

# **BROOK, MAITAI, RODING AND MARSDEN VALLEY FORESTS**

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**Owned by  
NELSON CITY COUNCIL**

## **Forest Management Plan**



**For the period June 2020 – June 2025**



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## 1. Introduction

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### Foundation Principle

Nelson City Council is committed to adopt the Forest Stewardship Council (FSC) Principles and to meet their Criteria pertaining to forest management.

The Council seeks FSC certification to:

- Set a leadership example as a forest owner and a regulator.
- Obtain the best access opportunities to the local processing market which is capable of and seeking to, source all its input requirements as FSC certified feedstock.

The FSC Principles and Criteria describe the essential elements or rules of environmentally appropriate, socially beneficial and economically viable forest management.

Nelson City Council is committed to the PF Olsen FSC Group Scheme that is implemented through the Group Scheme Member processes and associated documents, as this provides the most efficient mechanism to obtain certification.

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### About this plan

This Management Plan provides a summary of Brook, Maitai, Roding and Marsden Valley Forests and the intended management over the specified period. It contains:

- A description of the land and its landscape context.
- A description of the external operating environment.
- Management objectives.
- A description of the commercial plantation estate and its non-commercial elements and obligations.
- Forest management, harvesting, protection and land management intentions.
- Provisions for monitoring and protection and public usage.
- Maps showing plantation area, legal boundaries and protected areas.

This plan pertains to the management of Brook, Maitai, Roding and Marsden Valley Forests and will be current for the next 5 years. The next major review date for this plan is **June 2025**. Minor annual revisions made to this plan in the interim are recorded in Section 18: [Register of Plan Change and Review](#).

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# The Landscape Context

## 2. The Forest Land

### Overview

This section describes the legal and physical attributes of the land on which the forest is located. Included in this section are discussions of:

- Legal ownership and tenure.
- Location and access.
- Topography.
- Soils.
- Climate.

### Legal Ownership

The legal descriptions of the land on which the Brook, Maitai, Roding and Marsden Valley Forests are situated on are contained in [Appendix 1](#).

The tenure of all forests is freehold, owned by the **Nelson City Council**. No additional areas are leased to or from other parties. Table 1 gives the contact details for the Council.

**Table 1: Contact details for the Nelson City Council**

Council (Unitary Authority)	Phone	Fax	Email	Website
Nelson City Council	03 546 0200	+64 3 546 0239	<a href="mailto:enquiry@ncc.govt.nz">enquiry@ncc.govt.nz</a>	<a href="http://nelson.govt.nz/">http://nelson.govt.nz/</a>

### Forests & location

Brook, Maitai, Roding and Marsden Valley Forests are all located to the South / South-East of Nelson City Centre.

**Brook forest** is located approximately 2 - 3km south / south east of Nelson City Centre. The main blocks are accessed along Brook Street. Internal roads and tracks provide access to all parts of the forest. A smaller block of forest is accessed via Market Road. Overall, Brook Forest is split among 8 blocks, while two of these blocks currently do not contain plantations.

**Maitai forest** is located approximately 5 km south east of Nelson City Centre. The forest is made up of several different blocks in the nearby vicinity, all of which lie along Maitai Valley Road. Internal roads and tracks provide access to some parts of the forest.

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**Roding forest** is located approximately 10km south of Nelson City Centre. The main access is located off Aniseed Valley Road is best accessed via SH6. Internal forest roads and tracks provide access to all parts of the forest.

**Marsden Valley forest** is located approximately 7km south of Nelson City Centre. The main access for all three blocks are along Marsden Valley Road, best accessed off The Ridgeway. Internal forest roads and tracks provide access to all parts of the forest.

In relation to potential significant markets, the overwhelming bulk of the forest resources are all located within a close proximity to each other. The distances to major markets are listed in Table 2 below, the distances being estimated from the centre of all four forests.

**Table 2: Distances from forests to nearby markets**

Potential Market or Export Port	Log Market	Approx. Distance from Forests (km)			
		Brook	Maitai	Roding	Marsden Valley
Nelson Port	Export	5	10	30	10
South Pine Sawmill	Domestic	5	13	22	5
Carter Holt Harvey Sawmill	Domestic	28	36	27	27
Nelson Pine Industries – LVL and pulp mill	Domestic	17	25	25	16
Timberlink Sawmill	Domestic	115	120	150	120

The forest block's geographic locations are shown in [Map 1](#).

## Geology

The geology underlying the Nelson City forests is described in Table 3<sup>1</sup>. Although there are numerous faults present in the area, the underlying geology generally, is very stable.

**Table 3: Geological descriptions of the Forests**

Forest	Underlying Geological Description
Brook	Lower slopes are Greville formation basement sedimentary rock comprising finely bedded sandstones and siltstones grading into Stephens Subgroup basement sedimentary rock comprising variably bedded sandstone and siltstone with conglomerate lenses and limestone blocks locally fossiliferous.
Maitai	Basement sedimentary rock comprising finely bedded sandstones and siltstones
Marsden Valley	Undifferentiated Richmond group of variably bedded sandstone - siltstone with conglomerate containing granite clasts. Upslope geology grades into Greville formation basement sedimentary rock comprising finely bedded sandstones and

<sup>1</sup> <https://data.gns.cri.nz/geology/>

	siltstones with a further transition into Waiua Formation basement sedimentary rocks of sandstone.
<b>Roding</b>	Tramway & Greville formation basement sedimentary rock comprising finely bedded sandstones and siltstones

## Topography

### Brook

The topography of Brook Forest is predominantly areas of steep rolling hill country that requires cable-based harvesting systems. There are small areas of more gentle slopes in some blocks, which could be harvested by ground-based equipment. The altitude ranges are different in each block, but as a max and minimum ranges from 60 to 670 metres above sea level.

### Maitai

The topography of Maitai Forest is predominantly areas of steep rolling hill country that will require cable-based harvesting. There are a few smaller areas with gentle slopes that may also be ground-based. The altitude ranges from 80 to 595 metres above sea level.

### Roding

The topography of Roding Forest is entirely steep rolling hill country that will require cable-based harvesting systems. The altitude ranges from 185 to 955 metres above sea level in the most southern section.

### Marsden Valley

The topography of Marsden Valley Forest is predominantly steep rolling hill country that will require cable-based harvesting systems. In two smaller blocks, the slope is much gentler, allowing for a ground-based harvest. The altitude in the main block ranges from 170 to 845 m above sea level in the eastern section.

## Soils

Information regarding the soils of the Bryant ecological district is summarised from Department of Conservation's *Ecological Regions and Districts of New Zealand*, 1987.

Basic intrusive rocks in the north east soils have clayey, moderately deep subsoils, medium natural fertility but droughty in summer. Soils located on ultramafic dunite and serpentine rocks (Dun Mountain, Brook/ Maitai Forest region) which as classified in the NEW ZEALAND Soil Classification<sup>2</sup> are predominantly "Mafic Brown" have low natural fertility with toxic levels of magnesium, chromium and nickel.

In the hilly and steep country of the NW region soils are classed as "orthic Brown" (Roding and Marsden Valley Forests) and are moderately deep fertile soils with clayey subsoils. In the higher altitudes and higher rainfall areas, soils tend to be very strongly leached to podzolised with low natural fertility.

<sup>2</sup> Abridged from [Landcare Research's Soil Maps](#)

## Climate

The climate of the Northern South Island region is temperate, warm and humid in summer with cold winters. Summer droughts are frequent and predominant wind flow is from the northwest. The mean annual temperature for the region is around 12.7 degrees Celsius.

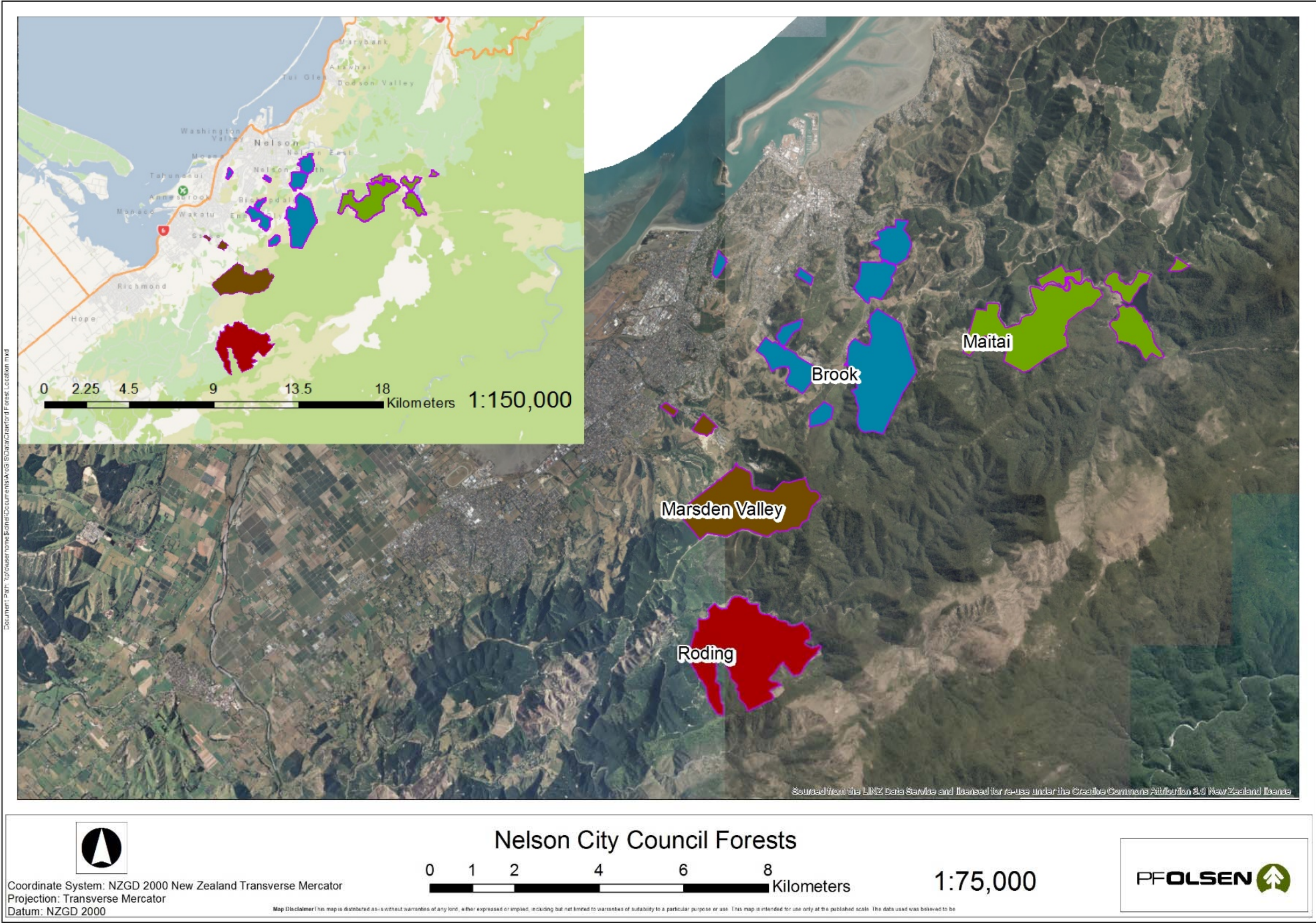
The average yearly rainfall in the region is 1000 – 1240 mm, relatively evenly distributed<sup>3</sup>. Occasionally the area can experience intense rainfall events, usually after degrading storms from the pacific make landfall.

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<sup>3</sup> Rainfall and temperature data is summarised from NIWA median annual maps.



Map 1 - Forest Location Map





### 3. The Broader Landscape

#### Ecological Districts

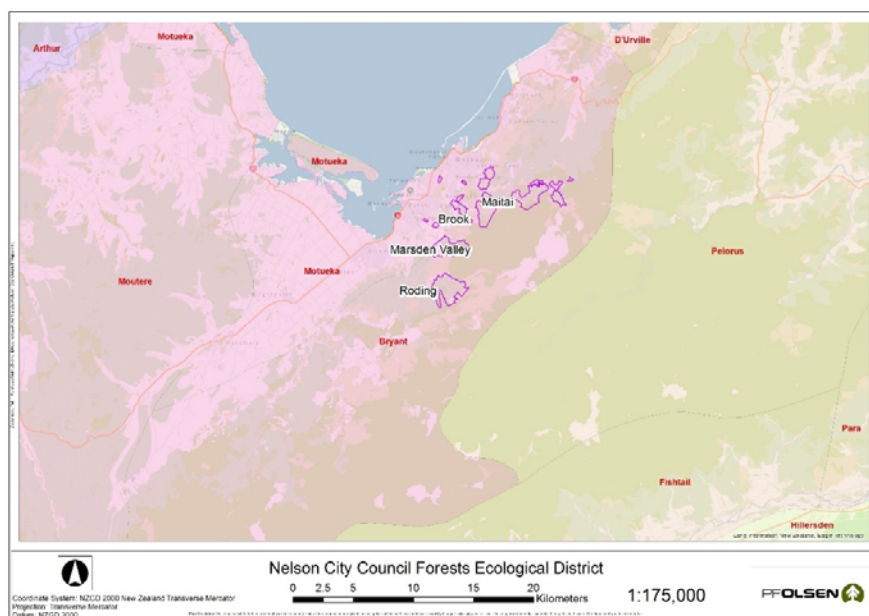
Information regarding the ecological districts is summarised from Department of Conservation *Ecological Regions and Districts of New Zealand*, 1987.

Brook, Maitai, Roding and Marsden Valley Forests all fall within the Bryant ecological district. The topology of this district is classified as being steep hill country. Geology is quite varied, containing a range of different metamorphic, sedimentary and igneous rocks.

Soils have clayey moderately deep subsoils with a medium natural fertility but prone to drought in the summer periods. Steepland soils near the coasts are shallow, stony, and have yellowish brown friable subsoils. In the higher altitudes of the forests, soils are likely to be strongly leached to podzolised.

Indigenous vegetation confined in the higher hills to the east and south. Forests generally contain mixed beech-podocarp, dominated by red beech, silver beech, the black beech-mountain beech complex and occasionally hard beech. Rimu, miro, matai and occasionally totara; tanekaha may be quite common in the sub-canopy. Scrub is generally in the lower altitudes and is generally manuka dominated. Tussockland contains mainly red tussock and restricted to higher altitudes, elsewhere snowgrass is dominant.

**Figure 1: Nelson City Council Forest Estate Ecological Districts**



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Under the FSC National Standard for Plantation Forest Management in New Zealand revised in 2013, an area of reserves equivalent to 10% of the productive area should be reserved within each ED, inclusive of reservation of 5% of the productive area within large forests (> 1,000 ha).

Table 4 illustrates the percentage of area protected within Brook, Maitai, Roding and Marsden Valley Forests, compared to the total forest property area. In all forests the total area of protected ecosystem reserves far exceeds the minima required for certification.

**Table 4: Protective status of the ecological landscape for Nelson City Forest Estate**

Ecological District	Forests	Total Forest Area (ha)	Reserve Area (ha)	Reserve (%)	Meets FSC?	Reserve Shortfall (ha) equivalent
Bryant	Brook	403	271	67%	Yes	Nil
Bryant	Maitai	480	294	61%	Yes	Nil
Bryant	Marsden	313	171	55%	Yes	Nil
Bryant	Roding	703	475	67%	Yes	Nil
<b>Totals</b>		<b>1,899</b>	<b>1,211</b>	<b>64%</b>	<b>Yes</b>	<b>Nil</b>

#### Other reserved areas

In addition to the areas protected for their intrinsic ecological value, there are a further 83ha within the total of 1,211ha reserved from production that are reserves under other classifications as listed below. The functions are multiple in some cases, but generally relating to the retirement from production of areas deemed unsuitable for continued production and better able to fulfill through reversion or active supplementary management, roles of riparian, recreational or aesthetic enhancement.

**Table 5: Other special function reserves in the Nelson City Forest Estate**

Forest	Landscape / Amenity	Recreation	Retired Production Land	Riparian Ecosystem	Terrestrial Ecosystem	Grand Total
Brook	38.0		3.5		1.3	42.8
Maitai	4.6		2.1			6.7
Marsden Valley	15.9	5.1	5.6			26.6
Roding				6.9		6.9
<b>Grand Total</b>	<b>58.5</b>	<b>5.1</b>	<b>11.2</b>	<b>6.9</b>	<b>1.3</b>	<b>83.0</b>

#### Threatened Environments Classification

The Landcare 'Threatened Environments Classification' (TEC) is a spatial tool providing information on the quantity and status of current indigenous vegetation cover relative to its pre-human extent. It is illustrative of the remaining extent, its legal protection status, and spatial distribution in New Zealand's landscape. The TEC is a combination of three national databases:

- Land Environments New Zealand (LENZ)
- Landcover Database
- Protected Areas Network

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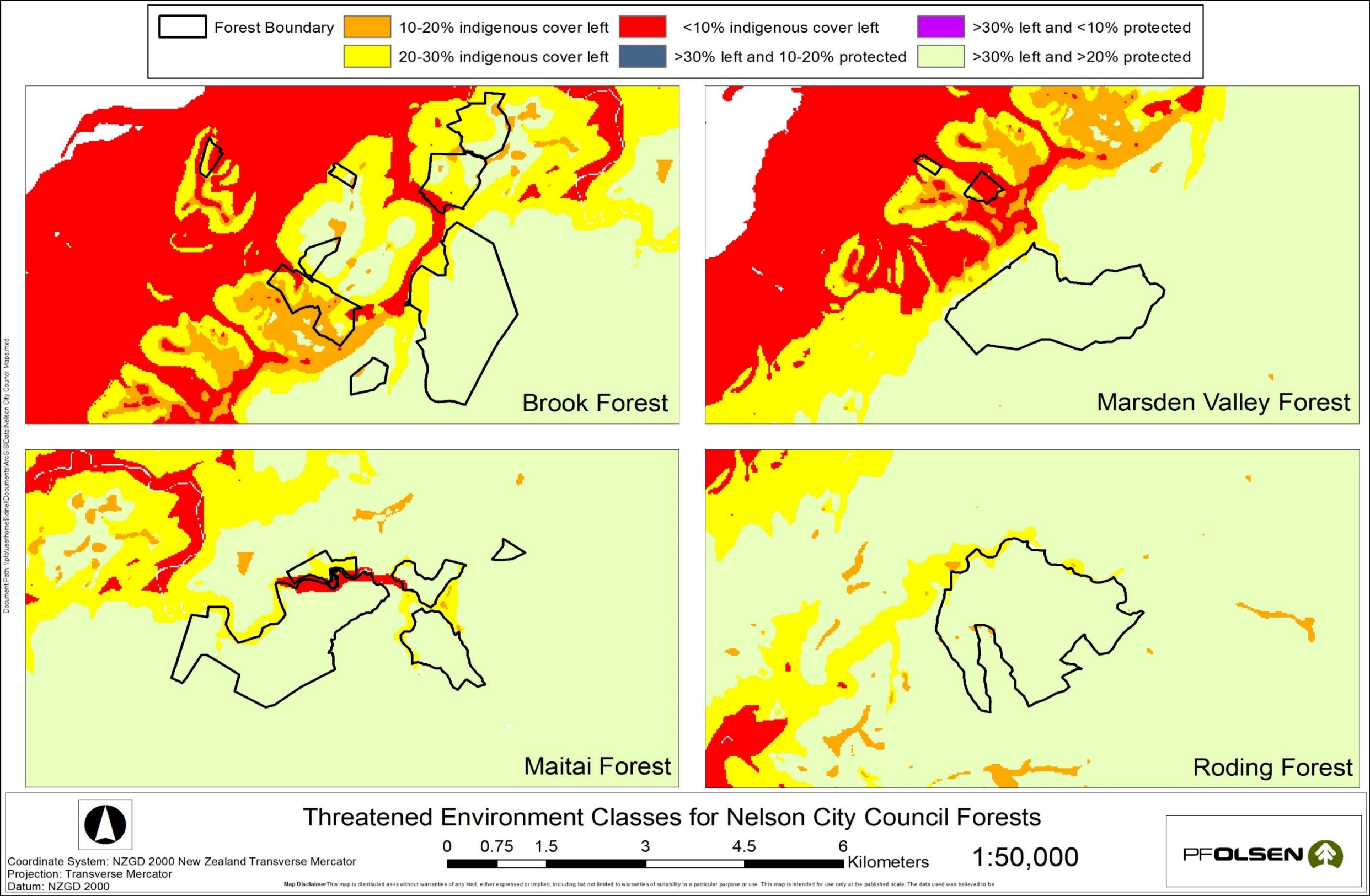
The TEC uses indigenous vegetation cover as a surrogate for indigenous biodiversity, which includes indigenous ecosystems, habitats, and communities; the indigenous species, subspecies and varieties that are supported by indigenous vegetation; and their genetic diversity. It uses legal protection as a surrogate for the relative vulnerability of indigenous biodiversity to pressures such as land clearance, extractive land uses, and the effects of fragmentation. The TEC is therefore most appropriately applied to help identify places that are priorities for formal protection against clearance and/or incompatible land uses, and for ecological restoration to restore lost species, linkages and buffers.

The TEC status of the reserves (Table 6) reflects the high representation and protection of Brook, Maitai, Roding and Marsden Valley Forests reserve types in the wider NEW ZEALAND context.

**Table 6: Distribution of protected Forest Areas in relation to the TEC**

<b>Threatened Environments Classification</b>	<b>Brook</b>	<b>Maitai</b>	<b>Marsden Valley</b>	<b>Roding</b>	<b>Total</b>
<10% remaining	2.0	6.8	14.0		<b>22.8</b>
10 – 20% remaining	5.2		1.4	1.0	<b>7.6</b>
20 – 30% remaining	62.0	19.5	6.5	7.4	<b>95.4</b>
>30% remaining & <10% protected					
>30% remaining & 10 – 20% protected					
>30% remaining & >20% protected	244.4	162.1	175.3	210.6	<b>792.4</b>
<b>Total Area (ha)</b>	<b>313.6</b>	<b>188.4</b>	<b>197.2</b>	<b>219.0</b>	<b>918.2</b>

Map 2 - Forest Ecological Context



## Historic and archaeological sites

Records of known archaeological and historical places are maintained in the New Zealand Archaeological Association (NZAA) Site Recording Scheme published in the 'Archsite' database<sup>4</sup>. PF Olsen retains a license to this dataset and all recorded site information is reproduced in mapping for forestry operations. The Archaeological Site Probability model published by the Department of Conservation<sup>5</sup> provides further guidance on the probability of pre-European archaeological evidence existing based on the geographical location of the forest and historical occupation of the local area.

Records from the 'Archsite' web resource has revealed there are no known historic sites at Brook, Roding and Marsden Valley Forests, although there are a number located in and around Maitai Forest and these are very significant to local Iwi.

The details of these sites are displayed in Table 7 and the Map 3 over the page.

**Table 7: Known archaeological sites in Maitai Forest**

Reference	Type
<b>027/23</b>	Artefact – stone flakes
<b>027/31</b>	Working area / flaking floor

The NCC Resource Management plan also has schedules of archaeological sites (from the same NZAA source) as well as other sites of heritage importance.

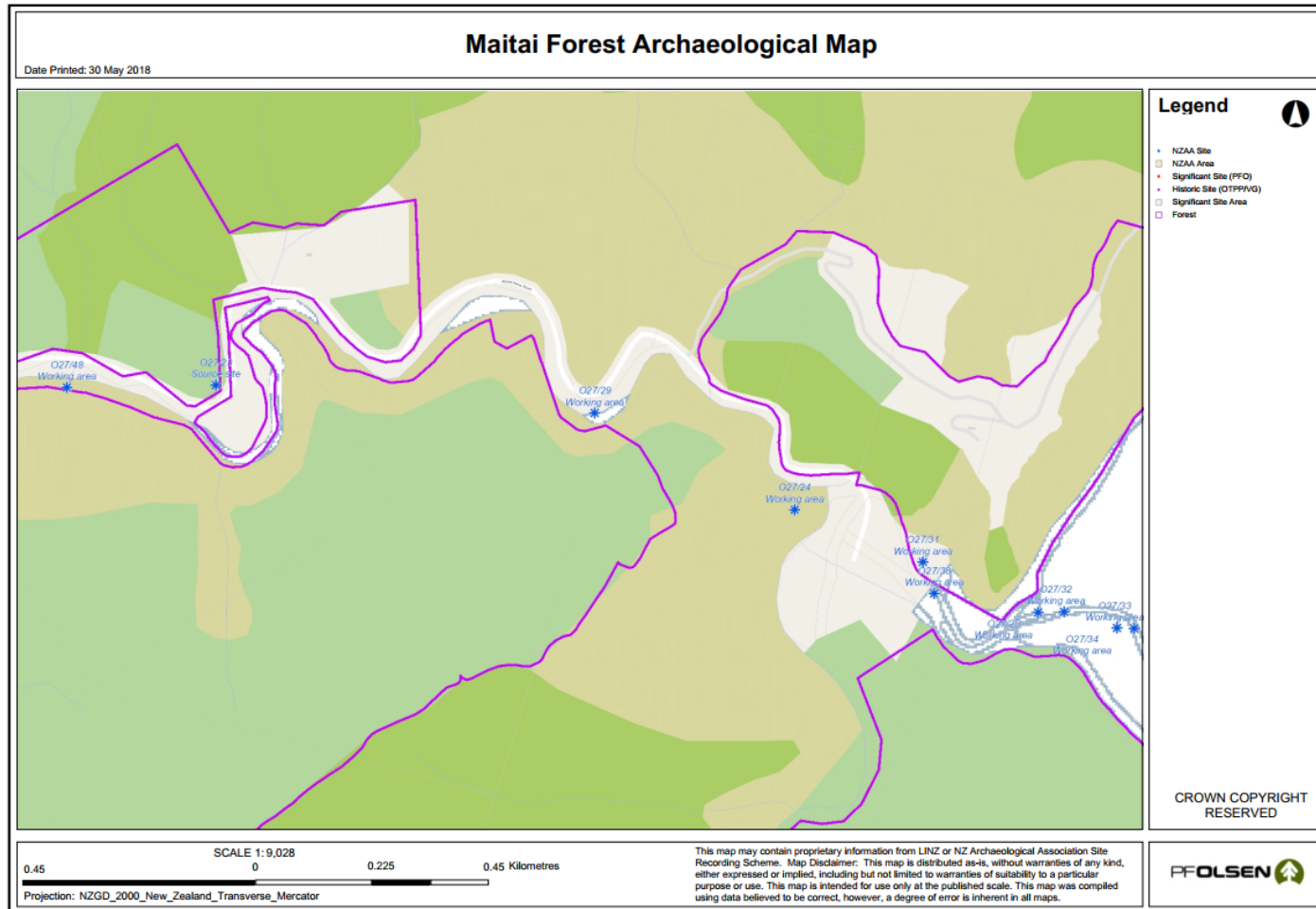
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<sup>4</sup> <https://archsite.eaglegis.co.nz/NZAAPublic>

<sup>5</sup> Arnold, G.; Newsome, P.; Heke, H. 2004: Predicting archaeological sites in New Zealand. *DOC Science Internal Series 180*. Department of Conservation, Wellington. 24 p.



### Map 3 – Map of know archaeological sites at Maitai Forest



## 4. Socio-economic profile and adjacent land

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### Forest history

The initial 640 ha of forest land that was purchased by Nelson City Council was a commercial investment and a means of protecting their water supplies from hazardous effects such as erosion and sediments. The four commercial forests all provide, in addition to timber generated incomes, various recreational opportunities whether they be mountain biking, hiking or general walking tracks.

Over the years since establishment there has been a need to review species choice and site suitability due to wilding spread and operational suitability in an encroaching urban environment.

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## Current social profile

The wider Nelson /Tasman economy is mature and diverse encompassing forestry, farming, horticulture and fishing and Tourism, as well as all the service industries associated with any modern regional economy. Some of the key social and economic indicators associated with Nelson City are tabulated below.

By the Nelson City Council's own assessment<sup>6</sup> "Nelson City Council's production forest is small in comparison to the total production forest area through Tasman-Marlborough". Together, the forested areas of the NCC estate makes up less than 1% of the large and well-developed plantation forest industry within the combined Nelson/Marlborough region and within the Nelson City Council boundary is a very small part of the city's GDP

However, at the margin, the commercial use of these forests is creating more local opportunities for silviculture and harvesting crews on a long-term basis, supporting a small proportion of the local, largely Tasman centred forestry and forestry processing industry. This sector, by New Zealand standards, is well integrated into the wider regional economy and contributing a substantial portion of the regional GDP when compared to national averages. In this contribution and in providing a potential offset to some Council rating, the forests are an incremental contributor to the economic and social profile of what is a diverse and well-developed economic area.

**Table 8: Key statistics as summarised from 2018 Census<sup>7</sup> data and MBIE 2015<sup>8</sup>**

Census Category	Nelson	NEW ZEALAND
Ethnicity: European	86.7%	70.2%
Ethnicity: Māori	10.7%	16.5%
Formal qualifications	80.7%	81.8%
Unemployment	3.1%	4.0%
Dominant occupation	Professional	Professional
Median annual household income	\$79,400	\$89,100
Internet access	87.1%	86.1%
Home ownership	68.6%	64.6%
Proportion of regional GDP – Forestry & Logging (Tasman Region)	2.2%	0.5%

<sup>6</sup> Nelson City Council's production forests – Assessment of non-monetary values A Beveridge P Gorman Rep 2016/066

<sup>7</sup> [http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request\\_value=13853&tabname=Business#](http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=13853&tabname=Business#)

<sup>8</sup> <https://webrear.mbie.govt.nz/theme/primary-sector-shares-of-regional-gdp/map/timeseries/2015/tasman/forestry-and-logging?accessedvia=tasman&left-zoom=1&right-transform=absolute>

## Associations with Tangata Whenua

The Te Kahui Mangai website [www.tkm.govt.nz](http://www.tkm.govt.nz) shows Iwi that are formally recognised in the northern Te Tau Ihu area in which Brook, Maitai, Roding and Marsden Valley Forests fall (Table 9).

