss the revised pine felling and removal methodologies presented in this report. An updated specification of works dated April 2018 was provided by Mark Benjamin (Mount Hobson Group Ltd) on 1 May 2018.

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A final plan for the pine felling and removal has been prepared by Treescape (released in February 2021). Key elements of the Treescape plan have been incorporated into this Ecological Management Plan where appropriate, e.g., tree felling methods to avoid/minimise impacts on the indigenous understorey.

3.2 Consultation with key stakeholders

A site visit was undertaken on 22 February 2021, which included Council representatives, the Project Manager (Karl McLeod), Nick Goldwater (Project Ecologist), Warren Spencer (Auckland Zoo), Simon Chapman (the Society's Ecologist), and Brad Beach (Treescape Manager). The aim of the site visit was to discuss the proposed tree felling methodology and allow Mr Spencer and Mr Chapman to raise any concerns. In doing this, the site visit ensures that Condition 11 is met (evidence of consultation provided within the EMP).

3.3 Priority areas for protection

A walk-through survey of the site was undertaken on 7 February 2018 to identify which indigenous vegetation areas better-quality. Higher quality vegetation was identified based on criteria such as estimated age, size, diversity, gradient on which the vegetation occurs, and the presence of watercourses. A hand-held GPS unit was used to record the location of (i) higher quality vegetation, (ii) individual or clusters of trees that were relatively large and mature compared with surrounding indigenous plant species, and (iii) a revised access track entry point on the eastern boundary. Each area was briefly described and then digitally mapped using ArcGIS (Figure 2). Representative site photographs were taken in the field.

3.4 Pest plants

Pest plant species were recorded during the surveys of the pine forest. Recommended methodologies for control are provided in Appendix 3. It is acknowledged that Council has undertaken considerable pest plant control since 2014, although this has recently ceased with the closure of the pine forest.

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4. SITE DESCRIPTION

The study site comprises a c.3.2-hectare block of radiata pine forest on moderate to steep southwest-facing slopes. The forest is bounded by Motion Creek along its western boundary and residential properties along some of its northeast margin. It is contiguous with mixed indigenous-exotic forest within Auckland Zoo to the north and a small amount of kānuka (*Kunzea robusta*) forest to the east (adjacent to Western Springs Stadium).

The 35-45+ metre tall canopy of pine has progressively thinned over recent years. This in turn has allowed the development of a sub-canopy and understorey dominated by indigenous plant species. A mixture of ponga (*Cyathea dealbata*), māpou (*Myrsine australis*), māhoe (*Melicactus ramiflorus*), and karo (*Pittosporum crassifolium*) occurs in the sub-canopy, with lesser amounts of cabbage tree (*Cordyline australis*) and mamaku (*C. medullaris*) (Appendix 1: Plate 1). In the understorey, kawakawa (*Piper excelsum*) occurs frequently with hangehange (*Geniostoma ligustrifolium*), while on the forest floor tūrutu (*Dianella nigra*), shining spleenwort (*Asplenium oblongifolium*), panic grass (*Oplismenus hirtellus*), hooked sedge (*Carex uncinata*), and meadow rice grass (*Microlaena stipoides*) occur. Much of the forest floor is covered in pine needles.

Environmental pest plants were once common throughout the understorey of the pine forest, the most common of which included tradescantia (*Tradescantia fluminensis*), wild ginger (*Hedychium gardnerianum*), and mile-a-minute (*Dipogon lignosus*) (N. Goldwater, pers. obs.). Recent weed control activity, however, has significantly reduced the density and abundance of all pest plant species. During the 2014 site visits, pest plants were localised along the northern boundary of the site, adjacent to residential properties on Westview Road (Appendix 1: Plate 2), with few infestations observed throughout the understorey. However, since the site has been closed, pest plants such as woolly nightshade (*Solanum mauritianum*) and mile-a-minute have increased in abundance throughout the pine forest.

A small intermittent tributary to Motions Creek occurs in a steeply incised gully at the northern end of the site (Figure 1). The upstream reach of the tributary is piped. Mature pine and indigenous shrub buffer most of the open reaches.

5. PRIORITY AREAS FOR PROTECTION

5.1 Overview

Six Priority Areas for Protection (PAP) were identified during the February 2018 survey, although these were subsequently merged to form four areas (Figure 2), covering a combined area of c.7,702 m², which is approximately 26 percent of the entire site. A brief description of each area is provided below.

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5.2 Priority Area for Protection 1 (1,759 m²)

PAP 1 occurs near the track entrance at West View Road and comprises a mixture of good quality planted and naturally occurring vegetation, including mature specimens of māhoe (*Melicytus ramiflorus*), karaka (*Corynocarpus laevigatus*), rimu (*Dacrydium cupressenum*), kānuka (*Kunzea robusta*), pōhutukawa (*Metrosideros excelsa*), and ngaio (*Myoporum laetum*) (Plate 1). Sub-canopy species include houpara (*Pseudopanax lessonii*), karamū (*Coprosma robusta*), and harakeke (*Phormium tenax*). Given that this area is upslope of all mature pines, it should be relatively easy to avoid during the felling process.

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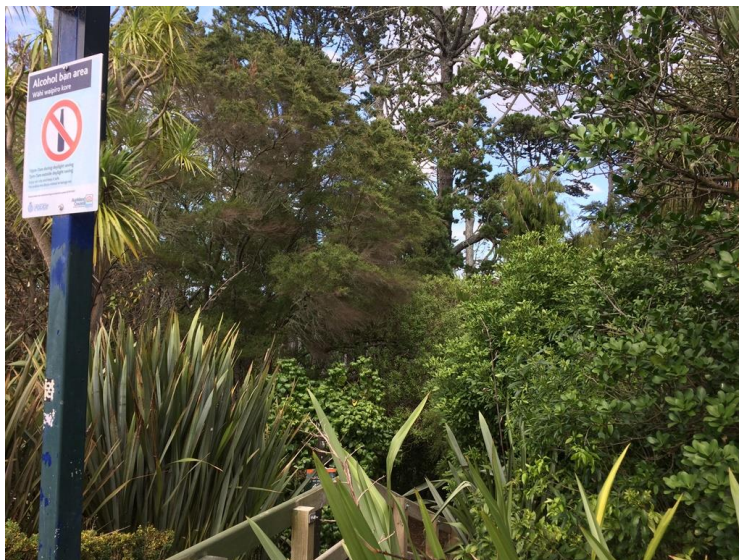


Plate 1: Mature karaka, kānuka, māhoe and tī kōuka in PAP 1. 7 February 2018.

