

Crawford Forest

Owned by
**R & H CRAWFORD AND
WHAKAPOUNGAKAU AGGREGATED
TRUST**

For the period Feb 2018 – Feb 2023



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1. INTRODUCTION

Foundation Principle

R & H Crawford and Whakapoungakau Aggregated Trust is committed to adopt the Forest Stewardship Council (FSC) Principles and to meet their Criteria and the FSC standards of good forest management. These standards include ecological, social and economic parameters.

R & H Crawford and Whakapoungakau Aggregated Trust is committed to the PF Olsen FSC Group Scheme that is implemented through the Group Scheme Member Manual and associated documents.

About this plan

This document provides a summary of the forest management plan and contains:

- Management objectives;
 - A description of the land and forest resources;
 - Environmental safeguards;
 - Identification and protection of rare, threatened and endangered species;
 - Rationale for species selection, management regime and harvest plan and techniques to be used;
 - Appropriate management of unstocked reserve areas;
 - Maps showing plantation area, legal boundaries and protected areas;
 - Provisions for monitoring and protection.
-

The Landscape Context

2. The Forest Land

Overview

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

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

Legal ownership

The forest is legally described on certificate of title numbers 63b/630 as follows:

MBLK 4K2B1AWhakapoungakau **63.9535 hectares**
MBLK 4K2C1 Whakapoungakau ML 14518 **82.2540 hectares**

The tenure is freehold.

Forests & location

Crawford forest is located off Hawthornden Drive, which in turn is located off Cookson Road near Rotorua. Internal forest roads provide access to all parts of the forest.

The location of the forest in relation to potential markets is listed in the table below and shown in Map 1.

The geographic locations of the main forest blocks within the Bay of Plenty and Hawkes Bay are shown in Map 1 in Section 3.

Table 1. Distance from forest to log markets

Potential Market or Export Port	Distance from Forest (km)	Log market
Port of Tauranga	70	Export
Waipa Sawmill	20	Domestic
Kawerau	50	Pulp

Topography

Strongly rolling to moderately steep hills with recent soils formed from a mantle of Rotomahana ash overlying various rock types. Surface pugging limits growth during wet periods.

There is a potential for moderate sheet and gully erosion. Production forestry is a suitable land use for these soil types. (Source: NZ Land Resource Inventory sheet N67 and the Bay of Plenty –Volcanic Plateau Region legend).

Prior to being established in trees, the property was used for pastoral farming.

Soils

Strongly rolling to moderately steep hills with recent soils formed from a mantle of Rotomahana ash overlying various rock types. Surface pugging limits growth during wet periods.

There is a potential for moderate sheet and gully erosion. Production forestry is a suitable land use for these soil types. (Source: NZ Land Resource Inventory sheet N67 and the Bay of Plenty –Volcanic Plateau Region legend).

Prior to being established in trees, the property was used for pastoral farming.

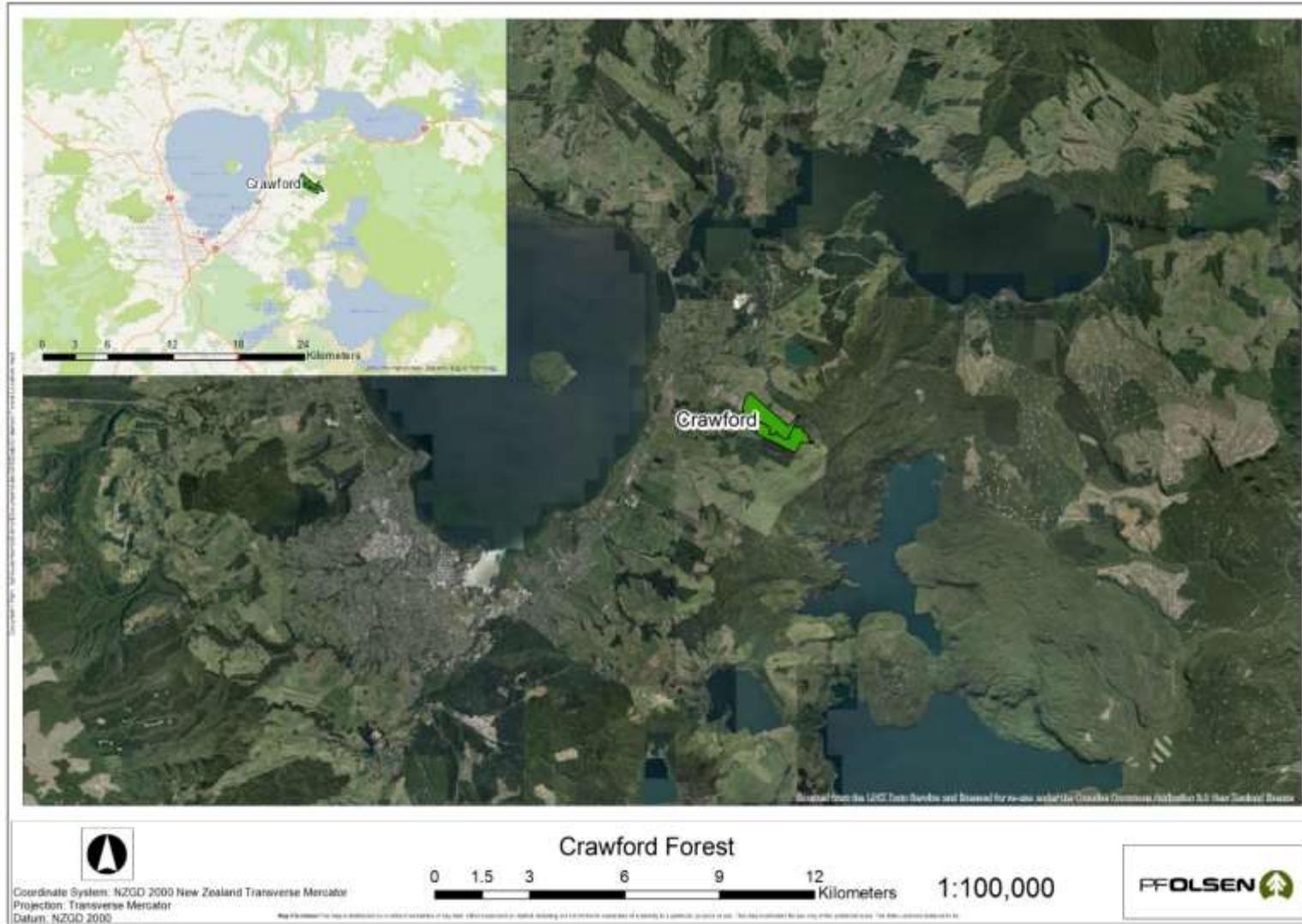
Climate

Climate has a significant effect on tree growth. NZ Meteorological service data recorded at nearby Rotorua Airport indicate an average annual rainfall of 1,491 mm per year. This ranges from an average of 94 mm per month in January up to an average of 161 mm per month in June (Source: NZ Meteorological Services, summaries of climatological observations to 1980).

Temperature: The mean annual temperature is around 12 to 13 degrees Celsius.

These climatic features are generally suitable for establishment and are conducive to good growth of Radiata pine.

