31 January 2023

File Ref: OIAP-7-27029

[redacted]

Tēnā koe [redacted]

Request for information 2023-006

I refer to your request for information dated 10 January 2023 (addressed to Wellington City Council) which they transferred to Greater Wellington Regional Council (Greater Wellington) on 16 January 2023. You have requested the following:

"Why have you people removed the cattle from the Farm???

Do you think this could pose a fire risk if someone let go of fireworks or children playing with matches or someone throw a cigarette over the Farm?"

Greater Wellington's response follows:

Greater Wellington's Regional Parks are managed under the Toitu Te Whenua Parks Network Plan, adopted by Greater Wellington in 2020. The plan outlines the direction of the regional parks for the next 10 years. One of the key principals of the plan is to phase out grazing across our regional parks (17P on page 45). This plan can be found on our website at: www.gw.govt.nz/your-region/plans-policies-and-bylaws/plans-and-reports/parks-plans/toitu-te-whenua-parks-network-plan-2020-2/

The phasing out of grazing will reduce Greater Wellington's carbon emissions, allow Greater Wellington to further enhance the natural environment by protecting water ways and reducing erosion, and also allow Greater Wellington to provide for increased recreational opportunities.

Potential Fire threat:

There will always be a potential fire threat weather the land is grazed or not, this threat will continue into the future for some time as the land use changes from pasture to native forest.

Greater Wellington is in the initial phase implementing our Wildfire Risk Management Plan for Waitangirua (**Attachment One**). This plan outlines in priority several actions to undertake. Please

note that the Wildfire risk management plan has many proposed actions and Greater Wellington has a plan to implement these over a period of time in order of priority.

Greater Wellington will be constructing fire breaks along the ridges and main tracks; these fire breaks will be at least 10 metres wide and consist of short grass and a gravel track. There will also be open retreat areas created so that in the event of a fire, people will have somewhere safe to head to.

Greater Wellington will also look at planting low flammability native tree species along the rural urban interface, these areas are the most likely ignition points for a fire, the species have been identified as low flammability and act as a green fire break.

Greater Wellington has developed a restoration plan (**Attachment Two**) for the Western side of Belmont Regional Park (old Waitangirua farm, West of Transmission Gully). This plan has been developed by Cardno consulting; it details which plant species to plant within the area.

If you have any concerns with the decision(s) referred to in this letter, you have the right to request an investigation and review by the Ombudsman under section 27(3) of the Local Government Official Information and Meetings Act 1987.

Please note that it is our policy to proactively release our responses to official information requests where possible. Our response to your request will be published shortly on Greater Wellington's website with your personal information removed.

Nāku iti noa, nā

Al Cross
Kaiwhakahaere Matua Taiao | General Manager Environment Management

Belmont Regional Park Western section

Wildfire Risk Management Analysis

Tony Teeling

December 2021

Disclaimer

The information and opinions provided in the Report have been prepared for the Client and its specified purposes. The report has been provided in good faith and on the basis that every endeavour has been made to be accurate and not misleading and to exercise reasonable care, skill and judgment in producing it. Any person using the information contained in this report does so entirely at their own risk.

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1. Introduction

Greater Wellington Regional Council (GWRC) is responsible for Belmont Regional Park. The Transmission Gully highway between Porirua and Pauatahanui has essentially split the park into West and East sections. The area of interest for this wildfire risk analysis is the smaller Western section of the park (Western Belmont). Refer Appendix 1.

The Park is held under the Reserves Act 1977 as a recreation and scenic reserve. The western section is located east of the Porirua suburbs of Cannons Creek and Waitangirua and is bounded to the east and south by the Transmission Gully highway, with farmland and small block forestry to the north.

Western Belmont is approximately 284 hectares and rises from the rural urban interface (RUI) at around 100 metres to a maximum elevation 227 metres. The landscape is steep slopes dissected by many gullies rising east of Porirua to a main ridgeline before falling away to Duck Creek. Many of the gullies are damp with seepage and support native species. Duck Creek on the eastern side begins just past Te Ara Toa (Bridge 20) flowing northeast beside the highway before heading to the sea through Whitby. Cannons Creek flows through the southern end in an area of native forest remnants and regenerating native broadleaf forest.

The boundary consists of approximately 2 km of RUI, 3.4 km of road, and 3.1 km of other park land, farming, forestry, and school grounds. Approximately two thirds of the area is grazed as the Waitangirua Farm.

Vegetation cover can be broadly classified into grazed and ungrazed pasture grass with some tussock, flax, manuka/kanuka, regenerating podocarp and broadleaf forest including Tawa and Kohekohe, intermix native with grass and gorse, and ground cover of smaller species shrub. There are some exotic tree species including old conifers here and there.

Current use ranges from recreation, farming, routes for major utility networks, and community restoration projects. GWRC through its Parks Network Plan intends to begin retiring the current farming operation in 2022 and returning the landcover to a natural state. Already there is restoration planting occurring including areas disturbed by the construction of the Transmission Gully highway.

Consideration of fire impacts during revegetation planning can help reduce future damage potential from fire. For example, there are several utility assets within the park including gas, power transmission and distribution lines, and a city water main supply pipeline. Overhead lines require specific maintenance, with buffers that limit vegetation height, species that are low flammability, and access to the infrastructure.

Wildfire is considered a risk to Western Belmont and its users. The risk is likely to increase over the next several years as grazing is removed and land either revegetated or left to revert to native. The increasing risk during transition to mature native is due to higher vegetation fuel loads that are mixed native and exotic species (including gorse). Once native is dominant the risk will begin to reduce so long as the native mix is not large continuous areas of high flammability species such as manuka/kanuka. On the other hand, existing areas of predominantly mature native are lower risk, and areas that have been transitioning to native cover for a few years will be reaching their highest risk soon.

For vegetation transition the vision is restoration to native cover but allowing for utility buffers that prevent vegetation contacting overhead line, reduce fire intensity, and allow for access. For the vegetation transition the analysis considers three key time points, firstly the current vegetation cover, followed by an estimated concept cover at 12-years and 60-years. Refer Appendix 2.

The analysis presented here can be used to inform near and long-term strategic planning related to revegetating Western Belmont. Quantifying wildfire risk will help identify opportunities to reduce risk that can then be incorporated in restoration planning including vegetation selection and priority planting locations, as well as visitor and third-party property risk.

The New Zealand fire growth modelling software Prometheus was used to model fire spread through the vegetation covers under both moderate and extreme fire dangers. Refer supplementary report *'Western Belmont Regional Park – Prometheus Wildfire Risk Report Supplement'*. The modelling was competed for a level of retained grazing and not full removal of it. Risk treatments have however been presented for the option of full removal of grazing.

2. Assumptions and Limitations

The Analysis is specific to the vegetation fire environment.

Wildfire ignitions occur from either natural or human causes through many activities and their associated heat sources. It is not possible to have control over natural occurring ignitions or activities of those not directly related to the area including deliberate ignitions with or without malicious intent.

There are numerous limitations and assumptions within the vegetation fire behaviour fuel models and systems. They are however based on sound science and best practice and have been adjusted to represent the observed vegetation fuels in the park.

Weather data from Titahi Bay remote automatic weather station (RAWS) may have some data errors that affect averages and data for specific hours on specific days. Topography will influence local weather due to elevation, steep slopes, valleys, ridges, and waterbodies. Where there were gaps in the data record, data was sourced from nearby RAWS.

The selected weather records from the fire climate analysis used for modelling the extreme scenario was derived using daily inputs as opposed to hourly.

The 12-year and 60-year concept vegetation covers are estimates only.

The vegetation cover for a full removal of grazing is a concept and was not modelled using Prometheus.

Quantifying risk based on likelihood of ignition and spread uses wildfire occurrence return periods and assumes an ignition will spread, with consequence using a range of descriptive terms that identify damage levels. A final risk level is determined by combining likelihood and consequence. The setting of the data ranges and descriptors is somewhat subjective and can be adjusted for organisational risk tolerance if necessary.

3. Stakeholders

Refer to the GWRC Parks Network Plan.

4. Definitions

Escape routes. Are routes that can be used to get to a safety zone if the primary route being used is cut off.

Entrapment. Are unexpected situations in which a wildfire poses an immediate threat to peoples' lives because the use of escape routes and safety zones is difficult or impossible. In such situations last resort sheltering may be required to increase survival probability.

Evacuation point. Is a specified assembly location assessable by helicopter or vehicle where people, trapped or otherwise, can be picked up and transported to safety. Evacuation points are not safety zones and do not provide protection from all levels of fire behaviour.

Peri-Urban. Areas surrounding cities and other urban areas that is neither urban nor rural and can extend well beyond the suburban edge. They are often contested spaces largely regarded as being in transition can be wildfire prone and often their rapid growth puts added demands on public services. *LA Trobe University* *https://www.latrobe.edu.au/periurban/about/focus* .

Rural-urban interface (RUI). The area or zone where structures (houses) and other human development adjoin or overlap with flammable vegetation.

Safety Zone. Safety zones are places of refuge, places a person can be assured of their safety. Safety zone size is dictated by the fuel, terrain, weather conditions, and worst-case fire behaviour. Escape routes would lead to safety zones.

Wildfire. Unplanned vegetation fire. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective (https://knowledge.aidr.org.au/glossary/).

Wildfire Risk. The likelihood and consequence of a wildfire at a specific location under specified conditions.

Wildfire Management. All those activities directed to prevention, detection, damage mitigation, and suppression of wildfires (https://knowledge.aidr.org.au/glossary/)

5. Risk Context

The analysis sets out to identify wildfire risk associated with Western Belmont, and to recommend risk treatments to manage the risk during and after restoration. Managing the risk of ignition (likelihood) is primary followed by managing damage potential (consequence). Managing the likelihood of ignition would aim to reduce risk through treatments informed by the history of occurrence and the presence of ignition sources. Managing consequence would aim to reduce risk through vegetation and visitor management treatments that reduce damage and injury potential. From the point of view of vegetation management, the current cover is considered along with the long-term vision of native cover with ongoing vegetation maintenance required for utility infrastructure.

The modification of risk (controls and treatments) must consider the concept of residual risk, as it is not possible to reduce risk to zero. The risk assessment process follows the AS/NZS ISO 31000:2018(E) – Risk management – Guidelines and utilises the New Zealand Fire Danger Rating System.

Wildfire is dynamic in that it moves across a landscape. Because a wildfire starting outside Western Belmont could travel inside, the risk has been considered from both within and adjacent. Treatments aimed at reducing risk must therefore be applied within and adjacent to Western Belmont.

Collaboration with neighbouring land managers, utility companies, community and other organisations is needed to ensure optimum risk management outcomes. This essentially becomes a shared risk approach through the sharing of relevant risk information and determination of risk treatments and their ownership.

The tools and techniques to be employed are the New Zealand Fire Danger Rating System (Anderson 2005), Prometheus Fire Growth Modelling program (Tymstra et al. 2010), NZ Fire Behaviour Toolkit (Scion 2012) and Field Manual for Predicting Fire Behaviour in New Zealand Fuels (Pearce et al. 2012), representative remote automatic weather stations (https://fireweather.niwa.co.nz/), fuel flammability guidelines (e.g. Clifford et al. 2013; Scion 2018), and existing Nelson/Marlborough activity control guidelines for spark hazardous operations (MKRFA 2016, Pearce et al. 2016, FENZ 2019) and forestry operations (WRFA 2016, Pearce et al. 2016).

Wildfire management is regulated by the Fire and Emergency Act 2017, the Resource Management Act 1991 and the Local Government Act 2002 and subsequent amendments.

6. Scope

6.1. In scope

Advice in the form of an analysis and report outlining the wildfire risk for the area of interest along with risk treatment recommendations.

Fire growth modelling supplementary report for Prometheus inputs and outputs.

6.2. Out of scope

Implementation of treatment recommendations including compilation of management processes and procedures.

Review and update of any existing risk plans.

7. Risk Criteria

The risk assessment process and determination of risk treatments will consider risk Reduction, Readiness, and Response in the context of wildfire.

7.1. Overall objective

To provide Western Belmont management recommendations aimed at reducing wildfire risk during and after the development from farm-park to recreation area park.

7.2. Likelihood and consequence

The risk assessment process will consider the fire environment for Western Belmont and likely fire behaviour and damage potential. Ignition likelihood is based on the presence of ignition sources, fuel receptiveness, and history of fire occurrence.

7.2.1. Likelihood

Likelihood is concerned with whether a wildfire can ignite within or adjacent to Western Belmont. Ignitions that occur on land adjacent are only of interest if there is continuous vegetation that could spread fire to the park.

To determine likelihood level, the return period of a fire from annually to 10 years is considered along with ignition sources. The return period ranges are assigned a descriptor from Almost Certain to Very Rare.

It is a given that an ignited fire will spread due to the fire behaviour modelling using the Moderate and Extreme fire danger classes. Moderate fire danger has been used for a likely scenario and Extreme for a worst-case scenario.

7.2.2. Consequence

Consequence is concerned with the impact on values including visitors. A wildfire's intensity or energy release determines damage potential which includes injury to people. Radiant and convective heat as well as smoke and ember hazards will impact values. The consequence assessment requires an understanding of how a fire will behave once ignited, followed by its potential impact.

To determine the consequence level, the most likely location of ignitions and subsequent fire spread are identified, and fire behaviour modelled. Refer supplementary report *'Western Belmont Regional Park – Prometheus Wildfire Risk Report Supplement'*. Consequence levels range from insignificant to catastrophic with each considering the effects to people, the environment, and fixed assets.

7.3. Approach to evaluating risk

7.3.1. Risk level

Risk likelihood will account for wildfire ignitions within and adjacent to Western Belmont. For adjacent ignitions risk treatment approaches may need to include shared risk based on either a proportion of the risk, or fully transferred risk. For example, private properties on the park boundary or power supply infrastructure passing through the area.

The likelihood and consequence levels are combined using the risk level matrix to determine a risk level. The risk levels have designators of Very Low to Extreme with each having a range based on multiplying the likelihood and consequence level scores. Refer Appendix 11.

The risk level outputs can be skewed if necessary to account for organisational risk tolerance. Likelihood and consequence weightings could be adjusted or rather than using a multiplier for risk levels they could be assigned based on likelihood and consequence descriptors that in turn align with acceptable risk tolerance.

7.4.Risk treatment planning

7.4.1. Specific treatment objectives

Risk treatments can be considered under one or more specific objectives and where applicable assigned a function of reduction, readiness, and response. The combination of treatments from across these objectives would aim to reduce risk to a tolerable level.

1) To reduce the likelihood of ignitions.

2) To reduce the consequence on values.

3) To share the risk with other parties.

4) To transfer the risk to another party.

5) To retain or accept the risk.

6) To avoid the risk.

8. Risk identification

Wildfires are a threat in areas of vegetation and develop based on the environment in which they are burning. The fire environment consists of three components that interact to determine how a fire will behave. The three components are the fuel available to burn, the topography the fire is burning in, and the prevailing weather with its cumulative effect on the underlying level of dryness. The ability of a fire to ignite, develop, spread, and do damage is dependent on the environmental conditions at any one time and place. These conditions vary in time and space, with weather (air temperature, relative humidity, wind speed and direction, and rainfall) the most dynamic, and fuel condition (moisture content) close behind. Fuel is the one component that can be easily manipulated to reduce relative fire behaviour.

A heat source of enough temperature is required before a wildfire can ignite and develop. Once again this is dynamic in regards fuel condition and weather. To have a wildfire there must be a capable heat source, a receptive fuel bed, and a mechanism that brings these two things together.

In New Zealand, more than 98% of wildfires are caused by human activity, whether through careless use or poor maintenance of machinery or cooking equipment, discarding of lighted material, accidental circumstances, or malicious activities. Because of the human factor there is an excellent opportunity available to control activities that are sources of heat, sparks or flame that could cause a wildfire.

8.1.Vegetation Fire Environment

Western Belmont presents a complex fire environment with planned changes to vegetation adding to the complexity. Normally the fuel component of the vegetation fire environment would be considered fixed but in this analysis it will instead be variable. This is due to the change in land use from farm park to recreation park with the ongoing revegetation or natural reverting to native species. As already stated, there are three vegetation cover time points being

considered, firstly the current cover as at the time of this report followed by a 12-year and 60-year concept covers.

Topography (terrain) remains a fixed component and changes very slowly over time, and weather the most variable of the three with its hour to hour and day to day changes.

8.1.1. Topography

The area of interest is approximately 3km long and 1.3km at its widest, running longways northeast to southwest. There is a backbone ridge running in the same direction until it bends southeast dividing the Cannons Creek and Duck Creek catchments.

Elevation is approximately 80 metres to 227 metres on the northwest side, with Duck Creek rising from 80 metres in the northeast to a saddle at around 200 meters further south. The Duck Creek side of the main ridge has steep faces broken with many tight narrow gullies flattening out across the creek to the southeast and rising to Takapu Road and then to the highway.

On the northwest side there are several subsidiary spurs running northwest, with the farm buildings located mid-elevation on one of these, with another main spur leading down to Waihora Park. This spur acts as a demarcation between grazing and regenerating native. On the south side of Cannons Creek another spur runs northwest from the Transmission Gully highway to the RUI at Northumberland Street. The spurs have relatively broad slopes but with some steep and broken gullies.

Aspects on the Duck Creek side are predominantly southeast through east, with the western side east through north to west. The lower sections of gullies west of Duck Creek have slope angles greater than 50° that lay back to 20° as they near the lower angle main ridgeline. The gullies west of the main ridgeline are longer with some parts greater than 50° but more 30° - 40°. The spur tops are low angles from 10° - 30°. The section of Cannons Creek west of Transmission Gully highway has very steep sides greater than 60° in places before laying back as the creek gets closer to the built-up area and the RUI. Refer appendix 6 and 7.

Roads and tracks are the main barriers to wildfire spread with some non-fuel areas like carparks associated with the farm buildings and reticulated gas distribution facility. There are bare ground construction work areas along the Transmission Gully highway corridor that will be revegetated as the project progresses.

There is a metaled road from the farm entrance off Waihora Crescent that services the farm buildings and gas distribution facility, traveling on to the north-eastern boundary. There is also the metaled road (Takapu Road) running alongside Duck Creek and the Transmission Gully highway.

There is a 4x4 track network northeast of Cannons Creek that services the farm and utility infrastructure. These crisscross the area with access/egress on both the western and eastern sides. There is also one section of 4x4 track running from the end of Carnavon Place through to the Transmission Gully highway.

The option of removing all grazing requires the 4x4 track along the main ridgeline to be upgraded to a non-fuel surface.

A recreation track network runs through the Cannons Creek catchment from Warspite Avenue past Brandon Intermediate School where its divides in two to go north and south. The southern section climbs out of the creek to a ridgeline and drops to the Transmission Gully highway, following it back to Cannons Creek. The southern ridgeline above the creek has an out-of-service utility 4x4 track that is accessible by foot.

Completely circling the southern and eastern boundary is the multilane Transmission Gully highway.

8.1.2. Weather

The area has a maritime climate effect due to its proximity to the Tasman Sea and particularly the arms of Porirua Harbour. The Met Service climate zone (NZMS 1983) for the location is D1, which is characterised by prevailing west to northwest winds with relatively frequent gales. Annual rainfall 900 to 1,300mm. Rainfall is reliable and evenly distributed throughout the year. Warm summers and mild winters.

During the month of January and February the weather is settled with pleasant average temperatures that fall between 20 degrees Celsius and 25 degrees Celsius. The warmest month is February and coldest July, with July also the wettest. March is the driest month.

The Titahi Bay RAWS was used for the long-term fire climate analysis and to identify days in the record that met the fire growth modelling scenarios for Moderate and Extreme fire danger classes. Refer Appendix 3, 4 and 5. The RAWS is 5 km west of the park and is considered representative of weather for the area.

8.1.3. Fuel

Vegetation fuel cover is varied and will be in constant change for many years to come as farming is retired and the park left to naturally revert to native cover. The area has a significant RUI on the western boundary as well as suburban parks and school fields. On the southern and eastern boundary, the fuel is interrupted by the multilane Transmission Gully highway except where it bridges across Cannon Creek. To the north is farmland and small block forestry with urban development further north again.

The three vegetation cover time points stated earlier have had their vegetation classified to align with the fuel requirements of the New Zealand Wildfire Growth Modelling software, Prometheus, and those within the Manual for Predicting Fire Behaviour in New Zealand Fuels. Refer Appendix 2. The detail of each of the fuels can be found in the supplementary report *'Western Belmont Regional Park – Prometheus Wildfire Risk Report Supplement'*. Below is a summary of the vegetation fuel covers.

Additionally, a second version of the 60-year vegetation cover has been compiled (Appendix 2) that removes all grazing areas, replacing them with ground cover low flammability native species, a fire barrier along the main ridgeline and visitor evacuation points that are low grass only.

Current vegetation cover

Presently the vegetation is in three broad covers intermixed with other vegetation types. The Duck Creek side is predominantly a low producing grassland/scrub mix with pockets of scrub only. In the steep gullies there is native broadleaf and freshwater species, and in the south some non-fuel land disturbance areas.

Grazed pasture with odd gorse pockets dominates the main ridgeline from above Cannon Creek through to the north-eastern boundary, and west to the RUI and Waihora Park. The gullies also have native broadleaf and freshwater species. This is the farmed section of the park.

The Cannons Creek catchment has a cover of broadleaf indigenous hardwoods, interspersed with pockets of podocarp forest, pockets of gorse or gorse/broadleaf mix. The same vegetation covers the area south of the creek as well as in a strip running behind Brandon Intermediate and Porirua College to Waihora Park.

There are the odd pockets of exotic trees including conifer at the southern boundary including near where Cannons Creek flows under the Transmission Gully highway, around Waihora Park and around the farm buildings and road leading to them. There are also two sites with forest harvest slash, one behind Porirua College and the other on land between Glenview School and Matauaia Hall off Bedford Street.

12-year concept vegetation cover

With reference to the current vegetation cover the farmed area has been reduced to the main ridgeline with wider areas at either end, as well as down the spur to Waihora Park and down an eastern spur where the subsurface gas pipeline runs. The retained grazed area tends to follow existing farm fences and will allow vegetation reduced buffers around the utilities and help maintain access to them. The vegetation will remain high producing grassland that is grazed thereby reducing the damage potential of a fire.

The retired farmland has been changed to broadleaf/gorse mix on gully sides with the drier spur tops predominate gorse. The existing broadleaf and freshwater vegetation have been expanded out of creeks and drainages up gully sides for a distance.

A no-grazing option replaces retained grazing stated above with a ground cover of low flammability native species, a non-fuel/short grass edged fire barrier along the main ridgeline, and short grass evacuation points.

On the Duck Creek side, the grassland/scrub mix changes to broadleaf/gorse mix with predominant gorse on the drier spur tops. The existing broadleaf and freshwater vegetation have been expanded out of the creeks and drainages up gully sides for a distance. The upper end of Duck Creek where there were highway work operations, the manuka kanuka plantings have been expanded to the edge of the Transmission Gully motorway and in a small drainage area above this. Subsequent fire growth modelling has shown that this vegetation should not be planted along barrier edges such as roads and tracks or beneath overhead lines. Energy release from a fire in this fuel will allow fire to breech barriers and damage utility infrastructure.

The Cannons Creek area has had the broadleaf/gorse pockets replaced with broadleaf only and the two forest harvest slash sites changed to predominant gorse. The southern boundary edge of grass has remained as have the podocarp and exotic tree pockets.

60-year concept vegetation cover

Referring to the 12-year vegetation cover, the grazed farmland area remains unchanged. Areas of broadleaf/gorse are replaced with broadleaf only. The drier spur tops on the western and eastern sides change from predominant gorse to broadleaf/gorse mix.

The no grazing option has ground cover of low flammability native species, a non-fuel/short grass edged fire barrier along the main ridgeline, and short grass evacuation points.

The Cannons Creek area has the podocarp forest pockets expanded, with the rest left as broadleaf forest. Exotic tree pockets remain, with one area of grassland at the southern boundary.

8.2. Ignition sources

Heat sources are those with enough temperature to ignite vegetation fuel, with around 300˚C required. Heat sources have been categorised below and include those that may be present in the park and nearby.

8.2.1. Motorised equipment, heavy machinery, and motor vehicles

1) Chainsaws, mowers and cutters/slashers striking solid material such as rocks, wire, and cable.
2) Welding, heating, steel cutting (gas and manual) and other spark hazardous operations.
3) Engine exhaust emission of hot carbon.
4) Exhaust system failures resulting in very hot parts that can break away (catalytic converters).
5) Liquid fuel and hydraulic fluid igniting on hot exhausts.
6) Direct vegetation contact with hot exhaust parts.
7) Friction on accumulated vegetation within vehicle systems.
8) Electrical failures resulting in fire.
9) Vehicle and machinery accidents.

8.2.2. Open air burning or cooking

1) Use of outdoor barbeques, braziers, stoves (liquid and gas), and other oven types.
2) Camp and bon fires
3) Private dwellings in the vicinity (RUI) burning rubbish or tree trimmings, etc.

8.2.3. Natural

1) Lightning.

2) Spontaneous combustion.

8.2.4. Powerline infrastructure

3) Line breakages and line strike.

4) Line disconnects from insulators and arcs on poles and cross arms.

5) Transformer and fuse failures.

8.2.5. Careless discarding of hot material

1) Lighted cigarettes discarded.

2) Home fire ashes discarded.

3) Fireworks and other incendiaries.

8.2.6. Deliberate lighting of fire

1) Malicious lighting of fire.

8.2.7. Mountain bikes and personal accessories

1) Electric bike battery failure, generally home built systems, or any system whilst on charge.

2) Electrical device battery failures such as mobile phones, etc.

8.2.8. Structure fire

1) Structures including other infrastructure fire.

8.3. People

People and their activities are mostly the mechanism that bring heat sources into contact with a receptive fuel bed causing a fire. This may be contractors and visitors or someone causing a fire further away that later impacts the area. Western Belmont has or is surrounded by public and private roads, private land, residential dwellings, and electricity and gas infrastructure.

The following categorises people by activity who are likely to be within or adjacent to the park whose activities may cause a fire.

8.3.1. Recreation visitors

Visitor numbers are high and peak over the summer months. The area is easily accessible day and night from key access points or from routes traversing from other parts of the wider Belmont Park. Vehicle access is restricted. There are two neighbourhood parks that boarder with the western side of the park both with multiple recorded fires over the past ten years.

8.3.2. Private Property

Private property owners that boundary Western Belmont. There is a significant RUI on the western side with many recorded fires along its length. Additionally, there are three schools with fields that boundary the area.

8.3.3. Commercial and other approved operators

Transmission Gully highway construction personnel including those doing revegetation, farm management personnel, and other concession operations.

8.3.4. Regional Council

Council staff, volunteers, and contractors undertaking maintenance, track construction and maintenance, revegetation, as well as spraying and mowing operations.

8.3.5. Water supplies

There is a reticulated water supply main running along Takapu Road. The farm buildings have water service pipes to and around them. Staff and contractors' access these for maintenance purposes.

8.3.6. Electricity and Gas

There are transmission and powerlines running through the park. Power company staff and their contractor's access these for maintenance purposes including track and vegetation maintenance.

There are three subsurface gas pipelines running through the area, all connected at the gas compound on the main ridgeline. Gas company staff and their contractor's access these for maintenance purposes.

8.4.Buildings and infrastructure

8.4.1. Buildings

There is an RUI on the western boundary that is approximately 2km long comprising 70 private dwellings. Additionally, there are three schools close to or on the boundary. Activities on these properties may be a source of ignition and in turn these properties and their occupants may need protection from a threatening wildfire.

On the western side towards the northern end, buildings associated with the farm park are sited at mid elevation on a broad terraced spur. The buildings include a domestic dwelling and several farm outbuildings.

On the crest of the main ridge above the farm buildings is the gas compound facility with buildings and above ground pipe infrastructure. There is approximately 3.5km of subsurface pipeline within the park.

8.4.2. Utilities

Electricity

The high voltage transmission lines cross into the area at Cannons Creek and travel along the main ridge exiting at the north-eastern boundary. The 33kv lines enter the area in two places with one crossing Cannons Creek west of the transmission lines, running through the currently grazed land to exit west of Waihora Park. The other line runs up the ridge south of Cannons Creek and drops down to the end of Carnavon Place. There is an 11kv line running from Waihora Crescent to the farm buildings.

There is approximately 2.3km of high voltage transmission line with 6 associated pylons. The two 33kv lines running from Cannons Creek to near Waihora Park are both approximately

1.9km long with around 18 poles (single or double stays) associated with each line. The other two 33kv lines running to Carnavon Place are both approximately 650 metres long with 8 poles each. The 11kv line running from Waihora Crescent to the farm buildings is approximately 230 metres long with 4 poles. In summary there is approximately 7.7km of overhead lines with 62 poles and pylons.

Gas

One of the three gas pipelines runs near the power transmission line from the north-eastern boundary, through the gas compound and on to Cannons Creek. A second pipeline runs from the gas compound south-east down a spur to the Transmission Gully highway, with the third pipeline running from the gas compound down a spur to the north-west down to Waihora Crescent.

Water

There is a water supply main to Porirua running alongside Takapu Road for approximately 2km.

8.4.3. Park facilities and other assets

There are many kilometres of roads and tracks as well as fences, gates and styles servicing the area. To the north is a boundary with private farmland and small block forestry.

9. Risk Analysis

To analyse the risk of a fire starting, spreading, and doing damage, three factors must be present, i.e., enough dry fuel adequately arranged, a heat source, and a way to bring them together (in most cases human activities).

9.1.Fuel (vegetation) condition

The fire environment determines fuel condition and the ability for fuel to burn. The New Zealand Fire Danger Rating System is used to help determine how fuels will burn under given conditions. The New Zealand Fire Danger Class Criteria are used to give qualitative ratings of fire danger based on available fuel to burn and its propensity to spread in the three broad New Zealand fuel types, forest, scrub, and grass.

Topography also affects wildfire behaviour with slopes increasing the spread rate and intensity of a fire, thereby increasing the damage potential. The Fire Danger Classes do not account for these slope effects.

The Fire Danger Classes occurring are Low through Extreme for forest, grass, and Low to Very Extreme for scrub (mainly gorse and manuka fuels). An analysis of the annual average number of days in a year that each class prevailed is presented using 22 years of fire climate data from the Titahi Bay RAWS up to June 2020.

The fuel cover is a mix of forest, scrub and grass and will remain that way for the concept 12-year and leading in to the 60-year vegetation covers. The Fire Danger Classes related to the three broad fuel types are therefore relevant.

The following tables summarise the annual average number of days per year in each Fire Danger Class for each of the three New Zealand broad fuel types.

The forest and grass fire danger data shows most days in an average year are Low to Moderate, indicating fires that do start would be generally controllable. Grass hardly shows any days in the Very High and Extreme fire danger classes due to averaging, however there are single days in the fire climate long-term record with grass in extreme.

The scrub fire danger class is different with 279 days in an average year in High to Very Extreme. In fact, the analysis indicates there are 206 days on average that fire danger is Extreme or higher in this fuel type.

The coloured rows in the tables below indicate the fire danger classes used for Prometheus scenarios. Refer to appendix 4.

Fire Danger Class results based on Titahi Bay RAWS 22-year record.

Table 1: Forest fuel fire danger classes

Fire Danger Class	Number of days	Months of occurrence
Low	248	All months
Moderate	**94**	**All months**
High	18	November through May
Very High	3	December through April
Extreme	**2**	**December through April**

Table 2: Scrub fuel fire danger classes

Fire Danger Class	Number of days	Months of occurrence
Low	86	All months
Moderate	**0**	**NA**
High	28	All months
Very High	45	All months
Extreme	**103**	**All months**
Very Extreme	103	All months

Table 3: Grass fuel fire danger classes

Fire Danger Class	Number of days	Months of occurrence
Low	164	All months
Moderate	**184**	**All months**
High	16	December through March
Very High	0.5	February
Extreme	**0.5**	**February**

The degree of curing is a measure of the proportion of dead grass fuels present, which affects the ease of fire spread. The lower the percentage the more live green component is present.

Table 4: Degree of grass curing (DoC%) Wellington

Month	J	A	S	O	N	D	J	F	M	A	M	J
DoC%	20	20	30	40	40	50	60	70	60	40	20	20

9.2.Wildfire history - ignitions

The following tables present FENZ incident occurrence data from the last ten years up to May 2021. The incidents all occurred adjacent to the park with some having potential to spread in continuous fuel. A ten-year data set has been used to ensure the information is applicable to current human behaviour related to wildfire risk.

The table is sorted alphabetically by general location.