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5.3 Priority Area for Protection 2 (1,019 m²)

The vegetation in PAP 2 is characterised by mature ponga (*Cyathea dealbata*) present within the riparian margin of the intermittent stream in the northeastern part of the forest. Other canopy and sub-canopy species include mamaku (*C. medullaris*), karamū, kawakawa (*Piper excelsum*), and hangehange (*Geniostoma ligustrifolium*) (Plate 2). The vegetation is providing good buffering and shading for the stream, as well as maintaining bank stability. In recent years, pines have fallen (or been felled) across the stream without causing noticeable damage to the stream channel (e.g. slumping/collapse of stream bank), although it is recommended that the proposed felling operation avoids the stream and associated riparian vegetation where possible.

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5.4 Priority Area for Protection 3 (4,160 m²)

The northern part of PAP 3 comprises established indigenous scrub located on a steep toe slope adjacent to the floodplain. Plant species include mature karo, māhoe, ponga, and karamū (Plate 3). The middle section of Area 3 comprises a relatively diverse, mature area of indigenous vegetation that bounds either side of the walking track adjacent to the floodplain of Motions Creek. It is characterised by karaka, māhoe, māpou (*Myrsine australis*), mature tī kōuka (cabbage tree; *Cordyline australis*), karamū, ponga, karo, and tōtara (*Podocarpus tōtara*) (Plate 4). Further to towards the southern-most boundary of the forest park entrance, the vegetation comprises an area of established indigenous scrub situated on moderate to steep slopes. The vegetation is characterised by mature karo, māhoe, ponga, tī kōuka, and one semi-mature pūriri (*Vitex lucens*). This area warrants protection give its floristic diversity, its potential for acting as a source of seeds post-felling, and also for its contribution to maintaining slope stability.

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Plate 2: Ponga canopy with kawakawa in the understorey forms a good buffer for the intermittent stream in PAP 2. 7 February 2018.





Plate 3: Mature karo with māhoe and ponga in PAP 3. The grassed floodplain is visible in the bottom-right side of the photograph. 7 February 2018.

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Plate 4: View looking eastwards along the walking track, which bisects good quality vegetation in PAP 3. 7 February 2018.

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5.5 Priority Area for Protection 4 (764 m²)

PAP 4 includes a mixture of semi-mature planted species such as taraire (*Beilschmiedia tarairi*), tōtara, pūriri, pōhutukawa, tarata (*Pittosporum eugenoides*), and kōhūhū (*P. tenuifolium*) together with naturally occurring species such as mature kānuka and tī kōuka with a dense understorey of hangehange and ponga (Plate 5). A young planted kauri (*Agathis australis*) is also present.

This area warrants protection given its floristic diversity, its potential for acting as a source of seeds post-felling, and for its contribution to maintaining slope stability. Based on interpretation of the 'Draft of the site setup' provided by David Stejskal, the proposed access track may pass through the southern part of PAP 4. We consider this as acceptable, provided the track formation is overseen by the supervising ecologist.



Plate 5: Young taraire (centre) grows with māhoe and kōhūhū in Area 4.
7 February 2018.

5.6 Avoidance of mature indigenous trees

Three larger individual trees were identified during the survey that are worthy of protection, if possible. All of these trees occur outside of the recommended areas for protection and comprise species such as karo, pigeonwood (*Hedycarya arborea*), and planted kauri. The location of each tree (or cluster of trees) is shown in Figure 2 together with their respective common names. Pink flagging tape was used in the field to help identify these trees prior to felling (Plates 6 and 7).

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Plate 6: Three mature karo with pink flagging tape. 7 February 2018.



Plate 7: Semi-mature pigeonwood with pink flagging tape. 7 February 2018.

5.7 Areas of lower ecological value

Approximately 2.2 hectares (or 74 percent) of the site have been identified as having lower ecological values (Figure 2). The following broad criteria were used to assess the vegetation in this area include:

- Sparse vegetative cover (e.g., parts of Area2).
- Relatively young vegetation with poor floristic diversity.

Most of the proposed felling operations will occur within the area of lower ecological value.

6. PROPOSED REMOVAL METHODOLOGY

6.1 Overview

Two broad areas for pine control have been identified (Areas 1 and 2, Figure 3) that require different approaches. These approaches largely relate to site access for machinery.

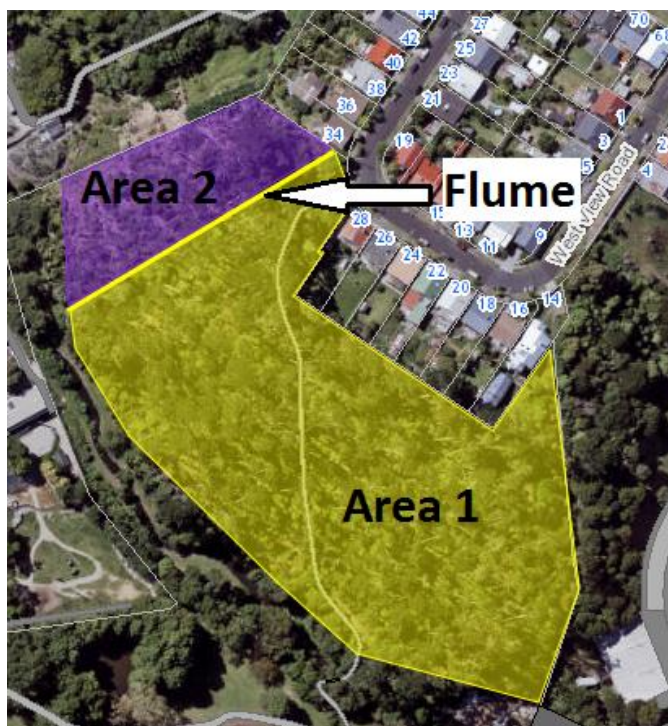


Figure 3: Pine removal areas at Western Springs Park. 'Flume' demotes the intermittent stream. Figure supplied by MHG Ltd.