**Table 9: Iwi Organisations within the Nelson City Council Forests Region**

Iwi Organisation
Ngāti Toa Rangatira
Te Atiawa o Te Waka-a-Māui
Ngāti Apa ki te Rā Tō
Ngāti Kuia
Ngāti Rārua
Ngāti Kōata
Ngāti Tama ki Te Tau Ihu

A Memorandum of Understanding (MoU) between the Council and Tangata Whenua ō Whakatū establishes collective goals and principles by which the parties will engage. In particular the principles call for engagement that involves “partnership”, “mutual respect”, “honesty of purpose”, “open communication” and “active engagement”.

**Tenure &  
resource rights**

There are numerous Licences and agreements pertaining to existing non-timber forest uses with the forests that prevail. These groups are summarised in the below table.

**Table 10: NCC Forest Tenure and Resource Rights**

Forest	Commercial	Right to Occupy	Concessionaires	Other
Brook	Grazing, Recreation, Beehives	Stock Mountain bikers training sessions and events, helie bikers, Recreational walkers Beehives (Manuka Honey)	On Reserves lands for all purposes as mentioned	Brook Conservation has areas for Ministry of Education NMIT facilities, Riding for Disabled, Community Garden
Roding	As above	As above	As above	
Maitai	As above plus Cell & broadcast coverage	As above plus Korida Cell tower	As above plus Lease for Kordia ex Broadcasting Corp.	
Marsden	Grazing, recreation, beehives, various	Stock, mountain bikers, recreational, bees, paragliding (needs vehicle access)		

## Neighbours

Neighbours to the forest estate boundaries may have a special interest in the management of the forest. Activities within the forest may positively or negatively impact upon their quality of life or businesses in a number of ways, while inappropriately managed operations could create risks of adverse health, safety and environmental and biosecurity hazards. As such, neighbours are considered stakeholders with a potential interest in the management of the forests.

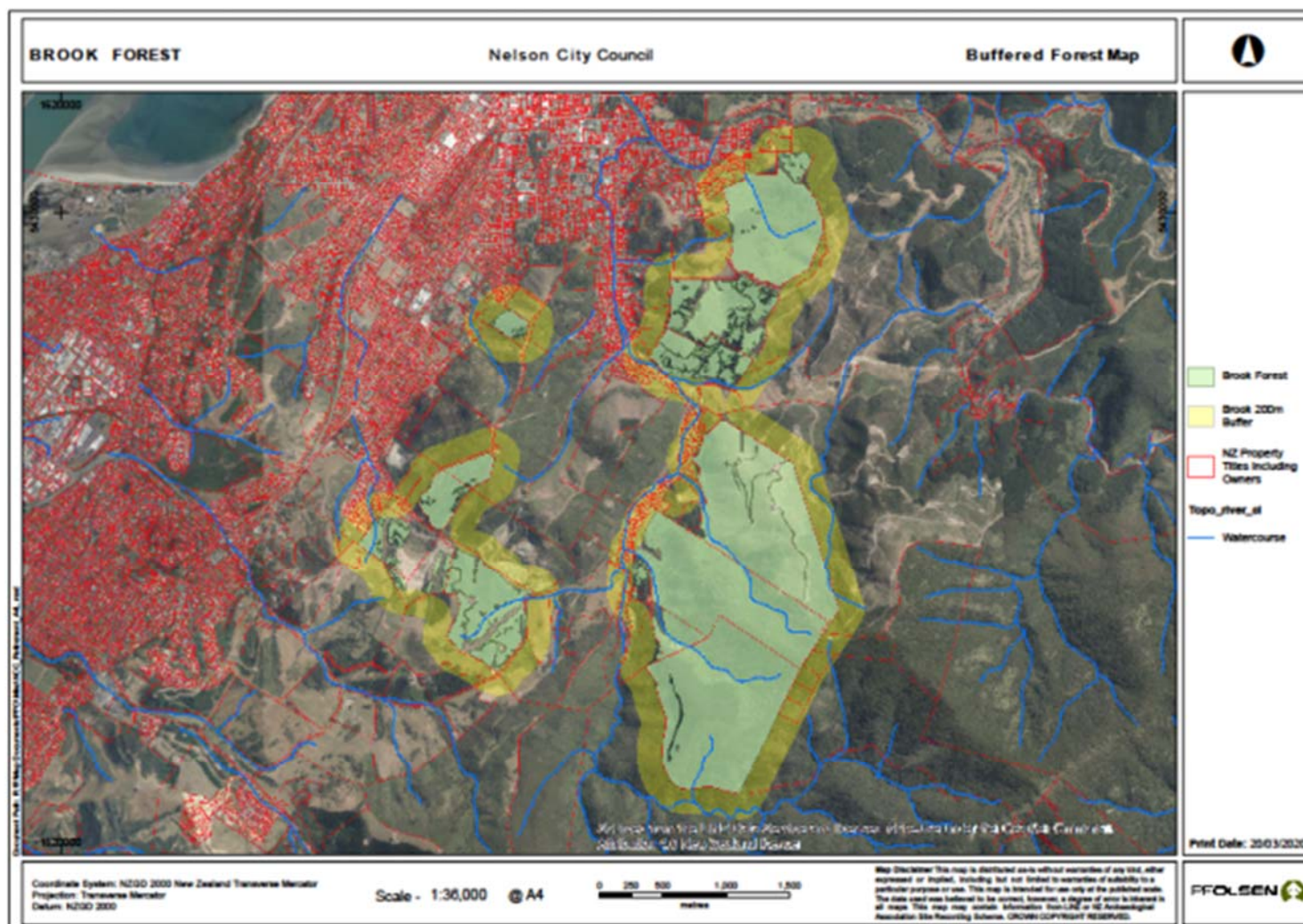
The NCC forests are among a relative few in New Zealand that are in close proximity to a large urban concentration, the boundaries of which have steadily encroached on the original forests. Similarly, as urban scales have increased, so too, pressures to use and to protect recreational opportunities and environmental assets have increased. These are manifest in the existence of groups representing recreational interests or such as the 'Friends of the Maitai' organisation.

As peri-urban forests the notion of a 'neighbour' is much less straight forward than is common for a rural forest property. For day-to-day management issues, an arbitrary zone within 200m of the plantation forest boundary will be considered a zone in which "potentially directly affected" neighbours may need to be consulted over some operational issues; [Map 4](#).

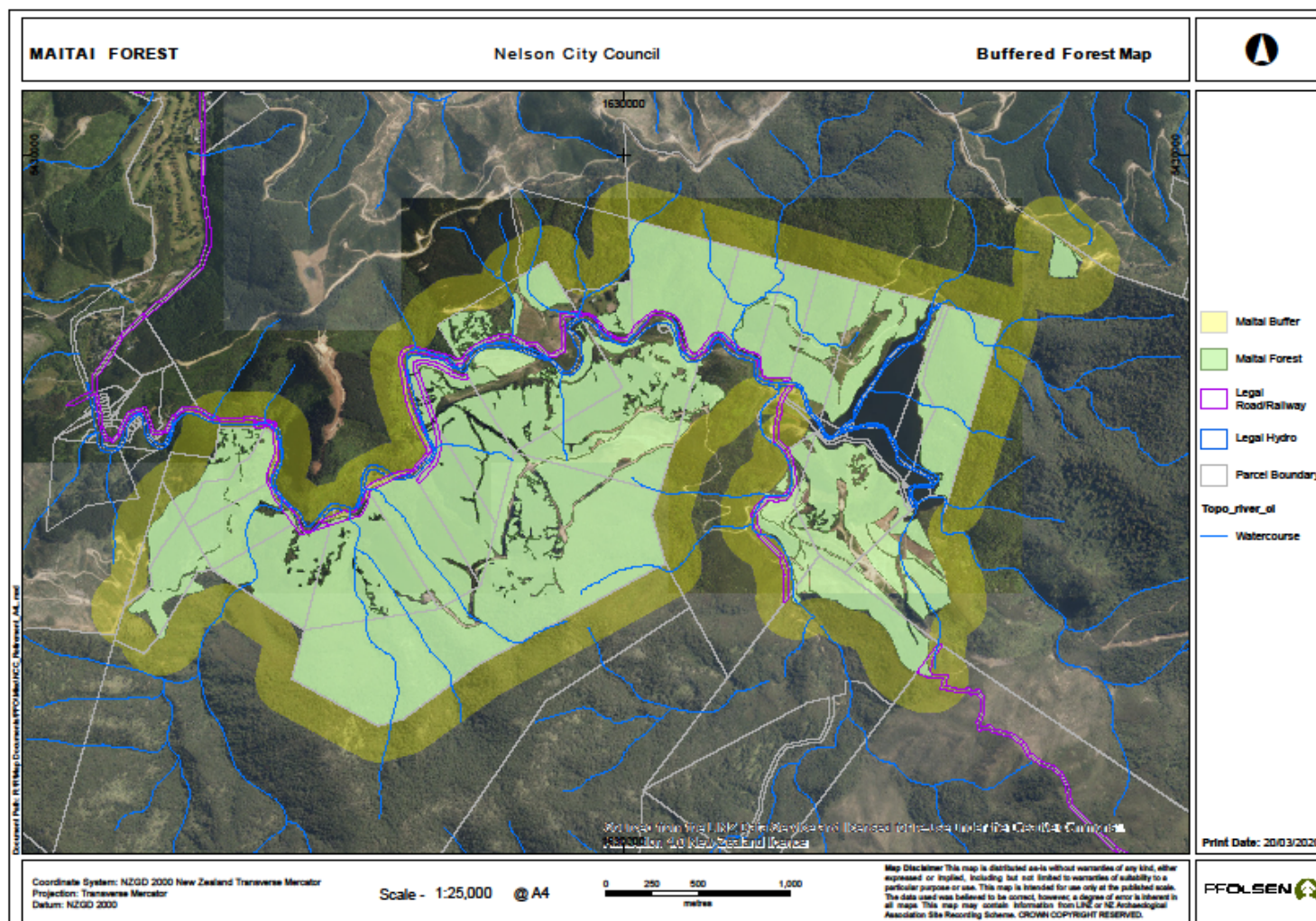
Other public interest groups generally have engagement via various mechanisms and forums with the Council and its management agents. Engagement with these groups which include those such as the Nelson Biodiversity Forum, the Maitai Forestry Forum and the Nelson Mountain Bike Club, will be maintained as long as the parties believe they add value to their engagement process.



Map 4(a) – Brook Forest Neighbours - within 200m of forest estate.

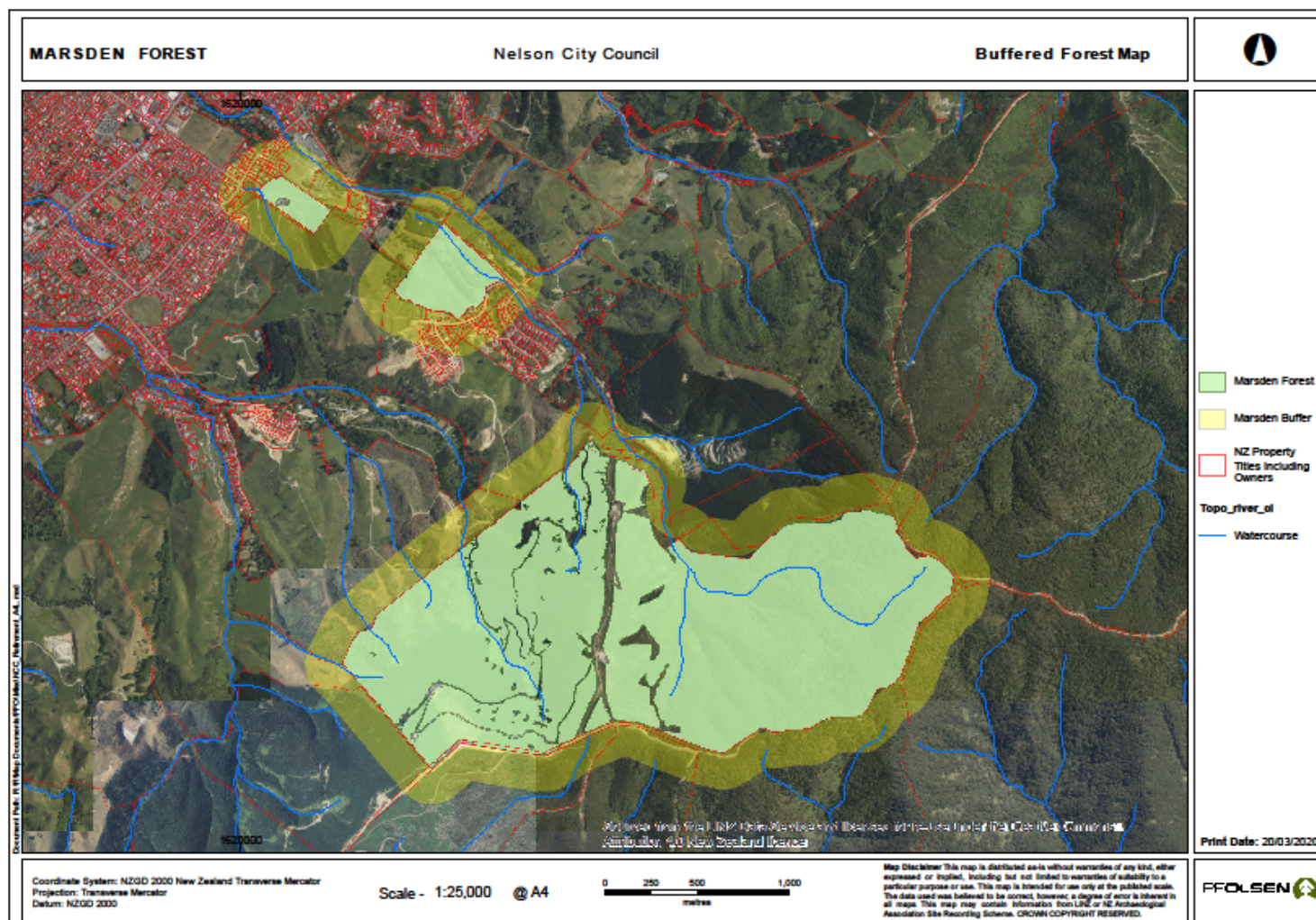


Map 4(b) – Maitai Forest Neighbours - within 200m of forest estate.

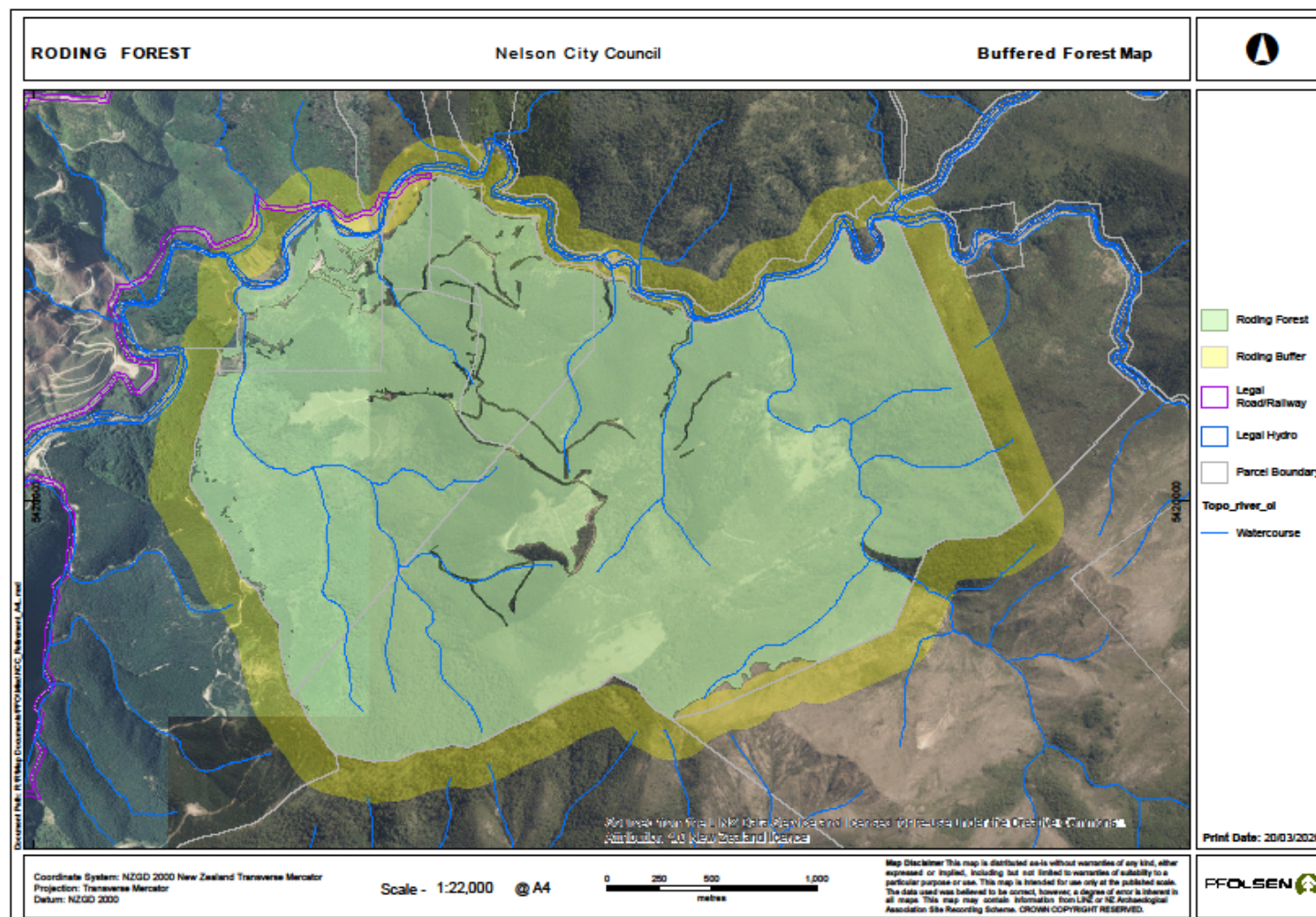




Map 4(c) – Marsden Valley Forest Neighbours - within 200m of forest estate.



Map 4(d) – Roding Forest Neighbours - within 200m of forest estate.





# Regulatory Environment & Risk Management

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## 5. The Regulatory Environment & Risk

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### Regulatory considerations

Forestry operations throughout New Zealand are undertaken within the context of a regulatory framework that aims to ensure wider economic, social and environmental goals are achieved for the populace as a whole.

Failure to meet regulatory requirements is a key business risk that must be managed. The following section summarise key regulatory requirements and risk management controls exercised over forestry operations in the forests.

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### Health and Safety at Work Act 2015

Leadership, a constant focus on health and safety, and the strong message that safety rates as the number one priority ahead of any other business driver are all highly important for PF Olsen management. The company also takes the following steps to ensure worker health and safety:

- Contractor selection process including emphasis on:
    - Safety systems and track record;
    - Worker skills and training; and
    - Equipment type and standard.
  - Work planning.
  - Contractor induction.
  - Monitoring, including random and reasonable cause drug testing, safe work practices and PPE.
  - Incident investigation and reporting, including investing in software, training and processes development to enable good transparency on lag and lead indicators.
  - Regular reporting to and interaction with the Client on matters related to safety.
  - Regular (annual) review and update of the critical risks as identified in PF Olsen data sets and from Industry indicators. Such a review shall focus on incidents that have caused harm and/or loss, any known cause factors and mitigations and revised controls.
-

**Resource  
Management Act  
(RMA) 1991**

Within the framework of the RMA, there exist a number of functional instruments that are designed to manage the effects of all undertakings in or on land and water to ensure sustainable outcomes.

Key amongst those instruments are briefly described below:

**National  
Environmental  
Standard for  
Plantation  
Forestry (NES-PF)**

Coming into force in 1<sup>st</sup> May 2018, the NES-PF<sup>9</sup> is a suite of regulations designed specifically to manage most activities related to commercial plantation forestry. The regulations establish a nationally uniform rules hierarchy intended to cover operational phases from afforestation and new planting through to harvesting and road construction. The hierarchy takes a risk-based approach to define situations in which activities may be undertaken as 'permitted activities' and those where "Resource Consents" will be required. The NES gives direction to Councils and forest operators<sup>10</sup> and is intended to encourage a uniform and standardised approach to a series of activities that are conducted in similar fashion throughout the country.

The underpinning the structure of the NES-PF is a rule hierarchy linked to the erosion susceptibility of the lands upon which forestry operations are to be conducted. The stringency of the rules hierarchy, i.e. whether consents are needed and the degree to which Councils can apply discretion to the conditions attached to a consent, is then tied closely to the recognised erosion susceptibility of the lands involved and the risks created by the operations.

In broad terms, harvesting, roading (earthworks) and new afforestation operations will need consents in the red zones (very high) while consents will also be needed for earthworks in orange (high) zones. In the green and yellow zones most operations will be permitted subject to conditions.

In the case of the Brook, Maitai, Roding and Marsden Valley Forests, Table 11 below indicates the proportion of the estate by the respective ESC classes. The coverage of the erosion classes within the estate are illustrated in [Maps 5 a - d](#).

**Table 11: Productive Area (ha) within each ESC Classes (Erosion Risk)**

Forest	Low	Moderate	High	Very High	Very High (8e)	Total
Brook	3.8	128.5				132.3
Maitai	2.7	177.1	1.0			180.8
Marsden Valley		141.0				141.0
Roding		224.0	4.7			228.7
Total	6.5	670.6	5.7	0.0	0.0	682.8

<sup>9</sup> <https://www.mpi.govt.nz/growing-and-harvesting/forestry/national-environmental-standards-for-plantation-forestry/>

<sup>10</sup> <https://docs.nzfoa.org.nz/forest-practice-guides/amalgamated-guides/>



**Council RMA  
Plans**

Implicit in the framework of the RMA is the role of Council District and Regional Plans which can cover matters of land use, water management biodiversity and air-quality either as separate planning documents or as integrated plans.

As they relate to forestry, local planning rules must align and or give effect to National Environmental Standards such as the NES-PF. As notified by NCC, the relevant changes to the Resource Management plans have been notified (see below).

Notwithstanding the above, under the NES-PF local Councils are able to exercise greater stringency over the NES-PF through their plans where that stringency is required to give effect to an NPS or in situations related to outstanding natural landscapes and other specific situations. The local planning rules must be followed in these situations.

Currently for Nelson City Council as a unitary authority, the relevant plan governing these matters is listed below.

- [Nelson Resource Management Plan](#)
- [NRMP – Alignments for NES-PF](#)
- [Nelson Air Quality Plan](#)

At the time of writing the NCC is about to make available for public consultation a new integrated plan. The details of this as they may or may not affect forestry activities have not been assessed.

**National Policy  
Statement and  
NES - freshwater**

A National Policy Statement on Freshwater and an associated National Environmental Standard have been issued by the Ministry for the Environment, upgrading an existing NPS. Presently undergoing a period of evaluation in relation to public submissions, it is, at the time of writing, unclear to what extent the final law will impact forestry. As a general tenor, the wider industry submissions on this proposed legislation were that in most cases, provided that the industry codes were adhered to, the standards could be met.

**National Policy  
Statement -  
Biodiversity**

At this time of writing this proposed legislation is about to enter a phase of public consultation. The final form and impact upon forestry operations is unknown.

**Heritage New  
Zealand Pouhere  
Taonga Act 2014**

It is the landowner's responsibility to identify any historic sites on their land prior to undertaking any work which may disturb or destroy such sites.

If a site is found or suspected on any block, the protocols specified in PF Olsen's Environmental Management Processes (EMP), and any others specifically developed in conjunction with Heritage New Zealand (HNZ) and Iwi or other stakeholders, must be observed. Where circumstances require, an 'Authority to Modify or Destroy' will be sought from HNZ with the assistance of an archaeologist. Such Authorities are similar in function to a resource consent and, if granted, come with conditions that must be met. The process to apply for Authorities is documented in PF Olsen's EMPs. If necessary, consents from the local Territorial Authority (NCC) may also be required under the Heritage related rules of the NRMP.

Management responses to the potential presence of archaeological and cultural evidence may include, but are not limited to:

- Map and ground surveys to identify, mark and protect known heritage sites.
- Iwi consultation and surveys for unknown sites.
- Archaeological Authorities to modify sites if required.
- Accidental Discovery Protocols to stop work and engage experts if sites are discovered during operations.

**Consents &  
authorities held**

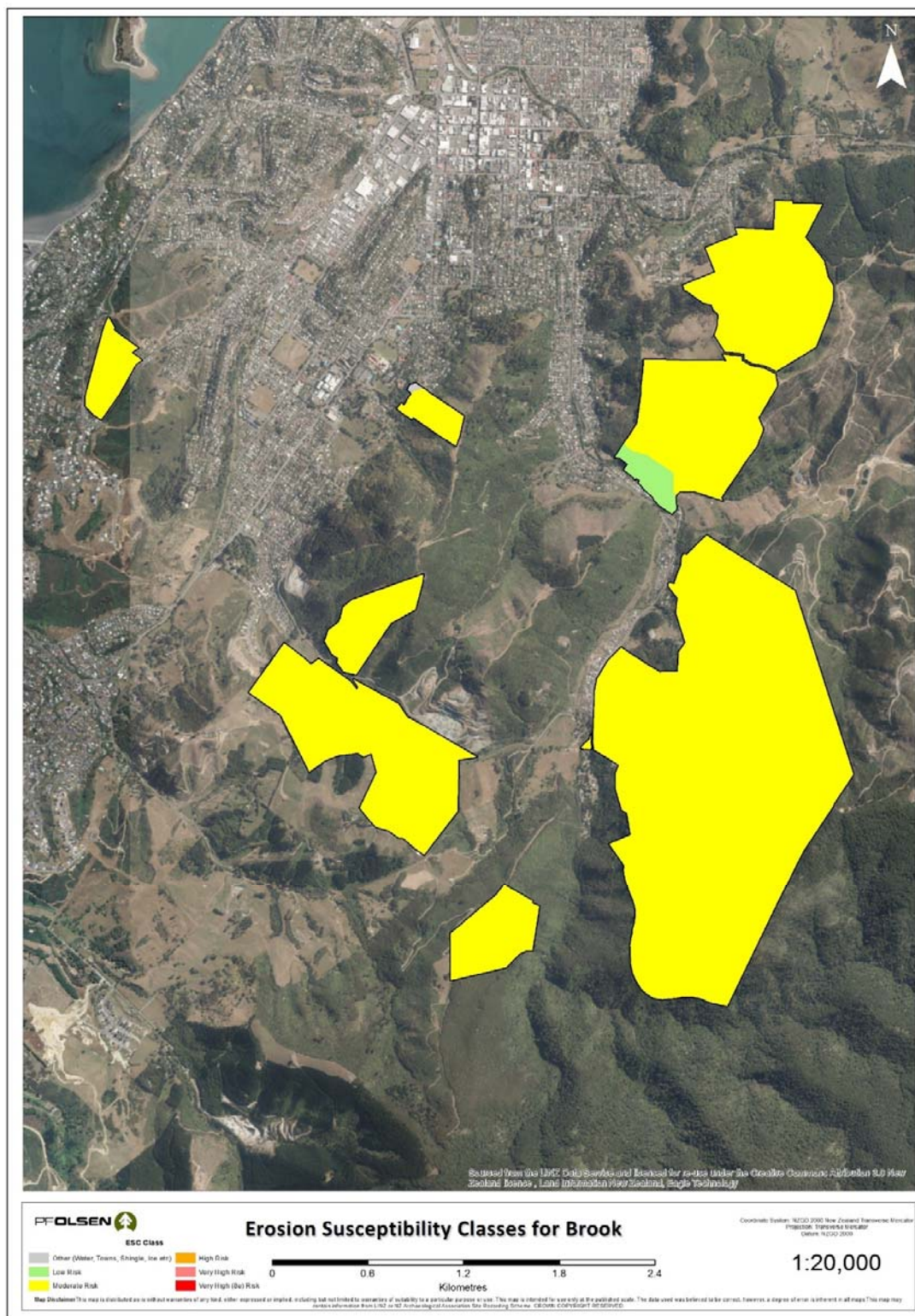
Brook, Maitai and Marsden Valley Forests each hold the resource consents, shown below.

