Te Kararo Queenstown Gardens Conifer Succession Plan

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Brief:

This succession plan presents a strategic approach to systematically remove undesirable conifers from Te Kararo Queenstown Gardens, replacing them with native and suitable exotic species. The primary aim is to retain the function of the existing shelterbelt while enhancing biodiversity, transforming the shelterbelt into a resilient and vibrant public space that reflects both ecological and cultural values. The phased implementation will ensure the Gardens remain a cherished and sustainable asset for future generations.

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1. Introduction

The establishment of conifers around Te Kararo Queenstown Gardens peninsula has served a key functional purpose, acting as a windbreak that provided critical shelter for the establishment of amenity tree planting and supporting the Gardens as a valued and usable public space. This shelter enabled the successful growth of diverse tree and plant species within the Gardens, contributing to the early development of the landscape. However, over time, these conifers have become a dominating feature of the Gardens, and their advancing age requires careful management and transition to a more sustainable and ecologically diverse shelterbelt.

Current Role of the Conifer Plantation

The conifer plantation covers approximately 5 hectares, about 33% of the Gardens total 15 hectares (152,400 m²). The conifer trees serve as a windbreak, sheltering other trees and providing a more comfortable environment for recreational activities within the reserve. This protective function is critical in maintaining the usability of the Gardens, particularly in exposed areas where strong winds can deter visitors and damage other vegetation.

The mature conifer plantation is estimated to sequester approximately 51 metric tonnes of CO_2 per year[1]. Although beneficial, this contribution to carbon capture does not offset the long-term ecological damage caused by these undesirable species.

Ecological Impact of Pest Plants

The spread of pest species, such as wilding conifers, within the Queenstown Lakes District has led to significant ecological imbalances through soil degradation, biodiversity loss, and seed spread risks. The dense canopy of these trees blocks sunlight, suppresses understory growth and disrupts natural regeneration processes, significantly reducing native flora and fauna. Their needle litter contributes to soil acidification and reduces nutrient availability, resulting in poor soil health that challenges the establishment of other plant species. Additionally, the monoculture created by these conifers increases fire risk, posing further environmental threats.

Seed sources, such as the protruding peninsula of Te Kararo Queenstown Gardens, enable the spread of wilding species into surrounding natural areas, compounding the ecological challenges and threatening local ecosystems. Previous conifer control measures within the Gardens have been inconsistent and reactive, lacking a comprehensive strategy to systematically remove and replace these undesirable species.

The conifers surrounding the peninsula are predominantly Douglas fir (*Pseudotsuga menziesii*), a longer-lived evergreen that produces dense needle litter, contributing to soil acidification, and Radiata Pine (*Pinus radiata*), a fast-growing species with a lifespan of less than 100 years. Both of these are considered pest species due to their invasive spread and ecological impacts.

[1] based on an assumed density of 500 trees per hectare and an average sequestration rate of 20 kilograms of CO_2 per tree annually

Purpose of the Succession Plan

The primary purpose of this succession plan is to provide a clear, actionable framework for the systematic removal of undesirable conifers from Te Kararo Queenstown Gardens and their replacement with suitable species. The plan outlines specific actions, timelines, responsibilities and resources required to achieve project goals over the coming decades.

A strategic approach involving Zones, Stages and Phases has been developed to gradually remove conifers and reintroduce a diverse range of plant species to enhance the Gardens' ecological resilience. By replanting with a mix of native and suitable exotic species, the plan aims to restore ecological balance, improve soil health and create a sustainable landscape that provides aesthetic, recreational and cultural benefits.

This succession plan is aligned with regional and national strategies, such as the New Zealand Wilding Conifer Management Strategy and the Queenstown Gardens Reserve Management Plan (2011), both of which advocate for the removal of undesirable conifers to protect ecosystems. Additionally, the plan supports the broader environmental goals of Queenstown Lakes District Council (QLDC), including enhancing public spaces and ensuring the sustainable management of natural resources for future generations.

Importantly, the plan recognises the need for a gradual, carefully managed removal process to mitigate the risks associated with sudden wind load changes, ensuring that the overall landscape and the framework of highly valued tree assets within the Gardens remain stable throughout the transition.

Immediate Need for Action

Immediate action is required to prevent further ecological degradation and restore Te Kararo Queenstown Gardens to a more natural and resilient state. The conifers are damaging the Gardens' current landscape and threatening the broader ecological integrity of the region.

The phased approach detailed in this succession plan spans several decades, making timely action crucial. Delaying the start will exacerbate the existing issues and heighten risks to garden visitors as the maturing conifer trees approach the end of their life cycle.

2. Key Challenges

Gradual vs. Large-Scale Removal Approaches

One of the primary challenges facing the succession plan is balancing the need for conifer removal with the potential impacts on the Gardens' existing trees and public safety. Large-scale removal poses risks, such as sudden changes in wind dynamics, which can destabilise remaining trees and expose them to damage. While trees naturally adapt their structure to withstand wind over time, through a process called thigmomorphogenesis[2], sudden exposure to increased wind can result in branch or complete tree failure. A gradual, staged approach mitigates these risks by allowing trees and landscapes to adapt over time, while transitioning to a more diverse shelterbelt canopy.

The staged removal approach also helps manage water retention, as trees play a crucial role in intercepting rainfall through their canopies. This slows down the rate of rainfall, allowing water to gradually infiltrate the soil and reduce the risk of soil erosion and surface flooding. When large numbers of trees are removed all at once, this natural water interception is lost, leading to increased surface runoff that can potentially overwhelm stormwater systems. Furthermore, removing many trees, particularly those providing wind protection, may temporarily affect the gardens' usability.

Planting Conditions and Soil Challenge

The monoculture established by conifers has influenced local biodiversity, with the dense canopy limiting understory growth and reducing light availability for a variety of plant species. This presents a challenge for reintroducing more diverse plant species.

While conifer soils can support the re-establishment of diverse plant species, having a pH range similar to that of native beech forests, some areas exhibit compacted or nutrient-limited conditions due to long-term monoculture. To enhance soil quality and support successful replanting, organic amendments such as compost, mulch, or biochar can be applied. These interventions can improve soil structure, encourage microbial activity, and increase nutrient availability, facilitating the transition to a more diverse ecosystem.

Reinvasion Risks

The Gardens' location on a peninsula, coupled with its own conifer seed source, increases the risk of reinvasion both within the Gardens and into surrounding natural areas. Conifer seeds can travel significant distances, spreading rapidly and undermining control efforts. Continuous monitoring of the Gardens will be essential to identify new wilding seedling growth quickly.

Public Perception

Managing the public perception of the succession plan is essential, particularly when visible changes, such as extensive tree removals, are underway. The public may have emotional or cultural connections to the existing landscape, so communicating the project's long-term benefits is important.

Funding and Resource Limitations

Securing sustainable funding is vital for the continued implementation of the succession plan. The project's long-term nature, with removal and replanting occurring over multiple decades, requires consistent financial resources.

[2] the response of plant cells to mechanical stimulation. For example, the thigmomorphogenetic response of trees in windy environments is to grow shorter, with thicker trunks and stronger roots.

3. Succession Plan Outline

The succession plan prioritises the systematic removal and thinning of undesirable conifers from Te Kararo Queenstown Gardens through a structured approach involving distinct **Zones**, **Stages**, and **Phases**. This gradual approach ensures that wind protection for amenity and heritage trees within the Gardens, as well as public safety, is managed carefully, mitigating the risks associated with increased wind exposure.

A key focus of the plan is to reintroduce a diverse mix of native and exotic species to enhance biodiversity and create a more resilient, ecologically balanced landscape. Additionally, tall-growing, suitable conifers not recognised as pest species will be strategically planted to preserve the crucial windbreak function currently provided by the existing conifer stands. The wind shelter properties of the existing conifers, particularly the edge trees, will be leveraged to protect and support the establishment of new plantings during the transition.

Continuous monitoring of wind impacts, tree health, stability and the establishment of new plantings will guide adaptive management decisions. Ongoing assessments will inform necessary adjustments to both removal and planting strategies as required, ensuring the plan remains flexible and responsive to evolving conditions.

Zoning, Stages and Phases

Using LiDAR mapping and site assessments, the removal strategy has been divided into 12 distinct **Zones** based on existing canopy gaps, groupings and their role in providing wind protection. Each Zone is then assigned **Stages** and **Phases** to determine the sequence of removal and replanting efforts.

Each Stage represents a ten-year cycle, while each Phase corresponds to one year. This structured approach enables gradual, manageable progress, as well as monitoring and reassessment.

The table below shows the **Zone**, **Stage** and **Phasing** structure used to form the Maintenance Schedule.

The overlay map, *Figure 1,* shows the 12 Zoning areas and individual conifers located throughout the reserve.

Table 1: Succession Plan Maintenance Schedule

	Stage 1 (Years 1-10)										Stage 2 (Years 11-20) *etc...*									
	Phases (years)										Phases (years) *etc...*									
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
ZONE 1																				
ZONE 2																				
ZONE 3 *etc..*																				

Figure 1: Zoning Overview & Individual Douglas Fir identified for removal

Zoning, Stages and Phases (cont.)

The detailed maintenance schedule, including specific removal and replanting timelines, can be found in ***Appendix 1 – Succession Plan Maintenance Schedule***. This schedule outlines key milestones and indicative dates, with initial removals planned to begin in Year 1 and extend over a 70-year period.

While the proposed timeline is flexible and can be adjusted to accommodate budgetary constraints or other considerations, the overall structure of the schedule should be adhered to. This phased approach allows sufficient time for newly planted shelter species to establish and mature, ensuring that replacement trees provide adequate cover before subsequent removals.

