Residual biomass fuel projections for New Zealand; 2024

Indicative availability by region and source

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Executive summary

Objective

The goal of this report and the accompanying tables is to describe the woody biomass residue resources in New Zealand by volume, type, energy content, and region over time from 2024 to 2053 (~30 years). The focus is on existing resources derived from established forests, processing, residue streams etc.

The estimated delivered costs of biomass supply in 2024 are included. These are estimated costs, which include a profit margin, and should be regarded as indicative only. They are not, and are not meant to be, a price.

This report is an update and expansion of the preceding work done in 2021/22. This analysis includes more resources; with the addition of A grade logs and stumps. The data on resources that were reported on in 2021/22 are updated based on the latest available information.

The potential for biomass supply from new forest, or bioenergy crop plantings such as short rotation coppice is not addressed here.

Approach

The various resources; in-forest residues, municipal wood waste, wood processing residues, orchard residues, straws / stover from arable cropping, port bark, shelter belt turnover / harvest residues, production thinnings, waste thinnings, pruning residues and pulp logs are described in terms of gross volumes (green tonnes and energy) and two levels of recoverability. The estimates of recoverable material vary by resource but are intended to allow for some material being unsuitable for recovery for quality, financial or environmental reasons.

The in-forest, post-harvest residues are assessed as three categories based on the location of the residues, landings, flat to rolling cutovers (suitable for ground-based harvesting) and steep cutovers (cable / hauler harvest). The availability of post-silvicultural treatment residues such as waste thinnings and prunings are affected by slope. The split of forest where logging operations require hauler-based operations versus ground-based operations are estimated from Geographic Information System analysis at a Regional and Territorial Authority level.

The characteristics (moisture content, ash content, gross calorific value and typical net calorific value) of the residues are described.

The costs of the various resources including; any fees for accessing the materials, recovery / harvesting, hogging, screening, loading and transport are estimated based off 2024 costs for capital, fuel, labour etc. These costs are an estimate and are not intended to suggest market prices but as an indicator of where prices might start.

Key results

The woody biomass resource in New Zealand is substantial and is summarised below. These figures are for a variable percentage (1st recovery level) of the gross resources estimated to be available. Full details on the percentages and the gross resources are presented in the methods and a set of appendices (tables) included at the end the report.

The long run supply of material that could be considered for wood and other lignocellulosic biomass fuels is around 7.3 million green tonnes per annum based on the low point in supply

around 2027 caused by historic variation in forest plantings. If the materials that currently have a market (sawmill chip, pulp logs that are utilised domestically and export K grade logs) are excluded the total is around 4.1 million green tonnes per annum.

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
In-forest post-harvest*	3,842,944	2,785,329	2,353,087	2,387,255	2,505,697	2,971,222
MWW**	235,710	253,414	272,779	293,980	317,213	342,698
Orchard	121,511	123,942	126,420	128,949	131,528	134,158
Straw and stover	294,782	300,678	306,691	312,825	319,081	325,463
Shelter belt	81,920	81,920	81,920	81,920	81,920	81,920
Thin to waste	488,544	477,446	332,923	343,142	359,854	392,278
Production thin residues	28,732	26,328	195,881	275,250	146,012	69,047
Port bark	227,928	205,135	193,739	227,928	227,928	227,928
Prunings	13,764	61,356	34,909	19,868	14,435	13,764
Douglas fir production thinnings	438,192	470,512	101,744	108,498	-	-
Sawmill chip surplus	569,085	569,085	569,085	569,085	569,085	569,085
Pulp log (surplus to domestic demand)	2,120,926	368,845	-202,915	-101,579	21,617	257,422
KIS, etc grade logs***	4,211,674	3,247,273	2,843,215	2,953,903	3,643,362	4,497,075
Total	**12,675,712**	**8,971,263**	**7,209,478**	**7,601,024**	**8,337,732**	**9,882,060**

*Data in cubic metres per annum, ** Municipal wood waste ***excludes K grade, includes, KIS, KS and KI

Potential resources that could be used but are not suggested as residual resources are A grade logs and stumps. Volumes of these resources estimated to be available (green tonnes per annum) are shown below.

A summary of the volumes over time is shown on the next page.

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
A grade logs	6,438,550	11,008,204	8,500,522	6,742,599	6,798,078	7,340,516
Stumps	250,296	175,200	133,641	133,427	146,243	158,162

SRF eucalyptus forests	340,000	340,000	340,000	340,000	340,000	340,000

An estimate of current use of these residual woody resources is that around 290,000 green tonnes per annum is being used. However, this figure is likely to increase in the future as coal burning operations look to low carbon alternatives for their heat supply. The declining supply of natural gas from domestic sources along with the associated rising prices for gas may also lead to increased interest in wood as a process heat fuel. This use of the residuals needs to be tracked and publicly reported to give confidence to potential wood fuel users around available supply.

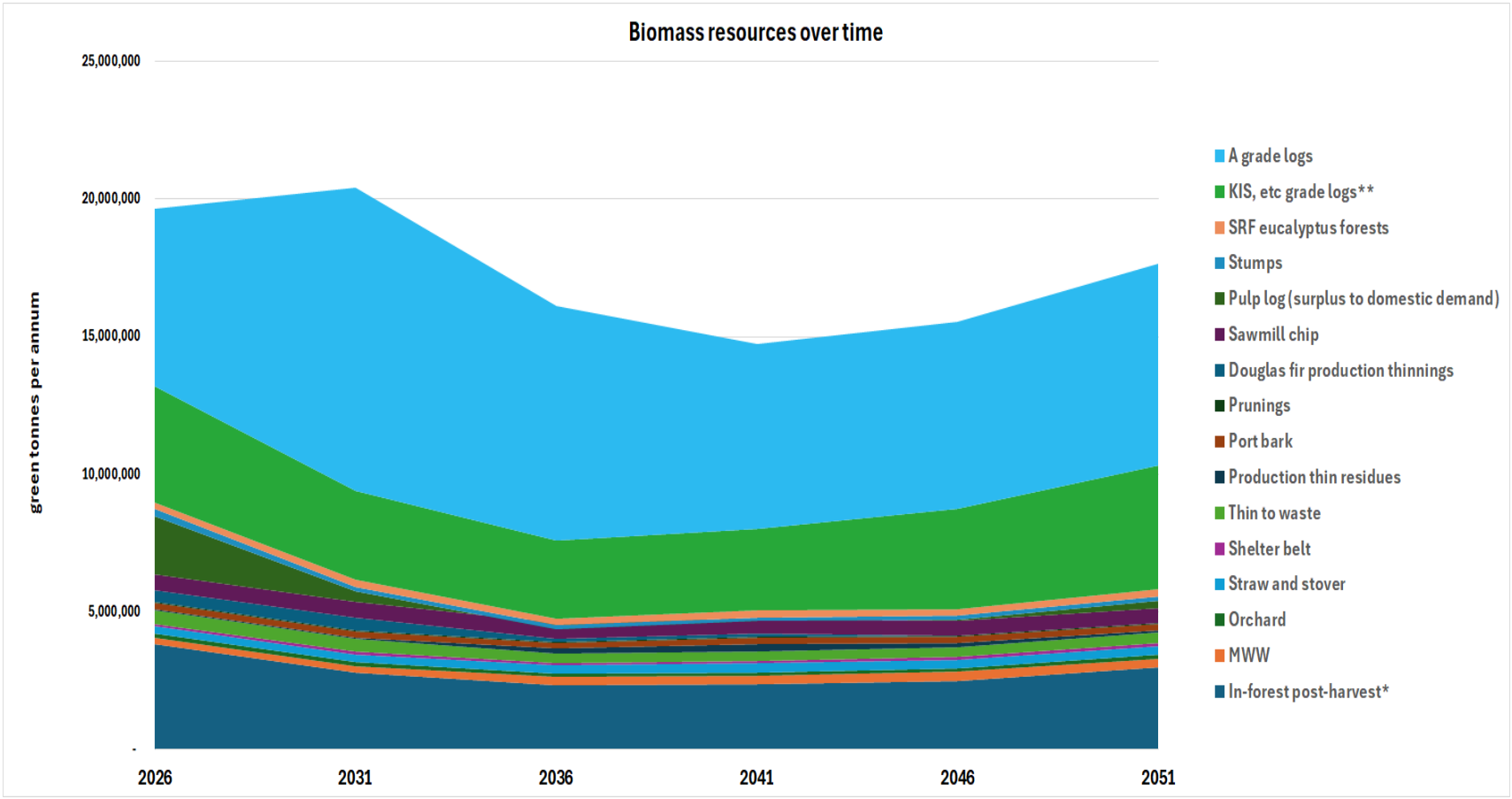
The cost of supply was estimated, and a national level cost supply curve generated.

Further work

The data in this report is based on data available as of August 2024. As plantation forestry derived resources are a fundamental component of the woody biomass and as the situation regarding forestry plantings and removals changes over time this data will need updating in the future. The initial analysis and report were done in 2017, with an update in 2021 and this update is 3 years after that. It is suggested that another update be considered in 3 to 4 years' time.

A further critical issue is the increasing amount of use of some of these resources as boiler fuel replacing coal. Examples are the conversions of the Danone dairy factory near Balclutha from LPG to wood, the conversion Canterbury DHB boilers from coal to wood and the interest from other parties in similar conversion. Tracking the volume and location of this use so that the available volumes are accurately represented is of increasing importance.

Analysis of the potential for new afforestation to provide future supply is possible using GIS based models with input layers such as slope, site productivity, roading network, land prices, carbon prices and log prices (including energy products).


Biomass resources over time
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
-
green tonnes per annum
2026
2031
2036
2041
2046
2051
A grade logs
KIS, etc grade logs**
SRF eucalyptus forests
Stumps
Pulp log (surplus to domestic demand)
Sawmill chip
Douglas fir production thinnings
Prunings
Port bark
Production thin residues
Thin to waste
Shelter belt
Straw and stover
Orchard
MWW
In-forest post-harvest*

Residual biomass fuel projections for New Zealand; 2021 - Indicative availability by region and source

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Introduction

The intent of this report is to present estimates of current and future possible regional volumes of combustible biomass residues suitable for heat, heat and power, fuel supply and potential feedstock for biofuel production. Assessments are given for every 5-year period out to 2053; for gross supply and estimates of realisable / recoverable supply biomass (green tonnes) and energy (GJ).

The assumptions behind the information are provided to support the findings of the assessment and to allow others to apply their own interpretations to the base data on the levels of recoverable biomass.

The resource analysis covers in-forest harvest residues (from landings and cutover), thin to waste volumes from forests, pruning residues, unutilised wood processing residues, municipal wood waste, horticultural wood residues and agricultural (straw & stover) residues, bark from ports and material from shelterbelt turnover. Volumes of A, K and pulp grade logs are also estimated. The recoverable volume of stumps is also calculated, based on assumptions around reasonable limits on slope and soil disturbance.

In-forest residues were split into categories by site type; – landing / roadside, flat to rolling terrain (ground-based harvest) cutover, steep terrain (hauler harvest) cutover. These residues have differing levels of accessibility, cost of recovery, and levels of recoverability (Table 1). There are environmental limits which need to be applied to some resources (e.g. straw and stover and in-forest cutover residues) to maintain soil fertility, biodiversity, and potentially mitigate soil erosion.

Estimates of currently surplus quantities available from wood processing facilities are included in the assessment. Wood processing residue availability estimates excludes those that are estimated as already being used by the wood processing industry for the production of on-site heat and power.

The availability of pulp logs is based on the quantities remaining after meeting the demands of the pulp, paper, and fibre board industries.

Bark from ports is reported as a potential fuel resource. However, there are issues around this material and its availability in the future;

- most of it is currently used for landscape mulch or composting
- predicting future volumes is difficult given the uncertainty around the impact of both phytosanitary regulations and log export markets / volumes.

Estimates of the amount of greenhouse gases (GHGs) that could be reduced by displacing coal with biomass are made for national level data.

GLOSSARY

CO	cutover
GB	ground- based
GHG	greenhouse gas
GCV	gross calorific vale
GJ	Gigajoule
g. t.	green tonne = wood with an as received moisture content
LR	landing residues
MDF	medium density fibreboard
MWW	municipal wood waste
NEFD	national exotic forest description
NCV	net calorific value
odt	oven dry tonne = biomass at 0% moisture content
p. a.	per annum
Stover	corn stalk from maize grain harvesting
WPW	wood processing waste

Residuals Assessment: outline of approach and categories

Table 1 - outline of residue data categories and recoverability levels and factors

	Gross volume	**Recoverable level 1**	**Recoverable level 2**
Municipal wood waste	Total estimated at landfill	= Gross x 0.80 (to exclude treated and highly contaminated wood)	= Gross x 0.60 (for losses and sites to remote to use)
Wood processing waste	Gross amount after producer sites own use	= Gross x 0.95 to account for losses	=Gross x 0.90 for small remote sites and lack of participation
Horticultural residues	Gross amount produced	= Gross x 0.80 for losses during gathering and screening etc.	=Gross x 0.65 to account for sites too remote, small or lack of interest in utilisation)
Agricultural residues	Gross amount produced; accounting for 50% retention for soil sustainability	= Gross x 0.80 for losses during gathering and screening etc.	= Gross x 0.60 to account for sites too remote, small or lack of interest in utilisation)
In-forest Landing	Gross amount	= Gross x 0.80 to small / hard to recover	=Gross x 0.65 sites too remote
In forest Cutover **a. Ground-based** **b. Hauler**	Gross amount; a Gross amount; b	a. = Gross x 0.70, rest to small / hard to recover b. = 10% recoverable; rest assumed to be too expensive and risky	a. = Gross x 0.55; allows for sites that are too remote b. = 5% recoverable; rest assumed to be too expensive and risky
Port bark	Gross amount estimated from log volume	= Gross x 0.80 (to allow for losses and sales to other users)	= Gross x 0.60 (to allow for losses and sales to other users)

Shelter belt turnover	Gross amount estimated from mapping of shelter belts	= Gross x 0.80 to small / hard to recover	= Gross x 0.65 sites too remote
Production thinnings	Gross volume of residues (not thinnings volume)	= Gross x 0.80 to small / hard to recover	= Gross x 0.50 sites too remote
Waste thinnings	Gross volume of thinnings	= Gross x 0.50 to small / hard to recover	= Gross x 0.25 sites too remote
Prunings	Gross volumes of prunings	= Gross x 0.30 for flat / rolling terrain only	=Gross x 0.15 close to roadside only
Pulp logs	Volume of pulp logs after existing market demands are met	= Gross x 0.90 to small / hard to recover	= Gross x 0.90 sites too remote
K grade	Gross volume of KIS, KI and KS grades	= Gross X 0.95 **to small / hard to recover**	= Gross X 0.80 **to small / hard to recover**
A grade	Gross volume of KIS, KI and KS grades	= Gross X 0.95 **to small / hard to recover**	= Gross X 0.95 **to small / hard to recover**
Stumps*	Gross volume of stumps from areas suitable from ground-based harvest. Steep terrain excluded. 1 in 4 stumps removed.	= Gross X 0.70 **to small / hard to recover**	= Gross X 0.40 **to small / hard to recover**
In-forest total	In-forest total	In-forest total	In-forest total
All biomass totals	All biomass Gross totals	All biomass total at recoverability level 1	All biomass total at recoverability level 2

***Gross volumes assume 350 stumps per ha, taking only 25% of these with each stump having a recoverable volume of 0.2 m3.**

Methods

FUEL CHARACTERISTICS

Fuel characteristics (moisture content, ash content, net and gross calorific values) for the different resources were derived from a range of sources; including Trolove and Garrood (2007), Hall (2000, 2023), EECA (2010), van Loo (2008) and a range of unpublished laboratory testing results from bioenergy studies conducted by NZFRI and Scion (Veritec Laboratory reports).

COSTS

Indicative delivered costs (including profit margins of 10%) were derived using 2024 cost inputs for capital, fuel, labour and consumables, etc. and the transport and harvesting system costing template (Excel spreadsheet) in Riddle (1994), revised by Blackburne (2009). Capital costs were sourced from the INFORME harvesting price guide (2023) and various other sources for items such a fuel, oil, tyres, labour, etc.

The same process was used on transport costs. Forest residue transport distances are based on forest industry data for average log hauls (Galbraith, 2007) and estimates of other distances derived from Google maps etc. Standard 44 tonne Gross Vehicle Mass (GVM) trucks were used in the transport cost analysis. Potentially the use of high productivity motor vehicles (HPMVs) may reduce transport costs in the order of 5 to 10%, but these larger units are not able to use all rural roads due to bridge weight limit restrictions.

These indicative costs do not necessarily reflect actual delivered prices as site specifics such as transport distance, limitations on truck size due to access restrictions and scale of demand can have a substantial influence. Costs were derived based on full utilisation of equipment, in reality some idle time will likely occur; increasing operation costs and risks which would be reflected in delivered prices.

However, as technology develops, and system productivity improves costs may reduce over time. For example, recent innovations in chipper technology are expected to substantially reduce fuel consumption in this part of the system (where chipping is applicable).

IN-FOREST RESIDUES - MAXIMUM VOLUMES

Forest harvest potential varies over time due to the uneven age class distribution of the forests and can be estimated using data from the national exotic forest description (MPI, 2023). If we are looking at long-term secure supply, we also need to consider the long-term (out to 2053) volume as the maximum supply, not the peaks. that might occur before then. This is important because in-forest residue resource is the largest biomass resource in New Zealand, and its fluctuations have considerable effect on the volumes available.

The low point in forest harvest and therefore in-forest harvest residue supply tends to occur at around 2035 to 2039.

IN-FOREST RESIDUES SMOOTHING

Due to the peakiness of the forest plantings (based of the mid 1990s planting boom) the residue calculation based on the forest age class data is also peaky. It is unlikely that the

forest harvest will reach the maximum peak of potential wood available supply, as the required necessary harvesting infrastructure is not likely to be available. Therefore, some smoothing of the harvest is predicted to occur (MPI wood availability forecasts, 2021). In the analysis here, smoothing of the data has been applied by averaging of adjacent periods.

WOOD PROCESSING RESIDUES

Wood processing volumes were derived from a combination of data from Scions wood processing database and the EECA heat plant database; which allows estimates of the volume of wood processing residues produced along with the demand for those residues at an individual processor level.

MUNICIPAL WOOD WASTES

Estimates of municipal wood waste were derived from a survey of municipal landfills (Ireland-Blake 2017) conducted as part of the Scion Biofuels Road Map project. Anecdotally there is a further significant amount of wood waste going to non-municipal clean fill sites that has not been captured.

PORT BARK

Data on bark produced from a log export port was obtained and related to the volume of logs being exported. This data was used to estimate the volume of bark being produced at other log export ports. The unknown variable going forward is the log export volume. This has been estimated based on domestic processing demand and projected log volumes available.

HORTICULTURAL RESIDUES

Horticulture and Viticulture residues are principally derived from the removal of old or unwanted trees and vines. Data on this was derived from Saggar et al 2007, which indicates that turnover rates in orchards range from 4% to 12% per annum depending on the crop. The amount of material is adjusted over time allowing for a small expansion of the industry. Not all the estimated gross material will be available for cost / access reasons and recoverability was set at 80% (high) and 65% (low) of the gross.

AGRICULTURAL RESIDUES (STRAWS AND STOVER)

The amounts of straw and stover residue produced were estimated based on Saggar et al., (2007) and Ministry of Agriculture and Forestry (MAF, 2011). Further, more recent data was obtained from the Foundation for Arable Research. The land area under crops was derived from the land cover database. The total produced amount of material has to be reduced by half to give the gross available, as half the straw is deemed to be needed to be retained on site for soil nutrition and health (Saggar et al, 2007). Straw and stover data are presented in oven dry tonnes (odt) per annum, as opposed to green tonnes (g. t.) which were used for wood residues. From the gross tonnage we take 50% as the start point; then use two recoverability factors, 80% and 60%, to account for some material being lost during harvest and transport or being inaccessible or sold to other uses such as animal bedding.

SHELTER BELT RESIDUALS

A GIS map layer of shelter belts across New Zealand was used to determine the length of shelter belts present. Google Earth was used as a cross reference for this map layer and as an

estimator of shelter belt width. Taking the length of shelter belts by region, an average width 6 metres and assuming a 50-year life for a shelter belt, harvest volume of 650 ^{m3} per ha of shelterbelt and 30% residuals an estimate of the amount of woody biomass from turnover of shelterbelts was derived.

PRODUCTION THINNINGS RESIDUES

The volume of residual material available from production thinnings was not included in the previous analysis. Residue volumes have been derived from the area by age class of tree crops identified as being planned to have a production thinning in the 2023 NEFD (MPI, 2023). The volume to be extracted was estimated by simulating the size of the trees at production thinning age by region and then taking proportion of that volume as waste generated at landings during stem to log processing.

WASTE THINNINGS

Waste thinnings were not assessed in the previous analysis. In this assessment they are included as we have heard that some forestry companies are considering the extraction of this material as market demand for fuel increases. The area of waste thinnings being carried out was estimated from the 2023 NEFD and the volume of material (stem and crown) was derived from a combination of forestry models PradCalc and NuBalM.

PRUNINGS

Prunings are considered an unlikely source of biomass due to the cost of extraction. However, the material exists and there have been enquiries about extracting it. As the analysis of thinnings etc had identified the areas being pruned (MPI, 2023) and the crown mass of the trees can be estimated using NuBalM the amount of crown mass available from pruning was estimated, based on the assumptions that there would be 2 pruning lifts and that at least 1/3rd of the green crown was left after pruning.