Table 5: Fire incident notifications by location

Date	Fire type 1	Fire type 2	Cause	General location
8/12/2017	Structure Fire	Structure fire with damage	Undetermined	Arahura Crescent (RUI with farmland to the north)
1/08/2019	Other Fire	Other Fire - not classified above	Controlled burn, land clearing fire	Arahura Crescent (RUI with farmland to the north)
10/08/2019	Other Fire	Outside Rubbish bin, Skip fire	Unable to classify	Arahura Crescent (RUI with farmland to the north)
6/03/2014	Structure Fire	Structure fire with damage	Other electrical failure	Arahura Crescent (RUI)
25/08/2020	Other Fire	Mobile Property Fire	Suspicious	Arahura Crescent (RUI)
27/07/2013	Other Fire	Hangi, Umu fire, Cultural cooking fire	Lawful	Bedford Street (RUI)
28/07/2013	Other Fire	Other Fire - not classified above	Legality not known	Bedford Street (RUI)
21/10/2020	Vegetation Fire	Vegetation Fire	Incendiaries / Suspicious	Brandon Intermediate
12/11/2013	Vegetation Fire	Vegetation Fire	Unlawful	Cardiff Crescent (RUI with Cardiff Park)
28/11/2017	Other Fire	Outside Rubbish bin, Skip fire	Lawful	Cardiff Crescent (RUI with Cardiff Park)
5/03/2014	Structure Fire	Structure fire with damage	Other electrical failure	Cardiff Crescent (RUI)
7/12/2018	Structure Fire	Structure fire with damage	Part failure, leak or break	Cardiff Crescent (RUI)
10/04/2012	Other Fire	Mobile Property Fire	Unlawful	Cardiff Park
1/05/2016	Vegetation Fire	Vegetation Fire	Suspicious	Cardiff Park
18/11/2017	Other Fire	Outside Rubbish bin, Skip fire	Unlawful	Carnavon Place (RUI)
1/10/2020	Structure Fire	Structure fire with no damage	Unattended cooking	Carnavon Place (RUI)
24/11/2020	Structure Fire	Structure fire with no damage	Unattended cooking	Carnavon Place (RUI)
28/10/2020	Structure Fire	Structure fire with damage	Other electrical failure	Durham Street (RUI)
16/12/2012	Vegetation Fire	Vegetation Fire	Unlawful	Farmland to the north (400m)
7/02/2020	Structure Fire	Structure fire with no damage	Unattended cooking	Marne Grove (RUI)
20/02/2014	Other Fire	Other Fire - not classified above	Unlawful	Northumberland Street (RUI)
7/10/2015	Vegetation Fire	Vegetation Fire	Careless disposal or use: cigarettes, ashes, embers	Suffok Place (RUI)
12/01/2015	Vegetation Fire	Vegetation Fire	Other electrical failure	Surprise Place (RUI)
25/06/2019	Structure Fire	Structure fire with damage	Short circuit, earth fault	Surprise Place (RUI)
9/10/2019	Vegetation Fire	Vegetation Fire	Outside Fire / Burn off	Surprise Place (RUI)
6/01/2013	Other Fire	Mobile Property Fire	Unlawful	Takapu Road (near substation)
15/09/2013	Other Fire	Other Fire - not classified above	Controlled burn, land clearing fire	Takapu Road (near substation)
6/07/2019	Structure Fire	Structure fire with damage	Heat source too close to combustibles	Takapu Road (north of Cannons Creek)
15/02/2013	Vegetation Fire	Vegetation Fire	Careless disposal or use: cigarettes, ashes, embers	Waihora Crescent (RUI)
5/11/2016	Vegetation Fire	Vegetation Fire	Careless disposal or use: cigarettes, ashes, embers	Waihora Crescent (RUI)
26/03/2018	Other Fire	Other Fire - not classified above	Other electrical failure	Waihora Crescent (RUI)
21/06/2020	Structure Fire	Structure fire with damage	Unattended cooking	Waihora Crescent (RUI)
17/09/2015	Vegetation Fire	Vegetation Fire	Unlawful	Waihora Park
21/10/2016	Vegetation Fire	Vegetation Fire	Suspicious	Waihora Park
2/12/2018	Other Fire	Outside Rubbish bin, Skip fire	Lawful	Waihora Park
18/02/2019	Vegetation Fire	Vegetation Fire	Incendiaries / Suspicious	Waihora Park

Table 6: Summary - general location of fires

Ref	Location	Number of reports
1	Waihora Crescent RUI with Western Belmont Park	4
2	Waihora Park	4
3	Arahura Crescent RUI with farmland north of park	3
4	Carnavon Place RUI with Western Belmont Park	3
5	Surprise Place RUI with Western Belmont Park	3
6	Takapuna Road	3
7	Arahura Crescent RUI with Western Belmont Park	2
8	Bedford Street RUI with Western Belmont Park	2
9	Cardiff Park	2
10	Cardiff Crescent RUI with Cardiff Park	2
11	Cardiff Crescent RUI with Western Belmont Park	2
12	Brandon Intermediate	1
13	Durnham Street RUI with Western Belmont Park	1
14	Farmland to the north of park	1
15	Marne Grove RUI with Western Belmont Park	1
16	Northumberland Street RUI with Western Belmont Park	1
17	Suffolk Place RUI with Western Belmont Park	1
	Total Fires - 10 years	**36**

Table 7: Summary of fire types

Vegetation	14
Outdoor rubbish	4
Outdoor cooking	1
Not classified	3
Mobile Property	3
Structure	11
Total Fires - 10 years	**36**

9.3.Fire Behaviour

Once a wildfire ignites, it goes through an acceleration phase before reaching its optimal forward rate of spread (equilibrium ROS) and head fire intensity (HFI) for the fuel, weather, and topographical conditions. It is the HFI at the equilibrium ROS that determines the damage potential. Fuel loads are estimated in tonnes per hectare (t/ha), ROS in metres per hour (m/h) and HFI in kilowatts per linear metre (kW/m). ROS is determined from the Initial Spread Index (ISI) component of the New Zealand Fire Danger Rating System.

HFI has been calculated using the Prometheus Fire Growth Modelling software with fuels (vegetation) aligned to the model's available fuels, adjusted for slope angle, and using selected days with actual weather and fire danger ratings observed from the Titahi Bay RAWS 22-year historical record. Fires were modelled for 'worst-case' conditions based on fire weather within the extreme fire danger class, as well as for more 'likely' based on fire weather within the Moderate fire danger class. These provide estimates of fire behaviour for periods when the park's vegetation fuels are dry enough for spreading fires and grass curing is at the higher end. The predominant wind directions selected for fire growth modelling were in the vicinity of north-northeast through northwest. The selected record from the fire climate analysis for the extreme scenario had a constant wind direction due to extrapolation of hourly data from daily data.

9.4.Prometheus fire growth modelling

Prometheus fire growth modelling was undertaken from two ignition points identified using historic fire locations. Fire growth modelling was applied to both extreme and moderate fire danger class levels, with weather data from Titahi Bay RAWS.

The modelled inputs and outputs have been compiled in a separate report supplement titled *'Western Belmont – Prometheus Wildfire Risk Report Supplement'*.

Note the full removal of grazing was not modelled.

9.5.Park users

The Park provides for a variety of outdoor recreation activities including walking, running mountain biking. Amenity areas include roads, carparks, and a track network through Cannons Creek catchment to Transmission Gully highway and onto the higher viewpoints on the main ridgeline. With the retirement of a large part of grazing the recreation track network will increase as will visitor numbers. Visitors use the park all year with peaks during the summer months. The area is on the doorstep of city suburbs with schools on the boundary.

Volunteer groups are engaged in revegetation of retired areas. Staff and contractors undertake park development and maintenance work, with power and gas companies, farming personnel and their contractors working within the area.

9.6.Farm operation

A large part of the farming activity is presently being retired. Because of the need to manage fuel reduced buffers around utilities passing through the area it has been suggested to retain some of the grazing. A retained grazing area concept was used for fire growth modelling.

9.7.Existing treatments

9.7.1. Plans and awareness

1) GWRC manage activities through its Parks Network Plan as either allowed, managed, restricted, or prohibited. Specific to Western Belmont is the prohibition of motorised recreation, hunting, fireworks, and fires.

2) There are numerous reports on the removal of grazing and the restoration of the area to its natural state. As the native vegetation begins to dominate it will reduce likely fire behaviour but will still burn under certain conditions.

9.7.2. Operating guidelines and regulation

1) Fire and Emergency New Zealand (FENZ) in collaboration with industry have compiled activity guidelines for organisations undertaking spark hazardous or hot works in the open air. These include specific guidelines for forestry operations, general spark hazardous operations such as roadside mowing, welding, as well as power reclosure systems. Organisations involved in activities covered in the guidelines are strongly encouraged to adopt them as standard practice.

2) FENZ also have community guides related to evaluating and preparing private properties for wildfire.

3) Electricity supply companies undertake line and tower/pole maintenance which reduces the likelihood of failures that can cause fires. They also maintain fuel reduced corridors for their overhead powerlines.

4) GWRC manage a network of recreation tracks, 4x4 roads/tracks, roads, and hard surface carparks. These provide

   - access for day-to-day management and recreation routes,
   - evacuation (escape) routes,
   - response to wildfire,
   - barriers to fire spread.

5) Porirua City Council manages reticulated water supplies that are accessible to emergency services through pressure hydrants located on most sealed roads on the western side. Refer Appendix 8. These can be utilised by mobile water vehicles, but those suitable for servicing aircraft operations would need to be identified and operational setup pre-planned.

6) Open water ponds are located within the farmed section and should be retained for firefighting purposes. Due to overhead lines and the hazard they pose to aircraft operations, the ponds need to be designated for either mobile access, aircraft access or for both.

7) GWRC can close areas to the public or restrict operations on their lands when fire dangers exceed their risk tolerance, or an event occurs that impacts the ability to deal with a wildfire. Examples of restrictions are the use of chainsaws or other motorised machinery, limited operating hours starting and finishing early before the hot and dry part of a day, or operating on colder damper locations on more southerly aspects. FENZ can also regulate activities and close areas.

8) FENZ regulate the use of fire in the open air using a tiered system of personal responsibility (Open fire season), permits required (Restricted fire season), and fires totally banned (Prohibited fire season). As fuels dry out the restrictions on activities that could start fires become stronger.

9.7.3. Emergency response

9) FENZ supply an emergency service response to fires.

Table 8: FENZ emergency service response

Station/Resource	Estimated arrival time from notification
Porirua Station	• Total 5 minutes to Waihora Park entrance with 1 minute muster and approximately 4-minute drivetime. Distance is approximately 4km. • Total 3 minutes to Cardiff Park with 1-minute muster and approximately 2-minute drivetime. Distance is approximately 2.5km.
Titahi Bay Station	• Total 13 minutes to Waihora Park entrance with 5-minute muster and approximately 8-minute drivetime. Distance is approximately 8.2km. • Total 11 minutes to Cardiff Park with 5-minute muster and approximately 6-minute drivetime. Distance is approximately 6.5km.
Wgtn Rural Fire Force	• Total 15 minutes to Waihora Park entrance with 7-minute muster and approximately 8-minute drivetime. Distance is approximately 8.3km. • Total 13 minutes to Cardiff Park with 7-minute muster and approximately 6-minute drivetime. Distance is approximately 6.5km.
Tawa Station	• Total 14 minutes to Waihora Park entrance with 5-minute muster and approximately 9-minute drivetime. Distance is approximately 9km. • Total 13 minutes to Cardiff Park with 5-minute muster and approximately 7-minute drivetime. Distance is approximately 7.5km.
Plimmerton Station	• Total 16 minutes to Waihora Park entrance with 5-minute muster and approximately 11-minute drivetime. Distance is approximately 11.5km.

	• Total 14 minutes to Cardiff Park with 5-minute muster and approximately 9-minute drivetime. Distance is approximately 9.5km.

10. Risk Evaluation

Wildfire responds to fuel, weather, and topography, with fuel being the one component that is easily modified. To sustain fire, fuel (vegetation), oxygen and heat are all required. Removal of any one of these will result in no fire. In the presence of slopes and gullies, fires will travel faster and be more intense than those on flat ground. Fuel types and species have different flammability levels resulting in different ignitability, development and spread potential. Wildfire poses a risk to the area and will incrementally worsen as fire dangers increase and vice versa. As fire weather conditions increase so too does the probability of ignition and damage potential.

Ignition may occur within or adjacent to Western Belmont. Over the past 10-years there have been 36 recorded fires in the area, 33 of these on the western side. Fires are more likely to originate along the RUI, including school grounds and parks. A spreading wildfire could threaten a range of locations within the park. The 10-year history of ignitions identifies fires are loosely clustered along the southern section of the RUI to Cardiff Park, and from Waihora Park north. There have been 2 or 3 fires recorded on the Duck Creek side.

It should be noted that ignition frequency over 2019 and 2020 doubled on previous years along the RUI. Generally, there were 3 ignitions annually except in 2013, but over the two years 2019 and 2020 there were 13 recorded fires of which 7 were structure related.

The planned land use change that reduces the farmed area and replaces it with the natural vegetation state will take many years. Because of this the vegetation consideration has looked at the current and a conceptual 12 and 60-year cover. A typical example of vegetation transition is from predominant grass to grass/scrub mix (native and gorse), to broadleaf/gorse, to broadleaf predominant, to broadleaf/podocarp. Additionally, there may be pockets of highly flammable native species. Along this continuum likely fire behaviour will increase before it decreases with the less flammable native species dominating.

Careful planning of the vegetation transition is required to protect values and users. Maintaining or developing a defensible environment along the RUI, neighbourhood parks and school grounds and around utilities will be necessary. This is especially the case for the section of RUI from Waihora Park north that is presently farmed and will be retired. South of this the boundary has variable vegetation cover that in most places is well on the way to reverting to native. The focus for this section would be to increase fire awareness with neighbours. Focus should also fall on areas where there has been forest harvesting behind Porirua College and near Glenview School, as well as where there are faces of broadleaf/gorse behind Northumberland Street and behind Carnavon Place around to Cardiff Park.

As a priority, the northern section of RUI should be revegetated in lower flammability native species to a width of 20 -30 metres. Whilst the revegetation area is juvenile it will need weed management. Once native dominates, this strip will act to slow fire spread coming either from private property or spreading towards it.

The retention of grazing along the main ridgeline as well as corridors down to Waihora Park and Duck Creek will afford a level of protection to overhead utilities due to reduced fuel. It will also offer clear views of the surrounding landscape, as well as easier fire suppression due to lower fire intensity, and easier access. Grazed areas under certain conditions will also offer users a level of protection from spreading fire, and for relatively easier self-evacuation or rescue via either aircraft of vehicle.

If grazing is fully retired there will need to be reduced vegetation cover under and around utilities as well as a barrier to fire spread along the main ridge line. This barrier would link to two or three evacuation points located on the ridge at track junctions. The evacuation points would need to be minimal vegetation and 60x60 metres minimum. Additionally, there would need to be a fuel reduced area surrounding the gas compound.

On the Transmission Gully highway side there are some natural defences. Firstly, the highway is a very wide barrier however it will carry large volumes of traffic with motor vehicle accidents likely and fire possible. Located below and west of the highway is Takapu Road which will also act as a barrier, and below this again is Duck Creek with wetter damper conditions and regenerating native cover. Enhancing the native cover in the creek and gullies will further strengthen defence against spreading fire. Additionally, the terrain is very steep and on a slightly colder aspect where fires are more likely to be long and narrow.

The existing track and road network has created barriers to fire spread. These should all remain and be well maintained as either non-fuel or reduced fuel. They can have targeted removal of flammable weed species along their edges, replaced by low flammable species that will assist slowing or stopping fire spread. Three locations have been identified for fire breaking or reduced vegetation cover, all associated with utilities. The first is on the ridge running northwest from the gas compound down to Waihora Crescent, following the subsurface gas pipeline. The second follows the 11kv powerline from the farm buildings to Waihora Park. If the no grazing option is adopted the third would follow the gas pipeline from the gas compound down a spur to Transmission Gully.

As areas of lower flammability vegetation increase, and barriers to fire spread are strengthened, areas of either mixed flammability or higher flammability species can be planted. These would in effect become surrounded by barriers including lower flammability vegetation areas, giving fire a level of natural containment, or at least allowing for more effective fire suppression.

Strengthening barriers has the advantage of increasing the security of egress for park users should there be a need to evacuate. Routes out of the park should be clearly identified so users are able to make informed decisions which direction to go if having to leave quickly.

With effective risk reduction treatments, risk rating can be lowered over the long term but there will always remain a level of residual risk. Determining a level of acceptable residual risk at points along the vegetation transition timeline helps determine the quantum and type of risk treatments to be applied and when.

Reducing the likelihood of ignitions is the priority both inside and adjacent the area. This would require targeted wildfire awareness with neighbours along the RUI and recreation users as well as a

requirement for any works operation to adopt and implement appropriate risk reduction activity guidelines.

The consequences from wildfire can be considered on a scale from insignificant to catastrophic depending on prevailing fire danger. At risk are people's lives, the environment, utility infrastructure, built assets and park assets (including trails). Where possible, measures need to be employed to reduce consequences to these values.

In all cases preventing ignitions is primary followed by engineering works aimed at limiting fire behaviour, fire detection, early fire suppression, and evacuation to keep people safe. Because wildfires develop and spread faster during higher fire danger the application of treatments would need to keep pace with increasing fire danger levels.

10.1. Fire Danger

The Fire Danger Classes relevant to the area are forest, grassland, and scrub. Analysis of the 22-year fire climate data indicates the average number of days in a fire season that fire danger is moderate is 94 for forest, 184 for grass and zero for scrub. For high to extreme fire danger, the number of days is 23 for forest, 17 for grass and 176 for scrub. For very extreme fire danger, the number of days for forest is zero, for grass is zero, and for scrub is 103. All other days are low fire danger.

For forest and grass there is less than one month in the year where the annual average number of days have fire danger levels that would be considered problematic for fire suppression. For the scrub fuel type, it is the opposite with around 7 months where fire behaviour could be uncontrollable. This is a significant point when considering selection of species for revegetation purposes and their locations. Scrub fuels such as gorse and manuka/kanuka are top of the flammability list but other vegetation can respond to fire in a similar manner. An example of this is when revegetating, often for the first couple of years the vegetation carrying a fire would be grass. As the revegetated plants achieve a level of canopy closure and begin to dominate over the grass and weeds, the fuel may burn more like scrub especially if it has a gorse component.

There are two key scrub fuel revegetation considerations.

1. Any planned compartments of high flammability scrub species should be limited in size, not boarder barriers to fire spread such as roads and tracks and be enclosed by a mix of low to moderate flammability species, followed further out by low flammability species closer to and at barrier edges.

2. When planning revegetation try to stagger locations so there are not large continuous areas of the same aged plantings. Keeping fire out of newly planted areas through the period when they may burn as scrub is important. A high intensity fire will destroy vegetation including the subsurface organics. By maintaining an age mosaic, the closer to mature areas can assist in reducing damage potential from spreading fire.

10.2. Ignition probability

There were no ignitions recorded within the park over the last 10 years. Analysis of ignition sources, ignition history and existing treatments suggest ignitions are most likely to occur on private property along the RUI, along overhead power line corridors, and along roadways or access tracks. There was one ignition on farmland to the north.

Of the 36 recorded fires of interest, 14 were either structure or mobile property fires with the rest considered outdoor. The frequency of fires doubled during 2019 and 2020

10.3. Fire Behaviour

Refer to the '*Western Belmont Regional Park – Prometheus Wildfire Risk Report Supplement*'. Within this report are tables that indicate fire suppression success based on fire intensity levels. These are presented for each ignition scenario under moderate and extreme fire dangers.

10.4. Life risk

There is a need to provide for the safety of all users at risk of being overrun or trapped by wildfire. During a wildfire the safest option is to remove users from the area if time allows. If time does not allow for evacuation, then users should remove themselves from harm's way to an area that will not be affected by the fire, or to where the fire environment can reduce fire intensity to a level not to cause harm. An example of an environment that could reduce fire intensity is very short grassland on flatter terrain.

Recreation users would be the most at-risk from wildfire as they undertake their pursuit. They could be mid-slope with fire spreading uphill giving them nowhere to shelter or move away to. Visitors also have a range of mobility, with some able to quickly move to safety and others much slower, especially young children.

Those working or operating within the area could be impacted by a threatening wildfire, such as staff, volunteers and contractors and concessionaires.

Residential property owners on the RUI may be impacted from a head fire spreading downhill towards their properties. This scenario is low likelihood considering prevailing winds are from the north to northwest, with most historic ignitions located on the RUI property boundaries themselves. These properties are more likely to receive boundary damage to fences and plantings and be inconvenienced by smoke and embers as a fire either backs down or flanks towards them.

10.5. Asset risk

These include the ecological and recreational assets, commercial forestry, power transmission and distribution utilities, gas utilities and the farming operation.

10.5.1. Buildings

There are numerous farm buildings on the slope above Waihora Crescent as well as the gas compound on the ridge above.

Along the western RUI there are 77 properties with dwellings and other buildings, and grounds associated with 3 schools.

10.5.2. Utility infrastructure

There is approximately 7.7km of overhead powerline with 62 poles and towers as well as 3.5km of subsurface gas pipeline.

The Porirua water main follows Duck Creek for approximately 2km.

10.5.3. Environmental

This risk relates to the loss of biomass, ecosystems (fauna and flora), soil (through erosion) and water quality, as well as the invasion of pest plants and animals. Because the area is heavily invested in revegetation, the loss would be great especially as there are long maturity timeframes and volunteer planting effort.

There is regenerating native forest and patches of older remnant forest in the lower reaches of Cannons Creek including a small original tawa/kohekohe forest remnant being the largest pocket of native forest on the eastern side of the Porirua Basin.

The southwestern third of the area (Cannons Creek) is well on its way to a native vegetation cover but still has many places where gorse is only just being dominated by the native. These locations could still burn intensely, and therefore maintaining and strengthening barriers to fire spread near and around them remain important.

The north-eastern two thirds, not including the grazed ridgeline and corridors, poses more of a challenge as it reverts or is revegetated in native. Presently most gullies on the eastern and western sides have remnant native vegetation including freshwater species. The gully sides are a mix of grassland, native and exotic scrub. As these areas are removed from grazing and allowed to revert, the vegetation cover will transition to high fuel load grass, to grass/scrub and broadleaf mix, to mainly scrub with broadleaf and finally broadleaf to podocarp. Once grazing is removed the damage potential from fire will initially increase as vegetation transitions over many years with the highest potential being when there is high fuel load grassland and or scrub (especially gorse and manuka/kanuka).

At risk from fire are native fauna including birds (habitat loss), lizards and invertebrates. Freshwater fish are at risk if riparian margins or larger areas are burnt with subsequent washdown of contaminates into waterways. Duck Creek contains rare and threatened native freshwater fish.

Trail aesthetics would be damaged by fire through the removal of vegetation leaving a destroyed environment that would take many years to recover. Trails and tracks themselves are more likely to be damaged during fire suppression operations or post-fire events through heavy machine operation or heavy rains wash them out.

10.5.4. Cultural, historic, and archaeological

Originally the area was covered in Rimu and Northern Rata emerging over a canopy of Tawa and Hinau. Māori used the area as connecting routes between Wellington and Porirua Harbours. A large part of the area has been farmed for many years before its ownership passed to government and administration to GWRC.

10.6. Risk scoring

Evaluating and scoring wildfire risk has considered the history of fire occurrence and the three vegetation covers being analysed. In all three cases the likelihood of ignition is Almost Certain, but the consequence will change through the 12-year to the 60-year vegetation covers. The following table indicates the risk scoring for the three situations. Refer appendix 11.

Table 9: Risk scores

Situation	Likelihood descriptor	Consequence level	Risk level
Current	Almost Certain	Moderate	High
12-year	Almost Certain	Moderate to Major	High to Very High
60-year	Almost Certain	Minor	Medium

11. Risk treatment recommendations

This section outlines wildfire risk treatments aimed at managing the wildfire risk associated with Western Belmont. The priority ranking uses low to very high as an indicator of which risk treatments should be undertaken first (very high) and last (low). For example, the ranking low does not mean the risk treatment should not be completed at some point.

Table 14 is a summary list of all risk treatments, with tables 15 and 16 listing the order of implementation priority for the Very High, and High-level risk treatments. During implementation planning, synergies should be identified from across the range of treatment levels. For example, if technical equipment is needed for a Very High treatment and there is a nearby medium treatment requiring the same equipment it may be sensible to complete both.

Where there is vegetation planting detail within a risk treatment the reader should also refer to table 13 that contains specific vegetation treatments that may need to be considered concurrently. Refer to appendix 10 for risk treatment locations.

11.1. Rural Urban Interface (RUI)

Table 10: RUI risk treatments

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
RUI-1	High	Full RUI	To reduce likelihood and consequence	Reduction and readiness	1. In conjunction with FENZ encourage Fire Smart self-checks at all properties on the RUI.	GWRC, FENZ and property owners
RUI-2	Medium	Full RUI	To reduce consequence	Reduction	1. In conjunction with FENZ, encourage the use of low or non-flammable boundary fence materials.	GWRC, FENZ and Property owners
RUI-3	High	Full RUI	To reduce consequence	Reduction	1. In conjunction with FENZ, encourage property owners to have minimal vegetation on their fence line or plant low flammability species (native or exotic), and apply the FENZ defensible space criteria.	GWRC, FENZ property owners.

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
RUI-4	Medium	Carnavon Place/Cardiff Park	To reduce likelihood and consequence	Reduction	1. Remove the conifer tree stand at the boundary with Cardiff Park and replace with low flammability native species. 2. Encourage the removal of any other conifer trees or pockets of them that are on or near the boundary. 3. Work with the power supply company to ensure vegetation clearance in and around the power termination compound at the end of Carnavon Place. 4. Encourage Porirua City Council to display adequate signage at Cardiff Park outlining restrictions on the use to fire and other spark hazardous activities.	GWRC, Porirua DC and property owners
RUI-5	High	Glenview School to Northumberland Road	To reduce consequence		1. Where there has been forest harvesting outside the boundary encourage the landowner to replace with either a. low flammability species b. deciduous trees at very low density to allow for a clean understory c. mown grass d. if the land is to be developed, then at the boundary apply treatments RUI – 2 & 3 2. Encourage the removal of any other old conifer trees or pockets of them that are on or near the boundary.	GWRC, property owners.

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					3. In Western Belmont replace areas of predominant gorse with low flammability species for 20 to 30 meters inside the boundary.	
RUI-6	High	Waihora Park/Porirua College	To reduce consequence	Reduction	1. Where there has been forest harvesting between the boundary and the college encourage the landowner to replace with either a. low flammability species b. deciduous trees at very low density to allow for a clean understory c. mown grass d. if the land is to be developed, then at the boundary apply treatments RUI – 2 & 3. 2. In Western Belmont replace areas of predominant gorse with low flammability species for 20 to 30 meters inside the boundary.	GWRC, property owners.
RUI-7	High	Waihora Crescent and Park, Arahora Crescent	To reduce consequence	Reduction	1. Encourage the removal or management of exotic trees on the Waihora Park boundary. a. Either remove or encourage the removal of the macrocarpa tree pocket on the south-eastern side of Waihora Park near the toilet block and replace with low flammability native species.	GWRC, Porirua DC and property owners

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					b. Other exotic trees on the western side could either be removed or lower limbs removed with waste material taken away to leave a clean understory. 2. The shelter belt running upslope behind 42 Waihora Crescent should be incrementally replaced with low flammability native species starting behind the private property. 3. Remove exotic trees from behind 20, 26, 28 and 38 Arahura Crescent, retaining any native species. 4. Revegetate the park boundary to between 20 - 30 meters behind private property from the Waihora Crescent access to Marne Grove cul-de-sac.	

11.2. Transmission Gully/Duck Creek

Table 11: Transmission Gully/Duck Creek treatments

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
TG-1	High	Cardiff Park to Cannons Creek (Transmission Gully side)	To reduce consequence	Reduction	1. Replace grass and gorse with low flammability native species to meet the existing regenerating native. 2. Remove the shelter belt of conifer trees at the end of the ridge south of Cannons Creek.	GWRC and Transmission Gully project

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					3. Remove other conifer trees in and around where the highway crosses Cannons Creek (both sides of the highway).	
TG-2	Medium	Cannons Creek to north-eastern boundary (Transmission Gully side)	To reduce consequence	Reduction	1. Revegetate between the highway and Takapu Road with only low flammability native species. Manuka/Kanuka should not be planted in this location. If it must be then it should be planted in very small pockets or very thinly mixed with low flammability. 2. Revegetate between Takapu Road and Duck Creek as for 1 above. 3. Ensure road authorities manage roadside vegetation as low as possible. Any vehicle turnout, pull-offs or carpark should be non-fuel.	GWRC and Transmission Gully project

11.3. Western Belmont environs including roads and tracks

Table 12: Western Belmont environs risk treatments

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
WB-1	Medium	Western Belmont	To reduce likelihood and consequence	Readiness	1. Prepare Fire Weather Index (FWI) triggers for implementing limited access and closure of the park. 2. Have fire related access control signage available. 3. Train a staff member in the New Zealand Fire Weather Index system (FWI).	GWRC

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
WB-2	High	Roads and tracks	To reduce consequence	Readiness and Response	1. Prepare a park evacuation plan for all track and road systems. The plan should in the first instance allow for visitor self-evacuation, followed through by emergency responders.	GWRC, FENZ and Police
WB-3	High	Roads and tracks	To reduce consequence	Readiness	1. Provide direction signage for evacuation that guides users to the nearest exit.	GWRC
WB-4	Very High	Evacuation points	To reduce consequence	Readiness	1. In conjunction with evacuation routes identify and mark evacuation points within the area. These should as flat as possible and have either a non-fuel surface or short grass with a minimum area of 60x60 metres for users to get far enough back from likely flame lengths and radiant heat. (Refer Veg-2b/2).	GWRC
WB-5	Very High	Western Belmont	To reduce likelihood and consequence	Reduction	1. Build into hazard plans the relevant actions contained within the activity control guidelines listed below. • *Fire Prevention Guidelines for Forestry Operations* are available from FENZ and New Zealand Forest Owners Association. • *Fire Prevention Guidelines for Heat and Spark Hazardous Activities / Hotworks* is available from FENZ.	GWRC
WB-6	Very High	Gas compound & reticulated pipeline	To reduce consequence	Readiness	1. Coordinate with the responsible gas supply company and FENZ in regards site planning for emergency response to fire or gas leak.	GWRC, Gas Company and FENZ

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
WB-7	Very High	Powerline infrastructure	To reduce likelihood	Reduction	1. Encourage power distribution companies to maintain their overhead line infrastructure to a standard that minimises faults that may cause ignitions.	GWRC and Powerline companies
WB-8	Medium	Powerlines	To reduce likelihood	Reduction	1. Communicate with power distribution companies and discuss feasibility of applying the FENZ *'Power Line Auto Re-Closure System Triggers - Fire Risk Guidelines'*	GWRC, FENZ and Power companies
WB-9	Medium	West Belmont	To reduce consequence	Reduction	1. Apply '*Minimum Impact Suppression Tactics'*. This will require targeted actions to specific values. For example, no fire chemicals within or near wetlands, no heavy machinery operations within or near sensitive archaeological sites (subsurface damage) or the gas and mains water supply pipelines. This approach should be outlined in a fire response plan and socialised with FENZ responders. A Western Belmont site plan stating the requirements could be lodged with FENZ for their action at response time.	GWRC and FENZ
WB-10	Medium	Open water ponds	To reduce consequence	Readiness	2. Maintain existing open water ponds. Some considerations. Refer Appendix 8. a. clear of weeds b. accessible edge and sufficient depth for pump placement or snorkel fill from an aircraft c. deep enough for helicopter buckets	GWRC

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					d. identify which ponds are not aircraft compatible due to overhead powerlines. 3. Install water supply direction signage. 4. Socialise with FENZ local brigades.	

11.4. Western Belmont vegetation management

Table 13: Western Belmont vegetation risk treatments

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
Note	*Refer to RUI treatments for vegetation management at the RUI boundary.*					
Veg-1	High	Farm structures	To reduce consequence	Readiness	1. Apply the FENZ defensible space criteria to farm structures.	GWRC
Veg-2a	Very High	Grazing option	To reduce consequence	Reduction and Readiness	1. Retain grazing along the main ridge line, down the south spur to Waihora Park, and a spur to Duck Creek. This will: a. Maintain vegetation beneath transmission lines and powerlines to avoid line contact and reduce fire intensity b. Maintain accessibility for maintenance of the powerline infrastructure and subsurface gas pipeline c. in the event of a fire give park users a fuel reduced area to move to and evacuate from	GWRC

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					d. Offer clear uninterrupted views of the surrounding area e. Reduce fire intensity to levels that can be more easily extinguished, or fire spread stopped by barriers such as roads and tracks.	
Veg-2b	Very High	No grazing option	To reduce consequence	Reduction and Readiness	1. Create a 10-metre-wide barrier to fire spread using the existing metalled road and 4x4 track along the main ridgeline and down to Transmission Gully at Cannons Creek. The following standard is recommended a. Maintain as a non-fuel surface the existing metal road section that passes the gas compound and terminates at the northeast boundary. b. Upgrade to a 4-metre-wide non-fuel surface (could be metalled), the 4x4 track stating just south of the gas compound and that follows along or close to the main ridgeline before dropping to Transmission Gully at Cannon Creek). c. Maintain 3-metre-wide short grass edges either side along the full length of a and b above. 2. Install two or three areas as evacuation points that can couple as locations to shelter from wildfire in the event evacuation is not possible (these are not safety zones). Note the suggested locations have powerlines	

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					nearby that may compromise aerial evacuation under certain wind conditions. The evacuation points need to be a. Connected to the barrier to fire spread in point 1 above b. maintained short grass 5 to 10 cm tall and be an area of no less than 60 metres x 60 metres. c. Suggested locations i. just to the south of the gas compound and linked to the multiple track/road junction ii. the large stock water pond on the ridge above Porirua College and/or iii. further south at the 4-way track junction 3. Maintain as short grass 10 – 20 cm tall a. the area west of the gas compound for 40 metres b. The area east of the road passing the gas compound for 20 metres. 4. Revegetate for 30 to 40 metres either side of overhead powerlines with low flammability native ground cover species no taller than 1 – 1.5 metres. 5. Create a 5-metre fuel reduced track that follows the gas pipeline from the gas compound down the southeastern spur to Transmission Gully highway.	

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					6. Maintain vegetation-clear 4x4 tracks presently used for utility maintenance access.	
Veg-3	High	Powerline corridors			1. Maintain vegetation in powerline corridors not subject to grazing (vege-2a above) or low flammability ground cover (vege-2b above), to a level that a. vegetation will meet statutory power regulation requirements as well as not touch overhead lines during lateral line sway and tree fall. b. where possible maintain a 10 to 15m fuel reduced corridor of mown grass beneath overhead lines c. has non-fuel or short grass areas beneath poles if possible.	GWRC and Power companies
Veg-4	High	Roads, tracks, and carparks	To reduce likelihood and consequence	Reduction	1. Maintain existing road and track network clear of vegetation (tracks to 1.5 metres, 4x4 tracks to 3 meters and roads to 4-5 metres) to a. act as barriers to fire spread b. give continued access for utility maintenance with reduced vegetation c. give options for user evacuation 2. Remove high flammability vegetation boarding roads and tracks 3 -4 metres either side and replace with lower flammability vegetation. For example, remove any gorse.	GWRC

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					3. During revegetation planning, aim to strengthen existing barriers such as roads and tracks by planting low flammability native species as 3 – 4 metre buffers. 4. For narrow roads ensure any passing bays or turnouts are either nonfuel or very short grass with surrounding vegetation cut back to its edges. 5. For carparks maintain nonfuel surfaces and any overflow parking is either nonfuel or very short grass.	
Veg-5	High	Roads and tracks	To reduce consequence	Reduction	1. Clear and maintain to 3 metres wide the existing track along the top of the ridge south of Cannons Creek from Transmission Gully highway to the high point above Northumberland Street. Note: This is for firefighting access until the gorse component in the regenerating vegetation has been grown out. The track could then be left to overgrow. 2. Maintain to 4 metres wide the 4x4 track running from the end of Carnavon Place to Transmission Gully highway. Note: this is for access as well as a barrier to fire spread.	
Veg-6	High	Firebreak/access	To reduce consequence	Reduction	1. Create a 5-metre fuel reduced track that follows the gas pipeline from the gas compound down the northwest spur to the farm access road.	GWRC, Gas and Power companies

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					2. Create a 5-metre fuel reduced corridor or track that follows the overhead powerline from the farm buildings to Waihora Crescent.	
Veg-7	Varied on location	Western Belmont	To reduce consequence	Reduction	1. Extend existing native species cover out of gullies and up slopes towards spur tops. Give priority to places that will strengthen tracks and roads as barriers to fire spread or protect other assets. 2. Manage gorse during the initial establishment of revegetated areas. 3. Consider the following a. Select lower flammability species where possible but especially surrounding roads, tracks, and high value environments. b. When selecting sites for revegetation avoid planting large areas in the same year. Staggering the planting year will help avoid continuous cover of one age class that fire can spread through. A mosaic age class including existing more mature areas will be less prone to extensive damage from fire. c. Newly planted areas are most prone to damage from fire in the first few years when there is a grass component and later when it is more like scrub.	GWRC

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					d. If high flammability native species must be used, then consider mixing them with lower flammability species. e. If areas of only high flammability species are to be planted, then keep them relatively small and compartmentalise them with a surrounding buffer of lower flammability species. In other words, avoid large continuous tracks of this vegetation where fire can accelerate to its maximum potential. f. Refer to the *'Western Belmont Regional Park – Prometheus Wildfire Risk Report Supplement'* for examples vegetation covers. **Note:** for modelling purposes an area of Manuka was included at the top of Duck Creek, and modelling showed Transmission Gully highway did not stop fire spread under extreme. **DO NOT plant this vegetation bordering roads and tracks as fire can be high intensity and spread across them.**	
Veg-8	Medium	Northeast boundary	Reduce consequence	Reduction	1. Revegetate the boundary with a 5 to 10 metre buffer of low flammability native species linking with the gully tops of similar vegetation. 2. This will	GWRC

Ref #	Priority	Location	Treatment Objective	Function	Action/activity	Groups concerned
					a. recognise ongoing urban development and farm forestry north of the area b. create a barrier to fire spreading from or to Western Belmont.	