By staggering activities across multiple zones, the Gardens will maintain a continuous flow of operations. This approach ensures that as trees in one Zone adapt to increased wind exposure, work can progress in other areas, balancing the landscape's transition.

The 70-year timeframe is considered the minimum duration required to balance the removal of undesirable conifers and the establishment of an effective replacement shelter. Accelerating the process could compromise the Gardens' ability to maintain windbreak functions and damage the internal framework of trees within the Gardens, and impact the usability of the Gardens by the public and clubs.

Activity by Zone

Each Zone will undergo a structured sequence of activities designed to manage removal, replanting and long-term management. A description of each activity is identified in the following table:

Table 2: Maintenance Schedule Activities

Activity	Description	Timeline	Key Activities	Monitoring & Evaluation
Shelterbelt Removal	Systematically thin out shelterbelt conifers in phases to reduce wind load gradually.	Est. 70 years from starting year	Select trees for thinning; Leave trees to acclimate to new wind exposure. Ensure safe public access during operations	Inspect trees for wind damage; Adjust thinning strategy if needed. Monitor soil erosion; Reevaluate shelterbelt effectiveness
Shelterbelt Rest	Pause operations to allow remaining trees to adapt to new conditions.	Allow three years rest minimum between removal phases.	Minimal intervention; Inspect trees regularly.	Record tree health; Plan for next removal phase.
Planting	Introduce native and exotic species in cleared areas, ensuring they are suited to local conditions.	During rest periods.	Prepare soil; Plant tree species; Install protective measures for young plants.	Monitor plant growth; Replace failed plants.
Weed Control	Regularly remove new wilding seedlings and maintain new planting areas.	During rest periods.	Identify and remove new wilding seedlings; Inspect new planting health.	Track seedling recurrence; Evaluate success of new tree plantings
Assessments (Removal & Planting)	Assess overall success and plan the next phase removal. Review planting progress and long-term maintenance requirements	Prior to each removal phase. During & after planting seasons	Conduct a comprehensive review; Plan for ongoing maintenance. Involve key stakeholders i.e. FOG & WCG	Document long-term outcomes; Adjust management strategies if needed.

FOG = *Friends of Wakatipu Gardens And Reserves*
WCG = Whakatipu Wilding Control Group

Initial Focus and Early Stages

The first stage (*Stage 1: Years 1-10*) of the succession plan will focus on critical goals, including establishing Operational Access, Focal Areas and Individual Conifers removals. These early stages are identified on the map below, *Figure 2*.

Operational Access

Operational access trails have been selected based on the natural contours of the land and existing entry points. Forming these access trails early will improve mobility for planting and removal equipment, teams and materials/soil amendments. A larger portion of tree removals may occur in the early stages to allow for the clearance of these access trails.

Focal Areas

Removing trees in these areas will align with the *Te Kararo Queenstown Gardens Development Plan*, creating viewshafts to connect visitors with the surrounding landscape and recreational spaces to relax.

Individual Conifers

Throughout the main Gardens, individual conifers can be removed at any time during the process, as their presence does not significantly affect wind dynamics. Arborist crews should carry out the removal in a controlled manner to minimise damage to the surrounding landscape. These removals will create space for the establishment of specimen trees, facilitating the Gardens' succession plan for its amenity trees.

It is crucial to emphasise that trees like the 'Five Sisters', Ponderosa Pines and Larch trees, provide significant amenity value due to their landscape presence, and the community wishes to retain them until the end of their Safe Useful Life Expectancy (SULE[3]), despite their classification as pest species.

[3]refers to the estimated period a tree can be safely and beneficially retained in its environment, considering factors like health, structural stability, and site conditions.

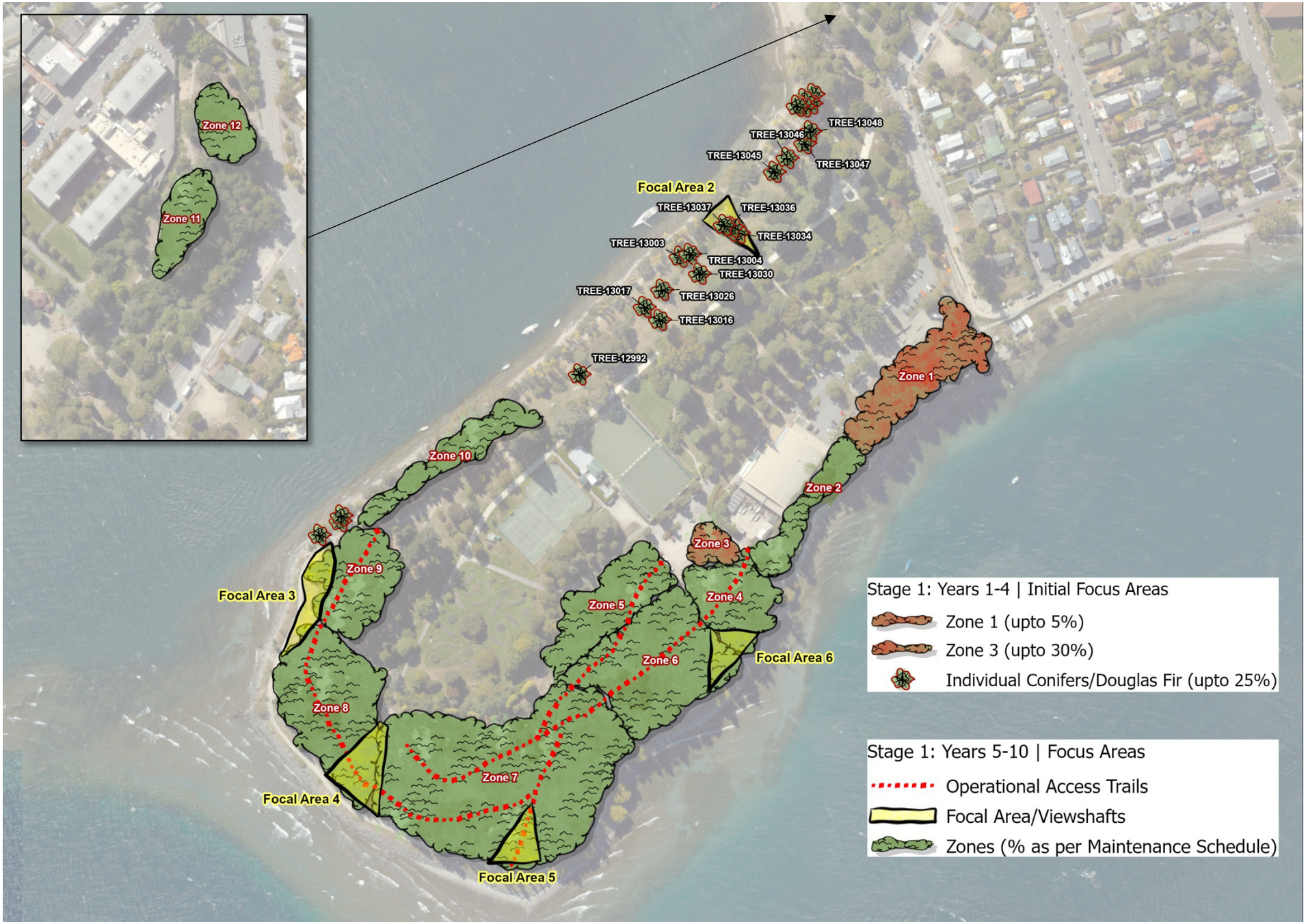


Figure 2: Initial Focus & Early Stages

4. Removal and Control Strategy

Methods of Tree Removal

The removal of conifers within Te Kararo Queenstown Gardens will employ a combination of mechanical felling and arboricultural dismantling. This approach ensures safe and efficient removal while minimising environmental impacts and maintaining public safety.

4.1.1 Mechanical Felling

Conifers will be felled using mechanised equipment in low public use zones where access allows, and large quantities of trees can be removed quickly. Felling will be staged carefully to avoid damaging nearby trees and vegetation.

4.1.2 Arboricultural Dismantling

Arboricultural dismantling will be employed in sensitive zones near high-value trees, public areas, or structures. This method involves manually sectioning trees in a controlled manner, reducing the risk of collateral damage and ensuring precision in constrained spaces.

4.1.3 Materials and Debris

Timber will be removed from the site. Branches will be processed into wood mulch of appropriate grade to assist with replanting efforts. The mulch will either be spread directly around planting areas to enhance soil moisture retention and suppress weeds or left in piles to age before further use. Any excess mulch that exceeds on-site requirements will be transported offsite.

4.1.4 Tree Stumps

In high-visibility or heavily frequented public areas, tree stumps will be either ground down or mechanically removed to improve aesthetics and ensure safe access for both users and equipment. In lower-priority zones, stumps will be cut low to the ground, and planting will be established around them, allowing for natural decomposition over time.

Ground and Weed Control

Ongoing efforts after the initial removal will focus on managing regrowth and preventing reinvasion of wilding conifers. Ground crews will conduct regular inspections of replanting zones to identify and promptly remove new seedlings.

Targeted herbicide treatments or manual control methods will be employed to prevent conifer re-establishment. Herbicide applications will be carefully managed to minimise environmental impacts, with applications timed for optimal weather conditions. Regular follow-up treatments will address any regrowth, with the frequency of treatment adjusted based on monitoring results. The goal is to reduce herbicide use over time while maintaining effective control.

Control measures and strategies will be adjusted as needed to ensure the long-term success of restoration efforts. Engaging the community in reinvasion prevention through initiatives and volunteer seedling removal days will provide additional support and increase awareness of the importance of ongoing conifer control.