Map 1 - Forest Location Map



3. The Broader Landscape

Ecological Districts

The Crawford forest falls within the Lake Rotorua caldera basin on the boundary between this and the Okataina catchment. Prior to significant human habitation almost the total catchment area was forested, the vegetation types reflecting the passage of time since local volcanic activity and the soils and geology resulting from such periods.

The relatively fertile and free draining caldera slopes were forested in tall Tawa, Podocarp, hardwood forests that formed part of a semi-continuous band from the Kaimais, around the elevated edge of the volcanic plateau through to the Raukumaras.

Subsequent human and particularly European settlement saw the clearance of significant portions of this forest for agricultural and forestry purposes. Nevertheless, there remain sizable portions of this forest type present and formally protected in the ecological district.

The Crawford forest is located in this context. Being surrounded on two sides by pasture and with a narrow linkage to large formally protected forests, this plantation and its associated indigenous reserve cannot provide ecological and biodiversity services of note. It does however provide soil erosion and water quality services to the benefit of the Lake Rotorua catchment.



Figure 1. Crawford Forest Ecological District

Protective Status

The following table shows vegetation types as required by the National Standard for Plantation Forest Management in New Zealand revised in 2013.

Table 2. Protective status of the ecological landscape

LENZ type:	LENZ H2.2
Original (pre-Maori) percentage of ecosystem type in Ecological District within land title:	44,826ha 100%
Natural ecosystem area remaining	19,678ha 43.9%
Proportion of remaining natural ecosystem under protection:	11,846ha 60.2%
Protection by certificate holder	3.3ha 0.2%
Protected areas as a % of management estate	3.3ha 9.5%
Protected areas as a % of the aggregated Group Scheme management estate by (Rotorua) Ecological District	1011.8ha 19%

Historic and archaeological sites

Records of known archaeological and historical places are maintained in the NZ Archaeological Association (NZAA) Site Recording Scheme. The Archaeological Site Probability model published by the Department of Conservation¹ 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.

If a site is found or suspected on any block, the protocols specified in PF Olsen’s EMS, and any others specifically developed in conjunction with Heritage NZ and Iwi or other stakeholders, must be observed. Where such circumstances require, an ‘Authority to Modify or Destroy’ will be sought from Heritage NZ with the assistance of an archaeologist. Such authorities are similar in function to a resource consent and, if granted, normally come with conditions that must be met. The process to apply for authorities is documented in PF Olsen’s EMS.

Note also that authorities to modify an archaeological site may sometimes be required from the local District Council and sites of cultural significance are often included in schedules of places and sites of significance in District Plans. Update checks for any sites will be required before any harvesting or related earthworks commences.

¹ Arnold, G.; Newsome, P.; Heke, H. 2004: Predicting archaeological sites in New Zealand. *DOC Science Internal Series 180*. Department of Conservation, Wellington. 24 p.

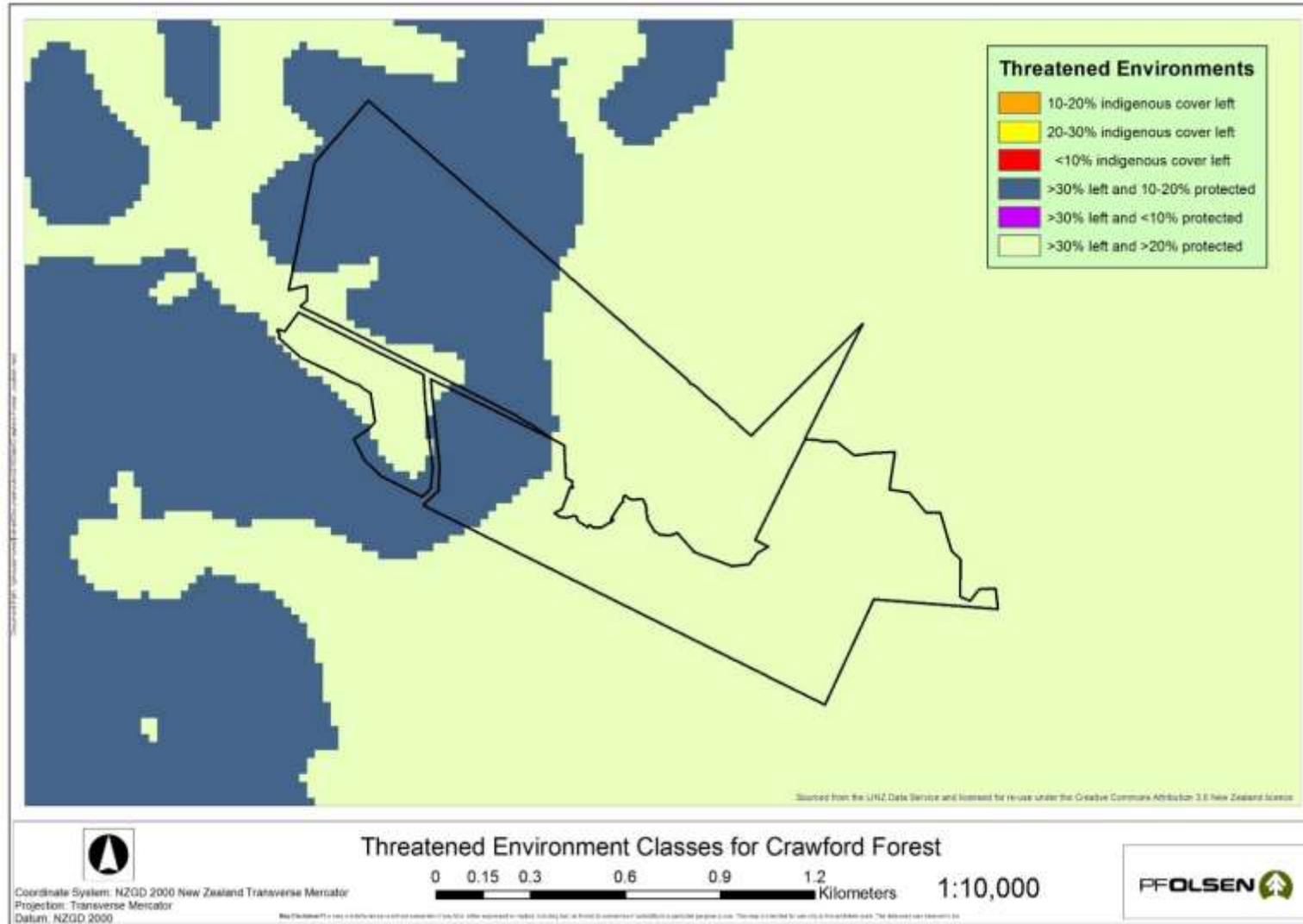
**Threatened
Environments
Classification**

The Landcare Threatened Environments Classification (TEC) is a measure of how much indigenous vegetation remains within land environments, its legal protection status, and how past vegetation loss and legal protection are distributed across New Zealand's landscape. The TEC is a combination of three national databases:

- Land Environments New Zealand (LENZ)
- Landcover Database 2
- Protected Areas Network

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.

Map 2. Forest Ecological Context



4. Socio-economic profile and adjacent land

Forest history

Crawford forest is established within a sheep and beef pastoral farming operation. Forestry has been established primarily for the purpose of soil conservation. The forest is a joint venture between R&H Crawford and Whakapoungakau Aggregated Trust.