PULP LOGS

Pulp logs a have a market in many regions, but not all. Examples of areas with no major adjacent pulp log market are; Gisborne, Wairarapa and Douglas-fir in Southland / Otago and parts of West Coast. Therefore, there are some regions where the pulp logs are potentially available for use as an energy feedstock. Further there are indications that the existing pulp log buyers may be challenged by the energy market as pulp logs sell for below the full cost of production. Our approach with pulp logs is to determine the gross supply from forests, which is reported) and then show the regional availability after the incumbent buyers off-take is allowed for.

SAWMILL CHIP

Sawmill chip also generally has existing outlets, with either pulp and paper, fibre board and chip exports being the main destinations. However, there are already some mills selling chip as fuel. Based on the Scion wood processing database we will estimate the quantity of sawmill chip that is available and report that volume. Information on where the sawmill chip goes is not publicly available in most cases. The amount of chip produced varies slightly from mill to mill but is typically in the order of 25 to 28% of the log volume.

K-GRADE LOGS

K grade logs are low grade sawlogs that are a common log product in most radiata pine plantation forests. They make up on average around 24% of the total recoverable volume in a harvest block although this percentage can vary from 17 to 33% depending on the region and regime. The available harvest volume for each region was calculated based on the area of pine forests by regime reported in the NEFD (MPI 2023) and then the proportion of K grade logs by regime and district was estimated using PradCalc (Kimberley, 2014). These calculations allow the approximate volume of K grade logs that are likely to occur now and in the future. The price of K grade logs was derived from a log price database. The prices for logs have been quite volatile over the last 3 years, so a 3-year monthly log price average was used (Table 2). For K grade logs the gross volume was estimated by forest crop modelling and then recovery rates of 90% and 70% were applied for recoverability levels 1 and 2 respectively.

Table 2 – K grade log prices (average $ per green tonne delivered)

Grade	3-year average
A	$117
K	$105
KS	$103
KI	$ 94
KIS	$ 78
K Average	**$ 95**

DOUGLAS-FIR PRODUCTION THINNINGS

Douglas-fir generally uses different regimes to radiata pine, and it is common that Douglas-fir stands have thinning that can be a production thinning if there is a suitable market for the logs. Theses logs tend to be small diameter. They are not generally a preferred feedstock for MDF or pulp and paper in New Zealand. A lot of the Douglas fir resources in New Zealand are in Otago and Southland where the key outlets for pulp logs are MDF and export. The volume of Douglas fir produced was derived from areas of Douglas fir by age class reported in the NEFD (MPI, 2023) and estimated yields from production thinning using a conventional regime. The logs produced could be a fuel resource if the price paid is sufficient to cover the costs of logging, transport and chipping with some margin for the grower.

STUMPS

Stumps are created on every logging site within the plantation forest estate. In some countries (Finland) stump harvesting for biomass for energy has been practised for some time. In New Zealand stump harvesting has been limited to areas of land clearing (forest to dairy conversion) and for supply to a resin extraction plant (operation now closed). In our analysis of the potential resource, we have made some assumptions that affect the volume available

significantly. Firstly, we assume that any land steep enough (over 19 degrees) to require hauler harvesting is not suitable for stump harvesting due to issues arising around rainfall, sediment production and erosion. Secondly, we assume that only 1 in 4 stumps is removed – this is a limit applied in some jurisdictions to limit the level of soil disturbance and soil carbon loss. Stump volumes are assumed to be 0.2 m^3 per recovered stump (anecdotal data from forest to farm conversions supported by volume estimate calculation) and that there are 350 stumps per hectare.

A GRADE LOGS

A grade logs are larger diameter than K grade, with smaller knots, but are largely exported rather than processed in New Zealand. They comprise 22 to 29% of the total recoverable harvest volume, depending on the regimes used (pruning or not has a significant influence). Based on the NEFD data for the various regions, including that round the regimes an estimate can be made for the volume of a grade logs being produced.

SHORT ROTATION FORESTS

New Zealand has a limited are of what would be called short rotation forest (SRF) and none of it is planted in Pinus radiata. The only areas of SRF of significance are in Otago and Southland and are in Eucalyptus nitens, which is grown for chip export. In theory this material could be sold into the New Zealand energy market of the price was attractive.

Results

RESIDUAL MATERIAL - FUEL CHARACTERISTICS

Typical fuel characteristics for the range of resources assessed are shown in Table 3. The gross calorific values (GCVs) are adjusted for ash content. The net calorific values (NCVs) reflect the effect of moisture content.

It should be noted that the GCVs and NCVs are not absolute values - they are typical averages. Biomass is inherently variable and multiple samples give a better indication of long-term average energy values than any individual sample.

Woody biomass is by its nature quite variable from site to site as well as piece to piece, and results for individual samples will likely vary from the averages. For example, some Pinus radiata woody biomass has high levels of resin content and this can push the net energy content for that sample up as high as 22 to 23 MJ/kg oven dry. However, these levels are not a typical average for softwoods, which is generally accepted as being 18.7 to 18.9 MJ/kg oven dry.

Further, there are variations in ash and moisture content from sample to sample that will change both the GCV and the NCV. Again, the values presented are typical averages. When conducting a site-specific analysis of the opportunities it is important to consider the impact of ash, moisture etc. and get some samples tested. Setting of delivered fuel quality standards is therefore important.

Likely ranges for moisture, ash and NCV are shown in Table 4.

In the tables below; CO = cutover, GB = ground based, MWW = municipal wood waste and WPR = wood processing residues.

Table 3 - summary of fuel properties by residue type

	Moisture Content % wet basis	**Ash Content % dry weight**	**GCV, GJ per tonne**	**NCV, GJ per tonne**	**NCV - 5%**	**NCV + 5%**
Landing stem	**56.5**	1.8	19.8	6.8	**6.5**	**7.2**
Landing mixed	**54.0**	4.5	19.3	7.0	**6.7**	**7.4**
CO GB stem	**51.5**	0.9	20.0	7.7	**7.3**	**8.1**
CO GB mixed	**51.5**	4.8	19.2	7.4	**7.0**	**7.8**
CO Hauler stem	**51.5**	0.9	20.0	7.7	**7.3**	**8.1**
CO Hauler mixed	**51.5**	4.8	19.2	7.4	**7.0**	**7.8**
MWW	**31.5**	4.5	19.3	11.0	**10.5**	**11.6**

Orchard*	**51.5**	1.5	19.9	7.9	**7.5**	**8.3**
Straw	**13.5**	6.8	18.1	14.4	**13.7**	**15.1**
Stover	**20.0**	5.6	17.8	13.8	**13.1**	**14.5**
WPR Wood**	**58.0**	0.5	20.1	7.3	**6.9**	**7.7**
WPR Bark debarker	**53.0**	3.0	19.6	7.4	**7.0**	**7.8**
WPR Bark yard	**58.0**	7.5	18.7	6.1	**5.7**	**6.4**
Logs (K, SRF and A)	**58.0**	0.3	20.1	7.1	**7.4**	**6.7**
Stumps	**58.0**	8.7	24.9	22.9	**24.0**	**21.7**

*Includes vineyards and kiwifruit orchards as well as pip, stone fruit and citrus orchards.

**includes a mix of residues (sawdust, off-cuts and dry shavings)

In-forest residues can be seasoned, or force dried after hogging or chipping. Fuel treated in this way is likely to have a moisture content of around 35%, with an NCV of around 11 GJ per tonne.

In-forest residues, such as waste from thinnings and prunings, are expected to have properties similar to ground-based cutover residues.

Table 4 - ranges of fuel properties likely to be encountered

	Moisture Content	**MC -10%**	**MC +10%**	**Ash Content**	**Ash -10%**	**Ash +10%**	**NCV, GJ/tonne**	**NCV -10%**	**NCV +10%**
Landing stem	56.5	50.9	62.2	1.8	1.6	1.9	6.8	6.1	7.5
Landing mixed	54.0	48.6	59.4	4.5	4.1	5.0	7.0	6.3	7.7
CO GB stem	51.5	46.4	56.7	0.9	0.8	0.9	7.7	6.9	8.5
CO GB mixed	51.5	46.4	56.7	4.8	4.3	5.2	7.4	6.7	8.1
CO Hauler stem	51.5	46.4	56.7	0.9	0.8	0.9	7.7	6.9	8.5
CO Hauler mixed	51.5	46.4	56.7	4.8	4.3	5.2	7.4	6.7	8.1

MWW	31.5	28.4	34.7	4.5	4.1	5.0	11.0	9.9	12.1
Orchard / Vineyard	51.5	46.4	56.7	1.5	1.4	1.7	7.9	7.1	8.7
Straw	13.5	12.2	14.9	6.8	6.1	7.5	14.4	13.0	15.8
Stover	20.0	18.0	22.0	5.6	5.0	6.2	13.8	12.4	15.2
WPR Wood	54.5	49.1	60.0	0.7	0.6	0.7	7.3	6.6	8.0
WPR Bark debark	53.0	47.7	58.3	3.0	2.7	3.3	7.4	6.7	8.1
WPR Bark yard	58.0	52.2	63.8	7.5	6.8	8.3	6.1	5.4	6.7
Stumps	58.0	56.0	60.0						
Logs	58.0	56.0	60.0						

*Logs and unprocessed landing residues can be dried to around 35% by simply stockpiling them and leaving them for 3 to 4 months.

Straw and stover volumes are substantial in some regions (Canterbury) - and they are included as they are a combustible ligno-cellulosic biomass. However, these materials may not be suited to existing boiler infrastructure and may require purpose-built boilers that are designed for straws. Otherwise, densification and co-firing at low percentages (>5%) in coal boilers may be possible. The principal issue with straws is the high ash content and ash composition which leads to lower ash fusion temperatures which can cause fouling of the boiler if combustion conditions are not set correctly. There is potential to co-fire both wood pellets and straw pellets.

RECOVERABILITY FACTORS

There is a difference between the gross amount of a biomass resource potentially available and that which can realistically recovered or should be recovered. The recoverability factors used in this analysis are outlined in Table 5. The recoverability factors were set based on industry feedback.

Table 5 – recoverability factors by resource type

Residue type	Recoverability factor 1 (% of gross)	Recoverability factor 2 (% of gross)
In-forest residues – landings	80	65
In-forest residues - cutover	70	55
Wood processing residues	95	90
Municipal wood waste	80	60
Port bark	80	70
Horticultural residues	80	65
Straw and Stover*	70	60
Shelter belt residuals	80	60
Production thinnings residuals	80	50
Waste thinnings	50	25
Prunings	30	15
Pulp log	95	90
Sawmill chip	75	50
K grade logs	95	80
A grade logs	90	80
Douglas-fir production thinnings	80	50
Stumps	80	50

*Only half of the total supply of straws is considered to be part of the gross available supply. This is due to the need to retain some of the straw on site to maintain nutrient levels.

COSTS

The costs of producing the biomass as a fuel by categories are estimated here. It should be noted that these are estimates of the costs and are not necessarily the same as a market price, which may be higher. Therefore, they are only an indicator of price. These costs estimates are presented in Table 6 and are based on operating costs as of January 2022. All prices include a fee paid to the owner of the residual biomass. This fee varies with the type of raw material. The costs also include a transport cost for an assumed transport distance of

90 km (residual source to user).

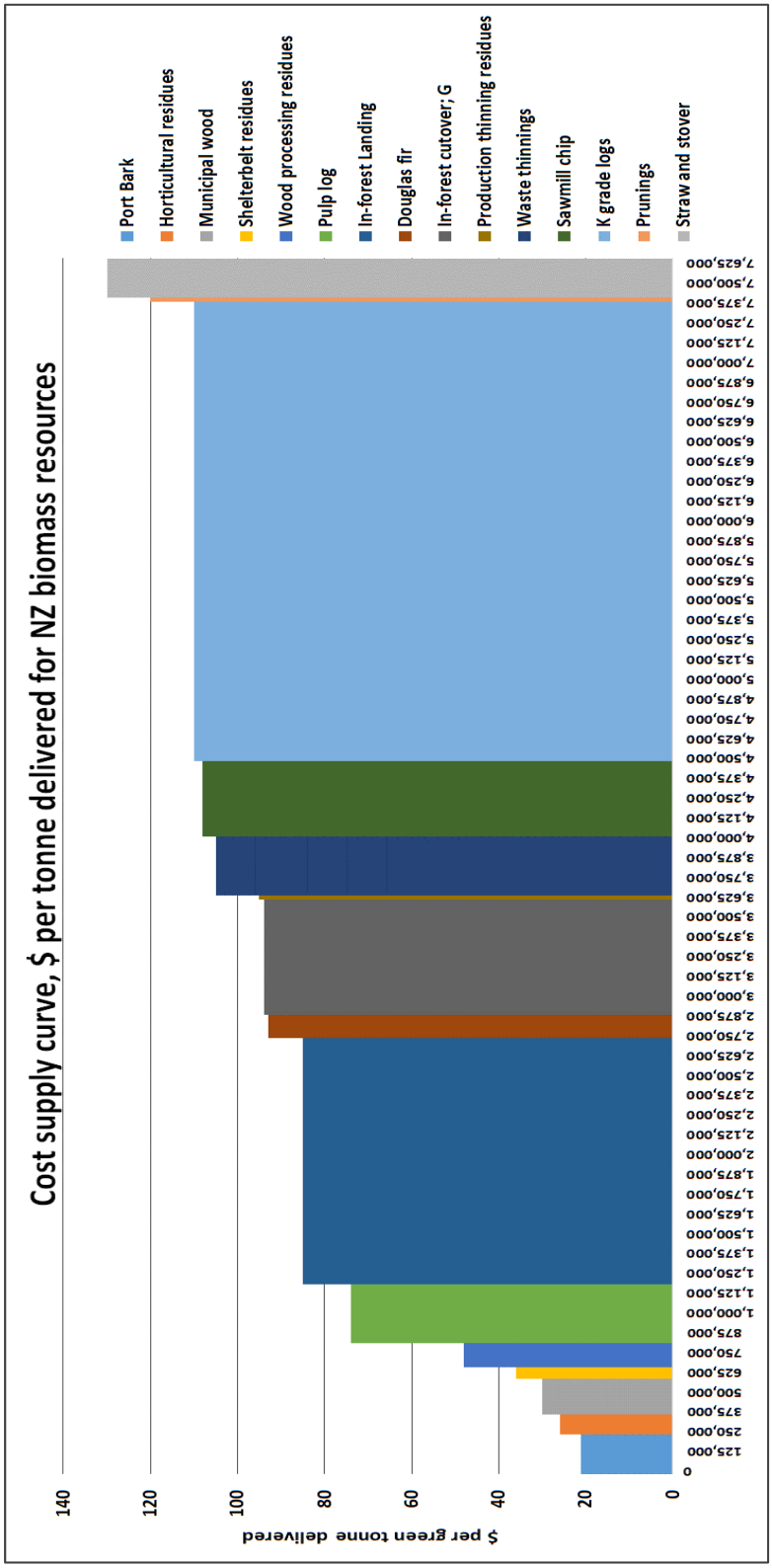
Table 6 – estimated costs for various biomass resources delivered (90 km) in fuel form

Residue type	Biomass owners fee: $ per green tonne	Cost $ per green tonne	Cost $ per GJ
Port bark	$5	$21	$3.04
Shelter belt residuals	$20	$36	$3.27
Horticultural residues	$10	$26	$3.77
Municipal wood waste	$10	$30	$4.35
Wood processing residues	$20	$48	$7.02
Pulp log	$59	$59	$8.55
Straw and Stover*	$100	$130	$11.82
In-forest residues - landings	$25	$85	$12.32
Douglas-fir production thinnings	$65	$93	$13.48
In-forest residues - cutover	$20	$94	$13.62
Production thinnings residuals	$20	95	$13.77
K grade logs	$95	$95	$13.77
Waste thinnings	$20	105	$15.22
Sawmill chip	$80	$108	$15.71
A grade logs	$117	$117	$16.96
Prunings	$5	120	$17.39
Stumps	$25	$145	$21.07

*Straw is assumed to have a “green” moisture content of 15% wet basis

The national level costs supply curve for biomass by resource type and assuming recoverability level 1 for each resource is shown in Figure 1. The amounts available are based on the long run supply which has a low point around 2036 – 2040. The equivalent graph for tonnages is presented in Appendix R. The data in Figure 1 is deemed to be more useful for comparative purposes as the GJ per tonne varies with fuel type.

Figure 1 – Cost ($ per GJ) supply curve for national amounts (GJ per annum) of biomass by resource type



The data in figure one gives a visual indication of the significance of each resource by the amount of energy

VOLUMES OVER TIME BY RESOURCE TYPE AND REGION

The volumes of material available over time for each resource type are presented in the series of graphs below. The data presented in this section are annual averages and cover the period 2024 to 2053 in 5-year steps. The data behind these graphs is presented in appendices A to Q. Further data is presented in the Appendices; gross volume and energy as well as recoverability levels 1 and 2 for both volume and energy.

IN-FOREST RESIDUES

The gross amount of in-forest post-harvest residues available by region over time are shown in Figure 2.

Figure 2 – Gross volume of in-forest post-harvest residues by region, g. t. per annum

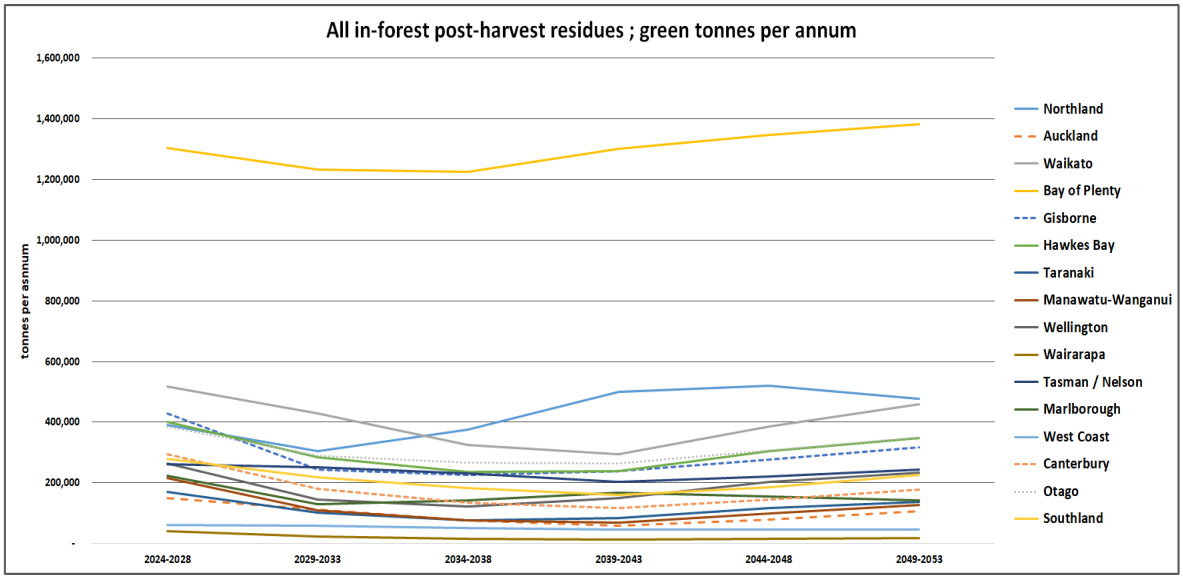
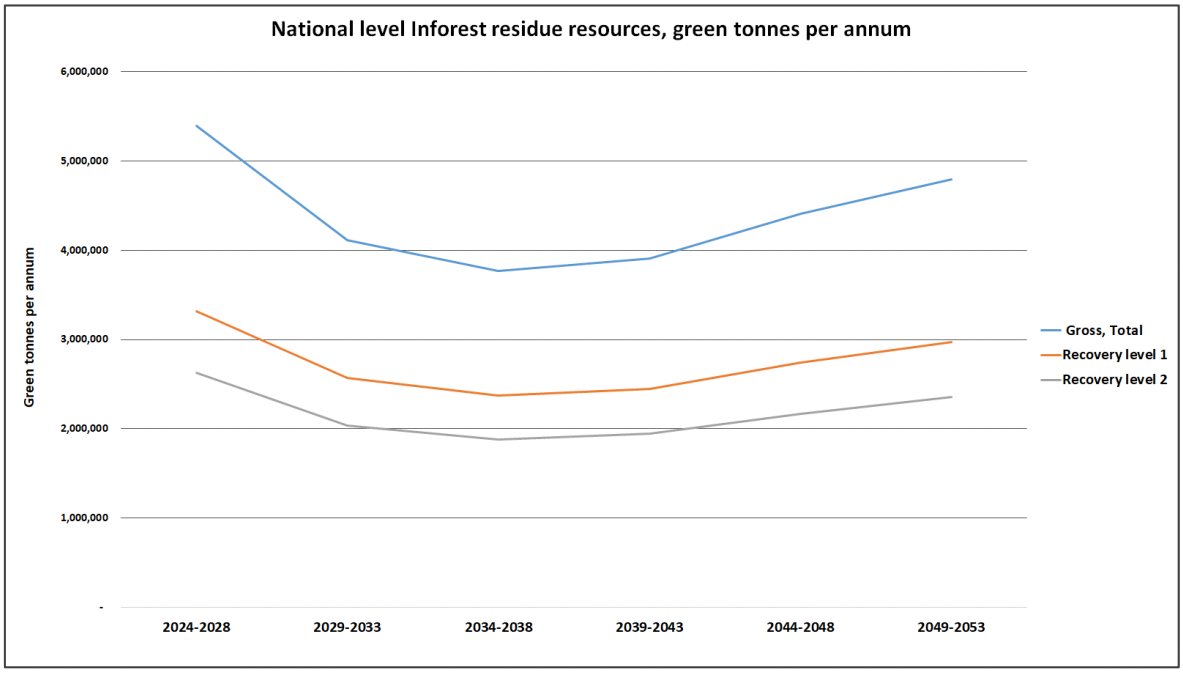


Figure 3 shows the national gross volume of in-forest post-harvest residues and the amounts available assuming different recovery rates.