Timing and Safety Considerations

The timing of removals will be critical to minimise disruption and ensure public safety. Operations will be scheduled during off-peak times, such as early mornings, weekdays, or low-tourism seasons, to reduce impacts on park users and QLDC Field Staff.

Removal activities in the *Succession Plan Maintenance Schedule* have been aligned into four-year cycles. This approach ensures efficient execution of removal operations within designated periods while providing intervals of rest and minimising disruption within the Gardens.

To ensure safety, protocols will include path closures, clear signage, and barriers to restrict public access to active work areas. Protective measures, such as barriers around sensitive vegetation and waterways, will also be in place. Low-impact machinery will be prioritised, and pre-removal assessments will identify and mitigate potential risks or challenges. Regular communication will keep park visitors informed about the schedule and purpose of removal operations.

5. Replanting Strategy

The replanting strategy aims to restore ecological balance, enhance biodiversity, and maintain functional shelter following tree removals. By prioritising early planting, optimal seasonal conditions, and a mix of native and exotic species, the strategy supports long-term restoration while addressing immediate site needs. Species recommendations and zoning plans are provided in *Appendix 1: Succession Plan Maintenance Schedule* and *Appendix 2: Species Selection Guide.*

Objectives and Approach
The replanting strategy focuses on:

- Rapid introduction of pioneer and secondary species to create shelter, improve soil conditions, and establish microenvironments.
- A 40% native and 60% exotic species mix to balance ecological restoration with functional shelter.
- A multi-layered canopy structure combining closed-canopy forest, open woodland, and scattered pockets to enhance ecological diversity and visual appeal.
- Strategic retention of existing conifer groups, particularly along the lakeshore, to provide temporary shelter until new plantings are established.

Planting will commence in the season following tree removals, primarily in Autumn and Spring, when conditions are most conducive to establishment.

Critical to the project's success, early planting opportunities in identified zones (see Appendix 1) should begin as soon as possible, with trial planting undertaken prior to Year 1 removals, to test methodologies and monitor success. **Subsequent removal phases will proceed only if tree establishment is successful.**

Planting Phases
Replanting is divided into two phases to ensure progressive restoration and adaptability.

5.1.1 Initial and Secondary Planting (Early to Mid-Stages)

Planting will begin immediately after conifer removal in designated zones as space and light become available. This phase combines:

Pioneer species (e.g., Kānuka): Resilient and adaptable, these species stabilise soil, enhance nutrient cycling, and create microenvironments. They are planted in clusters to establish presence effectively.

Secondary species (e.g., Kōwhai, Native Beech, Giant Sequoia): Inspired by successes at reserves like Jardine Park, taller native and exotic trees will be introduced concurrently to expedite canopy development, provide wind protection, and enhance biodiversity.

New shelter will replace the existing conifer windbreak using tall, fast-growing conifer species (see Appendix 2). The map below illustrates the strategic placement of conifers and other tall-growing trees used to create a functional, less intrusive shelter alongside open woodland areas, improving space usability.


Planting Strategy
Forest Closed Canopy
Woodland Open Canopy
Coniferous Forest: Tall growing Conifers such as Redwoods mixed with native hardwoods like Beech, forming a closed forest canopy
Mixed Woodland: Blend of native and exotic species, creating an open, diverse canopy and spacious woodland setting
Recreational Open Areas: Grassy expanses and low landscaped zones, designed for public recreational use
40% Native
60% Exotic
Targeted Tree Planting Distribution

Replanting Strategy (cont.)

5.1.2 **Final Planting (Later Stages)**

This phase focuses on filling gaps, introducing additional species to enhance habitat value, and replacing failed plantings. Additional plant variety and understorey vegetation will be prioritised to ensure a fully established ecosystem with vertical height, wind protection, and ecological diversity.

Species Selection and Planting Design

Native species will be eco-sourced from the Queenstown region, where possible, to ensure local provenance. Recommended spacing ensures optimal growth:

- Large trees (e.g., Native Beech): 2–3 meters apart to allow dominance.
- Shrubs and smaller trees (e.g., Kānuka): 1 meter apart for effective establishment.
- Grasses and ground covers: 500–800 mm apart for quick coverage.

A comprehensive species list, including large trees and understorey vegetation, is available in Appendix 2. Where early plantings may be affected or damaged by subsequent removals, strategic planning prioritises pioneer species in at-risk areas, as their soil-enhancing benefits persist even if trees are lost.

In areas with existing infrastructure, planting locations will be carefully planned to integrate with facilities such as the Ice Arena and QLDC Parks Buildings. These areas will feature mixed woodland with open, spacious plantings to ensure unobstructed access, preserve window views, support operational requirements, and avoid interference with maintenance or other infrastructure.

Replanting Strategy Summary

The replanting strategy integrates ecological restoration with functional design. By combining pioneer and secondary species, retaining select conifers for temporary shelter, and aligning plantings with optimal seasons, the approach ensures progressive restoration. The resulting multi-layered canopy will enhance biodiversity, provide improved wind protection, and create an enjoyable, resilient landscape.

Soil Enhancement and Preparation

To support the successful establishment of new plantings, soil conditions can be optimised through targeted enhancement practices. Applying organic materials, such as mulch, compost, biochar, or mycorrhizal inoculants, can improve soil structure, enhance water retention, and promote nutrient availability. These amendments foster a favourable environment for root development and plant growth, building on the existing soil foundation developed under the conifer plantation.

In areas where compaction is observed, soil conditioning may involve tilling or screefing to loosen soil and improve aeration. Following this, organic matter can be incorporated, and mulch applied around plant bases to conserve moisture, suppress weeds, and regulate soil temperature. These practices support robust root establishment and overall plant health.

Soil nutrient levels will be monitored throughout the replanting phases to identify any site-specific deficiencies. Based on these assessments, targeted applications of fertilisers or additional organic amendments may be used to optimise growth conditions. For detailed guidelines and best practices on soil conditioning and nutrient management, refer to ***Appendix 3—Soil Enhancement Techniques and Best Practices***.

Long-Term Maintenance and Monitoring

Ensuring the success of replanting efforts requires consistent monitoring and adaptive management to respond to challenges as they arise. This adaptive approach ensures that replanting efforts remain resilient and effective, supporting the long-term restoration goals.

Newly planted areas will be inspected regularly to monitor plant health, check for signs of stress or failure and manage wilding species that may compete with new growth. Maintenance will include watering, mulching and replacing any failed plants.

Protective measures, such as tree guards, plant shelters, targeted pest control and public awareness, will safeguard young plants from damage and activities like frisbee golf. Adjustments will be made based on observed impacts to ensure plant survival and success.

QLDC will enter into a Memorandum of Understanding (MOU) with Key stakeholders such as the Friends of Whakatipu Gardens (FOG), Whakatipu Wilding Control Group (WCC) and any future Queenstown Gardens stakeholders. The MOU will include seasonal planting walkover assessments to evaluate the progress and establishment of new plantings, and discuss the next stages of the Plan.

Alternative Planting Methodologies

One potential approach to enhance the replanting strategy within the Gardens is the **Miyawaki method**, a technique for creating dense, fast-growing and ecologically resilient forests. This method involves planting species in close proximity, closely mimicking natural forest regeneration processes.

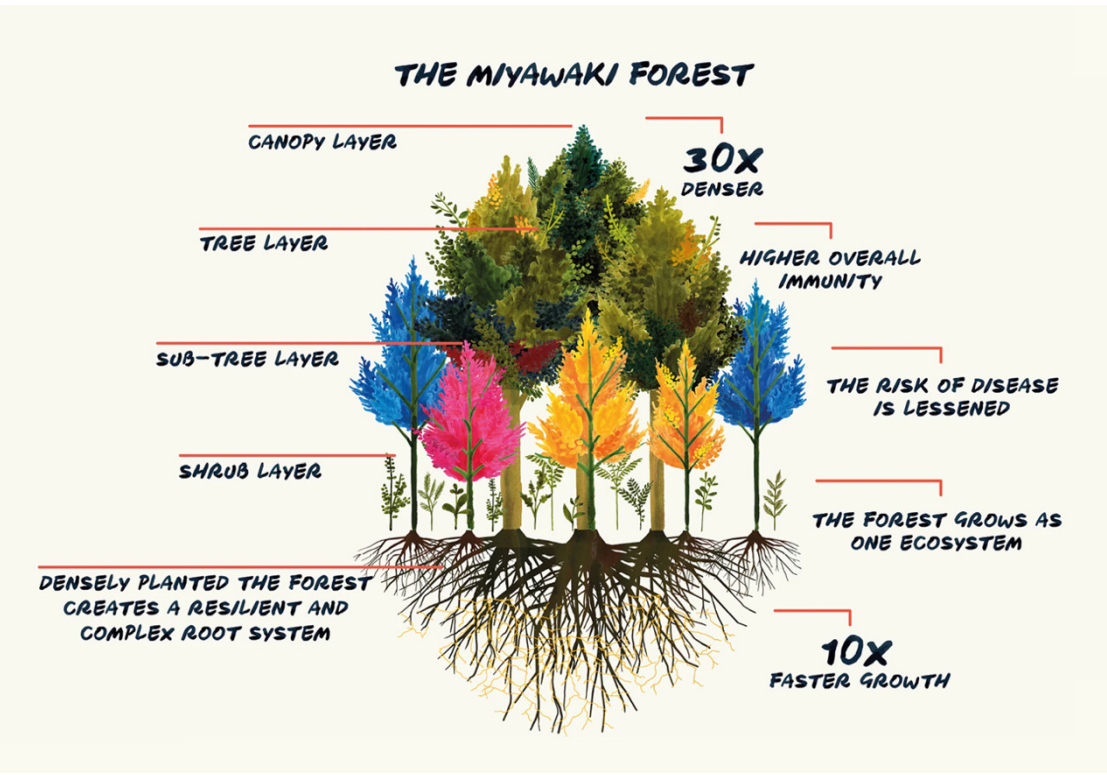
The Miyawaki method encourages plant growth much faster than traditional planting techniques, with vegetation maturing up to 10 times quicker. This acceleration can significantly reduce the time needed to establish a functional shelter and achieve soil restoration.