11.5. Risk treatment summary

Table 14: Risk treatment summary

Ref#	Table #	Priority	Location	Action/activity	Groups concerned
RUI-1	10	High	Full RUI	FENZ Fire Smart property self-checks.	GWRC, FENZ and property owners
RUI-2	10	Medium	Full RUI	Use of low flammability fencing materials.	GWRC, FENZ and property owners
RUI-3	10	High	Full RUI	Use of low flammability vegetation and the application of defensible space.	GWRC, FENZ and property owners
RUI-4	10	Medium	Carnavon Place/Cardiff Park	Removal of trees, vegetation clearance and signage.	GWRC, Porirua DC and property owners
RUI-5	10	High	Glenview School to Northumberland Road	Vegetation management options and use of low flammability vegetation buffer and tree removal.	GWRC and property owners
RUI-6	10	High	Waihora Park/Porirua College	Vegetation management options and use of low flammability vegetation buffer and tree maintenance.	GWRC and property owners
RUI-7	10	High	Waihora Crescent and Park, Arahora Crescent	Removal or maintenance of trees, use of low flammability vegetation buffer.	GWRC, Porirua DC and property owners
TG-1	11	High	Cardiff Park to Cannons Creek (Transmission Gully side)	Removal or maintenance of trees, use of low flammability vegetation buffer.	GWRC and Transmission Gully project

Ref#	Table #	Priority	Location	Action/activity	Groups concerned
TG-2	11	Medium	Cannons Creek to north-eastern boundary (Transmission Gully side)	Revegetation with low flammability vegetation	GWRC and Transmission Gully project
WB-1	12	High	Western Belmont	Fire Weather Index (FWI) access control triggers, signage, and staff training	GWRC
WB-2	12	High	Roads and tracks	Evacuation planning	GWRC, FENZ, Police
WB3	12	High	Roads and tracks	Evacuation signage	GWRC
WB-4	12	Very High	Evacuation points	Location of evacuation points	GWRC
WB-5	12	Very High	Western Belmont	Use of FENZ *spark hazardous/hot works activity control guidelines* and *Fire Prevention Guidelines for Forestry Operations*	GWRC
WB-6	12	Very High	Gas compound & reticulated pipeline	Site planning for emergency response	GWRC, Gas Company and FENZ
WB-7	12	Very High	Powerline infrastructure	Infrastructure maintenance	GWRC, Power companies
WB-8	12	Medium	Powerlines	Use of FENZ P*ower Line Auto Re-Closure System Triggers - Fire Risk Guidelines*	GWRC, FENZ and Power companies
WB-9	12	Medium	Western Belmont	Apply 'Minimum Impact Suppression Tactics'	GWRC and FENZ
WB-10	12	Medium	Open water ponds	Firefighting water supply ponds, signage and FENZ communication	GWRC and FENZ
Veg-1	13	High	Farm structures	Apply FENZ defensible space criteria	GWRC
Veg-2a	13	Very High	Grazing option	Retention of grazing area	GWRC

Ref#	Table #	Priority	Location	Action/activity	Groups concerned
Veg-2b	13	Very High	No grazing option	Main ridgeline fire barrier, evacuation points and ground cover low flammability species.	GWRC
Veg-3	13	High	Powerline corridors	Vegetation reduction management	GWRC and Power companies
Veg-4	13	High	Roads, tracks, and carparks	Road, track, and carpark vegetation maintenance	GWRC
Veg-5	13	High	Roads and tracks	Track clearance and maintenance – 2 x specific locations	GWRC
Veg-6	13	High	Firebreak/access	Installation of vegetation reduced utility access corridors	GWRC, Gas supply and Power company
Veg-7	13	Varied on location	Western Belmont	Revegetation consideration including priority location	GWRC
Veg-8	13	Medium	Northeast boundary	Revegetation buffer using of low flammability vegetation	GWRC

11.6. Risk treatment work priority

Table 15: Very High priority risk treatment order for implementation

The following table is the recommended order for implementing the Very High priority risk treatments with VH-1 being the first and VH-4 last.

Ref#	Table #	Order of Priority	Location	Action/activity	Groups concerned
WB-5	12	VH-1	Western Belmont	Use of FENZ *spark hazardous/hot works activity control guidelines* and *Fire Prevention Guidelines for Forestry Operations*	GWRC
WB-7	12	VH-2	Powerline infrastructure	Infrastructure maintenance	GWRC, Power companies

Ref#	Table #	Order of Priority	Location	Action/activity	Groups concerned
WB-6	12	VH-3	Gas compound & reticulated pipeline	Site planning for emergency response	GWRC, Gas Company and FENZ
Veg-2a	13	VH-4	Grazing option	Retention of grazing area	GWRC
Veg-2b	13	VH-4	No grazing option	Main ridgeline fire barrier, evacuation points and ground cover low flammability species.	GWRC

Table 16: High priority risk treatment order for implementation

The following table is the recommended order for implementing the HIGH priority risk treatments with H-1 being the first and H-14 last.

Ref#	Table #	Order of Priority	Location	Action/activity	Groups concerned
WB-1	12	H-1	Western Belmont	Fire Weather Index (FWI) access control triggers, signage, and staff training	GWRC
WB-2	12	H-2	Roads and tracks	Evacuation planning	GWRC, FENZ, Police
WB3	12	H-3	Roads and tracks	Evacuation signage	GWRC
Veg-3	13	H-4	Powerline corridors	Vegetation reduction management	GWRC and Power companies
Veg-1	13	H-5	Farm structures	Apply FENZ defensible space criteria	GWRC
RUI-1	13	H-6	Full RUI	FENZ Fire Smart property self-checks.	GWRC, FENZ and property owners

Ref#	Table #	Order of Priority	Location	Action/activity	Groups concerned
RUI-3	10	H-7	Full RUI	Use of low flammability vegetation and the application of defensible space.	GWRC, FENZ and property owners
RUI-7	10	H-8	Waihora Crescent and Park, Arahora Crescent	Removal or maintenance of trees, use of low flammability vegetation buffer.	GWRC, Porirua DC and property owners
RUI-6	10	H-9	Waihora Park/Porirua College	Vegetation management options and use of low flammability vegetation buffer and tree maintenance.	GWRC and property owners
RUI-5	10	H-10	Glenview School to Northumberland Road	Vegetation management options and use of low flammability vegetation buffer and tree removal.	GWRC and property owners
Veg-4	13	H-11	Roads, tracks, and carparks	Road, track, and carpark vegetation maintenance	GWRC
Veg-5	13	H-12	Roads and tracks	Track clearance and maintenance – 2 x specific locations	GWRC
Veg-6	13	H-13	Firebreak/access	Installation of vegetation reduced utility access corridors	GWRC, Gas supply and Power company
TG-1	11	H-14	Cardiff Park to Cannons Creek (Transmission Gully side)	Removal or maintenance of trees, use of low flammability vegetation buffer.	GWRC and Transmission Gully project

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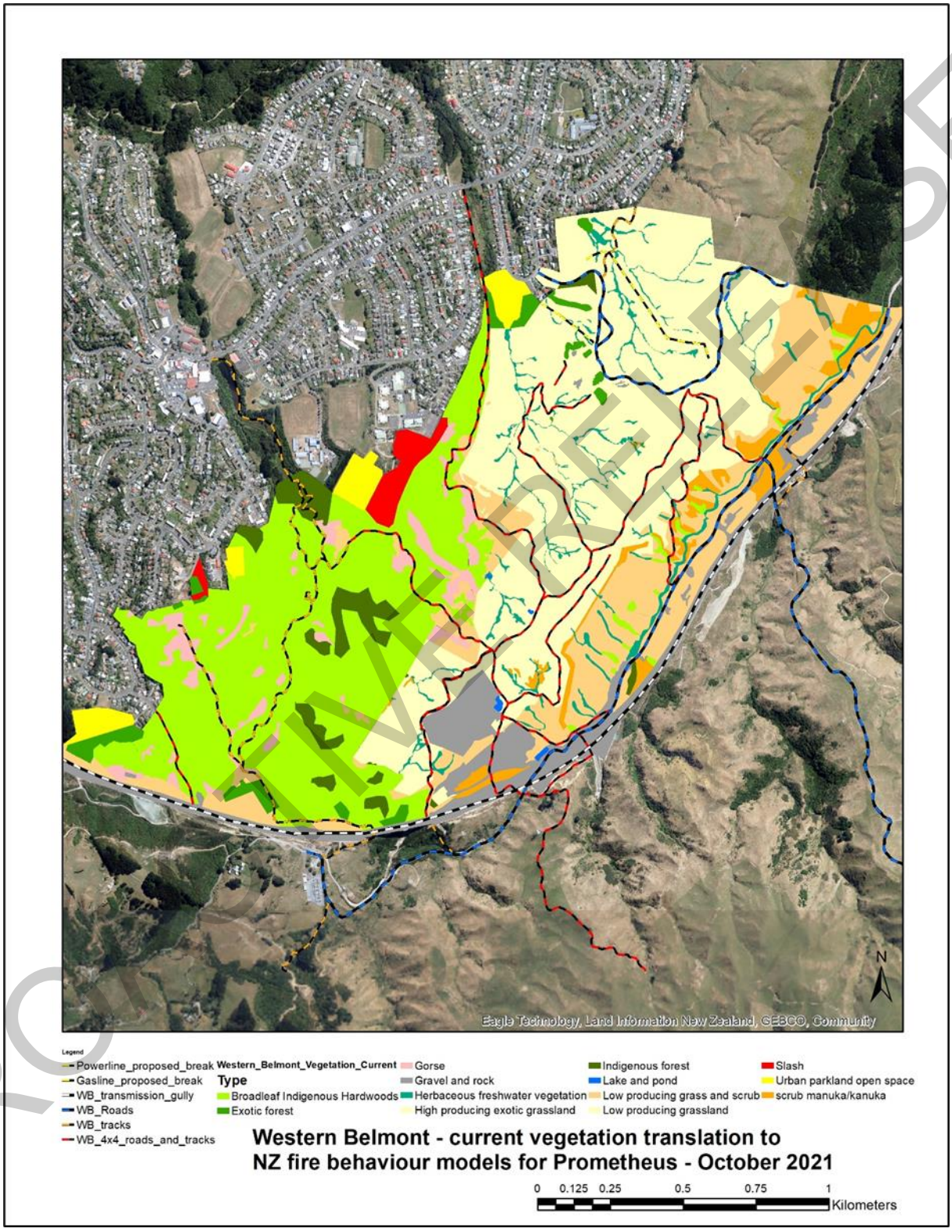
13. Appendices

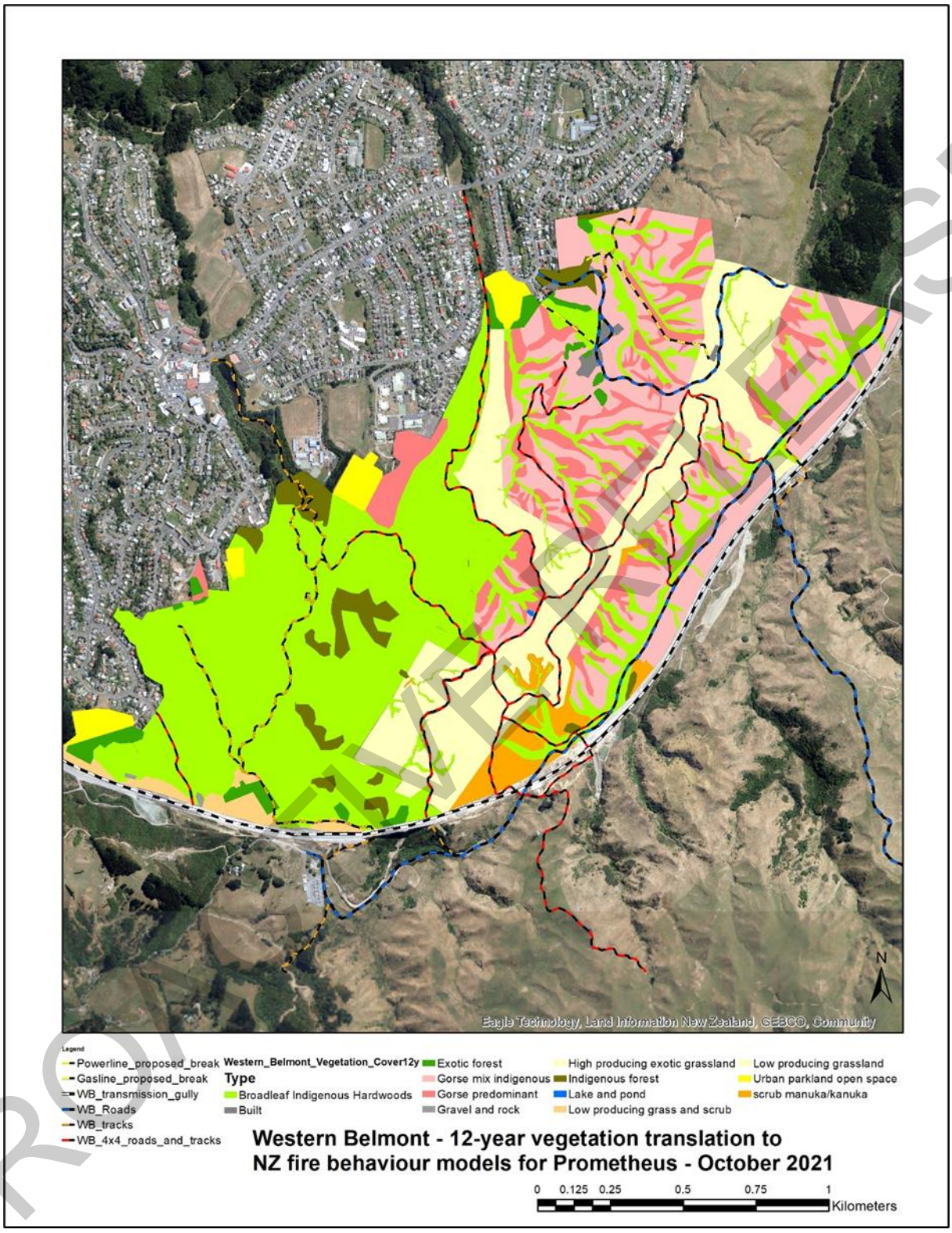
13.1. Appendix 1: Area of interest map

13.2. Appendix 2: Current and proposed vegetation cover maps

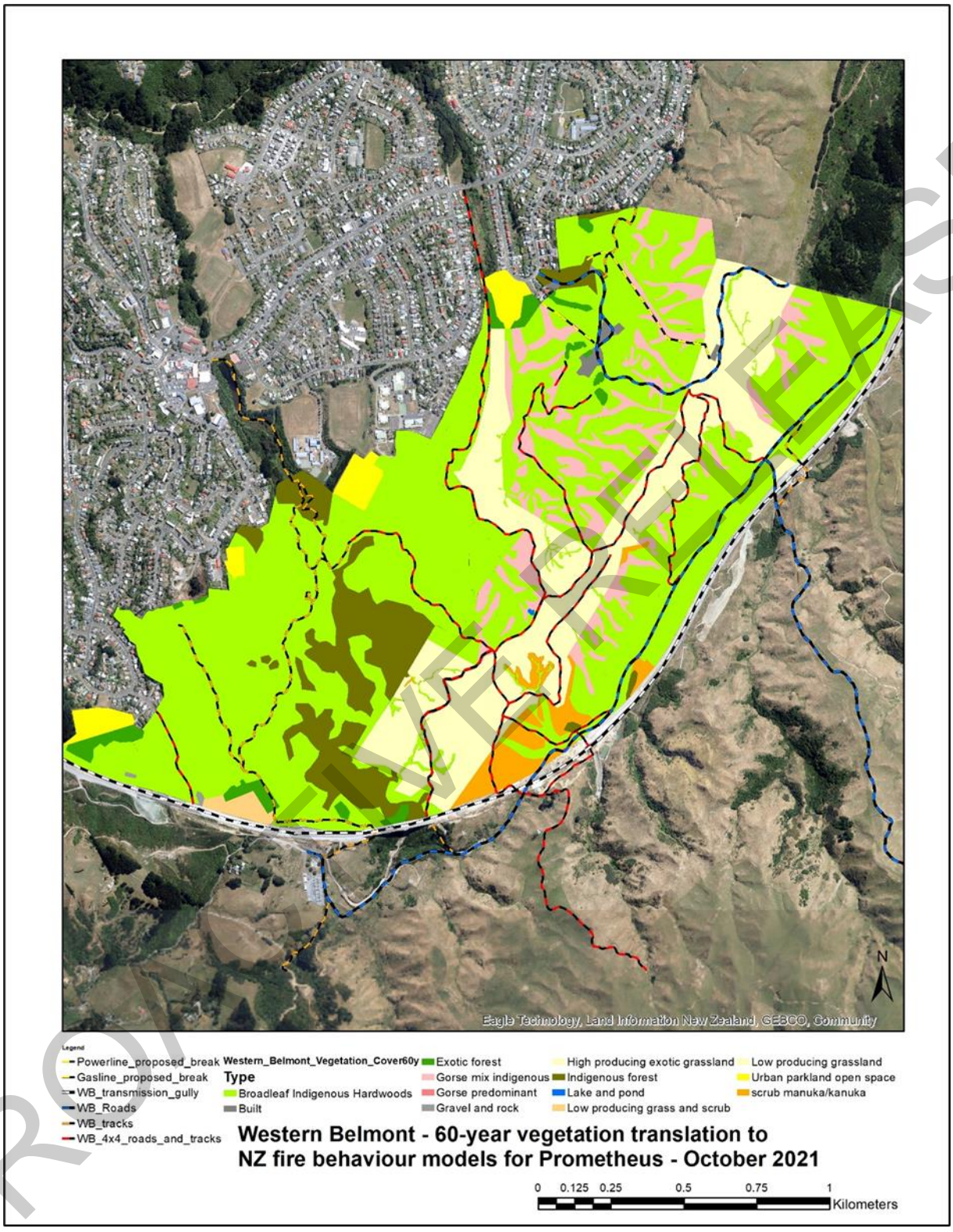
Current vegetation cover



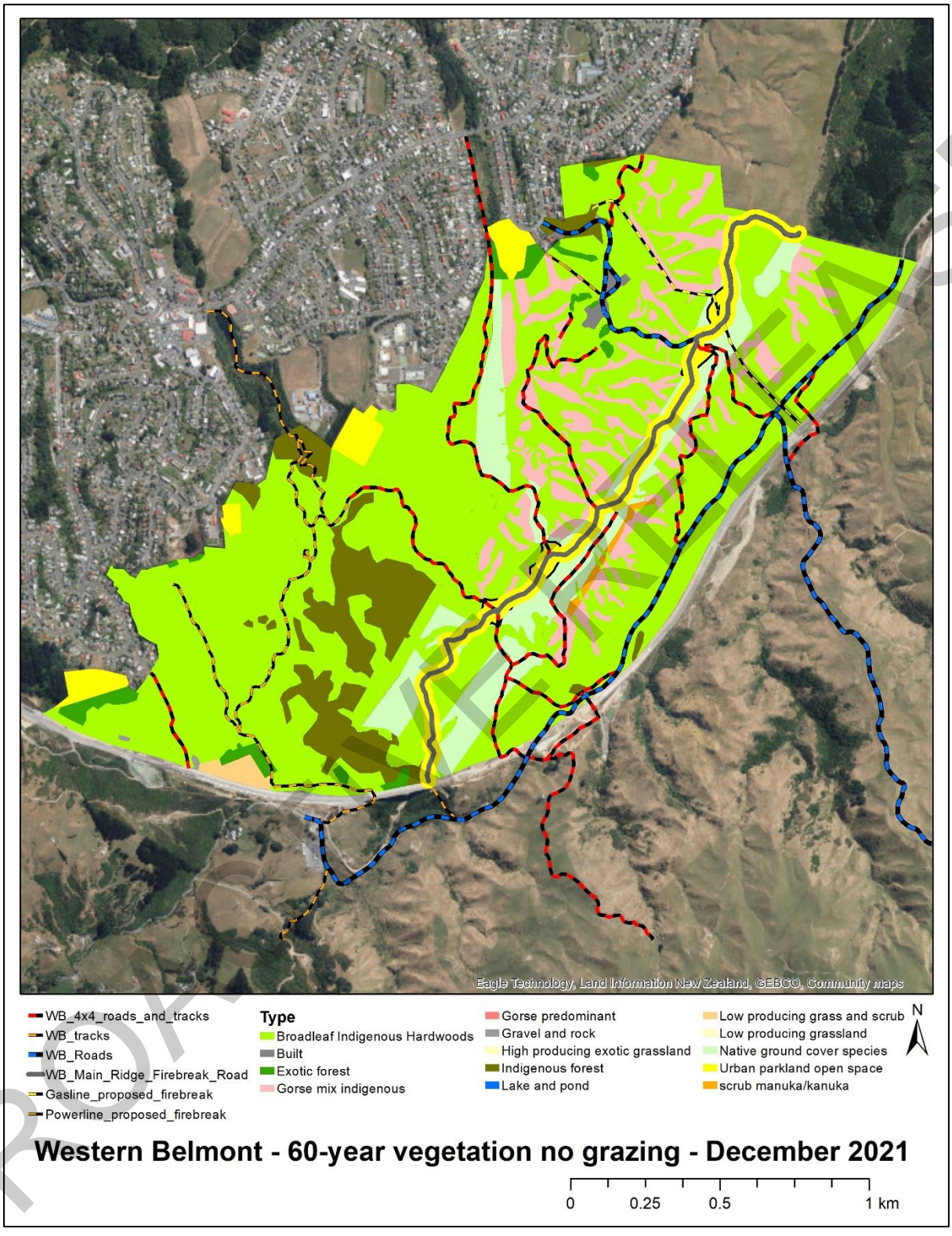
12-year vegetation concept



60-year vegetation concept



60-year vegetation concept – no grazing



13.3. Appendix 3: Fire Danger Class Criteria Definitions

Table of Suppression Interpretations for the New Zealand Fire Danger Classes (after Alexander, 2008).

Fire Danger Class	Fire Intensity (kW/m)	Description of Probable Fire Potential and Implications for Fire Suppression[†]	Nominal Max. Flame Height (m)
LOW	< 10	New fire starts are unlikely to sustain themselves due to moist surface fuel conditions. However, ignitions may take place near large and prolonged or intense heat sources (e.g., campfires, windrowed slash piles) but the resulting fires generally do not spread much beyond their point of origin and, if they do, control is easily achieved. Mop-up or complete extinguishment of fires that are already burning may still be required provided there is sufficient dry fuel to support smouldering combustion*. Colour code is GREEN.	no visible flame (< 0.2 m)
MODERATE	10 - 500	From the standpoint of moisture content, fuels are considered to be sufficiently receptive to sustain ignition and combustion from both flaming and most non-flaming (e.g., glowing) firebrands. Creeping or gentle surface fire activity is commonplace. Control of such fires is comparatively easy but can become troublesome as fire damages can still result and fires can become costly to suppress if they aren't attended to immediately. Direct manual attack around the entire fire perimeter by firefighters with only hand tools and back-pack pumps is possible. Colour code is BLUE.	0.2 to 1.3 metres
HIGH	500 - 2000	Running or vigorous surface fires are most likely to occur. Any fire outbreak constitutes a serious problem. Control becomes gradually more difficult if it's not completed during the early stages of fire growth following ignition. Water under pressure (from ground tankers or fire pumps with hose lays) and bulldozers are required for effective action at the fire's head. Colour code is YELLOW.	1.4 to 2.5 metres
VERY HIGH	2000 - 4000	Burning conditions have become critical as the likelihood of intense surface fires is a distinct possibility; torching and intermittent crowning in forests can take place. Direct attack on the head of a fire by ground forces is feasible for only the first few minutes after ignition has occurred. Otherwise, any attempt to attack the fire's head should be limited to helicopters with buckets or fixed-wing aircraft, preferably dropping long-term chemical fire retardants. Until the fire weather severity abates, resulting in a subsidence of the fire run, the uncertainty of successful control exists. Colour code is ORANGE.	2.6 to 3.5 metres
EXTREME	4000 - 10,000	The situation should be considered "explosive" or super critical. The characteristics associated with the violent physical behaviour of conflagrations or firestorms is a certainty (e.g., rapid spread rates, crowning in forests, medium- to long-range mass spotting, firewhirls, towering convection columns, great walls of flame). As a result, fires pose an especially grave threat to persons and their property. Breaching of roads and firebreaks occurs with regularity as fires sweep across the landscape. Direct attack is rarely possible given the fire's probable ferocity except immediately after ignition and should only be attempted with the utmost caution. The only effective and safe control action that can be taken until the fire run expires is at the back and along the flanks. Colour code is RED (or PURPLE for VERY EXTREME).	3.6 to 5.4 metres
VERY EXTREME	> 10,000		> 5.4 m

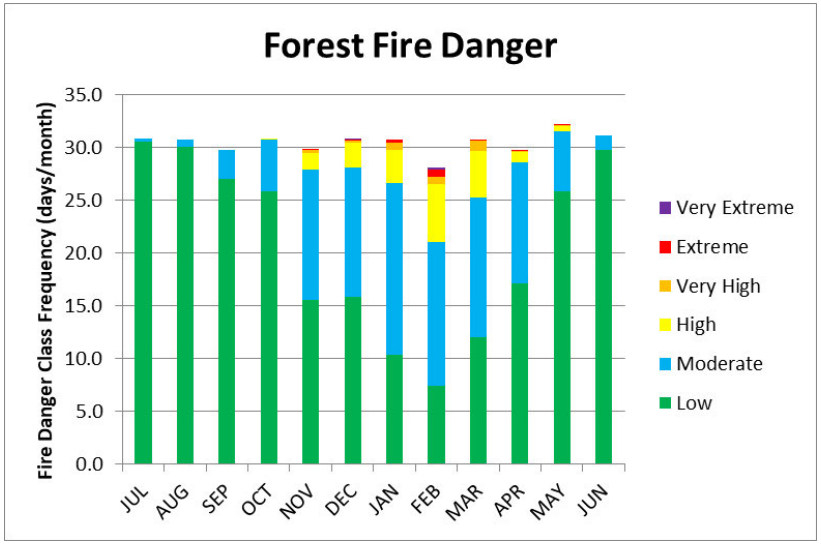
[1] **THE ABOVE SHOULD NOT BE USED AS A GUIDE TO FIREFIGHTER SAFETY, AS FIRES CAN BE POTENTIALLY DANGEROUS OR LIFE-THREATENING AT ANY LEVEL OF FIRE DANGER!**

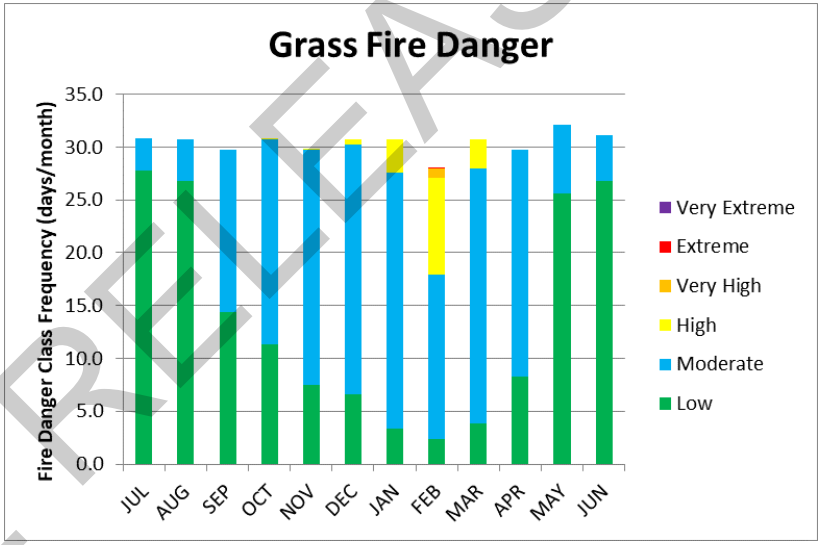
13.4. Appendix 4: Fire Danger Class summary

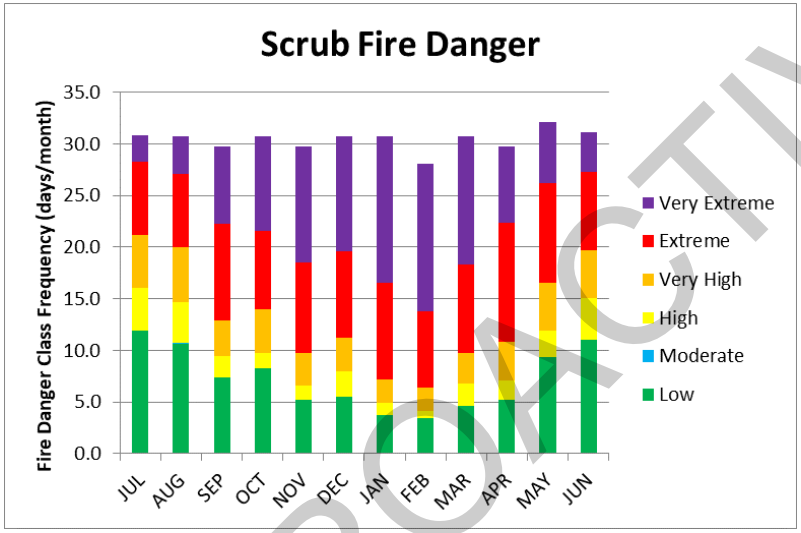
Table 17: Titahi Bay fire danger class summary (22 years to July 2020)

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	YEAR	FIRE SEASON
Forest Fire Danger Class (FFDC) Frequency														
Low	30.8	30.3	27	26	15.6	16.5	10.9	7.6	12.1	17.2	25.2	28.8	**248.1**	**105**
Moderate	0.2	0.7	3	5	12.4	12	16	13.8	13.1	11.5	5.2	1.2	**94.1**	**84.6**
High	0	0	0	0	1.7	2.2	3.1	5.2	4.7	1	0.4	0	**18.4**	**18.2**
Very High	0	0	0	0	0.2	0.1	0.7	0.7	1	0.1	0.1	0	**2.9**	**2.9**
Extreme	0	0	0	0	0	0.1	0.3	1	0.1	0.1	0	0	**1.7**	**1.6**
Grass Fire Danger Class (GFDC) Frequency														
Curing source		**Wellington (Wellington West)**												
Curing%	**20**	**20**	**30**	**40**	**40**	**50**	**60**	**70**	**60**	**40**	**20**	**20**		
Low	27.8	26.7	14.4	11.4	7.5	6.6	3.3	2.3	3.8	8.3	25.6	26.8	**164.6**	**43.3**
Moderate	3.0	4.0	15.4	19.4	22.2	23.6	24.3	15.6	24.2	21.5	6.5	4.3	**184.0**	**150.7**
High	0.0	0.0	0.0	0.0	0.0	0.5	3.2	9.2	2.8	0.0	0.0	0.0	**15.7**	**15.7**
Very High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	**0.9**	**0.9**
Extreme	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**0.1**	**0.1**
Scrub Fire Danger Class (SFDC) Frequency														
Low	11.9	10.9	7.4	8.3	5.2	5.8	3.9	3.4	4.7	5.4	9.1	10.8	**87**	**36.3**
Moderate	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
High	4.1	4	2.2	1.5	1.4	2.4	1.2	0.8	2.1	2	2.6	3.7	**28.1**	**11.4**
Very High	5.2	5.3	3.4	4.4	3	3.4	2.4	2.2	2.9	3.6	4.5	4.6	**44.9**	**22**
Extreme	7.2	7.1	9.3	7.6	8.8	8.4	9.4	7.4	8.5	11.5	9.7	7.6	**102.5**	**61.7**
Very Extreme	2.5	3.7	7.5	9.2	11.2	11.1	14.2	14.3	12.5	7.4	5.9	3.8	**103.3**	**79.9**