Current social profile

Crawford Forest is situated in a sparsely populated region where the permanent residents occupy a narrow coastal fringe in usually small communities often associated with traditional landholdings. There is no substantive forest processing or permanent forestry harvesting infrastructure. The forests were planted with the primary aim of providing financial return to the business owners via sale of logs to the nearest but distant market opportunities.

In the current market there is some uncertainty as to the financial returns from timber at harvest and other options related to carbon values may need to be considered.

Table 3. Key statistics as summarised from Census² data

Census Category	Bay of Plenty	NZ
Ethnicity: European	75.7%	74%
Ethnicity: Māori	25%	14.9%
Formal qualifications	75.5%	79.1%
Unemployment	9.0%	7.1%
Dominant occupation	Professional	Professional
Median income	\$26,200	\$28,500
Family with children	35.9%	41.3%
Internet access	72.6%	76.8%
Home ownership	64.7%	64.8%
Employed in agriculture, fishing & forestry	8.5%	5.7%

Associations with Tangata Whenua

As freehold tenure the land has no direct association with Tangata Whenua unless archaeological remains were discovered. The iwi to consult in such circumstances are Ngati Rangiteaorere

² http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=13853&tabname=Business#

Neighbours

Neighbours to the forest estate boundaries 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 hazards. Neighbours may use the forests for recreational purposes or place reliance on the forests for provision of water quality or quantity services. Boundary issues such as weed and pest control, access and boundary alignment issues may also involve neighbours.

The following table lists the forest neighbours and their primary activities. Some or all of these parties should be consulted when operations are proposed in forest areas adjacent to their boundaries.

Table 4. Current forest neighbours

Owner/Occupier	Contact #	Location (See Location Map)	Activities	Other Notes
Ngati Rangiteaorere Koromatua Council		North Boundary	Farming	Land owners, unknown lease
Driver Whitehills Farms Ltd			Forest	No lease on property
Nick Shapely		South Boundary	Farming	
R & H Crawford		South boundary	Farm / Forest	
R & H Crawford		West boundary	Farm / Forest	
Department of Conservation		Northern/eastern boundary	Reserve	
Brendon Conwell		West boundary	Farm	Whakapoungakau 4K2C

Regulatory Environment & Risk Management

5. The Regulatory Environment & Risk

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.

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

The RMA sets up a resource management system that promotes the sustainable management of natural and physical resources and is now the principal statute for the management of land, water, soil and other resources in New Zealand. The RMA effectively delegates much of the rule development and enforcement to local government organisations. The organisations relevant to the Crawford Forest are listed below:

Table 5. Regional and District Councils under Crawford Forest

Regional Council ³	District Councils ⁴
Bay of Plenty Regional Council	Rotorua District Council

Under the RMA, each Council has its own planning documents and associated rules that have been developed through public process. Any forestry operations must comply with the rules relevant to the Council area in which the operations are to take place.

At the time of formulation of this Management Plan, it was just announced that many individual Council rules will be superseded by a new instrument under the RMA, the ‘National Environmental Standard for Plantation Forestry’ (NES-PF), designed explicitly to assist streamlining, efficiency and consistency in the application of environmental law to the forest industry (see next section). Contact details for the councils is shown in [Appendix 1](#).

National Environmental Standard for Plantation Forestry (NES-PF)

Coming into law on 1 May 2018, the NES-PF is a whole new rule hierarchy that applies the same rule set uniformly across most forestry operations in all parts of New Zealand. Operations will come under the legal force of this RMA instrument, though local Councils will retain the ability to regulate specific areas outside the NES-PF, e.g. Significant Natural Areas, Outstanding Landscapes, giving effect to the Coastal Policy Statement etc.

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.

Work commissioned by the Ministry of Primary Industries led to the creation of a national spatial map, the ‘Erosion Susceptibility Layer’ (ESC) that classifies all of New Zealand into a series of four classes of erosion susceptibility from low (green) to very high (red).

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.

Continued on next page...

³ Regional Councils responsible for soil conservation and water and air quality issues

⁴ District Councils responsible for land use and biodiversity issues

...continued

In the case of Crawford Forest, the table below indicates the proportion of the productive forest by the respective ESC classes.

In broad terms, harvesting, roading (earthworks) and new afforestation operations will need consents in the red zone. Earthworks will need consents in orange, and in the green and yellow zones most operations will be permitted subject to conditions. The coverage of the erosion classes within the estate are illustrated in Map 4.

Table 6. ESC Classes (Erosion Risk)

	Low	Moderate	High	Very High	Very High (8e)	Undefined
Area (ha)	23.80	70.18	51.45	-	24.81	-
Area (%)	14.0%	41.2%	30.2%	-	14.6%	-

Heritage New Zealand Pouhere Taonga Act 2014

Under the Heritage NZ 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. Records of archaeological and historical places are maintained in the NZ Archaeological Association (NZAA) Site Recording Scheme <http://www.archsite.org.nz/>.

If a site is found or suspected on any block, protocols specified in PF Olsen’s EMS, and any others specifically developed in conjunction with Heritage NZ, archaeologists and Iwi or other stakeholders, will be observed and the necessary Archaeological Authorities obtained with Heritage NZ and if necessary the local Territorial Authority.

These responses may include, but are not limited to:

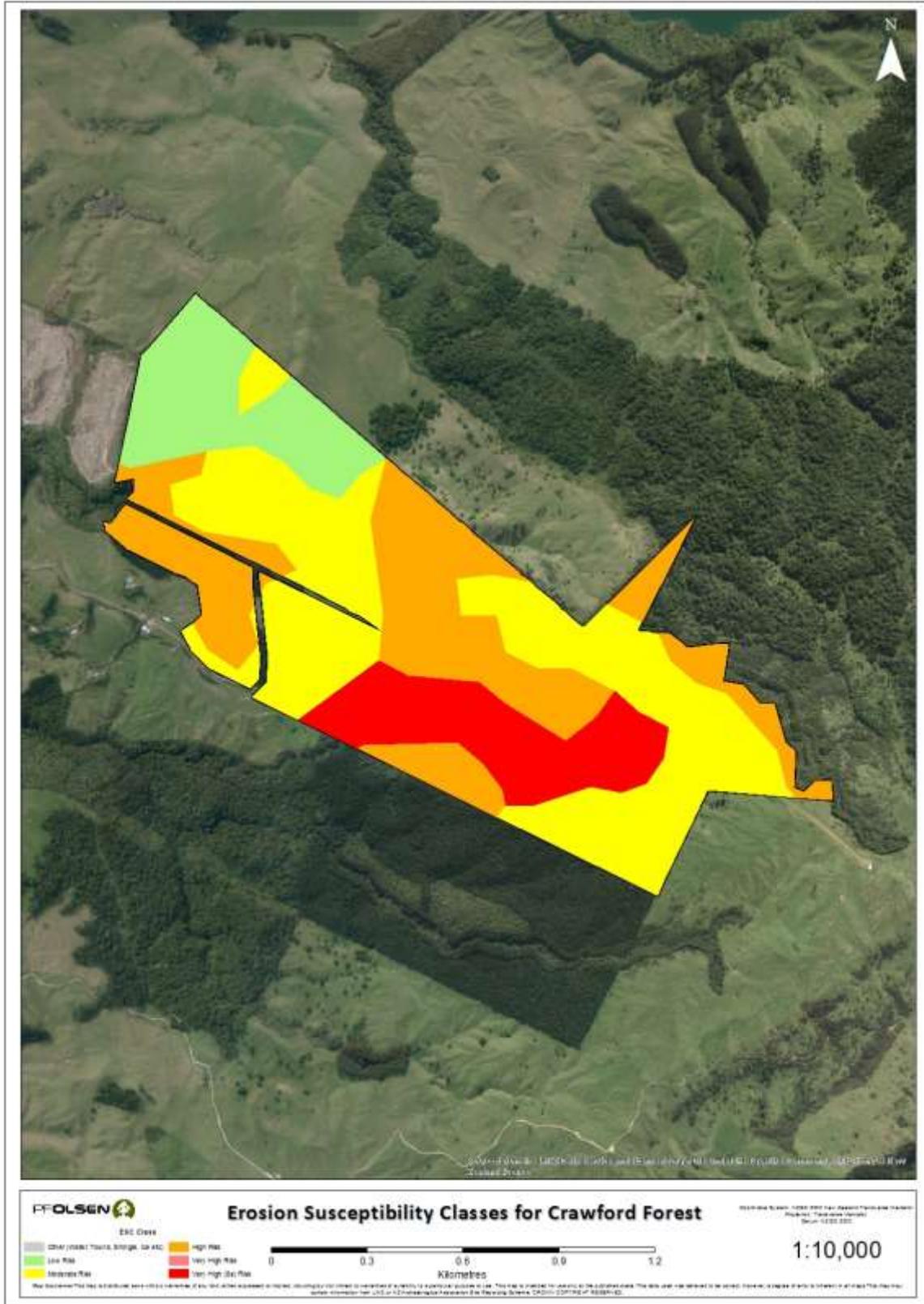
- Map and ground surveys to identify, mark and protect known heritage sites.
- Iwi consultation and surveys for unknown sites.
- Archaeological Authorities to modify sites if required.