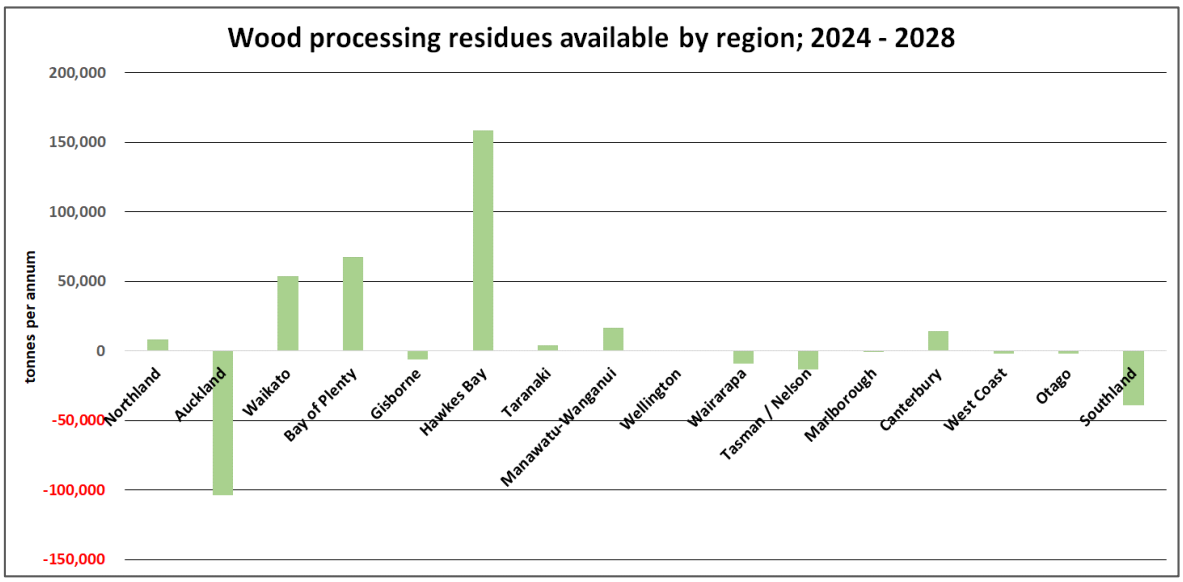
Figure 3 – National volumes of in-forest post-harvest residues



WOOD PROCESSING RESIDUES

The data for wood processing residue production and consumption show that overall, these are close to being in balance. Whilst the data in Figure 4 shows pluses and minuses, the overall deficit is around 8% of the total demand. Given the margin of error on the data (which is a calculation not a measured value) it is suggested that there is little wood processing residue available outside the industry once incumbent users demands are met. There is trading between entities and some of this is across regional boundaries (e.g. Waikato and Bay of Plenty). Unless there are major changes to the wood processing infrastructure these volumes are likely to remain relatively stable over time.

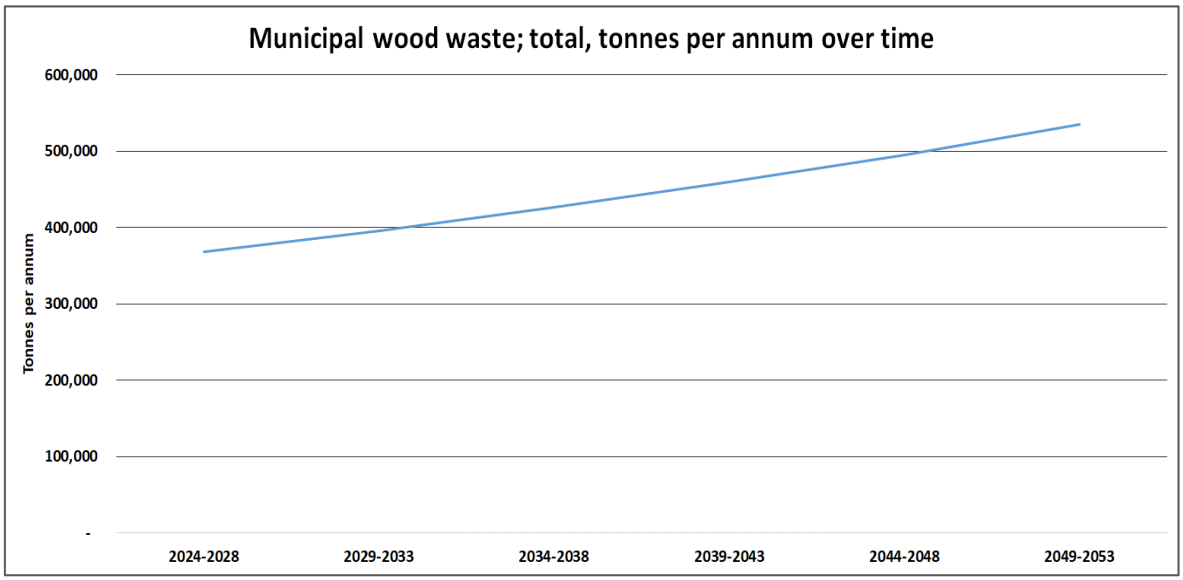
Figure 4 – Wood processing residues by region



MUNICIPAL WOOD WASTES

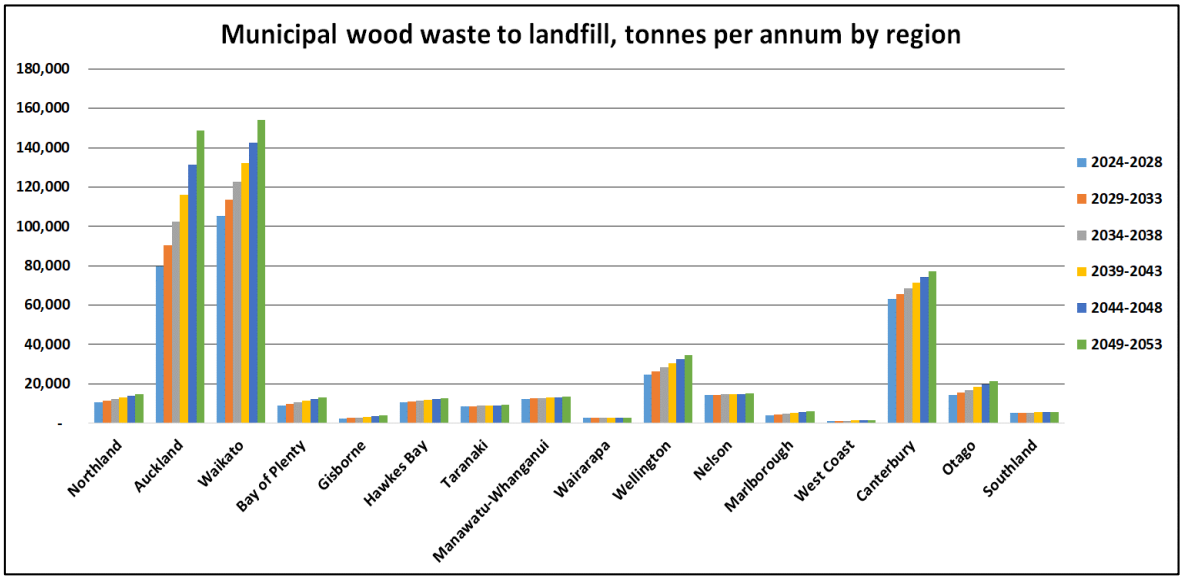
The gross amount of municipal wood waste estimated to be available is shown in Figure 5. Growth in this volume over time is driven by projected population growth. Projections are based on census data.

Figure 5 – Municipal wood waste to landfill, national total



Projections of wood waste to landfills are presented in Figure 6. The increases over time are based on population growth data from census figures, hence some regions have much steeper increases than others.

Figure 6 – Wood waste to landfill by region



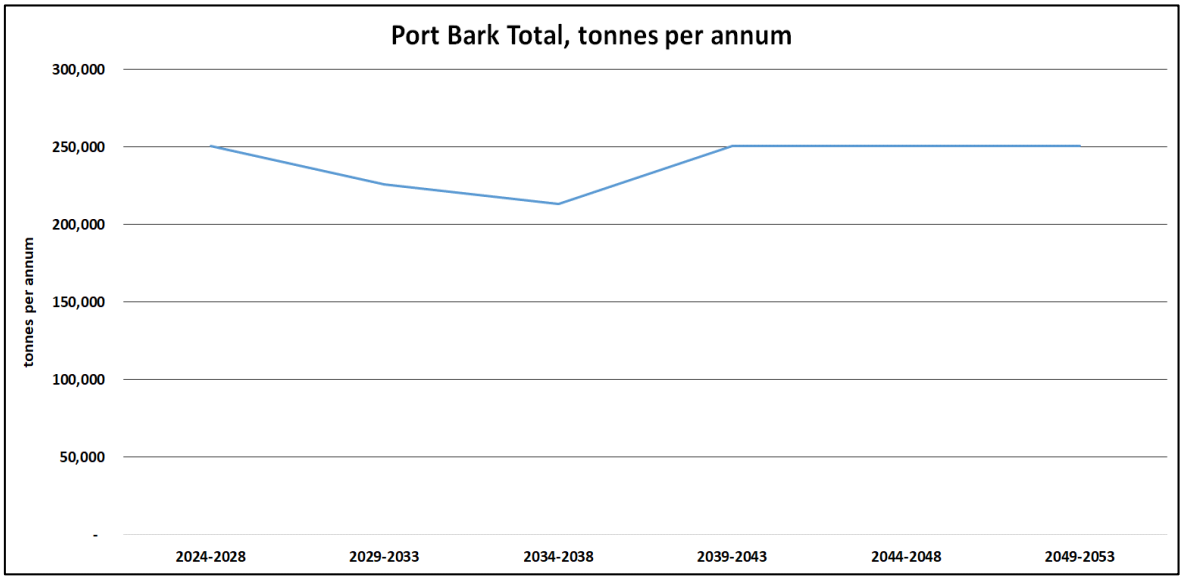
Anecdotally there is a significant amount of wood waste going into "clean-fills" that do not record the amounts of material being dumped. It has been suggested that this amount is roughly equivalent to that which is going into municipal landfills.

More data on the potential resource from the undocumented volume going to clean-fills would be useful but is difficult to find as much of it is not recorded.

PORT BARK

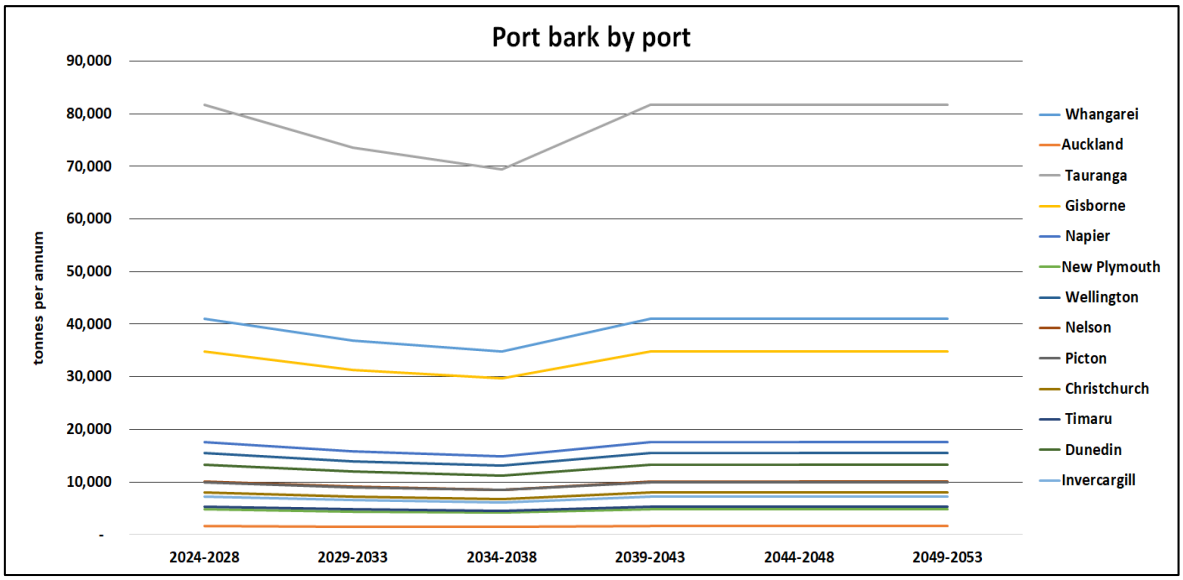
The data in Figure 7 reflects the estimated amount of bark (green tonnes per annum) available at log export ports. This bark is that from log yard debris. The decline in volumes post 2035 is due to the expected drop in NZ's forest harvest and therefore reduced log export volumes.

Figure 7 – Port bark national total



There are 13 ports around New Zealand that export logs. The estimated volume of bark produced for each port is shown in Figure 8. Ports with large volumes of logs passing through them (e.g. Tauranga) have larger volumes of bark.

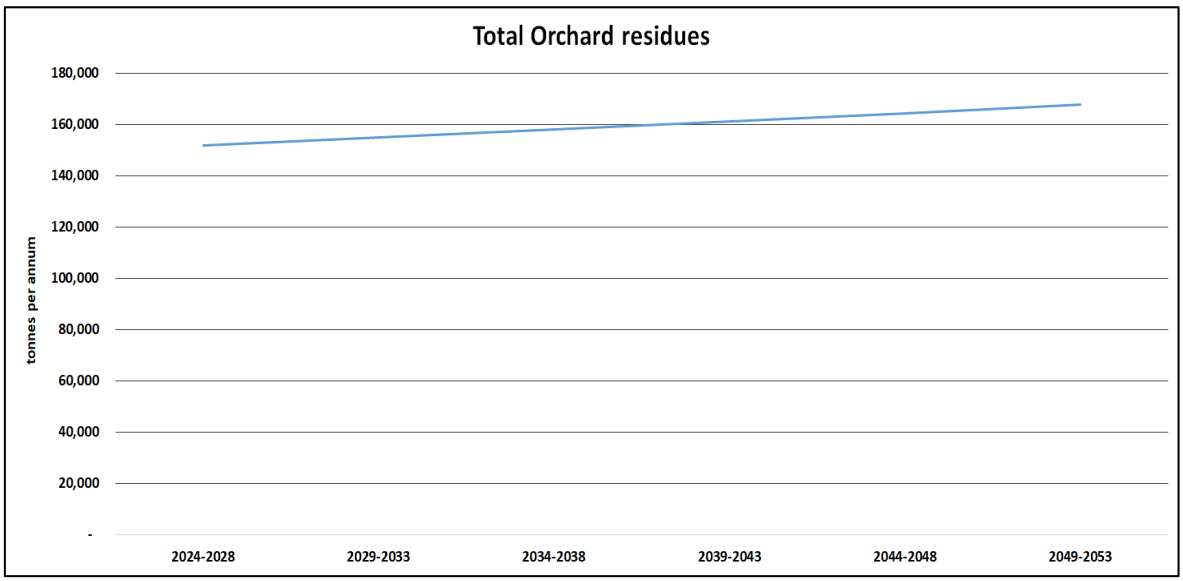
Figure 8 – Port bark by port



ORCHARD RESIDUES

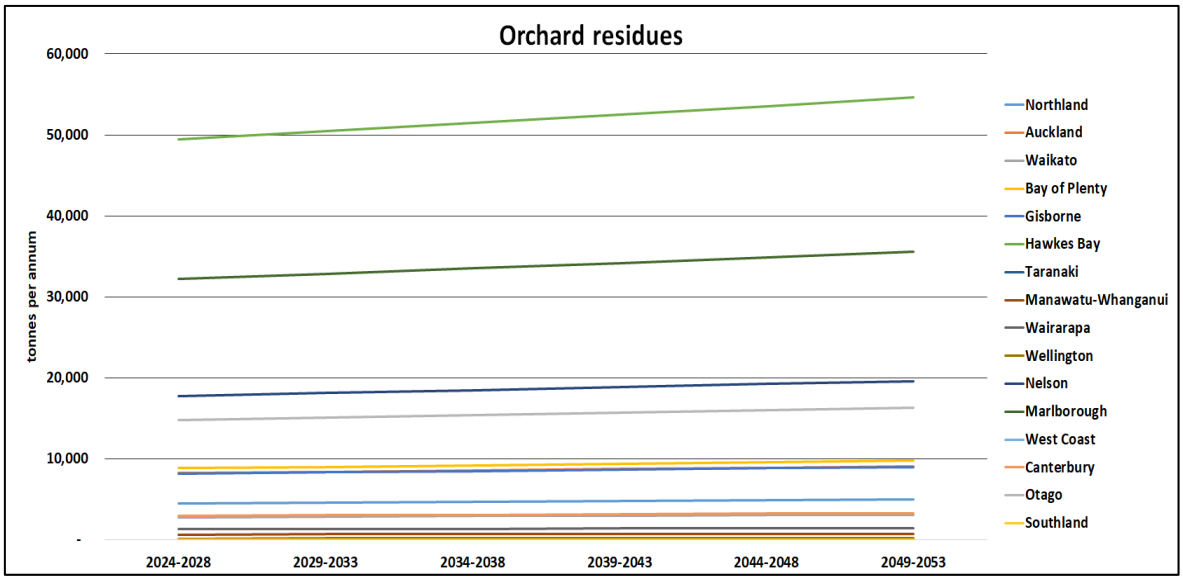
Orchards and vineyards produce woody debris from turn-over of over-mature trees and vines (replacing older plants). Figure 9 shows the volume of this material estimated to be available nationally. The increase in volume over time is due to anticipated increase in area of land used for orchards and vineyards.

Figure 9 – National total orchard residues



The regional availability of orchard residues is shown in Figure 10. Regions with large areas of fruit and grape growing (Hawkes Bay, Nelson, Gisborne, etc.) have higher volumes than some other regions (West Coast, Southland).

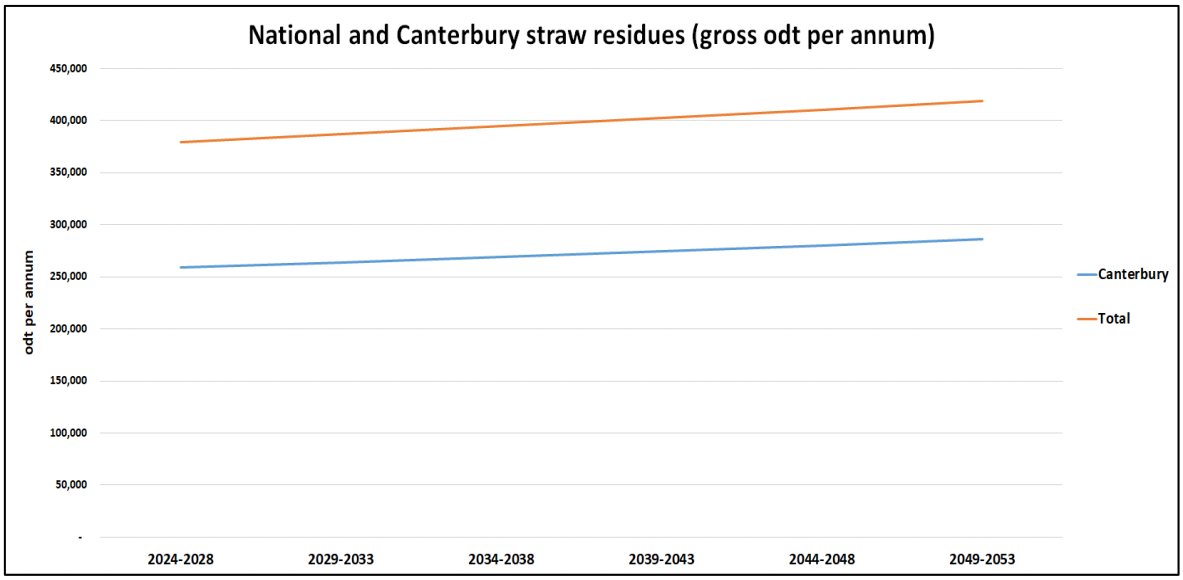
Figure 10 – Orchard residues by region



AGRICULTURAL RESIDUES (STRAWS AND STOVER)

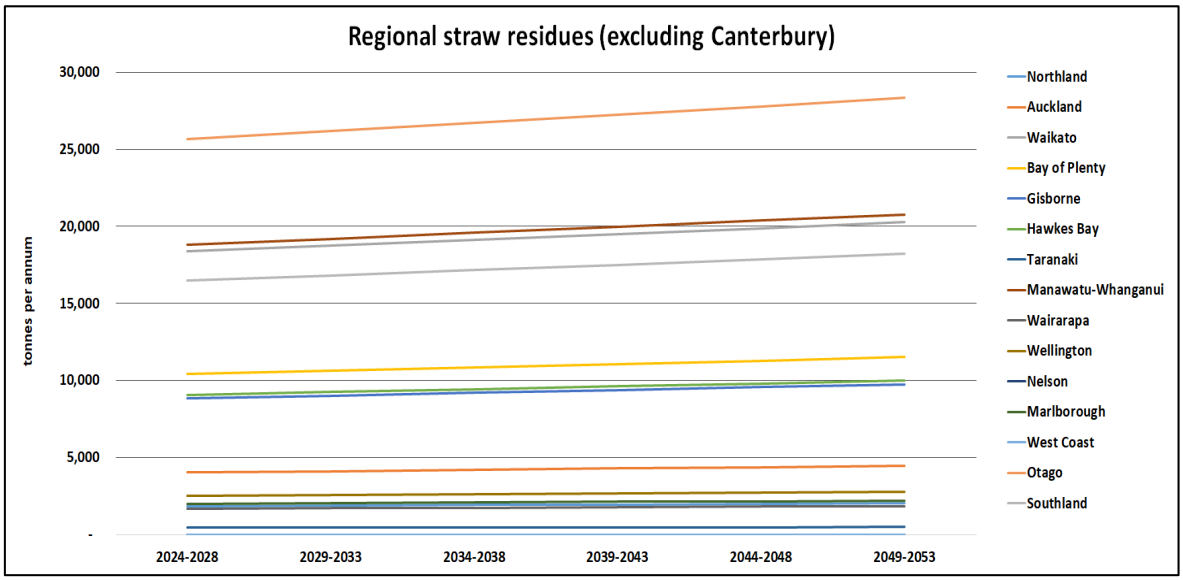
The amount of straw and stover residues potentially available nationally and in Canterbury are shown in Figure 11. Canterbury is included with the national figure as this region has around 70% of the national area under arable crops such as wheat, barley and oats. This figure is the amount that is sustainably recoverable allowing for the retention of half the straw on site as carbon and nutrients for the next crop.