A critical element of this method is **thorough site preparation**, which involves digging deep and wide pits and enriching the soil with biomass such as compost before planting. These organic additions enhance soil fertility, promote microbial activity and improve soil structure. By enriching the soil beforehand, the root systems of newly planted species benefit from optimal conditions for rapid growth, efficient water retention and improved nutrient absorption. The close planting means plants grow taller quicker as they compete for available light.

Once established, Miyawaki forests require less maintenance due to their density. The compact planting improves moisture retention, suppresses weed growth and provides resistance to environmental stressors, such as drought, pests or vandalism. This self-sustaining characteristic makes the Miyawaki method a cost-effective and efficient solution when combined with more conventional planting techniques.

The benefits of using the Miyawaki method can be seen in this video by Kent County Council (UK), where they explored techniques to improve tree establishment and survival rates, supporting the expansion of urban tree cover: https://www.youtube.com/watch?v=0VizWfEIW1U

While the Miyawaki method's high planting density may not be suitable for the entire shelterbelt area, it could be advantageous in isolated pockets. By selectively implementing this technique or other alternative methods, the Gardens can facilitate swift restoration in essential areas.



6. Monitoring and Adaptive Management Strategy

The Succession Plan's success hinges on a robust monitoring and adaptive management framework, enabling flexibility to respond to evolving conditions during conifer removal, replanting, and restoration. Advanced technologies, such as Geographic Information Systems (GIS) and LiDAR, will track progress and provide data to guide decisions on future removal and replanting phases.

Key performance indicators, including tree health, growth rates, soil quality, control method efficacy, and wind load impacts, will be monitored to inform timely adjustments to the plan. Wind load assessments will determine whether more cautious or extensive removal strategies are needed at each stage.

Regular evaluations, combining detailed in-depth surveys and walkover assessments, will measure the success of removal and replanting efforts. These assessments will ensure alignment with the plan's objectives.

Continuous stakeholder engagement will ensure the plan reflects community values and incorporates public feedback. Involving stakeholders in the decision-making and walkover assessments will build a broad base of support that helps drive its success, fostering a sense of ownership and stewardship within the community.

Effective communication strategies, such as visual examples and signage, will educate the community about the ecological benefits of the plan. Emphasis will be on the importance of conifer removal for the Gardens' long-term health and sustainability.

7. Conclusion and Recommendations

The succession plan for Te Kararo Queenstown Gardens offers a comprehensive framework for systematically removing undesirable conifers and re-establishing with native and suitable exotic species.

Success hinges on a well-coordinated approach incorporating thorough planning, robust stakeholder engagement, ongoing monitoring, and adaptive management practices. With effective implementation, the Gardens will evolve into a thriving, biodiverse landscape, reflecting the area's natural beauty and cultural significance, leaving a lasting legacy and safeguarding the Gardens for future generations.

Expected Outcomes

7.1.1 Restoration of Biodiversity

The systematic removal of conifers will facilitate the re-establishment of native plant species, enhance habitat for local fauna, and promote biodiversity. This will create a more balanced and thriving ecosystem aligned with regional conservation goals. To complement the restoration, select exotic species will also be introduced to maintain diversity and colour and continue the botanical theme within the Gardens' existing character.

7.1.2 Improved Soil Health and Landscape Function

Soil enhancement measures will build on the existing soil foundation established under the conifers, optimising conditions for the successful establishment of new plantings. These improvements will enhance soil health, supporting a more diverse and resilient landscape.

7.1.3 Enhanced Recreational and Aesthetic Value

The transformation of the Gardens will improve their visual appeal, providing a more diverse and dynamic landscape that enhances the visitor experience. New plantings will create further seasonal interest, enhance the aesthetic appeal and provide natural windbreaks that will protect the Gardens, its heritage trees and other key amenities.

7.1.4 Community and Stakeholder Engagement, and Memorandum of Understanding (MOU)

The Te Kararo Queenstown Gardens Succession Plan will foster a deep sense of community ownership and stewardship by actively involving key stakeholders, including the Friends of Wakatipu Gardens (FOG), Whakatipu Wilding Control Group (WCG), Queenstown Bowling Club, Tennis Club, Ice Arena, and future stakeholders. Stakeholders will be kept informed as the tree succession plan and operations progress, ensuring alignment with community goals and operational needs.

A Memorandum of Understanding (MOU) will be established to document the core principles of the Plan, promoting ongoing engagement, transparency, and collaboration throughout the project. The MOU will outline how stakeholders will support the Plan's operational components, including the formation of a management group to oversee implementation, make decisions on key milestones and hold points, and guide the principles shaping the Plan's execution. This includes conducting seasonal planting walkover assessments to evaluate the progress and establishment of new plantings and to plan subsequent stages of the project.

7.1.5 Adaptive Management for Long-Term Success

Ongoing monitoring and adaptive management will ensure the plan remains responsive to new challenges and opportunities. This approach will allow for continuous refinement of management practices, ensuring that the Gardens are resilient to changing environmental conditions and can thrive well into the future.

Key Recommendations for Plan Implementation

7.2.1 Secure Funding for Long-Term Implementation

The plan's success depends on robust, sustainable funding. QLDC should actively pursue diverse funding streams, including government grants, local fundraising campaigns, and strategic partnerships with businesses and community organisations. Collaborating with initiatives like **Trees That Count**, which connects businesses to native tree planting projects, can amplify resources. Additionally, QLDC should develop comprehensive contingency plans to address potential funding shortfalls, ensuring uninterrupted progress and long-term viability.

7.2.2 Plan for Long-Term Maintenance and Adaptive Management

To ensure the Gardens' transformation is sustainable, long-term maintenance plans must be established, with adaptive management strategies that can respond to changing conditions. A dedicated team should oversee the project, adjusting the plan as needed.

7.2.3 Implement Robust Monitoring and Reporting Mechanisms

Effective monitoring and reporting are crucial for tracking progress, measuring success, and informing management decisions. Monitoring protocols should be established, utilising GIS technology, site assessments, and regular stakeholder feedback sessions.

7.2.4 Develop a Public Communication Strategy

A clear and proactive communication strategy should be developed to manage public perception and educate the community on the plan's benefits. This strategy should include regular updates and educational materials that highlight the ecological, cultural, and recreational improvements resulting from the project.

7.2.5 Promote Community Involvement in Planting and Maintenance Activities

Encouraging community participation in planting days and ongoing maintenance activities will enhance public support and contribute volunteer resources. Educational programs that involve schools and youth groups should be considered to inspire the next generation of environmental stewards.

Recommendations for Broader Application and Future Projects

7.3.1 Apply Lessons Learned to Similar Projects in the Region

The insights gained from the Te Kararo Queenstown Gardens succession plan should be documented and shared to guide future restoration projects throughout the Queenstown Lakes District. This unique and complex project will offer valuable lessons, including the effectiveness of conifer removal and replanting techniques, as well as soil enhancement strategies.

7.3.2 Expansion of the Botanical Gardens

The removal of conifers will create an opportunity to expand the Botanical Gardens into the upper plateau of Zones 5, 7, and 8. Engaging landscape designers early in the project will be key to realising this vision.

7.3.3 Explore Opportunities for Ecological Education

This project offers a unique opportunity to educate the public about native biodiversity, the impacts of pest species and the importance of sustainable landscape management. Interpretive signage can be developed to showcase the Gardens as a living example of ecological restoration.

8. Appendices

Appendix 1 - Succession Plan Maintenance Schedule *(Spreadsheet)*
Appendix 2 - Species Selection Guide
Appendix 3 - Soil Enhancement Techniques and Best Practices

References and Supporting Documentation

1. Te Kararo Queenstown Gardens Development Plan
   A comprehensive plan detailing the long-term vision for Te Kararo Queenstown Gardens, including landscape enhancements, historical considerations, and environmental management strategies that align with the goals of the succession plan.

2. Queenstown Gardens Reserve Management Plan 2011
   This document provides the foundational guidelines for managing Te Kararo Queenstown Gardens, including policies on tree management, landscape preservation, and community engagement. It supports the alignment of the succession plan with existing management frameworks.

3. New Zealand Wilding Conifer Management Strategy 2014
   A national strategy that outlines best practices for wilding conifer control across New Zealand, emphasising collaborative approaches, funding mechanisms, and long-term management goals.