Accidental Discovery Protocols to stop work and engage experts if sites are discovered during operations.

Consents & authorities held

There are currently no resource consents or HPT authorities held that apply to Crawford Forest.

Map 4 – National Environmental Standard Erosion Susceptibility Classes in Crawford Forest



Emissions Trading Scheme

Forests in New Zealand are governed by rules related to New Zealand's Climate Change Response Act (CCRA) to reduce the nation's carbon footprint and contribution to associated climate change.

Crawford Forest was planted on 'Kyoto compliant' land that was vacant as at 31st December 1989. These forest areas have been registered to participate in the NZ Emissions Trading Scheme and are subject to the accrual of emissions credits and liabilities under that scheme.

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

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 R & H Crawford and Whakapoungakau Aggregated Trust retains credible access to its markets.

R & H Crawford and Whakapoungakau Aggregated Trust maintains independent third party environmental certification for its estate under Forest Stewardship Council certification (FSC). PF Olsen Ltd is responsible for the execution and maintenance of the required FSC certification elements of which this management plan forms an important component.

Log customer credit risk

There have been a number of NZ sawmills fail in recent years leaving log customers unpaid for the last month's deliveries. The PF Olsen manages customer credit risk exposure and mitigation measures for both export markets and domestic log customers.

Infrastructure damage or service disruption

Crawford Forest has no power or gas lines within the forest boundary. 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.
-

Fire

Fire is always a risk to the forests. Crawford Forest has minor risk as it is located in the Centre of the North Island, where there is a variety of weather conditions annually.

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 FENZ.
-

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.

7. Environmental Risk Management

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 System (EMS), supported by monitoring and reporting. PF Olsen's policies and R & H Crawford and Whakapoungakau Aggregated Trust business objectives are considered to be well in alignment.

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 3rd 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 **NZ Forest Accord** the **Principles for Commercial Plantation Forest Management in NZ**, 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 5 key aspects of the business:

1. Economic
2. Legal
3. Social
4. Health & safety
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.

EMS framework

The Environmental Management System (EMS) is an integrated set of cloud based, defined and documented policies, processes and activities that govern the physical implementation of forest management activities. The EMS applies a systematic approach certified to ISO:14001 standards to ensure that prevention of adverse and harmful impacts is effective.

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

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 NZ Forest Owners Association ‘New Zealand Environmental Code of Practice for Plantation Forestry’. This publicly available document sets out guidelines that underpin the requirements for sound and practical environmental management.

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, ‘NZ Forest Road Engineering Manual’, published 2012.

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.

As a broad assessment over the total Crawford Forest, the **potential** for adverse impacts across the range of operations and forest sites is indicated in the Environmental Assessment matrix below, 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 7. Risk assessment for key aspects involved in forest management activities

Forestry Operational Activities	ENVIRONMENTAL VALUES/ISSUES											
	Erosion & Sediment Control	Water Quality	Soil Conservation & Quality	Air Quality	Aquatic Life	Native Wildlife	Native Vegetation	Historical & Cultural Values	Landscape & Visual Values	Neighbours & other forest users	Public Utilities	Recreation Values
Harvesting	M	M	H	L	L	L	L	L	M	H	L	L
Earthworks	H	H	H	L	M	L	L	L	L	L	L	L
Slash Management	L	L	L	L	L	L	L	L	L	L	L	L
Stream Crossings	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mechanical Land Preparation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Burning	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Planting	L	L	L	L	L	L	L	L	L	L	L	L
Tending	L	L	L	L	L	L	L	L	L	L	L	L
Fertiliser Application	L	M	L	L	L	L	L	L	L	L	L	L
Agrichemical Use	L	L	L	L	L	L	M	L	L	H	H	H
Oil & Fuel Management	L	H	L	L	H	L	L	L	L	H	L	L
Waste Management	L	L	L	L	M	L	L	L	L	L	L	L
Forest Protection	L	L	L	L	L	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 hazardous materials which may be used within Crawford forest are:

- Pesticides ;
- Fuels and oils ;
- Fire retardants ;
- Surfactants.

Transportation, storage and labelling of these hazardous materials must all comply with the provisions of the Health and Safety Manual, which is maintained under ISO 9001 certification and incorporate legislative controls under EPA and NZS 8409:2004 Management of Agrichemicals code of practice.

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.

Highly hazardous chemicals

There are seven agrichemicals that have been classified ‘highly hazardous’ (HH) by FSC that are used in forestry and conservation operations within PF Olsen group certified forests. All these five have recently been added to FSC’s HH list. Special derogations to continue usage of these chemicals, subject to conditions, are being applied for by PF Olsen as FSC Group Manager in conjunction with the wider NZ certified industry. The derogation process is run according to specific policies put in place by FSC, including extensive canvassing of stakeholder views. These chemical pesticides are listed in the table below.

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

Continued on next page...