**Table 12: Current resource consents applied to Nelson City Council Forests**

Forest	Resource Consent ID	Expiry
Brook	RM155199	06/07/20
Maitai	RM165434	24/02/22
Marsden Valley	RM145096	25/06/19

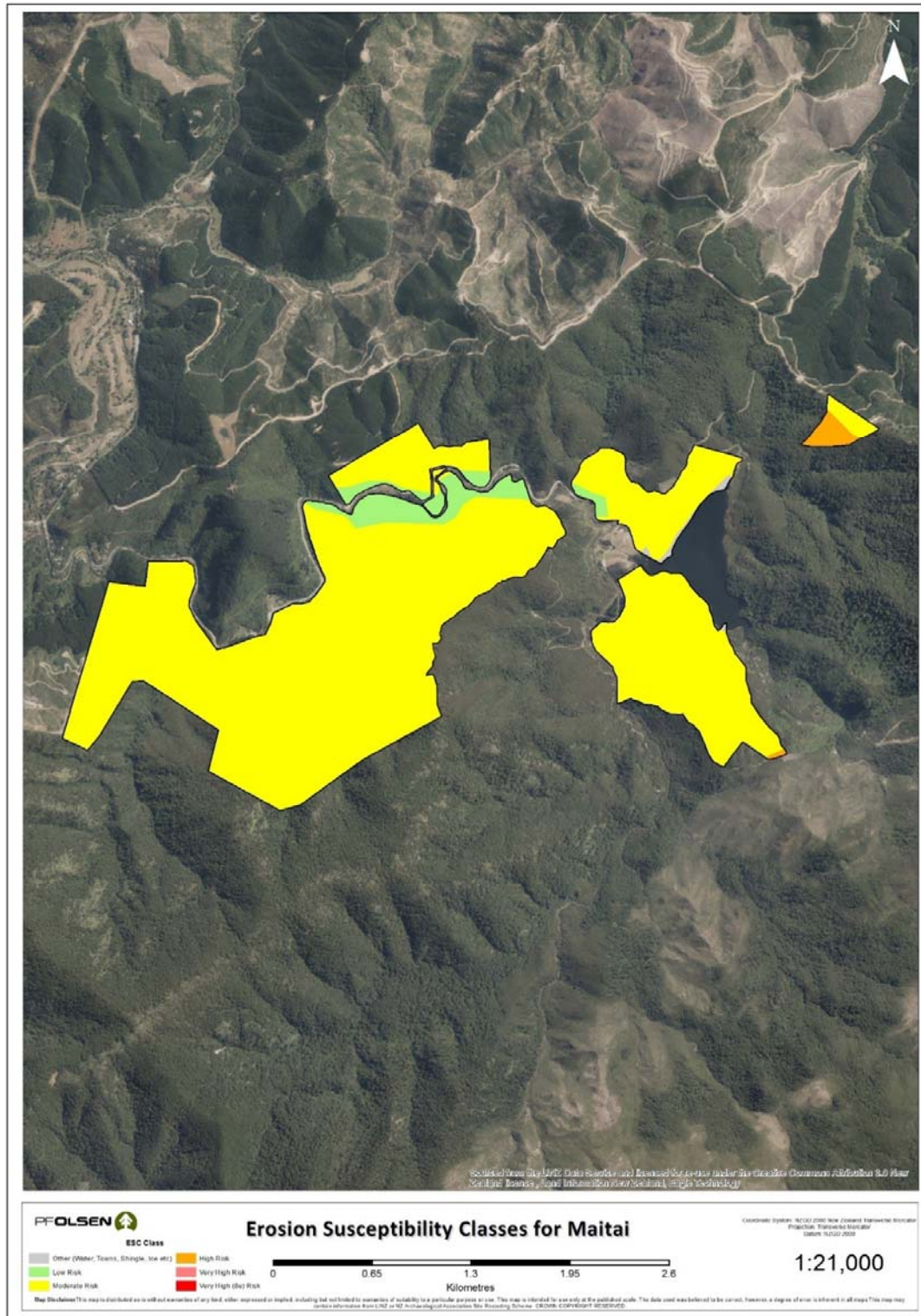
There are no Heritage New Zealand archaeological authorities current applying to Brook, Maitai, Roding or Marsden Valley Forests.

## Map 5(a) - National Environmental Standard Erosion Susceptibility Classes in Brook Forest

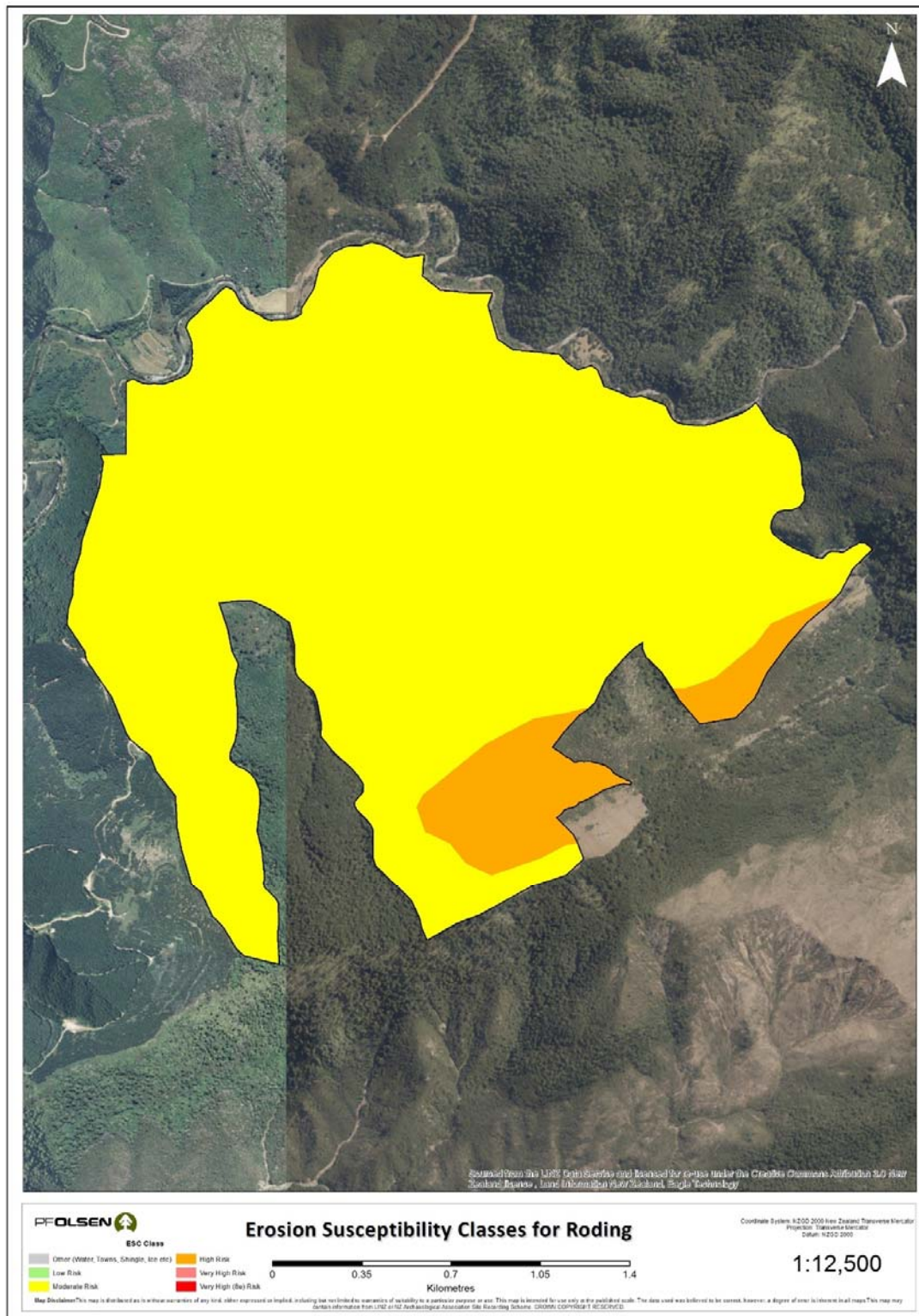




## Map 5(b) - National Environmental Standard Erosion Susceptibility Classes in Maitai Forest

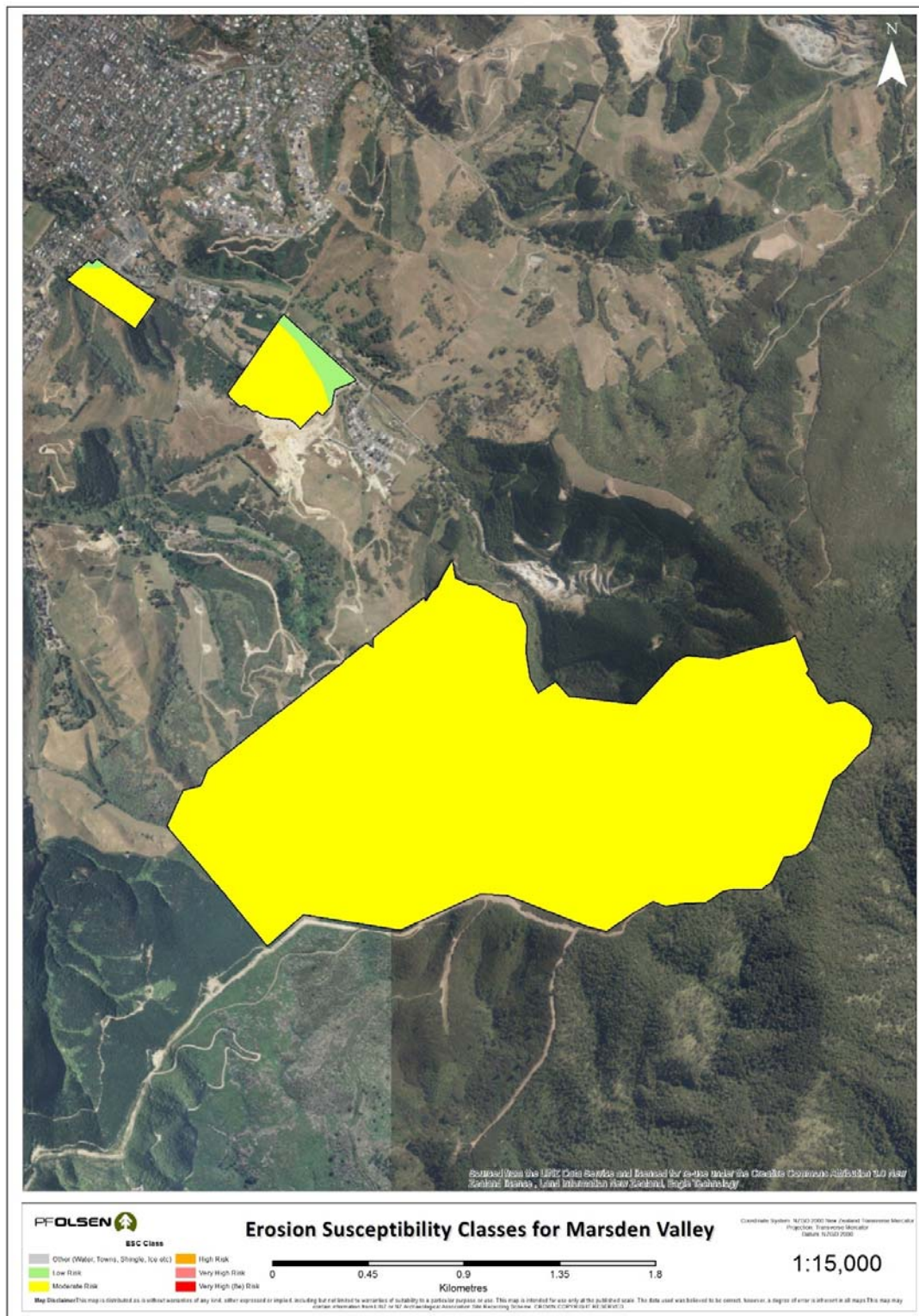


## Map 5(c) - National Environmental Standard Erosion Susceptibility Classes in Roding Forest





## Map 5(d) - National Environmental Standard Erosion Susceptibility Classes in Marsden Valley Forest



## **Emissions Trading Scheme**

Forests in New Zealand are governed by legislation, the Climate Change Response Act 2002 (the Act) and associated Emission Trading Scheme (ETS), which is related to New Zealand's Kyoto commitments to reduce the nation's carbon emissions and contribution to associated climate change.

Most of the NCC estate qualifies as pre-1990 forest land because this land was used for forestry as at 31<sup>st</sup> December 1989. Deforestation of this pre-1990 forest land would require the owner of this land to surrender carbon credits related to the carbon stocks (tonnes of CO<sub>2</sub>) at the time of the clearing. Deforestation is deemed to have occurred if the forest is not replanted or, if left to regenerate naturally, does not achieve the regulated heights and stocking densities.

Within the Council estate there were 123ha of land that was eligible as post-1989 forest land, land that was used for farming as at 31 December 1989.

Because of the age-class profiles of the areas meaning full carbon liabilities at harvest, and uncertainties over the market predictability for Carbon prices these areas were deregistered from the emissions trading scheme and the carbon units handed back so there are no residual potential long-term liabilities.

## **Other relevant legislation**

There are numerous other statutes and regulations that impact on forest operations. Forest owners can be held liable for breaches of these Acts and may be held responsible for damage to third party property. Management processes seek to manage and minimise these risks.

Other relevant legislation is listed in [Appendix 2](#).

## 6. Commercial Risk Management

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### **Market access retention**

It is a major focus of the Property Manager to ensure contracted products are delivered on time and in specification to ensure Nelson City Council retains credible access to its markets.

Nelson City Council is seeking to maintain independent third party environmental certification for its estate under Forest Stewardship Council certification (FSC) to assist in this process. PF Olsen Ltd acting under the instruction of its client will be responsible for the execution and maintenance of the required FSC certification elements of which this management plan forms an important component.

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### **Log customer credit risk**

There have been a number of NEW ZEALAND sawmills fail in recent years leaving log customers unpaid for the last month's deliveries. The PF Olsen Investment Manager manages customer credit risk exposure and mitigation measures for export markets while PF Olsen manages these risks for domestic log customers. PF Olsen also provides NCC with a payment protection insurance against log buyers who foreclose on payments.

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### **Infrastructure damage or service disruption**

Brook, Maitai, Roding and Marsden Valley Forests all have multiple over-ground electricity lines that either run directly through or along the boundaries of the forests. There are also a series of underground main water pipelines that run along or through boundaries. Risks around these are managed by:

- Identification on maps and on the ground any utilities at planning stage.
  - Early engagement with utility owner to plan operations to minimise risks.
  - Operational execution of agreed plans with parties specifically qualified for the tasks involved when working close to utilities.
- 

### **Pests and diseases**

Pests and diseases are managed according to any statutory obligations and best practices as identified by scientific research and past experience, with the type and intensity of treatment (if any) subject to what is at risk and the age of trees (see [Section 13](#)).

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## Fire

Fire is always a risk to forests. The, Brook, Maitai, Roding and Marsden Valley Forests have, through a matrix assessment, been assessed as having a high fire risk (see [Property Management & Protection](#)) although the components that lead to that assessment vary slightly between the forests. As this region of the South Island can be prone to drought periods over the summer the risk can become elevated and an increased frequency of these events is a possibility under climate change scenarios.

Fire risk is managed through:

- Protocols to restrict work hours or to stop work in periods of extreme fire risk.
- Annual auditing and regular monitoring of contractors' fire prevention and first response equipment prior to fire season each year.
- Maintenance of trained personnel and fire suppression equipment.
- Protocols for pooling of resources as a first response to fires under the leadership of the relevant Fire and Emergency NEW ZEALAND organisation.
- Management of public and recreational use when risks become high.

## 7. Environmental Risk Management

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### Environmental risk

Environmental risk is managed by PF Olsen as appointed property manager, through a cascade framework from high level 'intent' determined by the Forestry Rights owner, through PF Olsen's own environmental policies, thence through defined and documented processes constituting an Environmental Management Process (EMP's), supported by monitoring and reporting. PF Olsen's policies and Nelson City Council business objectives are considered to be well in alignment.

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### Environmental policy

*PF Olsen Limited is committed to:*

- *Sustainable forest and land management;*
- *Promoting high environmental performance standards that recognise the input of the community in which we operate;*
- *Supporting an environment of continuous improvement in environmental performance;*
- *Obtaining and retaining independent 3<sup>rd</sup> party forest certification in conformance with the Principles and Criteria of the Forest Stewardship Council and / or the Programme for Endorsement of Forest Certification as specified by forest owning clients, or in any case ISO:14001 Environmental Management Systems.*

In order to achieve these commitments **PF Olsen** (and PF Olsen Certification Scheme Members) will undertake the following:

- Where applicable to a particular forest, comply with the presiding **Certification Standards** as set out in any agreements between the forest owners and PF Olsen.
  - **Planning** of operations to avoid, mitigate or remedy degradation of **ecological, heritage** and **amenity** values;
  - Compliance with all relevant **legislation** and where appropriate exceed environmental statutory requirements;
  - **Training** for all employees and contractors to ensure an understanding of certification member's commitments to high standards of environmental performance, their responsibilities under the environmental legislation and to assist the implementation of sound environmental practices;
  - **Monitoring** environmental and socio-economic research and international agreements that may improve environmental and certification performance;
  - Regular environmental performance **audits** of operations;
  - Support for environmental **research**;
  - Undertake forest management in accordance with the principles and ethics of the **NEW ZEALAND Forest Accord** the **Principles for Commercial Plantation Forest Management in NEW ZEALAND**, and other relevant agreements, conventions and accords.
  - Promotion of the prevention of **waste** and **pollution** / efficient use of **energy**;
  - Due regard for the well-being of the **community**.
-

**Objectives,  
targets and  
monitoring**

PF Olsen's objectives, targets and monitoring categorised across five key aspects of the business:

1. Economic;
2. Legal;
3. Social;
4. Health & Safety; and
5. Environment

A systematic management approach ensures these objectives and targets remain the cornerstone of PF Olsen's business, backstopped by monitoring processes that form a regular review of practices. These are summarised in [Appendix 9](#).

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**EMP framework**

The Environmental Management Process (EMP) is an integrated set of cloud based, defined and documented policies, processes and activities that govern the physical implementation of forest management activities. The EMP's apply a systematic approach certified to ISO:14001 standards to ensure effective mechanisms to manage potential adverse or harmful impacts from operations.

The framework is reviewed annually with the input of an Environmental Management Group (EMG).

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**Environmental  
Code of Practice**

As a member of the New Zealand Forest Owners Association, all operations carried out on the property should be undertaken in conformance to the NEW ZEALAND Forest Owners Association 'New Zealand Environmental Code of Practice for Plantation Forestry'<sup>11</sup>. This publicly available document sets out guidelines that underpin the requirements for sound and practical environmental management.

Operations will also be following the Forest Practice Guides<sup>12</sup> published in support of the National Environmental Standard.

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**Forest Road  
Engineering  
Manual**

As a member of the New Zealand Forest Owners Association, roading and engineering techniques employed within the forest should conform to the industry best practice as outlined in the New Zealand Forest Owners Association publication, 'New Zealand Forest Road Engineering Manual', published 2020<sup>13</sup>.

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<sup>11</sup> <https://www.nzfoa.org.nz/resources/file-libraries-resources/codes-of-practice/44-environmental-code-of-practice/file>

<sup>12</sup> <https://docs.nzfoa.org.nz/forest-practice-guides/>

<sup>13</sup> [https://www.nzfoa.org.nz/images/NZ\\_Road\\_Engineering\\_Manual\\_Web\\_Feb\\_2020\\_compressed.pdf](https://www.nzfoa.org.nz/images/NZ_Road_Engineering_Manual_Web_Feb_2020_compressed.pdf)

## Assessment of environmental risks

Environmental risks arising from forest operations are assessed and managed on a site-by-site basis prior to execution. The relative probability and magnitude of adverse effect attributable to any particular operation on any particular site is highly variable.

At a high level, 'risks' are presented as consuming services summarised for a typical plantation life cycle in [Appendix 10](#). As a broad assessment over all Brook, Maitai, Roding and Marsden Valley Forests, the **potential** for adverse impacts across the range of operations and forest sites is indicated in the Environmental Assessment matrix below (Table 13), which summarises the identified risks across 'key management aspects'. The level of potential risk has been evaluated in the matrix as high 'H', medium 'M' or low 'L', or not applicable 'NA' and is thus indicative of the level of care that might need to be applied to ensure the potential for adverse effects is minimised.

**Table 13: Risk assessment for key aspects involved in forest management activities**

Forestry Operational Activities	ENVIRONMENTAL VALUES/ISSUES MATRIX												
	Erosion & Sediment Control	Water Quality	Soil Conservation & Quality	Air Quality	Aquatic Life	Native Wildlife	Native Vegetation	Historical & Cultural Values	Landscape & Visual Values	Neighbours	Public Utilities	Recreation Values	Threatened Species
Harvesting	H	M	H		M	H	L	M	M	M	M	M	M
Earthworks	H	H	H		M	M	L	H	L	L	L	L	L-M
Slash Management	H*	H*	H		H	L	L		L	L	H	L	L
Stream Crossings	M	M	M										M
Mechanical Land Preparation	NA	NA	NA	NA	NA	H	NA	NA	NA	NA	NA	NA	M
Burning	L	L	L	H	L	H	L		H	H	L	H	L-M
Planting							L	L	L	L	L		L
Tending										L	L		L
Fertiliser Application		H		L	H					L	L	L	L
Agrichemical Use		H	L	L	H	M	M		L	H	H	H	L-H
Oil & Fuel Management		H	L		H		L			H	L		L
Waste Management		L			L				L	L			L
Forest Protection		L			L	L	L			L		L	L

**Hazardous substances management**

Hazardous substances are any substances, which may cause adverse environmental impacts and/or injury or health problems if incorrectly handled or used. The permitted hazardous materials are:

- Pesticides
  - Herbicides : for commercial and ecological weeds;
  - Fungicides : for forest fungal disease control; and
  - Vertebrate or invertebrate toxins: used for control of pest mammals e.g hares and possum or wasps.
- Fuels and oils.
- Fire retardants – only ever used if there is a fire.
- Surfactants – to increase herbicide efficacy.

Transportation, storage and labelling of these hazardous materials must all comply with the provisions of legislative controls under the Environmental Protection Agency (EPA) and the NZS 8409:2004 Management of Agrichemicals code of practice.

During actual usage, the highest risks are associated with chemical trespass or bulk fuel spillages. These risks are managed by:

- Neighbour consultation over planned spray operations.
- Careful planning and timing of any aerial operations having regard to wind and spray drift.
- Unsprayed buffer strips on neighbour boundaries and riparian or other protected reserves.
- GPS flight path control and records.
- Monitoring and recording of weather conditions during the operation, including using smoke bombs and photos/video.
- Moving contractors into the use of double skinned bulk fuel storage tanks as the preferred method of containment for all larger capacity tanks.
- Tracking of all active ingredient usage within the estate.

Risk management includes active involvement in and review of technologies and research into alternative methods for the control of weeds, pests and diseases where these are effective and efficient.

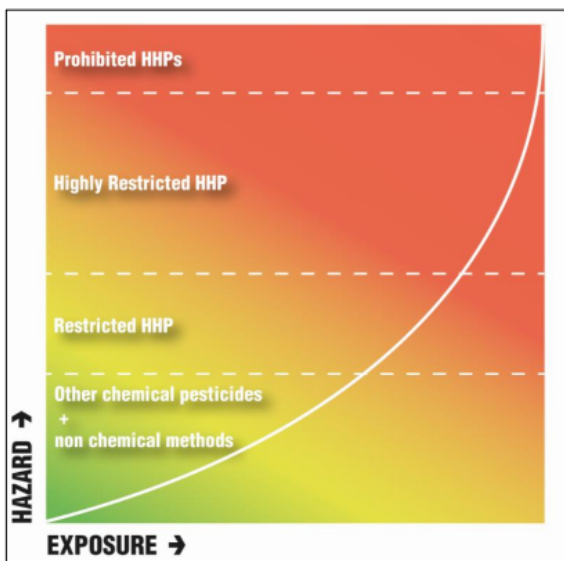
Fuel use is directly related to the machinery used in forestry operations and the market locations. Using modern efficient machine technology is still the primary area where efficiency gains can be made. There is a steady programme to transfer chain bar oils to vegetable based low toxicity oils.

## Hazardous Chemicals

FSC applies a risk-based approach to rules around the use of Chemical pesticides. The framework defining this approach is documented in new policies released by FSC in 2019<sup>14</sup>. Chemicals are classified according to an FSC Hazard rating. The rating then requires differing levels of actions by managers to enable their use under regionally prescribed situations.

The hazardous rankings run from 'Prohibited', to 'Highly Restricted' to 'Restricted' and finally those with no particular FSC obligations.

**Figure 2 FSC Hazardous Risk Management approach**



Of the chemical pesticides used or potentially used in the NCC forest estate, none fall into the Prohibited or Highly restricted categories. Those that fall into the Restricted category are listed in Table 14 below.

Most of the Restricted pesticides are vertebrate poisons and insecticides that if used, would be targeted at specific pest problems, such as wasps or high possum or pest predator numbers. In the latter case such use is only likely in conjunction with a wider coordinated application aimed at achieving positive biodiversity outcomes.

Within the herbicides and fungicides, usage is expected at between 1-2 and 2-4 times per radiata rotation respectively.

All the classes of formulations used are registered and legally approved for in use New Zealand by the NEW ZEALAND Environmental Protection Agency, subject to various controls, and for the purposes to which they are applied as listed below.

*Continued on next page...*

<sup>14</sup> FSC Pesticides Policy FSC-POL-30-001 V3-0 <https://www.fsc.org/en/document-centre/documents/resource/208>

...continued

**Table 14: FSC Highly hazardous chemicals used or potentially used within Brook, Maitai, Roding and Marsden Valley Forests**

Active ingredient	Purpose	FSC Hazard	Common usage
Boric Acid	Fertilizer	Restricted	Component of micro-nutrient fertilization
Copper based products	Fungicide	Restricted	Needle cast control
Glyphosate	Herbicide	Restricted	Establishment weed control/pest weed control
Haloxypop-methyl	Herbicide	Restricted	Establishment weed control/pest weed control
Picloram	Herbicide	Restricted	Establishment weed control/pest weed control
<b>Animal and insect pest control</b>			
Brodifacoum	Vertebrate pesticide	Restricted	Ground-based Vertebrate pest control
Carbaryl	Insecticide (wasps)	Restricted	Localised wasp control
Cholecalciferol	Vertebrate pesticide	Restricted	Ground-based / Vertebrate pest control
Fipronil	Insecticide (wasps)	Restricted	Localised wasp control
Pindone	Vertebrate pesticide	Restricted	Rabbit and hare control
Sodium Monofluoroacetate (1080)	Vertebrate pesticide	Restricted	Vertebrate pest control / extensive aerial possum control
Sodium cyanide	Vertebrate pesticide	Restricted	Vertebrate pest control, ground-based possum control

## The Managed Plantation Estate

### 8. Commercial Plantation Estate

#### Productive capacity strategy

Forest management is carried out to ensure the productive capacity of Brook, Maitai, Roding and Marsden Valley Forests is not compromised. This encompasses multiple aspects that include:

- [Pests and weeds](#) and [forest health](#) - can reduce productivity,
- [Inventory](#) - to feed into growth estimation, a core step in timing silviculture and formulating the cutting strategy,
- [Silviculture](#) - to enhance the value of the resource,
- [Harvesting](#) - achieving a successful harvest in terms of the forest owner's health and safety, environmental and commercial objectives.

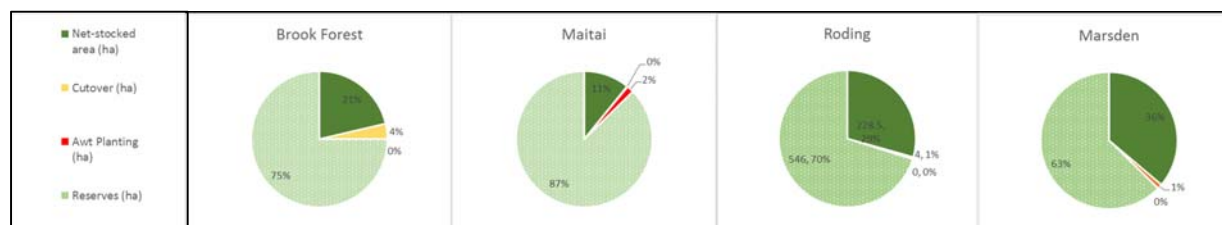
#### Forest area

The net stocked areas have been measured from a map produced by PF Olsen. The estimated net stocked areas of each stand are set out in the Table 15.

Table 15: Brook, Maitai, Roding and Marsden Valley Forest area (ha)

Forest	Gross Forest Area (ha)	Net-stocked area (ha)	Cutover (ha)	Awt Planting (ha)	Reserves (ha)
Brook	529.4	113.0	19.4	0.0	397.0
Maitai	1,475.8	160.0	2.8	24.0	1,289.0
Roding	778.5	228.5	4.0	0.0	546.0
Marsden Valley	381.5	138.0	4.4	0.0	239.1

Figure 3. Brook, Maitai, Roding and Marsden Valley Forest area proportions





### Current species

The predominant species planted at Brook, Maitai, Roding and Marsden Valley Forests is radiata pine. Brook Forest contains a range of different species, although in small numbers. The three other forests contain at least one to four other species in small numbers.

Radiata pine has been selected as it is the most commercially viable species. However, the small areas that have been planted in a range of species are for the purpose of primary functions such as shelter or riparian protection.