Appendix 1: Succession Plan Maintenance Schedule Te Kararo Queenstown Gardens

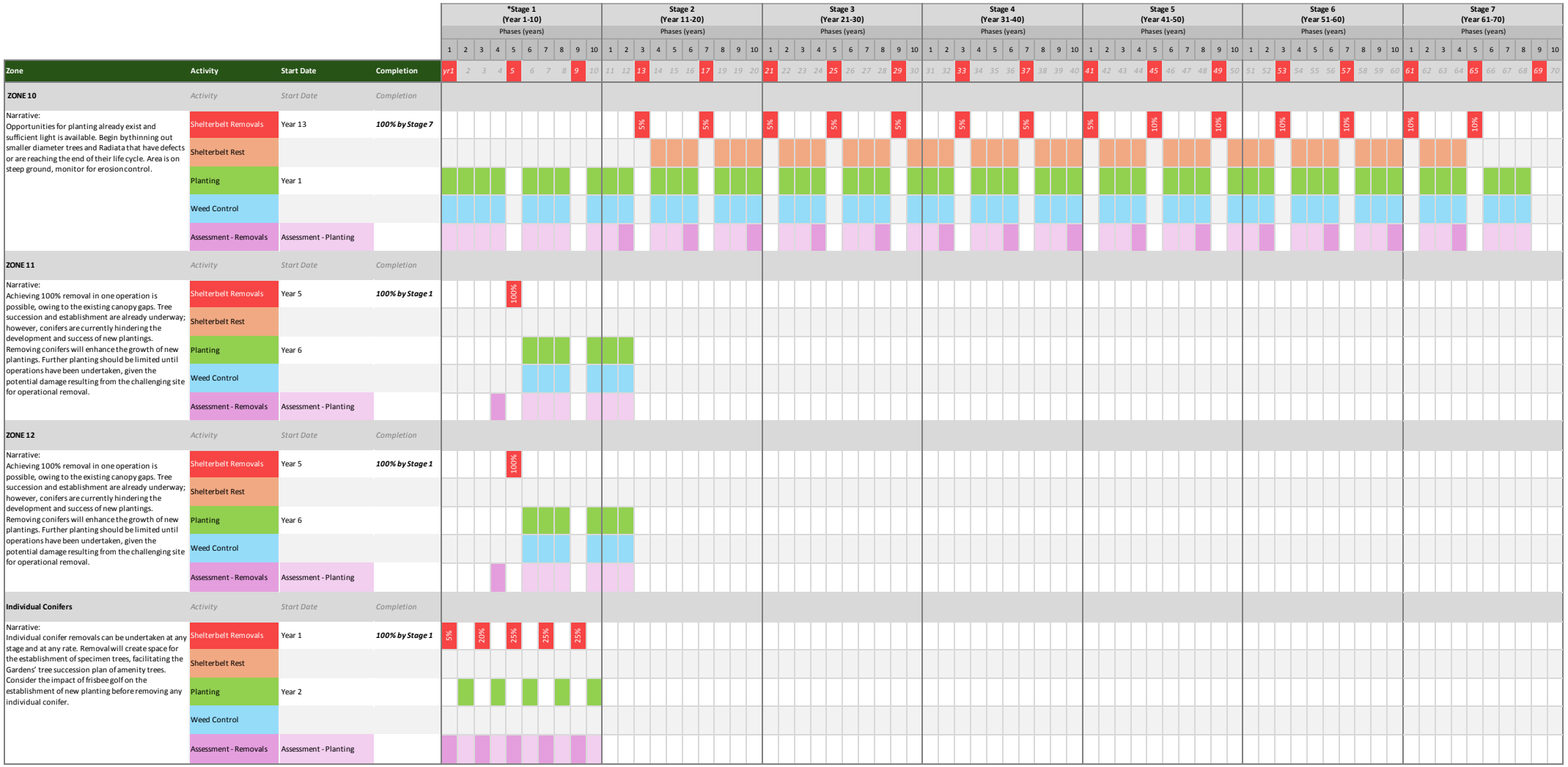
July 2025 v1

Zone	Activity	Start Date	Completion	*Stage 1 (Year 1-10) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 2 (Year 11-20) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 3 (Year 21-30) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 4 (Year 31-40) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 5 (Year 41-50) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 6 (Year 51-60) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 7 (Year 61-70) Phases (years) 1 2 3 4 5 6 7 8 9 10
				yr1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 19 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50	51 52 53 54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69 70
ZONE 1	*Activity*	*Start Date*	*Completion*	**Stage 1: Early removals will focus on operational access trails, smaller diameter trees, trees with defects, and those reaching the end of their life cycle, as well as removals for the Focal Area identified in the Queenstown Gardens Development Plan.*						
Narrative: Begin by thinning smaller diameter trees to create opportunities for planting. Undertake strategic individual removals to improve access for equipment. Next, commence thinning trees evenly throughout the zone, focusing on Radiata that are nearing the end of their life cycle. Preserve clusters of lakeside trees to provide shelter for new plantings. Assess the requirement for height reductions as necessary based on wind dynamics assessments. Conduct crown lifting operations to increase light for new plants as required.	Shelterbelt Removals	Year 1	***100% by Stage 2***	5% 10% 15%	30% 40%					
	Shelterbelt Rest									
	Planting	Year 2								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 2	*Activity*	*Start Date*	*Completion*							
Narrative: Minor opportunity for early planting. Start by thinning smaller diameter trees to create space for planting opportunities and undertake strategic individual removals to improve access for equipment. Conduct crown lifting operations to increase light for new plants as required. Keep new plantings well clear of buildings/ice arena.	Shelterbelt Removals	Year 5	***100% by Stage 2***	10% 20%	30% 40%					
	Shelterbelt Rest									
	Planting	Year 2								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 3	*Activity*	*Start Date*	*Completion*							
Narrative: Begin by removing a selection of trees, including Radiata that are nearing the end of their lifespan and a pocket at the SE of the group to enable space for establishing new shelter planting. Complete removal within Stage 1 is possible, however assess the changes in wind dynamics before proceeding to the next removal phase. Select removal of narrow and exposed trees in Zone 4 maybe necessary.	Shelterbelt Removals	Year 1	***100% by Stage 1***	30% 70%						
	Shelterbelt Rest									
	Planting	Year 2								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 4	*Activity*	*Start Date*	*Completion*							
Narrative: In the early stages, establish access trails and carry out removals for the Focal Area 6. Retain parts of the lakeside trees for shelter to aid planting establishment, while crown lifting to enhance light and air movement.	Shelterbelt Removals	Year 5	***100% by Stage 3***	10% 10%	10% 15%	15% 20% 20%				
	Shelterbelt Rest									
	Planting	Year 6								
	Weed Control									
	Assessment - Removals	Assessment - Planting								

Appendix 1: Succession Plan Maintenance Schedule Te Kararo Queenstown Gardens

July 2025 v1

Zone	Activity	Start Date	Completion	*Stage 1 (Year 1-10) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 2 (Year 11-20) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 3 (Year 21-30) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 4 (Year 31-40) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 5 (Year 41-50) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 6 (Year 51-60) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 7 (Year 61-70) Phases (years) 1 2 3 4 5 6 7 8 9 10
				yr1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 19 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50	51 52 53 54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69 70
ZONE 5	*Activity*	*Start Date*	*Completion*							
Narrative: This Zone has the tallest trees within the shelter belt, protecting the Gardens' taller amenity trees, as well as the wider Bay/CBD. Begin by establishing the access trail for and thinning trees within the group to create lightwells. The focus should be on the gradual removal of vertical structure, either through whole tree removal or height reductions. Monitor wind dynamic changes of the trees within the Gardens.	Shelterbelt Removals	Year 5	***100% by Stage 7***	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 10%	10% 10%
	Shelterbelt Rest									
	Planting	Year 6								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 6	*Activity*	*Start Date*	*Completion*							
Narrative: Opportunity for spot planting around the edge for early planting; crown lift trees near new planting to improve growing conditions. Early stages should establish access trails, remove pockets within the group to create lightwells, and Focal Area 6. Retain portions of lakeside trees for planting and wind shelter until new trees have established.	Shelterbelt Removals	Year 5	***100% by Stage 7***	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5%	5% 10% 10%
	Shelterbelt Rest									
	Planting	Year 2								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 7	*Activity*	*Start Date*	*Completion*							
Narrative: Opportunity for early interplanting along the edge, crown-lift trees to improve these areas for new plant establishment. Early stage removals to establish access trails and Focal Area 5 & 4. Gradually thin and remove within the group to create lightwells. Retain portions of lakeside trees for planting and wind shelter until new trees have established.	Shelterbelt Removals	Year 5	***100% by Stage 7***	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5%	5% 10% 10%
	Shelterbelt Rest									
	Planting	Year 1								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 8	*Activity*	*Start Date*	*Completion*							
Narrative: Opportunity for early interplanting along the edge, crown lift trees to improve these areas for new plant establishment. Early stage removals to establish access trail and area surrounding Focal Area 4. Gradually thin and remove within the group to create lightwells, focusing on Radiata reaching the end of life. Retain portions of lakeside trees for planting and wind shelter until new trees have established	Shelterbelt Removals	Year 5	***100% by Stage 7***	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5%	5% 10% 10%
	Shelterbelt Rest									
	Planting	Year 1								
	Weed Control									
	Assessment - Removals	Assessment - Planting								
ZONE 9	*Activity*	*Start Date*	*Completion*							
Narrative: Begin by thinning out smaller-diameter trees and Radiata that have defects or are nearing the end of their life cycle. Opportunities for planting already exist along the edge. Exposed to prevailing winds, retain the lakeside Conifers until new planting and shelter have been established internally.	Shelterbelt Removals	Year 5	***100% by Stage 7***	5% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5%	10% 10% 10%
	Shelterbelt Rest									
	Planting	Year 1								
	Weed Control									
	Assessment - Removals	Assessment - Planting								