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Table 8. FSC Highly hazardous chemicals used or potentially used within Crawford Forest

Active ingredient	Purpose	Common usage
Copper based products	Fungicide	Needle cast control
Picloram	Herbicide	Establishment weed control
Carbaryl	Insecticide	Localised wasp control
Cholecalciferol	Vertebrate pesticide	Localised possum control
Pindone	Vertebrate pesticide	Rabbit and hare control
<i>Use also subject to Animal Health Board emergency provisions only</i>		
Sodium cyanide	Vertebrate pesticide	Animal Health Board only, ground based possum control
Sodium Monofluoroacetate (1080)	Vertebrate pesticide	Animal Health Board only, extensive aerial possum control

The PEFC classification for ‘highly hazardous’ chemicals are based on the WHO classes. Chemicals that are classified class 1a and 1b are banned from use in certified forests, unless a ruling from PEFC international representation via the local PEFC administrative support organisation is given, approving the local use of a certain chemical. In NZ, this approval for use has been given to sodium monofluoroacetate (1080, class 1a).

The Managed Plantation Estate

8. Commercial Plantation Estate

Productive Capacity strategy

Forest management is carried out to ensure the productive capacity of the Crawford Forest 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 Ltd. The estimated net stocked areas of each stand are set out in the following table.

Table 9. Crawford Forest area (ha)

Gross area	Net stocked area	Reserves
38.1	34.8	3.3

Unproductive areas include stocking gaps, roads and tracks, and other small unplanted areas. Total unproductive area has been derived by subtraction.

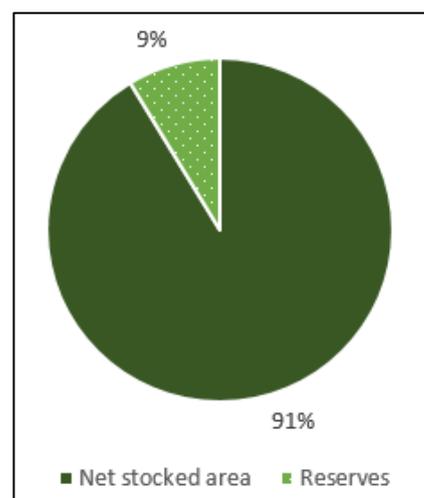


Figure 2. Crawford Forest area (ha)

Current species

The species grown at Crawford forest is *Pinus radiata* (radiata pine). This species has been chosen to best meet the management objectives set out above and in section 2 given the characteristics of the forest land as described in section 3.

Treestocks established in the forest are summarised in the table below:

Table 10. Treestock seedlot and GF ratings.

Stand	Treestock
1/01	GF Plus bare rooted cuttings. Seedlots

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 at age 20.

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

The site index for Crawford forest is approximately 30.
The 300 index for Crawford forest is approximately 33.

Crawford forest is about average for site productivity in the general area for forestry sites.

Current crop status

Measurement data from the most recent inventory November 2009 was summarised to give the current status of the crop. The entire plantation within the forest is of the same age class. This is shown in the table below:

Table 11. Current crop status of Crawford Forest

Stand	Year planted	NSA (ha)	Total stocking (s/ha)	Basal area (m ² /ha)	Mean Crop Ht (m)	Mean DBH (cm)	Pruned stocking (s/ha)	Pruned height (m)
1/01	2002	34.8	342	8.7	10.6	17.8		

9. Commercial Crop Establishment and Silviculture

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.

Forest management goals

The Crawford Forest owners are committed to ensure that the forest 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.
-

Crop species

In Crawford forest, the main crop species grown is Radiata pine.

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. The 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.

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

Alternative species have been considered, but these did not meet the R & H Crawford and Whakapoungakau Aggregated Trust’s objectives.

Unwanted pine spread

The use of the Wilding Spread Risk Calculator is a requirement under the NES-PF when afforesting or changing species when reforesting. There is no intention to replant in other species with a calculated risk index higher than the existing radiata crop.

Establishment

There is no further establishment planned at Crawford forest during the period of this management plan.

Re-establishment will aim to use high quality treestocks suitable for the site and market. These will be investigated at time of establishment.

Pre-establishment considerations

Prior to re-establishment of the tree crop, a review will be conducted to identify whether there are any rare, threatened or endangered species of flora or fauna within the area to be planted and what, if any, adjustments in planning may be required. This may include the extension of an existing wildlife corridor or riparian area by increasing setbacks at the time of crop replanting. A plantation crop is likely to confer beneficial habitat buffering rather than cause adverse effects.

These considerations are covered by the afforestation checklist and riparian rules contained within the EMS.

Tending

The tending regime executed at Crawford Forest is a pruned regime consisting of two pruning lifts and a waste thinning operation.

Over the duration of this plan there are two planned operations:

- Annual Dothistroma checks;
 - Pre-harvest inventory at age 20.
-

Tree nutrition

The soils in Crawford Forest are not likely to be deficient in nutrients for healthy tree growth. However, there are soils within New Zealand that are deficient in one or more nutrients. The most common nutrient deficiencies are likely to be:

- **Magnesium** – Magnesium deficiency is a particular problem of the Central North Island and is associated with the phenomenon known as mid crown yellowing where the middle of the tree crown turns a yellow colour. Heavily pruned trees and some seedlots are more predisposed to the deficiency than others.
- **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 will be 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.

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

As a plantation with a non-normalised age-class structure, the harvesting strategy employed at Crawford forest is to harvest the forest or constituent stands 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 cost 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 and 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.

Harvesting is not planned over the duration of this plan.

Planning and preparing for harvest

Forward planning is essential when considering harvesting activities. Harvest planning should ideally 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 when log prices are fluctuating.

Harvest planning is conducted within a detailed structured framework controlled within the PF Olsen FIPS system. Planners are guided through a total of 100 elements involving environmental, cultural, community, infrastructural, and safety issues that must be addressed as well as direct operational and economic considerations, prior to the issuing of final prescriptions.

Harvesting operations will be undertaken by contractor and supervised by the forest manager.

Infrastructure

Forest infrastructure includes roads, tracks, landings, bridges and culverts. Design specifications for these are outlined in the ‘PF Olsen Standard Specifications for Road and Landing Construction’.

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.

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. With regard to crew configuration, 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.

Upon appointment all new contractor crews undergo a comprehensive safety and environmental induction, 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

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: to obtain estimates of

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

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.

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.

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

Mapping

All mapping within Crawford Forest is in digital format and is constantly updated in a Geographic Information System (GIS) that is linked to FIPS. The GIS system spatially records a vast array of forest data, from stand and legal boundaries, to reserves, rivers, roads, infrastructure, topography and soils.

Accurate mapping also assists budgeting, planning, calculation of future revenue/tree crop value, calculation of payments, infrastructure location, and harvest planning.

Forest records

Forest records are essential in monitoring the forest operations by providing a historic perspective to the physical condition of each stand.

Crawford forest has detailed records of each stand’s silvicultural management history, productivity, inventory and other attribute data are compiled and maintained in a stand records database and Geographic Information System (GIS). These records form the basis for informing silvicultural scheduling, harvesting schedules and other management activity.

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.

Non-commercial Estate Management & Protection

12. Protected Forests, Habitats, Ecosystems and Species

Introduction

Indigenous biodiversity management 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 ecosystems

The protected ecosystems are recorded and ranked on the basis of ecological criteria reflecting the stands representativeness, rarity of species, size and connectivity, function and landscape values. Relative value in terms of the ‘ecological landscape’ (Section 4) also informs that process.

Crawford Forest contains one small area of near natural tawa, podocarp broadleaved hardwood forest that is linked to a much larger areas that form part of the Okatina Conservation lands. The area is typical of a large well represented and well protected forest type. Present in this and adjacent Ecological Districts.