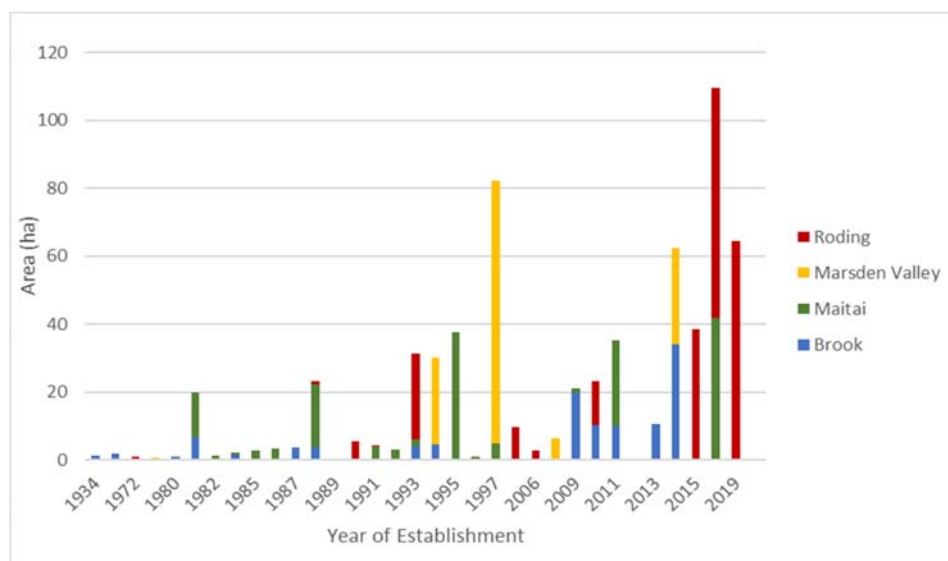
Forests with mixed species help reduce risk, acting as a buffer for market changes and pest and disease threats. Downturn in the markets for radiata pine may be offset somewhat by access to minor species timber resources. The same offsetting in risk could apply if a pest or disease was introduced that caused damage or mortality to radiata pine.

For establishment that has occurred since PF Olsen commenced management of these forests, the radiata pine treestocks planted by year and stand are contained within FIPS.

### Age class distribution

The combined age class distribution of Brook, Maitai, Roding and Marsden Valley Forests is illustrated in the figure below. There are a number of small older stands that have not been harvested, mostly due to access and poorer quality of these stands. The age class distribution is irregular for each forest, with two distinct age class groupings – those established between 1993 and 1997 and 2014 onwards.

**Figure 4. Area/Age class distribution in Brook, Maitai, Roding and Marsden Valley Forests**



## Species Mix

Table 16 below shows the combined species distribution for each Nelson City Council forest.

**Table 16: Species distribution within Brook, Maitai, Roding and Marsden Valley Forests**

Species	Brook Forest (ha)	Maitai Forest (ha)	Roding Forest (ha)	Marsden Valley Forest (ha)
P.rad	101.5	152.9	224.1	111.3
C.mac	4.6	0.1	0	6.3
Ps.menz	3.6	5.7	0	20.6
E.fas	0.2	0	0	0
Mix.exo	1.9	0	0	0
Sq.sem	1.2	0	0	0
Ac.mel	0	1.0	4.4	0
Euc.spp	0	0.3	0	0
<b>Forest Totals</b>	<b>113.0</b>	<b>160.0</b>	<b>228.5</b>	<b>138.2</b>

## Productivity indices

The two most common estimators of the productivity of a site are the Site index and 300 index.

Site index is a measure of productivity of a site in terms of height growth of radiata pine. The parameter used is the mean height in metres of the largest 100 trees per hectare at age 20 years. Equations exist to predict this height given a measured height at any age.

The 300 index is a measure of productivity of a site based on stem volume growth (mean annual increment) of 300 stems per hectare.

Based on the productivity surfaces produced by Future Forests Research the estimated productivity indices for each forest are illustrated in Table 17 below.

**Table 17: Productivity indices for Brook, Maitai, Roding and Marsden Valley Forests**

Forest	Site Index (m)	300 Index (m <sup>3</sup> )
<b>Brook</b>	22.5 – 37.5	25 – 35
<b>Maitai</b>	22.5 – 32.5	22.5 – 32.5
<b>Roding</b>	20 – 35	22.5 – 30
<b>Marsden Valley</b>	20 – 37.5	25 – 35

The site productivity for each forest varies quite a lot between the different blocks and in the region as a whole is quite irregular.

### Current crop status

Measurement data from the most recent inventory is stored in PF Olsen databases and summarised in reports to provide the current status of the stands. Due to the number of stands, data for these forests is not presented in detail. Currently just over 50% of stands are currently pruned with the balance unpruned and no further pruning planned. Due to the largely steep topographies of the forests no production thinning is planned.

Table 18 below illustrates the area by forest in each National Exotic Forest Description (NEFD) tending regime.

**Table 18: NEFD crop type for Brook, Maitai, Roding and Marsden Valley Forests**

Forest	Species	Hardwood	Other cypress, softwoods, eucalypts & hardwoods	Radiata-Pruned without production thinning	Softwood	Radiata - Unpruned without production thinning	Douglas fir - without production thinning	Grand Total
Brook	C.mac				4.6			4.6
	E.fas	0.2						0.2
	Mix.exo		1.9					1.9
	P.rad			54.9		46.6		101.5
	Ps.menz						3.6	3.6
	Sq.sem		1.2					1.2
<b>Brook</b>		<b>0.2</b>	<b>3.1</b>	<b>54.9</b>	<b>4.6</b>	<b>46.6</b>	<b>3.6</b>	<b>113</b>
Maitai	Ac.mel		1					1
	C.mac				0.1			0.1
	Euc.spp	0.3						0.3
	P.rad			82.8		70.1		152.9
	Ps.menz						5.7	5.7
<b>Maitai</b>		<b>0.3</b>	<b>1</b>	<b>82.8</b>	<b>0.1</b>	<b>70.1</b>	<b>5.7</b>	<b>160</b>
Marsden Valley	C.mac				6.3			6.3
	P.rad			111.3				111.3
	Ps.menz						20.6	20.6
<b>Marsden Valley</b>				<b>111.3</b>	<b>6.3</b>		<b>20.6</b>	<b>138.2</b>
Roding	Ac.mel		4.4					4.4
	P.rad			91.9		132.2		224.1
<b>Roding</b>			<b>4.4</b>	<b>91.9</b>		<b>132.2</b>		<b>228.5</b>
<b>Grand Total</b>		<b>0.5</b>	<b>8.5</b>	<b>340.9</b>	<b>11</b>	<b>248.9</b>	<b>29.9</b>	<b>639.7</b>

## 9. Commercial Crop Establishment and Silviculture

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### Introduction

Forest operations are implemented to ensure a good quality crop and maximum growth. These operations include land preparation, establishment, weed control, pest and disease control, fire protection, pruning and thinning, and general property asset maintenance.

The choice of species is the most important issue in plantation forestry. The species has to be suitable for the site and meet the objectives of Nelson City Council. Also important is to ensure that the planting material is of good quality.

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### Forest management goals

The Nelson City Council forest owners are committed to ensure that Brook, Maitai, Roding and Marsden Valley Forests will be managed to:

- Grow trees and produce logs for the manufacturing of different wood products in New Zealand and overseas with a focus on 'fit for purpose' log production;
- Ensure that the productivity of the land does not decline;
- Ensure that environmental values are identified and maintained;
- Ensure that historic sites are identified and protected;
- Ensure that other forest values and products are identified, protected and where possible enhanced;
- Ensure that the forest estate's contribution to carbon cycles is maintained or enhanced;
- Harvest the trees as close as possible to their economic optimum age and achieve the best possible financial returns to the owners;
- Replant following harvesting where agreements require;
- Meet all statutory requirements and comply with forest industry best practice;
- Provide recreational opportunities where practical;
- Act as a good corporate citizen and neighbour; and
- Ensure all forest management practices are consistent with the principles of the Forest Stewardship Council and NZS AS:4708:2014

These goals are further detailed in 'PF Olsen Key Aspects - Objectives, Targets and Monitoring' in [Appendix 9](#).

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### Crop species

Radiata pine, when intensively managed, will produce a range of different log types suitable for various processing options. The pruned butt log can be used to make knot-free veneer or decorative timber. The unpruned logs can be used for structural timber, for veneer or for feedstock for finger jointing. Small logs and those with defects and excessive knots can be used for pulp and paper, MDF and other reconstituted wood products such as tri-board and particle board.

Radiata pine is the most common species processed in New Zealand and export markets are well developed for both finished products and logs.

In New Zealand radiata pine is also the main focus in terms of research and development. Past research and development has resulted in improvements in growth, form and wood characteristics as well as development of a range of finished products, building codes and timber standards.

### Other species

There are a number of small areas planted in alternative species at Brook, Maitai, Roding and Marsden Valley Forests. Recent plantings have been predominantly radiata pine. Alternative non spreading species may continue to be considered for future establishment for small areas where other management objectives predominate.

### Wilding spread avoidance.

Two management strategies are employed.

1. Avoidance of planting any forests in wilding prone species such as Douglas fir. This also includes as part of the requirement of the NES-PF that any change in species must be evaluated on the basis of the "wilding Spread calculator"<sup>15</sup> to ensure that the threshold for spread will not be exceeded.
2. Execution of an policy decision to remove and convert areas currently planted in Douglas fir, and replant in the lower spread risk radiata pine or native species dependent upon locational factors. (See also "[Retirement Programme](#)").

<sup>15</sup> <https://www.mpi.govt.nz/growing-and-harvesting/forestry/national-environmental-standards-for-plantation-forestry/wilding-tree-risk-calculator/>

## Retirement programme

As in many areas of New Zealand, parts of the NCC estate were planted in locations with little consideration for the practicalities of access and harvesting, the environmental risks associated with the location or in some cases the needs of society e.g. aesthetics, have simply resulted in altered priorities.

To this end Council commissioned a study<sup>16</sup> to look at the whole plantation estate and come up with recommendations in relation to the future of parts of the estate. In the lead-up to the final recommendations a range of parties relevant to the particular areas were consulted including the 'Biodiversity Forum' and Recreational interests, neighbours etc.

The recommendations include a variety of actions for implementation depending on the specifics of the sites. These range from natural reversion, or active native planting to conversion to non-spreading commercial species after harvest, stand poisoning to retention of existing stands but with no harvest.

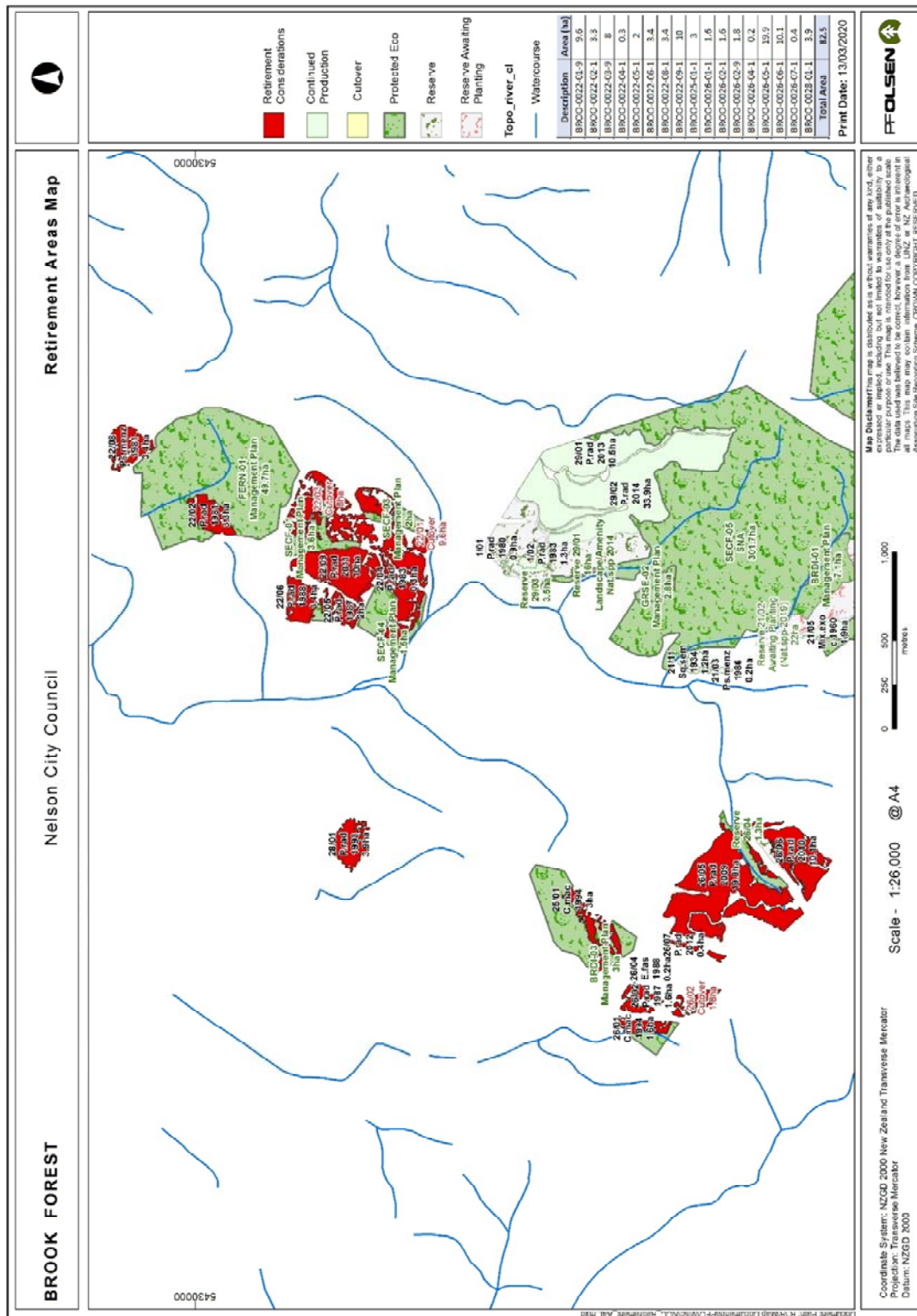
The areas subject to this assessment are summarised below and mapped in the following maps. Details are contained in the referenced report and the list of stands tabulated in [Appendix 3](#)

**Table 19: Commercial crop retirement recommendations**

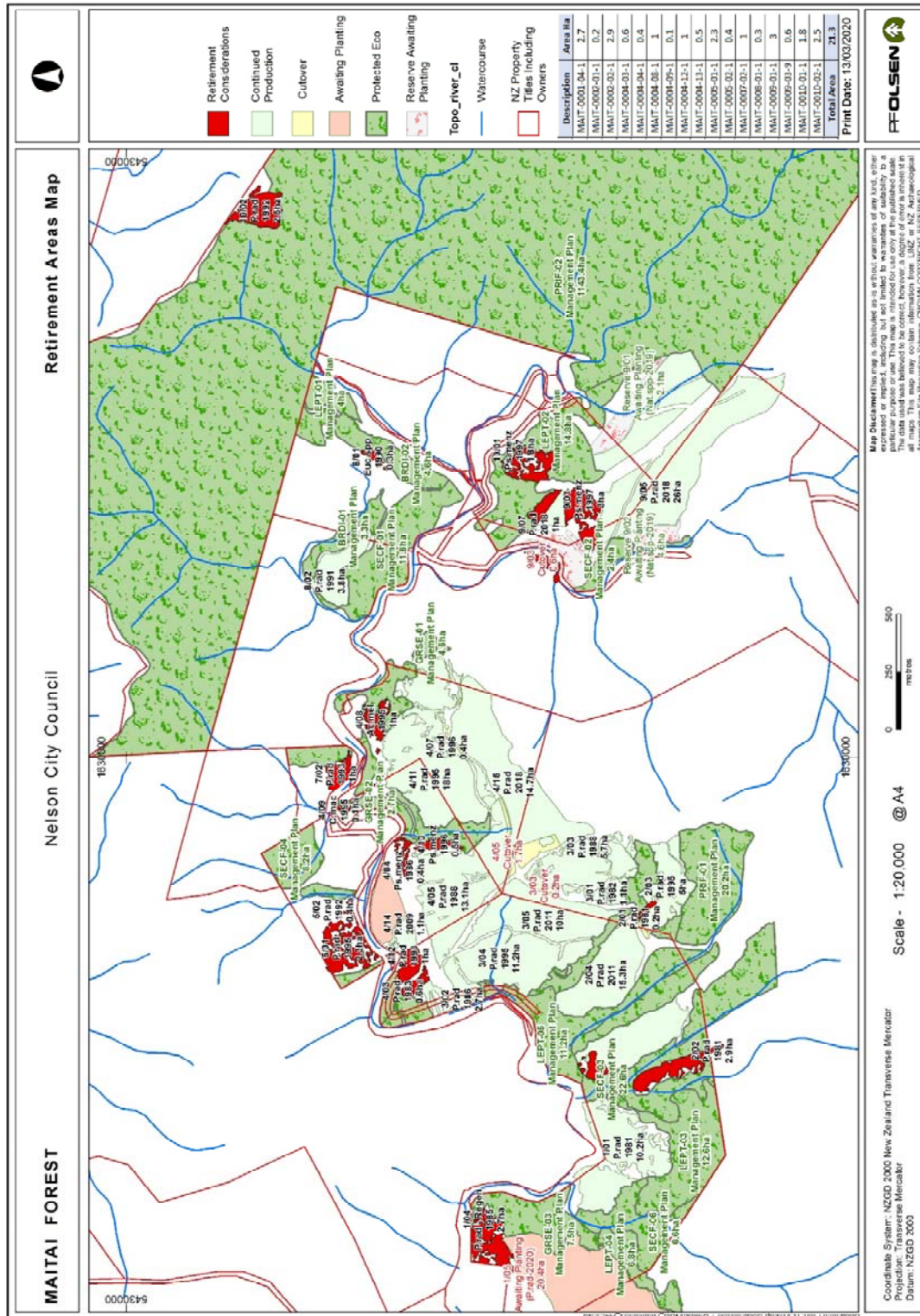
Forest	Number of Stands	Area subject to recommendations
Brook	18	94.4 ha
Maitai	19	21.6 ha
Marsden	3	21.7 ha
Roding	8	66.3 ha

<sup>16</sup> Nelson City Council Forestry Alternative Management 2018 – LandVision Ltd

# Map 6(a) – Areas for retirement from commercial forestry-Brook

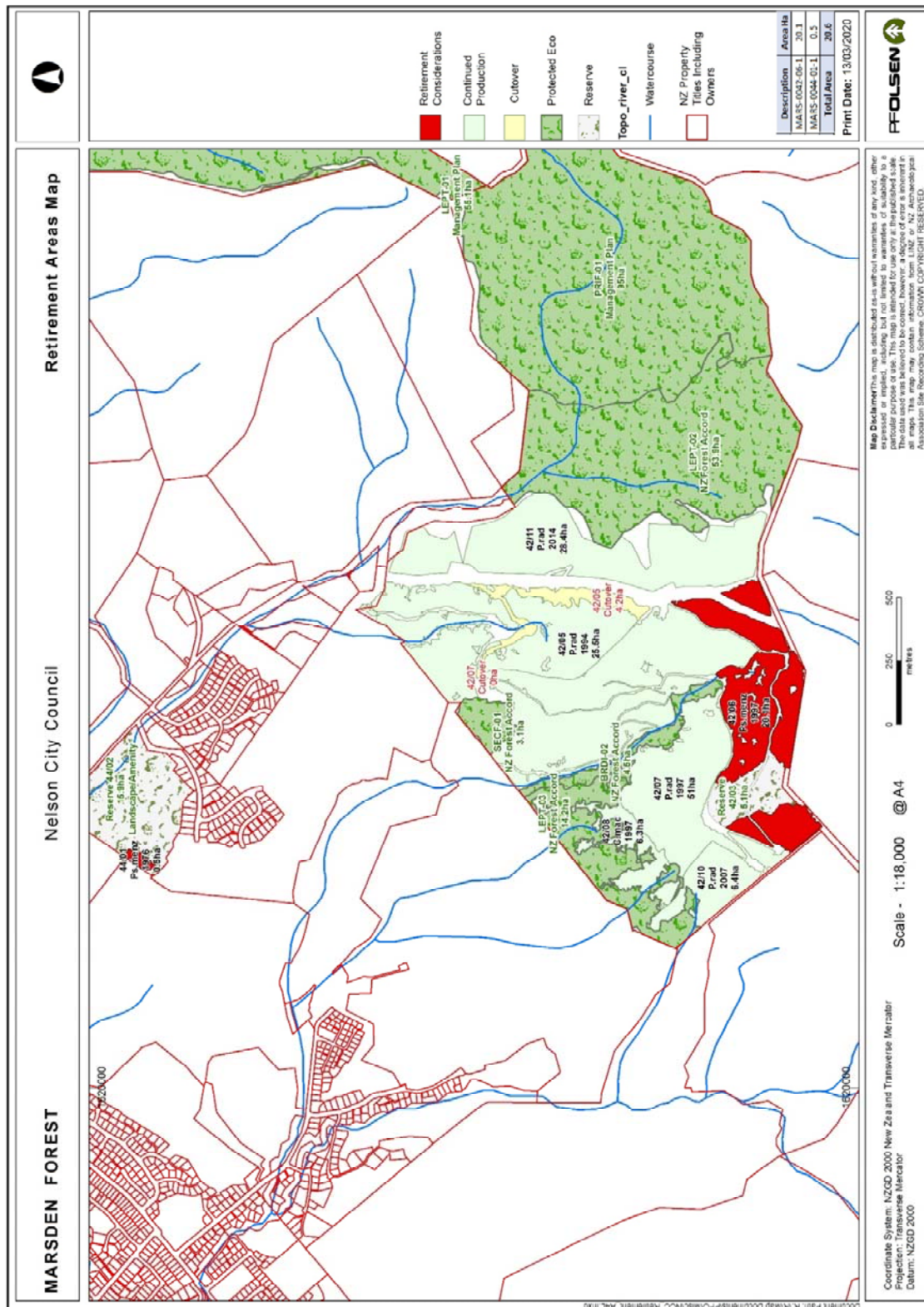


Map 6(b) – Areas for retirement from commercial forestry - Maitai

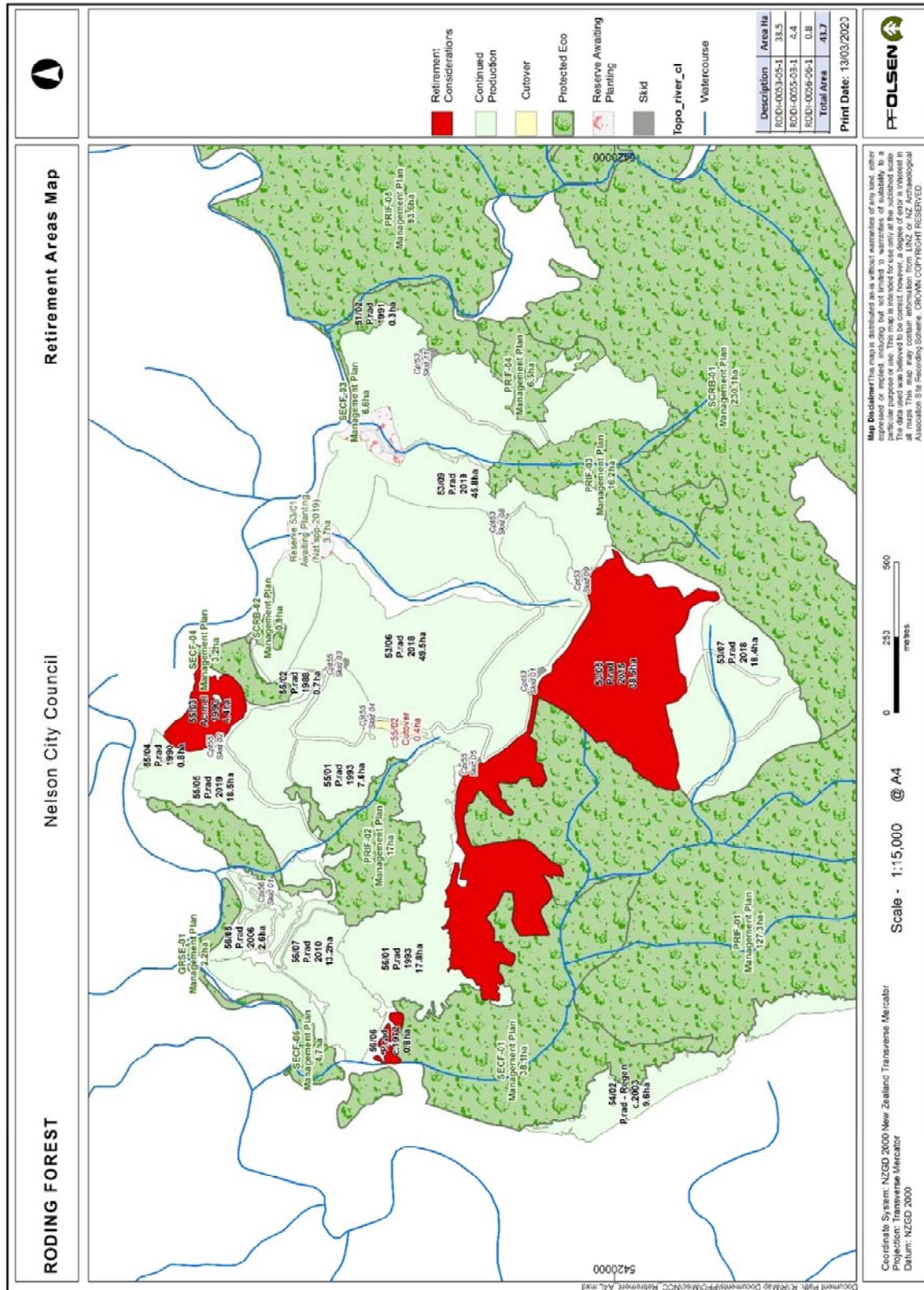




Map 6(c) – Areas for retirement from commercial forestry- Marsden



Map 6(d) – Areas for retirement from commercial forestry-Roding



## Establishment methods

Re-establishment where provided under the terms and conditions of the various agreements will aim to use high quality tree stocks suitable for the site and market. These will be investigated at the time of establishment.

Under the respective agreements that make up Brook, Maitai, Roding and Marsden Valley Forests, the current re-establishment regime will take place after harvest and involves a combination of:

- Crushing or line raking felling debris/waste (where necessary) to enable planting access;
- Spot mounding in frost prone sites;
- Line ripping of compacted skid sites;
- Aerial desiccation spraying of weeds (including naturally regenerated pines);
- Oversowing with various species of legumes to facilitate nitrogen fixing, and temporary soil stability;
- 'Planting with genetically improved radiata seedlings at 800-1000 stems per hectare;
- Fertilising those sites where required at planting; and
- Spot releasing or aerial releasing where necessary to eliminate competition from weeds.
- Replanting, which is important for maintaining soil stabilisation functions of the forests, will follow harvesting as it occurs with only minor deviation for seasonal or operational logistics reasons and boundary rationalisation.

## Pre-establishment considerations

In addition to any actions predicated from the Alternative Management Review (see 'Retirement Programme'), prior to re-establishment of the tree crop, a review will be conducted to identify and incorporate any boundary changes or other considerations in relation to riparian or reserve protection what would assist better outcomes for both the commercial management of the crop and or the environmental outcomes within the forest as a whole.

## Tending

The tending regime executed to date in NCC Forests for radiata pine stands up until ~2010 had been a clearwood regime consisting of two pruning lifts and one thinning to waste operation.

The intention for all future silvicultural treatment is that the forests will be managed for a 'structural or framing' regime involving a single thinning to waste at age eight.

## Tree nutrition

The soils in the specific locations of the Brook, Maitai, Roding and Marsden Valley forest plantations are not generally seen to be deficient in nutrients for healthy tree growth. However, there are soils within New Zealand and locations close by in the Nelson 'mineral belt' that are deficient in one or more nutrients. In the locations of these plantations, the most common nutrient deficiencies are likely to be:

- **Nitrogen** – Generally west coast sands in the North Island and the Canterbury Plains, West Coast and Nelson regions in the South Island.
- **Phosphate** – Upper North Island, Marlborough and West Coast have marginal available phosphate concentrations. This is often associated with clay soils.
- **Boron** – Boron deficient trees can suffer dieback from the terminal buds and this symptom is closely associated with moisture stress and drought. Trees growing on the drier East Coast of both Islands and on the pumice soils of the Central North Island are prone to boron deficiency.

Foliar samples are taken if nutrient deficiency symptoms are seen or expected. Fertiliser will only be applied if the health and the growth of the trees are significantly affected or where economic analysis demonstrates a benefit.

Site productivity and tree nutrition are actively researched components of industry research programmes in which PF Olsen is an active stakeholder and all harvesting entities are a financial contributor through the Forest Research Levy Fund.



## 10. Harvesting Strategy and Operations

### Harvesting strategy

The harvesting strategy employed Brook, Maitai, Roding and Marsden Valley Forests is to harvest the forest as close as possible to the optimum economic age as practical. This is the age at which the growth in volume and improvement in quality is offset by the accumulated interest costs to maintain the forest for another year. The optimum rotation length for radiata pine is expected to be within 25 to 30 years (this may be less for framing or unpruned stands).

Of importance in this assessment is the actual growth of the tree crop, the market for the wood at the time of the harvest and the outlook then for the near future. These factors, together with logistics such as the availability of suitable harvest contractors and the requirements of resource consents, will determine the actual harvest time.

The planned harvesting over the next five years at Brook, Maitai, Roding and Marsden Valley Forests is outlined in the table below. The stands scheduled for harvesting are small to moderate sized and spread amongst the four forests.