*Stage 1 (Year 1-10)
Stage 2 (Year 11-20)
Stage 3 (Year 21-30)
Stage 4 (Year 31-40)
Stage 5 (Year 41-50)
Stage 6 (Year 51-60)
Stage 7 (Year 61-70)
Phases (years)
Zone
Activity
Start Date
Completion
ZONE 10
Narrative: Opportunities for planting already exist and sufficient light is available. Begin bythinning out smaller diameter trees and Radiata that have defects or are reaching the end of their life cycle. Area is on steep ground, monitor for erosioncontrol.
Shelterbelt Removals
Year 13
100% by Stage 7
Shelterbelt Rest
Planting
Year 1
Weed Control
Assessment - Removals
Assessment - Planting
ZONE 11
Narrative: Achieving 100% removal in one operation is possible, owing to the existing canopy gaps. Tree succession and establishment are already underway; however, conifers are currently hindering the development and success of new plantings. Removing conifers will enhance the growth of new plantings. Further planting should be limited until operations have been undertaken, given the potential damage resulting from the challenging site for operational removal.
Year 5
100% by Stage 1
Year 6
ZONE 12
Narrative: Achieving 100% removal in one operation is possible, owing to the existing canopy gaps. Tree succession and establishment are already underway; however, conifers are currently hindering the development and success of new plantings. Removing conifers will enhance the growth of new plantings. Further planting should be limited until operations have been undertaken, given the potential damage resulting from the challenging site for operational removal.
Individual Conifers
Narrative: Individual conifer removals can be undertaken at any stage and at any rate. Removalwill create space for the establishment of specimen trees, facilitating the Gardens' tree succession plan of amenity trees. Consider the impact of frisbee golf on the establishment of new planting before removing any individual conifer.
Year 2

Appendix 1: Succession Plan Maintenance Schedule Te Kararo Queenstown Gardens - Summary

July 2025 v1

Removal & Planting Summary

Zone	Activity	Start Year	End Year	Duration (yrs)	Stage 1 (Year 1-10) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 2 (Year 11-20) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 3 (Year 21-30) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 4 (Year 31-40) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 5 (Year 41-50) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 6 (Year 51-60) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 7 (Year 61-70) Phases (years) 1 2 3 4 5 6 7 8 9 10
					yr1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50	51 52 53 54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69 70
ZONE 1	Shelterbelt Removals	1	17	*17*	5% 10% 15%	30% 40%					
ZONE 2	Shelterbelt Removals	5	17	*13*	10% 20%	30% 40%					
ZONE 3	Shelterbelt Removals	1	5	*5*	30% 70%						
ZONE 4	Shelterbelt Removals	5	29	*25*	10% 10%	10% 15%	15% 20% 20%				
ZONE 5	Shelterbelt Removals	5	65	*61*	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 10%	10% 10%
ZONE 6	Shelterbelt Removals	5	69	*65*	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 10% 10%
ZONE 7	Shelterbelt Removals	5	69	*65*	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 10% 10%
ZONE 8	Shelterbelt Removals	5	69	*65*	10% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 10% 10%
ZONE 9	Shelterbelt Removals	5	69	*65*	5% 5%	5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	5% 5% 5%	10% 10%
ZONE 10	Shelterbelt Removals	13	65	*53*		5% 5%	5% 5% 5%	5% 5% 10%	5% 10% 10%	10% 10% 10%	10% 10%
ZONE 11	Shelterbelt Removals	5	5	*1*	100%						
ZONE 12	Shelterbelt Removals	5	5	*1*	100%						
Individual	Shelterbelt Removals	1	9	*9*	5% 20% 25% 25% 25%						

Planting Summary

Zone	Activity	Start Year	End Year	Planting Seasons (yrs)	Stage 1 (Year 1-10) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 2 (Year 11-20) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 3 (Year 21-30) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 4 (Year 31-40) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 5 (Year 41-50) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 6 (Year 51-60) Phases (years) 1 2 3 4 5 6 7 8 9 10	Stage 7 (Year 61-70) Phases (years) 1 2 3 4 5 6 7 8 9 10
					yr1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50	51 52 53 54 55 56 57 58 59 60	61 62 63 64 65 66 67 68 69 70
ZONE 1	Planting	2	20	*15*	1 2 3 4 5 6 7	8 9 10 11 12 13 14 15					
ZONE 2	Planting	2	20	*15*		15					
ZONE 3	Planting	2	8	*6*	6						
ZONE 4	Planting	6	36	*24*				24			
ZONE 5	Planting	6	68	*48*							48
ZONE 6	Planting	2	70	*51*							51
ZONE 7	Planting	1	70	*53*							53
ZONE 8	Planting	1	70	*53*							53
ZONE 9	Planting	1	70	*53*							53
ZONE 10	Planting	1	68	*52*							52
ZONE 11	Planting	6	12	*6*		6					
ZONE 12	Planting	6	12	*6*		6					
Individual	Planting	2	10	*5*	5						

Appendix 2 -Species Selection Guide

A comprehensive guide to the native and suitable exotic species that will be used in replanting efforts, including information on their ecological roles, growth characteristics, and suitability for different conditions within Te Kararo Queenstown Gardens. Including a list of native species from *Growing Native Plants in the Wakatipu* by Whakatipu Reforestation Trust.

Species	Type	Ecological Role	Growth Characteristics	Suitability
Pioneer Native Species (non-exhaustive)				
Olearia avicenniifolia (Tree Daisy)	Native	Provides shade and wind protection for slower-growing species	Grows 2-4m; fast-growing shrub tolerates harsh conditions	Suited to dry, rocky sites, provides quick cover for exposed areas
Kunzea serotina (Kānuka)	Native	Provides early shelter, nitrogen-fixing, creates microenvironments	Grows 10-15m; thrives in dry, rocky, low-nutrient soils	Excellent for stabilising soil in rocky outcrops, supports succession
Phormium cookianum (Mountain Flax)	Native	Stabilises soil, attracts nectar-feeding birds	Grows 1-2m; tolerates dry to moist, rocky soils	Ideal for rocky slopes, erosion control in non-wetland areas
Ozothamnus leptophyllus (Tauhinu)	Native	Rapid coloniser, provides cover in exposed areas	Grows 1-2m; tolerates dry, windy conditions	Perfect for dry, rocky outcrops post-conifer removal
Secondary and Tertiary Native Species (non-exhaustive)				
Sophora microphylla (Kōwhai)	Native	Attracts native birds, provides habitat and visual interest	Grows 8-12m; prefers well-drained, moist soils	Enhances biodiversity, medium canopy in moist, rocky areas
Olearia lineata (Thin Leafed Tree Daisy)	Native	Provides quick cover, supports dry-site succession	Grows 4-6m; adapted to dry, rocky conditions	Ideal for dry, exposed rocky sites post-conifer removal
Aristotelia serrata (Wineberry/Makomako)	Native	Provides food for birds with berries, adds medium canopy	Grows 5-10m; prefers moist, well-drained soils	Excellent for forest margins in moist, sheltered areas
Carpodetus serratus (Putaputaweta)	Native	Contributes to biodiversity, tolerates shaded areas	Grows 6-10m; thrives in moist, well-drained soils	Ideal for secondary planting in moist, shady spots
Griselinia littoralis (Kapuka/Broadleaf)	Native	Provides medium canopy cover, habitat for birds	Grows 6-10m; tolerates wind and rocky soils	Great for filling canopy gaps, hardy against wind
Pittosporum tenuifolium (Kōhūhū)	Native	Creates microclimates, stabilizes soil	Grows 5-10m; tolerates wind and poor soils	Provides shelter for delicate species in moist areas
Elaeocarpus hookerianus (Pōkākā)	Native	Enhances biodiversity, provides habitat for birds/insects	Grows 10-15m; tolerates moist to dry conditions	Effective in semi-shaded, rocky plantings
Plagianthus regius (Lowland Ribbonwood)	Native	Fast-growing, provides shade and habitat, stabilizes soil	Grows 10-20m; prefers moist, fertile soils	Ideal for quick shelter in moist, well-drained areas
Melicytus ramiflorus (Māhoe)	Native	Improves soil, attracts birds with berries, dense canopy	Grows 5-10m; fast-growing in moist conditions	Provides dense cover in sheltered, semi-shaded areas
Cordyline australis (Tī Kouka/Cabbage Tree)	Native	Attracts birds, adds structural diversity	Grows 8-15m; tolerates moist, rocky soils	Suitable for moist, rocky areas, supports fauna
Pseudopanax ferox (Fierce Lancewood)	Native	Adds structural diversity, transitions to canopy tree	Grows 4-6m; tolerates moist, well-drained soils	Ideal for mid-succession, unique juvenile form
Coprosma propinqua (Mingimingi)	Native	Stabilizes soil, attracts birds with berries	Grows 4-6m; tolerates dry to moist soils	Versatile for rocky, exposed to semi-shaded sites
Hebe salicifolia (Koromiko)	Native	Provides quick cover, attracts pollinators	Grows 4-6m; tolerates moist to dry conditions	Ideal for early succession in rocky, moist areas
Exotic Species (non-exhaustive)				
Platanus varieties i.e.. x acerifolia (London Plane)	Exotic Deciduous	Provides broad canopy cover, aesthetic and structural balance	Grows up to 30m	Ideal for shade and structure in high-use public areas
Tilia x europaea (Lime)	Exotic Deciduous	Adds seasonal interest and shelter	Grows up to 25m	Suitable for aesthetic value and providing valuable shelter
Quercus varieties i.e.. robur ‘Fastigiata’ (English Oak)	Exotic Deciduous	Provides structural form and wind resistance	Grows up to 20m; fastigiate form	Ideal for exposed areas, offering wind tolerance and visual appeal
Ulmus varieties i.e.. procera (English Elm)	Exotic Deciduous	Provides wind tolerance and broad canopy	Grows up to 35m	Suitable for large areas where shade and shelter are needed
Fagus sylvatica (European Beech)	Exotic Deciduous	Adds structural diversity and dense shade	Grows 25-30m; slow-growing	Ideal for adding long-term shade and visual structure
Carpinus betulus (European Hornbeam)	Exotic Deciduous	Provides dense hedge and structural shelter	Grows 20-25m; dense foliage	Suitable for structured hedges and windbreaks in urban gardens
Betula varieties i.e.. utilis (Himalayan Birch)	Exotic Deciduous	Tolerates a range of soils and conditions, provides fast-growing shelter	Grows 15-20m; fast-growing	Ideal for open areas requiring quick canopy cover and soil stabilisation.
Acer varieties i.e.. platanoides (Norway Maple)	Exotic Deciduous	Provides broad canopy cover, seasonal interest, and habitat for urban wildlife	Grows 20-25m; fast-growing, tolerates a range of soils and urban conditions	Ideal for urban settings, parks, and large gardens requiring shade and aesthetic appeal
Aesculus varieties i.e.. hippocastanum (European horse chestnut)	Exotic Deciduous	Adds structural diversity, provides shade, and supports pollinators with flowers	Grows 20-30m; prefers moist, well-drained soils, moderately fast-growing	Suitable for large open spaces, parks, and avenues where shade and visual impact are desired
Juglans regia (English walnut)	Exotic Deciduous	Provides food (nuts) for wildlife and humans, adds structural diversity	Grows 15-25m; prefers deep, fertile, well-drained soils, moderately slow-growing	Ideal for large gardens, or open areas where nut and shade are valued