Actions are prioritised according to the ‘Protection Category’ status allocated to the areas from the assessments and classifications undertaken. The management implications pertinent to each status are summarised in the table below. Prioritisation of work effort will also be based on the principle of ensuring successful and maintainable outcomes at limited scales as a priority over wide scale but marginally beneficial outcomes.

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Table 12. 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 table below details the areas in the special protection category within the Crawford Forest, categorised by protective function.

Table 13. Protected Ecosystems management categories by function and area

Protective Function	Protective Category			
	Special	Full	Limited	Passive
Erosion Control				
Landscape / Amenity				
Non-specific				
Rare Species				
Riparian Ecosystem				
Terrestrial Ecosystem			3.3	
Wetland Ecosystem				
Total Area (ha)			3.3	

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 EMS 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.

It also provides the minimum set-backs upon establishment or reestablishment of forest after harvest where riparian setbacks had not existed before. The morphology of streams can mean that the minimum set back is wider in many instances.

The stream categories within Crawford Forest are summarised below. The total length of waterways within the forest estate is 2.2 km.

Table 14. Length of stream by REC class

REC Class	Length (m)	Length (km)
Med_Low_Wet_Hard	10.7	0.011
Med_Low_Wet_Soft	286.4	0.286
Med_Low_Wet_Soft	116.8	0.117
Med_Low_Wet_Hard	699.4	0.699
Small_Low_Wet_Soft	332.4	0.332
Med_Low_Wet_Soft	33.5	0.034
Small_Low_Wet_Hard	696.6	0.697
Total	2175.8	2.176

Rare and threatened species

The small indigenous area is not known nor expected to contain permanent habitat for rare or endangered species. It is highly likely that Kereru will make transitory use to the forest habitat, especially during tawa fruiting but such usage will form a minor component of use of the larger adjacent forest environment. Long tailed cuckoo may inhabit the area as the plantation forest matures.

Records of sightings and locations are currently collected and reported in FIPS. Over time this has enabled the build-up of a spatial distribution picture of species within different geographical locations.

As of June 2018, PF Olsen will have transitioned into using the NatureWatch app for rare species reporting. This app contains a spatial database of the distribution for every rare species recorded within our plantation forests. A listing of key species of interest is held by all contractors and staff along with species sighting forms and a request to report such information

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 EMS, or online at:

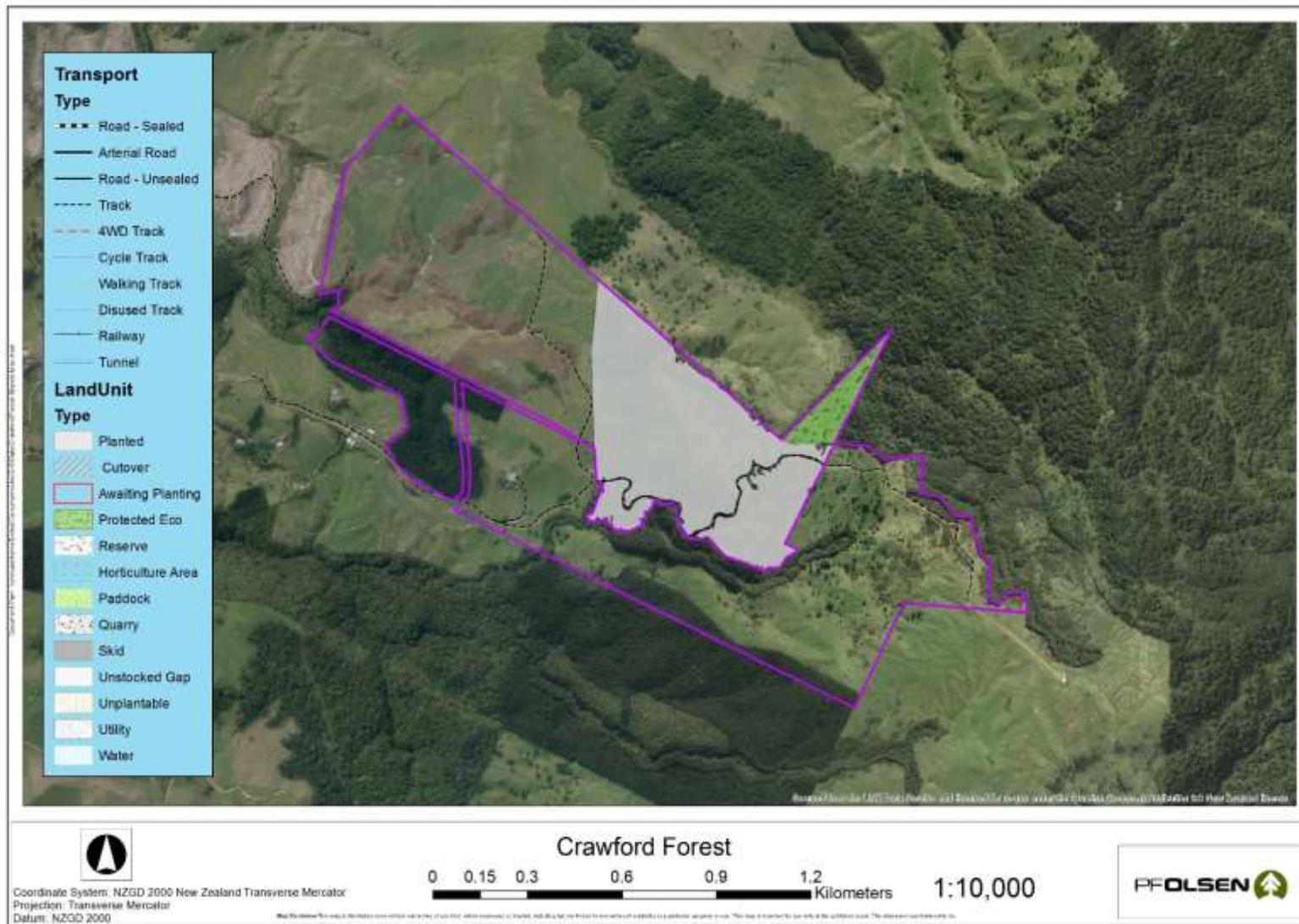
<http://www.doc.govt.nz/about-doc/role/international/endangered-species/cites-species/nz-cites-listed-species/> .

Anticipated activities

In line with the prioritisation approach described previously, key areas of work related to protected ecosystems within Crawford Forest over the next 5 years are expected to be:

- Co-operation with neighbours on pest control.
 - Maintenance of long term photopoint monitoring sequence.
 - Maintenance of threatened species records database and integration into industry Naturewatch 'Biodiversity in Plantations' project.
-

Map 5 – Forest Stands Map



13. Property Management and Protection

Statutory pest obligations

Pest management within Crawford Forest is subject to statutory obligations under the Regional Pest Management Strategy administered by Bay of Plenty Regional 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 in [Appendix 3](#). These plans are maintained online by the relevant Regional Council.

Plant Pests

The overall objective in managing plant and animal pests is to:

- Meet statutory obligations under the Regional Pest Management Strategy,
- Reduce their direct impacts on both plantations and indigenous biodiversity values,
- Ensure that any impacts on neighbouring properties are promptly dealt with,
- Monitor the abundance and distribution of these species within Crawford Forest.