Figure 1: Fire danger class graphs







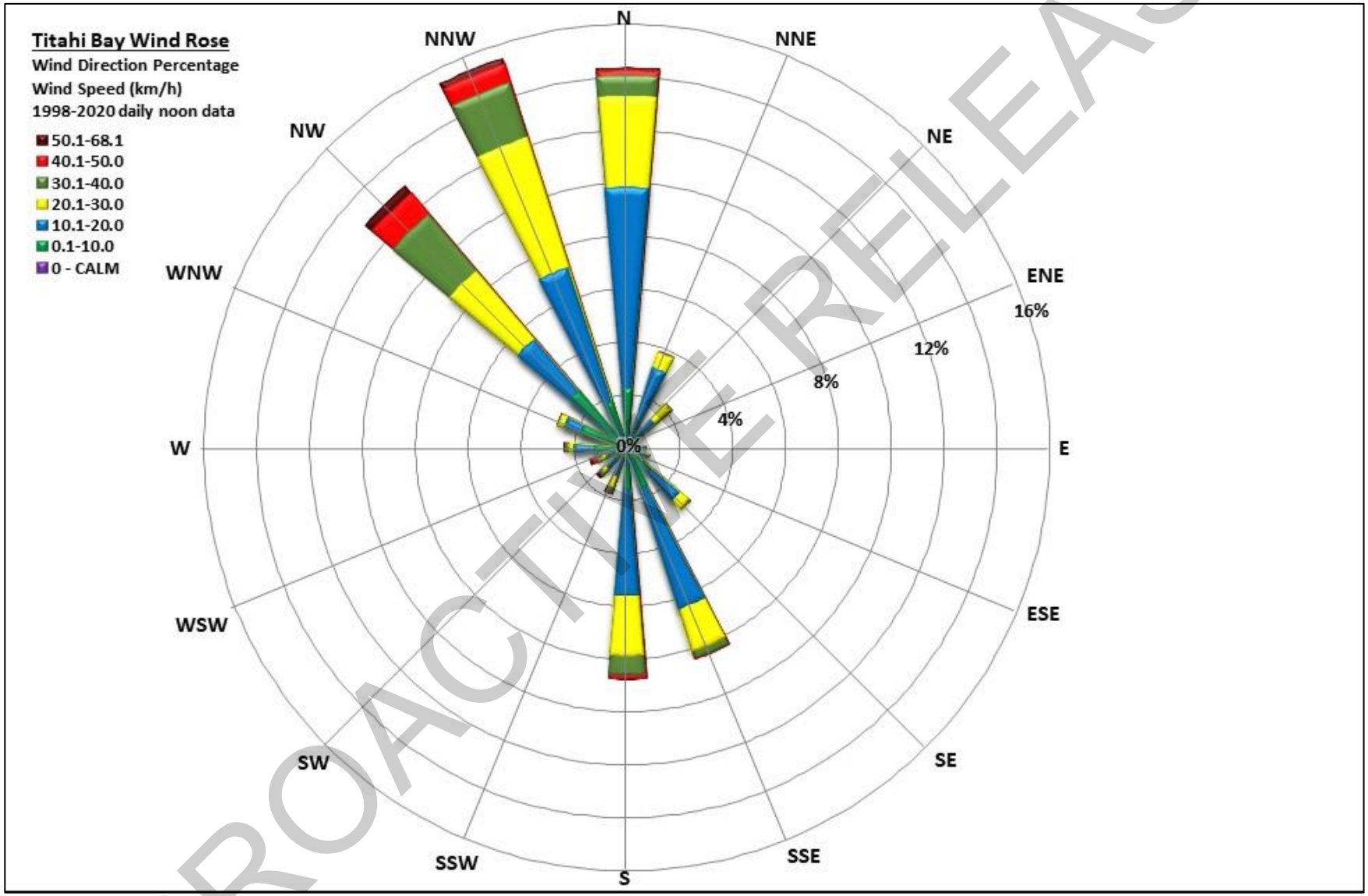
13.5. Appendix 5: Weather and FWI summary

Table 18: Weather and FWI summary

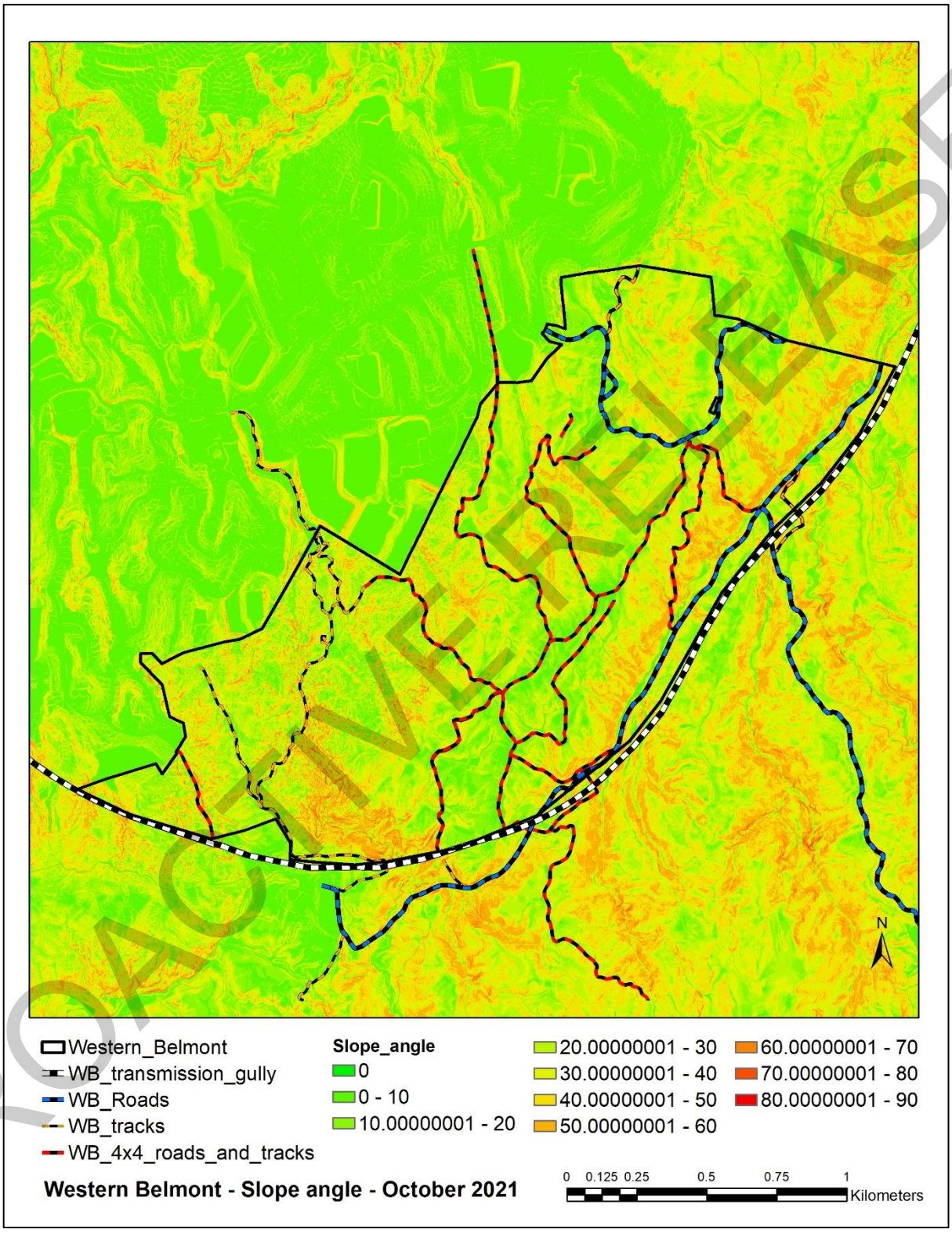
Station Name: Titahi Bay Raws (TTB)						Period: 1998-05-02 - 2020-07-01					Length of record: 22 years			
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	FIRE SEASON
Temperature, degrees Celsius														
mean	19.5	19.8	18.7	16.2	14.5	12.4	11.6	12	13.2	14.4	16.3	18.3	15.5	17.6
median	19.5	20	19.1	16.8	14.8	12.7	11.9	12.4	13.5	14.7	16.4	18.4	15.4	17.7
max	29.1	25	24.5	23	21.1	17.6	16.1	18	20	20.7	23.8	26.8	29.1	29.1
min	10.5	10.2	10.3	6	2.3	3.2	2.9	2.6	5.3	5.6	6.7	10.3	2.3	5.6
Relative Humidity, %														
mean	68.5	67.1	68.3	70.4	72.4	73.3	72.3	72.4	71.8	71.7	68.3	69.5	70.5	69.1
median	69	66	68	70	72	73	72	72	72	71	67	69	70	69
max	100	100	100	100	100	100	100	99.8	100	100	100	100	100	100
min	33	32	36	38	35	37	32	43	34	34	36	36	32	32
Wind Speed, km/h														
mean	19.2	19.1	18.3	17.6	18.2	17	16.4	17.1	21.2	22	20.9	19.8	18.9	19.6
median	17.5	17.4	16.2	16.6	16.5	14.8	14.8	14.9	19.3	20.5	19.2	17.6	16.9	17.8
max	68.1	60.2	67.2	62.9	61.3	58.9	55	65	60.5	60.8	66.3	59.3	68.1	68.1
min	0	1.5	0	0	0	0	0	0	2.9	0	0	0	0	0
24-hr Rainfall, millimeters														
mean	1.8	2.1	2	2.2	3.1	3.3	3.4	3.2	2.2	3.3	2.2	2.5	2.6	2.3
median	0	0	0	0	0	0.2	0.5	0.2	0	0	0	0	0	0
max	45.3	74.9	68.6	58.8	96.6	54.1	73.6	85.4	44.9	74.9	76.4	72.2	96.6	76.4
min	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall, millimetres														
mean	59.1	60.4	59.6	68.6	95.6	99.4	104.2	101.7	66.5	94.4	66.9	80.3	79.7	69.9
max	122.3	328.4	133.5	168.9	219.7	213.9	234.9	204.1	133.2	159.2	184.4	176.6	328.4	328.4
min	2.9	10.4	19.4	12.4	43.4	24	24.8	39.5	17.3	31.7	8.9	15.3	2.9	2.9
Seasonal Rainfall, millimetres														
mean													956.7	490.6
max													1358.4	804.8
min													579.7	190.2

Station Name: Titahi Bay Raws (TTB)					Period: 1998-05-02 - 2020-07-01						Length of record: 22 years			
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	FIRE SEASON
Fine Fuel Moisture Code, FFMC														
mean	77	78	75.8	73.6	68.2	63.9	62.9	64.8	69.7	68.6	74.2	73.4	70.8	74.3
median	83.3	84	83.5	81.4	76.5	71.1	67.5	70.4	76.8	75.9	81.6	80.5	79	81.9
max	89.7	89.9	89.4	87.6	87.6	87.2	85.5	85.6	87.4	86.7	88.8	88.8	89.9	89.9
min	9.3	9.1	4.2	1.6	2.2	7.2	12	11.1	8.9	1.6	5.3	13.8	1.6	1.6
Duff Moisture Code, DMC														
mean	19.5	25.3	20.3	13.3	6.6	2.8	1.9	2.8	5.3	6	13.1	15.6	10.9	16.1
median	16.1	21.8	17.7	10.3	4.3	2.2	1.4	2.2	4.3	4.5	10.8	11.2	6.3	11.9
max	69.9	75.9	61.8	55.3	38.9	13.8	12.1	12.5	19.9	23.1	53.1	78.6	78.6	78.6
min	0.3	0	0.9	0	0	0	0	0	0	0	0	0.1	0	0
Drought Code, DC														
mean	243.6	317.2	339.8	302.6	204.5	103.6	51.4	34.4	37.7	38.2	91	167.4	160	213.1
median	229.3	319.4	353.2	273.6	165.4	46.7	15	11.2	17.3	25.9	87.2	150.6	111.2	181.8
max	517.7	638.5	648.2	686.8	706.4	578.3	311.4	317.6	247.2	212.6	281.7	406.8	706.4	686.8
min	6.8	4.8	4	3.3	1.3	0.7	0.7	0.2	1.2	2	3.7	6.3	0.2	2
Initial Spread Index, ISI														
mean	4.4	4.8	4.1	3.1	2.7	2	1.8	2	3.1	3.2	4.2	3.8	3.2	3.9
median	3.9	4.3	3.7	2.9	2	1.4	1.2	1.4	2.6	2.5	3.5	3.1	2.6	3.4
max	20.6	28.8	20.3	21.9	24.2	17.8	17.6	14.1	19	26	25.7	23.5	28.8	28.8
min	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buildup Index, BUI														
mean	31.2	40.9	34	22.9	11.7	4.9	2.9	3.9	6.7	7.8	18.7	24.1	17.3	25.5
median	26.7	36.7	31	18.1	7.5	3.6	2.1	2.8	5.3	5.8	16.3	18.3	9.9	19.4
max	91.9	103.2	90.5	79.8	68.4	25.3	20.8	16.4	26.8	28	65.4	96.2	103.2	103.2
min	0.6	0	1.4	0	0	0	0	0	0	0	0	0.2	0	0
Fire Weather Index, FWI														
mean	8.9	10.9	8.6	5.6	3.3	1.6	1	1.3	2.7	3.1	6.4	6.5	4.9	7.1
median	8	9.6	7.6	4.1	1.5	0.6	0.4	0.5	1.7	1.8	5.1	5	2.5	5.4
max	42.7	57.5	33.9	40.5	38	20.3	15.6	14.5	19.7	20.8	37.4	49.5	57.5	57.5
min	0	0	0	0	0	0	0	0	0	0	0	0	0	0

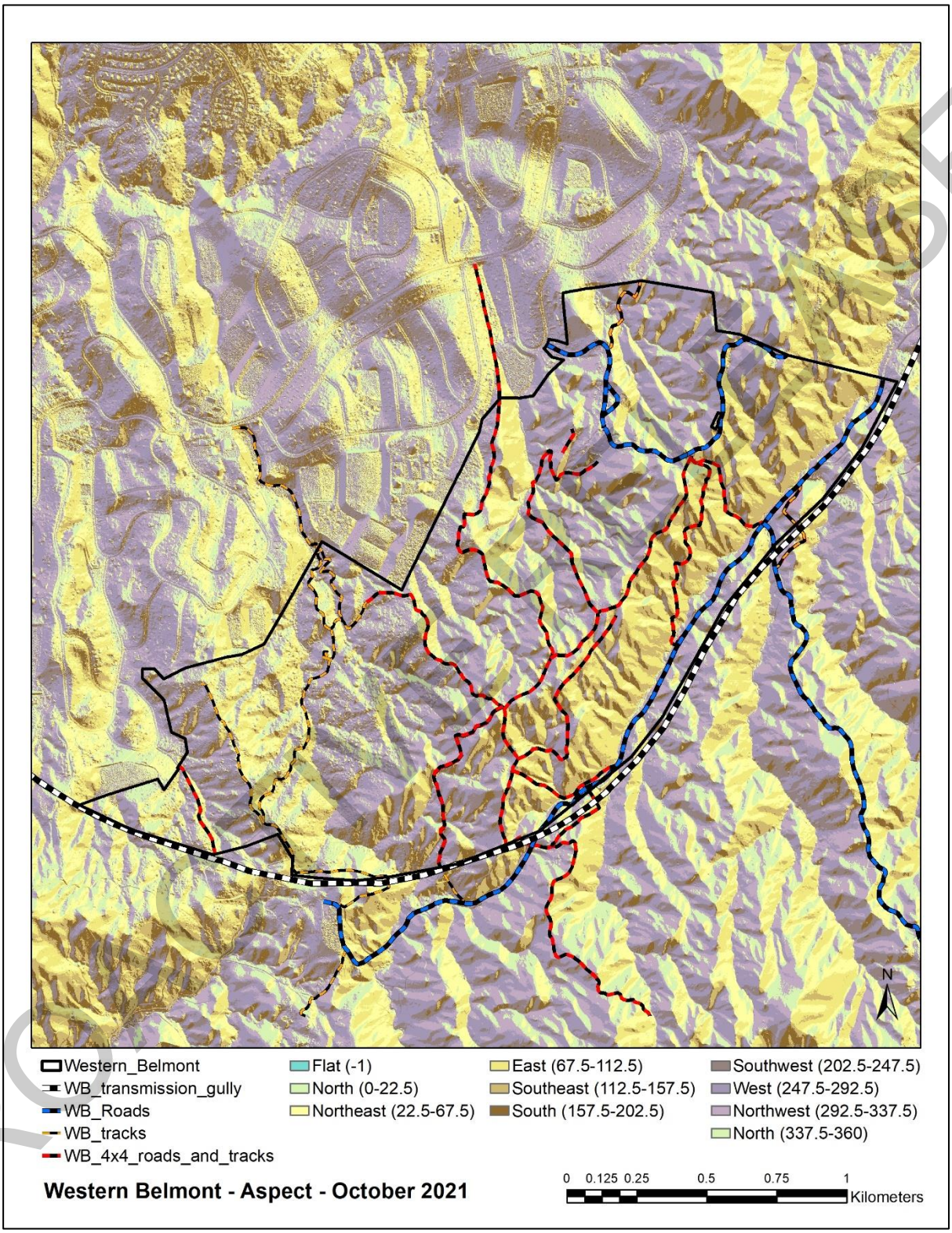
Figure 2: Titahi Bay wind rose



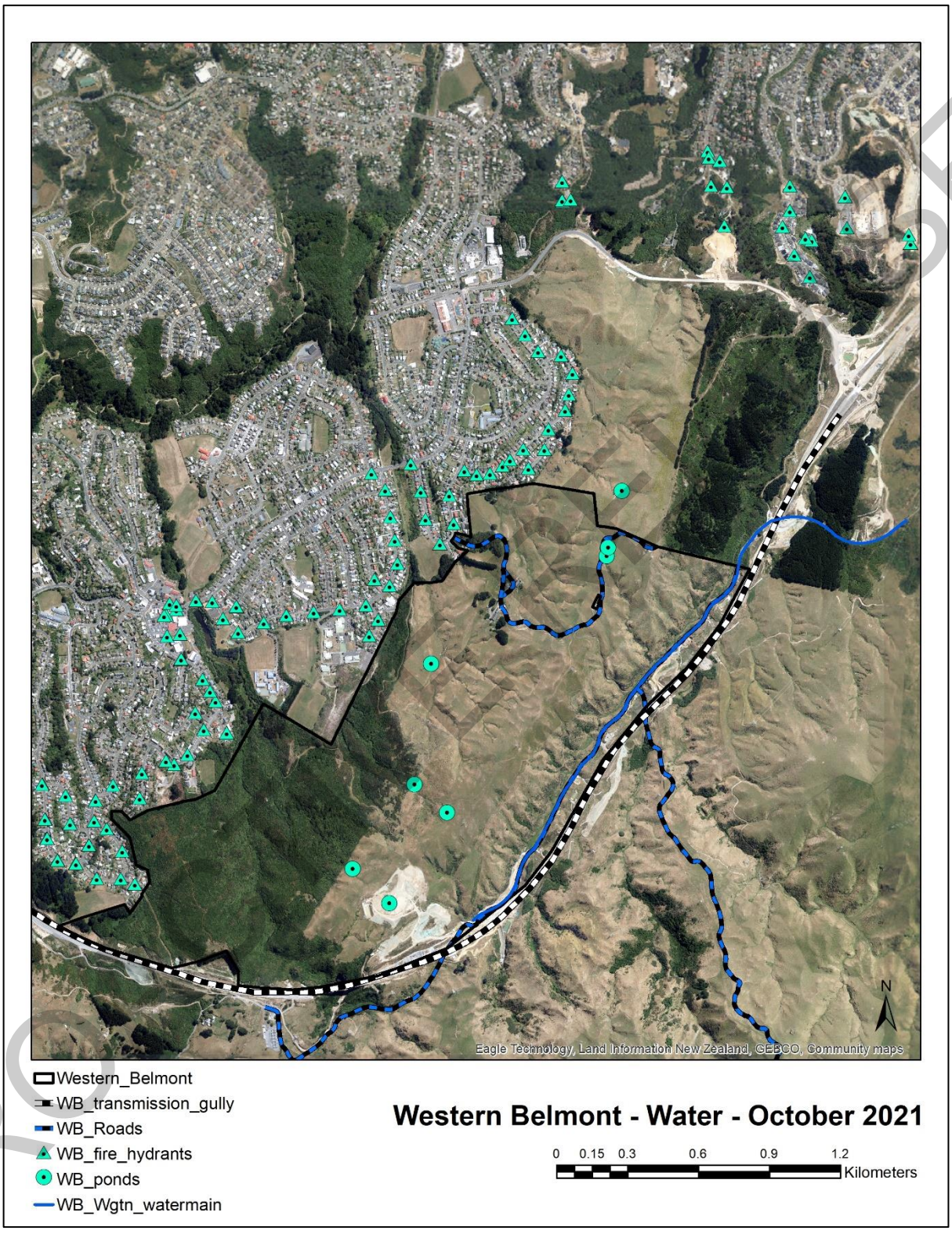
13.6. Appendix 6: Slope steepness map



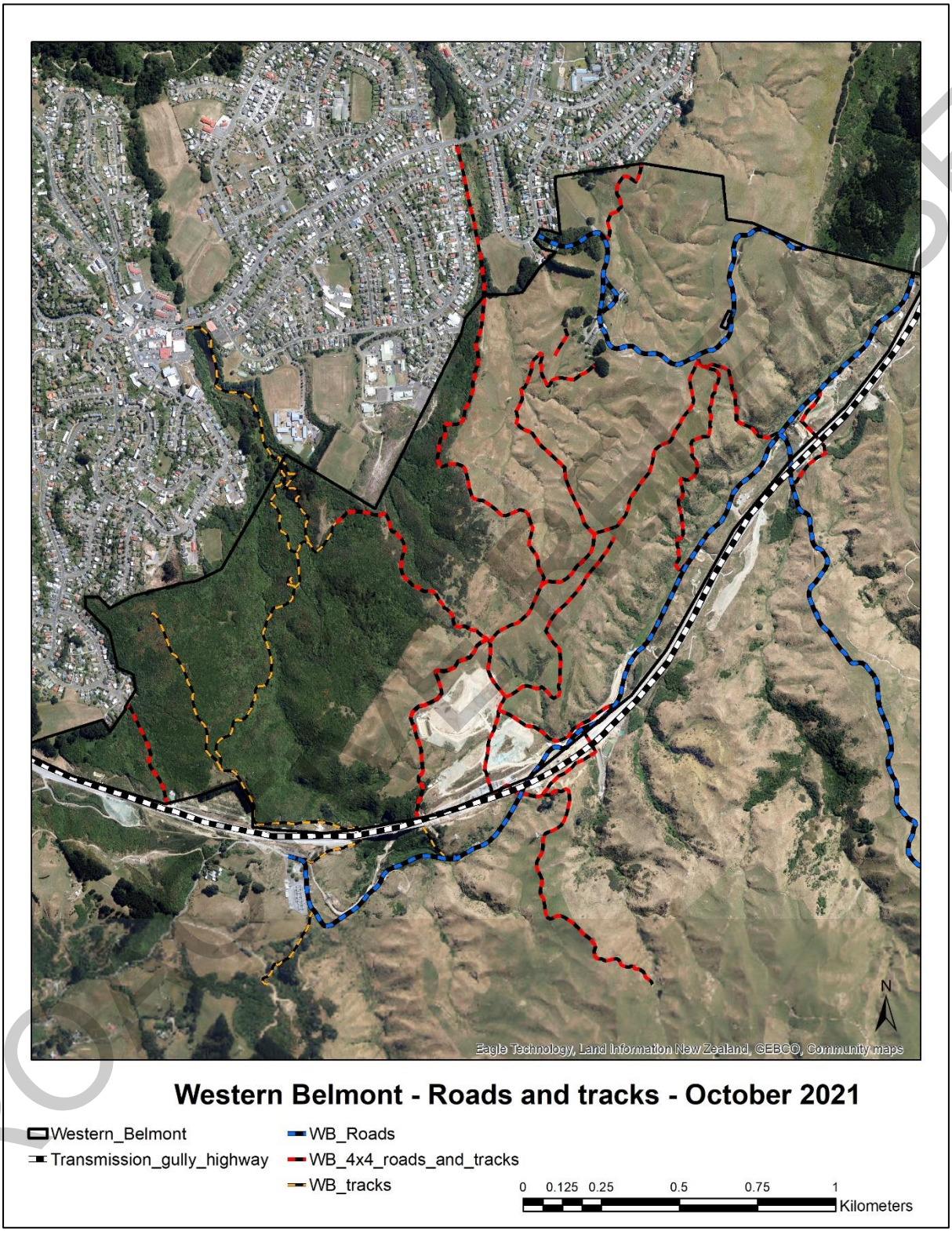
13.7. Appendix 7: Terrain aspect map



13.8. Appendix 8: Water supply locations map

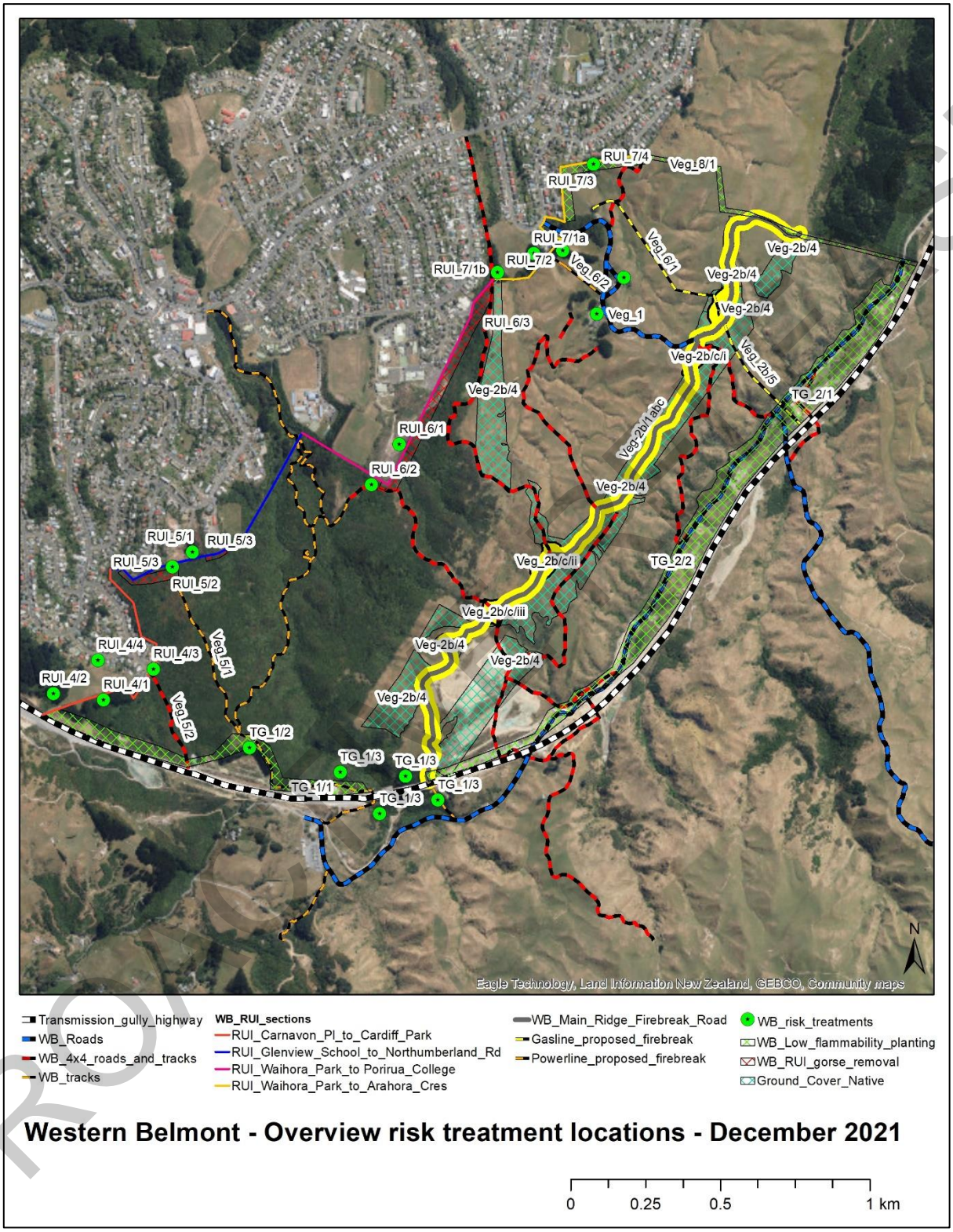


13.9. Appendix 9: Road and track layout map

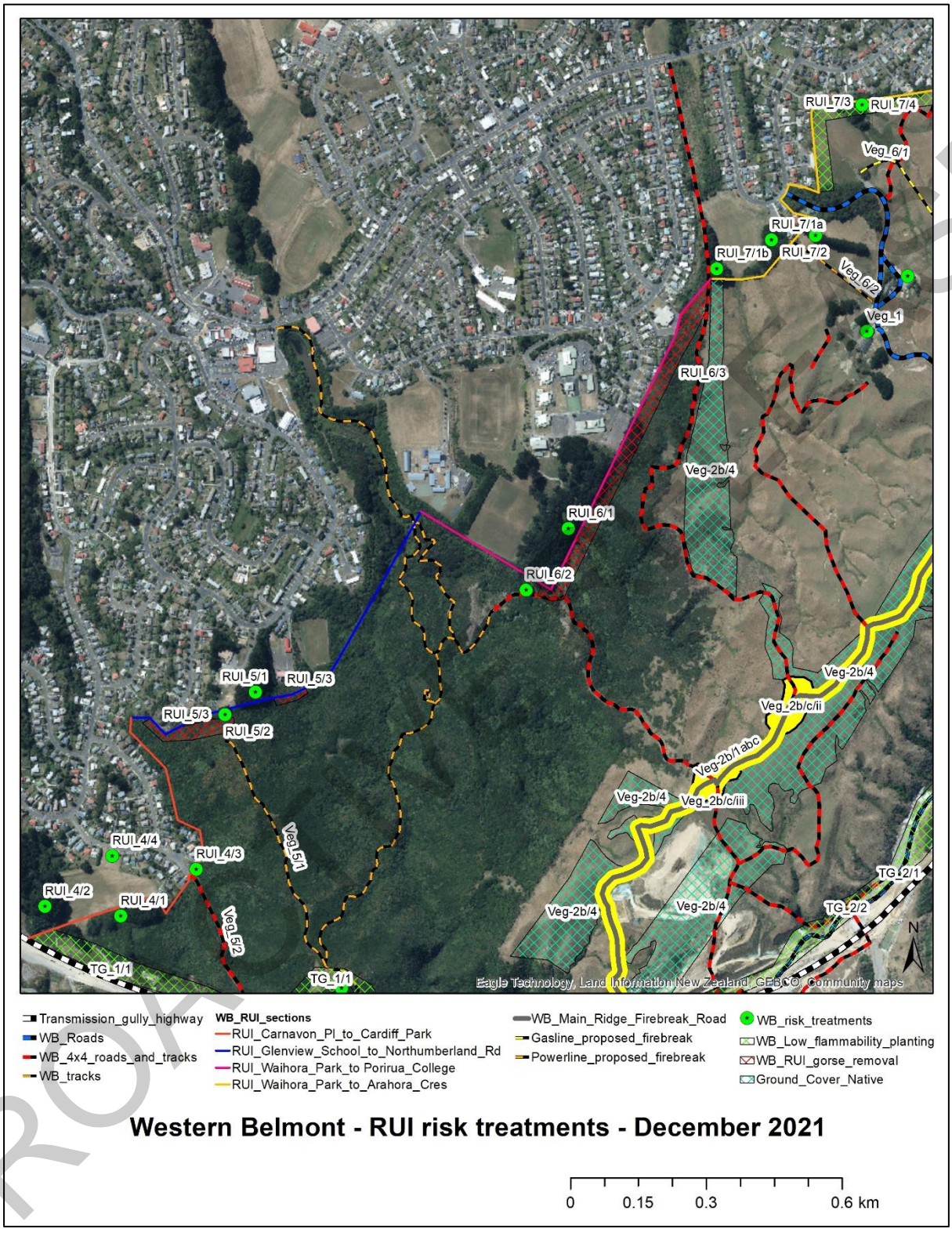


13.10. Appendix 10: Risk treatment location maps

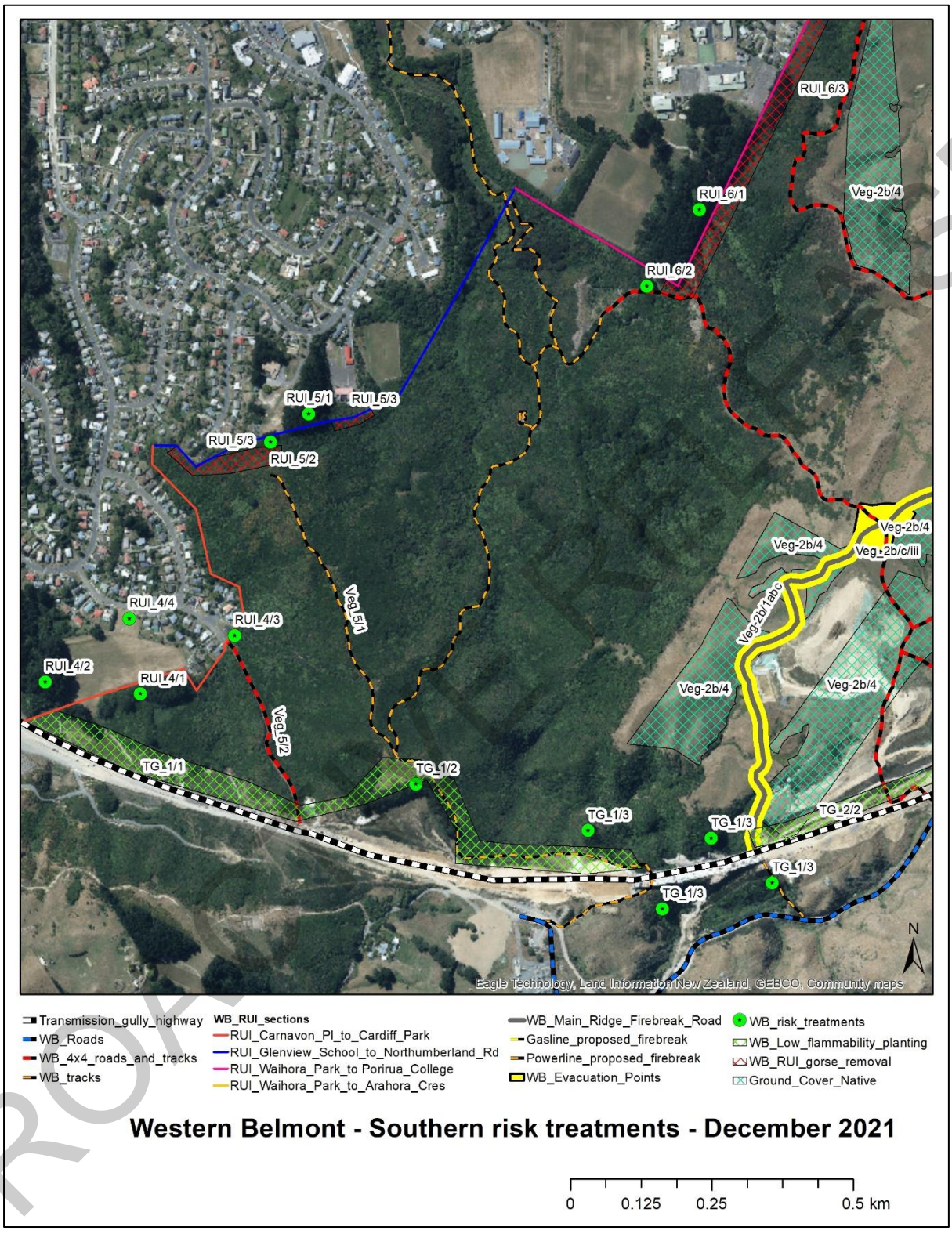
Risk treatment locations overview



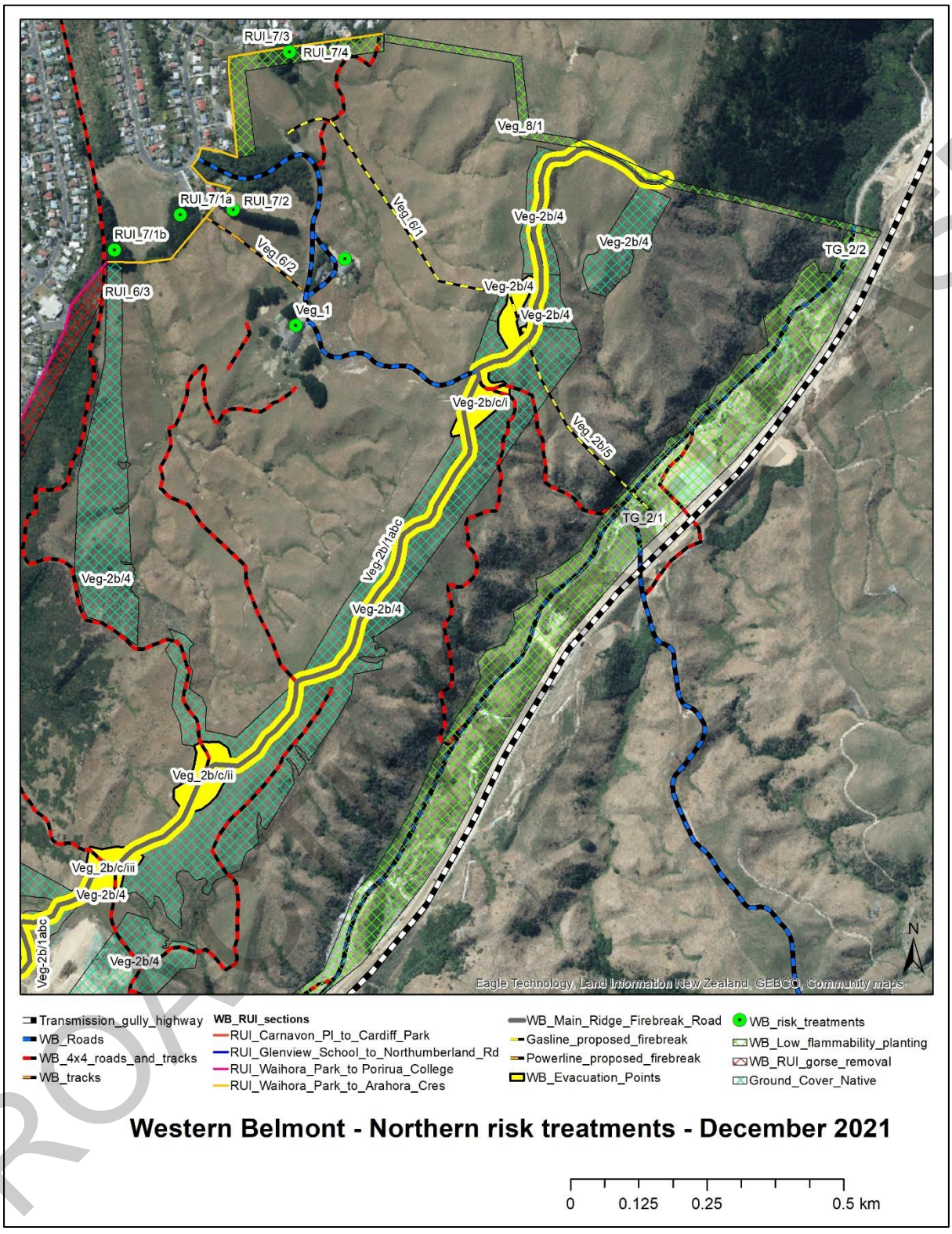
RUI risk treatment locations



Southern section risk treatment locations



Northern section risk treatment locations



13.11. Appendix 11: Risk level matrices

Table 19: Likelihood of ignition and spread

Likelihood of ignition and fire spread matrix						
Descriptor	**Description**	**Number of days in a month that fire danger is Moderate to Very Extreme**				
		30/31	**24 - 29**	**16 - 23**	**7 - 15**	**1 - 6**
Almost certain (5)	Expected to occur one or more times every year.	**100.0**	**92.9**	**74.0**	**51.0**	**30.0**
Likely (4)	Expected to occur once every two years.	**89.9**	**83.5**	**66.5**	**45.8**	**27.0**
Possible (3)	Expected to occur once every three to five years.	**49.9**	**46.4**	**36.9**	**25.4**	**15.0**
Unlikely (2)	Expected to occur once every six to ten years.	**19.9**	**18.5**	**14.7**	**10.1**	**6.0**
Rare (1)	Expected to occur once every eleven to thirty years.	**9.0**	**8.4**	**6.7**	**4.6**	**2.7**