**Table 20. Planned harvest schedule – Hectares per year**

Year	Brook	Maitai	Marsden	Roding	Total
2019-20	12	26	-	-	<b>38</b>
2020-21	2	22	-	-	<b>24</b>
2021-22	3	-	45	26	<b>74</b>
2022-23	-	27	-	-	<b>27</b>
2023-24	-	5	-	-	<b>5</b>
2024-25			51	-	<b>51</b>
<b>Total</b>	<b>17</b>	<b>80</b>	<b>96</b>	<b>26</b>	<b>219</b>

Forward planning is essential when considering harvesting activities. Planning should commence 2 years before harvesting to enable roading infrastructure to be developed and any resource consents, archaeological surveys, etc. to be undertaken. This reduces the chance of hold-ups to the commencement of harvesting, which can be costly and disruptive in relation to market supply chains and contractors.

The harvest planning process is comprehensively outlined in the PF Olsen EMP's and I.T supported through a harvest planning system that requires an array of ~120 planning issues to be addressed, assists in the development of an 'Assessment of Environmental Effects' and the resulting operational prescriptions that address those effects.

## Post-harvest retirement

Policy decisions have been made post-harvest, to convert areas of the spread prone Douglas fir, either to radiata where the site is conducive to the commercial management of that species or to allow and encourage reversion to native species where that conforms to a better outcome within the overall landscape/landuse matrix. (See [Retirement Programme](#))

## Infrastructure

Forest infrastructure includes roads, tracks, landings, bridges and culverts. Design specifications are aligned with those of the industry Road Engineering design manual<sup>17</sup> and associated forest guidelines for support of the NES-PF.

Typically, infrastructure within an early- to mid-rotation age 'greenfields' forest is limited to access for a 4WD vehicle. During harvest planning, upgrades of existing roads/culverts/bridges and planning for new roads, landings and crossings will be identified and scheduled. The type of infrastructure designed and constructed is influenced by topography, harvest duration and intensity of use.

Once established, these require maintenance. The PF Olsen Asset Hazard Register is a GIS-linked database of forest assets that includes bridges, culverts and crossings under resource consent. This provides the framework for a record of the asset attributes, and its associated maintenance schedule, some of which are required under consent conditions.

## Infrastructure programme

Over the next 5 years the estimated infrastructure programme is scheduled as below:

**Table 21. Planned road infrastructure schedule.**

Forest	2019/20	2020/21	2021/22	2022/23	2023/24
Brook	Road upgrade				
Maitai	Road upgrade				Road upgrade
Marsden			Road upgrade	Road upgrade	
Roding				Road upgrade	

<sup>17</sup> New Zealand Forest Road Engineering Manual 2020

## River crossings

Historically, a number of access points to some forest areas relied on ford crossings. At time of harvest these pose a major source of fine sediment transport direct to the rivers. To address this matter NCC have committed to bridge installations to replace fords. Two significant bridge installations are proposed over the next 5 years.

**Table 22. Planned ford replacement schedule.**

Forest	2019/20	20/21	21/22	22/23	23/24
Maitai	Bridge Maitai River - South branch				
Roding		Bridge Roding River			

## Contractor management

Prior to engaging a new contractor, a comprehensive review of the contractor's safety systems, safety record, systems of work organisation and equipment is carried out. Where topography and terrain allows, mechanised felling, extraction and processing is a mandatory requirement. PF Olsen as the Property Manager must be satisfied on this review, regardless of the tendered price.

All new contractor crews undergo a comprehensive safety and environmental inductions, while PF Olsen Ltd, in conjunction with its contractors and NZQA training providers NorthTech, runs a comprehensive programme of training to ensure the workforce is competent for the work they are required to perform. The formal NZQA qualifications are supplemented periodically by internally run training courses including those on environmental matters.

All harvesting, engineering and silviculture contractors are subject to quarterly contractor monitoring audits and random drug testing. A full safety systems audit is scheduled and carried out annually. Full crew re-inductions take place every 5 years.

Weekly crew visits and monthly (or fortnightly according to risk) KPI assessments including environmental audits pick up corrective actions and follow-up on those.

WorkSafe undertakes audits on an unannounced basis from time to time.

## 11. Forest Inventory, Mapping and Forest Records

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### Inventory

Forest growth and development is monitored through forest inventory. Forest inventories providing stand information are required at different times and for different reasons throughout the life of the rotation:

- Pre-assessment: for silviculture rate setting and validating operational timing vs silvicultural targets;
- Quality control: to check contractor's performance and update stand records;
- Mid-crop: to collect measurement inputs for growth modelling;
- Pre-harvest inventory is scheduled for stands around age 24, to collect measurement data on the crop. This is used for harvest planning, marketing and revenue estimation.

New technologies may see some of this information gathered and analysed using remote sensing in the future.

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### Pre-assessment

Pre-assessment is the collection of stand parameters prior to a tending operation. It allows for:

- The calculation of contract rate for tending;
- A final check on the validity of the regime and timing of commencement of operations i.e. DOS targets can be achieved, or crop height is sufficient for pruning lift scheduled.

Sampling intensity is low but pre-assessment does provide good quality information on the work content involved in each tending operation and sets a base price for negotiation.

Pre-assessment was completed at Brook, Maitai, Roding and Marsden Valley Forests prior to tending operations commencing.

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### Quality control

Quality control is carried out during and after a tending operation. The aims of the quality control system PF Olsen have established are to:

- Collect sufficient data to monitor a contractor's performance and correct this if necessary, with minimum delay;
- Collect sufficient quantitative data to provide reliable estimates of the crop state;
- Provide data as input for growth modelling; and
- Provide data for estimating timing of the next tending operation.

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PF Olsen's 'Tending Manual' details the procedures to follow for pre-assessment and quality control plotting.

Quality control was completed at Brook, Maitai, Roding and Marsden Valley Forests at the completion of each tending operation.

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**Mid-crop inventory**

The principal aim for the mid-crop inventory is to collect stand data for inputs for growth modelling. Under current tending regimes mid-crop inventory is scheduled for between 11 and 15 years of age.

Sampling intensity is targeted to achieve 10% confidence limits on basal area on a stand-by-stand basis. Smaller stands may be aggregated into crop types to achieve this.

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**Pre-harvest inventory**

The principal aim for the pre-harvest inventory is to obtain estimates of recoverable volume by log grade. This information can then be used to develop marketing and harvesting strategies. Pre-harvest inventories will be undertaken when stands reach five years or less from harvesting.

Sampling intensity is targeted to achieve 10% confidence limits on basal area on a stand-by-stand basis. Smaller stands may be aggregated into crop types to achieve this as in mid-crop inventory. Use of Lidar is increasingly able to replace plot based inventory systems.

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**Mapping and stand records**

All mapping within Brook, Maitai, Roding and Marsden Valley Forests is in digital format and is constantly updated in a Geographic Information System (GIS). The GIS and forest information system spatially records a large array of forest data, from stand and legal boundaries, to reserves, rivers, roads, infrastructure, topography, soils, environmental constraints, stand operational and cost histories and productivity and post-harvest yield information.

Accurate mapping assists operational budgeting & planning, silvicultural payments, calculation of future revenue/tree crop value, protected ecosystems management, infrastructure location, and harvest planning. They also provide a means of measuring the performance of a Forest Manager. In a management audit, forest records can be verified against the status of the tree crop and unit costs derived for each operation.

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# Non-commercial Estate Management & Protection

## 12. Protected Forests, Habitats, Ecosystems and Species

### Introduction

Consideration of Indigenous biodiversity in or associated with exotic forests is a normal component of everyday forest management. Environmental certification systems place obligations upon the forest manager to be aware of and, where required, enact procedures to assist with the maintenance and protection of important biodiversity where they are able.

Exotic forests can and do provide a level of biodiversity, though this is often enhanced by natural forest ecosystem remnants embedded within the plantation matrix. These are often the most important contributor to the total of the productive landscape's biodiversity. However, rare and threatened species can also be found associated with exotic forests and may require special attention for management.

### Protected areas

The areas of indigenous forest that abut the external boundaries of all the planted forest areas form extensive tracts of natural ecosystems that have been assessed as part of the Council's obligations to protect areas of significant vegetation and significant habitats of indigenous species. These areas form, in their own right, "significant natural area (SNA 186-188)"<sup>18</sup> the assessment reports of which is included in [Appendix 4](#)

A further SNA assessment has been completed for the "Orphanage creek" within the Marsden Forest<sup>19</sup>. The assessment concludes the area just met SNA criteria on the basis of a presence of remnant lowland tree species now poorly represented in the locality but was seriously compromised by its shape and weed infestation levels that were severe over much of the area.

Other than at the boundary interface, forestry operations are not expected to conflict with the management nor function of these SNA's in any way. They remain fully protected.

These classifications **do not** override any assessment processes used by Council in executing its statutory obligations under the RMA but in relative terms provide an indicative means for prioritised action or avoidance / mitigation according to the 'Protection Category' status allocated to the areas from the assessments and classifications undertaken.

<sup>18</sup> 2006/2007 Survey of Areas of Significant Indigenous Vegetation and Significant Habitats of indigenous Fauna Michael North (2008)

<sup>19</sup> Nelson City Council Ecological Significance Assessment Report - Orphanage Creek within NCC Forestry 22 March 2016 Michael North

## Biodiversity planning

### Conservation and Landscape Reserves Management Plan 2009

However, all these areas, as NCC property, are effectively fully incorporated into 'reserve areas', namely the Roding and Maitai water reserves, the Marsden valley and Brook conservation reserves and the Grampians and Tangratree reserves.

A management plan prepared by Council in 2009 covers the Objectives and policies for these areas until 2019<sup>20</sup>. These are presented below.








**Table 23. Biodiversity and monitoring objectives and policies of the Conservation and Landscape Reserves Management Plan 2009.**

Current Situation/Issue	Objectives	Policies
<b>5.2 Biodiversity Protection</b>  The reserves covered by this plan contain some very important biodiversity values. Legislation, Council policies and public demand require that these values are protected as best possible. Some indigenous ecosystems within the reserves are substantially degraded. Restoration of degraded indigenous ecosystems may be necessary for successful biodiversity protection.	To protect, enhance and restore indigenous biodiversity in reserves.	5.2.1 Protect areas of indigenous vegetation and habitats of indigenous fauna on reserves, especially those areas adjoining streams and rivers, and on or adjacent to mineral belt areas.  5.2.2 Enhance indigenous biodiversity values of reserves as part of reserve maintenance and development.  5.2.3 Restore, or encourage the restoration of, indigenous vegetation and habitats of indigenous fauna on reserves, where appropriate.  5.2.4 Permit the removal of indigenous plants and animals (alive or dead) from reserves only when the species is not 'threatened' or 'at risk', the adverse effects are minor and the removal is specifically authorised, or where removal is for reserves management or scientific purposes and is specifically authorised.  5.2.5 Ensure that any works or other activities (such as forest harvesting or quarrying) undertaken in reserves or on adjoining lands are managed to minimise the adverse affects on instream habitats, including fish passage, and the water quality and quantity.
Current Situation/Issue	Objectives	Policies
<b>5.8 Monitoring</b>  Information on the condition of reserves provides the basis for making management decisions. Currently low levels of monitoring are in place.	To ensure a regular system of monitoring key species, habitats and threats is in place to guide management actions.	5.8.1 Monitor the condition of reserves and key species and habitats within them to identify threats and guide management actions.  5.8.2 Monitor the performance of measures taken to reduce threats to key species and habitats.

### Nelson Biodiversity Strategy- 2018

More recently an updated "Nelson Biodiversity Strategy"<sup>21</sup> produced in association with the Nelson Biodiversity Forum which includes NCC produced a revised set of priorities and actions for biodiversity protection in the area. At a high level, the summary of outcomes from proposed actions are presented below. More detail is in [Appendix 7](#).

**Table 24. Outcomes sought from the Nelson Biodiversity Strategy**

Outcome	Symbol
1. Nationally and regionally threatened indigenous species are sustained or restored.	
2. Rare and representative examples of native communities are protected and restored.	
3. Indigenous biodiversity is ecologically connected to sustain its functioning.	
4. Degraded indigenous ecosystems are restored and then sustained.	
5. Biodiversity is resilient in the face of climate change.	
6. Ecologically unsustainable use is prevented.	
7. Valued resources are available for use.	

<sup>20</sup> Conservation and Landscape Reserves Management Plan 2009 – Nelson City Council

<sup>21</sup> Nelson Biodiversity Strategy- Reviewed 2017/2018 Nelson Biodiversity Forum

## Protected ecosystems

PF Olsen's EMP's provide broad guidance and specification on the application and execution of ecological management targets and actions.

The first steps are to accurately map the indigenous vegetation present within the plantation areas. The NCC estate is a little atypical in that the Council has jurisdiction and is undertaking a range of biodiversity management functions over much larger areas associated with or adjacent to the plantations. For the purposes of the defining a "zone of influence" Council owned property parcels that include parts of the commercial plantations have been included in this plan to their fullest extent, including the indigenous vegetation within those property parcels.

Brook, Maitai, Roding and Marsden Valley Forests contain a combined 1,241 hectares of protected ecosystems. Characteristics of the protected ecosystems are summarised in tables 21-23 following, while they are also shown on the forest stands map 7(a) – (d).

The protected ecosystems are recorded and ranked based on ecological criteria reflecting the stands representativeness, rarity of species, size and connectivity, function and landscape values. Relative status in relation to the ['ecological landscape'](#) also informs that process as does any Council related ecological assessments of areas.

**Table 25. Protected Ecosystems Management Categories**

Protection Category	Primary Management Objective	Activity Level	Monitoring
Passive	Minimise non-essential damage, maintain area	Fire protection	- Area - with adjacent stand assessments
	Observe RPMS obligations	3rd party arrangements regarding pests, apply RPMS	- Pests - to meet RPMS
			- General forest health survey
Limited	Protect from non-essential damage, maintain area, maintain function (where practical)	Fire protection	- Sample forest condition monitoring
	Observe RPMS obligations	3rd party arrangements regarding pests, apply RPMS. Associated maintenance pest control	- Low level pest monitoring where relevant - Sample related fauna if relevant
Full	Protect from all controllable damage, maintain area & function	Fire protection	- Area monitoring
	Improve quality	Specific management	- Forest condition monitoring
	Observe RPMS obligations	Targeted pest control, 3rd party arrangements regarding pests	- Pest monitoring where relevant - Related fauna monitoring if relevant
Special	Restoration if practical	As above, plus fencing, covenanting, co-management agreements & funding (where practical)	- As above, plus as defined in any restoration agreement

The tables below provide a breakdown of the indigenous ecosystems identified, mapped and classified within the scope of this plan, providing an indications of the key ecological functionality of areas and their relative ranking and well as the key vegetations associations by canopy species dominance.

**Table 26. Protected Ecosystems management categories by function and area.**

		Protective Status					Grand Total
Forest	Ecosystem function	Special	Full	Limited	Passive	Other	
<b>Brook</b>			182.5	59.5	29		271
	Landscape/Amenity			49.7	7.9		57.6
	Non Specific			9.8			9.8
	Riparian Ecosystem				4.6		4.6
	Terrestrial Ecosystem		182.5		16.5		199
<b>Maitai</b>		45.6	122.6	56	53.6	16.4	294.2
	Non Specific				5.7		5.7
	Riparian Ecosystem	22.6	2.4	20.4	2.7		48.1
	Terrestrial Ecosystem	23	120.2	35.6	45.2		224
	Other					16.4	16.4
<b>Marsden Valley</b>			98.1	58.4	14.2	29.7	200.4
	Other					29.7	29.7
	Riparian Ecosystem			4.5			4.5
	Terrestrial Ecosystem		98.1	53.9	14.2		166.2
<b>Roding</b>		316.4	117.3	6.5	15.3	19.9	475.4
	Terrestrial Ecosystem	316.4	117.3	6.5	15.3		455.5
	Other					19.9	19.9
<b>Grand Total</b>		362	520.5	180.4	112.1	66	1,241

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Table 27. Protected Ecosystems management categories by function

Forest	Vegetation types / Functionality	Key functionality of the different vegetation types					Grand Total
		Landscape/ Amenity	Non Specific	Riparian Ecosystem	Terrestrial Ecosystem	Other	
<b>Brook</b>		57.6	9.8	4.6	199		271
	Beech Hard/Red dominant/ Podocarp		9.8		175.7		185.5
	Broadleaved Hardwood Shrub&fernland	54		2.7	13.7		70.4
	Hardwood/Podocarp/beechn			1.9			1.9
	Manuka/kanuka/BroadleavedHW	3.6			2.8		6.4
	Podocarp/hardwood/Hard_Red Beech				6.8		6.8
<b>Maitai</b>			5.7	48.1	224	16.4	294.2
	Adventive and exotic weeds & grasses			4.6		16.4	21
	Black beech/ hardwoods/softwoods			30.9	19.6		50.5
	Broadleaved Hardwood Shrub&fernland				13.7		13.7
	Exotic Species		1.1				1.1
	Gorse / nurse crop cover		4.6	10.2			14.8
	Hard beech/ mixed hardwood/softwood				112.4		112.4
	Hardwood/Podocarp/beechn				8.2		8.2
	Manuka/kanuka/BroadleavedHW				70.1		70.1
	Podocarp/hardwood/Hard_Red Beech			2.4			2.4
<b>Marsden Valley</b>				4.5	166.2	29.7	200.4
	Broadleaved Hardwood Shrub&fernland			4.5			4.5
	Kahikatea/matai/podocarp/HW				3.1		3.1
	Manuka/kanuka/BroadleavedHW				68.1		68.1
	Podocarp/Hard_Red Beech				95		95
	Other					29.7	29.7
<b>Roding</b>					455.5	19.9	475.4
	Adventive and exotic weeds & grasses					19.9	19.9
	Black beech/ hardwoods/softwoods				101.1		101.1
	Broadleaved Hardwood Shrub&fernland				0.9		0.9
	Gorse / nurse crop cover				2.2		2.2
	Hard Beech/Red Beech/Mixed Hardwoods				43.7		43.7
	Mountain beech/ Black beech				127.3		127.3
	Silver beech/Hard beech/ Hardwoods				29.3		29.3
	Subalpine mixed flax/shrubhardwood &tussock				151		151
<b>Grand Total</b>		58	16	57	1,045	66	1,241



## Management and riparian setbacks

A standardised GIS-based stream classification system based on NIWA's River Environment Classification (REC) has been used to develop a rationale for defining riparian management with a set of rules in the EMP's that apply to operations occurring near the riparian corresponding with each stream category. Categorisation of each stream reach is done by the physical characteristics of the particular reach, e.g. underlying geology, streambed slope, climate, and reach order.

The guidance also includes minimum set-backs upon establishment or reestablishment of forest after harvest where riparian setbacks had not existed before which are aligned with the NES-PF. Notwithstanding these minima, FSC standards yet to come into play at the time of writing, will set a 10m minimum setback on all streams and this will apply across the estate. In many instances in this estate, the morphology of streams and the presence of existing native riparians can mean that the minimum set back is significantly wider.

The stream categories within Brook, Maitai, Roding and Marsden Valley Forests are summarised below. The total length of waterways within all four forests is **19.3 km**.

**Table 28(a). Length of streams by REC class for Brook Forest**

REC Class	Length (m)	Length (km)
Large_Mod_Wet_Hard	80.1	0.08
Large_Steep_Wet_Hard	18.7	0.018
Med_Low_Wet_Hard	269.5	0.27
Med_Mod_Dry_Soft	462.7	0.46
Med_Mod_Wet_Hard	239.8	0.24
Med_Steep_Wet_Hard	2439.1	2.44
Small_Mod_Wet_Hard	591.2	0.59
<b>Total</b>	<b>4,101</b>	<b>4.1</b>

**Table 28(b) Length of streams by REC class for Maitai Forest**

REC Class	Length (m)	Length (km)
Large_Mod_Wet_Hard	859.1	0.86
Large_Steep_Wet_Hard	187.3	0.19
Med_Mod_Wet_Hard	1814.8	1.81
Med_Steep_Wet_Hard	875.7	0.88
Small_Mod_Wet_Hard	1765.9	1.77
Small_Steep_Wet_Hard	1001.6	1.0
<b>Total</b>	<b>6,504</b>	<b>6.5</b>

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**Table 28(c). Length of streams by REC class for Roding Forest**

REC Class	Length (m)	Length (km)
Large_Mod_Wet_Hard	240.0	0.24
Large_Steep_Wet_Hard	525.1	0.53
Med_Mod_Wet_Hard	166.1	0.17
Med_Steep_Wet_Hard	2353.0	2.35
Small_Mod_Wet_Hard	728.9	0.73
Small_Steep_Wet_Hard	1258.5	1.26
<b>Total</b>	<b>5,271</b>	<b>5.3</b>

**Table 28(d). Length of streams by REC class for Marsden Valley Forest**

REC Class	Length (m)	Length (km)
Med_Low_Wet_Soft	452.2	0.45
Med_Mod_Wet_Hard	2480.5	2.48
Med_Steep_Wet_Hard	224.4	0.22
Small_Steep_Wet_Hard	231.2	0.23
<b>Total</b>	<b>3,388</b>	<b>3.4</b>

#### Rare and threatened species

Plantation forests and their intertwined native habitats have proved capable of supporting or contributing to the support of important NEW ZEALAND fauna including threatened species.

Information arising from NCC records from surveys in surrounding environments indicate a potential presence of a number of species within the plantation areas and their immediate surrounds.

Records of sightings and locations are currently starting to be collected using the NatureWatch application “Biodiversity in Plantations” project which provides means for recording any sightings of any biodiversity into a spatial dataset from which long-term data can be extracted for rare species reporting. These records can be made available to conservation authorities.

A listing of key species of interest is held by all contractors and staff and a request to report such information using the application is part of their training. Over time, data from this application has enabled the build-up of a spatial distribution picture of species within different geographical locations within plantations in NZ. The geographical resolution of that data will improve the more forests (such as NCC forest) are added and the more sightings are recorded.

## Avifauna & Bats

Local checklists of avifauna present in the Nelson region are extensive due to the wide range of habitat types and altitudinal ranges. Records derived for the general region have recorded 98 species<sup>22</sup> within 40 groupings ([Appendix 5](#)). Many of these are shore birds or common introductions and not likely present and or significant within forest habitats. Those native species that are potentially or most likely to occur in the forests and their adjacent environments are listed below<sup>23</sup>:

**Table 29. Species of particular interest that are or maybe present in the Maitai, Roding and Marsden Valley Forests.**

Nationally Critical	Nationally endangered	Declining	Recovering
Bittern	Kea	Fernbird	Kaka
L-tailed Bat	Landsnails	S.I Robin	NEW ZEALAND Falcon
		Spotless crane	Pied shag
		Forest gecko	
		Speckled skink	

At this point, the first recordings of bird species in the Biodiversity in Plantations project are as tabled below:

**Table 30. Recent recorded sightings of species reported in Maitai, Roding and Marsden Valley Forests.**

NZ Threat Classification System Category	Maitai Species	Roding Species	Marsden Valley Species
Nationally endangered		Kea	
Recovering	New Zealand Falcon		New Zealand Falcon
Naturally uncommon		Little Black Shag	
Common		Weka /Fantail	

## Primary actions

Primary management actions in relation to avifauna and bats are:

- Adherence to industry protocols developed for management of NEW ZEALAND falcon, kea, & bats if required<sup>24</sup>.

<sup>22</sup> <https://ebird.org/newzealand/region/NZ-NSN?yr=all&m=&rank=hc>

<sup>23</sup> <https://rarespecies.nzfoa.org.nz/>

<sup>24</sup> Kea: <https://go.promapp.com/pfolsen/Documents/Minimode/Permalink?crypto=D0KKqOc8QPbj7IWYFNJ0Dr>

Falcon: <https://go.promapp.com/pfolsen/Documents/Minimode/Permalink?crypto=GpQDQzJNsfpld30mDb64yR>

Bats: <https://go.promapp.com/pfolsen/Documents/Minimode/Permalink?crypto=BgAibCbpglrW32GGdw35jv>

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- Deployment of bat detection devices along possible corridor areas ahead of harvest operations to check for a possible presence and if confirmed seek further professional advice.
  - Inclusion of threatened species sightings into the PF Olsen sightings database, and subsequently into the NEW ZEALAND Forest Owners NatureWatch – Biodiversity in Plantations Project<sup>25</sup>,
  - Minimising damage to natural forest areas and any small wetlands and shrublands during harvest and reforestation, particularly any gully systems that already form natural corridors through the larger plantation areas,
  - Promotion of the development of improved riparian corridors after harvest.
  - Integration and co-operation within Council biodiversity protection / enhancement programmes applied across the wider landscape within and external to the stocked plantation areas.
- 

## Herpetofauna

Most NEW ZEALAND lizard species are now threatened, principally due to predation but also habitat loss. Nelson is home to the Nelson Green Gecko which is confined to the area and incredibly rare. The forest Gecko and speckled skink have some potential to be present within or immediately adjacent to the operational plantation areas.

This suggests some preliminary work should be undertaken to assess the likelihood of their presence within at least some parts of the forest.

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## Primary actions

Primary management actions in relation to herpetofauna are:

- Adherence to industry protocols developed for management of NEW ZEALAND lizards which are currently under development.
  - Minimising damage to natural forest areas and any small wetlands and shrublands during harvest and reforestation, particularly any gully systems that already form natural corridors through the larger plantation areas.
  - Seek advice on necessity of pre-operational surveys.
  - Inclusion of threatened species sightings into the PF Olsen sightings database, and subsequently into the NEW ZEALAND Forest Owners NatureWatch – Biodiversity in Plantations Project<sup>26</sup>
  - Integration and co-operation within Council biodiversity protection / enhancement programmes applied across the wider landscape within and external to the stocked plantation areas.
- 

<sup>25</sup> <http://naturewatch.org.nz/projects/biodiversity-in-plantations>

<sup>26</sup> <http://naturewatch.org.nz/projects/biodiversity-in-plantations>

## Fish

The Niwa Freshwater fisheries database and Freshwater Environments of New Zealand (FWENZ) models have been used to inform the potential for threatened fish species to be present in streams affected by operations and if necessary, any response to such a presence.

While the forests abut (with some setbacks) larger rivers such as the Maitai and Roding, the actual effects upon their fish populations are likely to be low. Tributaries from within the forest production areas are very small and fish information is sparse as a result. The Poorman running through Marsden forest is a larger tributary but the majority of its length is through the upper large native forest headwater areas with only a short section in close proximity to the planted forest.

Species presence as derived from the sources and relevant to small in-forest tributaries is shown below.

**Table 31: Fish species present or likely in the small tributaries of the forests**

	Brook	Maitai	Marsden	Roding
<b>Brown trout</b>	?	Y	?	
<b>Lonfin eel</b>	?	Y	Y	y
<b>Koaro</b>		Y		
<b>Koura</b>		Y		
<b>REgfin Bully</b>		Y		
<b>Torrent fish</b>		Y		
Y: present (NZFFDB or FWENZ high probability) ?: FWENZ moderate possibility				

## Primary actions

Primary management actions in relation to fish, in addition to those already covered under water quality are:

- Utilisation of the Fish Spawning Indicator as a management tool<sup>27</sup>, to avoid operations involving works over or in the beds of streams during spawning periods and at all times maintain good sediment controls around earthworks.
- Development and maintenance of a register of crossings and an inspection routine to ensure fish passage,
- Sound design and construction of all new stream crossings,
- Timing of in bed crossing construction to avoid peak spawning period,
- Minimising damage to streamside environments and provision of setbacks where they were not originally present,
- Identification of, and avoidance and/or buffering of waterbodies during aerial spraying for replanting and *Dothistroma* control or aerial fertilisation if ever required,
- Protection of any wetlands identified within the plantation matrix.

<sup>27</sup> Published by NIWA to support the regulations of the NES-PF



## CITES species

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments.

Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than 34,000 species of animals and plants.

The full list of New Zealand CITES listed species are available in the EMP's, or online at <http://www.doc.govt.nz/about-doc/role/international/endangered-species/cites-species/nz-cites-listed-species/>.