Appendix 2 -Species Selection Guide

Species	Type	Ecological Role	Growth Characteristics	Suitability
Native Shelter Species (non-exhaustive)				
Fuscospora cliffortioides (Mountain Beech)	Native	Provides canopy cover, habitat for fauna	Grows 15-20m; prefers well-drained, rocky soils	Excellent for exposed, rocky areas, wind-tolerant
Fuscospora fusca (Tawhai Raunui, Red Beech)	Native	Forms long-term canopy, dense foliage for wind shelter	Grows 25-35m; suited to moist, well-drained soils	Perfect for wind-resistant canopy in moist areas
Podocarpus totara (Tōtara)	Native	Dense foliage for windbreaks, biodiversity enhancement	Grows up to 30m; slow-growing, adaptable	Long-lived shelter for rocky, well-drained sites
Metrosideros umbellata (Southern Rata)	Native	Supports fauna, provides nectar and habitat	Grows 15-20m; suited to moist, cooler climates	Ideal for moist, rocky areas, canopy formation
Prumnopitys taxifolia (Matai)	Native	Dense, long-lived windbreak and habitat	Grows 20-25m; slow-growing, adaptable	Durable shelter for moist, rocky areas
Hoheria sexstylosa (Lacebark)	Native	Fast-growing, provides early canopy and wind protection	Grows 8-10m; prefers moist, well-drained soils	Quick shelter for moist, rocky sites, supports succession
Lophozonia menziesii (Silver Beech)	Native	Provides tall canopy, enhances biodiversity	Grows 20-30m; suited to moist, rocky soils	Long-term shelter for moist, semi-shaded areas
Suitable Exotic Shelter Species (non-exhaustive)				
Sequoiadendron giganteum (Giant Redwood)	Exotic Shelter Tree	Creates iconic, towering landscape features, provides strong wind protection	Grows over 60m; highly wind-tolerant	Ideal for creating iconic and functional shelter in large open areas
Sequoia sempervirens (Coast Redwood)	Exotic Shelter Tree	Provides wind protection, grows rapidly in suitable conditions	Grows 50-70m; very long-lived	Suitable for large spaces where fast-growing, tall windbreaks are needed
Abies varieties i.e.. grandis (Grand fir)	Exotic Shelter Tree	Strong windbreak species with symmetrical, tall structure	Grows up to 75m	Ideal for large landscape areas requiring dense, tall shelter
Picea varieties i.e.. abies (Norway Spruce)	Exotic Shelter Tree	Provides dense shelter and is effective at blocking wind	Grows up to 35-55m; prefers cooler climates and well-drained soils, fast-growing	Excellent for areas requiring fast-growing, high shelter, especially in cooler regions
Cedrus varieties i.e.. deodara (Deodar Cedar)	Exotic Shelter Tree	Fast-growing, evergreen, coniferous tree that provides excellent wind shelter	Grows 40-50m	Ideal for wide open areas requiring strong shelter
Eucalyptus varieties i.e.. nitens (Shining Gum)	Exotic Shelter Tree	Provides rapid shelter, stabilizes soil, attracts pollinators	Grows 20-30m; fast-growing, tolerates frosts to -14°C, requires well-drained soils	Ideal for cold, drier regions, offering quick, tall shelter in well-drained sites
Cupressus × leylandii (Leyland Cypress)	Exotic Shelter Tree	Provides fast-growing, dense shelter and wind protection	Grows up to 20-30m; very fast-growing and adaptable to a range of soils and climates	Ideal for quick shelterbelt establishment, and could be removed later if undesirable
Chamaecyparis lawsoniana (Lawson's Cypress)	Exotic Shelter Tree	Creates dense foliage suitable for wind protection and screening	Grows up to 30-50m; prefers well-drained soils and cooler, moist environments	Great for providing a tall, dense windbreak in areas that experience cooler, moist climates
Cupressus macrocarpa (Monterey Cypress)	Exotic Shelter Tree	Fast-growing, tall, and hardy windbreak species	Grows up to 30m	Perfect for exposed windy areas
Cupressus arizonica (Arizona Cypress)	Exotic Shelter Tree	Offers good wind resistance and dense foliage for shelter	Grows up to 15-20m; drought-tolerant, thriving in dry soils and hot climates	Best for dry, arid regions where strong windbreaks are required
Populus varieties i.e.. nigra (Black Poplar)	Exotic Shelter Tree	Fast-growing, stabilizes soil, provides quick canopy cover and wind protection	Grows 20-30m; very fast-growing, thrives in moist, fertile soils	Suitable for riparian zones, shelterbelts, or areas needing rapid shelter and soil stabilization

Growing Native Plants in the Wakatipu by Whakatipu Reforestation Trust

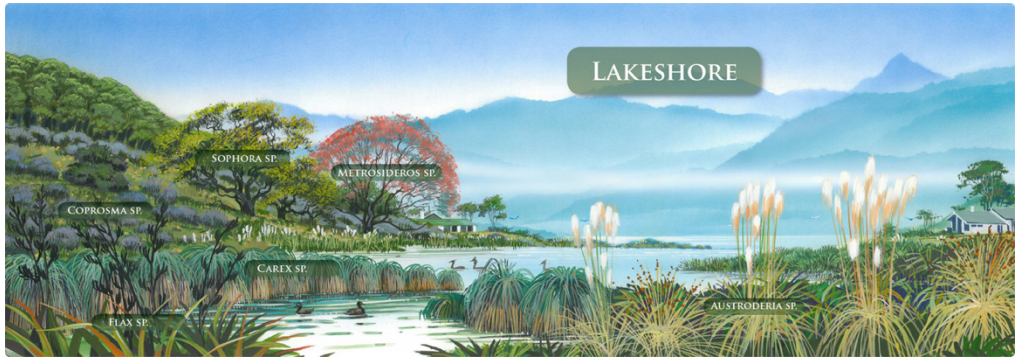
Tall Trees 15m to 25m
Elaeocarpus hookerianus (pōkākā)
Fuscospora cliffortioides (tawhai rauriki, mountain beech)
Fuscospora fusca (tawhai raunui, red beech)
Lophozonia menziesii (tawhai, silver beech)
Plagianthus regius (manatu, lowland ribbonwood)
Prumnopitys taxifolia (matai, black pine)
Metrosideros umbellata (southern rātā)
Podocarpus totara (tōtara)

Medium size trees 8m to 10m
Aristotelia serrata (makomako, wineberry)
Carpodetus serratus (putaputaweta, marble leaf)
Coprosma linariifolia (mikimiki yellow wood)
Cordyline australis (tī kōuka, cabbage tree)
Fuchsia excorticata (kōtukutuku, konini, tree fuchsia)
Griselinia littoralis (kapuka, broadleaf)
Hoheria sexstylosa (houhere, lacebark, ribbonwood)
Melicytus ramiflorus (māhoe, whitey wood)
Pennantia corymbosa (kaikomako)
Pittosporum tenuifolium (kōhūhū)
Sophora microphylla (South Island kōwhai)

Small Trees to large shrubs 4m to 6m	
Coprosma crassifolius	Olearia aviceniifolia
Coprosma, intertexta	Olearia bullata (swamp tree daisy)
Coprosma lucida (karamū)	Olearia fimbriata (robust tree daisy)
Coprosma propinqua (mingimingi, mikimiki)	Olearia lineata (narrow-leaved tree daisy)
Coprosma virescens	Olearia odorata (scented tree daisy)
Corokia cotoneaster (korokia)	Phyllocladus alpinus (mountain toatoa)
Hebe salicifolia (koromiko)	Pseudopanax colensoi var. ternatus (orihou, three finger)
Leptospermum scoparium (mānuka)	Pseudopanax ferox (fierce lancewood)
Lophomyrtus obcordata (rahotu)	Myrsine australis (mapou, red matipo)
Melicope simplex (poataniwha, wharangi)	Myrsine divaricata (weeping mapou)

Small Shrubs
Carmichaelia petriei (native broom)
Coprosmas acerosa & brunnea (dwarf coprosmas)
Hebe biggarii
Hebe buchananii
Hebe hectori (whipchord hebe)
Hebe pimeleoides var. faucicola
Hebe pimeleoides var. pimeleoides
Heliohebe cupressoides
Melicytus alpinus (porcupine shrub)
Muehlenbeckia complexa (scrambling creeper)
Ozothamnus leptophyllus var vauvilliersii
Podocarpus nivalis (snow tōtara)

Flaxes, Ferns, grasses, sedges and other plants
Phormium cookianum (whaririki, mountain flax)
Phormium tenax (harakiki swamp flax)
Astelia fragrans (bush lily)
Austroderia richardii (toi toi)
Chionochloa rigida (narrow-leaved snow tussock)
Festuca novaezelandiae (hard tussock)
Poa colensoi (blue tussock)
Carex buchananii
Carex secta (makura, oio)
Asplenium gracillimum
Blechnum pennamarina
Polystichum vestitum (prickly shield fern)



This appendix outlines the soil enhancement techniques that will be employed throughout the restoration process in Te Kararo Queenstown Gardens, focusing on reversing the negative impacts caused by long-term conifer dominance. Best practices are included for improving soil health, addressing nutrient deficiencies, and preventing soil erosion to support the successful establishment of new plantings.