Figure 11 – National and Canterbury region gross straw residue resource



The regional availability (excluding Canterbury) of straw and stover residues is shown in Figure 12. In the North Island the resource is skewed towards corn stover, with much less wheat and barley straw. This estimate does not include maize silage, only the stover residue from corn cropping.

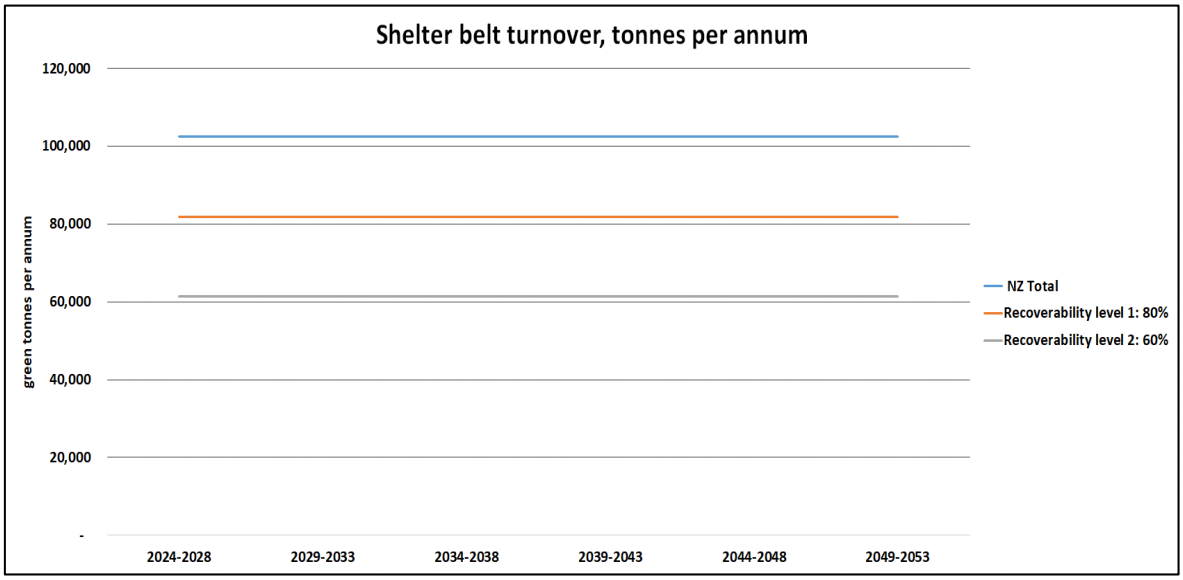
Figure 12 – Regional straw and stover resources (gross).



SHELTER BELT RESIDUALS

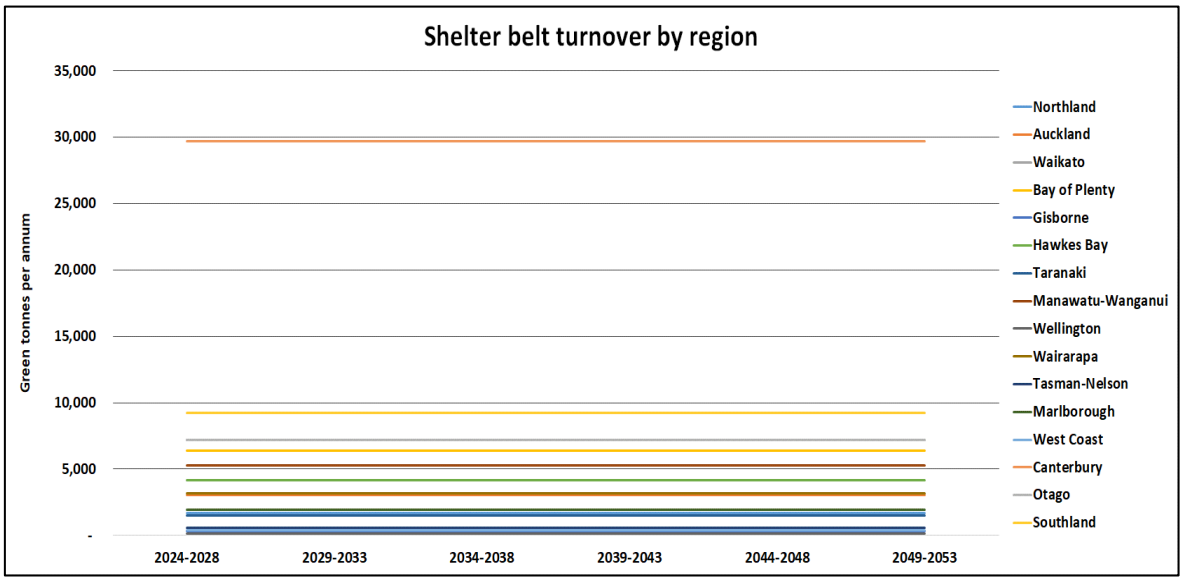
The gross volume of material available from shelterbelt turnover / replacement is shown in Figure 13, along with estimates of the volumes available at recoverability rates of 80 and 60%.

Figure 13 – National gross volume and at recoverability rates of 80 and 60%



The volume of shelter belt turnover residues by region is shown in Figure 14. Canterbury has significantly more of this potential fuel resource than any other region.

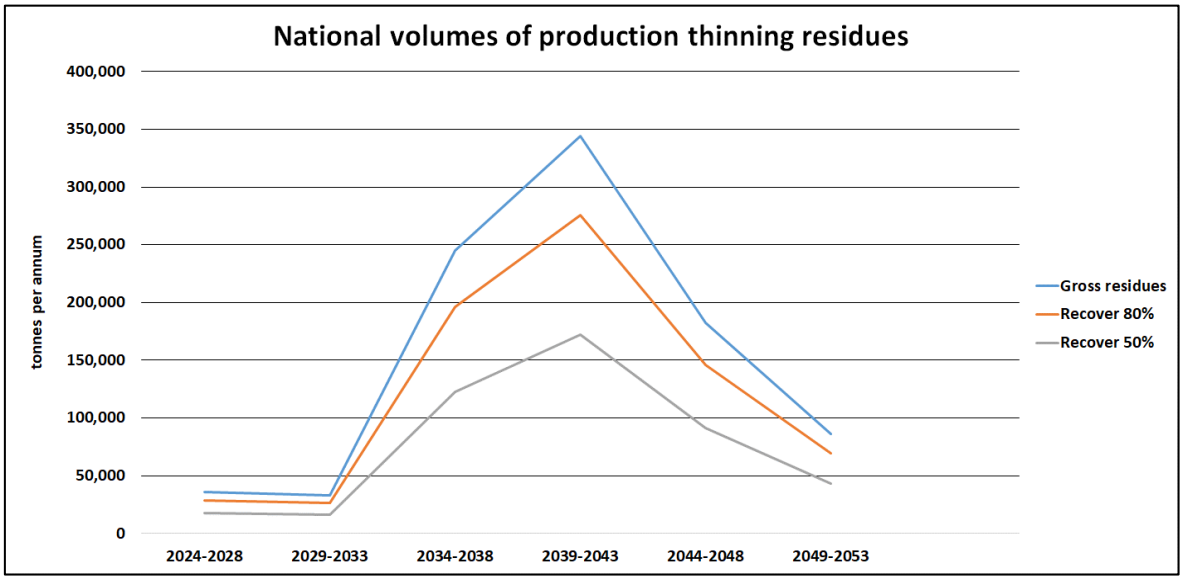
Figure 14 – Shelter belt turnover residues by region



PRODUCTION THINNINGS RESIDUALS

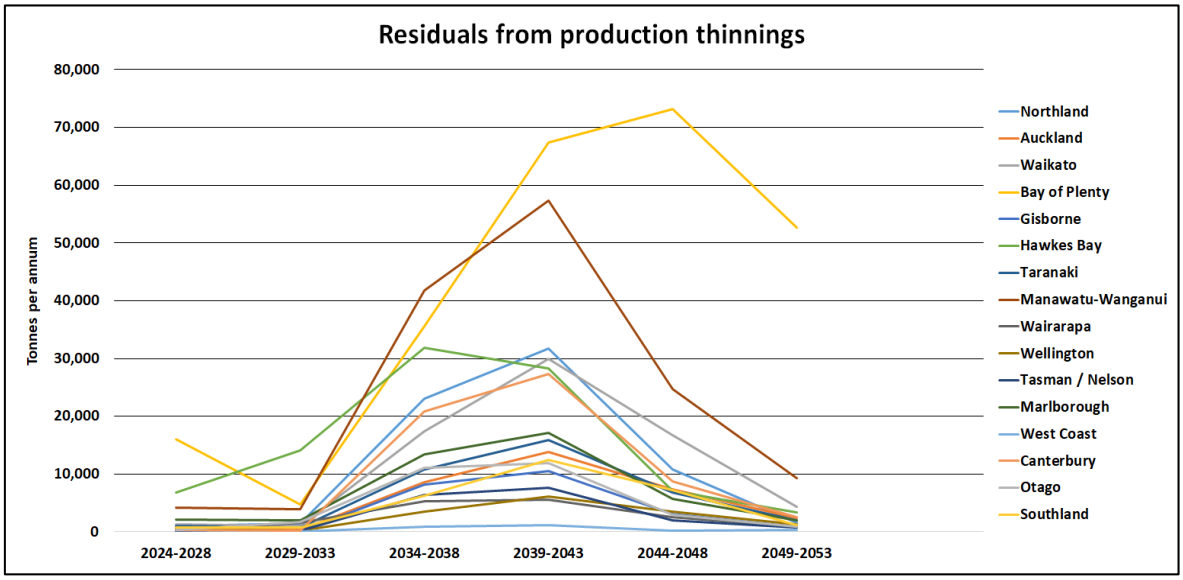
The volume of residues from this source is peaky due to the age class distribution of the forests and changes in regimes used with less production thinning occurring currently than has been the case historically. We have assumed the same pattern of production thinnings going forward into the future as the changes in production thinning volumes may be dictated by the slope of the land being harvested, with changes to harvests off steeper land on the increase reducing the amount of area viable for production thinning. The ability to smooth the supply from this resource by delaying or bringing forward operations is much more limited than with clear-fell operations. The gross volume of residuals from production thinnings is shown in Figure 15, along with volumes assuming recovery rates of 80 and 50%.

Figure 15 – National volumes of production thinnings residues



The volume of production thinnings by region are shown in Figure 16. The Bay of Plenty region has the largest volume of this material.

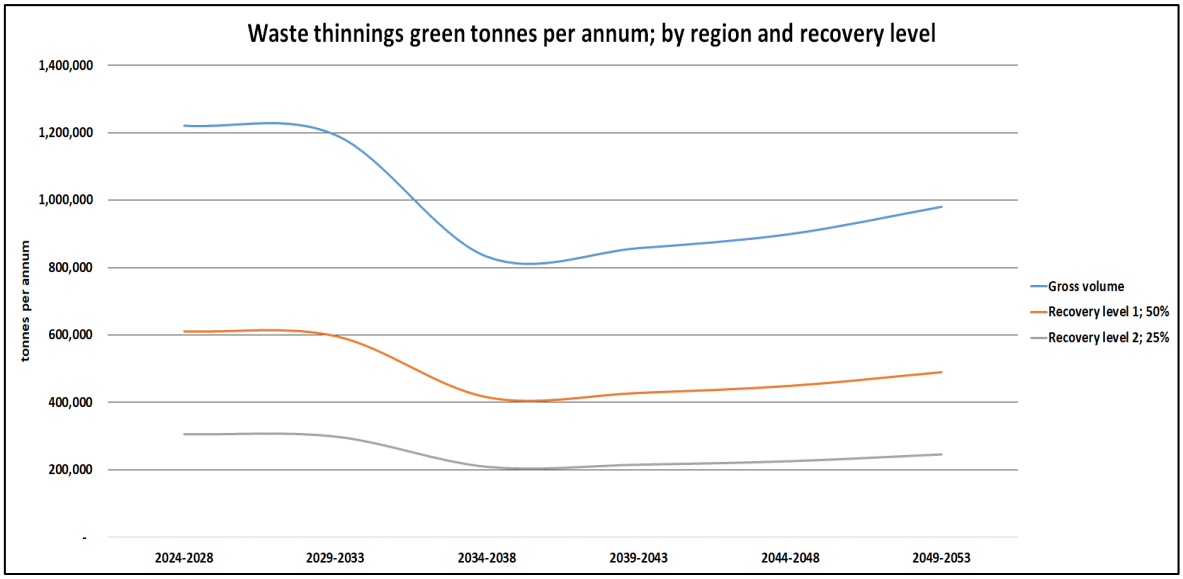
Figure 16 – Production thinnings residue volumes by region



WASTE THINNINGS

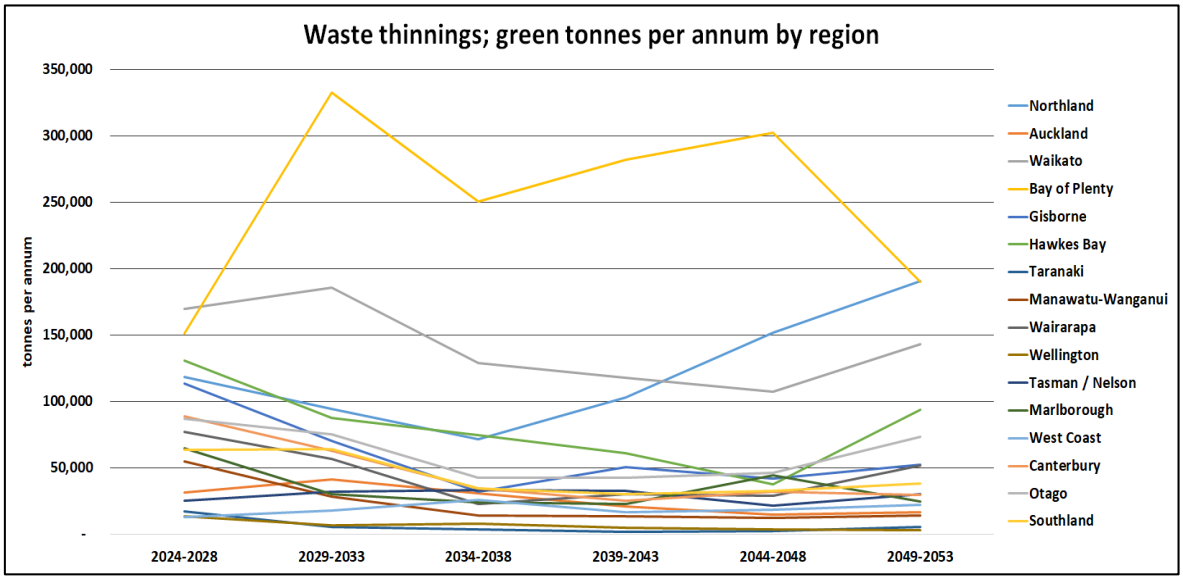
Much of this material would be difficult to recover with modest volumes per hectare, spread over a large area. The recovery levels of this material may well be much lower than for other more accessible residues. The estimated gross volume available nationally, along with the volumes from 50% and 25% recovery are shown in Figure 17.

Figure 17 – National levels of waste thinnings, gross and at 50% and 25% recovery levels



The gross amounts of waste thinnings by region are shown in Figure 18. The largest volume is available in the Central North Island (Waikato and Bay of Plenty). The CNI has around 30% of New Zealand's plantation forests by area.

Figure 18 – Waste thinnings volumes (gross) by region



PRUNINGS

The volume of biomass estimated to be available national from pruning of Pinus radiata forests is shown in Figure 19. This material is likely to be difficult to access and expensive to extract in many stands, especially those on steep slopes. The variation in the volume of supply is due to changes in forestry practices, with less are of forest being reported as being planned for a regime that includes pruning (MPI, 2022).

Figure 19 – Pruning residuals, national level

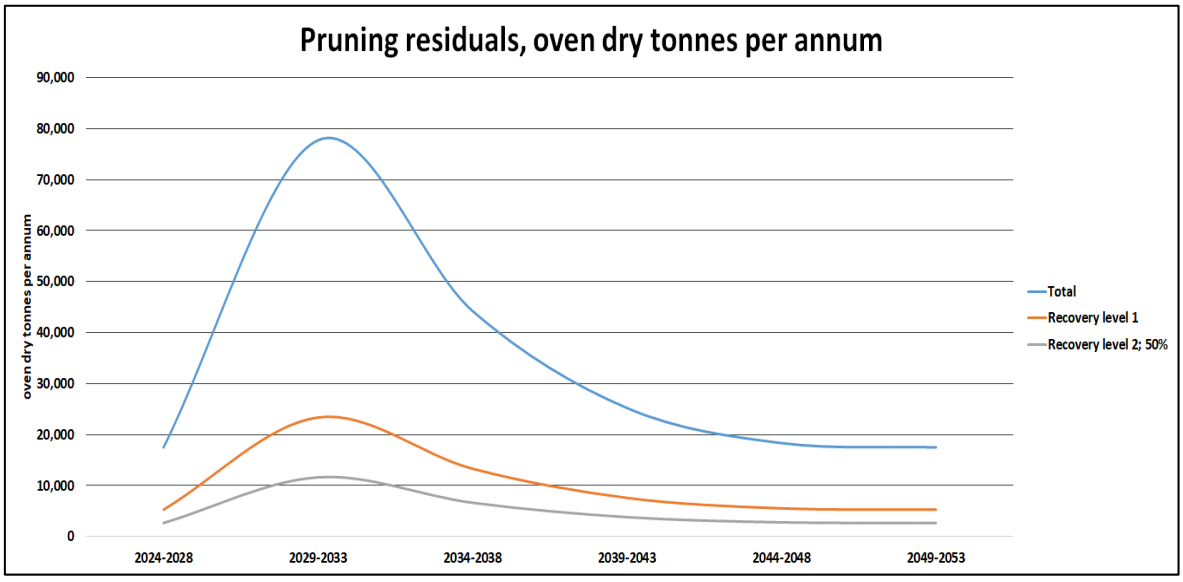
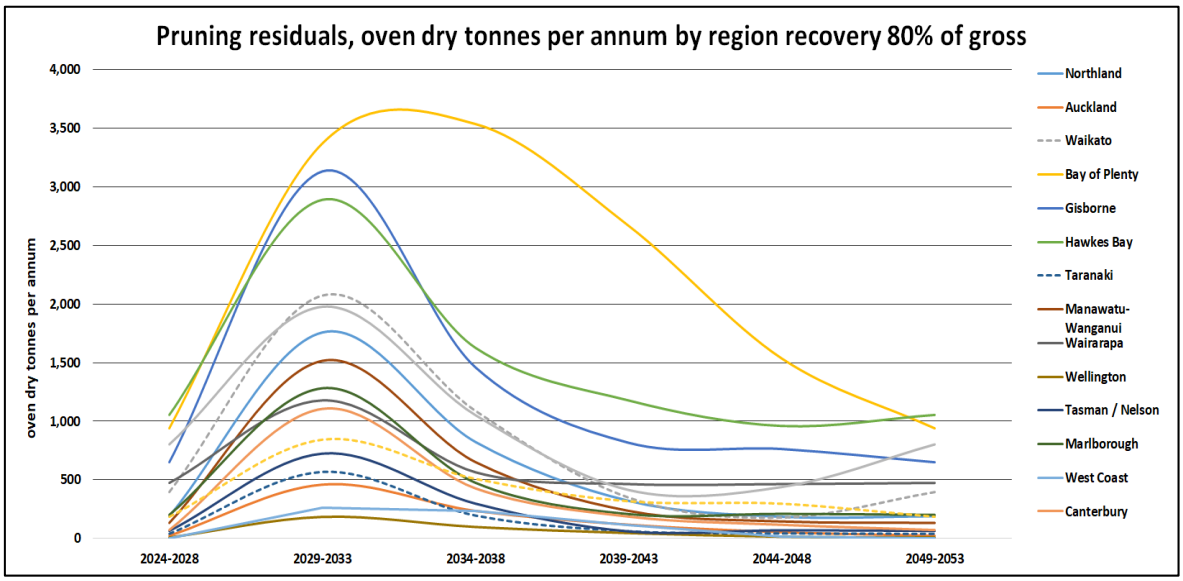


Figure 20 shows the estimated pruning resource by region. This resource has potentially low estimates in the future – but this depends on decisions around pruning that may change in the future.

Figure 20 – Pruning residuals, regional level



PULP LOGS

The gross volume of pulp logs produced in New Zealand is shown in Figure 21 (blue line). This volume is for all pulp logs produced and does not allow for the current use of these logs by existing users such as pulp mills and MDF plants. The orange line shows the amount estimated to be available after incumbent users (pulp mills, MDF mills etc.) has been accounted for. The amount of material taken by incumbent users may change over time as mills close or configure their operations.