In general terms the felling of the pine trees is to be undertaken via directional felling with the felled logwood generally remaining in place unless it can be easily removed and the removal is supported by the project supervising ecologist.

6.2 Pre-felling works and fauna surveys

Prior to the commencement of any physical works, the alignment of the access track will be marked with wooden pegs and the PAPs will be delineated with hi-vis flagging tape. Trees identified to be retained as totems will also be marked with hi-vis ribbons.

A bat survey is currently being undertaken at the site, the results of which will be reported in early March in order to satisfy consent conditions 36 and 37.

A lizard survey and salvage operation is set to commence in the week commencing 1 March 2021, in accordance with the Lizard Management Plan (Wildland Consultants 2019).

6.3 Felling works

As shown on the Overall Site Plan prepared by CLC Consulting Group (Appendix 4), it is proposed that a digger will form an access track into the site from the adjacent Western Springs Stadium. The initial part of this track will be metalled as shown but most of it will be formed from removed vegetation and minor earthworks. The access track will be four metres wide to cater for an excavator and chipper. Five (6 × 15 metre) landing/chipping areas will be formed along the access track (see Appendix 4).

There will be daily pre-start meetings between the Treescape project manager, Treescape site supervisor and the supervising ecologist. The purpose of the meetings will be to identify which trees are to be felled so that the supervising ecologist can provide advice on avoiding or minimising impacts on the indigenous understorey.

Given that tree-felling will be undertaken outside of the bird breeding season (August to March inclusive), targeted surveys for birds in the works area are not required. However, as a precaution, prior to all earthworks and the felling of trees the supervising ecologist will conduct a visual search of the understorey for active bird¹ nests in the impact areas. If any active nests are detected, then consent condition 34 will trigger the requirement for all vegetation removal within 20 metres of that nest to cease until the supervising ecologist has confirmed that the nest has either failed or the chicks have fledged. Any active nests will be clearly demarcated by hi-vis flagging tape.

In terms of the actual felling of the trees, the following process is to be followed:

- Area around the tree is inspected and higher value vegetation identified.
- Possible machine placements are identified.
- Combination of a and b determines the desired direction of tree fall.

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¹ Bird surveys will be limited to indigenous species.

d) Climber climbs up the tree and places steel cable above ground (as high as needed to obtain enough leverage).

e) Climber descends.

f) Machine tensions the steel rope by pulling on it.

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g) Felling cuts are made.

h) Machine further tensions.

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i) Tree is felled.

j) Area is assessed by the supervising ecologist and the direction for management of the fallen tree is issued to the Treescape contractor.

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k) Management direction implemented.

Where safe to do so, trees may be felled without machine assistance by an arborist using chainsaw and felling wedges. Where trees cannot be felled whole, they will be manually climbed by an arborist and dismantled in sections.

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The trees in the four Priority Areas of Protection (PAP) will be directionally felled but trunks left in situ with only the crowns and any portion that fall outside the PAP cut and chipped on site (unless directed otherwise by the supervising ecologist). If, in the opinion of the supervising ecologist, the removal of larger trunks would be ecologically beneficial (e.g., to allow better regrowth of existing understorey) then the log wood will be removed.

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The post felling management differs between Area 1, Area 2 and the Priority Area's for Protection as shown in Figure 3 below. ¶

6.4 On-site management of felled material

It is proposed to retain up to 70% of the felled material on-site in order to minimise disturbance to the understorey and reduce soil disturbance. Within Area 2, the trees would be felled, but left in-situ with only parts accessible from Area 1 cut and chipped on site (less than 600 millimetres diameter), or removed from site (if able to be moved without additional damage to understorey). Within Area 1 (outside the PAPs), the canopy and logwood smaller than 600 millimetres in diameter from the felled trees will be chipped (again unless directed otherwise by the supervising ecologist). Trunks and any branches larger than 600 millimetres will primarily be left in situ unless they can be easily lifted by an excavator or where the removal would, in the opinion of the supervising ecologist, be more beneficial than leaving in situ. Felled trees would either remain in situ or parts of them would be moved by hand (manual labour) to the processing area or by an excavator, depending on direction issued by the supervising ecologist. Chipped wood will be reused on site as mulch and mixed with soil to reinstate the track. If the supervising ecologist considers that the amount of chipped wood is excessive, some of it will be carted off-site.

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Logs will not be stacked or piled on the ground, or left in locations that are likely to impede planting and natural regeneration. For instance, if a group of trees are felled close to each other, the logs will be sectioned and carefully moved to create sufficient space between them. Measures to speed up the natural decomposition of logs will be implemented during the felling operation. This will include the use of chainsaws to create 'plunge cuts' along the upper surface of the logs, which will allow water to enter the wood and thus speed up microbial action. Over time, the rotting logs will provide useful additional habitat for lizards, invertebrates, epiphytic plants, lichens, and fungi (as is already observed throughout the forest).

In summary, each tree removal would involve two phases. In the first phase, the tree is felled in the safest possible way while minimising the disturbance to indigenous understorey. The second phase is an assessment how to best deal with the felled tree to enhance the regeneration process (under direction of the supervising ecologist) and minimise damage to adjacent indigenous vegetation. This includes but is not limited to trees left lying as they are and/or canopies chipped and/or trunks chipped (or repositioned with the excavator or trucked off-site via the access track).