Table 20: Consequence level

Consequence level					
Consequence level	**Wildfire ignition and spread**	**Evacuation opportunity and safety zones**	**Level of harm to people**	**Level of property damage (losses)**	**Level of environmental, cultural and historic damage (losses)**
Catastrophic (6)	Location of ignition and the subsequent fire spread will impact values in a very short time.	No time to evacuate, and no adequate vegetation clear areas that could be used as safety zones. Burn-over of people will most likely occur.	Multiple fatalities. Search and rescue involvement. Incident investigated by coroner.	Greater than $10 million.	Permanent loss of nationally significant values
Extreme (5)	Location of ignition and the subsequent fire spread will impact values in a short time.	There is little time to evacuate and no adequate vegetation clear areas that could be used as safety zones. There is no place for people to shelter from an advancing fire, or little time to move sufficiently away from it to a safe location. Access/egress may only be one way in and one way out as well as narrow roads and traffic congestion.	Multiple fatalities. Search and rescue involvement. Incident investigated by coroner.	Between $5 and $10 million.	Permanent loss of nationally significant values
Major (4)	Location of ignition and the subsequent fire spread will impact values in a relatively short time .	There are vegetation clear areas of sufficient area, and time to re-locate to them, or to evacuate to somewhere clear of a spreading fire. People who are not particularly mobile may not move fast enough to a clear area or are unable to evacuate quickly. Access/egress may only be one way in and one way out as well as narrow roads and traffic congestion.	Single person fatality or major injury to multiple (more than 3) subjects. Search and rescue involvement. Incident investigated, possibly by coroner.	Between $500,000 to $5 million	Permanent loss of regionally significant values
Moderate (3)	Location of ignition is somewhat away from values and may develop sufficiently to cause damge. Subsequent fire spread may eventually cut off evacuation routes.	Generally there is time to evacuate or move sufficiently away to a safe location. People may be impacted if travel away from a fire is difficult, including very narrow roads and/or traffic congestion, steep up and down tracks or zig zagging tracks, poor track surface, no track. A fire may cut off their evacuation route or some peoples mobility may result in slow evacuation.	Serious injuries to an individual requiring rescue party, or moderate injuries to multiple subjects. Incident investigated. Medical treatment required, including immediate off site assistance, e g., follow-up emergency medical treatment. Incident reported.	Between $50,000 and $500,000 million.	Significant damage with long term recovery time required (>20y) or district level losses.
Minor (2)	Direction of fire spread is not aligned for a direct impact on values, or a fire is unlikely to develop sufficiently to cause too much damage to nearby values, however dense smoke and ash maybe dispersed over or near them, or a flanking	People would either evacuate or move sufficiently away to avoid smoke and ash fallout or a flank fire impact.	Minor injuries requiring first aid treatment - managed by those on site, e.g., minor cuts and bruises. No incident follow-up.	up to $50,000.	Moderate damage with medium term recovery time required (up to 20y) or local level losses.
Insignificant (1)	Direction of fire spread disperses low density smoke over values, or values are well away from a spreading fire and are not directly effected. Visual only	People do not need to take evasive action to protect themselves. Evacuation may be precautionary in situations where people have existing health issues. People may continue to go about their activities.	No injuries, "fright factor". No incident follow-up.	Minor or no cost	Minor damage only - short recovery time.

Table 21: Risk level

Risk levels							
Likelihood level	Almost certain (5)	Medium	Medium	High	Very High	Very High	Very High
	Likely (4)	Low	Medium	High	High	Very High	Very High
	Possible (3)	Low	Medium	Medium	High	High	High
	Unlikely (2)	Low	Low	Medium	Medium	High	High
	Rare (1)	Low	Low	Low	Medium	Medium	Medium
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Extreme (5)	Catastrophic (6)
	Consequence level						

Restoration Plan

Belmont Regional Park

NZ0122042

Prepared for
Greater Wellington Regional Council

03 November 2022

Cardno

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Document Information

Prepared for	Greater Wellington Regional Council
Project Name	Belmont Regional Park
File Reference	NZ0122042
Job Reference	NZ0122042
Date	03 November 2022
Version Number	3

Author(s):

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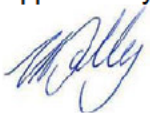
Approved By:



Vanessa Dally Water and Environment Manager		Date Approved	17/12/2021

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
1	17/12/2021	For Client Use	Hayley Swan & Helen Armstrong	Astrid van Meeuwen-Dijkgraaf
2	09/09/2022	Draft for Review	Hayley Swan	Vanessa Dally
3	03/11/2022	Issued	Hayley Swan	Vanessa Dally

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1 Introduction

Cardno now Stantec was engaged by Greater Wellington Regional Council (GWRC) to produce a restoration plan that acts as a supporting document to the Recloaking Papatūānuku Technical Restoration Guide (RPTRG) and the Toitū Te Whenua Parks Network Plan 2020-30. Upon approval of the overarching documents (GWRC RPTRG), this restoration plan is to be read as a technical guide for site-specific implementation and to be read in conjunction with the high-level principles from the GWRC plans. Cardno now Stantec anticipate a high-level detailing of the plans will be interpreted from this technical document.

2 Cultural Values

At a high-level interpretation from the RPTRG, there is future opportunities for discussion with mana whenua to be developed during implementation to ensure values and principles are captured. This technical guide can be incorporated as a living document, to move through implementation stages and interpretation.

3 Site Description

Greater Wellington Regional Council (GWRC) has identified approximately 200ha of the Belmont Regional Park as suitable for retirement from grazing to revert back to native forest. This will contribute to the council's carbon offsetting strategy and improve biodiversity values within the park. This report addresses two areas:

- The Kilmister site, which is in the southern part of the regional park. The restoration area is 50.2ha in size and is located eastward and downstream of the Hill Road gate. It lies within the Belmont Stream catchment, which in turn is a tributary of Te Awa Kairangi / Hutt River, which flows into Te Whanganui-a-Tara/Wellington Harbour.
- The Waitangirua site, which is in the eastern part of Belmont Regional Park is now separated from other areas of the park by the Transmission Gully designation and newly constructed expressway. This area comprises approximately 133ha and is located east of Waitangirua and west of Transmission Gully.

Following *GWRC's long term plan 2021-31,* a comprehensive desktop exercise was carried out by Cardno now Stantec to produce a restoration plan for both sites. Cardno now Stantec has proposed options for planting suitability depending on site conditions with alternative planting strategies if site conditions differ from what has been recorded.

4 GIS Methodology

We have overlaid all the potential restrictions on a GIS map to identify various limitations to planting, which include the following:

- Existing tracks;
- Favoured routes as per Strava heat map;
- Height restrictions beneath pylons (provided by Transpower);
- Existing or proposed fence lines;
- Underground gas pipelines; and
- Other relevant information.

Following the analysis of existing data, we undertook a digital elevation model of the site to determine the following:

- Orientation of the slope to guide what plant species may be more suitable or successful (e.g. frost resistant on southern slopes, or drought-resistant on northern slopes);
- The steepness of the slopes;

  - Areas that could be planted by volunteers;
  - Areas that can be planted by experienced professionals; and
  - Areas that are too steep for planting.
- Potential areas of wetland (very shallow slopes and basins);
- Potential areas of lizard habitat; and
- Any other formed tracks.

The layers of the complied data have been used to propose a planting strategy that endeavours to be best suited to the site as well as creating as many opportunities as possible for volunteer planting, rongoā and other cultural species, and recreational pursuits.

5 Planting Strategy

5.1 Kilmister (South Belmont)

This site has a lot of steep-sided gullies with areas that have pronounced changes in aspect and therefore, the sunlight hours these slopes are subjected to over the winter months varies dramatically. Aspect has been used to divide this area into smaller sections for ease of planting effort, and to aid in ordering appropriate plants for each section.

From our investigations, there are very few (if any) locations that are suitable to create a wetland. On-ground conditions may differ, hence the inclusion of riparian or wetland type planting. The area calculations for the riparian areas were based on a 2m width for the stream and a 2m buffer from the stream edge. Plants immediately adjacent to the stream should be selected from the wet riparian species list. The area of wet riparian margin will be wider in shallow topography areas and may only comprise one metre on steep slopes. Species from the dry riparian planting list should be used for the remainder of the riparian areas and where the stream bank is more than 0.5m above the normal stream surface.

There are some areas where the terrain is too steep to safely access. Many of these areas align closely with existing vegetation and therefore planting is not likely to be required as it can regenerate naturally from the existing vegetation. Nevertheless, a planting plan has been provided in the event this may be required.

Track buffers have been included with a 2m no-planting area on either side of the 4WD tracks and a 1m no-planting area along walking tracks. The first 2-5m of these buffers along the tracks should not be planted with trees/grasses that will become a health and safety risk. For example, Phormium (flax) and Cordylines (cabbage trees) whose leaves become slippery and are a tripping hazard and an impediment to mowing the tracks.

5.2 Waitangirua (West Belmont)

This site is more undulating than the Kilmister site and as such, has a much less distinct aspect separation to create natural planting zones. Therefore, management blocks are based more on paddocks, which allows for the use of existing fences to implement staggered grazing retirement or staggered planting zones.

Some of these paddocks may be larger than can be planted in one season, which in this case a temporary fence may need to be erected to retire smaller sections at a time to exclude stock from the planting sites (if any stock is present).

GWRC provided existing vegetation type layers for Waitangirua, which included areas of wetland vegetation. These have been used to define areas of wetland and riparian planting with an extra buffer of 1m around these features to accommodate dry riparian planting.

There are existing buildings in the restoration area that have been excluded from analysis. Therefore, the final configuration and area of exclusion may differ from what is used for the calculations in this report. Thus, final plant numbers may differ from what has been indicated.

At present, there is consideration to create a commuter track linking Waihora Crescent in Waitangrua to Hill Road in Belmont. This will potentially require the formation of new tracks, which would impact the size of the restoration area. This will need consideration regarding planting sequence and the location of planting, so that trees aren't planted in areas needed for track works.

5.2.1 Works Commenced

As of August 2022, a section of the Waitangirua block has been implemented with 14,000 native plants. Refer to Appendix D.

Cardno now Stantec, notes that following community consultation, there is a focus for riparian areas within the catchment to be prioritised first.

5.3 Restoration purpose

The purpose of the revegetation plan for the Kilmister and Waitangirua sites is to:

- Protect and restore freshwater quality and the blue belt;
- Implement nature-based solutions to Climate Change - reduce carbon offsets;
- Protect and restore indigenous biodiversity and ecosystem health;
- Regional economic development and recovery in a COVID-19 era (provide jobs and opportunities to the community through strategic involvement); and
- Effective partnerships and co-designed agreements with mana whenua and associated territorial authorities.

5.4 Staged Planting

Planting will likely need to be staged across multiple years due to the quantity of plants required and the substantial areas of planting to be undertaken. As a general rule the lower slopes and areas that are further from accessible tracks should be planted first to minimise the movement through already planted areas. It is often easier to establish plants on the lower slopes and in gullies due to a more favourable micro-climate (generally more sheltered). These lower slope areas may then assist with providing shelter for areas that are subsequently planted.

If helicopters are to be used to deliver plants to planting sites, then the delivery areas need to remain unplanted until the helicopter deliveries are no longer needed (contractor to assess site for helicopter delivery suitability).

If there are areas where grazing is being phased out over a period of time, then planting in these areas should follow the same staggered approach using existing fencing for stock exclusion. It is recommended that retirement allows for a logical restoration pattern, e.g. retiring blocks in the southern section first and moving north.

The planting season within the Wellington Region is typically 1st April to 1st September each year, depending on weather conditions and suitability. This may be extended upon approval from GWRC and guidelines.

It is also recommended that the types of species to be planted are staggered, through planting of hardy pioneer species initially, supplemented with other less hardy species in subsequent seasons. Using this technique is the best approach to ensure a dense and full cover canopy is achieved within a relatively short timeframe.

- Year 1 planting: Planting that will take place in year 1 of the planting programme. Includes hardy pioneer species which are the first to colonise bare ground.
- Year 2-5 planting: Successional canopy planting that is typically implemented following the establishment of year 1 plants – to provide greater species diversity toward a representative coastal broadleaved forest community. This includes species to supplement pioneer planting with longer-lived species that will gradually over-top pioneer species and dominate the canopy.

Information from Wellington City Council (WCC) planting audits indicates that canopy closure in Wellington is estimated to complete a full coverage within 10 years[1].

[1] Benbrook A. 2016: Wellington City Council Restoration Audit Report; October 2016 (Draft). Wellington City Council. 41pp. Handford P.A. 2009: Wellington City Council Re-vegetation Audit. Report for Wellington City Council. PA Handford & Associates Ltd contract report. September 2009. 32 pp.

How soon (number of years after initial planting) successional species can be planted will depend on how frost or drought (including wind effects) tolerant the species are, and whether they require light gaps or shade to establish.

5.5 Planting Categories

Active restoration and natural regeneration areas have been identified where terrain and existing vegetation of the site restrict the extent of restoration planting areas.

- Active Restoration - Areas where planting can be undertaken in accessible locations to enhance the overall ecology of the site and restore the land to native forest.
- Natural regeneration - Areas where physical planting is likely not possible due to steep terrain and/or because the area is already vegetated. These natural regeneration areas can be left to restore by natural succession and self-seeding.

5.5.1 Habitat types

The following habitats were identified and mapped:

- North facing slope;
- North facing slope cluster planting (above/near areas that are too steep to safely access);
- South-facing slope (also includes south-west and west);
- South-facing slope cluster planting (above/near areas that are too steep to safely access);
- East facing slope (also includes southeast);
- East facing slope cluster planting (above/near areas that are too steep to safety access);
- Wet riparian margins or wetland;
- Dry riparian margins;
- Rocky boulders (creating opportunities for lizard habitat); and
- Under pylons/powerlines in three different height classes - up to 5m, up to 10m and up to 20m.

Refer to Appendix A for a complete species list for each habitat type.

5.5.2 Planting Sub-categories

Within the areas of active restoration and natural regeneration we have identified 4 planting sub-categories:

- Riparian planting (both wet and dry riparian margins);
- Lizard habitats;
- General revegetation (north and south-facing slopes); and
- Community/volunteer planting areas.

There is also scope to work with mana whenua to identify locations and species that would provide for rongoā and other cultural practices. These species have not been separately identified as this requires input from mana whenua. Early consultation is advised so that these plant species can be incorporated into planting areas that are readily accessible.

5.6 Species Selection

The bulk of the planting comprises plant species that are known to occur in pioneer or high light environments. Smaller numbers of plants are proposed for those species requiring more shelter that are planned for planting in 2-5 years after the initial planting (successional planting).

The plant species selection has also been refined to include or exclude species that have been noted to do well or poorly within the adjacent Transmission Gully planting.

The plant selection varies somewhat to reflect the different habitat types (e.g. northern slope, eastern slope etc) but across the habitat types includes the full range of species expected to be found on the site[2].

In areas of established indigenous shrubs, the planting should be in and around these shrubs. Where there are areas of established gorse and/or other weedy species, then transect lines should be cut through the exotic shrubs/scrub at right angles to the prevailing wind so that the exotic species provide shelter to the plants for establishment purposes. These transect lines should be no more than 2-3m apart. If there is no specific prevailing wind direction, then lines should be cut along the contours of the slopes.

5.6.1 Culturally Important Species

Some of the species that have been included may be of cultural importance; however, it is likely that additional species could be identified and preferred by iwi. For medicinal/rongoā species, it would be more suitable if these were planted within 20m of access tracks to enable easy and safe harvesting from the public in the future. At this stage in the design, we have not proposed any species that are of significance or importance to iwi. Any iwi specified planting requirements would be included as part of the implementation phase.

5.6.2 Specialist Plants

The Pareraho Forest Trust and GWRC have developed a list of specialist plants to be included in restoration projects. The aim is to establish these species within restoration areas with support from the community to source and raise them. The Pareraho Forest Trust would like to see the inclusion of the following species. If these species are planted, it will increase the local biodiversity and establish species that are not commonly planted:

- Kaikomako;
- Kohekohe;
- Poataniwha;
- Toro;
- Mountain Alseuosmia;
- Prickly mingimingi;
- Rata (species dependant on location suitability); and
- Various wetland species (where applicable).

These plants have been adopted into the planting specifications in the habitats for which they are best suited, with the exception of prickly mingimingi, which has a low planting success rate. If prickly mingimingi is to be included then it will need planted as a successional species and will likely still not have high survivorship. It is recommended that if this plant is to be included then it should be grown on-site to ensure better site acclimatisation.

5.6.3 Plant Schedule

Refer to Appendix A for plant schedules. These schedules identify the appropriate species for the different habitat types shown in Appendix B and C.

5.7 Plant Survival

Ideally plant survival would exceed 80%. Where plant survival within an area is less than 90%, or there are areas more than 5m in diameter where planting has failed, then replacement planting will be required. If a particular species fails to thrive (either at a site scale or within pockets) then suitable replacement species need to be determined and planted.

In addition to putting fertilizer tablets in the base of the planting holes (Section 7.2.5), to ensure good plant survival and establishment during the first few years, additional aerial fertiliser spray applications are recommended 1-2 years after planting to ensure plants get an additional booster during the initial establishment period.

[2] Determined from plant species lists for nearby areas.

5.8 Planting Implementation

5.8.1 Professional planting

Many areas are unsuitable to be planted by volunteers and should be planted by professional planters with the best horticultural practices to ensure good plant survival and establishment rates. The identification of suitable area boundaries (e.g. south facing, or riparian areas) for regularly spaced planting and/or cluster planting will be the responsibility of the professional planters in consultation with the project lead.

5.8.2 Community Involvement

Much of the terrain in the Kilmister block is steep and some distance from tracks; however, some areas have been identified that may be suitable for planting by volunteers. There are one or two locations near the existing 4WD track. There may also be opportunity for volunteers to be involved in track side planting alongside the walking and access tracks.

Waitangirua has a much more suitable terrain for the inclusion of volunteer planting and there are multiple potential areas around the site.

Through community consultation, the Pareraho Forest Trust and GRWC established that the community could be involved in more than just planting days by providing opportunities for seed collection and growing of the rarer species. Focusing on speciality plants, rather than quantity of plants, will ensure a valuable contribution to the project and wider community without overstretching budgets, time lost (compared to professional planting rates and time) and other contributing factors.

Waitangirua could potentially provide a location for an on-site nursery for this activity and hardening off of plants that can subsequently be used in the replanting efforts.

6 Pest Control Management

Ongoing sustained management and control (monthly basis for pest plant control and fortnightly until controlled for pest animals) are highly recommended as a methodology of control as it is proven to increase plant survival rates and ensure planting areas achieve a greater coverage overall.

Secure stock fencing with stile access for pedestrians/cyclists is recommended. This will reduce the likelihood of stock accessing the site and eating the plants. Where vehicle access is required along 4WD tracks, gates can be installed with the requirement to close gates after use. Substantial browse by pest mammals or stock could mean the site will not achieve canopy closure, full coverage, and carbon offset targets.

Pest plant and pest animal species, and the required levels of management are described in the GWRC Pest Management Plan 2019-2039.

6.1 Pest Animal Management and Control

6.1.1 Methodology

Rabbits, hares, stoats, possums, deer, goats, and pigs are the predominant pest animals present within the Belmont Hill area and regular culls, trapping and poisoning are recommended. Pukeko can also cause significant damage, especially in newly planted and wetland areas, by pulling plants out of the ground. Any plants that have been affected by pest animals will need to be rectified. If the plant is not dead it can be left in its current condition to recover, if a plant has been pulled out of the ground and is not yet dead, the plant can be replanted. However, any plants that have been killed or browsed completely need to be replaced with new plants within the next planting season. Below is a recommendation for the following pest animal control methodologies:

- Completely fence off the site with appropriate fencing to ensure pest animal numbers do not increase during the course of the plant establishment. Frequent culls (shoots) are recommended within the site boundaries to ensure plants establish without major competition.
  - Stock proof fencing (conventional post and batten 8 wire) around the areas or no stock access to the wider area.
  - All of Kilmister site is fenced, should any additions or breakages occur, replacement fencing as above is recommended to reduce the chances of pest animals entering the site.

  - Most of the Waitangirua site is already fenced and existing fences can be used to ensure stock (if any) are excluded from planting sites.
  - If larger areas (within pastured land) need to be planted over several years, then well maintained temporary electric fences could be used (if stock are present).

> Reduce the density of pest animals prior to planting by carrying out a number of culls in the area. Ensure there are low pest animal densities before planting.

  - Fortnightly shoots and trapping (recommended during the site preparation before planting begins) – requires the site to be closed to public access [suggestion: fortnightly checks of planted areas are required to assess whether pest animals are impacting the planting.
  - Should there be evidence of damage by browsers then appropriate control activities will need to be taken. This may include the following:
    - Increasing the density and/or servicing frequency of bait stations and/or traps.
    - Giving 48 hours' notice of closing the park and undertaking a browser shooting event.
    - Organising a browser rounding up event (e.g. for goats).
  - Install, monitor, and clear traps (rabbits, hares, possums, rats, stoats etc) regularly (as per accepted best practice – refer to the Department of Conservation website[3]).
  - Where appropriate consider the use of bait stations or self-resetting traps to reduce labour and time requirements.

> Apply treepel (browsing repellent, or similar) to all plants after planting, with further applications every three months or so for the first year to ensure minimal browsing occurs.

> Ongoing trapping for all pests including, rabbits, hares, possums, stoats, rats, ferrets, weasels, hedgehogs etc.

> Use with combiguards around the plants (this will reduce pest animal damage, minimise competition with pest plants/long grass and provide additional protection from extreme conditions and provide shelter).

6.1.2 Control operations

The public and all personnel around the site shall be formally notified of any pest animal control activities at least 48 hours prior to chemical applications and/or professional hunting operations. This will include giving notification to the relevant local authority and putting up warning notices during cull operations.

6.1.3 Carcass Removal

The contractor shall collect carcases where recovery is practical, especially during all professional hunting operations and dispose of carcasses at licensed landfills.

> Fortnightly shoots – shut down the site to the public; and

> Install, monitor, and clear traps regularly.

6.2 Pest Plant Management and Control

Pest plant control should be undertaken prior to planting, during site preparation and post-planting during the establishment period (which may be up to 10 years). All planting areas are to be thoroughly cleared of pest plants prior to planting in order to eliminate any plant competition.

Pest plants are as defined in the Regional Pest Management Strategy. Plant pests should be regularly controlled, and the site monitored to achieve healthy plant establishment. The aim for all planted areas is to have all perennial weeds eradicated and annual species well controlled so as not to compete with any planting or pose a long-term risk to plant establishment.

Gorse is not required to be removed in the upper catchment areas. It can be managed as a pioneer nurse crop, as it provides good shelter and acts as a colonising plant for successional plants. It can be selectively cleared in transects into which native plants will be planted. See Appendix A for the planting plan.

[3] https://www.doc.govt.nz/nature/pests-and-threats/methods-of-control/ground-control/

Any indication of blackberry present is advised to be eradicated as soon as possible to minimise outbreak, where possible.

6.2.1 Methodology

Regular maintenance and control of pest plants is advised to ensure minimal plant competition and increase plant survival rates. Below is a recommendation for the following pest plant methodologies:

- Monthly maintenance visits from the contractor/council to monitor and manage any urgent works required;
- Spot spraying prior to planting (there is a stand-down period prior to planting);
- Slash spot circles are an alternative to spot spraying, planting can commence following slashing, provided plants are planted with combiguards;
- Removal of pest weeds where it is obstructing potential of restoration planting; and
- Hand releasing of long grass where applicable.

6.2.2 No Spray Zones

Identification is required for no spray buffer zones to ensure waterway restrictions are followed. Hand releasing of plants and slash spots is recommended in these areas.

6.3 Biosecurity

It is important for the future success of the restoration area that there are no unwanted organisms brought onto the site. This includes the planting or establishment of environmental pest plants, that there are no introductions of animals to site that would unnaturally establish dominance in the area, and that no unwanted organisms are inadvertently (or otherwise) brought on-site by contractors, volunteers, or staff.

6.3.1 Environmental pest plants

Ensure that plants supplied for this project are the correct species (i.e. native toetoe rather than pampas grass) and any species that are mistakenly brought to the site are promptly removed. This includes plants that are not locally native to the Wellington Region such as Pōhutukawa (*Metrosideros excelsa*), karo (*Pittosporum crassifolium*), pūriri (*Vitex lucens*), or karaka (*Corynocarpus laevigatus*; except for cultural purposes).

6.3.2 Animal translocations

Ensure all plants (and work gear) coming onto the site are free of unwanted pest animals. This includes ensuring animals such as plague skinks are not being moved onto the site (eggs and these small lizards can hide in potting soil) where they would quickly outcompete any native skinks in the area.

6.3.3 Unwanted organisms

Ensure checks are undertaken of any machinery (and vehicles) that are coming onto site. Gear must be cleaned before being brought onsite if it has been used prior at another site.

7 Site Preparation and Implementation

7.1 Clearing of indigenous vegetation for enrichment planting or access

Where clearing of vegetation is required for access tracks or cutting transects for planting as shown on the plan, the aim is to minimise vegetation clearance. Planting into closed-canopy scrub requires cutting into existing closed-canopy vegetation (indigenous scrub or gorse scrub) with the minimum amount of clearance to enable planting of successional species.

Prior to vegetation clearance, appropriate analysis and methodology should be discussed identifying the direction of the wind and suitable transect locations as described in 5.6 Species Selection. Species to be cut will be the most commonly reoccurring (tauhinu/olearia/māhoe/kānuka) rather than other less abundant successional species. Minimising perimeter clearance will ensure clusters of plantings are sheltered by plants along the outside edge of an area being cleared.

Salvaged debris will be kept whole as much as possible to ensure a slow breakdown into soils while plants become established. This will also provide an opportunity for cut transects to naturally regenerate from existing vegetation. Salvaged debris can also be used to assist with revegetating hard to plant areas. Laying the cut branches on the ground can suppress grass and weed growth and establish micro-climates for indigenous seed germination.

Salvage Method	Scrub/low shrubs
Description	Colonising shrubs (e.g. tauhinu, olearia, māhoe, kānuka) in open pasture or closed canopy scrub
Objective	Re-use whole branches (slash) or mulch to • Improve soils on disturbed/constructed areas to promote healthy plant establishment • Create surface microclimate and seed source to promote natural regeneration from local seeds
Method	1.a. Cut off at ground level OR 1.b. Mulch – if space constraints and programme preclude direct transfer 2.a. Direct transfer to the final location
Final location	Revegetation areas where applicable

Table 7-1 Salvage method for indigenous vegetation clearance.

7.2 Planting Implementation

The planting plan has been developed from a desktop exercise and as such the planting polygons and total planting area should be used as guidelines for undertaking planting. Final assessments must be made on-site for planting suitability (i.e. if the hillside is too steep to safely plant by hand then switch to cluster planting for that area, or use salvaged debris if available).

7.2.1 Site Preparation

Prior to planting, extensive pest plant and pest animal control is required to ensure that minimal pests are present. The site should be prepared as set out in sections 6.1.1 and 6.2.1

7.2.2 Plant Quality

All native plants need to be sourced from the Wellington Ecological District as far as practicable. All plant material needs to be first class specimens of nursery stock, being:

> True to name and type with well-developed and well-shaped trunk or stem and head. They need be well hardened off to cope with the climatic conditions of the site and free from pests and disease;

> The roots need have a high percentage of fibrous roots that are just touching the edge of their containers. Plants with roots that are wound round their containers in a circular fashion will need releasing prior to planting; and

> Plants need be free from disfiguring knots, bark abrasions, wind or freezing injury or other disfigurements and in a healthy and vigorous condition.

It is advised that the supplying nursery is visited prior to the plants being delivered to the site to check the condition of the plants and that the correct species are being delivered.

7.2.3 Plant Substitutions

In exceptional supply shortages, plant substitutions may be considered by GWRC. The supplier needs to discuss potential substitutions with the GWRC project manager at least two weeks before delivery to site. Only those species approved by the GWRC project manager as substitutions will be accepted. All plant substitutions shall be of a similar height and habitat to those specified and are suited to similar environmental conditions.

7.2.4 Combiguards and Matting

Best practice is the use of combiguards/sleeves with coir matting where possible to protect plants from rabbits and hares, suppress grass growth and retain moisture. Sustainable and biodegradable combi guards are encouraged during implementation. Where possible, it is recommended that materials are recycled and reused, further preference and supply shall be confirmed with GWRC during early stages of procurement.

7.2.5 Fertiliser

All plants should be planted with controlled, slow-release fertiliser of composition 6:15:3 (N: P: K) such as, 'Grotabs' or similar.

Fertiliser needs to be applied during the planting of each plant at the rate of 12g or 1x tab for 1.5-2.5 litre pots, 30g or 2x tabs for 5-litre pots and 100g or 3x tabs for 35-litre pots. Fertiliser tabs are to be placed at the bottom of the planting hole and backfilled with a small amount of native soil prior to placing the plant in the hole. Care needs to be taken to avoid the roots having direct contact with the fertiliser.

It is recommended that an additional application of fertiliser is applied to the plants 2 years following the planting to ensure plants receive an additional booster of nutrients if plants are struggling to establish. This could be by way of aerial top-dressing.

7.2.6 Wetland Planting

Wetland planting is to be carried out in areas where identified on the plan, or in appropriate locations determined by the ground crew. Wetland planting needs to be carried out in spring (August through to late October) when plants are emerging from dormancy and the water temperature is starting to rise.

No fertiliser is to be used in wetland planting that will be growing in water.

Plants are to be planted in water no deeper than 100mm, a minimum of 150mm of plant foliage shall extend above the water level. Plants shall be firmly planted to a depth of 40 to 70mm to anchor the plant so that they are less prone to uprooting and do not float out when the water levels are raised.

If Pukeko birds are present, the aquatic plants and grasses need to be pinned with "U" shaped wire pins 300mm long to ensure they do not get pulled out. If plants are pulled out, urgent replanting will be required as soon as possible, as well as the removal of pest animals.

7.2.7 Implementation

All plants need to be thoroughly watered a few hours prior to planting to promote successful establishment. All planting shall be performed by experienced ground crews (where prescribed) in accordance with the recognised best horticultural practices.

All plants need to be placed with the main stem vertical and at such a depth that the soil when firmed down is at the same height as the earth marks on the stem from the soil level of the container. Loose roots shall be spread out naturally; the soil being carefully placed under and amongst them to fill all voids and firmed in.

The bottom of each hole shall be pierced to a depth of 200mm with the tines of a fork or similar implement to ensure compactions are loosened for root penetration and free drainage. Fertiliser shall be applied to the base of the dug hole in accordance with 7.2.5 above.