Figure 21 – Gross volume of pulp logs produced in New Zealand

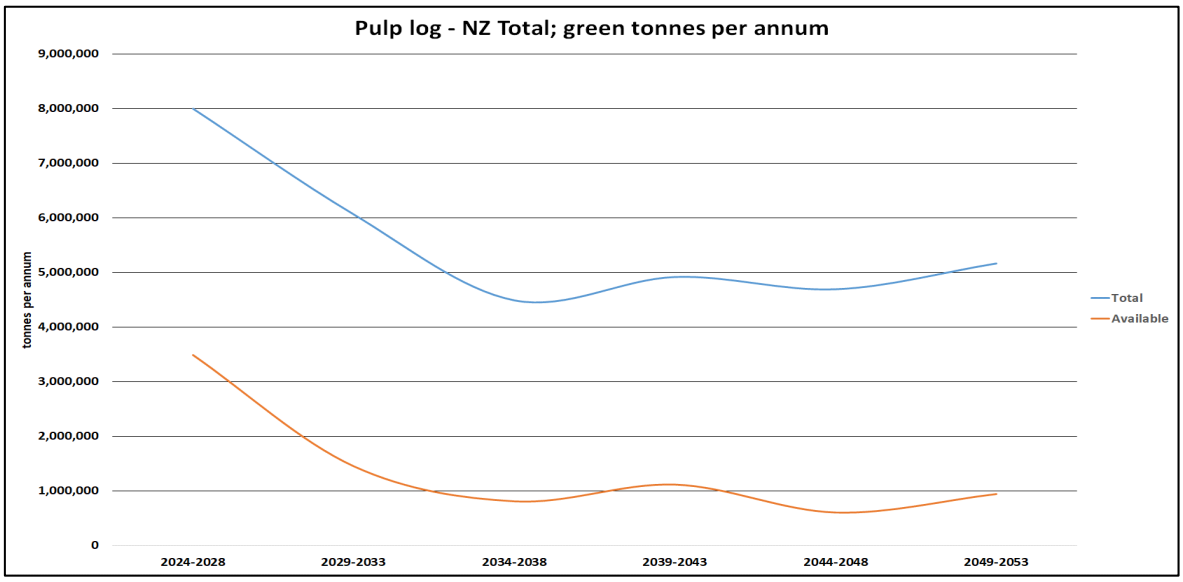
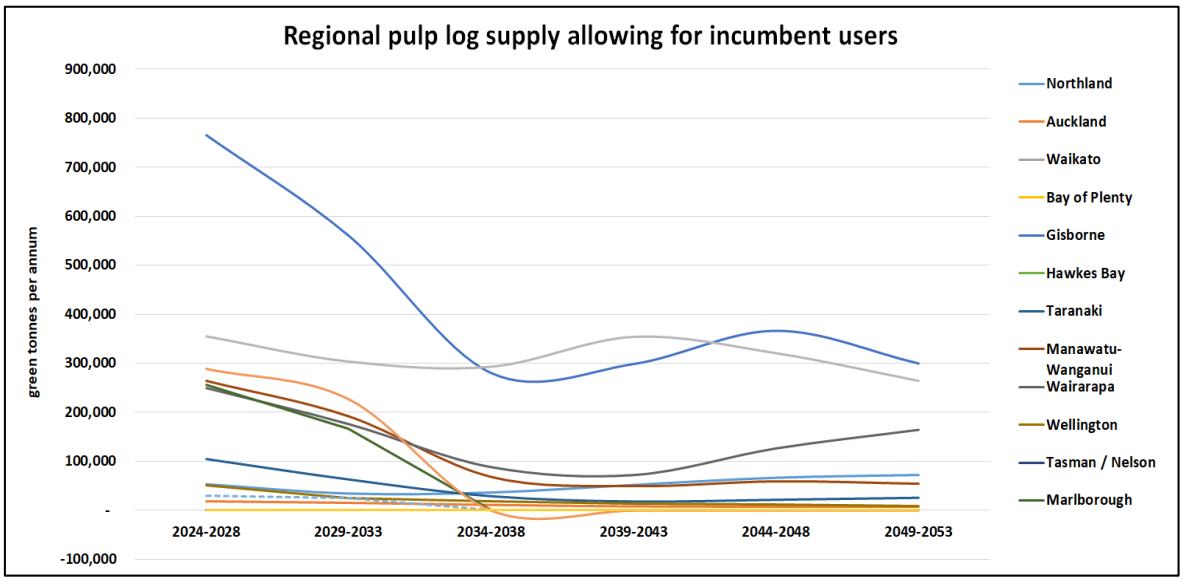


Figure 22 shows the amount of pulp logs available by region after the use by incumbent mills is allowed for. Gisborne has the largest volume of any region, as there are no incumbent users.

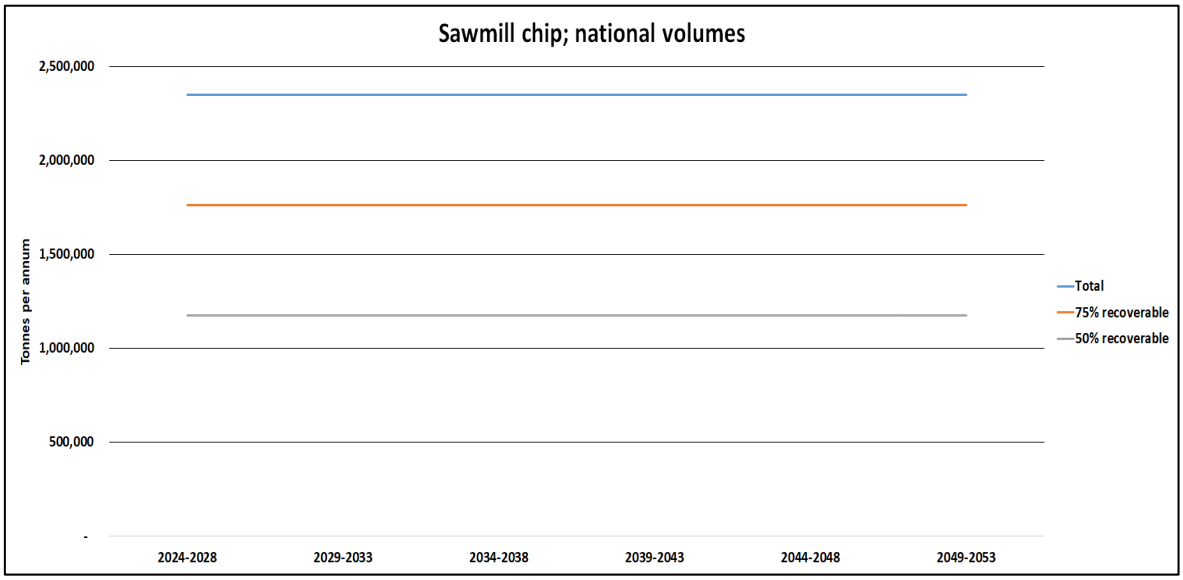
Figure 22 – Regional volume of pulp logs estimated to be available



SAWMILL CHIP

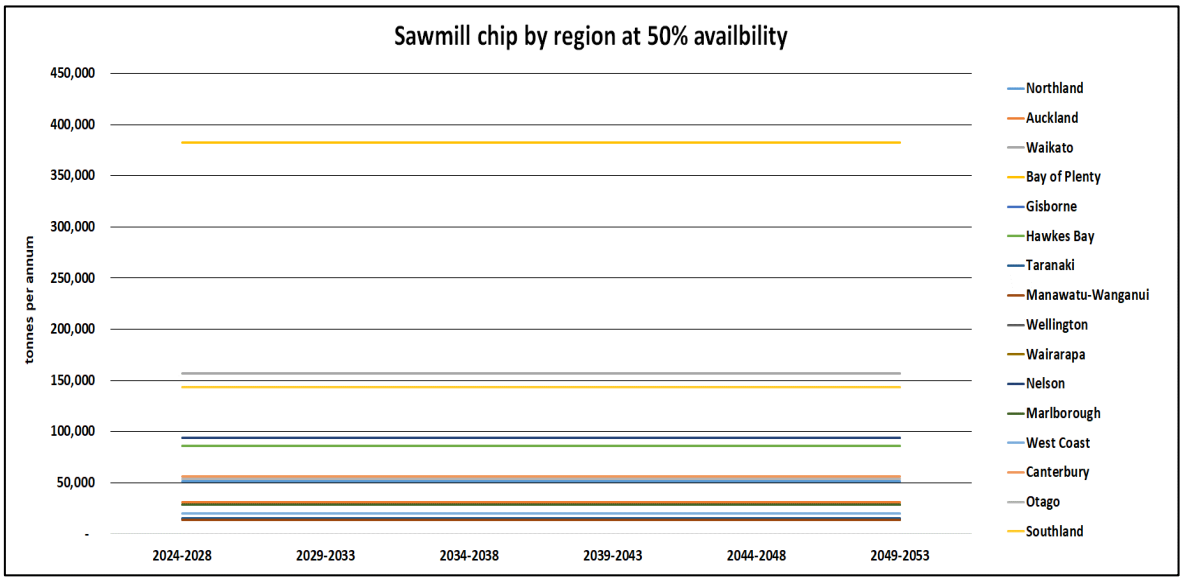
The gross amount of sawmill chip available in New Zealand is shown in Figure 23, along with figures assuming either 75% or 50% being available for purchase. These figures do not allow for the volume going to incumbent users such as pulp mills.

Figure 23 – National gross volume of sawmill chip



The data in Figure 24 shows the volume of sawmill chip available by region, assuming that 50% of the gross is available. Most of the sawmill chip currently produced has a market in either pulp, paper (Central North Island, Hawkes Bay), MDF (Southland, Canterbury & Nelson), particle board (Northland, Central North Island) or as export chip (Northland). However, from a chip producers' point of view the important point is having a market rather than the type of end-use and there is anecdotal evidence of fuel users expressing an interest in sawmill chip as a fuel. As carbon prices rise, this option becomes more viable.

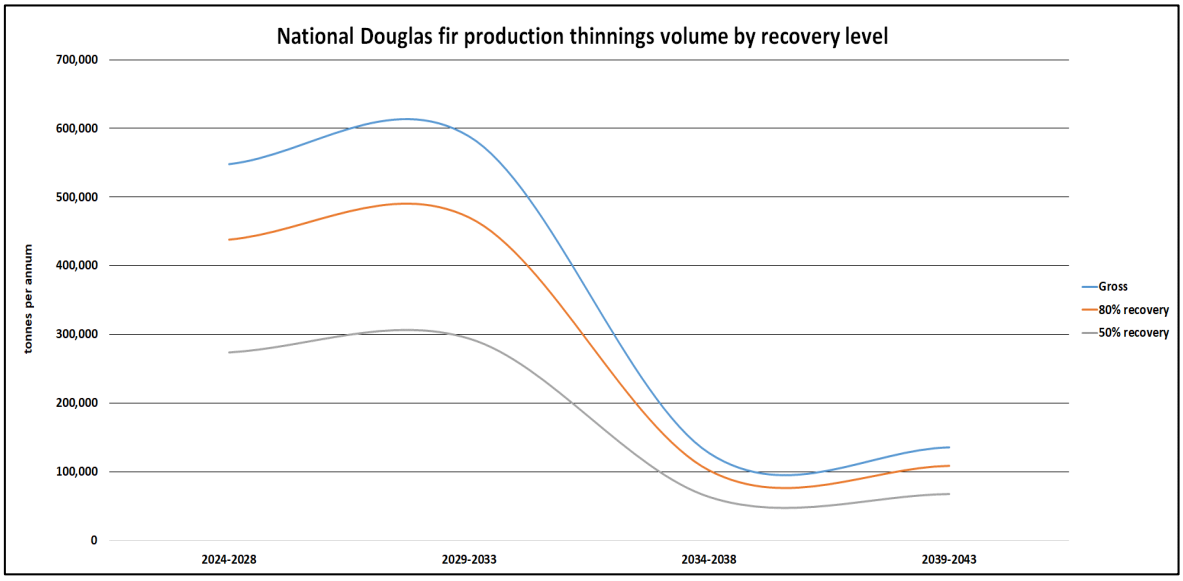
Figure 24 – Regional volume of sawmill chip assuming 50% recovery



DOUGLAS-FIR PRODUCTION THINNINGS

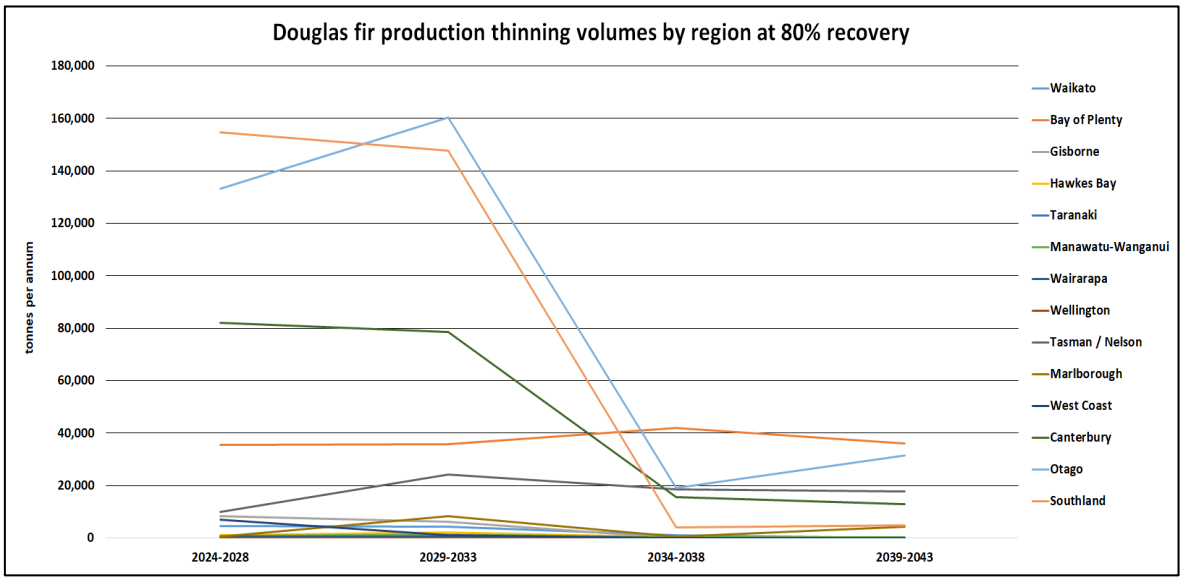
Douglas fir production thinnings were not previously reported. This resource is mostly in the South Island and is likely to be a short-term option as plantings of Douglas fir that had expanded during the 1990s and 2000s have declined due to concerns over the spread of wildings. There is a limited market in traditional solid wood processing for the small logs from the Douglas fir thinnings. They are not a preferred feedstock for MDF. The national level values of this resource are shown in Figure 25.

Figure 25 – National volumes of Douglas-fir production thinnings



The regional volumes of Douglas fir thinnings are shown in Figure 26. The bulk of this resource is in Southland, Otago and Canterbury. The only region in the North Island with a significant amount of Douglas fir is Bay of Plenty. The North Island volume is expected to continue to decline in the long term as few forestry companies are replanting sites that had Douglas fit with that species.

Figure 26 – Regional volumes of Douglas-fir production thinnings



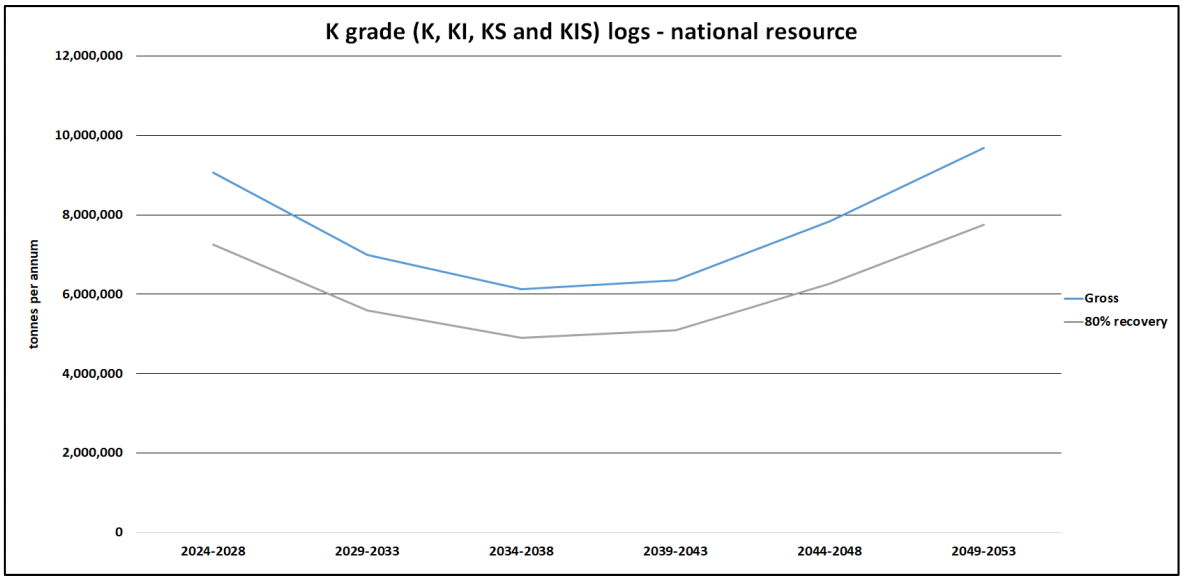
K GRADE LOGS (INCLUDES K, KI, KS AND KIS)

K grade logs are small diameter, short length, knotty logs. They are the lowest value of the sawlog grades (see Table 2). Most of this resource gets exported as raw logs, much of it to China. There are few processors using this material in New Zealand. Potentially this material could be used as a fuel resource depending on the price of the logs and the impact of the

price of carbon on coal users.

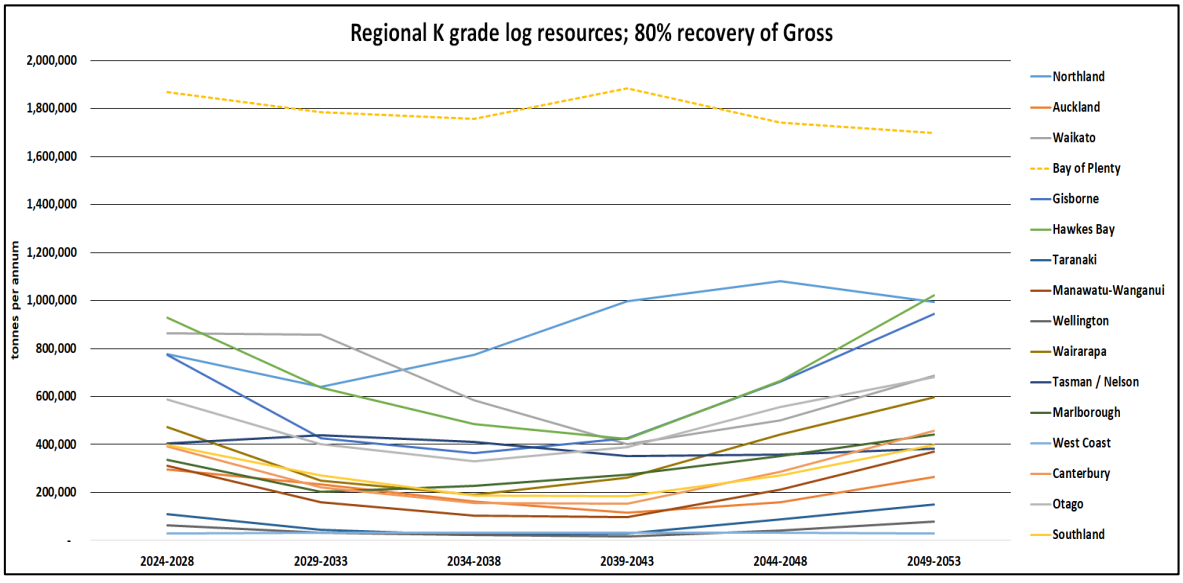
The national volume of K grade logs (combination of the 4 subgrades) potentially available, including availability for purchase levels of 75% and 50% are shown in Figure 27. These volumes are substantial, being several million tonnes per annum, regardless of scenario or timing. The maximum long run volume is around 5.5 million tonnes per annum, with a low point in supply around 2036 to 2040.

Figure 27 – National volumes of K grade logs



The regional volumes of K grade logs likely to be available over time are shown in Figure 28. The largest resource is in the Bay of Plenty (around 1.8 million tonnes per annum). However, even in many of the regions with smaller volumes the scale of this resource is still in the order of 150,000 to 200,000 green tonnes per annum.