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6.5 Post-felling reporting

Post-felling reports will be prepared by the supervising ecologist three days per week (end of Day 1, end of Day 3, end of Day5) in accordance with consent conditions 5 and 41, assuming trees are felled each day of any given week. Each report will describe the number of trees felled and their locations, and confirm the tree removal works have been undertaken in accordance with the methodology outlined in Section 6.3. Representative photos will be taken of each felled tree and included in the reports.

7. ENVIRONMENTAL PEST PLANTS

7.1 Pest plant priorities

Eleven pest plant species were recorded in Western Springs forest that are listed in the Auckland Regional Pest Management (ARPMP; Auckland Council 2019). A further four pest plant species were identified that are not listed in the ARPMP, but which should be controlled. In addition to the control of pest plants, two species of non-invasive exotic plants should be removed as they are not ecologically appropriate for the area.

All plant species that should be controlled have been assigned to one of the following categories:

- Site led pest plants on parks and reserves throughout the Auckland Region as per the ARPMP.
- Sustained control pest plants throughout the Auckland Region as per the ARPMP.
- Pest plants that are not currently included in the ARPMP, but for which control is recommended.

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Deleted: Twelve environmental pest plant species were identified within the project area, although the diversity and abundance of pest plants are likely to have increased since the closure of the pine forest (i.e. contractors have not been able to undertake control works due to health and safety reasons). One additional pest plant species, mignonette vine (*Anredera cordifolia*) has been recorded by residents and has now been included in this EMP. Environmental pest plants can be prioritised using the three categories in the Auckland RPMS (ARC 2007): (i) Total Control Pest Plants, (ii) Containment Pest Plants, and (iii) Surveillance Pest Plants. One additional class is used in this report: (iv) Environmental pest plants not currently included in the RPMS (ARC 2007). Overviews of each environmental pest plant species are provided below, within their respective categories.¶

- Exotic plant species that are not considered pests, but for which removal is recommended.

A full list of species for which control or removal is recommended is provided in Appendix 3.

7.2 Pest plant categories

7.2.1 Site led control pest plants

Under the ARPMP some pest plant species have been highlighted as requiring site led control within parks and reserves. These species are all known to have negative effects on indigenous ecosystems and in some cases can cause canopy collapse (Auckland Council 2019).

Three of the pest plants recorded at the site have been identified as site led control species (Table 1). Some of these species are also subject to a 'Good Neighbour Rule' that required Auckland Council and/or the affected land occupiers to carry out control within a 500-metre-wide buffer zone around areas of parkland (Table 1).

Table 1: Site led pest plants observed at Western Springs forest

<u>Common Name</u>	<u>Species Name</u>	<u>ARPMP Good Neighbour Rules and responsibilities</u>
<u>Chinese privet</u>	<u><i>Ligustrum sinense</i></u>	<u>N/A</u>
<u>Madeira vine</u>	<u><i>Anredera cordifolia</i></u>	<u>N/A</u>
<u>Moth plant</u>	<u><i>Araujia sericifera</i> syn. <i>Araujia hortorum</i></u>	<u>Rule 7.5.2.8.1 All occupiers of any land that is located within the buffer area of a park which is managed for moth plant, must destroy all moth plant on that land. Land occupier responsible for control</u>
<u>Woolly nightshade</u>	<u><i>Solanum mauritianum</i></u>	<u>N/A</u>

7.2.2 Sustained control pest plants

Sustained Control Pest Plants include species that have been identified as having potential to negatively impact environmental and economic values across the entire Auckland Region. Five sustained control pest plants were recorded during the field survey and are listed in

Table 2.

Under the ARPMP all Sustained Control Pest Plants are subject to the following rules:

- Rule 7.7.10.1.1: No person shall cause to breed any Sustained Control Pest Plant within the Auckland region.
- Rule 7.7.10.1.2: No person shall distribute or release (or cause to be released or distributed), any Sustained Control Pest Plant within the Auckland region.

- Rule 7.7.10.1.3: No person shall sell or offer for sale any Sustained Control Pest Plant within the Auckland.
- Rule 7.7.10.1.4: No person may plant or allow to be planted any Sustained Control Pest Plant (specified below) on or in any land within the Auckland region.
- Rule 7.7.10.1.5: Despite rule 7.7.10.1.4, a person may transfer or allow to be transferred an existing Sustained Control Pest Plant planted on their land from one location to another location within the boundaries of the same property. This exception does not apply to the following freshwater pest plants: alligator weed (*Alternanthera philoxeroides*), bladderwort (*Utricularia* spp.), Chilean rhubarb (*Gunnera tinctoria*), eel grass (*Vallisneria australis*), egeria (*Egeria densa*), hornwort (*Ceratophyllum demersum*), giant reed (*Arundo donax*), lagarosiphon (*Lagarosiphon major*), parrot's feather (*Myriophyllum aquaticum*), reed sweetgrass (*Glyceria maxima*), and water primrose (*Ludwigia peploides*).
- Rule 7.7.10.1.6: All occupiers of land in the Auckland region must destroy any Sustained Control Pest Plant that has been planted on their land in breach of the RPMP, if directed to do so by an authorised person.

Table 2: Sustained control pest plants observed at Western Springs forest.

<u>Common Name</u>	<u>Species Name</u>	<u>ARPMP Good Neighbour Rules and responsibilities</u>
<u>Blue passion flower</u>	<u><i>Passiflora caerulea</i></u>	<u>N/A</u>
<u>Crack willow</u>	<u><i>Salix fragilis</i></u>	<u>N/A</u>
<u>Himalayan honeysuckle</u>	<u><i>Leycesteria formosa</i></u>	<u>N/A</u>
<u>Mile-a-minute</u>	<u><i>Dipogon lignosus</i></u>	<u>N/A</u>
<u>Queen of the night</u>	<u><i>Cestrum nocturnum</i></u>	<u>N/A</u>
<u>Taiwan cherry</u>	<u><i>Prunus campanulata</i></u>	<u>N/A</u>
<u>Tradescantia</u>	<u><i>Tradescantia fluminensis</i></u>	<u>N/A</u>

7.2.3 Pest plants not within the ARPMP 2019-2029

Three pest plant species were observed that are not identified in the ARPMP (Table 3).