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## Anticipated activities

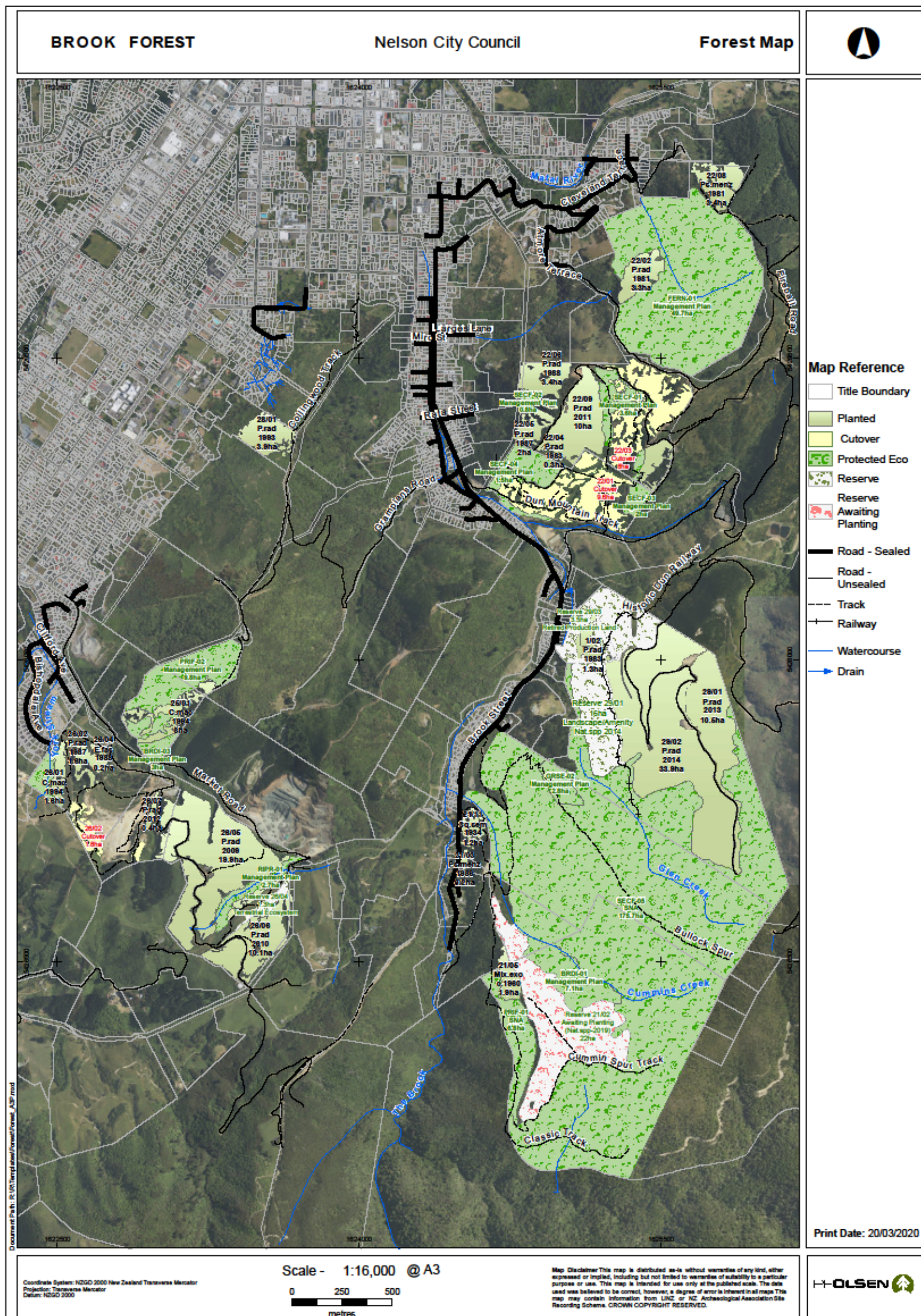
The primary actions noted for each key element of biodiversity identified within the NCC forests as well as pest control operations ( see: [Property Management and Protection](#)) and land retirements are anticipated to contribute to the sum total of positive biodiversity outcomes sought from the implementation of both the Conservation and Landscape Reserves plan and the Nelson Biodiversity Plan ([Appendix 7](#)).

Other specific actions and responses may also be implemented over time as the need arises as a consequence of both physical discoveries or co-ordination with the Reserves Managers within NCC identifying new areas where mutual benefits can be identified and leveraged.

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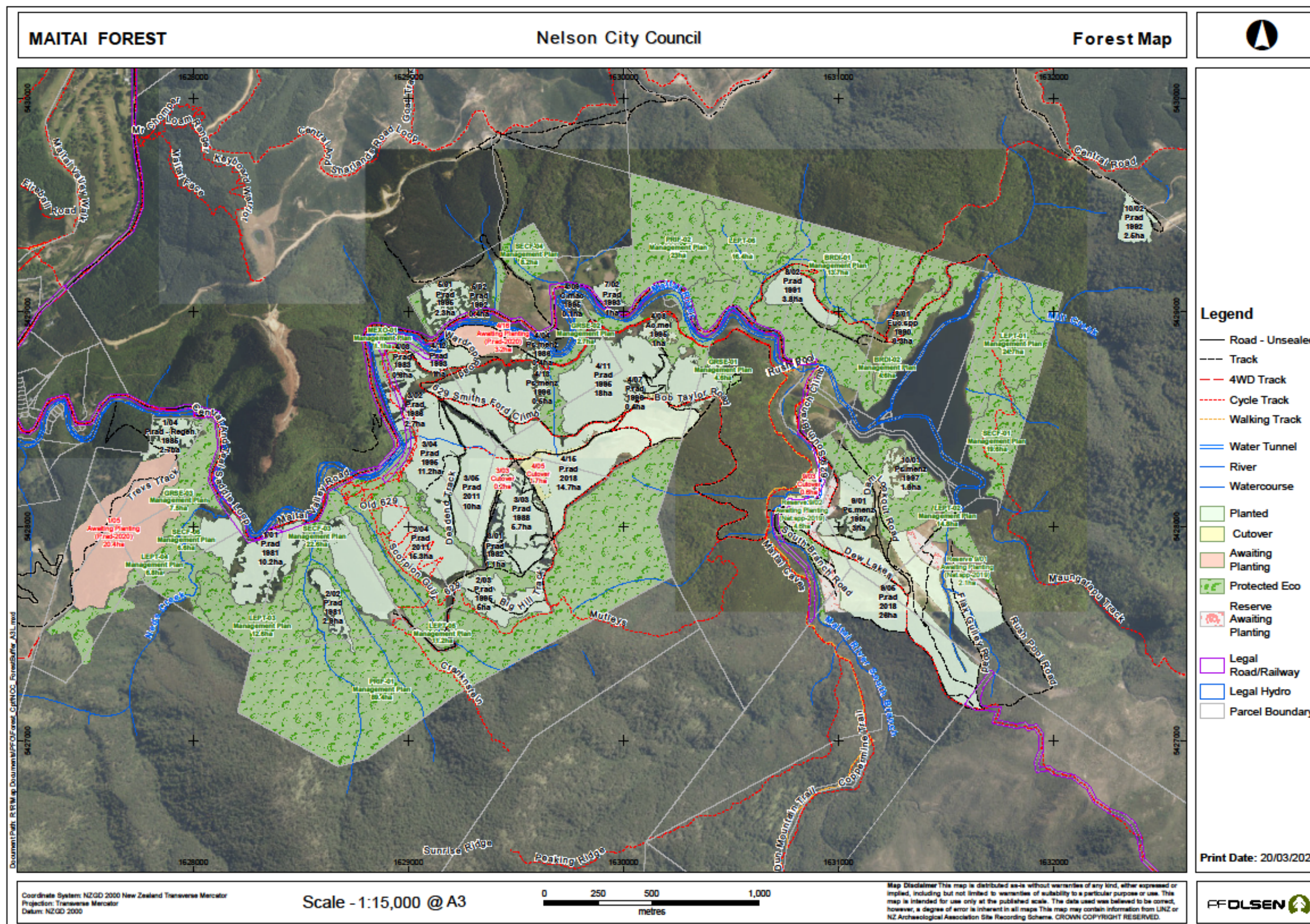


Map 7(a) – Brook Forest Detail



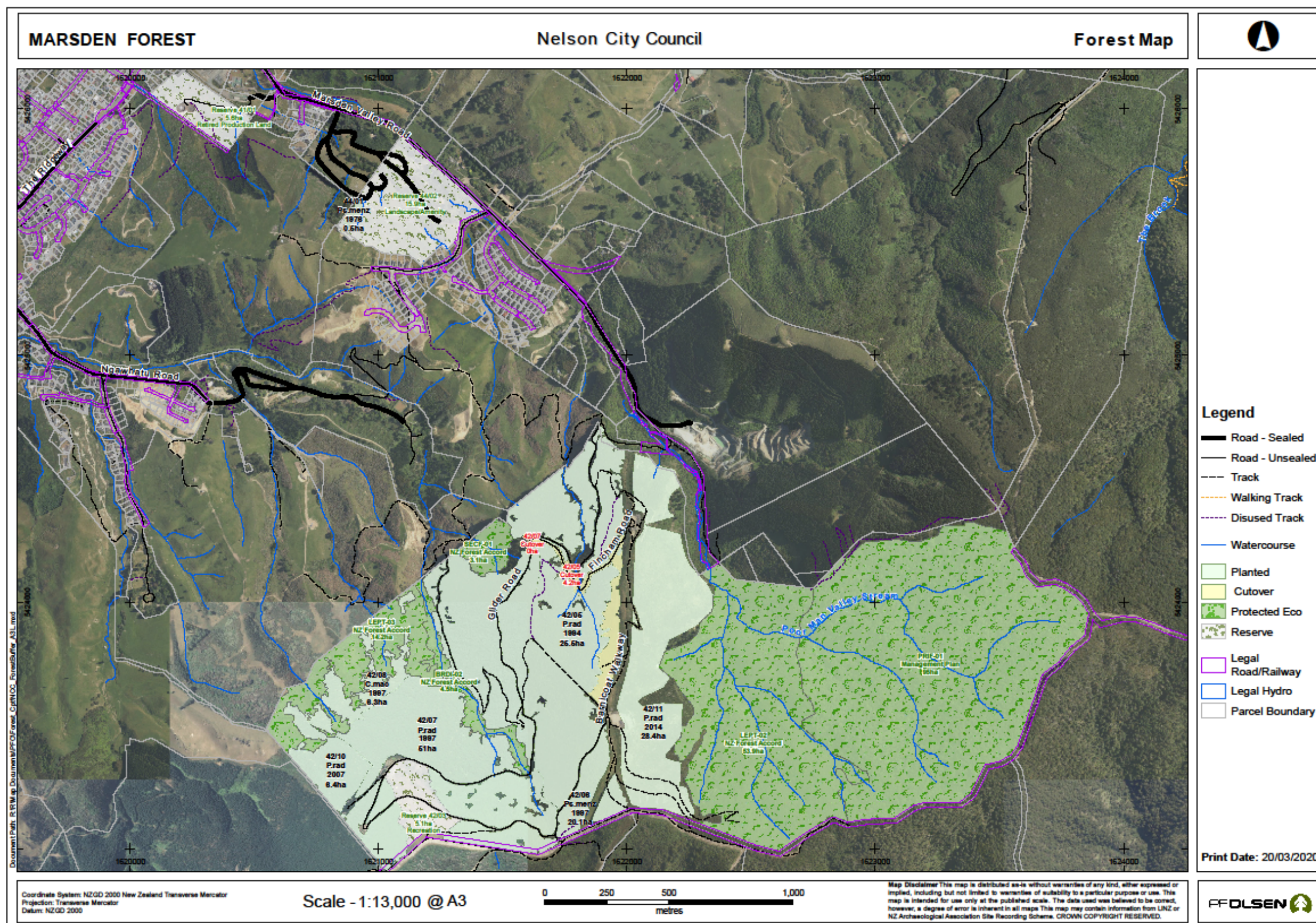


Map 7(b) – Maitai Forest Detail



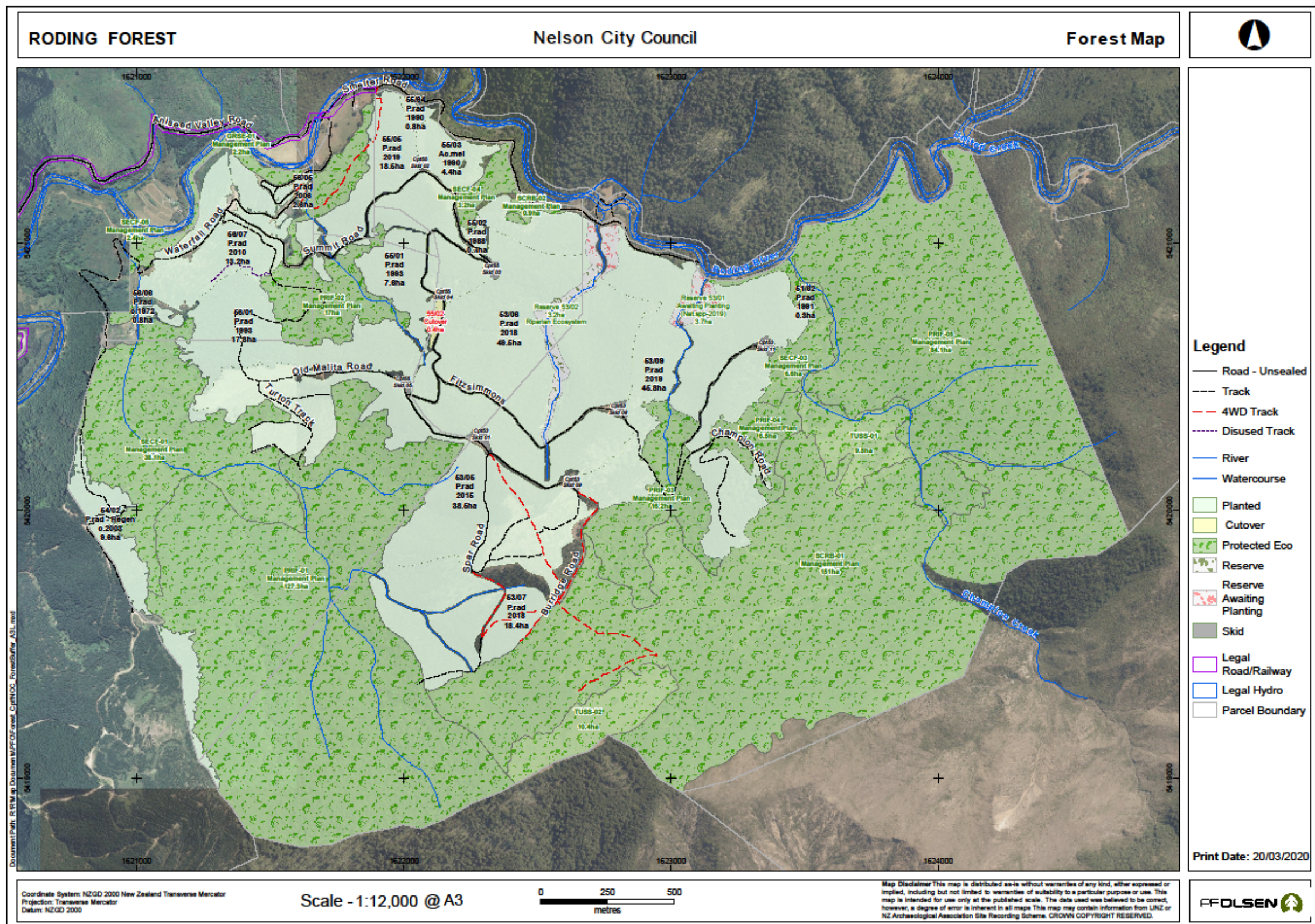


Map 7(c) – Marsden Valley Forest Detail





Map 7(d) – Roding Forest Detail





## 13. Property Management and Protection

### Statutory pest obligations

Pest management Brook, Maitai, Roding and Marsden Valley Forests is subject to statutory obligations under the Regional Pest Management Strategy administered by Nelson City Council.

The strategy applies to both pest plants and animals and categorises them, in terms of management objectives. The categories, objectives and land owner obligations are summarised the Regional Pest Management Strategy Plan 2019-29(RPMS)<sup>28</sup> in [Appendix 6](#). These plans are maintained online by the relevant Council.

### Reserves Management Plan

The NCC Conservation and Landscape reserves Management plan also lists a policies and objectives in respect of the management of pest plants and animals within these areas. The management of pests within the plantations will be targeted to manage commercial pests specific to plantation health and direct obligations under the RPMS and thereafter wider control initiatives will be coordinated within the Council's wider programmes covering the relevant reserves and objectives as appropriate to the areas of concern.

**Table 32: Pest control policy and objectives from the NCC Conservation and Landscape reserves Management plan.**

<p><b>5.7 Plant and Animal Pest Control</b></p> <p>The reserves covered by this plan are all affected to some extent by introduced (naturalised) plants and animals. In most reserves plant and animal pests pose a major threat to biodiversity values. The most effective control is early detection and removal of new pest infestations and the targeted control of existing populations.</p>	<p>To control populations of pest species in accordance with identified targets so that reserve values are protected.</p>	<p>5.7.1 Carry out surveillance to detect new plant and animal pest infestations and gather information on the size and extent of existing infestations.</p> <p>5.7.2 Control plants and animal pests in accordance with the Tasman-Nelson Regional Pest Management Strategy.</p> <p>5.7.3 Undertake priority plant and animal pest control in accordance with identified targets in reserves where such pests pose a threat to the natural values of the reserve or to public enjoyment of the reserve.</p> <p>5.7.4 Coordinate pest control activities with those of the Department of Conservation, the Animal Health Board, immediate neighbours and other agencies or groups wherever possible.</p> <p>5.7.5 Support projects which seek to control plant and animal pest populations or which prevent the establishment or re-invasion of pests.</p> <p>5.7.6 Allow recreational control of animal pest populations, as specified in Policy 5.16 (Hunting and Fishing) and in individual reserve policies.</p> <p>5.7.7 Consider best practice control methods and approaches to avoid adverse environmental impacts from pest control.</p>
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<sup>28</sup> [file:///pfo/userhome\\$/richk/Downloads/Tasman%20Nelson%20Regional%20Pest%20Management%20Plan%20new%20logo.pdf](file:///pfo/userhome$/richk/Downloads/Tasman%20Nelson%20Regional%20Pest%20Management%20Plan%20new%20logo.pdf)

### Plant pests

Unfortunately, within the Nelson region, due to climatic and probably a long history of urban proximity, there is a long list and large reservoir of problematic pest plants. Within the greater forest property boundaries, old man's beard, passionfruit, broom, gorse pampas, blackberry and wilding pines (Douglas fir) are issue.

In the low elevation sites Oldman's beard, and passionfruit are ecological threats within the native forest remnants. A number of the species pose risk if they become established in locations close to the mineral belt.

### Animal pests

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The main mammal pests in Brook, Maitai, Roding and Marsden Valley are the introduced possum, which can attack the growing tips of both plantation and native trees, causing stem malformation and die back. Possums are also a nationally significant ecological pests, predating on native birds and their eggs. Deer, goats and pig are present and while less commercially significant are again problematic for natural ecosystems. Stoats, rats and mice have no commercial impact but are a massive ecological threat in all natural ecosystems.

Rabbits and hares can be a problem at the time of plantation establishment.

Wasps are another pest that is both an ecological and general pest that can become a major problem to human safety over the (late) summer period.

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### Insects and fungal disorders

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Diseases, which can affect the forest trees and adjacent native vegetation, are monitored throughout the year by the forest manager, and once a year by a professional independent forest health assessor. Most diseases cause little damage and do not require control. The exception is *Dothistroma*, a fungus which attacks pine needles.

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## Pest control approach

### Plant pest control

Of the pest weeds, the major species are designated for 'sustained control' under the RPMS, meaning that at least their spread off-boundary, should be prevented and densities maintained at levels that do not create significant external effects.

The overall objective in managing plant pests is to:

- Meet statutory obligations under the Regional Pest Management Strategy which for most of the species around the forests is that of "Sustained Control"
- Ensure that any impacts on neighbouring properties are promptly dealt with,
- Monitor the distribution of these species within Brook, Maitai, Roding and Marsden Valley Forests.
- Reduce their direct impacts on both plantations and indigenous biodiversity values in accordance with the RPMS and in coordination or cooperation with the wider pest weed control programmes undertaken by NCC.

Wilding pines have been subject to ongoing off-site control and eradication as an integral part of the NCC Conservation and Amenity Reserves management programmes. Within the commercial forest boundaries this problem is also being managed on site long-term by the removal and replacement either by the less spread prone radiata pine or reversion back to native vegetative cover (see: [Retirement Programme](#))

For the control of plant pests, chemical herbicides are the usual approach whether for dealing with establishment weeds or ecological pest plants.

All chemicals used are subject to Environmental Protection Agency (EPA) approval and will also have to meet the FSC Hazardous chemicals policy (see: [Hazardous Chemicals](#)) and are applied in keeping with all legislative and safety requirements and with industry best practice.

Herbicides are used to desiccate most harvested areas prior to re-establishment, usually by aerial spraying, but occasionally by spot spraying in sensitive areas and where grasses are the main problem rather than woody weeds. Re-established trees are also released with another chemical application where necessary, during the first one to two years after establishment.

Pest weed control, where required can include aerial applications through to groundbased manual cut and swab or similar techniques dependent upon the site and weed species.

### Animal pest control

Under the RPMS, the highly significant ecological pests are subject to limited, targeted “site led” control programmes involving sensitive areas with definable and defensible boundaries and often involving local community efforts. At the top end of this spectrum of activity is the ‘Brook Sanctuary’ mainland island project abutting Brook forest and on NCC land. The project is strongly supported by the NCC and involves complete ecological restoration through predator proof fencing and complete predator control.

Control of commercial animal pests in Brook, Maitai, Roding and Marsden Valley plantation forests are expected to be controllable using ground-based methods as required, to prevent impacts on planted species.

Wasps can easily be controlled in required areas through the ground application of Vespex (active ingredient fipronil) to make areas safe for both workers, and recreationalists alike as well as proving a major benefit to native fauna. The forest manager will liaise and coordinate with the NCC reserves managers where appropriate for these operations.

In respect of ecological pest control operations, the forest manager will coordinate operations with other branches within Council tasked with wider scale pest control in the Council owned parks and reserves and if necessary also with the Department of Conservation, in order to achieve effective and efficient control within the areas of jurisdiction, where required. While access in the plantations or their immediately adjacent native forest areas would likely be amenable to ground based trapping and poisoning. Broader scale operations within the wider reserve environments would likely involve aerial controls and would be a process driven by NCC reserves managers and potentially the Department of Conservation. The forest managers would seek to co-operate in the facilitation of any such proposed operations.

### Fungal pest control

*Dothistroma pini* is the most commonly occurring fungal disorder within the radiata pine plantation. This fungus is controlled using an aerially applied copper-based fungicide spray, usually required between 1 to 4 times only, during the first third of a radiata rotation and only when the infection reaches a critical level.

*Dothistroma* can also be controlled through silviculture by timely thinning and pruning operations, which increases air movement and lowers humidity levels.



### Chemical management framework

All chemical applications are managed in accordance with PF Olsen's EMP's, the NEW ZEALAND Standard for agrichemical application, HSNO regulations and the obligations conferred by FSC to manage and minimise the use of chemicals including use of alternatives where available and to manage stakeholder expectations.

As part of the FSC commitments:

- All chemical usage is tracked by active ingredient and application area to enable reporting and monitoring of trends and is reported on an annual basis.
- PF Olsen is an active participant in research into chemical reduction, efficacy and safety issues related to the 'restricted use' derogations applied by FSC to various activities pursuing biological control agents.
- Chemicals classified by FSC as 'Restricted' are used only under the terms of any conditions agreed through the FSC Standards Development sub-process in NZ that includes representation from Commercial, Environmental, Social and Maori interests. (See the FSC Pesticides Policy for this process<sup>29</sup>)

### Fire prevention and control

With the weather patterns normally experienced in the Northern South Island region during the period late spring/summer, fire can be a potential threat to the forests. This can be minimised by:

1. Having an effective fire plan and rural fire control organisation.
2. A close link with the relevant fire authorities, and an understanding of equipment and trained manpower requirements.
3. Active prevention measures which include restrictions on allowable access, fire prevention signage, publicity when fire danger prevails, access to adequate water sources, and if required constructing and maintaining firebreaks.
4. Effective fire reporting communications systems, mapping, and fire plan alert procedures.
5. Good forest management that recognises the influence of terrain, roading network and accessibility, and fuel build-up from silvicultural practice that will influence fire prevention and control measures.

*Continued on next page...*

<sup>29</sup> FSC Pesticides Policy FSC-POL-30-001 V3-0 <https://www.fsc.org/en/document-centre/documents/resource/208>

...continued

**Table 33: Summary of the Fire Risk Assessment for NCC Forests**

Block	Fire potential	Fire Intensity	Fire Damage	Overall risk	Opportunities comments
Marsden Valley	High	Medium	moderate	High	Limit access when the vegetation index gets to a certain level starting with partial restriction through to total restriction.  Consider for the next rotation pruning buffer zones adjacent to the high use areas for the public.
Maitai	High	Medium	moderate	High	Limit access when the vegetation index gets to a certain level starting with partial restriction through to total restriction.  Consider for the next rotation pruning buffer zones adjacent to the high use areas for the public.
Brooke – Fringe Hill compartments	High	High	Moderate	High	Public access in this area in the future may increase from mountain biking.  Limit access when the vegetation index gets to a certain level starting with partial restriction through to total restriction.  There is an option to reduce the risk of the Fringe Blocks by pruning these stands. A decision on this need to be made now due to the age of the trees.
Brooke – Codgers	High	High	Moderate	High	The unpruned 2011 stand is unpruned and un thinned. Creating a pruned buffer zone adjacent to mountain bike tracks is an option or whole block pruning.  The alternative species – higher flammability species have been planted however these are considered less risky than the alternative gorse and broom areas.  Limit access when the vegetation index gets to a certain level starting with partial restriction through to total restriction.

**Fire authority responsibilities**

The legal responsibility for fighting forest fires lies with the local Rural Fire Authority (RFA), which in the case of Brook, Maitai, Roding and Marsden Valley Forests, is the Nelson Tasman Fire and Emergency New Zealand (FENZ) sector.

In the event of a fire that starts within the forest, the RFA is responsible for attending and providing the resources to extinguish the fire. Costs are borne through a general insurance levy that supports a rural firefighting fund.

If a fire starts outside the forested area and moves into the forest, those costs remain covered under the fund, however in both cases loss of crop value due to fire will be a matter for the forest owners crop insurance if any.

If in the event a fire, either internally or external to the forest boundaries was caused by negligence or identifiable criminal acts, the cost recovery might be attempted by FENZ.

There is a liaison with FENZ in terms of developing the 'fire plan' and the maintenance of good communication relative to potential risks and fire danger ratings.

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**Crop insurance**

Nelson City Council maintain crop insurance cover for fire under a PF Olsen managed crop insurance scheme. This is reviewed regularly.

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**Public liability insurance**

Nelson City Council and PF Olsen Ltd both maintain full public liability insurance as do contractors employed on forestry operations. This would include cover in the case of fire spreading from the forest onto adjoining land, where Nelson City Council could be liable for costs of any damage to the adjoining property.

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## Other Benefits from the Forest

### 14. Recreation, Forest Products and Other Special Values

#### Introduction

Forest plantations can provide non-timber forest products, recreational opportunities and special values that enhance the economic wellbeing of the owner or legitimate forest users. Non-timber products are an important means of maximising the productive capacity of the forest whilst maintaining environmental and social values. This management plan outlines the other values and the framework for managing their integration into the landscape.

#### Environmental and social cost-benefit analysis

Forests can deliver numerous social and environmental products and services, both positive and negative, to varying degrees. These non-timber products can be difficult to quantify, unlike financial costs and benefits.

The table below rates the relative positivity and negativity of the more common social and environmental products produced relative to the most likely alternative primary production system, pastoral dry stock farming. A high-level generalised analysis of provisioning and consuming services related to forest management is shown in [Appendix 10](#).

**Table 34. Environmental and social cost-benefit analysis of key non-timber products & services**

Environmental or social product	Increasingly negative				Neutral			Increasingly positive			
	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Soil stabilisation							HP				MR
Erosion/soil loss				HP							MR
Water quality				HP							MR
Riparian shading					HP					MR	
Water quantity					MR			HP			
Carbon sequestration				HP							MR
Native wildlife habitat			HP							✓	
Threatened fauna				HP					✓		
Native fish				HP						✓	
Air quality							HP				MR
Native reserve protection										✓	
Landscape/visual			HP						MR		
Recreation				HP						MR	
Commercial forest use										✓	
Firewood											HP
Local employment							MR				HP

*NOTE: where the ratings differ throughout a rotation, 'MR' is used to indicate the mid rotation (growing) stage of the forest, and 'HP' refers to during or post-harvest.*



## Nelson City Planning

Nelson City Council has encouraged recreational development and use of its production forests. This is to be applauded, even though it does raise the potential for conflict between production values and the current suite of values ascribed to, and uses of, the production forest resource. The potential for conflict has been further heightened by recent developments adjacent to existing production forests i.e. Brook Waimarama Sanctuary and residential subdivision development, and changes in the community's environmental awareness (e.g. landscapes and water quality).

In the Conservation and Landscape Reserves Management Plan a number of objectives and policies were developed to facilitate and manage high levels of public usage within the NCC estate. Key issues requiring facilitation and encouragement along with appropriate management are:

- **Public access and use** – objective of maximising wherever possible.
- **Walking & Mountain biking** – Objective to provide for these activities
- **Hunting and fishing** – Objective to permit as appropriate.
- **Camping, Huts and overnight stays** – Objective to maximise opportunities.
- **Fossicking and rock hounding** – Objective to allow for enjoyment while protecting features.
- **Aircraft and aerial sports** – Objective to restrict activity (non-motorised and foot launched motorised permitted subject to controls).

A more detailed listing of the Issues, objectives and policies extracted from the Conservation and Landscape Reserves Management Plan<sup>30</sup> is contained in [Appendix 8](#).

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<sup>30</sup> Conservation and Landscape Reserves Management Plan – Nelson City Council 2009

**Recreational  
usage**

Brook, Maitai, Roding and Marsden Valley receive strong recreational demand from the wider public.

- A series of mountain biking tracks (Codgers Mountain Bike Park) are present within some of the northern sections of Brook forest.
- Walking / Hiking tracks include the Dun Mountain Trail that runs through part of Maitai Forest or the Barnicoat Walkway through Marsden Valley Forest.