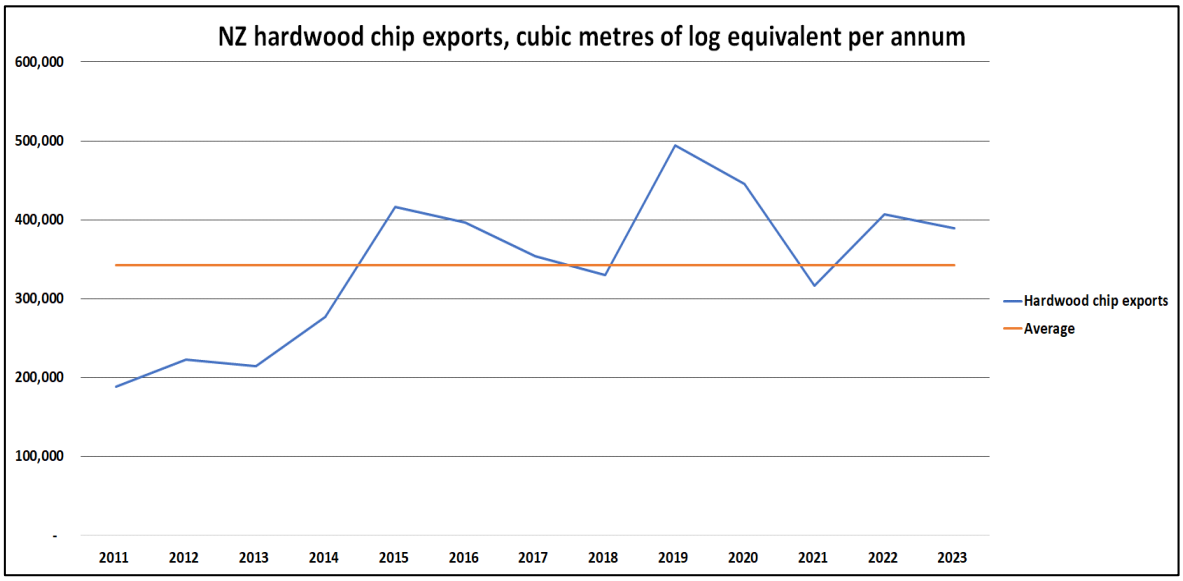
Figure 28 – Regional volumes of K grade logs



SHORT ROTATION FOREST (SRF) RESOURCES

There is a potential energy resource in Otago and Southland that comes directly from a crop, not as a residual. This is the *Eucalyptus nitens* resource managed by Southwood Exports. There is around 12,300 ha of this species in Southland and Otago. The trees are grown at high stockings for around 16 to 18 years. The logs produced are debarked and chipped at Awarua and exported via the port at Bluff. Data available from the MPI website on export volumes presented in Figure 29. Prices have ranged from $81 to $95 per cubic metre of log equivalent over the last 5 years. The chip mill has a single shift capacity of 320,000 green tonnes per annum. This material could also potentially be available as a wood fuel resource if circumstances (demand and price) change. The average volume produce from this resource is 342,000 m^3 per annum.

Figure 29 – Hardwood chip exports



In theory this resource represents a wood energy resource of around 340,000 green tonnes (2.3PJ of energy) per annum at around $14 to $15 per GJ ex the chip mill.

New short rotation forests are not included here but could be used to expand the supply of biomass for bioenergy. Modelling of the potential for SRF forests and future supply based on them is possible using GIS based models.

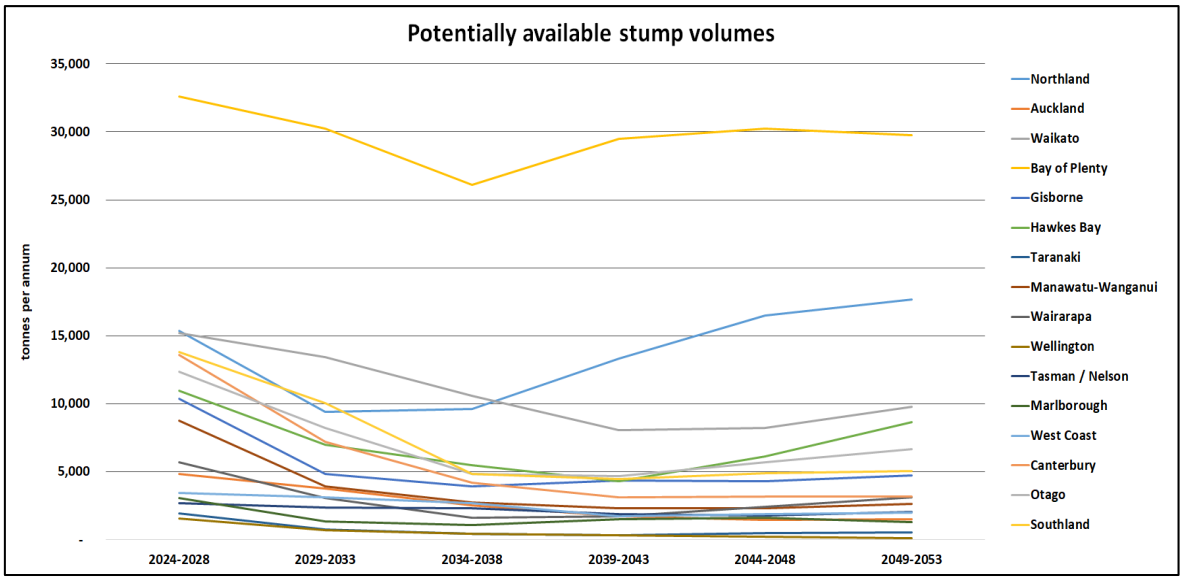
STUMPS

This assessment of the volume of wood available from stumps is not advocacy for the use of stumps as a fuel or biorefinery feedstock. It is included for completeness of the data set and in recognition of the fact that there is some interest in the stump resource for resin extraction with the post-extraction wood being used as a fuel.

The gross volume of stump wood associated with the current annual harvest could be in the order of 3.5 million m^3 per annum. However, not all of this volume should or could be harvested. In this assessment we assume that any harvest area that would require cable logging will be unsuitable for stump harvesting. Further we assume there will be a limit on the proportion of stumps extracted from a given site, with a maximum of 1 stump in every 4

(spread evenly across the cutover) being available for extraction. Additionally, it is assumed that not all growers would want their cutovers subject to stump removal, so only half of the area that meets the ground-based harvest criteria would be made available. After applying these assumptions, the national volume available in the long run is approximately 83,000 m^3 per annum in the long run. Regional amounts are shown in Figure 30.

Figure 30 – regional volumes of stump wood



A GRADE LOGS

A grade logs are larger diameter than K grade, with smaller knots. While some are processed in New Zealand, significant quantities are exported due to the large volumes grown. The pricing of these logs means they would be at the top of the price range with a delivered cost of around $115 to $120 per green tonne ($17 to $18 per GJ), excluding chipping (likely around $2.00 per GJ).

The total volume of A grade logs is estimated in Figure 31, and in the long run is around 7 million m^3 per annum. The amount that would potentially be available at a regional level if it is assumed that only 50% of the cut volume is available is shown in Figure 32.

Figure 31 – National total volume of A grade logs

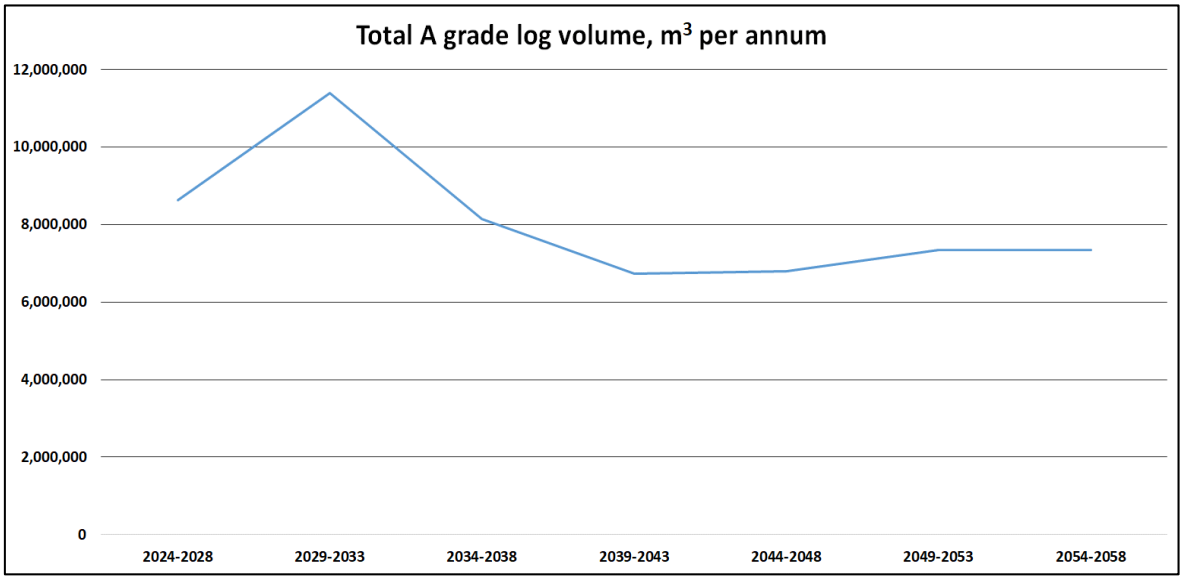
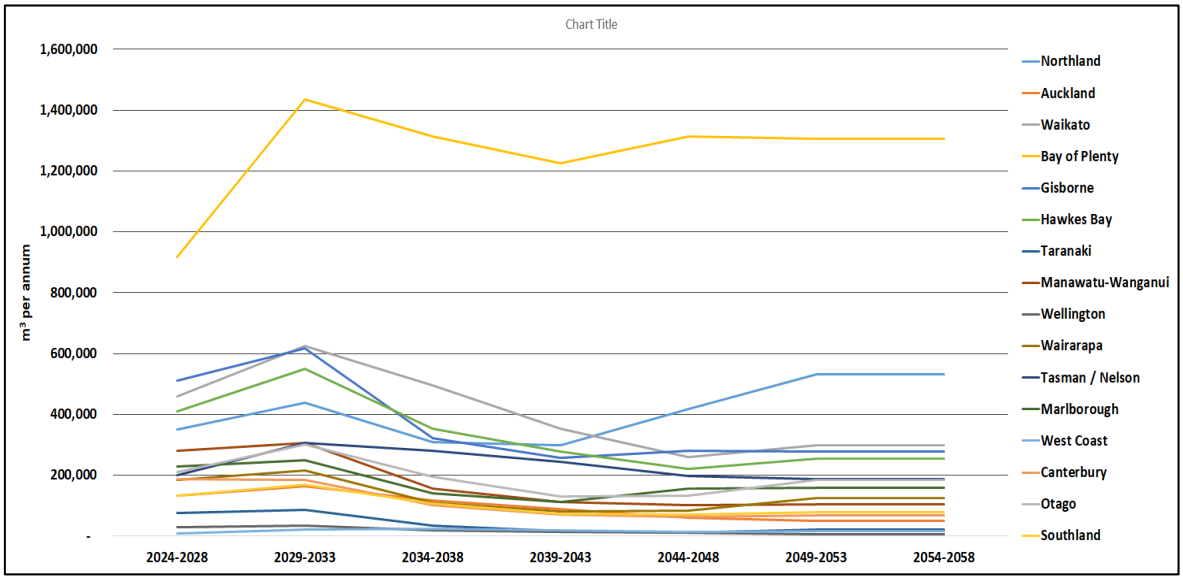


Figure 32 – Estimate of the regional volumes of A grade logs assuming 50% of the gross volume is available



Discussion

Outside of the residual, sawmill chip, export chip and log resources covered above there is potential to grow biomass for fuel from non-traditional forestry regimes. These approaches include short rotation coppice of willow and poplar. There are no commercial areas of this type of material in New Zealand, but there have been trials. Such potential is out of the scope of this report.

Short rotation forestry (SRF) without coppicing is also an option. The amount of wood from existing SRF is covered in this report (Page 32).

CURRENT WOOD FUEL FOR LARGE SCALE (< 1MWTH) HEAT.

There are several heat plants around New Zealand that have made a change in the recent past to using wood as fuel. Generally, the displaced fuel has been a fossil fuel, and many have been coal boilers.

Based on information that is publicly available (industry newsletters, company announcements, published case studies etc.) a list of know users of wood fuels is presented (Table 7). It indicates around 260,000 green tonnes per annum (at least) of wood residuals being used as fuel. This list is not believed to be complete and further work on expanding this dataset is planned. There are some further wood fuel plants being built or commissioned that are not included in the data as they are not yet operating; for example, the Waitoa dairy factory in Waikato.

Table 7 – current known wood fuel users (non-wood processing) greater than 1 MWth

Region	Location	Boiler size; MWth	Wood fuel type	Wood fuel demand; GJ p. a.	Wood fuel demand; t pellets p. a.	Wood fuel demand; chip, p. a.	Forest residues Wood fuel demand; g.t. hog, p. a.	MWW Wood fuel demand; g.t. hog, p. a.
Northland	Dargaville	1.5	Wood pellets	38,956	2,292	-	-	-
Auckland				-	-	-	-	-
Waikato	Te Awamutu	40	Wood pellets	680,000	40,000.0	-	-	-
Bay of Plenty				-	-	-	-	-
Gisborne				-	-	-	-	-
Hawkes Bay				-	-	-	-	-
Taranaki				-	-	-	-	-
Manawatu-Wanganui				-	-	-	-	-
Wairarapa				-	-	-	-	-
Wellington				-	-	-	-	-
Tasman / Nelson	Brightwater	7	Hog fuel	36,359	-	-	5,269	-
Marlborough				-	-	-	-	-
West Coast				-	-	-	-	-
Canterbury	Christchuch City	15	Hog fuel	335,000	-	-	48,500	-
Canterbury	Burwood	6	Hog fuel	134,000	-	-	19,000	-
Canterbury	Belfast	2.25	MMW hog	80,000	-	-	-	**8,607**
Otago	Clutha	13	Hog fuel	290,000	-	-	42,029	-
Otago	Clutha	11	Hog fuel	245,000	-	-	35,507	-
Otago	Clutha	8.5	Hog fuel	189,000	-	-	27,391	-
Otago	Dunedin	4	Hog fuel	104,000	-	-	15,000	-
Southland	Invercargill	3.4	Chip	63,000	-	9,140	-	-
Southland	Invercargill	0.675	Chip	71,500	-	6,805	-	-
Total		**112.325**		**2,266,815**	**42,292**	**15,945**	**192,697**	**8,607**

The list in Table 7 excludes the wood processing industry. Wood processors around New Zealand are the largest users of wood fuels and an estimate of this is that around 2.6 million green tonnes of wood fuels are consumed per annum at around 100 sites in 106 boilers with around 400 MWth total installed capacity. This material is typically sawdust, shavings, bark, sander dust, off-cuts, trim etc. This volume of consumption indicates that the use of wood as fuel is well established and has been extensively by the wood processing industry for decades. The technology can easily be used in other industries that have demands for medium and high temperature process heat.

Conclusions

There are many sources of residual woody biomass that could provide a low carbon fuel; in-forest post-harvest residues being the largest source. However, shelterbelt replacement, orchard turnover, municipal wood waste, straws, bark, wood processing residues, waste thinnings, and prunings from plantation forests etc. are also available. Further there are other resources such as sawmill chip, pulp logs and K grade logs which are typically used or exported but which based on current pricing could reasonably be used as wood fuels.

Residuals based on plantation forests are the largest source of residual material.

K and A grade logs are potentially a very large source of wood fuel.

Straws are a substantial potential fuel source in Canterbury. Operations and studies overseas and in New Zealand indicate that specialist straw boilers are likely to be required.

Orchard residues are potentially significant in regions with large horticulture and viticulture industries (Hawkes Bay, Gisborne, Marlborough, Tasman).

In the long run a mid-range (recoverability level 1) estimate of woody biomass supply is up to 7.6 million green tonnes per annum. If pulp logs, K grade logs and sawmill chip is excluded then the supply potential drops to around 3.5 million green tonnes per annum. The national level of biomass supply by resource and over time (2021 to 2050) is shown in Table 8.

Table 8 – National potential supply of woody biomass fuels; green tonnes per annum.

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
In-forest post-harvest*	3,842,944	2,785,329	2,353,087	2,387,255	2,505,697	2,971,222
MWW	235,710	253,414	272,779	293,980	317,213	342,698
Orchard	121,511	123,942	126,420	128,949	131,528	134,158
Straw and stover	294,782	300,678	306,691	312,825	319,081	325,463
Shelter belt	81,920	81,920	81,920	81,920	81,920	81,920
Thin to waste	488,544	477,446	332,923	343,142	359,854	392,278
Production thin residues	28,732	26,328	195,881	275,250	146,012	69,047
Port bark	227,928	205,135	193,739	227,928	227,928	227,928

Prunings	13,764	61,356	34,909	19,868	14,435	13,764
Douglas fir production thinnings	438,192	470,512	101,744	108,498	-	-
Sawmill chip surplus	569,085	569,085	569,085	569,085	569,085	569,085
Pulp log (surplus to domestic demand)	2,120,926	368,845	-202,915	-101,579	21,617	257,422
KIS, etc grade logs**	4,211,674	3,247,273	2,843,215	2,953,903	3,643,362	4,497,075
Total	**12,675,712**	**8,971,263**	**7,209,478**	**7,601,024**	**8,337,732**	**9,882,060**

Further resources which could potentially be available but would be lower in the priority list to use are shown in Table 9. These are;

- A grade logs – which will be expensive,
- Stumps – which would have environmental impacts and limits,
- Chip from short rotation Eucalyptus nitens forests in Otago and Southland – which have an incumbent market.

Table 9 – potential biomass resources

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
A grade logs	6,438,550	11,008,204	8,500,522	6,742,599	6,798,078	7,340,516
Stumps	250,296	175,200	133,641	133,427	146,243	158,162
SRF eucalyptus forests	340,000	340,000	340,000	340,000	340,000	340,000

A set of 17 appendices (A to Q) show the gross and recoverable tonnages (Levels 1 and 2) and energy content by resource, region and time for all the different resources assessed above.

These resources are based on current forest area and age class data, as well as crop residues.

Establishment of new forests, especially short rotation energy forests could expand the bioenergy supply available in the future. There has been some discussion and investigation of this option and there are plans to support up to 5,000 ha of SRF by central government through Te Uru Rakau New Zealand Forest Service but limited plantings to date beyond experimental trials.

Acknowledgements

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Appendix A – All in-forest residues

Gross supply all in-forest residues; m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	482,001	301,380	310,742	439,574	561,893	477,322
Auckland	165,920	132,341	90,614	61,875	53,108	106,463
Waikato	549,837	487,485	369,704	281,766	309,063	460,764
Bay of Plenty	1,303,411	1,307,234	1,160,170	1,291,354	1,313,802	1,381,977
Gisborne	586,238	271,359	215,223	236,902	238,743	317,004
Hawkes Bay	493,712	310,965	256,316	217,960	260,963	346,985
Taranaki	221,648	119,093	86,842	68,444	98,593	137,366
Manawatu-Wanganui	294,855	135,291	83,919	67,673	69,832	127,520
Wellington	57,229	26,013	19,490	14,214	10,903	19,329
Wairarapa	356,329	174,440	117,328	127,978	171,240	233,907
Tasman-Nelson	274,614	250,799	249,989	209,978	196,760	244,076
Marlborough	303,197	142,431	119,431	167,050	168,310	142,074
West Coast	64,571	59,566	57,651	44,705	45,230	46,387
Canterbury	377,537	212,926	148,865	120,188	113,098	176,797
Otago	459,262	311,227	267,145	265,402	265,262	350,026
Southland	313,690	244,960	191,028	175,336	144,426	226,842
NZ Total	**6,304,052**	**4,487,510**	**3,744,456**	**3,790,400**	**4,021,226**	**4,794,840**

Gross supply all in-forest residues; GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	3,325,807	2,079,519	2,144,120	3,033,060	3,877,059	3,293,522
Auckland	1,144,847	913,152	625,238	426,940	366,446	734,596
Waikato	3,793,875	3,363,644	2,550,955	1,944,186	2,132,532	3,179,271
Bay of Plenty	8,993,539	9,019,912	8,005,174	8,910,343	9,065,232	9,535,638
Gisborne	4,045,042	1,872,378	1,485,037	1,634,623	1,647,328	2,187,328
Hawkes Bay	3,406,614	2,145,662	1,768,579	1,503,923	1,800,643	2,394,198
Taranaki	1,529,369	821,745	599,209	472,265	680,295	947,826
Manawatu-Wanganui	2,034,502	933,509	579,044	466,942	481,841	879,890
Wellington	394,882	179,490	134,479	98,078	75,234	133,371
Wairarapa	2,458,671	1,203,637	809,561	883,051	1,181,557	1,613,956
Tasman-Nelson	1,894,837	1,730,513	1,724,921	1,448,847	1,357,643	1,684,125
Marlborough	2,092,060	982,774	824,073	1,152,646	1,161,341	980,309
West Coast	445,541	411,008	397,790	308,466	312,086	320,074
Canterbury	2,605,008	1,469,192	1,027,168	829,296	780,375	1,219,902
Otago	3,168,908	2,147,463	1,843,302	1,831,275	1,830,306	2,415,179
Southland	2,164,459	1,690,222	1,318,094	1,209,821	996,543	1,565,210
NZ Total	**43,497,961**	**30,963,822**	**25,836,745**	**26,153,760**	**27,746,460**	**33,084,393**

All in-forest residues, m^3 per annum at recoverability level 1 (landings 80%, GB cutover 70%, hauler cutover 10%)

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	325,248	204,541	213,430	301,153	381,267	322,469
Auckland	109,584	87,898	60,321	41,302	35,541	70,827
Waikato	370,654	329,438	248,247	188,384	209,704	312,636
Bay of Plenty	846,994	846,084	748,599	833,121	842,316	896,863
Gisborne	309,135	142,638	111,887	122,723	124,656	166,146
Hawkes Bay	284,788	180,194	145,456	127,019	142,963	193,237
Taranaki	138,950	76,964	57,144	44,820	65,257	90,501
Manawatu-Wanganui	193,076	87,927	54,767	45,085	45,704	82,583
Wellington	36,985	17,216	13,085	9,545	7,391	12,792
Wairarapa	205,224	102,113	67,904	74,230	98,635	136,292
Tasman-Nelson	137,560	128,820	130,326	111,727	103,942	127,886
Marlborough	151,521	71,972	61,793	86,051	87,051	72,577
West Coast	41,642	38,461	37,953	29,843	29,663	29,609
Canterbury	230,457	133,919	97,681	79,746	74,012	110,062
Otago	252,886	172,154	166,292	165,571	156,840	195,696
Southland	208,242	164,989	138,201	126,935	100,756	151,047
NZ Total	**3,842,944**	**2,785,329**	**2,353,087**	**2,387,255**	**2,505,697**	**2,971,222**