Although these species are not within the ARPMP, they are considered to be having a detrimental impact on ecological values at the site and may spread further if not controlled. As such, all non-ARPMP pest plant species should also be controlled within.

Table 3: Pest plant not listed in the ARPMP observed at Western Springs forest.

<u>Common Name</u>	<u>Species Name</u>
<u>Fruit salad plant</u>	<u><i>Monstera deliciosa</i></u>
<u>Garden nasturtium</u>	<u><i>Tropaeolum majus</i></u>
<u>Shrub balsam</u>	<u><i>Impatiens sodenii</i></u>

7.2.4 Other exotic plants

One exotic plant species were identified that should be removed (Table 4). While this species is not considered to be impacting the ecology of the site, it should be removed as it is not ecologically appropriate for the area.

Table 4: Exotic plant species that should be removed from Western Springs forest.

Common Name	Species Name
Inkweed	<i>Phytolacca octandra</i>

7.3 Pest plant management

All environmental pest plants recorded within the project area should be removed.

Deleted: - Classes (ii)-(iv): containment, surveillance, and non-RPMS pest plants -

As mentioned in Section 4, the abundance of pest plants has increased since the pine forest was closed to the public. Environmental pest plants are locally common on the northeast boundary of the site, most of which have spread from neighbouring residences into the recently cleared forest margins. Shrub balsam (*Impatiens sodenii*) (Plate 5) and Himalayan honeysuckle (*Leycesteria formosa*) occur in the largest quantities (Plate 6), while species such as tradescantia (*Tradescantia fluminensis*), inkweed (*Phytolacca octandra*), fruit salad plant (*Monstera deliciosa*), and garden nasturtium (*Tropaeolum majus*) are scattered throughout. It is noted that some pest plant control and planting has taken place since the 2014 surveys.

Pest plants such as mature crack willow (*Salix fragilis*) are scattered along the floodplain of Motions Creek.

Ongoing monitoring for environmental pest plants should be maintained throughout the project area on at least an annual basis, particularly for wetland habitat and bush margins. Other pest plant species encountered during the annual pest plant control operation should also be controlled.

Recommended control methods for all pest plant species and problem exotic species recorded at the site are presented in Appendix 3. Repeated treatment rounds may be required to achieve full control of some species, particularly those with large tubers or bulbs. The recommended timing of treatment rounds is provided in Section 10.

Deleted: (e.g. tuber ladder fern)

7.4 Disposal of material

Most of the environmental pest plant infestations can be dealt with *in situ*, removing the need for disposal. The seedlings of many pest plant species (e.g., Taiwan cherry and Chinese privet) can be controlled by hand-pulling and may be left to rot on site.

Deleted: monkey apple

Plants with bulbs or tubers (e.g. tuber ladder fern and montbretia) should be not dispersed within the site. These should be controlled using herbicides or if this is not possible they should be carefully triple bagged and sent to landfill. Where cut vegetation is to be left on site, seed heads should be removed, triple bagged, and should also be sent to land fill to avoid new infestations establishing.

7.5 Herbicide use, record keeping and reporting

Herbicides play an important role in revegetation projects. While manual control techniques are often preferable, particularly for community projects, controlling pest plants and ensuring the successful establishment of indigenous plants in relatively large sites is not practical without the use of herbicides.

Herbicides will only be used at the site as and when needed during the site preparation and planting maintenance stages of the restoration works. It is anticipated that the bulk of herbicide use will occur in the early stages (i.e., site preparation) and years 1 and 2 of planting maintenance.

It is intended to use non-residual herbicides to control pest plants and avoid herbicides such as Metsulfuron, which can stay in the soil for up to six months. Wherever possible, woody pest plant species will be cut at ground level and treated with a herbicide solution or gel, which will reduce the need for spraying and thus minimise herbicide use. It is possible that manual releasing of exotic species will be sufficient three to five years after planting, although this will need to be determined on-site by restoration managers.

Any control operations that require the use of herbicides should be undertaken in line with the Agrichemical Users' Code of Practice (NZS 8409 2004: The Management of Agrichemicals). This includes recording and maintaining records of all agrichemical usage on appropriate spray record sheets. All agrichemical usage should be submitted to Auckland Council to record as part of Councils Weed Management Policy.

Reports summarising the pest plant control work undertaken during each year of the programme should be presented to Auckland Council on an annual basis. This report should include, but is not limited to:

- Chemical application method.
- Start and finish time of application.
- Concentration, volume, brand name and active ingredient of herbicides used.
- The timing of pest plant control rounds.
- Weather conditions during control rounds.
- Pest plant species controlled.
- The results/effectiveness of the control.
- Recommendations for pest plant control priorities for the following year.

8. PROPOSED PLANTING METHODOLOGY

8.1 Overview

Four broad planting areas have been identified and mapped (Figure 4). Planting Area A encompasses the majority of the forest (mid to lower slopes); Planting Area B comprises the upper northeastern slopes bordering residential houses on West View Road; Planting Area C contains the incised riparian margins of the intermittent stream at the northern end of the site; and Planting Area D encompasses the true right floodplain along Motions Creek, which would also benefit from some weed control, e.g. crack willows. A plant schedule for the site has been compiled based on the physical site characteristics, existing vegetation cover, and species that would occur naturally on sites with these characteristics. Other factors considered include the selection of species that are likely to have a relatively high growth and survival rates.