In addition to the use of the Dun Mountain / Barnicoat walkways or Codgers Mountain Bike Park in Brook, the forests will all continue to be open for legitimate recreational use subject to entry by permit. This data will be collated for FSC reporting purposes.

All access is controlled through a permit system which is managed by Nelson City but involves close regular coordination between Council managers and the Forest Manager to ensure the potential for operational conflicts are avoided and PCBU obligations under health and safety legislation is managed.

Primary requirements in management of such forest usage are:

- Access subject to non-conflict with current operations and any other safety requirements,
- Acceptable fire danger status,
- Access provided to defined areas other than those freely open to the public.
- Appropriate liability and fire insurance to be carried by permittees,
- Forest usage rules to be adhered to.

To further facilitate smooth interactions between parties on the Council controlled lands, the NCC and Nelson Mountain Bike Club signed a Memorandum of Understanding in 2017 to promote close cooperation and communication between the parties over issues that may impact their mutual interests.

## Public access roads

Brook, Maitai, Roding and Marsden Valley Forests all contain some public access areas and a series of mountain biking or hiking trails. These routes remain open to public, subject to any temporary closures, organised through the Nelson City Council, as required for safety such as during times of high fire risk or forestry operations. All signage must be followed and those using the routes will still require a permit if there is any intention to access other parts of the forest itself, from the road routes or trails.

As well as being widely signposted and publicly documented by NCC, these public road locations are publicly viewable in the Walking Access Commission website<sup>31</sup>. Any users are expected to abide by the intent of the Outdoor Access Code<sup>32</sup> published by the Walking Access Commission and the Nelson City Council Website and specifically with any restrictions or rules put in place by NCC reserves managers.

## Non-timber forest products

There are no FSC certified non-timber forest products arising from Council or 3<sup>rd</sup> party commercial activities within the forest estate.

However, there are apiary sites leased in some forests and these are likely to continue subject to appropriate agreements.

## Visual /Amenity

There are recommended visual amenity/landscapes called 'Barnicoat Range', 'Grampions', 'Sharland Hill' and 'Fringed Hill' that overlap most of the Marsden and Brook forest blocks.

As noted in the 2016 Assessment of non-monetary values<sup>33</sup>, "the inclusion of part of Council's production forest within visual amenity landscape zones is not a cause for alarm. Production forestry within these landscape units is an existing use, and over the forest's growth cycle has contributed positively to the visual amenity of these units. However, there is potential for issues when the forest is harvested, through until the forest is re-established.

In an operational sense, while some parts of the estates are visually accessible, most of those parts also comprise quite small areas that are themselves fragmented across the wider landscape. This the removal of some areas from production and conversion to natural vegetation, the overall landscape effects will remain quite small and in keeping with much of the surrounding landuse pattern.

## Other special values

<sup>31</sup> [https://www.wams.org.nz/wams\\_desktop/index.html](https://www.wams.org.nz/wams_desktop/index.html)

<sup>32</sup> <http://www.walkingaccess.govt.nz/walkways-and-access/outdoor-access-code>

<sup>33</sup> Assessment of non-monetary values – Catalyst Group Jul 2016 Report 2016/066

## Looking Ahead

### 15. Monitoring

#### Introduction

To ensure that the management objectives identified in this plan are being achieved, various monitoring exercises outside normal operations management have been developed. Monitoring results are summarised and reported as and when required and are also, where appropriate, made publicly available through the PF Olsen webpage.

#### Values monitored

Management inspections are undertaken regularly. The direct forest monitoring framework implemented and applicable to Brook, Maitai, Roding and Marsden Valley Forests is tabulated below.

**Table 35. Environmental process monitoring framework**

Monitored Element	Components	Data Source	Data medium	Reporting / Website Frequency
Chemical Usage	- A.I Usage - Area Overuse	- Operational Supervisors	- FIPS - <a href="#">Form</a>	- On Demand - Annual
Client Satisfaction	- Post-operation client survey	- Clients	- Survey Form	- Post-operational - Annual
Consultation Activity	- Complaints - Other Interactions	- Operational Supervisors - Planners	- FIPS - <a href="#">Form</a> - <a href="#">Meeting Minutes</a>	- Annual - Annual
Environmental Incidents	- Incident Number - Categories	- Operational Supervisors	- FIPS - <a href="#">Form</a>	- On Demand - Annual
Environmental Goals	- All	- Environmental Management Group	- Meeting Minutes	- Annual
Environmental Training	- Courses - Numbers - Names	- Staff	- FIPS - NZQA	- Annual - Individual
Flora & Fauna	- Species & Status - Frequencies - New Finds	- Operational Supervisors - Public - Crews	- FIPS - <a href="#">Form</a> - <a href="#">Naturewatch</a>	- On Demand - Annual
Forest Estate Structure	- Area: Plantation & Protected Ecosystem - Age-class - Species - Forest Type - Protection Status	- Management Plans - Stand Records	- FIPS Stand Records	- On Demand - Annual
Forest Growth	- PSP Protocols - Periodic Inventory - ISO 9001	- Contractors	- Volume Reconciliations - Estate model	- Periodic-annual - Not on web

*Continued on next page...*



...continued

Monitored Element	Components	Data Source	Data medium	Reporting / Website Frequency
Forest Health	- Disease & health	- NFH Surveillance Program <sup>34</sup>	- Document	- Periodic-Annual - Not on web
FSC Membership	- Block - Location - Name	- Certifying Body	- Certificate	- On Demand - Annual
Health & Safety Statistics	- LTI / MTI / TIFR - Accidents & Incidents - Initiatives	- Operational Supervisors	- Noggin	- Monthly - Annual
High Conservation Value Forests	- Condition Trends - Photopoint Monitoring	- Contractors - Supervisors	- Drone, photos, - Spreadsheet	- Annual
Internal Audit CAR Activity	- Frequency * - Category	- Auditors(ees) - Operational Supervisors	- Noggin	- Annual
Log Production	- Total Logs - FSC Certification	- Log dockets at harvest	- Woodtrack	- On Demand - Annual
Operational Monitoring	- Audit Trends - Cause Analysis	- Operational Supervisors	- FIPS - <u>Form</u>	- Monthly - Annual
Pests	- RTC / RTI - Kill Returns - Other	- Contractors - Supervisors - Permittees	- FIPS - Various	- Annual - Where Relevant
Protected Ecosystem Condition	- Condition Trends - Photopoint Monitoring	- Contractors - Supervisors	- Spreadsheet	- Bi-annual if restoration initiated
Recreational & Non-Timber	- Permits Issued	- Branch Offices - Forest Security	- FIPS	- Annual
Resource Consents	- Number - Compliance	- Operational Planners	- FIPS	- Monthly - Annual
Social Survey	- Demographics, - Values - Work Conditions	- Contractors	- Survey form	- 3 yearly
Stream Monitoring	- Clarity +/- other specific - Full NOF	- Supervisors - Contractors - BOPRC	- Various	- Operational - BOPRC S.o.E.

<sup>34</sup> Forest health inspections are undertaken annually, by an independent specialist forest health assessor, through the NZ Forest Owners Association forest health scheme.

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**Other monitoring** Other operational standards are monitored through a variety of concurrent and post operational assessment procedures that cover all critical aspects of the business of the estate. This information which includes log manufacturing quality performance, safety performance, financial and budget performance as well as stakeholder feedback and client satisfaction surveys and other private or commercially sensitive is not made public.

However, the framework around this monitoring is tabulated in [Appendix 7](#).

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## 16. Industry Participation and Research

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**NZFOA and FGLT** Nelson City Council's primary means of participating as part of the forest owner community, and to gain industry intelligence and access to research findings is via:

- Membership of New Zealand Forest Owners' Association Inc. (NZFOA) <http://www.nzfoa.org.nz/> and representation through its Property Manager on the Executive Board and working committees of NZFOA.
  - Payment of a commodity levy (currently 27 cents/tonne or JAS) to the Forest Growers' Levy Trust (FGLT). <http://fglt.org.nz/>. The FGLT uses these funds to finance pan-industry good programmes and contracts NZFOA to carry out this work.
- 

**Research** A little over 50% of the funds raised by FGLT are allocated to forestry research projects. These funds are supplemented by New Zealand Government research for industry funds that are bid for on a contestable basis every few years.

Application of the research is via knowledge gained in workshops and uptake by contractors, commercial providers, PF Olsen staff and through the deployment of better genetics. PF Olsen's direct involvement with other research bodies across all the estates it manages contributes to and benefits Nelson City Council through early application of good ideas and research findings.

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**FISC** The Forest Industry Safety Council (FISC) was set up in early 2016 following an independent review of safety in the forest industry. FISC is a forum for exchange of safety improvement initiatives, and to develop resources for forest managers and contractors. These resources are primarily delivered via the Safetree website <http://safetree.nz/>. FISC is financed jointly from FGLT and government, primarily Accident Compensation Corporation (ACC).

PF Olsen's continued support of FISC in the form of senior staff involvement in the OAG and TAG committees ensure Nelson City Council interests are considered and that outcomes are understood and applied in practice.

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**Additional  
representation**

Other bodies that the Property Manager are active in, that bring benefit to Nelson City Forests include:

- Wood Council of New Zealand (Woodco)
  - Business Leaders' Health and Safety Forum
  - NEW ZEALAND Forest Nursery Growers' Association
  - Forest Health and Biosecurity Committee
  - Forest Owners Association – Transport, Environment and Safety committees.
  - Log Transport Safety Council
  - NEW ZEALAND Institute of Forestry Inc.
  - NEW ZEALAND International Business Forum
  - NEW ZEALAND China Council
  - Various organisations dealing with fresh water quality regulations
  - Nelson Tasman Fire and Emergency New Zealand Rural Fire Authority
  - Tr Uru Rakau and MPI (review of the National Environmental Standard for Plantation Forestry.
  - MFE – (Freshwater and biodiversity legislation)
-



## 17. Future Planning

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### Introduction

This plan will provide guidance on the management of the NCC forests for the next 5 years. Minor revisions may be made on an annual cycle. Any material changes made will be documented in the following section. The next major review date for this plan is June 2025

Deviations from this plan will only be justified on the basis that the changes do not adversely affect the environment and are necessary or beneficial to achieving the management goals and objectives.

The forest management plan is used for both medium and long-term planning.

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### Associated management plans

As already noted and referenced, this plan, although directed at the commercial management of a group of plantation forests and their immediate surrounds, does not exist in isolation. The estate's management and outcomes are implicitly integrated with the wider land bases of the Nelson City Council reserves. As such the objectives and policies of those plans will influence the outcomes expected of this plan and future reviews will need to take account of those wider planning documents and their successors.

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### Operation plans

Short term tactical planning is accomplished through development of annual operations plans in conjunction with detailed budgeting. These plans are prepared in accordance with this Management Plan. Harvesting operations are also planned on a block by block basis because of the level of detail required.

Such operational plans and associated budgets are subject to approval by the forest owners at the beginning of each financial year.

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### Stakeholder consultation

Consultation with key stakeholders has been enabled as part of the development of this plan which will be publicly available on the PF Olsen Certification website. Feedback from stakeholders (and others as they become apparent) is monitored, including actions undertaken to resolve disputes and issues and may inform changes in operational practice or future plan reviews.

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# 18. Register of Plan Change and Review

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**Introduction**            This plan pertains to the management of Brook, Maitai, Roding and Marsden Valley Forests and will be reviewed on an annual basis. This section documents specific changes made during each review.

Change	Date	Section/Page

## Appendix 1: Legal description of Nelson City Council Forests

Forest	CT	Legal Description
Brook	The Nelson City Council	Pt Section 33 Blk E Wakatu DIST
Brook	DP 430237	Nelson City Council Lot 3
Brook	DP 5365	The Nelson City Council Lot 1
Brook	DP 19858	The Nelson City Council Lot 2
Brook	The Nelson City Council	Pt Section 7 Suburban South DIST
Brook	DP 210	The Nelson City Council Pt Lot 34
Brook	DP 210	The Nelson City Council Pt Lot 37
Brook	DP 13488	The Nelson City Council Lot 1
Brook	DP 443557	The Nelson City Council Lot 5
Brook	DP 12745	The Nelson City Council Lot 2
Brook	DP 12745	The Nelson City Council Lot 1
Brook	The Nelson City Council	Pt Section XVIII Suburban South DIST
Brook	SQ 18	The Nelson City Council Section 22
Brook	The Nelson City Council	Pt Section 41 Brook Street and Maitai DIST
Brook	DP 764	The Nelson City Council Lot 2
Maitai	DP 6465	The Nelson City Council Pt Lot 1
Maitai	SQ 18	The Nelson City Council Pt Lot 31, 32
Maitai	DP 6465	Pt Lot 1
Maitai		Pt Section 2 Blk I Maungatapu SD
Maitai	SQ 18	The Nelson City Council Pt Section 6, 8, 9, 33, 35, 37, 39, 41, 43, 46, 47, 48, 49, 50, 58
Maitai	DP 17062	Nelson City Council Lot 1
Maitai	The Nelson City Council	Section 1 Blk II Maungatapu SD
Roding	The Nelson City Council	Section 12 Blk XII Waimea SD
Roding	The Nelson City Council	Pt Section 9 Blk XII Waimea SD
Roding		Section 7 Blk VIII Waimea SD
Roding	The Nelson City Council	Pt Section 8 Blk VIII Waimea SD
Roding	The Nelson City Council	Section 2 Blk VIII Waimea SD
Marsden Valley	SO 14979	Nelson City Council Section 6
Marsden Valley	DP 18451	Nelson City Council Lot 1
Marsden Valley	DP 18204	Nelson City Council Lot 2

## Appendix 2: Other Relevant Legislation

### Commercially relevant statutes & regulations

Accident Compensation Act 2001 #49  
Animal Welfare Act 1999  
Biosecurity Act 1993  
Climate Change Response Act 2002  
Conservation Act 1987  
Crown Forest Assets Act 1989  
Fencing Act 1978  
Fire and Emergency New Zealand Act 2017  
Forestry Rights Registrations Act 1983  
Forests Act 1949  
Freshwater Fisheries Regulations 1983  
Hazardous Substances and New Organisms Act 1996  
Health and Safety at Work Act 2015  
Heritage New Zealand Pouhere Taonga Act 2014  
Protected Objects Act 1975  
Reserves Act 1977  
Resource Management Act 1991 regulations  
Soil Conservation and Rivers Control Act 1941  
The Treaty of Waitangi Act 1975  
Trespass Act 1980  
Wildlife Act 1953

Relevant regulations to the above legislation also apply as well as various industry Accords, Codes of Practice as listed below.

### Industry Accords & Codes

New Zealand Forest Accord  
Principles of Commercial Plantation Forest Management  
New Zealand Environmental Forestry Code of Practice  
New Zealand Code of Practice for the Management of Agrichemicals.  
Climate Change Accord  
NEW ZEALAND Log Transport Safety Accord  
Eliminating Illegal Forest Products in New Zealand  
MoU Federated Farmers and Forest Owners Association and Farm Forestry Association  
New Zealand Forest Road Engineering Manual

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### Appendix 3: Stands programmed for conversion to alternative use.

Roding	51.01	Y		Y	P radiata	Unpruned	
	51.02	Y		Y	P radiata	Unpruned	Maintain 200m buffer from Roding River
	51.03	Y		Y	P radiata	Unpruned	
	52.01	Y		Y	P radiata	Unpruned	
	52.02	Y		Y	P radiata	Unpruned	Maintain 200m buffer from Roding River
	52.04	Y		Y	P radiata	Unpruned	
	53.01	Y		Y	P radiata	Unpruned	Convert to alternate use if seedlings fail
	53.02	Y		Y	P radiata	Unpruned	Convert to alternate use if seedlings fail
	53.04	Y		Y	P radiata	Unpruned	Convert to alternate use if seedlings fail
	53.05	Y		Y	P radiata	Unpruned	Convert to alternate use if seedlings fail
	54.02	Y	Harvest via Hancocks	Y	P radiata	Unpruned	Convert southern portion to alternate use
	55.01	Y		Y	P radiata	Unpruned	
	55.02	Y		Y	P radiata	Unpruned	Maintain 200m buffer from Roding River
	55.03	N	Poison/fell to waste				
	55.04	Y		Y	P radiata	Unpruned	
	55.06	Y		N			Convert to alternate use
	56.01	Y		Y	P radiata	Unpruned	
	56.04	Y		Y	P radiata	Unpruned	
	56.05	Y		Y	P radiata	Unpruned	Maintain 10m buffer around Roding River
	56.06	Y		Y	P radiata	Unpruned	
	56.07	Y		Y	P radiata	Unpruned	
Brook	21.03	N					Retain as amenity planting
	21.04	Y	Partially clear	Y	P radiata	Unpruned	Native regeneration of currently clear area, convert remainder to native vegetation after next rotation
	21.05	N		N			Retain as amenity plantings
	21.05		Currently clear	N			Native regeneration
	21.11	N					Retain as amenity plantings
	22.01		Currently clear	N			Convert to alternate use
	22.02	Y		N			Convert to alternate use
	22.03	Y	If economic, or poison/fell to waste	Y	P radiata	Unpruned	Convert to alternate use after next rotation
	22.04	Y		N			Convert to alternate use
	22.05	Y		N			Convert to alternate use
	22.06	Y		N			Convert to alternate use
	22.08	Y		N			Convert to alternate use
	22.09	Y		N			Convert to alternate use
	25.01	N	Poison/fell to waste	N			Convert to alternate use
	26.01	Y	Harvest when landfill moves	N			Convert to alternate use
	26.02	Y	Harvest when landfill moves	N			Convert to alternate use
	26.04	Y		N			Convert to alternate use
	26.05	Y	If get to harvestable age	Y	P radiata	Unpruned	Only those areas that won't be destroyed by landfill expansion
	26.06	Y	If get to harvestable age	Y	P radiata	Unpruned	Only those areas that won't be destroyed by landfill expansion
	26.07	Y	If get to harvestable age	N			Convert to alternate use
	28.01	Y		N			Convert to alternate use
	29.01	Y		Y	P radiata	Unpruned	Part of this stand already converted to native plantings
	29.02	Y		Y	P radiata	Unpruned	This decision can be reviewed at the time of harvest
Bell Island		Y		Y	P radiata	As per rest of block	

## **Appendix 4 SNA report: Significant natural area (SNA 186-188)**

These reports were completed for the NCC by Michael North and can be accessed on request.

These reports are titled:

### **SNA 186:**

Ecological Significance Assessment Report

Site No: 186  
Previous Site No: 128-133  
SUFI: 3630662  
Legal Description: Sec 12 SQ 18  
Landowners/Occupiers: Nelson City Council  
Ecological District: Bryant  
Surveyed By: Graeme Ure  
Survey Date: 2002 & 2003  
Report By: Michael North (2008)

### **SNA 187:**

Ecological Significance Assessment Report

Site No: 187  
Description: Orphanage Creek within NCC Forestry  
Landowners/Occupiers: Nelson City Council  
Ecological District: Bryant  
Surveyed By: Michael North  
Date: 22 March 2016

### **SNA 188:**

Ecological Significance Assessment Report

Site No: 188  
Previous Site No: 128-133  
SUFI: 3630662  
Legal Description: Sec 12 SQ 18  
Landowners/Occupiers: Nelson City Council  
Ecological District: Bryant  
Surveyed By: Graeme Ure  
Survey Date: 2002 & 2003  
This Report By: Michael North (2008)

## Appendix 5: Potential Avifauna Species in the Nelson Area

### eBird Field Checklist

#### Nelson, NZ

ebird.org/newzealand/region/NZ-NSN  
98 species (+11 other taxa) - Year-round, All Years

Date:

Start Time:

Duration:

Distance:

Party Size:

Notes:

This checklist is generated with data from eBird (ebird.org), a global database of bird sightings from birders like you. If you enjoy this checklist, please consider contributing your sightings to eBird. It is 100% free to take part, and your observations will help support birders, researchers, and conservationists worldwide.

This field checklist was generated using eBird (ebird.org)

Go to [ebird.org](http://ebird.org) to learn more!

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#### Waterfowl

Graylag Goose *Anser anser*  
Canada Goose *Branta canadensis*  
Mute Swan *Cygnus olor*  
Black Swan *Cygnus atratus*  
Paradise Shelduck *Tadorna variegata*  
Muscovy Duck (Domestic type) *Cairina moschata* (Domestic type)  
Maned Duck *Chenonetta jubata*  
Australian Shoveler *Spatula rhynchotis*  
Northern Shoveler *Spatula clypeata*  
Pacific Black Duck *Anas superciliosa*  
Mallard *Anas platyrhynchos*  
Mallard (Domestic type) *Anas platyrhynchos* (Domestic type)  
Mallard x Pacific Black Duck (hybrid) *Anas platyrhynchos* x *superciliosa*  
Gray Teal *Anas gracilis*  
New Zealand Scaup *Aythya novaeseelandiae*

#### Grouse, Quail, and Allies

California Quail *Callipepla californica*  
Red Junglefowl (Domestic type) *Gallus gallus* (Domestic type)  
Ring-necked Pheasant *Phasianus colchicus*  
Wild Turkey *Meleagris gallopavo*

#### Grebes

New Zealand Grebe *Poliocephalus rufopectus*

#### Pigeons and Doves

Rock Pigeon *Columba livia*  
New Zealand Pigeon *Hemiphaga novaeseelandiae*

#### Cuckoos

Long-tailed Koel *Urodynamis taitensis*  
Shining Bronze-Cuckoo *Chrysococcyx lucidus*

#### Rails, Gallinules, and Allies

Weka *Gallirallus australis*  
Buff-banded Rail *Gallirallus philippensis*

Eurasian Coot *Fulica atra*  
Australasian Swampphen *Porphyrio melanotus*  
Baillon's Crake *Zapornia pusilla*

#### **Shorebirds**

Pied Stilt *Himantopus leucocephalus*  
Pied x Black Stilt (hybrid) *Himantopus leucocephalus x novaezelandiae*  
South Island Oystercatcher *Haematopus finschi*  
Variable Oystercatcher *Haematopus unicolor*  
Masked Lapwing *Vanellus miles*  
Double-banded Plover *Charadrius bicinctus*  
Black-fronted Dotterel *Elseyornis melanops*  
Wrybill *Anarhynchus frontalis*  
Whimbrel *Numenius phaeopus*  
Bar-tailed Godwit *Limosa lapponica*  
Ruddy Turnstone *Arenaria interpres*  
Red Knot *Calidris canutus*  
peep sp. *Calidris sp. (peep sp.)*  
Red-necked Phalarope *Phalaropus lobatus*

#### **Skuas and Jaegers**

Pomarine Jaeger *Stercorarius pomarinus*  
Parasitic Jaeger *Stercorarius parasiticus*  
jaeger sp. *Stercorarius sp. (jaeger sp.)*

#### **Gulls, Terns, and Skimmers**

Black-billed Gull *Chroicocephalus bulleri*  
Silver Gull *Chroicocephalus novaehollandiae*  
Kelp Gull *Larus dominicanus*  
Little Tern *Sternula albifrons*  
Caspian Tern *Hydroprogne caspia*  
White-winged Tern *Chlidonias leucopterus*  
Black-fronted Tern *Chlidonias albobristatus*  
White-fronted Tern *Sterna striata*

#### **Penguins**

Little Penguin *Eudyptula minor*  
Fiordland Penguin *Eudyptes pachyrhynchus*

#### **Albatrosses**

Small albatross sp. *Thalassarche sp.*

#### **Petrels, Shearwaters, and Diving-Petrels**

Fairy Prion *Pachyptila turtur*  
Flesh-footed Shearwater *Ardenna carneipes*  
Hutton's Shearwater *Puffinus huttoni*  
Fluttering Shearwater *Puffinus gavia*  
Black-and-white shearwater sp. *Puffinus sp. (black-and-white shearwater sp.)*

#### **Frigatebirds, Boobies, and Gannets**

Australasian Gannet *Morus serrator*

#### **Cormorants and Anhingas**

Little Pied Cormorant *Microcarbo melanoleucos*  
Great Cormorant *Phalacrocorax carbo*  
Spotted Shag *Phalacrocorax punctatus*  
Little Black Cormorant *Phalacrocorax sulcirostris*  
Pied Cormorant *Phalacrocorax varius*  
New Zealand King Shag *Phalacrocorax carunculatus*

#### **Herons, Ibis, and Allies**

Great Egret *Ardea alba*  
White-faced Heron *Egretta novaehollandiae*  
Pacific Reef-Heron *Egretta sacra*  
Cattle Egret *Bubulcus ibis*  
Royal Spoonbill *Platalea regia*

#### **Vultures, Hawks, and Allies**

Swamp Harrier *Circus approximans*

#### **Owls**

Little Owl *Athene noctua*



Morepork *Ninox novaeseelandiae*

**Kingfishers**

Sacred Kingfisher *Todiramphus sanctus*

**Falcons and Caracaras**

New Zealand Falcon *Falco novaeseelandiae*

**New Zealand Parrots**

New Zealand Kaka *Nestor meridionalis*

**Parrots, Parakeets, and Allies**

Yellow-crowned Parakeet *Cyanoramphus auriceps*

Parakeet sp. *Psittaciformes* sp. (parakeet sp.)

**New Zealand Wrens**

Rifleman *Acanthisitta chloris*

**Honeyeaters**

Tui *Prosthemadera novaeseelandiae*

New Zealand Bellbird *Anthornis melanura*

**Thornbills and Allies**

Gray Gerygone *Gerygone igata*

**Whiteheads**

Pipipi *Mohoua novaeseelandiae*

**Bellmagpies and Allies**

Australian Magpie *Gymnorhina tibicen*

**Fantails**

New Zealand Fantail *Rhipidura fuliginosa*

**Australasian Robins**

South Island Robin *Petroica australis*

Tomtit *Petroica macrocephala*

**Larks**

Eurasian Skylark *Alauda arvensis*

**Grassbirds and Allies**

New Zealand Fernbird *Poodytes punctatus*

**Martins and Swallows**

Welcome Swallow *Hirundo neoxena*

**White-eyes, Yuhinas, and Allies**

Silvereye *Zosterops lateralis*

**Starlings and Mynas**

European Starling *Sturnus vulgaris*

Common Myna *Acridotheres tristis*

**Thrushes**

Song Thrush *Turdus philomelos*

Eurasian Blackbird *Turdus merula*

**Accentors**

Dunnock *Prunella modularis*

**Old World Sparrows**

House Sparrow *Passer domesticus*

**Wagtails and Pipits**

Australasian Pipit *Anthus novaeseelandiae*

**Finches, Euphonias, and Allies**

Common Chaffinch *Fringilla coelebs*

European Greenfinch *Chloris chloris*

Lesser Redpoll *Acanthis cabaret*

European Goldfinch *Carduelis carduelis*

**Old World Buntings**

Cirl Bunting *Emberiza cirlus*

Yellowhammer *Emberiza citrinella*

**Others**

Passerine sp. *Passeriformes* sp.

## Appendix 6: Regional Pest Management Plan for Nelson Region 2019- 2029

Table 1: Organisms Classified as Pests

COMMON NAME	SCIENTIFIC NAME	UNWANTED ORGANISM (YES/NO)	PROGRAMME	GNR (YES/NO)	LEAD RESPONSIBILITY FOR CONTROL*
African feather grass	<i>Pennisetum macrourum</i>	Yes	Eradication		TDC
Banana passion vine (Golden Bay and Upper Riwaka – different rules apply)	<i>Passiflora tripartita</i> var. <i>mollissima</i> , <i>P. tarminiana</i>	Yes	Sustained control		Occupier
Bathurst bur	<i>Xanthium spinosum</i>	No	Eradication		TDC
Blackberry	<i>Rubus fruticosus</i> agg.	No	Sustained control		Occupier
Black spot	<i>Venturia inaequalis</i>	No	Sustained control		Occupier
Bomarea	<i>Bomarea multiflora</i>	Yes	Progressive containment		Occupier
Boneseed (outside Port Hills)	<i>Chrysanthemoides monilifera</i>	Yes	Eradication		TDC
Boxthorn	<i>Lycium ferocissimum</i>	No	Eradication		TDC
Broom (Howard – St Arnaud)	<i>Cytisus scoparius</i>	No	Sustained control		Occupier
Broom (outside Howard - St Arnaud)	<i>Cytisus scoparius</i>	No	Sustained control	Yes	Crown and private occupiers
Brushtail possum (Waimea Estuary)	<i>Trichosurus vulpecula</i>	No	Site-led		TDC/groups Occupier
Cape tulip	<i>Moraea flaccida</i>	Yes	Exclusion		MPI
Cathedral bells	<i>Cobaea scandens</i>	Yes	Eradication		TDC
Chilean needle grass	<i>Nassella neesiana</i>	Yes	Exclusion		TDC
Chinese pennisetum	<i>Cenchrus purpurascens</i> (was <i>Pennisetum alopecuroides</i> )	Yes	Progressive containment		Occupier
Chocolate vine	<i>Akebia quinata</i>	Yes	Sustained control		Occupier
Climbing asparagus (E. Golden Bay)	<i>Asparagus scandens</i>	Yes	Sustained control		Occupier
Climbing spindleberry	<i>Celastrus orbiculatus</i>	Yes	Eradication		TDC
Codling moth	<i>Cydia pomonella</i>	No	Sustained control		Occupier
Cotoneaster spp. (Abel Tasman)	<i>Cotoneaster glaucophyllus</i> and others	No	Site-led		Occupier
Darwin's barberry (St Arnaud Village)	<i>Berberis darwinii</i>	Yes	Site-led		Occupier
Douglas fir (wildings only) (Abel Tasman)	<i>Pseudotsuga menziesii</i>	No	Site-led		Occupier

\*Note: lead responsibility for control in the sixth column does not infer 'management agency' responsibilities.