All in-forest residues, GJ per annum at recoverability level 1 (landings 80%, GB cutover 70%, hauler cutover 10%)

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	2,244,211	1,411,336	1,472,665	2,077,956	2,630,741	2,225,034
Auckland	756,128	606,493	416,217	284,980	245,234	488,705
Waikato	2,557,512	2,273,123	1,712,907	1,299,853	1,446,958	2,157,185
Bay of Plenty	5,844,255	5,837,978	5,165,331	5,748,535	5,811,980	6,188,355
Gisborne	2,133,031	984,203	772,021	846,790	860,124	1,146,405
Hawkes Bay	1,965,036	1,243,342	1,003,645	876,434	986,446	1,333,336
Taranaki	958,753	531,051	394,295	309,257	450,275	624,459
Manawatu-Wanganui	1,332,224	606,695	377,895	311,083	315,355	569,825
Wellington	255,196	118,790	90,286	65,862	50,999	88,262
Wairarapa	1,416,044	704,582	468,540	512,188	680,582	940,417
Tasman-Nelson	949,167	888,856	899,251	770,915	717,197	882,415
Marlborough	1,045,495	496,610	426,371	593,754	600,649	500,781
West Coast	1,590,155	924,043	674,001	550,249	510,680	759,429
Canterbury	287,326	265,378	261,873	205,915	204,672	204,300
Otago	1,744,916	1,187,864	1,147,414	1,142,439	1,082,195	1,350,300
Southland	1,436,868	1,138,424	953,587	875,853	695,218	1,042,221
NZ Total	**26,516,316**	**19,218,768**	**16,236,299**	**16,472,062**	**17,289,306**	**20,501,429**

All in-forest residues, m^3 per annum at recoverability level 2 (landings 65%, GB cutover 56%, hauler cutover 5%)

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	258,763	162,841	170,086	239,998	303,713	256,751
Auckland	87,115	69,925	48,001	32,877	28,301	56,356
Waikato	295,288	262,512	197,645	149,939	167,207	249,245
Bay of Plenty	673,482	672,999	595,448	662,592	669,531	713,329
Gisborne	243,678	112,427	88,139	96,666	98,234	130,947
Hawkes Bay	224,575	142,461	114,802	100,290	112,428	152,197
Taranaki	109,178	60,438	44,871	35,188	51,296	71,151
Manawatu-Wanganui	153,249	69,767	43,435	35,796	36,246	65,488
Wellington	29,312	13,650	10,365	7,568	5,857	10,139
Wairarapa	161,828	80,614	53,568	58,567	77,825	107,597
Tasman-Nelson	107,612	101,029	102,353	87,919	81,744	100,494
Marlborough	118,481	56,352	48,501	67,513	68,303	56,867
West Coast	32,753	30,268	29,980	23,666	23,468	23,298
Canterbury	181,561	105,868	77,640	63,493	58,813	86,911
Otago	198,093	134,937	132,107	131,578	123,920	153,576
Southland	164,761	130,833	110,752	101,725	80,309	119,568
NZ Total	**3,039,728**	**2,206,920**	**1,867,693**	**1,895,374**	**1,987,194**	**2,353,914**

All in-forest residues, GJ per annum at recoverability level 2 (landings 65%, GB cutover 56%, hauler cutover 5%)

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	1,785,466	1,123,600	1,173,594	1,655,987	2,095,623	1,771,579
Auckland	601,092	482,479	331,205	226,850	195,274	388,856
Waikato	2,037,485	1,811,332	1,363,749	1,034,579	1,153,728	1,719,787
Bay of Plenty	4,647,023	4,643,695	4,108,594	4,571,883	4,619,763	4,921,968
Gisborne	1,681,379	775,749	608,160	666,994	677,814	903,537
Hawkes Bay	1,549,565	982,982	792,135	692,000	775,750	1,050,161
Taranaki	753,328	417,019	309,608	242,794	353,939	490,940
Manawatu-Wanganui	1,057,417	481,393	299,699	246,990	250,097	451,870
Wellington	202,254	94,185	71,520	52,222	40,416	69,961
Wairarapa	1,116,616	556,236	369,622	404,112	536,989	742,419
Tasman-Nelson	742,519	697,100	706,235	606,644	564,033	693,407
Marlborough	817,522	388,828	334,657	465,837	471,288	392,383
West Coast	1,252,773	730,488	535,718	438,105	405,812	599,687
Canterbury	225,995	208,850	206,859	163,296	161,930	160,759
Otago	1,366,845	931,066	911,540	907,891	855,047	1,059,677
Southland	1,136,848	902,746	764,189	701,900	554,134	825,019
NZ Total	**20,974,126**	**15,227,748**	**12,887,084**	**13,078,084**	**13,711,638**	**16,242,009**

Appendix B – Municipal Wood Wastes

Wood waste to landfill; gross tonnage, tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	10,558	11,307	12,108	12,967	13,886	14,871
Auckland	79,860	90,442	102,427	115,999	131,370	148,778
Waikato	105,118	113,465	122,474	132,199	142,696	154,027
Bay of Plenty	8,964	9,685	10,464	11,306	12,216	13,199
Gisborne	2,375	2,630	2,912	3,225	3,571	3,954
Hawkes Bay	10,540	10,958	11,392	11,843	12,312	12,800
Taranaki	8,483	8,654	8,828	9,006	9,187	9,372
Manawatu-Wanganui	12,375	12,574	12,777	12,982	13,191	13,404
Wellington	2,758	2,802	2,847	2,893	2,939	2,986
Wairarapa	24,827	26,562	28,418	30,403	32,528	34,801
Tasman-Nelson	14,254	14,432	14,612	14,794	14,979	15,166
Marlborough	4,018	4,376	4,765	5,190	5,652	6,155
West Coast	1,103	1,211	1,329	1,459	1,601	1,757
Canterbury	63,198	65,768	68,442	71,225	74,121	77,135
Otago	14,482	15,663	16,940	18,321	19,814	21,430
Southland	5,384	5,433	5,482	5,531	5,581	5,631
NZ Total	**368,297**	**395,960**	**426,217**	**459,343**	**495,646**	**535,466**

Wood waste to landfill; gross energy, GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	95,360	102,121	109,362	117,116	125,420	134,313
Auckland	721,296	816,875	925,119	1,047,706	,186,538	1,343,767
Waikato	949,426	1,024,814	1,106,188	1,194,024	1,288,834	1,391,172
Bay of Plenty	80,963	87,476	94,514	102,118	110,334	119,210
Gisborne	948	1,050	1,163	1,288	1,426	1,579
Hawkes Bay	95,197	98,969	102,889	106,965	111,202	115,608
Taranaki	76,618	78,161	79,735	81,340	82,978	84,649
Manawatu-Wanganui	37,203	37,802	38,410	39,029	39,657	40,296
Wellington	24,910	25,309	25,714	26,125	26,543	26,968
Wairarapa	224,237	239,906	256,669	274,604	293,792	314,321
Tasman-Nelson	128,742	130,349	131,976	133,624	135,292	136,981
Marlborough	36,291	39,522	43,040	46,872	51,045	55,590
West Coast	9,962	10,935	12,002	13,173	14,459	15,870
Canterbury	570,804	594,014	618,168	643,304	669,462	696,684
Otago	130,801	141,466	152,999	165,473	178,965	193,556
Southland	48,628	49,067	49,510	49,957	50,408	50,863
NZ Total	**3,233,405**	**3,479,857**	**3,749,487**	**4,044,751**	**4,368,392**	**4,723,467**

Wood waste to landfill, tonnes per annum, recovery level 1, 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	6,757	7,236	7,749	8,299	8,887	9,517
Auckland	51,110	57,883	65,553	74,240	84,077	95,218
Waikato	67,276	72,617	78,384	84,608	91,326	98,577
Bay of Plenty	5,737	6,199	6,697	7,236	7,818	8,447
Gisborne	67	74	82	91	101	112
Hawkes Bay	6,746	7,013	7,291	7,579	7,880	8,192
Taranaki	5,429	5,538	5,650	5,764	5,880	5,998
Manawatu-Wanganui	2,636	2,679	2,722	2,766	2,810	2,855
Wellington	1,765	1,793	1,822	1,851	1,881	1,911
Wairarapa	15,889	17,000	18,187	19,458	20,818	22,272
Tasman-Nelson	9,123	9,236	9,352	9,468	9,587	9,706
Marlborough	2,572	2,800	3,050	3,321	3,617	3,939
West Coast	706	775	850	933	1,025	1,125
Canterbury	40,447	42,091	43,803	45,584	47,438	49,366
Otago	9,268	10,024	10,841	11,725	12,681	13,715
Southland	3,446	3,477	3,508	3,540	3,572	3,604
NZ Total	**228,973**	**246,437**	**265,542**	**286,464**	**309,396**	**334,556**

Wood Waste to landfill, GJ per annum, recovery level 1, 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	61,030	65,358	69,992	74,954	80,269	85,960
Auckland	461,629	522,800	592,076	670,532	759,385	860,011
Waikato	607,632	655,881	707,960	764,175	824,854	890,350
Bay of Plenty	51,816	55,985	60,489	65,355	70,613	76,294
Gisborne	607	672	744	824	913	1,011
Hawkes Bay	60,926	63,340	65,849	68,458	71,170	73,989
Taranaki	49,036	50,023	51,030	52,058	53,106	54,175
Manawatu-Wanganui	23,810	24,193	24,583	24,978	25,381	25,789
Wellington	15,943	16,198	16,457	16,720	16,988	17,259
Wairarapa	143,512	153,540	164,268	175,747	188,027	201,165
Tasman-Nelson	82,395	83,423	84,465	85,519	86,587	87,668
Marlborough	23,226	25,294	27,546	29,998	32,669	35,578
West Coast	6,376	6,998	7,681	8,431	9,254	10,157
Canterbury	365,315	380,169	395,628	411,715	428,456	445,878
Otago	83,713	90,538	97,920	105,903	114,537	123,876
Southland	31,122	31,403	31,686	31,972	32,261	32,552
NZ Total	**2,068,088**	**2,225,815**	**2,398,374**	**2,587,340**	**2,794,467**	**3,021,712**

Wood waste to landfill, tonnes per annum, recovery level 2, 60%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	5,068	5,427	5,812	6,224	6,665	7,138
Auckland	38,333	43,412	49,165	55,680	63,058	71,414
Waikato	50,457	54,463	58,788	63,456	68,494	73,933
Bay of Plenty	4,303	4,649	5,023	5,427	5,864	6,335
Gisborne	50	56	62	68	76	84
Hawkes Bay	5,059	5,260	5,468	5,685	5,910	6,144
Taranaki	4,072	4,154	4,237	4,323	4,410	4,499
Manawatu-Wanganui	1,977	2,009	2,041	2,074	2,108	2,141
Wellington	1,324	1,345	1,367	1,388	1,411	1,433
Wairarapa	11,917	12,750	13,641	14,594	15,613	16,704
Tasman-Nelson	6,842	6,927	7,014	7,101	7,190	7,280
Marlborough	1,929	2,100	2,287	2,491	2,713	2,954
West Coast	529	581	638	700	768	843
Canterbury	30,335	31,569	32,852	34,188	35,578	37,025
Otago	6,951	7,518	8,131	8,794	9,511	10,286
Southland	2,584	2,608	2,631	2,655	2,679	2,703
NZ Total	**171,730**	**184,827**	**199,156**	**214,848**	**232,047**	**250,917**

Wood Waste to landfill, GJ per annum, recovery level 2, 60%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	45,773	49,018	52,494	56,216	60,202	64,470
Auckland	346,222	392,100	444,057	502,899	569,538	645,008
Waikato	455,724	491,911	530,970	573,131	618,640	667,763
Bay of Plenty	38,862	41,989	45,367	49,017	52,960	57,221
Gisborne	455	504	558	618	684	758
Hawkes Bay	45,695	47,505	49,387	51,343	53,377	55,492
Taranaki	36,777	37,517	38,273	39,043	39,829	40,631
Manawatu-Wanganui	17,857	18,145	18,437	18,734	19,035	19,342
Wellington	11,957	12,148	12,343	12,540	12,741	12,945
Wairarapa	107,634	115,155	123,201	131,810	141,020	150,874
Tasman-Nelson	61,796	62,568	63,349	64,139	64,940	65,751
Marlborough	17,419	18,970	20,659	22,499	24,502	26,683
West Coast	4,782	5,249	5,761	6,323	6,940	7,618
Canterbury	273,986	285,127	296,721	308,786	321,342	334,408
Otago	62,785	67,904	73,440	79,427	85,903	92,907
Southland	23,342	23,552	23,765	23,979	24,196	24,414
NZ Total	**1,551,066**	**1,669,361**	**1,798,781**	**1,940,505**	**2,095,851**	**2,266,284**

Appendix C – Orchard & Viticulture Residues

Orchard & Viticulture residues, gross tonnage per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	4,479	4,568	4,660	4,753	4,848	4,945
Auckland	8,219	8,383	8,551	8,722	8,897	9,074
Waikato	2,788	2,844	2,901	2,959	3,018	3,078
Bay of Plenty	8,832	9,009	9,189	9,373	9,560	9,752
Gisborne	8,161	8,324	8,491	8,661	8,834	9,011
Hawkes Bay	49,465	50,454	51,463	52,492	53,542	54,613
Taranaki	127	130	132	135	138	140
Manawatu-Wanganui	678	692	706	720	734	749
Wellington	1,300	1,326	1,353	1,380	1,407	1,435
Wairarapa	143	146	149	152	155	158
Tasman-Nelson	17,768	18,123	18,485	18,855	19,232	19,617
Marlborough	32,201	32,845	33,502	34,172	34,855	35,553
West Coast	-	-	-	-	-	-
Canterbury	2,980	3,040	3,101	3,163	3,226	3,291
Otago	14,748	15,043	15,344	15,651	15,964	16,283
Southland	-	-	-	-	-	-
NZ Total	**151,889**	**154,927**	**158,026**	**161,186**	**164,410**	**167,698**

Orchard & Viticulture residues, gross energy (GJ) per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	32,964	33,623	34,296	34,982	35,681	36,395
Auckland	60,492	61,702	62,936	64,195	65,478	66,788
Waikato	20,520	20,930	21,349	21,776	22,212	22,656
Bay of Plenty	65,006	66,306	67,632	68,984	70,364	71,771
Gisborne	60,066	61,268	62,493	63,743	65,018	66,318
Hawkes Bay	364,059	371,340	378,767	386,343	394,069	401,951
Taranaki	936	955	974	993	1,013	1,033
Manawatu-Wanganui	4,992	5,092	5,194	5,298	5,404	5,512
Wellington	9,568	9,759	9,955	10,154	10,357	10,564
Wairarapa	1,052	1,074	1,095	1,117	1,139	1,162
Tasman-Nelson	130,769	133,384	136,052	138,773	141,548	144,379
Marlborough	237,000	241,740	246,575	251,506	256,536	261,667
West Coast	-	-	-	-	-	-
Canterbury	21,936	22,375	22,822	23,279	23,744	24,219
Otago	108,545	110,716	112,930	115,189	117,492	119,842
Southland	-	-	-	-	-	-
NZ Total	**1,117,905**	**1,140,263**	**1,163,068**	**1,186,330**	**1,210,056**	**1,234,257**

Orchard & Viticulture residues, green tonnes per annum, recoverability level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	3,583	3,655	3,728	3,802	3,878	3,956
Auckland	6,575	6,707	6,841	6,978	7,117	7,260
Waikato	2,230	2,275	2,321	2,367	2,414	2,463
Bay of Plenty	7,066	7,207	7,351	7,498	7,648	7,801
Gisborne	6,529	6,660	6,793	6,929	7,067	7,208
Hawkes Bay	39,572	40,363	41,170	41,994	42,834	43,690
Taranaki	102	104	106	108	110	112
Manawatu-Wanganui	543	553	565	576	587	599
Wellington	1,040	1,061	1,082	1,104	1,126	1,148
Wairarapa	114	117	119	121	124	126
Tasman-Nelson	14,214	14,498	14,788	15,084	15,386	15,693
Marlborough	25,761	26,276	26,802	27,338	27,884	28,442
West Coast	-	-	-	-	-	-
Canterbury	2,384	2,432	2,481	2,530	2,581	2,633
Otago	11,798	12,034	12,275	12,521	12,771	13,026
Southland	-	-	-	-	-	-
NZ Total	**121,511**	**123,942**	**126,420**	**128,949**	**131,528**	**134,158**

Orchard & Viticulture residues, energy (GJ) per annum, recoverability level 1, 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	26,371	26,899	27,437	27,985	28,545	29,116
Auckland	48,394	49,361	50,349	51,356	52,383	53,430
Waikato	16,416	16,744	17,079	17,421	17,769	18,125
Bay of Plenty	52,004	53,045	54,105	55,188	56,291	57,417
Gisborne	48,053	49,014	49,994	50,994	52,014	53,055
Hawkes Bay	291,247	297,072	303,014	309,074	315,256	321,561
Taranaki	749	764	779	795	811	827
Manawatu-Wanganui	3,994	4,073	4,155	4,238	4,323	4,409
Wellington	7,654	7,807	7,964	8,123	8,285	8,451
Wairarapa	842	859	876	894	911	930
Tasman-Nelson	104,615	106,707	108,841	111,018	113,239	115,503
Marlborough	189,600	193,392	197,260	201,205	205,229	209,334
West Coast	-	-	-	-	-	-
Canterbury	17,549	17,900	18,258	18,623	18,995	19,375
Otago	86,836	88,573	90,344	92,151	93,994	95,874
Southland	-	-	-	-	-	-
NZ Total	**894,324**	**912,210**	**930,455**	**949,064**	**968,045**	**987,406**

Orchard & Viticulture residues, green tonnes per annum, recoverability level 2, 60%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	2,911	2,969	3,029	3,089	3,151	3,214
Auckland	5,342	5,449	5,558	5,669	5,783	5,898
Waikato	1,812	1,848	1,885	1,923	1,962	2,001
Bay of Plenty	5,741	5,856	5,973	6,092	6,214	6,339
Gisborne	5,305	5,411	5,519	5,629	5,742	5,857
Hawkes Bay	32,152	32,795	33,451	34,120	34,802	35,498
Taranaki	83	84	86	88	89	91
Manawatu-Wanganui	441	450	459	468	477	487
Wellington	845	862	879	897	915	933
Wairarapa	93	95	97	99	101	103
Tasman-Nelson	11,549	11,780	12,015	12,256	12,501	12,751
Marlborough	20,931	21,349	21,776	22,212	22,656	23,109
West Coast	-	-	-	-	-	-
Canterbury	1,937	1,976	2,016	2,056	2,097	2,139
Otago	9,586	9,778	9,973	10,173	10,376	10,584
Southland	-	-	-	-	-	-
NZ Total	**98,728**	**100,703**	**102,717**	**104,771**	**106,866**	**109,004**

Orchard & Viticulture residues, energy (GJ) per annum, recoverability level 2, 60%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	21,427	21,855	22,292	22,738	23,193	23,657
Auckland	39,320	40,106	40,908	41,726	42,561	43,412
Waikato	13,338	13,605	13,877	14,154	14,437	14,726
Bay of Plenty	42,254	43,099	43,961	44,840	45,737	46,651
Gisborne	39,043	39,824	40,621	41,433	42,262	43,107
Hawkes Bay	236,638	241,371	246,199	251,123	256,145	261,268
Taranaki	608	621	633	646	659	672
Manawatu-Wanganui	3,245	3,310	3,376	3,443	3,512	3,583
Wellington	6,219	6,344	6,470	6,600	6,732	6,866
Wairarapa	684	698	712	726	741	755
Tasman-Nelson	85,000	86,700	88,434	90,202	92,006	93,847
Marlborough	154,050	157,131	160,274	163,479	166,749	170,084
West Coast	-	-	-	-	-	-
Canterbury	14,258	14,544	14,834	15,131	15,434	15,742
Otago	70,554	71,965	73,405	74,873	76,370	77,897
Southland	-	-	-	-	-	-
NZ Total	**726,638**	**741,171**	**755,994**	**771,114**	**786,536**	**802,267**

Appendix D – Straw and Stover residues

Straw and Stover residues, sustainable tonnage, per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,832	1,868	1,905	1,944	1,982	2,022
Auckland	4,032	4,113	4,195	4,279	4,365	4,452
Waikato	18,365	18,732	19,107	19,489	19,879	20,276
Bay of Plenty	10,433	10,641	10,854	11,071	11,293	11,519
Gisborne	8,838	9,015	9,195	9,379	9,567	9,758
Hawkes Bay	9,068	9,249	9,434	9,623	9,815	10,011
Taranaki	440	448	457	467	476	485
Manawatu-Wanganui	18,828	19,205	19,589	19,980	20,380	20,788
Wellington	1,676	1,709	1,744	1,778	1,814	1,850
Wairarapa	2,514	2,564	2,616	2,668	2,721	2,776
Tasman-Nelson	-	-	-	-	-	-
Marlborough	1,995	2,035	2,075	2,117	2,159	2,202
West Coast	-	-	-	-	-	-
Canterbury	258,814	263,991	269,270	274,656	280,149	285,752
Otago	25,674	26,188	26,712	27,246	27,791	28,347
Southland	16,497	16,827	17,163	17,507	17,857	18,214
NZ Total	**379,005**	**386,585**	**394,317**	**402,203**	**410,248**	**418,452**