8.2 Site preparation

Site preparation will be a key factor in the successful implementation of this project. All pest plants should be controlled prior to planting, preferably at three months and again at six weeks. Exotic grass species such as cocksfoot (*Dactylis glomerata*) and Veldt grass (*Ehrharta erecta*) occur frequently in open areas throughout the forest, while exotic herbs such as creeping buttercup (*Ranunculus repens*) occur locally in damper floodplain habitat. All of these species have the potential to spread rapidly following the felling and removal of pines, given that numerous light gaps will be created. These grass and herb species, as well as plantain (*Plantago* spp.) and dock (*Rumex* spp.), can be blanket-sprayed with a herbicide mix appropriate to the species being targeted. Extra care should be taken to avoid spraying the indigenous grass *Microlaena stipoides*, which occurs locally on the track margins. Some herbicides have a residual effect which may mean they need to be applied at least six weeks prior to planting (e.g. Metsulfuron-Methyl), but others - e.g. glyphosate-based herbicides - can be applied immediately beforehand. Plants can then be planted into sprayed rank grass, which will then create a natural 'mulch' as it decomposes.



8.3 Plant selection and sourcing

- Species have been selected on their proven survivability and relatively rapid plant growth, to ensure effective establishment on restoration sites.
- All plants should be sourced from the Tamaki Ecological District to avoid genetic contamination of distinctive populations, and because local plants tend to be better suited to local conditions. Plants should generally be grown from seed (as opposed to, for example, cuttings), so that the variability within local populations is preserved.
- A combination of half litre (0.5L), 1.5 litre, one litre (1L), and PB5 grade stock are recommended for the species to be planted in the revegetation planting areas.
- All plants brought on the site should be free of weeds, especially any potentially troublesome species.

8.4 Planting methods

- Planting should be undertaken at densities appropriate for the species being used. Restoration planting densities for half litre grades (woody species only) should be at an average of 1.4 metre centres (5,100 stems per hectare). This will achieve relatively rapid ‘canopy closure’ and reduce opportunities for weed establishment.
- While plants should be spaced at 1.4 metre centres overall, large tree species (e.g., kahikatea and tōtara) within plantings should be planted at least five metres apart from one another. Note that the proposed plant numbers take into account areas that have already been planted as well as the space that will be taken up by felled logwood. If there are obvious gaps after planting, more plants will be added in the following season.
- More sensitive mature phase species such as taraire, kohekohe and kauri that are planted in the first year will be planted in or close to existing indigenous vegetation so that sufficient shelter is provided.

8.5 Ongoing maintenance of planting and weed control

- Plantings generally need to be released from pest plant and non-pest plant competition three times a year for the first two years, and twice thereafter until Year 5, and then once a year ongoing. Releasing needs to be undertaken until canopy closure is achieved and/or the survival or vigour of the plantings is no longer affected by weeds. Depending on site conditions and plant growth, some parts of the site, and plantings undertaken with planter bag sized stock, may only require releasing for the first two years.
- Infill planting¹ may be required in the second planting season if significant numbers of plants die, e.g. as a consequence of severe frosts or droughts. Infill plants should

¹ Infill planting is required on sites where there are gaps in the planting because of plant mortality or where initial stocking rates were too low.

be of at least PB3 or 1 litre grade. Infill planting requirements should be identified in February/March prior to the upcoming planting season.

- Favourable growing conditions for plants can also promote the growth and survival of weeds, and events such as droughts or fire can facilitate their reinvasion. Ongoing monitoring and control of weeds will be required for at least the duration of the maintenance period.

8.6 Plant schedule

A plant schedule for the four planting areas is presented in Appendix 3 of this report.

9. PEST ANIMALS

9.1 Overview

The usual suite of mammalian pests is likely to be present at the study site, including ship rats (*Rattus rattus*), Norway rats (*R. norvegicus*), mice (*Mus musculus*), brushtail possums (*Trichosurus vulpecula*), hedgehogs (*Erinaceus europaeus*), and potentially mustelids (*Mustela* spp.). Possums, rats, and mice are likely to be adversely affecting vegetation condition through browsing of foliage and seed predation. All of these mammalian pests are likely to reduce the fauna values of the site through the predation of birds, lizards, and invertebrates.

9.2 Recommendations for the control of pest mammals

A pest-control contractor should be commissioned to establish a bait station and trap network throughout the project area (Figure 4). Lockable bait stations targeting rodents should be spaced approximately 50 metres apart on a grid pattern. Toxic baits should be pulsed four times a year with different bait formulations being used during each baiting session to avoid the risk of bait shyness developing.

Rodents can be effectively controlled using ground bait stations filled with Contrac™ (bromadiolone), and Ratabate™ (diphacinone) in line with the Local Parks best practice pest animal control methodology. Bromadiolone and dipachinone are less persistent in the environment than brodifacoum, and as such pose less of a secondary poisoning risk to morepork (*Ninox novaeseelandiae*).

Timms traps or Trapinators are effective kill traps for controlling possums. The traps should be baited with apple and treated with an aniseed lure. Three traps will be sufficient to cover the site; trapping should be pulsed at four times per year (two weeks each pulse) in line with Local Parks best practice pest animal control methodology.

10. RECOMMENDED WORK PROGRAMME

A recommended four-year work plan is outlined below. Timing is based on the Auckland Council financial year of 1 July to 30 June and assumes that pine tree removal will commence in 2019 and be carried out in one operation.

Year 1

Task	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Pine removal (not to coincide with bird breeding season).												
Site preparation for planting areas												
Planting												
Animal pest control (set up bait station and trap grid).												

Year 2

Task	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Planting												
Infill planting (if required)												
Follow up pest plant control and maintenance of plantings												
Bait station pulses (four per year)												
Possum traps (four pulses per year)												

Year 3

Task	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Infill planting (if required)												
Follow up pest plant control and monitoring of plantings												
Bait station pulses (four per year)												
Possum traps (four pulses per year)												

Year 4

Task	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Pest plant control and monitoring of plantings												
Bait station pulses (four per year)												
Possum traps (four pulses per year, if required)												

Year 5

Task	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Pest plant control and monitoring of plantings												
Bait station pulses (four per year)												
Possum traps (four pulses per year, if required)												

Ongoing (annually)

Task	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Pest plant control and monitoring of plantings												
Bait station pulses (four per year)												
Possum traps (four pulses per year, if required)												

ACKNOWLEDGMENTS

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APPENDIX 1

SITE PHOTOGRAPHS



Plate 1: View of indigenous understorey from the main walking track.
25 May 2014.