COMMON NAME	SCIENTIFIC NAME	UNWANTED ORGANISM (YES/NO)	PROGRAMME	GNR (YES/NO)	LEAD RESPONSIBILITY FOR CONTROL*
Egeria	<i>Egeria densa</i>	Yes	Eradication		TDC
Entire marshwort	<i>Nymphoides geminata</i>	Yes	Eradication		TDC
European canker	<i>Neonectria ditissima</i>	No	Sustained control		Occupier
European holly (Abel Tasman and St Arnaud Village)	<i>Ilex aquifolium</i>	No	Site-led		Occupier
Feral cats (Waimea Estuary)	<i>Felis catus</i>	No	Site-led		TDC/groups
Feral rabbits (Golden Bay)	<i>Oryctolagus cuniculus</i>	No	Eradication		Occupier
Ferrets (Waimea Estuary)	<i>Mustela putorius furo</i>	Yes	Site-led		TDC/groups
Fireblight	<i>Erwinia amylovora</i>	No	Sustained control		Occupier
Gambusia	<i>Gambusia affinis</i>	Yes	Eradication		DOC
Giant buttercup	<i>Ranunculus acris</i>	No	Sustained control		Occupier
Gorse (Howard – St Arnaud)	<i>Ulex europaeus</i>	No	Sustained control		Occupier
Gorse (outside Howard - St Arnaud)	<i>Ulex europaeus</i>	No	Sustained control	Yes	Crown and private occupiers
Greater bindweed (St Arnaud Village)	<i>Calystetia sylvatica</i>	No	Site-led		Occupier
Gunnera	<i>Gunnera tinctoria, G manicata</i>	Yes	Sustained control		Occupier
Himalayan balsam	<i>Impatiens glandulifera</i>	No	Eradication		TDC
Hornwort	<i>Ceratophyllum demersum</i>	Yes	Exclusion		TDC
Indian myna	<i>Acridotheres tristis</i>	No	Exclusion		TDC
Indian ring-necked parakeet (feral)	<i>Psittacula krameri manillensis</i>	Yes	Eradication		TDC
Johnson grass	<i>Sorghum halepense</i>	Yes	Exclusion		MPI
Knotweeds (Asiatic, giant and hybrids)	<i>Fallopia japonica, F. sachalinensis</i>	Yes	Eradication		Occupiers (TDC assist)
Koi carp	<i>Cyprinus carpio</i>	Yes	Exclusion		DOC
Kūmarahou (gumdigger's soap – Abel Tasman)	<i>Pomaderris kumeraho</i>	No	Site-led		Occupier
Lagarosiphon	<i>Lagarosiphon major</i>	Yes	Sustained control		Occupier
Madeira vine	<i>Anredera cordifolia</i>	Yes	Eradication		TDC

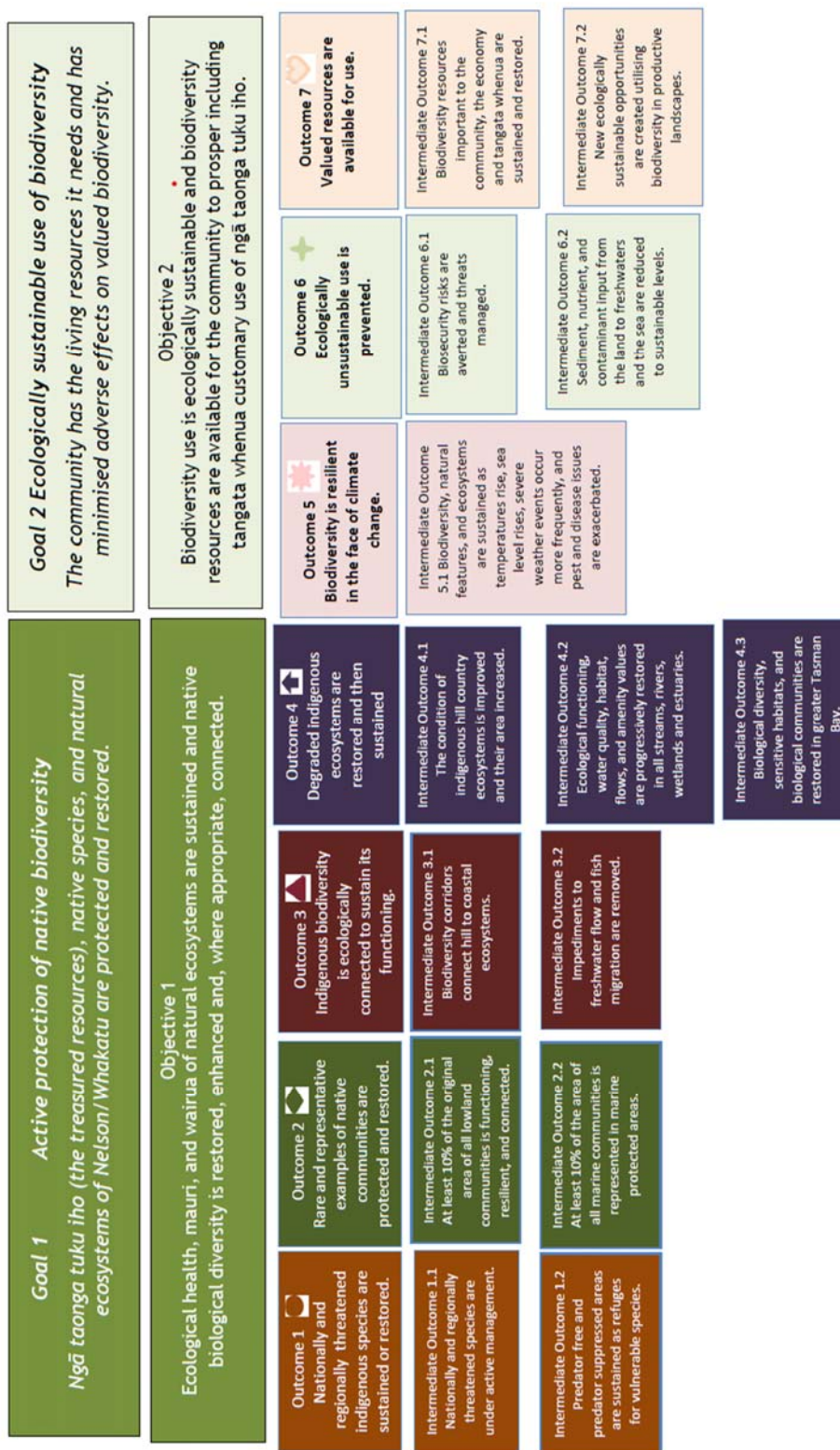
COMMON NAME	SCIENTIFIC NAME	UNWANTED ORGANISM (YES/NO)	PROGRAMME	GNR (YES/NO)	LEAD RESPONSIBILITY FOR CONTROL*
Magpie (Golden Bay)	<i>Gymnorhina species</i>	No	Eradication		TDC
Nassella tussock	<i>Nassella trichotoma</i>	Yes	Progressive containment		Occupier
Nodding thistle	<i>Carduus nutans</i>	No	Sustained control		Occupier
Old man's beard (Golden Bay – Riwaka, Upper Buller)	<i>Clematis vitalba</i>	Yes	Sustained control		Occupier
Perch	<i>Perca fluviatilis</i>	No	Eradication		DOC
Phragmites	<i>Phragmites australis</i>	Yes	Exclusion		MPI
Powdery mildew	<i>Podosphaera leucotricha</i>	No	Sustained control		Occupier
Purple loosestrife	<i>Lythrum salicaria</i>	Yes	Progressive containment		Occupier
Queensland poplar	<i>Homalanthus populifolius</i>	Yes	Sustained control		Occupier
Ragwort	<i>Jacobaea vulgaris</i> (previously <i>Senecio jacobaea</i> )	No	Sustained control		Occupier
Rat species (Waimea Estuary)	<i>Rattus rattus</i> ; <i>Rattus norvegicus</i>	No	Site-led		TDC/groups
Red-eared slider turtles (feral)	<i>Trachemys scripta elegans</i>	No	Eradication		TDC
Reed sweet grass	<i>Glyceria maxima</i>	No	Progressive containment		Occupier
Rooks	<i>Corvus frugilegus</i>	Yes	Exclusion		TDC
Rosemary grevillea (Abel Tasman)	<i>Grevillea rosmarinifolia</i>	No	Site-led		Occupier
Rowan (St Arnaud Village)	<i>Sorbus aucuparia</i>	No	Site-led		Occupier
Rudd	<i>Scardinius erythrophthalmus</i>	No	Eradication		DOC
Russell lupin (St Arnaud Village)	<i>Lupinus polyphyllus</i>	No	Site-led		Occupier
Sabella	<i>Sabella spallanzanii</i>	Yes	Eradication		TDC
Saffron thistle	<i>Carthamus lanatus</i>	No	Eradication		TDC
Senegal tea	<i>Gymnocoronis spilanthoides</i>	Yes	Exclusion		TDC
Spartina	<i>Spartina spp.</i>	No	Eradication		DOC

COMMON NAME	SCIENTIFIC NAME	UNWANTED ORGANISM (YES/NO)	PROGRAMME	GNR (YES/NO)	LEAD RESPONSIBILITY FOR CONTROL*
Stoats (Waimea Estuary)	<i>Mustela ermine</i>	Yes	Site-led		TDC/groups
Sycamore (St Arnaud Village and Abel Tasman)	<i>Acer pseudoplatanus</i>	No	Site-led		Occupier
Taiwan cherry and cultivars	<i>Prunus campanulata</i>	No	Eradication		TDC/NCC
Tench	<i>Tinca tinca</i>	No	Eradication		DOC
Variegated thistle	<i>Silybum marianum</i>	No	Progressive containment		Occupier
Velvet leaf	<i>Abutilon theophrasti</i>	Yes	Exclusion		TDC
Wallabies (dama, Bennett's)	<i>Macropus eugenii</i> , <i>M. rufogriseus</i>	Yes	Exclusion		TDC
Water hyacinth	<i>Eichhornia crassipes</i>	Yes	Exclusion		MPI
Weasels (Waimea Estuary)	<i>Mustela nivalis vulgaris</i>	Yes	Site-led		TDC/groups
White-edged nightshade	<i>Solanum marginatum</i>	Yes	Progressive containment		Occupier
Wild ginger (Golden Bay – Kaiteriteri)	<i>Hedychium gardnerianum</i> , <i>H. flavescens</i>	Yes	Sustained control		Occupier
Wild kiwifruit (including unmanaged or abandoned)	<i>Actinidia spp.</i>	No	Eradication		Occupier
Woolly nightshade (Golden Bay)	<i>Solanum mauritianum</i>	Yes	Sustained control		Occupier
Yellow bristle grass (Golden Bay and Upper Buller)	<i>Setaria pumila</i>	No	Sustained control		Occupier
Yellow flag	<i>Iris pseudacorus</i>	Yes	Sustained control		Occupier
Yellow jasmine	<i>Jasminum humile</i>	Yes	Sustained control		Occupier



## Appendix 7: Goals, Objectives and Outcomes – Nelson Biodiversity Plan.

### Goals, objectives, outcomes and intermediate outcomes



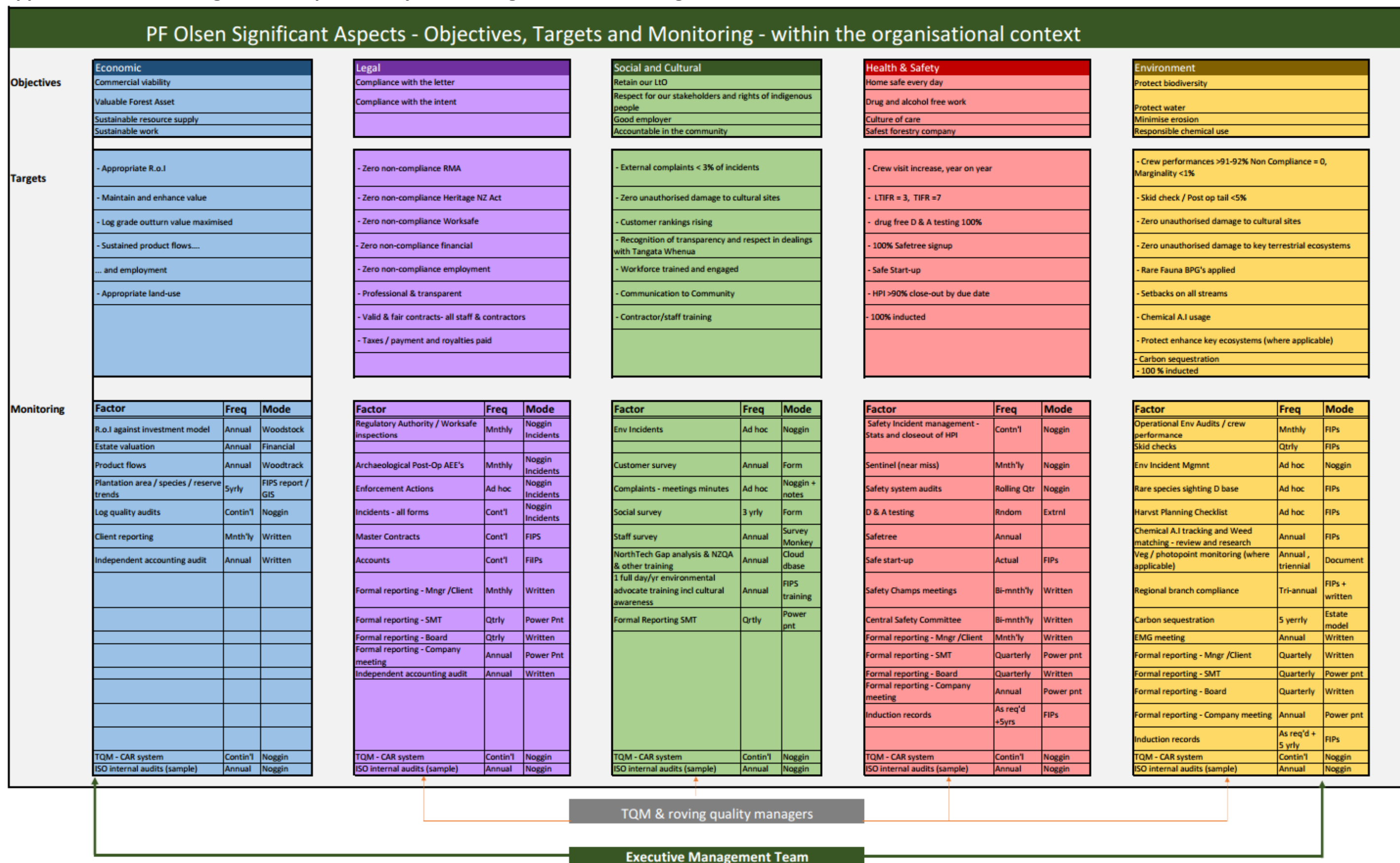
## Appendix 8: Recreational Issues, Objectives and Policies from the Nelson Conservation and Landscape Reserves Management Plan 2009

Current Situation/Issue	Objectives	Policies
<b>5.12 Public Access and Use</b>  One of the most important purposes of the reserves is to provide opportunities for public use. The reserves covered by this plan provide excellent opportunities for a range of recreational uses, notably walking, mountain-biking and scenery appreciation. There can sometimes be conflicts between different reserve users or between reserve use and reserve values. This plan aims to achieve a balance between unrestricted public access and the protection of reserve values and reserve users.	Maximise accessibility by ensuring that reserves are available, wherever possible, for public access and use.	5.12.1 Allow public access to and recreational use of reserves, unless restrictions are required for reserves management, Council-approved projects and activities, public safety, to manage conflict between users or for the protection of water quality and reserve values.  5.12.2 Encourage multiple uses of reserves.  5.12.3 Ensure that restrictions on reserve use are for the minimum period necessary for the event or activity.  5.12.4 Ensure that the reasons for any restrictions on reserve use are clearly communicated to the public.
Current Situation/Issue	Objectives	Policies
<b>5.14 Tracks and Track Marking</b>  There are a number of tracks in the reserves. Public use may create a demand for additional tracks. It is important that the reserves provide for a range of recreational experience. Reserve lands also provide opportunities to provide public access to other areas, such as Mt Richmond Forest Park.	To ensure tracks are appropriately sited, marked and maintained.	5.14.1 Provide, and upgrade where required, using modern design and construction techniques, paths and tracks through reserves where necessary to enable public use and to facilitate reserve management.  5.14.2 Site paths and tracks at locations that avoid natural hazards, help ensure public safety and seek to avoid damage to sensitive vegetation and habitats.  5.14.3 Ensure that the network of paths and tracks in reserves provides for a range of recreational experiences, and practical and enjoyable use of reserves by the public.  5.14.4 Seek to improve appropriate access through reserves to other public lands, especially public conservation lands in Mt Richmond Forest Park.  5.14.5 Prohibit the construction of unauthorised mountain-bike tracks in reserves.
<b>5.15 Walking and Mountain-biking</b>  Walking and mountain-biking are popular uses of the reserves. In most areas these activities are appropriate and compatible. In some areas these activities may need to be restricted to protect reserve values or to avoid conflict with other users.	To provide for walking, and, where appropriate, mountain-biking, in reserves.	5.15.1 Allow walking access to reserves and mountain biking on tracks, except where necessary to restrict access as specified in Policy 5.12 (Public Access and Use), or as restricted by policies for each reserve.  5.15.2 Provide opportunities for walking and mountain-biking in reserves through the establishment of a range of different paths and tracks to suit different users.
Current Situation/Issue	Objectives	Policies
<b>5.16 Hunting and Fishing</b>  Recreational hunting can assist in the control of populations of large animals (e.g. deer, pigs and goats). Inappropriate hunting can pose threats to indigenous biodiversity, water quality and public safety. There are very limited opportunities for recreational fishing in the reserves. Fishing has the potential to affect water quality of lakes in the water reserves.	To permit, where appropriate, recreational hunting and fishing in reserves.	5.16.1 Allow recreational hunting of large introduced mammals (e.g. deer, pigs, goats) in reserves, where permitted by policies for the reserve, and subject to a permit from Council.  5.16.2 Prohibit the use of small-calibre firearms in reserves, unless specifically authorised by Council, or for reserves management purposes.  5.16.3 Prohibit game-bird hunting in reserves, unless specifically permitted by policies for the reserve, authorised by Council and subject to any licence required from Nelson/Marlborough Fish and Game Council.  5.16.4 Allow recreational fishing in reserves, with the exception of the Maitai and Roding Water Reserves, subject to any licence required from Nelson/Marlborough Fish and Game Council.
<b>5.17 Camping, Huts and Overnight Stays</b>  Campsites, huts and shelters provide opportunities for overnight stays in reserves. In most of the reserves covered by this plan, there is little demand for overnight stays due to their size. In other reserves, overnight stays are guided by the reserve policies.	To maximise opportunities for recreational use by allowing, where appropriate, overnight stays in reserves.	5.17.1 Allow overnight camping or overnight stays at huts or shelters at specified sites, as determined by policies for the reserve, or for reserves management purposes.  5.17.2 Provide toilet facilities and fresh water at any campsites, huts and shelters where overnight stays are permitted.  5.17.3 Limit numbers at overnight campsites, huts or shelters if necessary to protect water quality and reserve values.

Current Situation/Issue	Objectives	Policies
<b>5.18 Fossicking and Rock-hounding</b>  Uncontrolled fossicking and rock-hounding has been a problem in the past, causing damage to some features.	To allow for the public enjoyment of geological features while ensuring their protection.	5.18.1 Prohibit the hand-collection of small quantities of rocks and minerals unless authorised by Council.  5.18.2 Prohibit collection of rocks, minerals, artifacts or any other material from archaeological or historic sites, unless indicated otherwise at the site and in policies for the reserve, or for reserve management purposes.
<b>5.19 Aircraft and Aerial Sports</b>  Motorised aircraft use is generally inappropriate in the reserves. Non-motorised flights and take-off sites generally have a low impact.	To restrict aircraft activity and aircraft use in reserves.	5.19.1 Prohibit recreational motorised aircraft landing and taking-off in reserves, unless permitted by policies for the reserve and specifically authorised by Council.  5.19.2 Permit motorised aircraft landing and taking-off in reserves for search and rescue, public safety, reserve management purposes or for one-off events specifically authorised by Council.  5.19.3 Permit non-motorised launching and landing of flights from suitably accessible areas in reserves, subject to Civil Aviation Authority regulations.  5.19.4 Permit foot-launched motorised launching and landing of flights from the Barnicoat Range only, or other areas in reserves where authorised by Council, subject to Civil Aviation Authority regulations
Current Situation/Issue	Objectives	Policies
<b>5.20 Grazing and Domestic Animals</b>  Grazing in reserves can assist in reducing fire risk or maintaining grassed areas. There is a public demand for the use and taking of dogs and in some cases horses in reserves. Some restrictions on these uses may be required to protect biodiversity values and avoid conflicts with other users.	To restrict grazing and the use and taking of domestic animals in reserves as necessary to protect reserve values (including water supply) and avoid conflicts with other reserve users.	5.20.1 Permit grazing of livestock in reserves only if grazing is compatible with the protection of reserve values and does not conflict with other reserve users.  5.20.2 Restrict grazing animals from accessing waterways.  5.20.3 Allow horses on reserves only where individual reserve policies permit such use.  5.20.4 Allow dogs on reserves, provided they are under control, except where prohibited by individual reserve policies.  5.20.5 Prohibit the taking of domestic animals (other than dogs and horses) onto reserves.
<b>5.21 Plantation Forestry and Firewood Gathering</b>  There are some substantial plantations of trees in some of the reserves. These plantations are appropriate at some sites. At other sites, it would benefit biodiversity values if regeneration of indigenous plant communities was encouraged following tree harvest. Recreational use is often compatible with plantation forestry.	To manage plantation forests in a way that protects reserve values and provides benefits to Council.	5.21.1 Manage forests in reserves in a way that is economically and environmentally sustainable.  5.21.2 Ensure plantation forests are planned and managed in a way that meets the objectives of this plan.  5.21.3 Encourage and manage the regeneration of indigenous vegetation after harvesting small or isolated or uneconomic or otherwise inappropriate areas of plantation forest.  5.21.4 Prohibit the gathering or harvesting of firewood from reserves unless specifically permitted by reserve policies and Council authorisation.  5.21.5 Allow and encourage the recreational use of plantation forests provided such use does not threaten the forest and is compatible with other reserve uses.



## Appendix 9: PF Olsen Significant Aspects – Objectives, targets and monitoring



## Appendix 10: Significant Aspects of a Plantation Forest Life Cycle

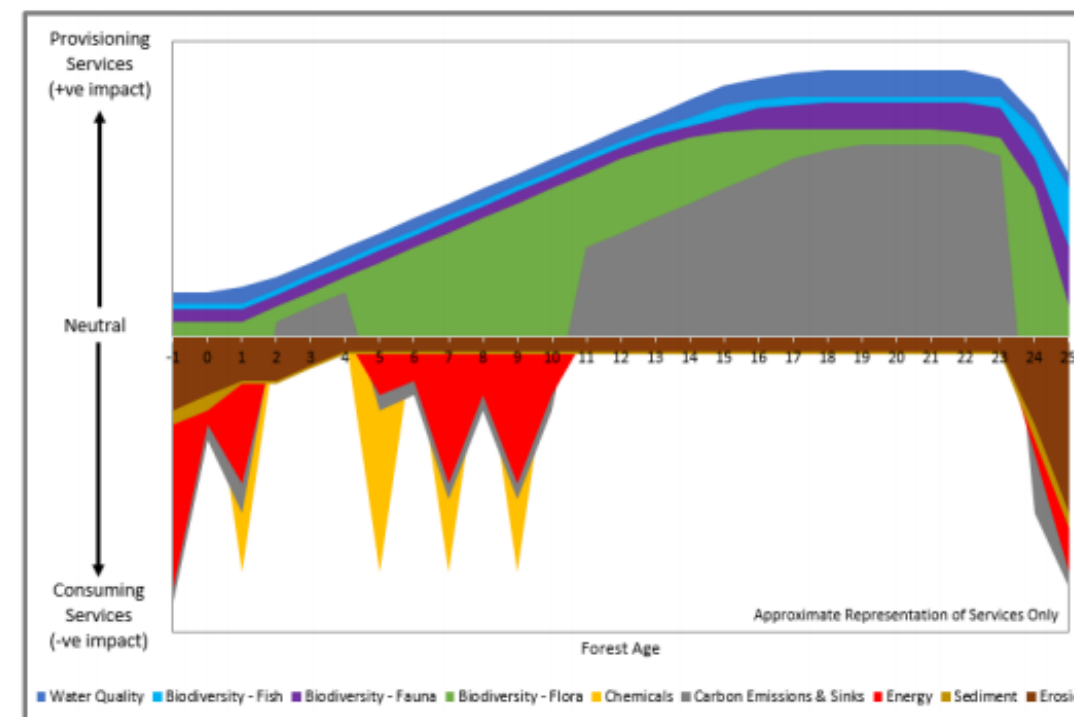


# SIGNIFICANT ASPECTS OF A PLANTATION FOREST LIFE CYCLE

## Provisioning and Consuming Services

### Provisioning Services (+ves)

- Biodiversity — Fauna:** plantation forests are home to a wide range of native and endemic species, including kiwi, New Zealand falcon, fernbird, weka, kokako, geckos, skinks, frogs, and short- and long-tailed bats.
- Biodiversity — Fish:** streams provide habitat for a range of native fish species, including Giant and Banded Kokopu, Long-finned Eel, Koura and whitebait species.
- Biodiversity — Flora:** plantation forests host a variety of native plants. Pioneering plants (ferns, coprosmas, manuka etc.) eventually form the sub-canopy layer under the production species. In addition riparian zones, wetlands, native reserves and other natural areas add a native flora component to the overall forest matrix. These are often protected under Regional/District Council plans, the NZ Forest Accord, management agreements, or as part of forest certification schemes.
- Carbon sinks:** trees absorb carbon dioxide from the atmosphere and convert it into oxygen. Trees store the absorbed carbon, even after they are harvested.
- Water quality:** once canopy closure is achieved the in-stream temperature stabilises. Riparian zones and the plantation trees stabilise the land, reducing and removing excess nutrient loads. This in turn provides a better quality of habitat for fish and freshwater insects.
- Clean air**
- Employment,** especially at the time of harvest, both within the forest and ancillary services such as transport and processing
- Recreation** opportunities such as hunting, walking, mountain biking, hunting, orienteering, horse riding, motor sport events,



Aspect	Provisioning / Consuming Services	Frequency	Impact Level	Control Level	Time of Impact	Control Methods
Biodiversity	Fauna	Low	Variable	Medium	Land prep, roadworks & harvesting	Protection, BEP's, buffer zones, timing of operations, monitoring, species management plans
	Fish	Low	Variable	Partial	Land prep, roadworks & harvesting	Protection, BEP's, buffer zones, timing of operations, monitoring, species management plans, fish passage
	Flora	Low	Variable	Partial	Harvesting	Protection, BEP's, buffer zones, timing of operations, monitoring, species management plans, weed control, remedial/enhancement planting
Ecosystem Health	Pests & Weeds	High	Variable	Medium	Ongoing	Control based on identification of weed/pest and associated threat. Chemical (aerial or ground-based), mechanical, biocontrol, trapping, species/management selection. Research into non-chemical alternatives
	Carbon Emissions & Sinks	Oscillating	Medium	Low	Land prep, silviculture, spraying, roading & harvesting	Use of bio oils and lubricants, try to minimise machine movements, replanting new crop after harvest
	Chemicals	Infrequent	High	High	Land prep & ages 5-10 years	Research into amounts used and chemical types, limit spray drift
	Energy	Medium	Low	Low	Any operation involving machinery	Invest in / research energy efficient machinery and technology
Soil & Water	Erosion	Intermittent	High	High	Until canopy closure (~1 to 5 years), extreme weather events, harvesting	Hydroseeding, mulching, BEP's, appropriate earthwork engineering, check sites after weather events, replanting new crop after harvest
	Sediment	Continuous but Low	Medium	High	Until canopy closure (~1 to 5 years), extreme weather events, harvesting	Use of sediment control traps, appropriate earthwork engineering, check sites after weather events, replanting of new crop after harvest
	Water Quality	Low	Variable	High	Extreme weather events, harvesting	Use of sediment control traps, appropriate earthwork engineering, buffer/riparian zones, protection of wetlands, remedial planting, replanting new crop after harvest
Social	Recreation	Medium	Variable	Medium	Variable, dependent on forest and location	Access provided through forest permit system to ensure user and operational safety. Permits allow monitoring of forest usage and hunting kill returns
	Employment	High	Variable	High	Ongoing, peak at harvest/replant	Seek to provide continuity of employment for high performing contractors, provide training opportunities to engage and retain a professional and capable workforce

### Consuming Services (-ves)

- Carbon Emissions:** heavy machinery and chainsaws during land prep, thinning and harvesting operations (fuel/oil use)
- Chemicals:** *Dothistroma* control and weed control
- Energy:** energy is released during any forestry operation involving machinery
- Erosion:** caused by harvesting, roading and land prep operations, plus extreme adverse weather events
- Sediment:** caused by harvesting, roading and land prep operations, plus extreme adverse weather events