The major plant species potentially threatening production values within the forest can be seen in [Appendix 3](#).

Animal Pests

The PF Olsen Integrated Pest Management provides guidance on application and execution of the PF Olsen Ltd Environmental Management System (EMS) for pest control and chemical use.

The main animal pest in Crawford Forest is the introduced possum and goats. Possums attack the growing tips of both plantation and native trees, causing stem malformation and die back. Possums are also a threat to neighbouring property owners who are farmers as they can carry and spread tuberculosis to domestic stock.

Other pests include rabbits and hares at the time of establishment and wild goats during the first half of the crop rotation when bark is soft and palatable.

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Animal pests in Crawford Forest will be controlled using ground control methods as required, which prevent impacts on non-target species. The forest manager will coordinate operations with organisations such as the Regional Council and the Department of Conservation to achieve effective and efficient control within the forest area and on neighbouring land, where required.

Insects and fungal disorders

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. This fungus is controlled using a copper-based fungicide, but only when the infection reaches a critical level.

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

Pest Control

Plant pests

When controlling plant pests, chemicals 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 or land handback to reduce weed competition. Re-established trees are also released with another chemical application where necessary during the first one to two years after establishment.

A bio-control weevil (*Cleopus japonicus*) that was being trialled in the previous plan period for efficacy against *Buddleia* has now widely established and is having some impact in some areas. Its full efficacy will not be known for some years.

Animal pests

Animal pests are controlled using shooting, trapping or toxins, especially prior to establishment and in the first few years of a tree's life. Only licensed operators are used for toxin control and all legal requirements are enforced. Permits are issued to private/recreational hunters on occasion and these permits require that kill returns be completed after hunting to provide information on animal densities, location and health.

The forest manager will co-ordinate operations with organisations such as the local Regional Council and Department of Conservation to achieve effective and efficient control within the forested area and on neighbouring land where required.

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Fungal pests

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, but 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.

No control is currently completed on the other fungal disorders.

Chemical control

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

As part of the FSC and PEFC 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.
 - No chemicals classified by FSC as ‘Highly Hazardous’ are used other than under the terms of any derogations applied by FSC.
 - Under PEFC no WHO class 1a or 1b chemical cannot be used unless legally approved for use in the country and with the additional clearance for use by PEFC following submissions of evidence from NZ Forest Certification Inc.
-

Fire prevention and control

With the weather patterns normally experienced in the Bay of Plenty during the period late spring/summer, fire can be a real threat to the forest. This can be minimised by:

1. 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;

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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.
-

Fire authority responsibilities

The legal responsibility for fighting forest fires lies with the recently created new organisation ‘Fire Emergency New Zealand’ (FENZ) that came into existence on the first of July 2017 ready for the 2017/18 fire season.

In the event of a fire that starts within the forest, FENZ is responsible for attending to and providing the resources to extinguish the fire. Where a fire starts outside the forested area and moves into the forest, FENZ has recourse to the Rural Fire Fighting Fund to compensate for fire-fighting costs.

There is a close liaison with the RFA in terms of developing the ‘fire plan’ and the maintenance of good communication relative to potential risks and fire danger ratings.

Public liability insurance

It is recommended that R & H Crawford and Whakapoungakau Aggregated Trust maintain public liability insurance cover. In the case of fire spreading from Crawford Forest onto adjoining land, CRAWFORD could be liable for the firefighting costs and any damage to property.

However, PF Olsen as management agency does carry comprehensive insurance against such issues and all contractors working in the forests must also maintain a level of cover approved by PF Olsen and provide regular verification of currency of policies.

Fire insurance

Regarding the location of the forest and the high public activity around the fringes, there will always be the potential for fire. If a fire originates within the forest, the owners will ultimately be liable for suppression costs. A major fire may cost many thousands of dollars to extinguish, with the main costs being the use of heavy machinery, helicopters, and manpower.

Insurance for Crawford forest is held by R & H Crawford and Whakapoungakau Aggregated Trust. The current extent of cover is:

- Firefighting cover (the costs of fire suppression) of
- Cover for the crop value and re-establishment costs are retained

R & H Crawford and Whakapoungakau Aggregated Trust should liaise closely with the forest manager at the time of fire insurance renewals and if necessary instruct the forest manager to keep premiums paid up.

Other Benefits from the Forest

14. Recreation, Forest Products and Other Special Values

Introduction

Forest plantations can provide non-timber forest products 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 production capacity of the forest whilst maintaining environmental and social values. The forest management plan provides procedures for developing and managing these resources.

Environmental and social cost-benefit analysis

Forests can deliver numerous social and environmental products, 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 by Crawford forest relative to the most likely alternative primary production system, pastoral dry stock farming.

Table 15. 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										✓	
Erosion/soil loss					HP						MR
Water quality				HP							MR
Riparian shading					HP					MR	
Water quantity					MR	HP					
Carbon sequestration			HP								✓
Native wildlife habitat									✓		
Threatened fauna						✓					
Native fish							✓				
Air quality					HP		MR				
Native reserve protection									✓		
Landscape/visual			HP					MR			
Recreation								✓			
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.

Recreational usage

Neighbouring farmers and graziers use the forest track to access paddocks out the back of the forest. Family members occasionally hunt deer in the forest and reserve. One permit for such usage was issued for the 07-08 year.

All access is controlled through a permit system; though this control is sometimes delegated to some (usually hunting) clubs with Iwi affiliations and customary right usage of their lands or otherwise strong controls over membership.

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.

Non-timber forest products

The primary commercial non- timber (timber and pulp) uses arising from the forests are:

- Sites for apiarists.
- Commercial firewood dealers who may be licensed to pick up low grade residues for resale to domestic households.
- Permitted collections of pine cones for community fundraising events.

None of these products hold any forest certification status. Currently Crawford Forest is not producing or developing non-timber products.

Other special values

In the regional landscape context, Crawford Forests plantations and indigenous ecosystems in combination provide well-defined ‘environmental services’. These include:

- Enhanced water quality, and buffering of regionally significant water bodies from agricultural and urban generated nitrification;
- Soil stabilisation and conservation;
- Providing a buffer against flooding during storms;
- Temperature moderation in waterways for maintenance of aquatic life including threatened native species and world-renowned sports fisheries;
- Enhance wildlife and plant habitat leading to increased biodiversity;
- Expanded habitat opportunities for some declining and or threatened fauna;
- Carbon sequestration and buffering of the effects from a nationally adverse carbon generation footprint.

In recent times some of these environmental services have acquired quantifiable and significant financial value (nitrogen and carbon in particular).

Over the term of this plan, the regulatory environment will continue to be actively monitored and where possible efforts made to secure the introduction of properly structured market mechanisms to ensure forestry is not dis-incentivised, relative to other land uses.

Other environmental services will continue to be supplied or enhanced based on good corporate citizenship and responsible environmental management.

Public access roads

There are no public roads or tracks that are within or adjacent to the boundaries of Crawford Forest. All signage of roads and tracks must be followed and those using the routes will still require a permit if there is any intention to access the forest from the road routes.

These public road locations are publicly viewable in the Walking Access Commission website⁵. Any users are expected to abide by the Outdoor access code⁶ published by the Walking Access Commission.