7.2.8 Spacing

To reduce ongoing maintenance costs, pioneer plants need to be placed at approximately 0.6m centres for Carex, Cyperus, Juncus, Tetragonia and Aciphylla, and 1m centres for all other species. This dense spacing is likely to achieve 100% canopy cover quicker, which will result in reduced weed control requirements. Later succession plant species should be planted at approximately 5m intervals (Figure 7-2-8).

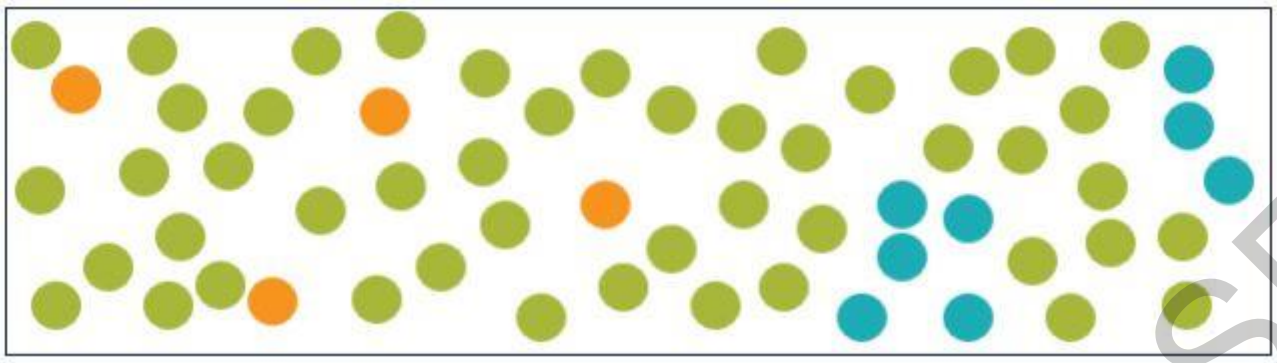


Figure 7-2-8 Example of plant spacing to achieve desired spacing within a planting area. Across all of the plants, the average desired spacing is achieved.

Enhancement species, in orange (Figure 7-2-8), are separated by approximately 5m from other enhancement species because these will grow taller or wider than pioneer species. Small groups (in aquamarine) are separated from other groups by approximately 5m and achieve the desired spacing within a group (i.e. 0.6m 1m centres). Species that are planted in later years are planted into small gaps and/or where other plants have not been established.

7.2.9 Planting near walking and 4WD tracks

In order to allow tracks to remain clear and free of debris, there will need to be a margin of 1m on either side of a walking track and 2m on either side of a 4WD track that is not planted. In addition, no Phormium or Cordyline species are to be planted within 5m of either track. The leaves from these plants can be very slippery and can cause issues for traversing the track, track maintenance and mowing.

7.3 Post Planting

Following the planting of areas, monitoring will be required by the contractor monthly until plants have created an acceptable coverage GWRC approves of. The contractor needs to maintain the restoration area for at least 3 years from completion of all planting within each area. Maintenance relates to work associated with rectifying any defects and maintaining the planting to completion of the recommended period.

All areas need to be kept free from noxious and invasive weeds and grasses that may impede plant growth. Refer to the Regional Pest Management Strategy for further information on pest plants.

In addition to routine maintenance, the planting areas need to be monitored and responsive maintenance and repairs implemented as necessary. This includes repairs following storm events, after prolonged dry or wet periods and damage from pest animals.

8 Recreation Opportunities

Enhancing the local ecology of the site aims to increase the use of the existing park tracks by creating further opportunities for bird sighting/watching and amplifying current viewpoints that overlook the valley. There is an opportunity to support local harvesting of medicinal/rongoā plants by implementing a zone where these plants are accessible, and close to the public carpark and near the access track.

Pedestrian/cyclist access may be required if the proposed fence intersects any existing tracks within the park.

There are opportunities to create further walking and biking tracks throughout the regional park, with high points around transmission towers as potential viewpoints into the wider landscape.

8.1.1 Interpretation of proposed works from the community

Within the Kilmerster block; recreational, pest management and photo points have been identified on the map, incorporating community feedback to integrate retired areas within the wider Pareaho tracks network. The below figure annotates the communities' visions and values for the park.

Indicators:

- A – Pareraho Trust have established a picnic area with bench seat and have planted trees to support the existing environment.
- B – Improved river crossing with suitable plant selection for tracks proposed.
- C – Gorse has been cleared from the stream. Suitable plant selection for tracks proposed.
- D – The Pahero Trust have planned to place a bench seat with suitable planting here, to maintain a viewpoint, with information boards on the land retirement and photo point project.
- E – Gorse has been cleared from stream at a swimming spot, suitable plant selection for tracks proposed.
- F – Proposed bench seat.

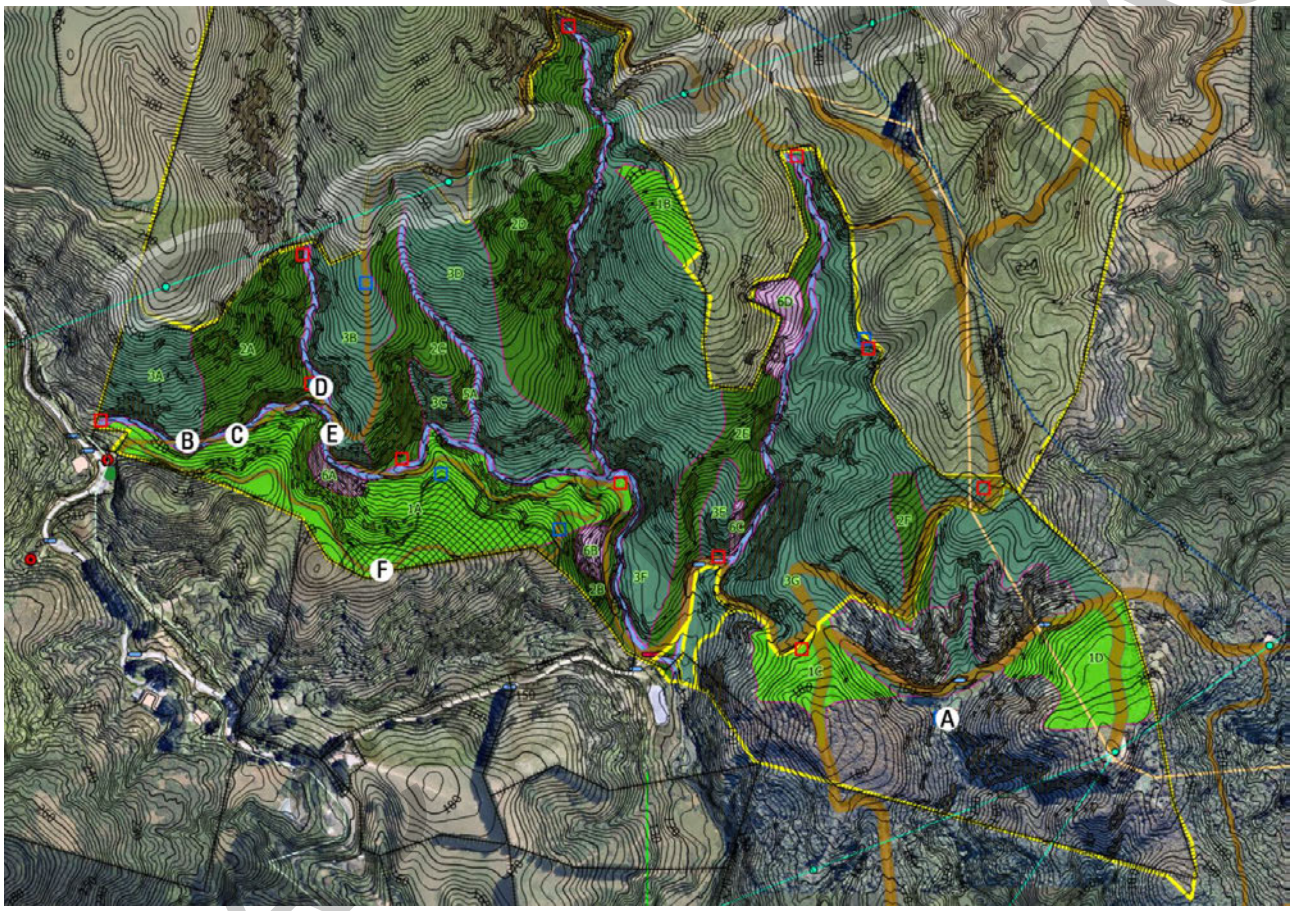


Figure 8-1-1 Proposed recreation opportunities from Pareho Trust at Kilmister. Refer to Appendix B for further detail.

9 Social Procurement

9.1 Community Engagement

9.1.1 Community Led Engagement

There is an opportunity to encourage community engagement and involvement within the project, creating job opportunities by collecting seeds for plant propagation, setting up a community nursery in one of the old farm sheds, and involving key members from GWRC to assist and supervise the nursery's production. Once plants are at an appropriate grade, the community will have a chance to become involved in the physical planting of the species in appropriate areas.

Going forward into the establishment period of the planted areas, there is further opportunity to involve the community in maintenance/weeding and harvesting of medicinal/rongoā plants. This involvement creates a sense of well-being, identity, and ownership, while enhancing the connection the community has with the area, instead of irregular planting days. It creates a sense of unity and 'we did this' rather than 'the council did this'.

It is also possible to create opportunities for the community to be a part of the consultation process and assign them tasks within the scope of the restoration plan. This would further encourage the community to be a part of the process and foster community responsibility for the site in the future.

9.1.2 Collaboration with Contractors - Upskilling

Additionally, there is an opportunity the community and contractor could work together and upskill the community knowledge as well as provide local jobs. Sharing the role of implementation between local communities and contractors, encourages improvement to government services and social service providers.

9.2 Broader outcomes

As GWRC aims to achieve further carbon reduction targets, contractors involved with the project are recommended to demonstrate how they would minimise emissions (through the use of electric vehicles and machinery) and record emission data for council requirements. As the site stands, it is clear that full use of electric vehicles may not be applicable throughout as 4WD vehicles may be better suited for access in the challenging terrain.

The procured contractor shall consider the Emissions Trading Scheme (ETS) and carbon credit offsets during contracts and shall be coordinated with council guidelines and expectations. At this stage, species in the planting schedules do not have more value over another in terms of carbon credits. Shall the carbon capture change during the course of implementation, then applicable species shall be discussed with the council and incorporated where appropriate.

10 Community Consultation

A community consultation was held Tuesday, 17th May 2022 at the Helen Smith Community Room, Pataka Hub, Porirua with the following parties:

- Greater Wellington City Council
- Cardno now Stantec
- Porirua City Council
- Hutt City Council
- Pareraho Forest Trust
- Ngahere Korowai / Wesley Community Action
- Friends of Belmont Regional Park

The purpose of the consultation was to receive feedback following the draft issue of this restoration plan and coordinate a further understanding of this document's role in the wider GWRC parks plan network. As it stands, this restoration plan is to be read as a site-specific technical guide in coordination with the overarching documents Recloaking Papatūānuku Technical Restoration Guide (RPTRG) and the Toitū Te Whenua Parks Network Plan 2020-30, which contain the high-level principles for regional parks. This technical guide can be incorporated as a living document, as it moves through implementation stages and interpretation.

Feedback received was predominantly directed towards the over-arching principles for Belmont Regional Park, of which are awaiting approval of the GWRC RPTRG and Parks Network Plans. Furthermore, Cardno now Stantec has incorporated supplementary recommendations and opportunities for social procurement, how this document fits in with the over-arching documents and additional carbon reduction guidelines to enable GWRC to achieve carbon targets and heavily involve the community where practical.

11 Summary

This restoration plan provides guidance on how to undertake restoration of two areas within Belmont Regional Park. The habitat types in the Kilmister and the Waitangarua areas were identified, and species lists were developed to suit each of the habitat types. It is recommended that plant ordering and planting in Kilmister is undertaken on the basis of habitat types, and progressive access – starting on the lower slopes and away from access tracks to prevent traversing through already planted areas. Plant ordering and planting in the Waitangrua area should be based more on retiring paddocks to take advantage of existing fencing, and progressive retirement and access.

It is likely that planting will need to be staged over multiple years. Additionally, it is recommended that pioneer species are planted first, followed later by succession species 2-5 years after the initial planting. Ongoing pest animal and pest plant control will be required to ensure successful establishment, as well as fencing areas to exclude stock where required. Information from WCC indicates that canopy closure may take 10 years, so areas will need to be monitored and managed over that duration decreasing from monthly or quarterly monitoring to annual or bi-annual (depending on establishment and success rates).

Due to the scope of the project, climate condition modelling was not included as part of this technical restoration plan. The planting schedule produced provides a diverse composition of species, which given the timeframe of the project could be adapted over time to meet any recommendations that may change from any climate condition modelling.

This restoration plan includes guidance on pest animal and pest plant control and best practice methods for planting and shall be read in coordination with the over-arching documents, Recloaking Papatūānuku Technical Restoration Guide (RPTRG) and the Toitū Te Whenua Parks Network Plan 2020-30.

APPENDIX A

PLANT SCHEDULES

PLANTING TREATMENT	
Description	North facing slope
Method	Hand planting with appropriate spacing
Environmental conditions	Year-round sun. Plants need to be hardy enough to deal with long hours of sunlight but these plants will generally grow faster than those on other slopes.

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Brachyglottis repanda	Rangiora	6	1	PB3	3
Coprosma robusta	Karamū	6	1	PB3	10
Griselinia lucida	Puka/ Broadleaf	12	1	PB3	3
Kunzea ericoides	Kānuka	15	1	PB3	20
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	10
Leucopogon fasciculatus	Mingimingi	5	1	PB3	4
Metrosiderous robusta	Rātā/ northern rata	30	1	PB3	2
Myoporum laetum	Ngaio	10	1	PB3	20
Myrsine australis	Māpou	5	1	PB3	15
Olearia paniculata	Akiraho	6	1	PB3	2
Olearia rani	Heketara	6	1	PB3	2
Pennantia corymbosa	Kaikōmako	8	1	PB3	3
Pittosporum tenuifolium	Kōhūhū	10	1	PB3	3
Pseudopanax arboreus	Whauwhaupaku, Five-finger	8	1	PB3	3
Enhancement planting					
Dacrydium cupressinum	Rimu	50	5	PB5	5
Podocarpus totara	Tōtara	25	5	PB5	5
Prumnopitys taxifolia	Matai	40	5	PB5	5
Beilschmiedia tawa	Tawa	30	5	PB5	20
Elaeocarpus dentatus	Hīnau	15	5	PB5	20
Elaeocarpus hookerianus	Pōkākā	10	5	PB5	5
Hedycarya arborea	Porokaiwhiri, Pigeonwood	12	5	PB5	15
Melicytus ramiflorus	Māhoe	8	5	PB5	20
Clematis forsteri	Puawhananga/ Forster's clematis	5 (climber)	5	PB5	5

PLANTING TREATMENT	
Description	North facing slope- Cluster planting
Method	Plantings in clusters of plants
Environmental conditions	Same as north-facing slope but verging on areas too steep to hand plant

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Coprosma robusta	Karamū	6	1	PB3	10
Kunzea ericoides	Kānuka	15	1	PB3	25
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	15
Myoporum laetum	Ngaio	10	1	PB3	25
Myrsine australis	Māpou	5	1	PB3	15
Pittosporum tenuifolium	Kōhūhū	10	1	PB3	10

PLANTING TREATMENT	
Description	East facing slope (also includes southeast)
Method	Hand planting with appropriate spacing
Environmental conditions	These slopes receive between 4-7 hours of sunlight in winter months and are more sheltered from the prevailing winds so provide more protection for new plantings.

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	Mix (%)
Initial planting					
Podocarpus totara	Tōtara	25	5	PB5	2
Aristotelia serrata	Makomako/ wineberry	10	1	PB3	15
Brachyglottis repanda	Rangiora	6	1	PB3	2
Carpodetus serratus	Putaputawētā	8	1	PB3	2
Coprosma rhamnoides	Mingimingi	2	1	PB3	15
Griselinia littoralis	Kāpuka	18	1	PB3	5
Hoheria sexstylosa	Houhere/ lacebark	6	1	PB3	3
Knightia excelsa	Rewarewa	25	1	PB3	20
Kunzea ericoides	Kānuka	15	1	PB3	20
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	8
Melicope simplex	Poataniwha	5	1	PB3	2
Myrsine salicina	Toro	4	1	PB3	2
Olearia paniculata	Akiraho	6	1	PB3	2
Veronica parviflora	Tree hebe	7	1	PB3	2
Enhancement planting					
Alectryon excelsus	Tītoki	15	5	PB5	2
Beilschmiedia tawa	Tawa	30	5	PB5	2
Carmichaelia australis	Mākaka/ NZ broom	5	5	PB5	2
Coprosma robusta	Kāramuramu/ Karamū	5	5	PB5	15
Dysoxylum spectabile	Kohekohe	12	5	PB5	20
Elaeocarpus dentatus	Hīnau	15	5	PB5	5
Geniostoma ligustrifolium var. ligustrifolium	Hangehange	3	5	PB5	5
Hedycarya arborea	Porokaiwhiri/ pigeonwood	12	5	PB5	20
Melicytus ramiflorus	Māhoe	8	5	PB5	20
Nestegis lanceolata	Maire rauriki	18	5	PB5	3
Pseudopanax crassifolius	Horoeka/ lancewood	12	5	PB5	2
Streblus heterophyllus	Tūrepo/ small-leaved milk tree	4	5	PB5	2
Clematis forsteri	Puawānanga/ Forster's clematis	5 (climber)	5	PB5	1
Rhopalostylis sapida	Nīkau	12	5	PB5	1

PLANTING TREATMENT	
Description	East facing slope- Cluster planting
Method	Plantings in clusters of plants
Environmental conditions	Same as east-facing slope but verging on areas too steep to hand plant

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Podocarpus totara	Tōtara	25	5	PB5	5
Aristotelia serrata	Makomako/ wineberry	10	1	PB3	15
Knightia excelsa	Rewarewa	25	1	PB3	20
Kunzea ericoides	Kānuka	15	1	PB3	30
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	30

PLANTING TREATMENT	
Description	South-facing slope (also includes southwest and west)
Method	Hand planting with appropriate spacing
Environmental conditions	This area has reduced sunlight hours in winter with around 0-4 hours of sunlight during winter months.

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Aristotelia serrata	Makomako/ wineberry	10	1	PB3	15
Brachyglottis repanda	Rangiora	6	1	PB3	3
Carpodetus serratus	Putaputawētā/ marbleleaf	8	1	PB3	3
Coprosma robusta	Karamū	5	1	PB3	20
Kunzea ericoides	Kānuka	15	1	PB3	20
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	15
Myrsine australis	Mapou	5	1	PB3	10
Pennantia corymbosa	Kaikomako	8	1	PB3	3
Pseudopanax arboreus	Whauwhaupaku/ five-finger	8	1	PB3	3
Schefflera digitata	patete or pate/ seven-finger	7	1	PB3	3
Solanum laciniatum	Poroporo	3	1	PB3	2
Veronica stricta var. stricta	Koromiko	2	1	PB3	3
Enhancement planting					
Dacrydium cupressinum	Rimu	50	5	PB5	1
Prumnopitys ferruginea	Miro	20	5	PB5	2
Prumnopitys taxifolia	Matai	40	5	PB5	1
Alectryon excelsus	Tītoki	15	5	PB5	2
Alseuosmia pusilla	Mountain alseuosmia	5	5	PB5	2
Beilschmiedia tawa	Tawa	30	5	PB5	20
Coprosma grandifolia	Kanono/ large-leaved coprosma	6	5	PB5	15
Coprosma lucida	Karamū	3	5	PB5	2
Coprosma rhamnoides	Coprosma	2	5	PB5	5
Coprosma robusta	Kāramuramu/ Karamū	5	5	PB5	20
Pseudopanax crassifolius	Horoeka/ lancewood	12	5	PB5	2
Melicytus ramiflorus	Māhoe	8	5	PB5	20
Nestegis cunninghamii	Maire raunui/ black maire	18	5	PB5	2
Clematis paniculata	Puawhananga/ White clematis	9 (climber)	5	PB5	2
Freycinetia banksii	Kiekie	10 (climber)	5	PB5	2
Ripogonum scandens	Kareao/ supplejack	Climber	5	PB5	2

PLANTING TREATMENT	
Description	South facing slope- Cluster planting
Method	Plantings in clusters of plants
Environmental conditions	Same as south-facing slope but verging on areas too steep to hand plant

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Aristotelia serrata	Makomako/ wineberry	10	1	PB3	10
Coprosma robusta	Karamū	5	1	PB3	30
Kunzea ericoides	Kānuka	15	1	PB3	30
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	20

Veronica stricta var. stricta	Koromiko	2	1	PB3	10

PLANTING TREATMENT	
Description	Wet riparian margins or Wetland
Method	Hand planting with appropriate spacing
Environmental conditions	The soil remains wet for extended periods or has a water table no deeper than a spade length (~30 cms)

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Coprosma rhamnoides	Mingimingi	2	1	PB3	20
Cordyline australis	tī kōuka/cabbage tree	15	1	PB3	2
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	20
Carex virgata	Pukio, swamp sedge	1	0.6	PB3	20
Carex secta	Purei	1	0.6	PB3	5
Cyperus ustulatus	Umbrella sedge	1	0.6	PB3	5
Phormium tenax	Harakeke, Swamp flax	3	1	PB3	2
Austroderia toetoe	Toetoe	3	1	PB3	2
Juncus edgariae	Edgars rush	2	0.6	PB3	4
Juncus pallidus	Great Soft-rush	2	0.6	PB3	20
Enhancement planting					
Dacrycarpus dacrydoides	Kahikatea	50	5	PB5	5
Coprosma propinqua var. propinqua	Mingimingi	5	5	PB5	30
Coprosma rotundifolia	Round-leaved coprosma	3	5	PB5	15
Coprosma tenuicaulis	Hukihuki	2	5	PB5	15
Laurelia novae-zelandiae	Pukatea	35	5	PB5	5
Syzygium maire	Marie tawake	15	5	PB5	5
Olearia solandri	Coastal tree daisy	3	5	PB5	25

PLANTING TREATMENT	
Description	Drier riparian margins
Method	Hand planting with appropriate spacing
Environmental conditions	Higher upstream bank, the soil remains wet for periods. Includes areas of seasonal flooding. Becomes dry during times of reduced rainfall.

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Aristotelia serrata	Makomako/wineberry	10	1	PB3	20
Cordyline australis	tī kōuka/cabbage tree	15	1	PB3	2
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	20
Myrsine australis	Māpou/ mapou	5	1	PB3	20
Piper excelsum subsp. Excelsum	Kawakawa	5	1	PB3	2
Plagianthus regius subsp. regius	Manatu/lowland ribbonwood	15	1	PB3	2
Pseudopanax arboreus	Whauwhaupaku/ five-finger	8	1	PB3	2
Sophora microphylla	Kowhai	20	1	PB3	3
Veronica stricta var. stricta	Koromiko/ hebe	2	1	PB3	5
Cyathea medullaris	Mamaku/ black tree fern	15	1	PB3	2
Carex geminata	Rautahi, cutty grass	1	0.6	PB3	20

Carex uncinata	Hook grass	0.5	0.6	PB3	2
Enhancement planting					
Prumnopitys ferruginea	Miro	20	5	PB5	5
Beilschmiedia tawa	Tawa	30	5	PB5	20
Brachyglottis repanda	Rangiora	6	5	PB5	3
Carmichaelia australis	Mākaka, NZ broom	5	5	PB5	20
Coprosma grandifolia*	Kanono/ large leaved coprosma	6	5	PB5	20
Coprosma lucida*	Karamū	3	5	PB5	5
Fuchsia excorticata	Kotukutuku/ tree fuchsia	12	5	PB5	20
Pseudopanax crassifolius	Horoeka/ lancewood	12	5	PB5	2
Schefflera digitata	Patatē/ seven-finger	7	5	PB5	3
Rhopalostylis sapida	Nīkau	12	5	PB5	2

Those with * next to name should only be planted in initial planting if rabbit/hare numbers are low.

PLANTING TREATMENT	
Description	Rocky boulders
Method	Hand planting with appropriate spacing
Environmental conditions	Areas with large rocks (<10cms)

Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Initial planting					
Cordyline australis	tī kōuka/cabbage tree	15	1	PB3	5
Coriaria arborea var. arborea	Tutu	5	1	PB3	10
Coprosma propinqua var. propinqua	Mingimingi	5	1	PB3	20
Coprosma rhamnoides	Mingimingi	2	1	PB3	20
Ozothamnus leptopyllus	Tauhinu	2	1	PB3	20
Clematis paniculata	Puawānanga/ white clematis	9 (climber)	1	PB3	2
Muehlenbeckia australis	Pohuehue/ large-leaved muehlenbeckia	10 (climber)	1	PB3	2
Muehlenbeckia complexa var. complexa	Small-leaved pohuehue/ scrub pohuehue	8 (climber)	1	PB3	2
Rubus cissoides	Tātarāmoa/ bush lawyer	10 (climber)	1	PB3	2
Tetragonia trigyna	NZ spinach	4 (prostrate)	0.6	PB3	2
Aciphylla squarrosa var. squarrosa	Kurikuri/ speargrass	1	0.6	PB3	10
Phormium cookianum subsp. Hookeri	Mountain flax	1.5	1	PB3	5

PLANTING TREATMENT	
Description	Under pylons/ powerlines
Method	Hand planting with appropriate spacing
Environmental conditions	These are areas identified by Transpower as being in close proximity to power lines and/pylons. Large part also borders an access track which will also need plants in the up to 5m range.

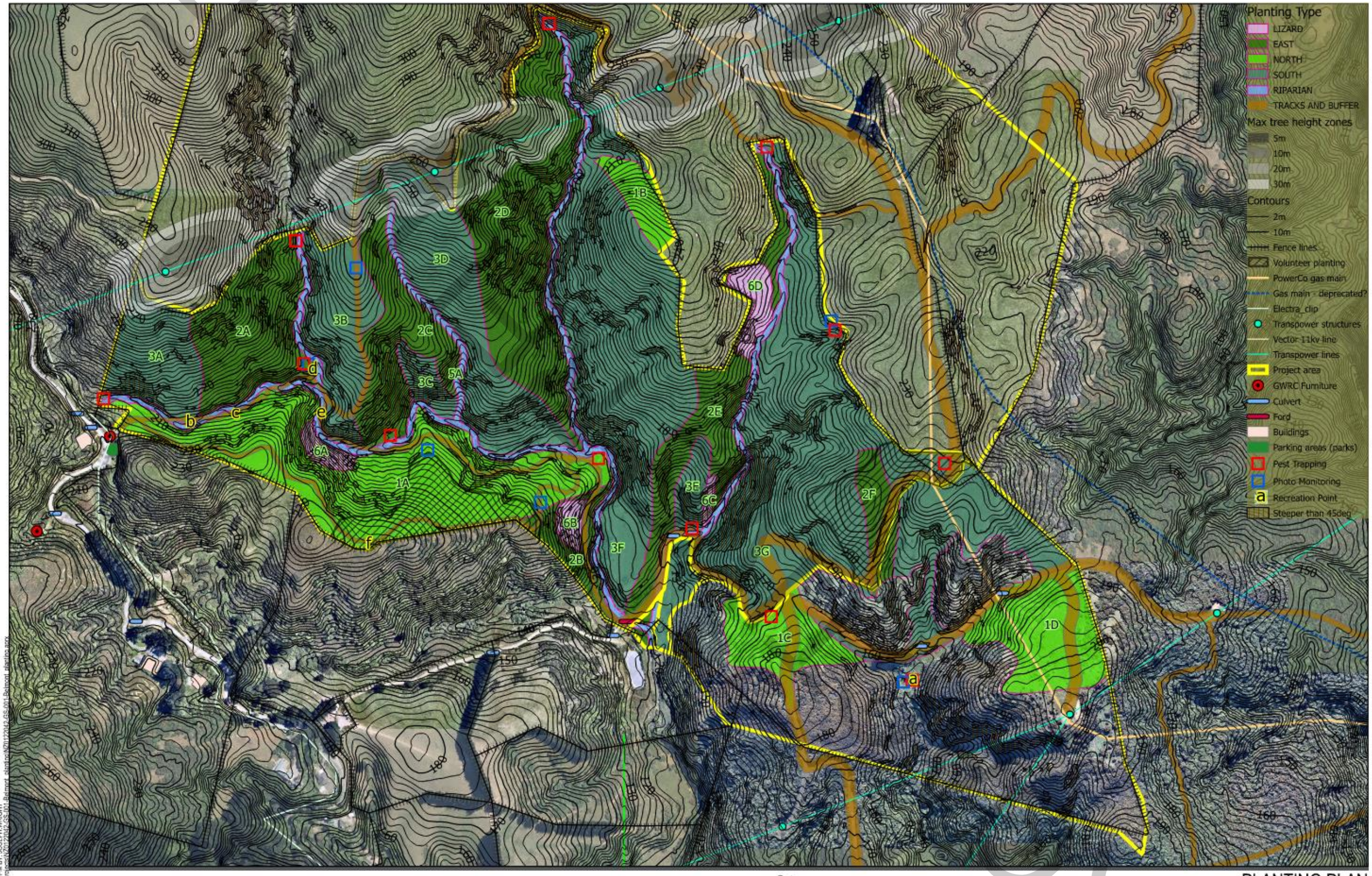
Scientific name	Common name	Mature height (m)	Spacing (m)	Size	% Mix
Up to 5m in height					
Coprosma rhamnoides	Mingimingi	2	1	PB3	40
Muehlenbeckia complexa var. complexa	Small-leaved pohuehue, scrub pohuehue	8 (climber)	1	PB3	40
Carex cf. testacea	Carex	1	0.6	PB5	20
Up to 10m in height					
Coprosma propinqua var. propinqua	Mingimingi	5	1	PB3	40
Brachyglottis repanda	Rangiora	6	1	PB3	10
Leptospermum scoparium var. scoparium	Mānuka	12	1	PB3	40
Olearia paniculata	akiraho	6	1	PB3	10
Up to 20m height					
Carpodetus serratus	Putaputawētā	8	1	PB3	40
Griselinia littoralis	kāpuka	18	1	PB3	20
Veronica parviflora	Tree hebe	7	1	PB3	40

APPENDIX

B

PLANTING NUMBERS: KILMISTER

Restoration Plan
Belmont Regional Park



DATE PLOTTED:31/08/2022 4:57 PM BY: JOSEPH.WRIGHT
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Cardno
Petone (NZ) Tel. 04-478 0342

Date
31/08/2022

Size
A3

Scale
1:4,000

Projection: NZGD 2000 New Zealand Transverse

0 80 160 240 320Metres

PLANTING PLAN

KILMISTER REVISION 1

BELMONT REGIONAL PARK RESTORATION PLAN

Initial plant numbers for polygons 1A, 1B, 1C and 1D by planting area and total plant numbers needed for each polygon.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total plants
1A	*Brachyglottis repanda*	Rangiora	47101	3	1413
1A	*Coprosma robusta*	Karamū	47101	10	4710
1A	*Griselinia lucida*	Puka/ Broadleaf	47101	3	1413
1A	*Kunzea ericoides*	Kānuka	47101	20	9420
1A	*Leptospermum scoparium var. scoparium*	Mānuka	47101	10	4710
1A	*Leucopogon fasciculatus*	Mingimingi	47101	4	1884
1A	*Metrosiderous robusta*	Rātā/ northern rata	47101	2	942
1A	*Myoporum laetum*	Ngaio	47101	20	9420
1A	*Myrsine australis*	Māpou	47101	15	7065
1A	*Olearia paniculata*	Akiraho	47101	2	942
1A	*Olearia rani*	Heketara	47101	2	942
1A	*Pennantia corymbosa*	Kaikōmako	47101	3	1413
1A	*Pittosporum tenuifolium*	Kōhūhū	47101	3	1413
1A	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	47101	3	1413
1B	*Brachyglottis repanda*	Rangiora	5217	3	157
1B	*Coprosma robusta*	Karamū	5217	10	522
1B	*Griselinia lucida*	Puka/ broadleaf	5217	3	157
1B	*Kunzea ericoides*	Kānuka	5217	20	1043
1B	*Leptospermum scoparium var. scoparium*	Mānuka	5217	10	522
1B	*Leucopogon fasciculatus*	Mingimingi	5217	4	209
1B	*Metrosiderous robusta*	Rātā/ northern rata	5217	2	104
1B	*Myoporum laetum*	Ngaio	5217	20	1043
1B	*Myrsine australis*	Māpou	5217	15	783
1B	*Olearia paniculata*	Akiraho	5217	2	104
1B	*Olearia rani*	Heketara	5217	2	104
1B	*Pennantia corymbosa*	Kaikōmako	5217	3	157
1B	*Pittosporum tenuifolium*	Kōhūhū	5217	3	157
1B	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	5217	3	157
1C	*Brachyglottis repanda*	Rangiora	11161	3	335
1C	*Coprosma robusta*	Karamū	11161	10	1116
1C	*Griselinia lucida*	Puka/ broadleaf	11161	3	335
1C	*Kunzea ericoides*	Kānuka	11161	20	2232
1C	*Leptospermum scoparium var. scoparium*	Mānuka	11161	10	1116
1C	*Leucopogon fasciculatus*	Mingimingi	11161	4	446
1C	*Metrosiderous robusta*	Rātā/ northern rata	11161	2	223
1C	*Myoporum laetum*	Ngaio	11161	20	2232
1C	*Myrsine australis*	Māpou	11161	15	1674
1C	*Olearia paniculata*	Akiraho	11161	2	223
1C	*Olearia rani*	Heketara	11161	2	223
1C	*Pennantia corymbosa*	Kaikōmako	11161	3	335
1C	*Pittosporum tenuifolium*	Kōhūhū	11161	3	335
1C	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	11161	3	335
1D	*Brachyglottis repanda*	Rangiora	17609	3	528
1D	*Coprosma robusta*	Karamū	17609	10	1761
1D	*Griselinia lucida*	Puka/ broadleaf	17609	3	528

1D	*Kunzea ericoides*	Kānuka	17609	20	3522
1D	*Leptospermum scoparium var. scoparium*	Mānuka	17609	10	1761
1D	*Leucopogon fasciculatus*	Mingimingi	17609	4	704
1D	*Metrosiderous robusta*	Rātā/ northern rata	17609	2	352
1D	*Myoporum laetum*	Ngaio	17609	20	3522
1D	*Myrsine australis*	Māpou	17609	15	2641
1D	*Olearia paniculata*	Akiraho	17609	2	352
1D	*Olearia rani*	Heketara	17609	2	352
1D	*Pennantia corymbosa*	Kaikōmako	17609	3	528
1D	*Pittosporum tenuifolium*	Kōhūhū	17609	3	528
1D	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	17609	3	528

Enhancement planting numbers for polygons 1A, 1B, 1C and 1D by planting area and total plant numbers needed for each polygon