Plate 2: Northeastern boundary of the forest where steep banks are covered in exotic plant species and household rubbish. 25 May 2014.



Plate 3: Directionally felled mature pine left to break down in the central part of the forest. 5 May 2014.



Plate 4: View across the northern end of the forest where mature pines are less numerous than the central region. 30 May 2014.



Plate 5: Large infestation of shrub balsam, inkweed and garden nasturtium on the northeastern boundary of the site. 30 May 2014.



Plate 6: Large infestation of Himalayan honeysuckle on the northeastern boundary of the site. 30 May 2014.

APPENDIX 2

RECOMMENDED HERBICIDE TREATMENTS

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
<u>Blue passion flower</u> <u>(Passiflora caerulea)</u>	<u>Cut and treat stems</u>	<u>Glyphosate gel</u> <u>120g/KG</u>	<u>Paste with glyphosate gel</u>	<u>October-March</u>	<u>Do not pull cut vegetation from host plant.</u>
	<u>Where practical foliar spray</u>	<u>Glyphosate 510g/L</u>	<u>140ml glyphosate + 20ml organosilicone/10L water</u>	<u>October-March</u>	<u>Pull away from non-target species before spraying.</u>
<u>Chinese privet</u> <u>(Ligustrum sinense)</u>	<u>Hand pull seedlings/small plants</u>	-	-	<u>Year round</u>	
	<u>Cut and treat stumps</u>	<u>Glyphosate gel</u> <u>120g/KG</u>	<u>Paste with glyphosate gel</u>	<u>Year round</u>	
	<u>Drill and inject</u>	<u>Glyphosate 510g/L</u>	<u>70ml glyphosate + 2ml organosilicone/1L water</u>	<u>October-April</u>	
Crack willow (<i>Salix fragilis</i>)	Drill and inject/frill and spray	<u>Glyphosate 510g/L</u>	5g/1 litre water, plus 2 ml surfactant	October-April	Preferred option as leaving the tree standing avoids broken twigs/branches resprouting on ground.
Garden nasturtium (<i>Tropaeolum majus</i>)	Knapsack - foliar spray	<u>Glyphosate 510g/L</u>	<u>70ml glyphosate + 2ml organosilicone/1L water</u>	November-March	Pull vines away from non-target vegetation before spraying.
Himalayan honeysuckle (<i>Leycesteria formosa</i>)	Knapsack - foliar spray	<u>Triclopyr</u>	<u>60ml/1 litre water</u>	November-March	Take care to avoid spraying over water.
	Cut and treat stump	<u>Glyphosate gel</u> <u>120g/KG</u>	<u>Paste with glyphosate gel</u>	<u>Year round</u>	
Inkweed (<i>Phytolacca octandra</i>)	Knapsack - foliar spray	<u>Glyphosate 510g/L</u>	<u>70ml glyphosate + 2ml organosilicone/1L water</u>	November-March	Take care to avoid spraying over water.
	Cut and treat stumps close to the ground	<u>Glyphosate gel</u> <u>120g/KG</u>	<u>Paste with glyphosate gel</u>	<u>Year round</u>	
Mignonette vine (<i>Anredera cordifolia</i>)	Cut and treat stump	<u>Triclopyr</u>	<u>60ml/1 litre water</u>	<u>Year round</u>	Follow up control required to treat propagules.
		Picloram gel 43g/KG	Paste with picloram gel	<u>Year round</u>	Carefully remove as many aerial tubers as possible that may drop. 'Cook' tubers in black plastic bag left in sun.
Mile-a-minute (<i>Dipogon lignosus</i>)	Hand pull seedlings	-	-	Year round	Take care to get all root.
	Knapsack - foliar spray	<u>Triclopyr</u>	<u>60ml/1 litre water</u>	Year round	

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Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
Moth plant (<i>Araujia sericifera</i>)	Hand pull seedlings/ small vines (if small numbers)			Year round	Dispose of off in a safe manner.
	Cut and treat stump	Triclopyr	60ml/1 litre water	October-March	Leave cut vegetation in host to die off. Remove seed pods if possible and dispose of safely.
Prunus species (Taiwan cherry, etc.) (<i>Prunus</i> spp.)	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	Year round	
Queen of the night (<i>Cestrum nocturnum</i>)	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	Year round	
Shrub balsam (<i>Impatiens sodenii</i>)	Foliar spray	Triclopyr	60ml/1 litre water + 2ml organosilicone/1L water	Year round	
Tradescantia (<i>Tradescantia fluminensis</i>)	Knapsack - foliar spray	Triclopyr	60ml/1 litre water	November-March	
Woolly nightshade (<i>Solanum mauritianum</i>)	Hand pull seedlings/small plants	-	-	Year round	
	Saplings - cut and treat stump	Glyphosate gel 120g/KG	Paste with glyphosate gel	Year round	