1.1 Soil Amendments

Amending the soil is a critical step in restoring the fertility and structure needed for successful plant growth. The following guidelines provide recommendations for organic amendments, including compost, mulch, and biochar.

Compost

Timing: Applied during early planting phases to enhance soil structure and moisture retention.
Benefits: Improves aeration, water retention, and nutrient availability, particularly in soils degraded by conifer needle litter.

Compost improves soil structure, increases organic matter, and promotes microbial activity. Application rates should range from 10-20cm in depth. Compost should be incorporated into the soil during initial site preparation, especially in areas where soil compaction or low organic content is evident.

Mulch

Timing: Applied after planting to maintain moisture and reduce temperature fluctuations.
Benefits: Helps maintain soil temperature, improves water retention, and protects soil from erosion.

Mulch provides soil insulation, reduces water evaporation, and suppresses weed growth. A layer of mulch (5-10cm deep) should be applied around new plantings but kept clear from the plant stem to prevent rot.

Biochar

Timing: Incorporated into soil during the preparation of planting zones.
Benefits: Increases water-holding capacity, enhances soil microbial diversity, and provides a long-term carbon sink.

Biochar is a long-lasting carbon-rich material that improves nutrient retention and microbial health in soils. It should be mixed with compost at a rate of 5-10% by volume.

Mycorrhizal Inoculation

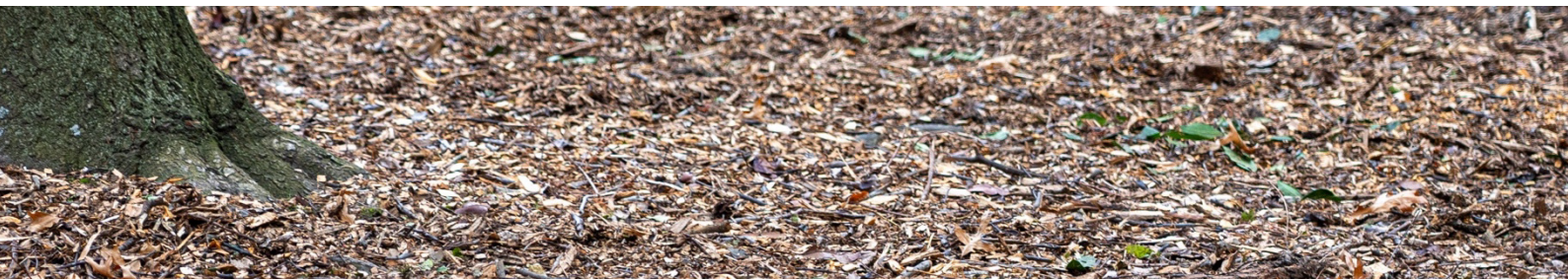
Timing: Applied during planting to enhance root development.
Benefits: Promotes nutrient uptake and plant resilience.

Mycorrhizal fungi form symbiotic relationships with plant roots, improving nutrient and water absorption. Inoculants should be applied directly to the root zones during planting.

Compost Tea

Timing: Applied during planting and throughout the growing season
Benefits: Enhances soil microbial activity and nutrient availability.

Compost tea is a liquid amendment that boosts beneficial microorganisms in the soil, promoting plant health. It should be applied as a soil drench or foliar spray.



1.2 Soil Conditioning

Soil conditioning is an essential part of site preparation for planting, ensuring that the ground is adequately prepared to support root establishment and overall plant health. The following protocols outline the key steps in soil conditioning.

Tilling and Screefing

Tilling: Mechanical tilling will break up compacted layers of soil, enhancing aeration and improving water infiltration.
Screefing: Involves removing the surface cover to expose the soil, allowing for better root penetration and nutrient absorption. This method is particularly useful in areas that have accumulated heavy organic debris or conifer needle litter.

Soil conditioning involves both tilling, which breaks up compacted soil and incorporates organic matter and screefing, which clears surface vegetation or organic debris (needles and cones) to expose the soil. Organic matter such as compost and biochar should be incorporated into the soil during tilling to improve soil structure, nutrient levels and microbial activity. This provides a more favourable environment for plant roots to establish and grow.

1.3 Nutrient Management

Nutrient management is essential to counteract the nutrient depletion caused by years of conifer dominance. The following strategies will support plant establishment by addressing soil nutrient deficiencies:

Slow-Release Fertilisers

Application Rates: Based on soil testing, slow-release fertilisers should be applied at 50-100g per square metre, depending on the species being planted.
Monitoring: Soil nutrient levels should be monitored every 6-12 months to track the progress of soil fertility recovery. Soil samples should be analysed for macronutrients (N, P, K) and micronutrients such as calcium, magnesium, and sulphur.
Corrective Actions: If soil testing reveals deficiencies in key nutrients, targeted amendments such as lime for pH adjustment or organic matter for improving microbial activity should be implemented.

Organic or slow-release fertilisers will be applied to provide essential nutrients gradually over time. Nitrogen, phosphorus, and potassium (NPK) fertilisers should be used based on soil test results, with applications tailored to meet the needs of different species.

Cover Crops

Benefits: Increases organic matter, improves soil structure, and prevents nutrient leaching during periods of soil disturbance.

Planting cover crops such as clover or grasses can improve soil fertility by fixing nitrogen and preventing erosion. These crops should be sown during rest periods between tree removals and replanting phases.

1.4 Watering and Irrigation

Proper watering and irrigation are crucial for the successful establishment of new plantings, particularly in the early stages of restoration. The following strategies ensure optimal moisture levels for plant growth while conserving water resources:

Drip or Irrigation Lines

Timing: Where practical, Drip irrigation systems will be used regularly during the first 2-3 years of establishment, especially during dry periods.
Benefits: Provides targeted watering, reduces water waste, and ensures that young plants receive the moisture they need to establish strong root systems.

Drip irrigation systems will be installed where feasible and existing water supplies exist, delivering water directly to the roots of newly planted species. This method reduces water loss from evaporation and ensures efficient use of water.

Watering Schedule

Timing: Watering should be done early in the morning or late in the afternoon to minimise water loss through evaporation.
Monitoring: Soil moisture sensors can be used to monitor the effectiveness of the watering schedule and prevent overwatering.

A regular watering schedule will be maintained for newly planted trees and shrubs, particularly during the first two growing seasons. Watering should be more frequent during the dry summer months, with adjustments made based on weather patterns and soil moisture levels.

Mulching for Moisture Retention

Benefits: Reduces the frequency of irrigation, improves water retention in the soil, and provides additional protection against temperature fluctuations.

The application of mulch around new planting areas will help retain soil moisture and reduce the need for frequent watering. Organic mulches, such as wood chips, can slow the evaporation of water from the soil.

Water-Saving Measures

Benefits: Minimises water usage while ensuring plant health and resilience in drier areas.

Drought-resistant and native species that are adapted to local moisture conditions will be prioritised for planting in areas with limited water availability. This reduces the need for extensive irrigation and ensures long-term sustainability.

1.5 Erosion Control Measures

Preventing soil erosion is crucial during tree removal and replanting phases. Erosion not only depletes soil nutrients but also damages the landscape, making it difficult for new plantings to establish. The following techniques will ensure soil stability throughout the restoration process:

Temporary Ground Covers

Timing: Applied immediately after tree removal and before new plantings to stabilise the soil surface.
Benefits: Provides temporary protection against erosion while improving soil health through root development.

Planting quick-growing grasses or using biodegradable mats will help stabilise soil during periods of tree removal. These ground covers prevent soil displacement from wind and rain, reducing erosion risks while allowing for future replanting.

Silt Fences and Erosion Barriers

Application: Installed in areas prone to soil displacement or runoff, particularly on slopes or near water bodies.
Benefits: Keeps soil on-site and prevents it from being washed into surrounding areas, thus protecting local ecosystems and water quality.

These barriers should be installed around areas where heavy machinery is used or where soil is likely to be disturbed during removal activities. Silt fences prevent soil runoff into waterways or adjacent areas. Erosion Barriers could consist of felled logs strategically place and backfilled with soil/mulch and planted.

Stabilisation Plantings

Timing: Planted as soon as possible after tree removal to stabilise soil before other species are introduced.
Benefits: Provides long-term erosion control and improves soil structure, ensuring successful establishment of subsequent plantings.

Early-stage pioneer species, such as Kānuka or erosion-resistant grasses, should be planted in areas susceptible to soil erosion. These plants are quick to establish and help anchor the soil with their root systems.