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total plants
1A	*Dacrydium cupressinum*	Rimu	47101	5	94
1A	*Podocarpus totara*	Tōtara	47101	5	94
1A	*Prumnopitys taxifolia*	Matai	47101	5	94
1A	*Beilschmiedia tawa*	Tawa	47101	20	377
1A	*Elaeocarpus dentatus*	Hīnau	47101	20	377
1A	*Elaeocarpus hookerianus*	Pōkākā	47101	5	94
1A	*Hedycarya arborea*	Porokaiwhiri, Pigeonwood	47101	15	283
1A	*Melicytus ramiflorus*	Māhoe	47101	20	377
1A	*Clematis forsteri*	Puawhananga/ Forster's clematis	47101	5	94
1B	*Dacrydium cupressinum*	Rimu	5217	5	10
1B	*Podocarpus totara*	Tōtara	5217	5	10
1B	*Prumnopitys taxifolia*	Matai	5217	5	10
1B	*Beilschmiedia tawa*	Tawa	5217	20	42
1B	*Elaeocarpus dentatus*	Hīnau	5217	20	42
1B	*Elaeocarpus hookerianus*	Pōkākā	5217	5	10
1B	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	5217	15	31
1B	*Melicytus ramiflorus*	Māhoe	5217	20	42
1B	*Clematis forsteri*	Puawhananga/ Forster's clematis	5217	5	10
1C	*Dacrydium cupressinum*	Rimu	11161	5	22
1C	*Podocarpus totara*	Tōtara	11161	5	22
1C	*Prumnopitys taxifolia*	Matai	11161	5	22
1C	*Beilschmiedia tawa*	Tawa	11161	20	89
1C	*Elaeocarpus dentatus*	Hīnau	11161	20	89
1C	*Elaeocarpus hookerianus*	Pōkākā	11161	5	22
1C	*Hedycarya arborea*	Porokaiwhiri, Pigeonwood	11161	15	67
1C	*Melicytus ramiflorus*	Māhoe	11161	20	89

1C	*Clematis forsteri*	Puawhananga/ Forster's clematis	11161	5	22
1D	*Dacrydium cupressinum*	Rimu	17609	5	35
1D	*Podocarpus totara*	Tōtara	17609	5	35
1D	*Prumnopitys taxifolia*	Mataī	17609	5	35
1D	*Beilschmiedia tawa*	Tawa	17609	20	141
1D	*Elaeocarpus dentatus*	Hīnau	17609	20	141
1D	*Elaeocarpus hookerianus*	Pōkākā	17609	5	35
1D	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	17609	15	106
1D	*Melicytus ramiflorus*	Māhoe	17609	20	141
1D	*Clematis forsteri*	Puawhananga/ Forster's clematis	17609	5	35

Initial plant numbers for polygons 2A, 2B, 2C, 2D, 2E and 2F by planting area and total plant numbers needed for each polygon.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total plants
2A	*Podocarpus totara*	Tōtara	19387	2	16
2A	*Aristotelia serrata*	Makomako/ wineberry	19387	15	2908
2A	*Brachyglottis repanda*	Rangiora	19387	2	388
2A	*Carpodetus serratus*	Putaputawētā	19387	2	388
2A	*Coprosma rhamnoides*	Mingimingi	19387	15	2908
2A	*Griselinia littoralis*	Kāpuka	19387	5	969
2A	*Hoheria sexstylosa*	Houhere/ lacebark	19387	3	582
2A	*Knightia excelsa*	Rewarewa	19387	20	3877
2A	*Kunzea ericoides*	Kānuka	19387	20	3877
2A	*Leptospermum scoparium var. scoparium*	Mānuka	19387	8	1551
2A	*Melicope simplex*	Poataniwha	19387	2	388
2A	*Myrsine salicina*	Toro	19387	2	388
2A	*Olearia paniculata*	Akiraho	19387	2	388
2A	*Veronica parviflora*	Tree hebe	19387	2	388
2B	*Podocarpus totara*	Tōtara	5125	2	4
2B	*Aristotelia serrata*	Makomako/ wineberry	5125	15	769
2B	*Brachyglottis repanda*	Rangiora	5125	2	103
2B	*Carpodetus serratus*	Putaputawētā	5125	2	103
2B	*Coprosma rhamnoides*	Mingimingi	5125	15	769
2B	*Griselinia littoralis*	Kāpuka	5125	5	256
2B	*Hoheria sexstylosa*	Houhere/ lacebark	5125	3	154
2B	*Knightia excelsa*	Rewarewa	5125	20	1025
2B	*Kunzea ericoides*	Kānuka	5125	20	1025
2B	*Leptospermum scoparium var. scoparium*	Mānuka	5125	8	410
2B	*Melicope simplex*	Poataniwha	5125	2	103
2B	*Myrsine salicina*	Toro	5125	2	103
2B	*Olearia paniculata*	Akiraho	5125	2	103
2B	*Veronica parviflora*	Tree hebe	5125	2	103

2C	*Podocarpus totara*	Tōtara	15250	2	12
2C	*Aristotelia serrata*	Makomako/ wineberry	15250	15	2288
2C	*Brachyglottis repanda*	Rangiora	15250	2	305
2C	*Carpodetus serratus*	Putaputawētā	15250	2	305
2C	*Coprosma rhamnoides*	Mingimingi	15250	15	2288
2C	*Griselinia littoralis*	Kāpuka	15250	5	763
2C	*Hoheria sexstylosa*	Houhere/ lacebark	15250	3	458
2C	*Knightia excelsa*	Rewarewa	15250	20	3050
2C	*Kunzea ericoides*	Kānuka	15250	20	3050
2C	*Leptospermum scoparium var. scoparium*	Mānuka	15250	8	1220
2C	*Melicope simplex*	Poataniwha	15250	2	305
2C	*Myrsine salicina*	Toro	15250	2	305
2C	*Olearia paniculata*	Akiraho	15250	2	305
2C	*Veronica parviflora*	Tree hebe	15250	2	305
2D	*Podocarpus totara*	Tōtara	40008	2	32
2D	*Aristotelia serrata*	Makomako/ wineberry	40008	15	6001
2D	*Brachyglottis repanda*	Rangiora	40008	2	800
2D	*Carpodetus serratus*	Putaputawētā	40008	2	800
2D	*Coprosma rhamnoides*	Mingimingi	40008	15	6001
2D	*Griselinia littoralis*	kāpuka	40008	5	2000
2D	*Hoheria sexstylosa*	Houhere/ lacebark	40008	3	1200
2D	*Knightia excelsa*	Rewarewa	40008	20	8002
2D	*Kunzea ericoides*	Kānuka	40008	20	8002
2D	*Leptospermum scoparium var. scoparium*	Mānuka	40008	8	3201
2D	*Melicope simplex*	Poataniwha	40008	2	800
2D	*Myrsine salicina*	Toro	40008	2	800
2D	*Olearia paniculata*	Akiraho	40008	2	800
2D	*Veronica parviflora*	Tree hebe	40008	2	800
2E	*Podocarpus totara*	Tōtara	17206	2	14
2E	*Aristotelia serrata*	Makomako/ wineberry	17206	15	2581
2E	*Brachyglottis repanda*	Rangiora	17206	2	344
2E	*Carpodetus serratus*	Putaputawētā	17206	2	344
2E	*Coprosma rhamnoides*	Mingimingi	17206	15	2581
2E	*Griselinia littoralis*	Kāpuka	17206	5	860
2E	*Hoheria sexstylosa*	Houhere/ lacebark	17206	3	516
2E	*Knightia excelsa*	Rewarewa	17206	20	3441
2E	*Kunzea ericoides*	Kānuka	17206	20	3441
2E	*Leptospermum scoparium var. scoparium*	Mānuka	17206	8	1376
2E	*Melicope simplex*	Poataniwha	17206	2	344
2E	*Myrsine salicina*	Toro	17206	2	344
2E	*Olearia paniculata*	Akiraho	17206	2	344
2E	*Veronica parviflora*	Tree hebe	17206	2	344
2F	*Podocarpus totara*	Tōtara	6306	2	5
2F	*Aristotelia serrata*	Makomako/ wineberry	6306	15	946

2F	*Brachyglottis repanda*	Rangiora	6306	2	126
2F	*Carpodetus serratus*	Putaputawētā	6306	2	126
2F	*Coprosma rhamnoides*	Mingimingi	6306	15	946
2F	*Griselinia littoralis*	Kāpuka	6306	5	315
2F	*Hoheria sexstylosa*	Houhere/ lacebark	6306	3	189
2F	*Knightia excelsa*	Rewarewa	6306	20	1261
2F	*Kunzea ericoides*	Kānuka	6306	20	1261
2F	*Leptospermum scoparium var. scoparium*	Mānuka	6306	8	504
2F	*Melicope simplex*	Poataniwha	6306	2	126
2F	*Myrsine salicina*	Toro	6306	2	126
2F	*Olearia paniculata*	Akiraho	6306	2	126
2F	*Veronica parviflora*	Tree hebe	6306	2	126

Enhancement plant numbers for polygons 2A, 2B, 2C, 2D, 2E and 2F by planting area and total plant numbers needed for each polygon.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total plants
2A	*Alectryon excelsus*	Tītoki	19387	2	16
2A	*Beilschmiedia tawa*	Tawa	19387	2	16
2A	*Carmichaelia australis*	Mākaka/ NZ broom	19387	2	16
2A	*Coprosma robusta*	Kāramuramu/ Karamū	19387	15	116
2A	*Dysoxylum spectabile*	Kohekohe	19387	20	155
2A	*Elaeocarpus dentatus*	Hīnau	19387	5	39
2A	*Geniostoma ligustrifolium var. ligustrifolium*	Hangehange	19387	5	39
2A	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	19387	20	155
2A	*Melicytus ramiflorus*	Māhoe	19387	20	155
2A	*Nestegis lanceolata*	Maire rauriki	19387	3	23
2A	*Pseudopanax crassifolius*	Horoeka/ lancewood	19387	2	16
2A	*Streblus heterophyllus*	Tūrepo/ small-leaved milk tree	19387	2	16
2A	*Clematis forsteri*	Puawānanga/ Forster's clematis	19387	1	8
2A	*Rhopalostylis sapida*	Nīkau	19387	1	8
2B	*Alectryon excelsus*	Tītoki	5125	2	4
2B	*Beilschmiedia tawa*	Tawa	5125	2	4
2B	*Carmichaelia australis*	Mākaka/ NZ broom	5125	2	4
2B	*Coprosma robusta*	Kāramuramu/ Karamū	5125	15	31
2B	*Dysoxylum spectabile*	Kohekohe	5125	20	41
2B	*Elaeocarpus dentatus*	Hīnau	5125	5	10
2B	*Geniostoma ligustrifolium var. ligustrifolium*	Hangehange	5125	5	10
2B	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	5125	20	41
2B	*Melicytus ramiflorus*	Māhoe	5125	20	41
2B	*Nestegis lanceolata*	Maire rauriki	5125	3	6

2B	*Pseudopanax crassifolius*	Horoeka/ lancewood	5125	2	4
2B	*Streblus heterophyllus*	Tūrepo/ small-leaved milk tree	5125	2	4
2B	*Clematis forsteri*	Puawānanga/ Forster's clematis	5125	1	2
2B	*Rhopalostylis sapida*	Nīkau	5125	1	2
2C	*Alectryon excelsus*	Tītoki	15250	2	12
2C	*Beilschmiedia tawa*	Tawa	15250	2	12
2C	*Carmichaelia australis*	Mākaka/ NZ broom	15250	2	12
2C	*Coprosma robusta*	Kāramuramu/ Karamū	15250	15	92
2C	*Dysoxylum spectabile*	Kohekohe	15250	20	122
2C	*Elaeocarpus dentatus*	Hīnau	15250	5	31
2C	*Geniostoma ligustrifolium var. ligustrifolium*	Hangehange	15250	5	31
2C	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	15250	20	122
2C	*Melicytus ramiflorus*	Māhoe	15250	20	122
2C	*Nestegis lanceolata*	Maire rauriki	15250	3	18
2C	*Pseudopanax crassifolius*	Horoeka/ lancewood	15250	2	12
2C	*Streblus heterophyllus*	Tūrepo/ small-leaved milk tree	15250	2	12
2C	*Clematis forsteri*	Puawānanga/ Forster's clematis	15250	1	6
2C	*Rhopalostylis sapida*	Nīkau	15250	1	6
2D	*Alectryon excelsus*	Tītoki	40008	2	32
2D	*Beilschmiedia tawa*	Tawa	40008	2	32
2D	*Carmichaelia australis*	Mākaka/ NZ broom	40008	2	32
2D	*Coprosma robusta*	Kāramuramu/ Karamū	40008	15	240
2D	*Dysoxylum spectabile*	Kohekohe	40008	20	320
2D	*Elaeocarpus dentatus*	Hīnau	40008	5	80
2D	*Geniostoma ligustrifolium var. ligustrifolium*	Hangehange	40008	5	80
2D	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	40008	20	320
2D	*Melicytus ramiflorus*	Māhoe	40008	20	320
2D	*Nestegis lanceolata*	Maire rauriki	40008	3	48
2D	*Pseudopanax crassifolius*	Horoeka/ lancewood	40008	2	32
2D	*Streblus heterophyllus*	Tūrepo/ small-leaved milk tree	40008	2	32
2D	*Clematis forsteri*	Puawānanga/ Forster's clematis	40008	1	16
2D	*Rhopalostylis sapida*	Nīkau	40008	1	16
2E	*Alectryon excelsus*	Tītoki	17206	2	14
2E	*Beilschmiedia tawa*	Tawa	17206	2	14
2E	*Carmichaelia australis*	Mākaka/ NZ broom	17206	2	14
2E	*Coprosma robusta*	Kāramuramu/ Karamū	17206	15	103
2E	*Dysoxylum spectabile*	Kohekohe	17206	20	138
2E	*Elaeocarpus dentatus*	Hīnau	17206	5	34
2E	*Geniostoma ligustrifolium var. ligustrifolium*	Hangehange	17206	5	34

2E	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	17206	20	138
2E	*Melicytus ramiflorus*	Māhoe	17206	20	138
2E	*Nestegis lanceolata*	Maire rauriki	17206	3	21
2E	*Pseudopanax crassifolius*	Horoeka/ lancewood	17206	2	14
2E	*Streblus heterophyllus*	Tūrepo/ small-leaved milk tree	17206	2	14
2E	*Clematis forsteri*	Puawānanga/ Forster's clematis	17206	1	7
2E	*Rhopalostylis sapida*	Nīkau	17206	1	7
2F	*Alectryon excelsus*	Tītoki	6306	2	5
2F	*Beilschmiedia tawa*	Tawa	6306	2	5
2F	*Carmichaelia australis*	Mākaka/ NZ broom	6306	2	5
2F	*Coprosma robusta*	Kāramuramu/ Karamū	6306	15	38
2F	*Dysoxylum spectabile*	Kohekohe	6306	20	50
2F	*Elaeocarpus dentatus*	Hīnau	6306	5	13
2F	*Geniostoma ligustrifolium var. ligustrifolium*	Hangehange	6306	5	13
2F	*Hedycarya arborea*	Porokaiwhiri/ pigeonwood	6306	20	50
2F	*Melicytus ramiflorus*	Māhoe	6306	20	50
2F	*Nestegis lanceolata*	Maire rauriki	6306	3	8
2F	*Pseudopanax crassifolius*	Horoeka/ lancewood	6306	2	5
2F	*Streblus heterophyllus*	Tūrepo/ small-leaved milk tree	6306	2	5
2F	*Clematis forsteri*	Puawānanga/ Forster's clematis	6306	1	3
2F	*Rhopalostylis sapida*	Nīkau	6306	1	3

Initial plant numbers for polygons 3A, 3B, 3C, 3D, 3E, 3F and 3G by planting area and total plant numbers needed for each polygon.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total plants
3A	*Aristotelia serrata*	Makomako/ wineberry	13952	15	2093
3A	*Brachyglottis repanda*	Rangiora	13952	3	419
3A	*Carpodetus serratus*	Putaputawētā/ marbleleaf	13952	3	419
3A	*Coprosma robusta*	Karamū	13952	20	2790
3A	*Kunzea ericoides*	Kānuka	13952	20	2790
3A	*Leptospermum scoparium var. scoparium*	Mānuka	13952	15	2093
3A	*Myrsine australis*	Mapou	13952	10	1395
3A	*Pennantia corymbosa*	Kaikomako	13952	3	419
3A	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	13952	3	419
3A	*Schefflera digitata*	Patete or pate/ seven-finger	13952	3	419
3A	*Solanum laciniatum*	Poroporo	13952	2	279
3A	*Veronica stricta var. stricta*	Koromiko	13952	3	419
3B	*Aristotelia serrata*	Makomako/ wineberry	16729	15	2509
3B	*Brachyglottis repanda*	Rangiora	16729	3	502
3B	*Carpodetus serratus*	Putaputawētā/ marbleleaf	16729	3	502

3B	*Coprosma robusta*	Karamū	16729	20	3346
3B	*Kunzea ericoides*	Kānuka	16729	20	3346
3B	*Leptospermum scoparium var. scoparium*	Mānuka	16729	15	2509
3B	*Myrsine australis*	Mapou	16729	10	1673
3B	*Pennantia corymbosa*	Kaikomako	16729	3	502
3B	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	16729	3	502
3B	*Schefflera digitata*	Patete or pate/ seven-finger	16729	3	502
3B	*Solanum laciniatum*	Poroporo	16729	2	335
3B	*Veronica stricta var. stricta*	Koromiko	16729	3	502
3C	*Aristotelia serrata*	Makomako/ wineberry	2178	15	327
3C	*Brachyglottis repanda*	Rangiora	2178	3	65
3C	*Carpodetus serratus*	Putaputawētā/ marbleleaf	2178	3	65
3C	*Coprosma robusta*	Karamū	2178	20	436
3C	*Kunzea ericoides*	Kānuka	2178	20	436
3C	*Leptospermum scoparium var. scoparium*	Mānuka	2178	15	327
3C	*Myrsine australis*	Mapou	2178	10	218
3C	*Pennantia corymbosa*	Kaikomako	2178	3	65
3C	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	2178	3	65
3C	*Schefflera digitata*	Patete or pate/ seven-finger	2178	3	65
3C	*Solanum laciniatum*	Poroporo	2178	2	44
3C	*Veronica stricta var. stricta*	Koromiko	2178	3	65
3D	*Aristotelia serrata*	Makomako/ wineberry	27359	15	4104
3D	*Brachyglottis repanda*	Rangiora	27359	3	821
3D	*Carpodetus serratus*	Putaputawētā/ marbleleaf	27359	3	821
3D	*Coprosma robusta*	Karamū	27359	20	5472
3D	*Kunzea ericoides*	Kānuka	27359	20	5472
3D	*Leptospermum scoparium var. scoparium*	Mānuka	27359	15	4104
3D	*Myrsine australis*	Mapou	27359	10	2736
3D	*Pennantia corymbosa*	Kaikomako	27359	3	821
3D	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	27359	3	821
3D	*Schefflera digitata*	Patete or pate/ seven-finger	27359	3	821
3D	*Solanum laciniatum*	Poroporo	27359	2	547
3D	*Veronica stricta var. stricta*	Koromiko	27359	3	821
3E	*Aristotelia serrata*	Makomako/ wineberry	3204	15	481
3E	*Brachyglottis repanda*	Rangiora	3204	3	96
3E	*Carpodetus serratus*	Putaputawētā/ marbleleaf	3204	3	96
3E	*Coprosma robusta*	Karamū	3204	20	641
3E	*Kunzea ericoides*	Kānuka	3204	20	641
3E	*Leptospermum scoparium var. scoparium*	Mānuka	3204	15	481
3E	*Myrsine australis*	Mapou	3204	10	320
3E	*Pennantia corymbosa*	Kaikomako	3204	3	96
3E	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	3204	3	96

3E	*Schefflera digitata*	Patete or pate/ seven-finger	3204	3	96
3E	*Solanum laciniatum*	Poroporo	3204	2	64
3E	*Veronica stricta var. stricta*	Koromiko	3204	3	96
3F	*Aristotelia serrata*	Makomako/ wineberry	55781	15	8367
3F	*Brachyglottis repanda*	Rangiora	55781	3	1673
3F	*Carpodetus serratus*	Putaputawētā/ marbleleaf	55781	3	1673
3F	*Coprosma robusta*	Karamū	55781	20	11156
3F	*Kunzea ericoides*	Kānuka	55781	20	11156
3F	*Leptospermum scoparium var. scoparium*	Mānuka	55781	15	8367
3F	*Myrsine australis*	Mapou	55781	10	5578
3F	*Pennantia corymbosa*	Kaikomako	55781	3	1673
3F	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	55781	3	1673
3F	*Schefflera digitata*	Patete or pate/ seven-finger	55781	3	1673
3F	*Solanum laciniatum*	Poroporo	55781	2	1116
3F	*Veronica stricta var. stricta*	Koromiko	55781	3	1673
3G	*Aristotelia serrata*	Makomako/ wineberry	85157	15	12774
3G	*Brachyglottis repanda*	Rangiora	85157	3	2555
3G	*Carpodetus serratus*	Putaputawētā/ marbleleaf	85157	3	2555
3G	*Coprosma robusta*	Karamū	85157	20	17031
3G	*Kunzea ericoides*	Kānuka	85157	20	17031
3G	*Leptospermum scoparium var. scoparium*	Mānuka	85157	15	12774
3G	*Myrsine australis*	Mapou	85157	10	8516
3G	*Pennantia corymbosa*	Kaikomako	85157	3	2555
3G	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	85157	3	2555
3G	*Schefflera digitata*	Patete or pate/ seven-finger	85157	3	2555
3G	*Solanum laciniatum*	Poroporo	85157	2	1703
3G	*Veronica stricta var. stricta*	Koromiko	85157	3	2555

Enhancement plant numbers for polygons 3A, 3B, 3C, 3D, 3E, 3F and 3G by planting area and total plant numbers needed for each polygon.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total plants
3A	*Dacrydium cupressinum*	Rimu	13952	1	6
3A	*Prumnopitys ferruginea*	Miro	13952	2	11
3A	*Prumnopitys taxifolia*	Matai	13952	1	6
3A	*Alectryon excelsus*	Tītoki	13952	2	11
3A	*Alseuosmia pusilla*	Mountain alseuosmia	13952	2	11
3A	*Beilschmiedia tawa*	Tawa	13952	20	112
3A	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	13952	15	84
3A	*Coprosma lucida*	Karamū	13952	2	11
3A	*Coprosma rhamnoides*	Coprosma	13952	5	28
3A	*Coprosma robusta*	Kāramuramu/ Karamū	13952	20	112
3A	*Pseudopanax crassifolius*	Horoeka/ lancewood	13952	2	11

3A	*Melicytus ramiflorus*	Māhoe	13952	20	112
3A	*Nestegis cunninghamii*	Maire raunui/ black maire	13952	2	11
3A	*Clematis paniculata*	Puawhananga/ white clematis	13952	2	11
3A	*Freycinetia banksii*	Kiekie	13952	2	11
3A	*Ripogonum scandens*	Kareao/ supplejack	13952	2	11
3B	*Dacrydium cupressinum*	Rimu	16729	1	7
3B	*Prumnopitys ferruginea*	Miro	16729	2	13
3B	*Prumnopitys taxifolia*	Matai	16729	1	7
3B	*Alectryon excelsus*	Tītoki	16729	2	13
3B	*Alseuosmia pusilla*	Mountain alseuosmia	16729	2	13
3B	*Beilschmiedia tawa*	Tawa	16729	20	134
3B	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	16729	15	100
3B	*Coprosma lucida*	Karamū	16729	2	13
3B	*Coprosma rhamnoides*	Coprosma	16729	5	33
3B	*Coprosma robusta*	Kāramuramu/ Karamū	16729	20	134
3B	*Pseudopanax crassifolius*	Horoeka/ lancewood	16729	2	13
3B	*Melicytus ramiflorus*	Māhoe	16729	20	134
3B	*Nestegis cunninghamii*	Maire raunui/ black maire	16729	2	13
3B	*Clematis paniculata*	Puawhananga/ white clematis	16729	2	13
3B	*Freycinetia banksii*	Kiekie	16729	2	13
3B	*Ripogonum scandens*	Kareao/ supplejack	16729	2	13
3C	*Dacrydium cupressinum*	Rimu	2178	1	1
3C	*Prumnopitys ferruginea*	Miro	2178	2	2
3C	*Prumnopitys taxifolia*	Matai	2178	1	1
3C	*Alectryon excelsus*	Tītoki	2178	2	2
3C	*Alseuosmia pusilla*	Mountain alseuosmia	2178	2	2
3C	*Beilschmiedia tawa*	Tawa	2178	20	17
3C	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	2178	15	13
3C	*Coprosma lucida*	Karamū	2178	2	2
3C	*Coprosma rhamnoides*	Coprosma	2178	5	4
3C	*Coprosma robusta*	Kāramuramu/ Karamū	2178	20	17
3C	*Pseudopanax crassifolius*	Horoeka/ lancewood	2178	2	2
3C	*Melicytus ramiflorus*	Māhoe	2178	20	17
3C	*Nestegis cunninghamii*	Maire raunui/ black maire	2178	2	2
3C	*Clematis paniculata*	Puawhananga/ white clematis	2178	2	2
3C	*Freycinetia banksii*	Kiekie	2178	2	2
3C	*Ripogonum scandens*	Kareao/ supplejack	2178	2	2
3D	*Dacrydium cupressinum*	Rimu	27359	1	11
3D	*Prumnopitys ferruginea*	Miro	27359	2	22
3D	*Prumnopitys taxifolia*	Matai	27359	1	11
3D	*Alectryon excelsus*	Tītoki	27359	2	22
3D	*Alseuosmia pusilla*	Mountain alseuosmia	27359	2	22
3D	*Beilschmiedia tawa*	Tawa	27359	20	219
3D	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	27359	15	164
3D	*Coprosma lucida*	Karamū	27359	2	22
3D	*Coprosma rhamnoides*	Coprosma	27359	5	55
3D	*Coprosma robusta*	Kāramuramu/ Karamū	27359	20	219

3D	*Pseudopanax crassifolius*	Horoeka/ lancewood	27359	2	22
3D	*Melicytus ramiflorus*	Māhoe	27359	20	219
3D	*Nestegis cunninghamii*	Maire raunui/ black maire	27359	2	22
3D	*Clematis paniculata*	Puawhananga/ white clematis	27359	2	22
3D	*Freycinetia banksii*	Kiekie	27359	2	22
3D	*Ripogonum scandens*	Kareao/ supplejack	27359	2	22
3E	*Dacrydium cupressinum*	Rimu	3204	1	1
3E	*Prumnopitys ferruginea*	Miro	3204	2	3
3E	*Prumnopitys taxifolia*	Matai	3204	1	1
3E	*Alectryon excelsus*	Tītoki	3204	2	3
3E	*Alseuosmia pusilla*	Mountain alseuosmia	3204	2	3
3E	*Beilschmiedia tawa*	Tawa	3204	20	26
3E	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	3204	15	19
3E	*Coprosma lucida*	Karamū	3204	2	3
3E	*Coprosma rhamnoides*	Coprosma	3204	5	6
3E	*Coprosma robusta*	Kāramuramu/ Karamū	3204	20	26
3E	*Pseudopanax crassifolius*	Horoeka/ lancewood	3204	2	3
3E	*Melicytus ramiflorus*	Māhoe	3204	20	26
3E	*Nestegis cunninghamii*	Maire raunui/ black maire	3204	2	3
3E	*Clematis paniculata*	Puawhananga/ white clematis	3204	2	3
3E	*Freycinetia banksii*	Kiekie	3204	2	3
3E	*Ripogonum scandens*	Kareao/ supplejack	3204	2	3
3F	*Dacrydium cupressinum*	Rimu	55781	1	22
3F	*Prumnopitys ferruginea*	Miro	55781	2	45
3F	*Prumnopitys taxifolia*	Matai	55781	1	22
3F	*Alectryon excelsus*	Tītoki	55781	2	45
3F	*Alseuosmia pusilla*	Mountain alseuosmia	55781	2	45
3F	*Beilschmiedia tawa*	Tawa	55781	20	446
3F	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	55781	15	335
3F	*Coprosma lucida*	Karamū	55781	2	45
3F	*Coprosma rhamnoides*	Coprosma	55781	5	112
3F	*Coprosma robusta*	Kāramuramu/ Karamū	55781	20	446
3F	*Pseudopanax crassifolius*	Horoeka/ lancewood	55781	2	45
3F	*Melicytus ramiflorus*	Māhoe	55781	20	446
3F	*Nestegis cunninghamii*	Maire raunui/ black maire	55781	2	45
3F	*Clematis paniculata*	Puawhananga/ white clematis	55781	2	45
3F	*Freycinetia banksii*	Kiekie	55781	2	45
3F	*Ripogonum scandens*	Kareao/ supplejack	55781	2	45
3G	*Dacrydium cupressinum*	Rimu	85157	1	34
3G	*Prumnopitys ferruginea*	Miro	85157	2	68
3G	*Prumnopitys taxifolia*	Matai	85157	1	34
3G	*Alectryon excelsus*	Tītoki	85157	2	68
3G	*Alseuosmia pusilla*	Mountain alseuosmia	85157	2	68
3G	*Beilschmiedia tawa*	Tawa	85157	20	681
3G	*Coprosma grandifolia*	Kanono/ large-leaved coprosma	85157	15	511
3G	*Coprosma lucida*	Karamū	85157	2	68
3G	*Coprosma rhamnoides*	Coprosma	85157	5	170

3G	*Coprosma robusta*	Kāramuramu/ Karamū	85157	20	681
3G	*Pseudopanax crassifolius*	Horoeka/ lancewood	85157	2	68
3G	*Melicytus ramiflorus*	Māhoe	85157	20	681
3G	*Nestegis cunninghamii*	Maire raunui/ black maire	85157	2	68
3G	*Clematis paniculata*	Puawhananga/ white clematis	85157	2	68
3G	*Freycinetia banksii*	Kiekie	85157	2	68
3G	*Ripogonum scandens*	Kareao/ supplejack	85157	2	68

Initial plant numbers for polygons 5A and 5B by planting area and total plant numbers needed for each polygon. This polygon will require more on the ground analysis than others for the placement of drier riparian plants and wet riparian plants. The total area has been split equally between the two types of planting habitats but should be amended as needed once habitat has been ascertained.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total
5A	*Coprosma rhamnoides*	Mingimingi	19340	20	3868
5A	*Cordyline australis*	Tī kōuka/cabbage tree	19340	2	387
5A	*Leptospermum scoparium var. scoparium*	Mānuka	19340	20	3868
5A	*Carex virgata*	Pukio/ swamp sedge	19340	20	10744
5A	*Carex secta*	Purei	19340	5	2686
5A	*Cyperus ustulatus*	Umbrella sedge	19340	5	2686
5A	*Phormium tenax*	Harakeke/ Swamp flax	19340	2	387
5A	*Austroderia toetoe*	Toetoe	19340	2	387
5A	*Juncus edgariae*	Edgars rush	19340	4	2149
5A	*Juncus pallidus*	Great soft-rush	19340	20	10744
5B	*Aristotelia serrata*	Makomako/wineberry	8606	20	1721
5B	*Cordyline australis*	Tī kōuka/ cabbage tree	8606	2	172
5B	*Leptospermum scoparium var. scoparium*	Mānuka	8606	20	1721
5B	*Myrsine australis*	Māpou/ mapou	8606	20	1721
5B	*Piper excelsum subsp. Excelsum*	Kawakawa	8606	2	172
5B	*Plagianthus regius subsp. regius*	Manatu/ lowland ribbonwood	8606	2	172
5B	*Pseudopanax arboreus*	Whauwhaupaku/ five-finger	8606	2	172
5B	*Sophora microphylla*	Kowhai	8606	3	258
5B	*Veronica stricta var. stricta*	Koromiko/ hebe	8606	5	430
5B	*Cyathea medullaris*	Mamaku/ black tree fern	8606	2	172
5B	*Carex geminata*	Rautahi/ cutty grass	8606	20	4781
5B	*Carex uncinata*	Hook grass	8606	2	478

Enhancement plant numbers for polygons 5A and 5B by planting area and total plant numbers needed for each polygon. This polygon will require more on the ground analysis than others for the placement of drier riparian plants and wet riparian plants. The total area has been split equally between the two types of planting habitats but should be amended as needed once habitat has been ascertained.

Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total
5A	*Dacrycarpus dacrydoides*	Kahikatea	19340	5	39
5A	*Coprosma propinqua var. propinqua*	Mingimingi	19340	30	232

5A	*Coprosma rotundifolia*	Round-leaved coprosma	19340	15	116
5A	*Coprosma tenuicaulis*	Hukihuki	19340	15	116
5A	*Laurelia novae-zelandiae*	Pukatea	19340	5	39
5A	*Syzygium maire*	Marie tawake	19340	5	39
5A	*Olearia solandri*	Coastal tree daisy	19340	25	193
5B	*Prumnopitys ferruginea*	Miro	8606	5	17
5B	*Beilschmiedia tawa*	Tawa	8606	20	69
5B	*Brachyglottis repanda*	Rangiora	8606	3	10
5B	*Carmichaelia australis*	Mākaka/ NZ broom	8606	20	69
5B	*Coprosma grandifolia**	Kanono/ large leaved coprosma	8606	20	69
5B	*Coprosma lucida**	Karamū	8606	5	17
5B	*Fuchsia excorticata*	Kotukutuku/ tree fuchsia	8606	20	69
5B	*Pseudopanax crassifolius*	Horoeka/ lancewood	8606	2	7
5B	*Schefflera digitata*	Patatē/ seven-finger	8606	3	10
5B	*Rhopalostylis sapida*	Nīkau	8606	2	7

Initial plant numbers for polygons 6A, 6B, 6C, and 6D by planting area and total plant numbers needed for each polygon. These sites are close to the slope that is above 45 degrees so some cluster planting may be necessary for this area.