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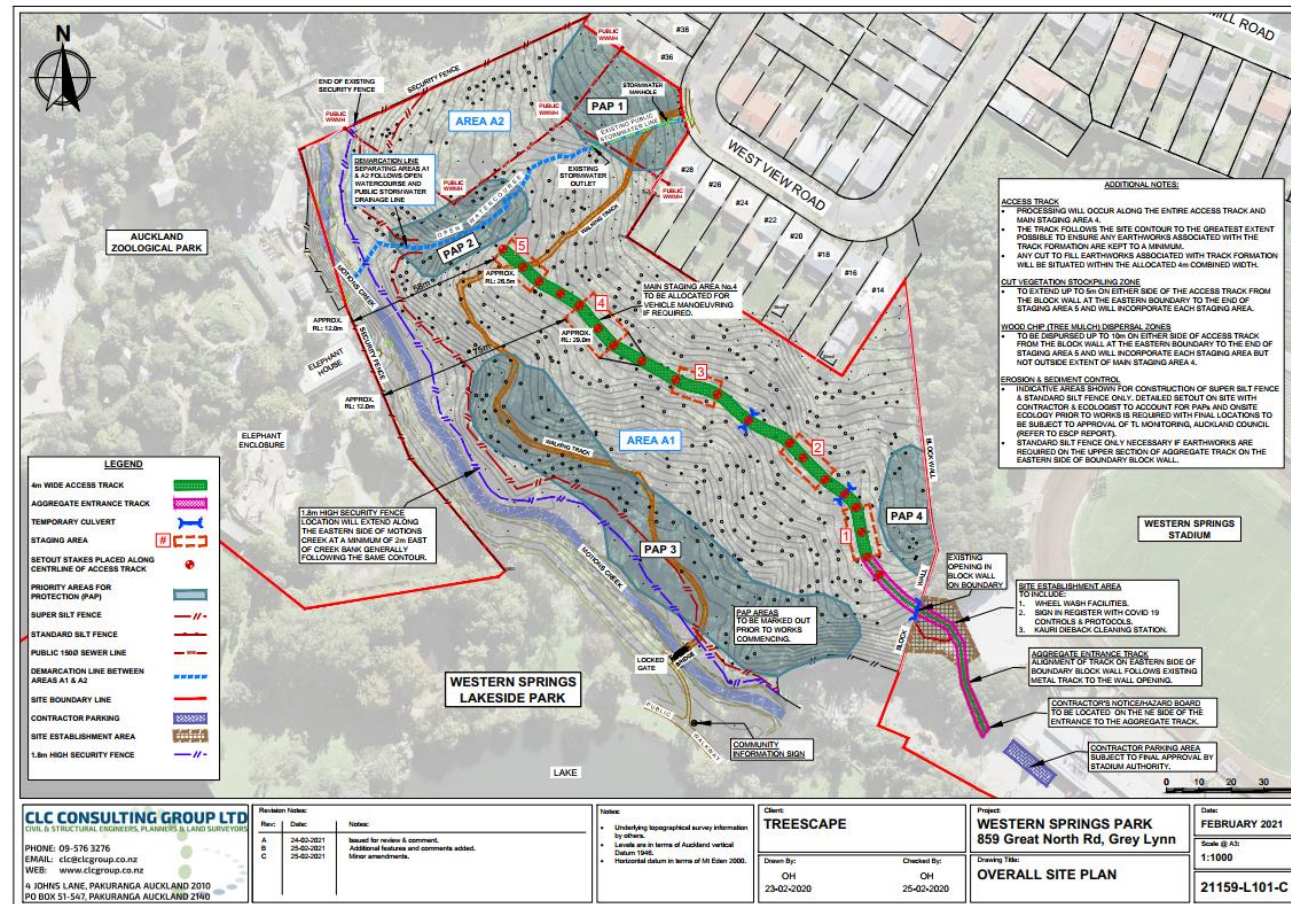
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APPENDIX 3

PLANT SCHEDULE FOR WESTERN SPRINGS PINE FOREST

Species	Common Name	Grade	Area A	Area B	Area C	Area D	Year 1	Year 2
<i>Agathis australis</i>	Kauri	PB5	350				0	350
<i>Alectryon excelsa</i>	Tītiki	PB5				25	25	
<i>Beilschmiedia tarairi</i>	Tarairi	PB5	110	40			0	150
<i>Carex lessoniana</i>	Rautahi	0.5 litre			500	675	1,175	
<i>Carex virgata</i>	Pūrei	0.5 litre				1,010	1,010	
<i>Carpodetus serratus</i>	Putaputawētā, marble leaf	1.5 litre (or PB3)			30	75	105	
<i>Coprosma robusta</i>	Karamū	PB2 or PB3	445	110		95	650	
<i>Cordyline australis</i>	Ti kōuka, cabbage tree	PB2 or PB3	445	75	45	95	660	
<i>Corynocarpus laevigatus</i>	Karaka	PB5	110	35			145	
<i>Dacrycarpus dacrydioides</i>	Kahikatea	PB5	110			25	135	
<i>Dacrydium cupressenum</i>	Rimu	PB5	110				0	110
<i>Dysoxylum spectabile</i>	Kohekohe	PB5	110				110	
<i>Hedycarya arborea</i>	Pigeonwood	1.5 litre (or PB3)	220				220	
<i>Hoheria populnea</i>	Houhere, lacebark	1.5 litre (or PB3)	220	35	25	45	325	
<i>Kunzea robusta</i>	Kānuka	PB2 or PB3	665	110			1,125	
<i>Laurelia novae-zelandiae</i>	Pukatea	PB5				25	25	
<i>Leptospermum scoparium</i>	Manuka	PB2 or PB3			60	120	180	
<i>Melicytus ramiflorus</i>	Māhoe	1.5 litre (or PB3)	665	110		95	870	
<i>Phormium tenax</i>	Harakeke	PB2 or PB3		75	60		135	
<i>Phyllocladus trichomanoides</i>	Tānekaha	PB5	200					200
<i>Piper excelsum</i>	tānekaha	1.5 litre (or PB3)	220				220	
<i>Pittosporum tenuifolium</i>	Kōhūhū	PB2 or PB3	110	75			185	
<i>Podocarpus totara</i>	Tōtara	PB5	220				220	
<i>Sophora chathamica</i>	Kowhai	PB5	110	35		25	170	
<i>Syzygium maire</i>	Swamp maire	PB5				20	20	
<i>Vitex lucens</i>	Pūriri	PB5	110	40			150	
Total			4,530	740	720	2,330	7,860	810

OVERALL SITE PLAN





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