⁵ https://www.wams.org.nz/wams_desktop/index.html

⁶ <http://www.walkingaccess.govt.nz/walkways-and-access/outdoor-access-code>

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 to R & H Crawford and Whakapoungakau Aggregated Trust 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 Crawford Forest is tabulated below.

Table 16. Environmental process monitoring framework

Monitored Element	Components	Data Source	Data medium	Reporting / Website Frequency
Chemical Usage	- A.I Usage - Area Overuse	- Operational Supervisors	- FIPS - <u>Form</u>	- On Demand - Annual
Client Satisfaction	- Post-operation client survey	- Clients	- Survey Form	- Post-operational - Annual
Consultation Activity	- Complaints - Other Interactions	- Operational Supervisors - Planners	- FIPS - <u>Form</u> - <u>Meeting Minutes</u>	- Annual - Annual
Environmental Incidents	- Incident Number - Categories	- Operational Supervisors	- FIPS - <u>Form</u>	- 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 - <u>Form</u> - <u>Naturewatch</u>	- 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 ⁷	- 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	- Spreadsheet	- Annual
Internal Audit CAR Activity	- Frequency * - Category	- Auditors(ees) - Operational Supervisors	- Noggin	- Annual
Log Production	- Total Logs - FSC Certification	- Log docket 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 - Permitees	- 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.

⁷ Forest health inspections are undertaken annually, by an independent specialist forest health assessor, through the NZ Forest Owners Association forest health scheme.

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 forest. 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.

16. Industry Participation and Research

NZFOA and FGLT R & H Crawford and Whakapoungakau Aggregated trust 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 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 certain portion of the funds raised by FGLT are allocated to forestry research projects. These funds are supplemented by NZ 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, uptake by contractors, commercial providers and better genetics. PF Olsen’s direct involvement with other research bodies such as FFR contributes to and benefits R & H Crawford and Whakapoungakau Aggregated trust through early application of good ideas and research findings.

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 R & H Crawford and Whakapoungakau Aggregated trust interests are considered and that outcomes are understood and applied in practice.

17. Future Planning

Introduction

This plan pertains to the management of Crawford forest and will be adhered to for the next 5 years. Any deviation from this plan will be justified only on the basis that the changes do not adversely affect the environment. Any changes which are contrary to the policies contained in this management plan require a full review of this plan. The next review date for this plan is February 2023.

Deviations from this plan will 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.

Associated management plans

Associated with this plan are forest agreement specific plans covering the descriptive and management detail pertinent to each forest. These plans contain primary descriptive data for the specific forest and details of planned silvicultural objectives. These plans are maintained by the investment manager for R & H Crawford and Whakapoungakau Aggregated trust.

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.

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.

18. Register of Plan Change and Review

Introduction

This plan pertains to the management of the Crawford forest estate and will be reviewed on an annual basis. This section documents specific changes made during each review.

Change	Date	Section/Page

Appendix 1 - Contact details for Regional and District Councils with jurisdiction over Crawford Forest

Council	Phone	Fax	Email	Website
Bay of Plenty Regional Council	0800 884 880	0800 884 882	info@boprc.govt.nz	https://www.boprc.govt.nz/
Rotorua District Council	07 348 4199	07 346 3143	info@rotorualc.nz	http://www.rotorualakescouncil.nz

Appendix 2 - Other Relevant Legislation

Statutes and Regulations
Accident Compensation Act 2001 #49
Animal Welfare Act 1999
Biosecurity Act 1993
Climate Change Response Act 2002
Commercially relevant statutes
Conservation Act 1997
Crown Forest Assets Act 1989
Fencing Act 1978
Forest and Rural Fires Act 1989
Forestry Rights Registrations Act 1983
Forests Amendment Act 1993 (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
National Environmental Standard for Plantation Forestry 2017
Protected Objects Act 1975
Relevant regulations
Reserves Act 1977
Resource Management Act 1991
Resource Management Act – administrative jurisdiction
Soil Conservation and Rivers Control Act 1971
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
 NZ 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

Appendix 3 - Regional Pest Management Plan for the Bay of Plenty 2011 – 2016

Species managed in the Regional Pest Management Plan

Agency pests	Eradication/ Exclusion pests	Containment pests	Restricted pests	
Cape tulip*	Alligator weed*	African feather grass	Agapanthus	Parrot's feather*
Didymo	Horse nettle	Apple of Sodom	Aluminium plant*	Periwinkle
Hydrilla	Kudzu vine	Asiatic knotweed*	Arum lily	Plectranthus
Johnson grass	Marshwort*	Blackberry (defined areas)	Banana passionfruit*	Prickly pear cactus
Manchurian wild rice*	Nassella tussock*	Boneseed*	Blue morning glory*	Privet*
Phragmites*	Noogoora bur	Chilean rhubarb*	Bushy asparagus*	Purple nutsedge
Pyp grass*	Purple loosestrife*	Climbing spindle berry*	Californian rush*	Rum cherry*
Phytophthora taxon agathis (PTA)	Senegal tea*	Coast tea tree	Cathedral bells*	Saltwater paspalum
Salvinia*	Spartina	Darwin's barberry*	Cestrum species (four)	Selaginella *
Water hyacinth*	Water poppy*	<i>Egeria densa</i> *	Chilean flame creeper*	Shield pennywort
White bryony	White edged nightshade*	Gorse (defined areas)	Chinese fan palm	Smilax*
Rainbow lorikeet	Brown bullhead catfish	Green goddess lily*	Climbing asparagus*	Snow poppy*
Feral sika deer	Koi carp	Hornwort *	Climbing dock	Strawberry dogwood
	Perch	Italian buckthorn	Coastal banksia	Sydney golden wattle
	Rooks	Lagarosiphon	Crack willow*	Tree of heaven*
		Lantana*	Elaeagnus	Taiwan cherry
		Lodgepole pine*	Elephant's ear	Thistle species other than variegated thistle
		Old man's beard*	<i>Elodea canadensis</i>	Tradescantia
		Ragwort (defined areas)	English ivy	Tuber ladder fern*
		Royal fern*	Firethorn*	Velvet groundsel
		Variiegated thistle	German ivy	Wilding conifers (excluding Lodgepole pine)
		Wild ginger – yellow and kahili*	Grey willow*	Wonder tree
		Wild kiwifruit	Heather*	Argentine and Darwin ants
		Woolly nightshade (defined areas)*	Himalayan balsam	Eastern Rosella
		Yellow flag iris*	Houttuynia	Hedgehog
		Feral Goats	Japanese honeysuckle*	Ferrets
		Rudd	Japanese spindle tree*	Wild cats
		Tench	Japanese walnut	Gambusia
		Wallabies	Jasmine	Magpies
			<i>Lilium formosanum</i>	Wild mice
			Mexican feather grass	Possums
			Mexican waterfily*	Feral rabbits
			Mignonette vine	Rainbow skinks
			Mile-a-minute*	Rats (Ship and Norway)
			Mistflower	Stoats
			Monkey apple*	Wasps (common wasp, German wasp, Asian paper wasp, Australian paper wasp)
			Moth plant*	Weasels
			Pampas*	

* These species are listed in the National Pest Plant Accord. The full list of species on the Accord is available on the Ministry of Agriculture and Forestry's website (www.maf.govt.nz).