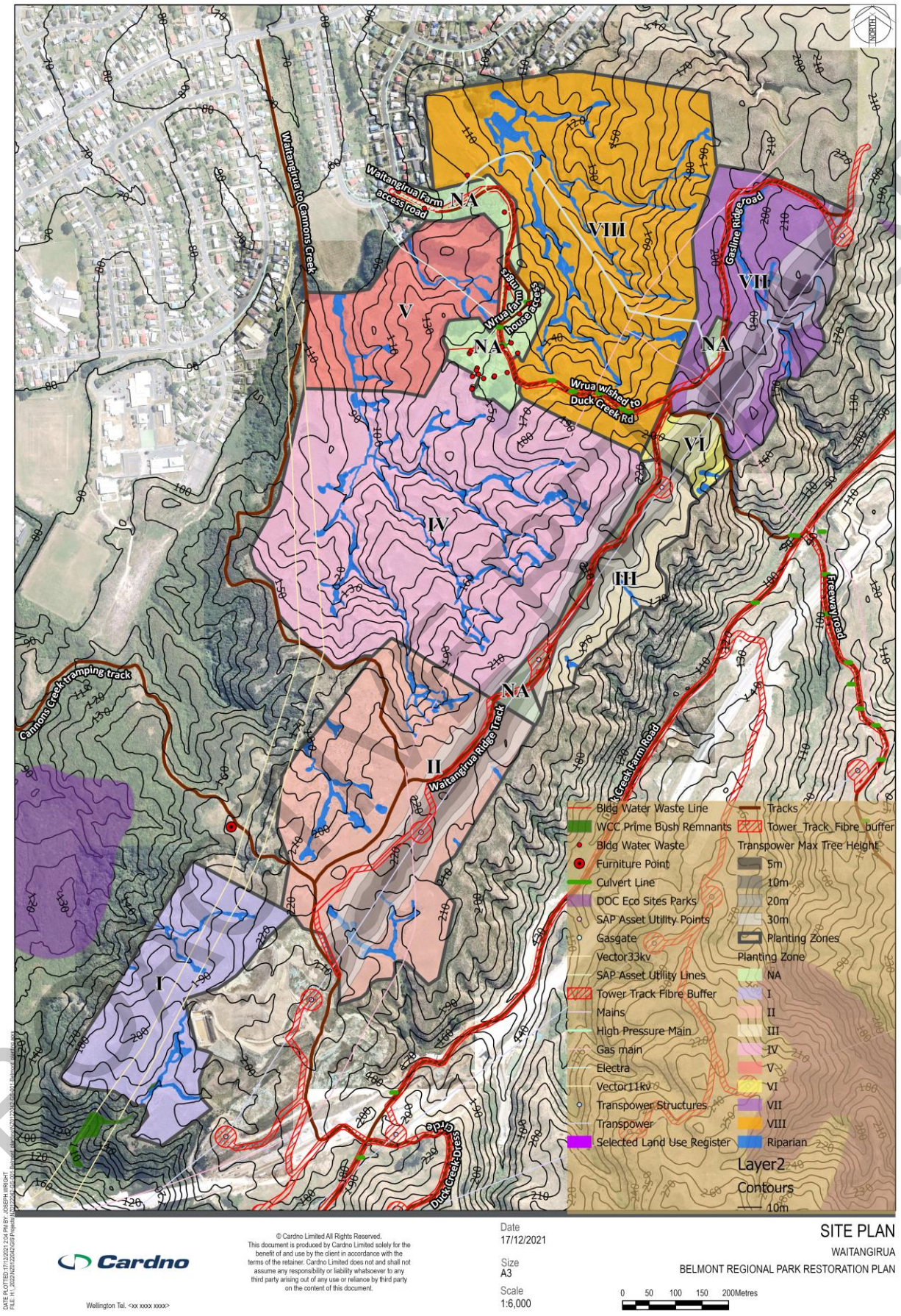
Polygon	Scientific name	Common name	<45 slope area	Mix (%)	Total
6A	*Cordyline australis*	Tī kōuka/ cabbage tree	277	5	14
6A	*Coriaria arborea var. arborea*	Tutu	277	10	28
6A	*Coprosma propinqua var. propinqua*	Mingimingi	277	20	55
6A	*Coprosma rhamnoides*	Mingimingi	277	20	55
6A	*Ozothamnus leptopyllus*	Tauhinu	277	20	55
6A	*Clematis paniculata*	Puawānanga/ white clematis	277	2	6
6A	*Muehlenbeckia australis*	Pohuehue/ large-leaved muehlenbeckia	277	2	6
6A	*Muehlenbeckia complexa var. complexa*	Small-leaved pohuehue/ scrub pohuehue	277	2	6
6A	*Rubus cissoides*	Tātarāmoa/ bush lawyer	277	2	6
6A	*Tetragonia trigyna*	NZ spinach	277	2	15
6A	*Aciphylla squarrosa var. squarrosa*	Kurikuri/ speargrass	277	10	77
6A	*Phormium cookianum subsp. Hookeri*	Mountain flax	277	5	14
6B	*Cordyline australis*	tī kōuka/cabbage tree	1275	5	64
6B	*Coriaria arborea var. arborea*	Tutu	1275	10	128
6B	*Coprosma propinqua var. propinqua*	Mingimingi	1275	20	255
6B	*Coprosma rhamnoides*	Mingimingi	1275	20	255
6B	*Ozothamnus leptopyllus*	Tauhinu	1275	20	255

6B	*Clematis paniculata*	Puawānanga/ white clematis	1275	2	26
6B	*Muehlenbeckia australis*	Pohuehue/ large-leaved muehlenbeckia	1275	2	26
6B	*Muehlenbeckia complexa var. complexa*	Small-leaved pohuehue/ scrub pohuehue	1275	2	26
6B	*Rubus cissoides*	Tātarāmoa/ bush lawyer	1275	2	26
6B	*Tetragonia trigyna*	NZ spinach	1275	2	71
6B	*Aciphylla squarrosa var. squarrosa*	Kurikuri/ speargrass	1275	10	354
6B	*Phormium cookianum subsp. Hookeri*	Mountain flax	1275	5	64
6C	*Cordyline australis*	Tī kōuka/ cabbage tree	292	5	15
6C	*Coriaria arborea var. arborea*	Tutu	292	10	29
6C	*Coprosma propinqua var. propinqua*	Mingimingi	292	20	58
6C	*Coprosma rhamnoides*	Mingimingi	292	20	58
6C	*Ozothamnus leptopyllus*	Tauhinu	292	20	58
6C	*Clematis paniculata*	Puawānanga/ white clematis	292	2	6
6C	*Muehlenbeckia australis*	Pohuehue/ large-leaved muehlenbeckia	292	2	6
6C	*Muehlenbeckia complexa var. complexa*	Small-leaved pohuehue/ scrub pohuehue	292	2	6
6C	*Rubus cissoides*	Tātarāmoa/ bush lawyer	292	2	6
6C	*Tetragonia trigyna*	NZ spinach	292	2	16
6C	*Aciphylla squarrosa var. squarrosa*	Kurikuri/ speargrass	292	10	81
6C	*Phormium cookianum subsp. Hookeri*	Mountain flax	292	5	15
6D	*Cordyline australis*	Tī kōuka/ cabbage tree	3503	5	175
6D	*Coriaria arborea var. arborea*	Tutu	3503	10	350
6D	*Coprosma propinqua var. propinqua*	Mingimingi	3503	20	701
6D	*Coprosma rhamnoides*	Mingimingi	3503	20	701
6D	*Ozothamnus leptopyllus*	Tauhinu	3503	20	701
6D	*Clematis paniculata*	Puawānanga/ white clematis	3503	2	70
6D	*Muehlenbeckia australis*	Pohuehue/ large-leaved muehlenbeckia	3503	2	70
6D	*Muehlenbeckia complexa var. complexa*	Small-leaved pohuehue/ scrub pohuehue	3503	2	70
6D	*Rubus cissoides*	Tātarāmoa/ bush lawyer	3503	2	70
6D	*Tetragonia trigyna*	NZ spinach	3503	2	195
6D	*Aciphylla squarrosa var. squarrosa*	Kurikuri/ speargrass	3503	10	973
6D	*Phormium cookianum subsp. Hookeri*	Mountain flax	3503	5	175

APPENDIX

C

PLANTING NUMBERS: WAITANGIRUA


Waitangirua to Cannons Creek
Waitangirua Farm access road
Wrua farm house access
Wrua Wished to Duck Creek Rd
Gasline Ridge Road
Cannons Creek tramping track
Waitangirua Ridge Track
N Creek Farm Road
Freeway road
Duck Creek Dress
NA
V
VIII
VII
VI
IV
III
II
I
Bldg Water Waste Line
WCC Prime Bush Remnants
Bldg Water Waste
Furniture Point
Culvert Line
DOC Eco Sites Parks
SAP Asset Utility Points
Gasgate
Vector33kv
SAP Asset Utility Lines
Tower Track Fibre Buffer
Mains
High Pressure Main
Gas main
Electra
Vector11kv
Transpower Structures
Transpower
Selected Land Use Register
Tracks
Tower_Track_Fibre_buffer
Transpower Max Tree Height
5m
10m
20m
30m
Planting Zones
Planting Zone
NA
I
II
III
IV
V
VI
VII
VIII
Riparian
Layer2
Contours
10m
NORTH
Cardno
Wellington Tel. <xx xxxx xxxx>
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Date
17/12/2021
Size
A3
Scale
1:6,000
SITE PLAN
WAITANGIRUA
BELMONT REGIONAL PARK RESTORATION PLAN
0 50 100 150 200Metres

Planting Zone	I				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	*Brachyglottis repanda*	Rangiora	18524	3	556
	Coprosma robusta	Karamū	18524	10	1852
	Griselinia lucida	Puka/ Broadleaf	18524	3	556
	Kunzea ericoides	Kānuka	18524	20	3705
	Leptospermum scoparium var. scoparium	Mānuka	18524	10	1852
	Leucopogon fasciculatus	Mingimingi	18524	4	741
	Metrosiderous robusta	Rātā/ northern rata	18524	2	370
	Myoporum laetum	Ngaio	18524	20	3705
	Myrsine australis	Māpou	18524	15	2779
	Olearia paniculata	Akiraho	18524	2	370
	Olearia rani	Heketara	18524	2	370
	Pennantia corymbosa	Kaikōmako	18524	3	556
	Pittosporum tenuifolium	Kōhūhū	18524	3	556
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	18524	3	556
East	*Podocarpus totara*	Tōtara	10814	2	216
	Aristotelia serrata	Makomako/ wineberry	10814	15	1622
	Brachyglottis repanda	Rangiora	10814	2	216
	Carpodetus serratus	Putaputawētā	10814	2	216
	Coprosma rhamnoides	Mingimingi	10814	15	1622
	Griselinia littoralis	Kāpuka	10814	5	541
	Hoheria sexstylosa	Houhere/ lacebark	10814	3	324
	Knightia excelsa	Rewarewa	10814	20	2163
	Kunzea ericoides	Kānuka	10814	20	2163
	Leptospermum scoparium var. scoparium	Mānuka	10814	8	865
	Melicope simplex	Poataniwha	10814	2	216
	Myrsine salicina	Toro	10814	2	216
	Olearia paniculata	Akiraho	10814	2	216
	Veronica parviflora	Tree hebe	10814	2	216

South	*Aristotelia serrata*	Makomako/ wineberry	18420	15	2763
	Brachyglottis repanda	Rangiora	18420	3	553
	Carpodetus serratus	Putaputawētā/ marbleleaf	18420	3	553
	Coprosma robusta	Karamū	18420	20	3684
	Kunzea ericoides	Kānuka	18420	20	3684
	Leptospermum scoparium var. scoparium	Mānuka	18420	15	2763
	Myrsine australis	Mapou	18420	10	1842
	Pennantia corymbosa	Kaikomako	18420	3	553
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	18420	3	553
	Schefflera digitata	patete or pate/ seven-finger	18420	3	553
	Solanum laciniatum	Poroporo	18420	2	368
	Veronica stricta var. stricta	Koromiko	18420	3	553
West	*Aristotelia serrata*	Makomako/ wineberry	42996	15	6449
	Brachyglottis repanda	Rangiora	42996	3	1290
	Carpodetus serratus	Putaputawētā/ marbleleaf	42996	3	1290
	Coprosma robusta	Karamū	42996	20	8599
	Kunzea ericoides	Kānuka	42996	20	8599
	Leptospermum scoparium var. scoparium	Mānuka	42996	15	6449
	Myrsine australis	Mapou	42996	10	4300
	Pennantia corymbosa	Kaikomako	42996	3	1290
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	42996	3	1290
	Schefflera digitata	patete or pate/ seven-finger	42996	3	1290
	Solanum laciniatum	Poroporo	42996	2	860
	Veronica stricta var. stricta	Koromiko	42996	3	1290

Planting Zone	II				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	*Brachyglottis repanda*	Rangiora	43390	3	1302
	Coprosma robusta	Karamū	43390	10	4339

	Griselinia lucida	Puka/ Broadleaf	43390	3	1302
	Kunzea ericoides	Kānuka	43390	20	8678
	Leptospermum scoparium var. scoparium	Mānuka	43390	10	4339
	Leucopogon fasciculatus	Mingimingi	43390	4	1736
	Metrosiderous robusta	Rātā/ northern rata	43390	2	868
	Myoporum laetum	Ngaio	43390	20	8678
	Myrsine australis	Māpou	43390	15	6509
	Olearia paniculata	Akiraho	43390	2	868
	Olearia rani	Heketara	43390	2	868
	Pennantia corymbosa	Kaikōmako	43390	3	1302
	Pittosporum tenuifolium	Kōhūhū	43390	3	1302
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	43390	3	1302
East	*Podocarpus totara*	Tōtara	50117	2	40
	Aristotelia serrata	Makomako/ wineberry	50117	15	7518
	Brachyglottis repanda	Rangiora	50117	2	1002
	Carpodetus serratus	Putaputawētā	50117	2	1002
	Coprosma rhamnoides	Mingimingi	50117	15	7518
	Griselinia littoralis	Kāpuka	50117	5	2506
	Hoheria sexstylosa	Houhere/ lacebark	50117	3	1504
	Knightia excelsa	Rewarewa	50117	20	10023
	Kunzea ericoides	Kānuka	50117	20	10023
	Leptospermum scoparium var. scoparium	Mānuka	50117	8	4009
	Melicope simplex	Poataniwha	50117	2	1002
	Myrsine salicina	Toro	50117	2	1002
	Olearia paniculata	Akiraho	50117	2	1002
	Veronica parviflora	Tree hebe	50117	2	1002
South	*Aristotelia serrata*	Makomako/ wineberry	29102	15	4365
	Brachyglottis repanda	Rangiora	29102	3	873
	Carpodetus serratus	Putaputawētā/ marbleleaf	29102	3	873
	Coprosma robusta	Karamū	29102	20	5820

	Kunzea ericoides	Kānuka	29102	20	5820
	Leptospermum scoparium var. scoparium	Mānuka	29102	15	4365
	Myrsine australis	Mapou	29102	10	2910
	Pennantia corymbosa	Kaikomako	29102	3	873
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	29102	3	873
	Schefflera digitata	patete or pate/ seven-finger	29102	3	873
	Solanum laciniatum	Poroporo	29102	2	582
	Veronica stricta var. stricta	Koromiko	29102	3	873
West	*Aristotelia serrata*	Makomako/ wineberry	58301	15	8745
	Brachyglottis repanda	Rangiora	58301	3	1749
	Carpodetus serratus	Putaputawētā/ marbleleaf	58301	3	1749
	Coprosma robusta	Karamū	58301	20	11660
	Kunzea ericoides	Kānuka	58301	20	11660
	Leptospermum scoparium var. scoparium	Mānuka	58301	15	8745
	Myrsine australis	Mapou	58301	10	5830
	Pennantia corymbosa	Kaikomako	58301	3	1749
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	58301	3	1749
	Schefflera digitata	patete or pate/ seven-finger	58301	3	1749
	Solanum laciniatum	Poroporo	58301	2	1166
	Veronica stricta var. stricta	Koromiko	58301	3	1749

Planting Zone	III				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	*Brachyglottis repanda*	Rangiora	920	3	28
	Coprosma robusta	Karamū	920	10	92
	Griselinia lucida	Puka/ Broadleaf	920	3	28
	Kunzea ericoides	Kānuka	920	20	184
	Leptospermum scoparium var. scoparium	Mānuka	920	10	92

	Leucopogon fasciculatus	Mingimingi	920	4	37
	Metrosiderous robusta	Rātā/ northern rata	920	2	18
	Myoporum laetum	Ngaio	920	20	184
	Myrsine australis	Māpou	920	15	138
	Olearia paniculata	Akiraho	920	2	18
	Olearia rani	Heketara	920	2	18
	Pennantia corymbosa	Kaikōmako	920	3	28
	Pittosporum tenuifolium	Kōhūhū	920	3	28
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	920	3	28
East	*Podocarpus totara*	Tōtara	23422	2	19
	Aristotelia serrata	Makomako/ wineberry	23422	15	3513
	Brachyglottis repanda	Rangiora	23422	2	468
	Carpodetus serratus	Putaputawētā	23422	2	468
	Coprosma rhamnoides	Mingimingi	23422	15	3513
	Griselinia littoralis	Kāpuka	23422	5	1171
	Hoheria sexstylosa	Houhere/ lacebark	23422	3	703
	Knightia excelsa	Rewarewa	23422	20	4684
	Kunzea ericoides	Kānuka	23422	20	4684
	Leptospermum scoparium var. scoparium	Mānuka	23422	8	1874
	Melicope simplex	Poataniwha	23422	2	468
	Myrsine salicina	Toro	23422	2	468
	Olearia paniculata	Akiraho	23422	2	468
	Veronica parviflora	Tree hebe	23422	2	468
South	*Aristotelia serrata*	Makomako/ wineberry	15202	15	2280
	Brachyglottis repanda	Rangiora	15202	3	456
	Carpodetus serratus	Putaputawētā/ marbleleaf	15202	3	456
	Coprosma robusta	Karamū	15202	20	3040
	Kunzea ericoides	Kānuka	15202	20	3040
	Leptospermum scoparium var. scoparium	Mānuka	15202	15	2280

	Myrsine australis	Mapou	15202	10	1520
	Pennantia corymbosa	Kaikomako	15202	3	456
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	15202	3	456
	Schefflera digitata	patete or pate/ seven-finger	15202	3	456
	Solanum laciniatum	Poroporo	15202	2	304
	Veronica stricta var. stricta	Koromiko	15202	3	456
West	*Aristotelia serrata*	Makomako/ wineberry	1116	15	167
	Brachyglottis repanda	Rangiora	1116	3	33
	Carpodetus serratus	Putaputawētā/ marbleleaf	1116	3	33
	Coprosma robusta	Karamū	1116	20	223
	Kunzea ericoides	Kānuka	1116	20	223
	Leptospermum scoparium var. scoparium	Mānuka	1116	15	167
	Myrsine australis	Mapou	1116	10	112
	Pennantia corymbosa	Kaikomako	1116	3	33
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	1116	3	33
	Schefflera digitata	patete or pate/ seven-finger	1116	3	33
	Solanum laciniatum	Poroporo	1116	2	22
	Veronica stricta var. stricta	Koromiko	1116	3	33

Planting Zone	IV				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	*Brachyglottis repanda*	Rangiora	89681	3	2690
	Coprosma robusta	Karamū	89681	10	8968
	Griselinia lucida	Puka/ Broadleaf	89681	3	2690
	Kunzea ericoides	Kānuka	89681	20	17936
	Leptospermum scoparium var. scoparium	Mānuka	89681	10	8968
	Leucopogon fasciculatus	Mingimingi	89681	4	3587
	Metrosiderous robusta	Rātā/ northern rata	89681	2	1794

	Myoporum laetum	Ngaio	89681	20	17936
	Myrsine australis	Māpou	89681	15	13452
	Olearia paniculata	Akiraho	89681	2	1794
	Olearia rani	Heketara	89681	2	1794
	Pennantia corymbosa	Kaikōmako	89681	3	2690
	Pittosporum tenuifolium	Kōhūhū	89681	3	2690
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	89681	3	2690
East	*Podocarpus totara*	Tōtara	47028	2	38
	Aristotelia serrata	Makomako/ wineberry	47028	15	7054
	Brachyglottis repanda	Rangiora	47028	2	941
	Carpodetus serratus	Putaputawētā	47028	2	941
	Coprosma rhamnoides	Mingimingi	47028	15	7054
	Griselinia littoralis	Kāpuka	47028	5	2351
	Hoheria sexstylosa	Houhere/ lacebark	47028	3	1411
	Knightia excelsa	Rewarewa	47028	20	9406
	Kunzea ericoides	Kānuka	47028	20	9406
	Leptospermum scoparium var. scoparium	Mānuka	47028	8	3762
	Melicope simplex	Poataniwha	47028	2	941
	Myrsine salicina	Toro	47028	2	941
	Olearia paniculata	Akiraho	47028	2	941
	Veronica parviflora	Tree hebe	47028	2	941
South	*Aristotelia serrata*	Makomako/ wineberry	28994	15	4349
	Brachyglottis repanda	Rangiora	28994	3	870
	Carpodetus serratus	Putaputawētā/ marbleleaf	28994	3	870
	Coprosma robusta	Karamū	28994	20	5799
	Kunzea ericoides	Kānuka	28994	20	5799
	Leptospermum scoparium var. scoparium	Mānuka	28994	15	4349
	Myrsine australis	Mapou	28994	10	2899
	Pennantia corymbosa	Kaikomako	28994	3	870
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	28994	3	870

	Schefflera digitata	patete or pate/ seven-finger	28994	3	870
	Solanum laciniatum	Poroporo	28994	2	580
	Veronica stricta var. stricta	Koromiko	28994	3	870
West	*Aristotelia serrata*	Makomako/ wineberry	115157	15	17274
	Brachyglottis repanda	Rangiora	115157	3	3455
	Carpodetus serratus	Putaputawētā/ marbleleaf	115157	3	3455
	Coprosma robusta	Karamū	115157	20	23031
	Kunzea ericoides	Kānuka	115157	20	23031
	Leptospermum scoparium var. scoparium	Mānuka	115157	15	17274
	Myrsine australis	Mapou	115157	10	11516
	Pennantia corymbosa	Kaikomako	115157	3	3455
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	115157	3	3455
	Schefflera digitata	patete or pate/ seven-finger	115157	3	3455
	Solanum laciniatum	Poroporo	115157	2	2303
	Veronica stricta var. stricta	Koromiko	115157	3	3455

Planting Zone	V				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	*Brachyglottis repanda*	Rangiora	17524	3	526
	Coprosma robusta	Karamū	17524	10	1752
	Griselinia lucida	Puka/ Broadleaf	17524	3	526
	Kunzea ericoides	Kānuka	17524	20	3505
	Leptospermum scoparium var. scoparium	Mānuka	17524	10	1752
	Leucopogon fasciculatus	Mingimingi	17524	4	701
	Metrosiderous robusta	Rātā/ northern rata	17524	2	350
	Myoporum laetum	Ngaio	17524	20	3505
	Myrsine australis	Māpou	17524	15	2629
	Olearia paniculata	Akiraho	17524	2	350
	Olearia rani	Heketara	17524	2	350
	Pennantia corymbosa	Kaikōmako	17524	3	526

	Pittosporum tenuifolium	Kōhūhū	17524	3	526
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	17524	3	526
East	*Podocarpus totara*	Tōtara	15239	2	12
	Aristotelia serrata	Makomako/ wineberry	15239	15	2286
	Brachyglottis repanda	Rangiora	15239	2	305
	Carpodetus serratus	Putaputawētā	15239	2	305
	Coprosma rhamnoides	Mingimingi	15239	15	2286
	Griselinia littoralis	Kāpuka	15239	5	762
	Hoheria sexstylosa	Houhere/ lacebark	15239	3	457
	Knightia excelsa	Rewarewa	15239	20	3048
	Kunzea ericoides	Kānuka	15239	20	3048
	Leptospermum scoparium var. scoparium	Mānuka	15239	8	1219
	Melicope simplex	Poataniwha	15239	2	305
	Myrsine salicina	Toro	15239	2	305
	Olearia paniculata	Akiraho	15239	2	305
	Veronica parviflora	Tree hebe	15239	2	305
South	*Aristotelia serrata*	Makomako/ wineberry	6120	15	918
	Brachyglottis repanda	Rangiora	6120	3	184
	Carpodetus serratus	Putaputawētā/ marbleleaf	6120	3	184
	Coprosma robusta	Karamū	6120	20	1224
	Kunzea ericoides	Kānuka	6120	20	1224
	Leptospermum scoparium var. scoparium	Mānuka	6120	15	918
	Myrsine australis	Mapou	6120	10	612
	Pennantia corymbosa	Kaikomako	6120	3	184
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	6120	3	184
	Schefflera digitata	patete or pate/ seven-finger	6120	3	184
	Solanum laciniatum	Poroporo	6120	2	122
	Veronica stricta var. stricta	Koromiko	6120	3	184
West	*Aristotelia serrata*	Makomako/ wineberry	37202	15	5580
	Brachyglottis repanda	Rangiora	37202	3	1116

	Carpodetus serratus	Putaputawētā/ marbleleaf	37202	3	1116
	Coprosma robusta	Karamū	37202	20	7440
	Kunzea ericoides	Kānuka	37202	20	7440
	Leptospermum scoparium var. scoparium	Mānuka	37202	15	5580
	Myrsine australis	Mapou	37202	10	3720
	Pennantia corymbosa	Kaikomako	37202	3	1116
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	37202	3	1116
	Schefflera digitata	patete or pate/ seven-finger	37202	3	1116
	Solanum laciniatum	Poroporo	37202	2	744
	Veronica stricta var. stricta	Koromiko	37202	3	1116

Planting Zone	VI				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	*Brachyglottis repanda*	Rangiora	4718	3	142
	Coprosma robusta	Karamū	4718	10	472
	Griselinia lucida	Puka/ Broadleaf	4718	3	142
	Kunzea ericoides	Kānuka	4718	20	944
	Leptospermum scoparium var. scoparium	Mānuka	4718	10	472
	Leucopogon fasciculatus	Mingimingi	4718	4	189
	Metrosiderous robusta	Rātā/ northern rata	4718	2	94
	Myoporum laetum	Ngaio	4718	20	944
	Myrsine australis	Māpou	4718	15	708
	Olearia paniculata	Akiraho	4718	2	94
	Olearia rani	Heketara	4718	2	94
	Pennantia corymbosa	Kaikōmako	4718	3	142
	Pittosporum tenuifolium	Kōhūhū	4718	3	142
	Pseudopanax arboreus	Whauwhaupaku/ Five-finger	4718	3	142
East	*Podocarpus totara*	Tōtara	9454	2	8
	Aristotelia serrata	Makomako/ wineberry	9454	15	1418
	Brachyglottis repanda	Rangiora	9454	2	189

	Carpodetus serratus	Putaputawētā	9454	2	189
	Coprosma rhamnoides	Mingimingi	9454	15	1418
	Griselinia littoralis	Kāpuka	9454	5	473
	Hoheria sexstylosa	Houhere/ lacebark	9454	3	284
	Knightia excelsa	Rewarewa	9454	20	1891
	Kunzea ericoides	Kānuka	9454	20	1891
	Leptospermum scoparium var. scoparium	Mānuka	9454	8	756
	Melicope simplex	Poataniwha	9454	2	189
	Myrsine salicina	Toro	9454	2	189
	Olearia paniculata	Akiraho	9454	2	189
	Veronica parviflora	Tree hebe	9454	2	189
South	*Aristotelia serrata*	Makomako/ wineberry	2420	15	363
	Brachyglottis repanda	Rangiora	2420	3	73
	Carpodetus serratus	Putaputawētā/ marbleleaf	2420	3	73
	Coprosma robusta	Karamū	2420	20	484
	Kunzea ericoides	Kānuka	2420	20	484
	Leptospermum scoparium var. scoparium	Mānuka	2420	15	363
	Myrsine australis	Mapou	2420	10	242
	Pennantia corymbosa	Kaikomako	2420	3	73
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	2420	3	73
	Schefflera digitata	patete or pate/ seven-finger	2420	3	73
	Solanum laciniatum	Poroporo	2420	2	48
	Veronica stricta var. stricta	Koromiko	2420	3	73
West	*Aristotelia serrata*	Makomako/ wineberry	336	15	50
	Brachyglottis repanda	Rangiora	336	3	10
	Carpodetus serratus	Putaputawētā/ marbleleaf	336	3	10
	Coprosma robusta	Karamū	336	20	67
	Kunzea ericoides	Kānuka	336	20	67
	Leptospermum scoparium var. scoparium	Mānuka	336	15	50

	Myrsine australis	Mapou	336	10	34
	Pennantia corymbosa	Kaikomako	336	3	10
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	336	3	10
	Schefflera digitata	patete or pate/ seven-finger	336	3	10
	Solanum laciniatum	Poroporo	336	2	7
	Veronica stricta var. stricta	Koromiko	336	3	10

Planting Zone	VII				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	Brachyglottis repanda	Rangiora	9049	3	271
	Coprosma robusta	Karamū	9049	10	905
	Griselinia lucida	Puka/ Broadleaf	9049	3	271
	Kunzea ericoides	Kānuka	9049	20	1810
	Leptospermum scoparium var. scoparium	Mānuka	9049	10	905
	Leucopogon fasciculatus	Mingimingi	9049	4	362
	Metrosiderous robusta	Rātā/ northern rata	9049	2	181
	Myoporum laetum	Ngaio	9049	20	1810
	Myrsine australis	Māpou	9049	15	1357
	Olearia paniculata	Akiraho	9049	2	181
	Olearia rani	Heketara	9049	2	181
	Pennantia corymbosa	Kaikōmako	9049	3	271
	Pittosporum tenuifolium	Kōhūhū	9049	3	271
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	9049	3	271
East	Podocarpus totara	Tōtara	28345	2	23
	Aristotelia serrata	Makomako/ wineberry	28345	15	4252
	Brachyglottis repanda	Rangiora	28345	2	567
	Carpodetus serratus	Putaputawētā	28345	2	567
	Coprosma rhamnoides	Mingimingi	28345	15	4252
	Griselinia littoralis	Kāpuka	28345	5	1417

	Hoheria sexstylosa	Houhere/ lacebark	28345	3	850
	Knightia excelsa	Rewarewa	28345	20	5669
	Kunzea ericoides	Kānuka	28345	20	5669
	Leptospermum scoparium var. scoparium	Mānuka	28345	8	2268
	Melicope simplex	Poataniwha	28345	2	567
	Myrsine salicina	Toro	28345	2	567
	Olearia paniculata	Akiraho	28345	2	567
	Veronica parviflora	Tree hebe	28345	2	567
South	Aristotelia serrata	Makomako/ wineberry	25695	15	3854
	Brachyglottis repanda	Rangiora	25695	3	771
	Carpodetus serratus	Putaputawētā/ marbleleaf	25695	3	771
	Coprosma robusta	Karamū	25695	20	5139
	Kunzea ericoides	Kānuka	25695	20	5139
	Leptospermum scoparium var. scoparium	Mānuka	25695	15	3854
	Myrsine australis	Mapou	25695	10	2570
	Pennantia corymbosa	Kaikomako	25695	3	771
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	25695	3	771
	Schefflera digitata	patete or pate/ seven-finger	25695	3	771
	Solanum laciniatum	Poroporo	25695	2	514
	Veronica stricta var. stricta	Koromiko	25695	3	771
West	Aristotelia serrata	Makomako/ wineberry	42974	15	6446
	Brachyglottis repanda	Rangiora	42974	3	1289
	Carpodetus serratus	Putaputawētā/ marbleleaf	42974	3	1289
	Coprosma robusta	Karamū	42974	20	8595
	Kunzea ericoides	Kānuka	42974	20	8595
	Leptospermum scoparium var. scoparium	Mānuka	42974	15	6446
	Myrsine australis	Mapou	42974	10	4297
	Pennantia corymbosa	Kaikomako	42974	3	1289
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	42974	3	1289

	Schefflera digitata	patete or pate/ seven-finger	42974	3	1289
	Solanum laciniatum	Poroporo	42974	2	859
	Veronica stricta var. stricta	Koromiko	42974	3	1289

Planting Zone	VIII				
	Scientific name	**Common name**	**Area (m2)**	**Mix (%)**	**Total plants**
North	Brachyglottis repanda	Rangiora	56309	3	1689
	Coprosma robusta	Karamū	56309	10	5631
	Griselinia lucida	Puka/ Broadleaf	56309	3	1689
	Kunzea ericoides	Kānuka	56309	20	11262
	Leptospermum scoparium var. scoparium	Mānuka	56309	10	5631
	Leucopogon fasciculatus	Mingimingi	56309	4	2252
	Metrosiderous robusta	Rātā/ northern rata	56309	2	1126
	Myoporum laetum	Ngaio	56309	20	11262
	Myrsine australis	Māpou	56309	15	8446
	Olearia paniculata	Akiraho	56309	2	1126
	Olearia rani	Heketara	56309	2	1126
	Pennantia corymbosa	Kaikōmako	56309	3	1689
	Pittosporum tenuifolium	Kōhūhū	56309	3	1689
	Pseudopanax arboreus	Whauwhaupaku, Five-finger	56309	3	1689
East	Podocarpus totara	Tōtara	26427	2	21
	Aristotelia serrata	Makomako/ wineberry	26427	15	3964
	Brachyglottis repanda	Rangiora	26427	2	529
	Carpodetus serratus	Putaputawētā	26427	2	529
	Coprosma rhamnoides	Mingimingi	26427	15	3964
	Griselinia littoralis	Kāpuka	26427	5	1321
	Hoheria sexstylosa	Houhere/ lacebark	26427	3	793
	Knightia excelsa	Rewarewa	26427	20	5285
	Kunzea ericoides	Kānuka	26427	20	5285

	Leptospermum scoparium var. scoparium	Mānuka	26427	8	2114
	Melicope simplex	Poataniwha	26427	2	529
	Myrsine salicina	Toro	26427	2	529
	Olearia paniculata	Akiraho	26427	2	529
	Veronica parviflora	Tree hebe	26427	2	529
South	Aristotelia serrata	Makomako/ wineberry	31192	15	4679
	Brachyglottis repanda	Rangiora	31192	3	936
	Carpodetus serratus	Putaputawētā/ marbleleaf	31192	3	936
	Coprosma robusta	Karamū	31192	20	6238
	Kunzea ericoides	Kānuka	31192	20	6238
	Leptospermum scoparium var. scoparium	Mānuka	31192	15	4679
	Myrsine australis	Mapou	31192	10	3119
	Pennantia corymbosa	Kaikomako	31192	3	936
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	31192	3	936
	Schefflera digitata	patete or pate/ seven-finger	31192	3	936
	Solanum laciniatum	Poroporo	31192	2	624
	Veronica stricta var. stricta	Koromiko	31192	3	936
West	Aristotelia serrata	Makomako/ wineberry	112624	15	16894
	Brachyglottis repanda	Rangiora	112624	3	3379
	Carpodetus serratus	Putaputawētā/ marbleleaf	112624	3	3379
	Coprosma robusta	Karamū	112624	20	22525
	Kunzea ericoides	Kānuka	112624	20	22525
	Leptospermum scoparium var. scoparium	Mānuka	112624	15	16894
	Myrsine australis	Mapou	112624	10	11262
	Pennantia corymbosa	Kaikomako	112624	3	3379
	Pseudopanax arboreus	Whauwhaupaku/ five-finger	112624	3	3379
	Schefflera digitata	patete or pate/ seven-finger	112624	3	3379
	Solanum laciniatum	Poroporo	112624	2	2252
	Veronica stricta var. stricta	Koromiko	112624	3	3379

APPENDIX

D

WAITANGIRUA STATUS

Appendix D

Received from GWRC, 28.08.2022. Green ‘polygon’ indicates area(s) planted.