Straw and Stover residues, sustainable energy, (GJ) per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	32,601	33,253	33,918	34,596	35,288	35,994
Auckland	71,778	73,213	74,677	76,171	77,694	79,248
Waikato	326,896	333,434	340,103	346,905	353,843	360,920
Bay of Plenty	185,704	189,418	193,206	197,070	201,012	205,032
Gisborne	157,316	160,463	163,672	166,945	170,284	173,690
Hawkes Bay	161,402	164,630	167,922	171,281	174,706	178,200
Taranaki	7,826	7,982	8,142	8,305	8,471	8,640
Manawatu-Wanganui	335,138	341,841	348,678	355,652	362,765	370,020
Wellington	29,829	30,426	31,034	31,655	32,288	32,934
Wairarapa	44,752	45,647	46,560	47,491	48,441	49,410
Tasman-Nelson	-	-	-	-	-	-
Marlborough	35,508	36,218	36,943	37,682	38,435	39,204
West Coast	-	-	-	-	-	-
Canterbury	4,606,895	4,699,033	4,793,014	4,888,874	4,986,652	5,086,385
Otago	457,003	466,143	475,465	484,975	494,674	504,568
Southland	293,647	299,520	305,510	311,620	317,853	324,210
NZ Total	**6,746,294**	**6,881,220**	**7,018,845**	**7,159,222**	**7,302,406**	**7,448,454**

Straw and Stover residues, tonnage per annum recoverability level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	1,425	1,453	1,482	1,512	1,542	1,573
Auckland	3,136	3,199	3,263	3,328	3,395	3,463
Waikato	14,284	14,570	14,861	15,158	15,461	15,771
Bay of Plenty	8,114	8,277	8,442	8,611	8,783	8,959
Gisborne	6,874	7,011	7,152	7,295	7,441	7,589
Hawkes Bay	7,053	7,194	7,337	7,484	7,634	7,787
Taranaki	342	349	356	363	370	378
Manawatu-Wanganui	14,644	14,937	15,236	15,540	15,851	16,168
Wellington	1,303	1,329	1,356	1,383	1,411	1,439
Wairarapa	1,955	1,995	2,034	2,075	2,117	2,159
Tasman-Nelson	-	-	-	-	-	-
Marlborough	1,552	1,583	1,614	1,647	1,679	1,713
West Coast	-	-	-	-	-	-
Canterbury	201,300	205,326	209,433	213,621	217,894	222,252
Otago	19,969	20,368	20,776	21,191	21,615	22,047
Southland	12,831	13,088	13,349	13,616	13,889	14,166
NZ Total	**294,782**	**300,678**	**306,691**	**312,825**	**319,081**	**325,463**

Straw and Stover residues, energy (GJ) per annum. recoverability level 1, 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	25,356	25,863	26,380	26,908	27,446	27,995
Auckland	55,827	56,944	58,082	59,244	60,429	61,638
Waikato	254,253	259,338	264,524	269,815	275,211	280,715
Bay of Plenty	144,436	147,325	150,272	153,277	156,343	159,469
Gisborne	122,357	124,804	127,300	129,846	132,443	135,092
Hawkes Bay	125,535	128,045	130,606	133,218	135,883	138,600
Taranaki	6,087	6,208	6,333	6,459	6,588	6,720
Manawatu-Wanganui	260,663	265,876	271,194	276,618	282,150	287,793
Wellington						
Wairarapa	34,807	35,503	36,213	36,937	37,676	38,430
Tasman-Nelson	-	-	-	-	-	-
Marlborough	27,618	28,170	28,733	29,308	29,894	30,492
West Coast	-	-	-	-	-	-
Canterbury	3,583,141	3,654,804	3,727,900	3,802,458	3,878,507	3,956,077
Otago	355,446	362,555	369,806	377,203	384,747	392,442
Southland	228,392	232,960	237,619	242,371	247,219	252,163
NZ Total	**5,247,118**	**5,352,060**	**5,459,101**	**5,568,283**	**5,679,649**	**5,793,242**

Straw and Stover residues, tonnage per annum recoverability level 2, 60%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	1,221	1,245	1,270	1,296	1,322	1,348
Auckland	2,688	2,742	2,797	2,853	2,910	2,968
Waikato	12,243	12,488	12,738	12,993	13,253	13,518
Bay of Plenty	6,955	7,094	7,236	7,381	7,529	7,679
Gisborne	5,892	6,010	6,130	6,253	6,378	6,505
Hawkes Bay	6,045	6,166	6,289	6,415	6,543	6,674
Taranaki	293	299	305	311	317	324
Manawatu-Wanganui	12,552	12,803	13,059	13,320	13,587	13,858
Wellington	1,117	1,140	1,162	1,186	1,209	1,233
Wairarapa	1,676	1,710	1,744	1,779	1,814	1,851
Tasman-Nelson	-	-	-	-	-	-
Marlborough	1,330	1,356	1,384	1,411	1,440	1,468
West Coast	-	-	-	-	-	-
Canterbury	172,543	175,994	179,514	183,104	186,766	190,501
Otago	17,116	17,459	17,808	18,164	18,527	18,898
Southland	10,998	11,218	11,442	11,671	11,905	12,143
NZ Total	**252,670**	**257,724**	**262,878**	**268,136**	**273,498**	**278,968**

Straw and Stover residues, energy (GJ) per annum. recoverability level 2, 60%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	21,734	22,168	22,612	23,064	23,525	23,996
Auckland	47,852	48,809	49,785	50,781	51,796	52,832
Waikato	217,931	222,289	226,735	231,270	235,895	240,613
Bay of Plenty	123,803	126,279	128,804	131,380	134,008	136,688
Gisborne	104,878	106,975	109,115	111,297	113,523	115,793
Hawkes Bay	107,601	109,753	111,948	114,187	116,471	118,800
Taranaki	5,217	5,322	5,428	5,537	5,647	5,760
Manawatu-Wanganui	223,426	227,894	232,452	237,101	241,843	246,680
Wellington						
Wairarapa	29,835	30,431	31,040	31,661	32,294	32,940
Tasman-Nelson	-	-	-	-	-	-
Marlborough	23,672	24,146	24,629	25,121	25,624	26,136
West Coast	-	-	-	-	-	-
Canterbury	3,071,264	3,132,689	3,195,343	3,259,250	3,324,435	3,390,923
Otago	304,668	310,762	316,977	323,317	329,783	336,378
Southland	195,764	199,680	203,673	207,747	211,902	216,140
NZ Total	**4,497,530**	**4,587,480**	**4,679,230**	**4,772,814**	**4,868,271**	**4,965,636**

Appendix E – Wood processing residues

Gross wood processing residues (after incumbent use) green tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	8,551	8,551	8,551	8,551	8,551	8,551
Auckland	-109,053	-109,053	-109,053	-109,053	-109,053	-109,053
Waikato	56,872	56,872	56,872	56,872	56,872	56,872
Bay of Plenty	70,983	70,983	70,983	70,983	70,983	70,983
Gisborne	-6,636	-6,636	-6,636	-6,636	-6,636	-6,636
Hawkes Bay	166,620	166,620	166,620	166,620	166,620	166,620
Taranaki	4,474	4,474	4,474	4,474	4,474	4,474
Manawatu-Wanganui	17,375	17,375	17,375	17,375	17,375	17,375
Wellington	0	0	0	0	0	0
Wairarapa	-9,679	-9,679	-9,679	-9,679	-9,679	-9,679
Tasman-Nelson	-13,712	-13,712	-13,712	-13,712	-13,712	-13,712
Marlborough	-71	-71	-71	-71	-71	-71
West Coast	15,138	15,138	15,138	15,138	15,138	15,138
Canterbury	-1,752	-1,752	-1,752	-1,752	-1,752	-1,752
Otago	-1,914	-1,914	-1,914	-1,914	-1,914	-1,914
Southland	-41,255	-41,255	-41,255	-41,255	-41,255	-41,255
NZ Total	**155,941**	**155,941**	**155,941**	**155,941**	**155,941**	**155,941**

The gross wood energy use for heat within the wood processing industry is 23,868,000 GJ (23.868 PJ) per annum. The apparent deficit after incumbent use is 8% and given margin of error in calculations it can basically be assumed to be in balance with some site exceptions. The wood processing industry is largely in balance and provides much of its own heat energy demand from internally generated residues.

Gross wood processing residues (after incumbent use) energy (GJ) per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	59,002	59,002	59,002	59,002	59,002	59,002
Auckland	-752,466	-752,466	-752,466	-752,466	-752,466	-752,466
Waikato	392,417	392,417	392,417	392,417	392,417	392,417
Bay of Plenty	489,783	489,783	489,783	489,783	489,783	489,783
Gisborne	-45,788	-45,788	-45,788	-45,788	-45,788	-45,788
Hawkes Bay	1,149,678	1,149,678	1,149,678	1,149,678	1,149,678	1,149,678
Taranaki	30,871	30,871	30,871	30,871	30,871	30,871
Manawatu-Wanganui	119,888	119,888	119,888	119,888	119,888	119,888
Wellington	0	0	0	0	0	0
Wairarapa	-66,785	-66,785	-66,785	-66,785	-66,785	-66,785
Tasman-Nelson	-94,613	-94,613	-94,613	-94,613	-94,613	-94,613
Marlborough	-490	-490	-490	-490	-490	-490
West Coast	104,452	104,452	104,452	104,452	104,452	104,452
Canterbury	-12,089	-12,089	-12,089	-12,089	-12,089	-12,089
Otago	-13,207	-13,207	-13,207	-13,207	-13,207	-13,207
Southland	-284,660	-284,660	-284,660	-284,660	-284,660	-284,660
NZ Total	**1,075,993**	**1,075,993**	**1,075,993**	**1,075,993**	**1,075,993**	**1,075,993**

Wood processing residues, green tonnes per annum, recovery level 1, 95%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	8,123	8,123	8,123	8,123	8,123	8,123
Auckland	-103,600	-103,600	-103,600	-103,600	-103,600	-103,600
Waikato	54,028	54,028	54,028	54,028	54,028	54,028
Bay of Plenty	67,434	67,434	67,434	67,434	67,434	67,434
Gisborne	-6,304	-6,304	-6,304	-6,304	-6,304	-6,304
Hawkes Bay	158,289	158,289	158,289	158,289	158,289	158,289
Taranaki	4,250	4,250	4,250	4,250	4,250	4,250
Manawatu-Wanganui	16,506	16,506	16,506	16,506	16,506	16,506
Wellington	0	0	0	0	0	0
Wairarapa	-9,195	-9,195	-9,195	-9,195	-9,195	-9,195
Tasman-Nelson	-13,026	-13,026	-13,026	-13,026	-13,026	-13,026
Marlborough	-67	-67	-67	-67	-67	-67
West Coast	14,381	14,381	14,381	14,381	14,381	14,381
Canterbury	-1,664	-1,664	-1,664	-1,664	-1,664	-1,664
Otago	-1,818	-1,818	-1,818	-1,818	-1,818	-1,818
Southland	-39,192	-39,192	-39,192	-39,192	-39,192	-39,192
NZ Total	**148,144**	**148,144**	**148,144**	**148,144**	**148,144**	**148,144**

Wood processing residues, energy (GJ) per annum, recovery level 1, 95%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	56,052	56,052	56,052	56,052	56,052	56,052
Auckland	-714,842	-714,842	-714,842	-714,842	-714,842	-714,842
Waikato	372,796	372,796	372,796	372,796	372,796	372,796
Bay of Plenty	465,294	465,294	465,294	465,294	465,294	465,294
Gisborne	-43,499	-43,499	-43,499	-43,499	-43,499	-43,499
Hawkes Bay	1,092,194	1,092,194	1,092,194	1,092,194	1,092,194	1,092,194
Taranaki	29,327	29,327	29,327	29,327	29,327	29,327
Manawatu-Wanganui	113,893	113,893	113,893	113,893	113,893	113,893
Wellington	0	0	0	0	0	0
Wairarapa	-63,446	-63,446	-63,446	-63,446	-63,446	-63,446
Tasman-Nelson	-89,882	-89,882	-89,882	-89,882	-89,882	-89,882
Marlborough	-465	-465	-465	-465	-465	-465
West Coast	99,230	99,230	99,230	99,230	99,230	99,230
Canterbury	-11,484	-11,484	-11,484	-11,484	-11,484	-11,484
Otago	-12,546	-12,546	-12,546	-12,546	-12,546	-12,546
Southland	-270,427	-270,427	-270,427	-270,427	-270,427	-270,427
NZ Total	**1,022,193**	**1,022,193**	**1,022,193**	**1,022,193**	**1,022,193**	**1,022,193**

Wood processing residues, green tonnes per annum, recovery level 2, 90%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	7,696	7,696	7,696	7,696	7,696	7,696
Auckland	-98,148	-98,148	-98,148	-98,148	-98,148	-98,148
Waikato	51,185	51,185	51,185	51,185	51,185	51,185
Bay of Plenty	63,885	63,885	63,885	63,885	63,885	63,885
Gisborne	-5,972	-5,972	-5,972	-5,972	-5,972	-5,972
Hawkes Bay	149,958	149,958	149,958	149,958	149,958	149,958
Taranaki	4,027	4,027	4,027	4,027	4,027	4,027
Manawatu-Wanganui	15,638	15,638	15,638	15,638	15,638	15,638
Wellington	0	0	0	0	0	0
Wairarapa	-8,711	-8,711	-8,711	-8,711	-8,711	-8,711
Tasman-Nelson	-12,341	-12,341	-12,341	-12,341	-12,341	-12,341
Marlborough	-64	-64	-64	-64	-64	-64
West Coast	13,624	13,624	13,624	13,624	13,624	13,624
Canterbury	-1,577	-1,577	-1,577	-1,577	-1,577	-1,577
Otago	-1,723	-1,723	-1,723	-1,723	-1,723	-1,723
Southland	-37,130	-37,130	-37,130	-37,130	-37,130	-37,130
NZ Total	**140,347**	**140,347**	**140,347**	**140,347**	**140,347**	**140,347**

Wood processing residues, energy (GJ) per annum, recovery level 2, 90%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	53,102	53,102	53,102	53,102	53,102	53,102
Auckland	-677,219	-677,219	-677,219	-677,219	-677,219	-677,219
Waikato	353,175	353,175	353,175	353,175	353,175	353,175
Bay of Plenty	440,804	440,804	440,804	440,804	440,804	440,804
Gisborne	-41,210	-41,210	-41,210	-41,210	-41,210	-41,210
Hawkes Bay	1,034,710	1,034,710	1,034,710	1,034,710	1,034,710	1,034,710
Taranaki	27,784	27,784	27,784	27,784	27,784	27,784
Manawatu-Wanganui	107,899	107,899	107,899	107,899	107,899	107,899
Wellington	0	0	0	0	0	0
Wairarapa	-60,107	-60,107	-60,107	-60,107	-60,107	-60,107
Tasman-Nelson	-85,152	-85,152	-85,152	-85,152	-85,152	-85,152
Marlborough	-441	-441	-441	-441	-441	-441
West Coast	94,007	94,007	94,007	94,007	94,007	94,007
Canterbury	-10,880	-10,880	-10,880	-10,880	-10,880	-10,880
Otago	-11,886	-11,886	-11,886	-11,886	-11,886	-11,886
Southland	-256,194	-256,194	-256,194	-256,194	-256,194	-256,194
NZ Total	**968,394**	**968,394**	**968,394**	**968,394**	**968,394**	**968,394**

Appendix F - Port bark

Gross bark supply at ports (no debarking) tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Whangarei	40,205	36,184	34,174	40,205	40,205	40,205
Auckland	1,618	1,456	1,375	1,618	1,618	1,618
Tauranga	80,008	72,007	68,007	80,008	80,008	80,008
Gisborne	34,155	30,740	29,032	34,155	34,155	34,155
Napier	17,226	15,503	14,642	17,226	17,226	17,226
New Plymouth	4,783	4,305	4,066	4,783	4,783	4,783
Wellington	15,202	13,682	12,922	15,202	15,202	15,202
Nelson	9,870	8,883	8,389	9,870	9,870	9,870
Picton	9,769	8,792	8,304	9,769	9,769	9,769
Christchurch	7,786	7,007	6,618	7,786	7,786	7,786
Timaru	5,176	4,659	4,400	5,176	5,176	5,176
Dunedin	12,996	11,696	11,047	12,996	12,996	12,996
Invercargill	7,088	6,379	6,025	7,088	7,088	7,088
Total	**245,881**	**221,293**	**208,999**	**245,881**	**245,881**	**245,881**

Gross bark supply at ports (no debarking) energy (GJ) per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Whangarei	277,412	249,671	235,800	277,412	277,412	277,412
Auckland	11,162	10,046	9,488	11,162	11,162	11,162
Tauranga	552,056	496,850	469,247	552,056	552,056	552,056
Gisborne	235,670	212,103	200,320	235,670	235,670	235,670
Napier	118,856	106,971	101,028	118,856	118,856	118,856
New Plymouth	33,006	29,705	28,055	33,006	33,006	33,006
Wellington	104,895	94,405	89,161	104,895	104,895	104,895
Nelson	68,100	61,290	57,885	68,100	68,100	68,100
Picton	67,406	60,666	57,295	67,406	67,406	67,406
Christchurch	53,721	48,349	45,663	53,721	53,721	53,721
Timaru	35,716	32,145	30,359	35,716	35,716	35,716
Dunedin	89,672	80,705	76,221	89,672	89,672	89,672
Invercargill	48,908	44,017	41,572	48,908	48,908	48,908
Total	**1,696,581**	**1,526,923**	**1,442,094**	**1,696,581**	**1,696,581**	**1,696,581**

Bark supply at ports, tonnes per annum, recovery level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Whangarei	32,820	29,538	27,897	32,820	32,820	32,820
Auckland	1,321	1,189	1,123	1,321	1,321	1,321
Tauranga	65,313	58,781	55,516	65,313	65,313	65,313
Gisborne	27,882	25,094	23,699	27,882	27,882	27,882
Napier	14,062	12,655	11,952	14,062	14,062	14,062
New Plymouth	3,905	3,514	3,319	3,905	3,905	3,905
Wellington	12,410	11,169	10,548	12,410	12,410	12,410
Nelson	8,057	7,251	6,848	8,057	8,057	8,057
Picton	7,975	7,177	6,779	7,975	7,975	7,975
Christchurch	6,356	5,720	5,402	6,356	6,356	6,356
Timaru	4,226	3,803	3,592	4,226	4,226	4,226
Dunedin	10,609	9,548	9,018	10,609	10,609	10,609
Invercargill	5,786	5,208	4,918	5,786	5,786	5,786
Total	**200,719**	**180,648**	**170,612**	**200,719**	**200,719**	**200,719**

Bark supply at ports, energy (GJ) per annum, recovery level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Whangarei	223,177	200,859	189,700	223,177	223,177	223,177
Auckland	8,980	8,082	7,633	8,980	8,980	8,980
Tauranga	444,126	399,714	377,507	444,126	444,126	444,126
Gisborne	189,596	170,636	161,156	189,596	189,596	189,596
Napier	95,619	86,057	81,276	95,619	95,619	95,619
New Plymouth	26,553	23,898	22,570	26,553	26,553	26,553
Wellington	84,387	75,949	71,729	84,387	84,387	84,387
Nelson	54,786	49,307	46,568	54,786	54,786	54,786
Picton	54,228	48,805	46,094	54,228	54,228	54,228
Christchurch	43,219	38,897	36,736	43,219	43,219	43,219
Timaru	28,734	25,860	24,424	28,734	28,734	28,734
Dunedin	72,141	64,927	61,320	72,141	72,141	72,141
Invercargill	39,346	35,411	33,444	39,346	39,346	39,346
Total	**1,364,892**	**1,228,403**	**1,160,158**	**1,364,892**	**1,364,892**	**1,364,892**

Bark supply at ports, tonnes per annum, recovery level 2, 70%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Whangarei	28,718	25,846	24,410	28,718	28,718	28,718
Auckland	1,156	1,040	982	1,156	1,156	1,156
Tauranga	57,149	51,434	48,576	57,149	57,149	57,149
Gisborne	24,397	21,957	20,737	24,397	24,397	24,397
Napier	12,304	11,074	10,458	12,304	12,304	12,304
New Plymouth	3,417	3,075	2,904	3,417	3,417	3,417
Wellington	10,859	9,773	9,230	10,859	10,859	10,859
Nelson	7,050	6,345	5,992	7,050	7,050	7,050
Picton	6,978	6,280	5,931	6,978	6,978	6,978
Christchurch	5,561	5,005	4,727	5,561	5,561	5,561
Timaru	3,697	3,328	3,143	3,697	3,697	3,697
Dunedin	9,283	8,355	7,890	9,283	9,283	9,283
Invercargill	5,063	4,557	4,303	5,063	5,063	5,063
Total	**175,630**	**158,067**	**149,285**	**175,630**	**175,630**	**175,630**

Bark supply at ports, energy (GJ) per annum, recovery level 2, 70%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Whangarei	195,280	175,752	165,988	195,280	195,280	195,280
Auckland	7,858	7,072	6,679	7,858	7,858	7,858
Tauranga	388,611	349,750	330,319	388,611	388,611	388,611
Gisborne	165,896	149,307	141,012	165,896	165,896	165,896
Napier	83,667	75,300	71,117	83,667	83,667	83,667
New Plymouth	23,234	20,911	19,749	23,234	23,234	23,234
Wellington	73,839	66,455	62,763	73,839	73,839	73,839
Nelson	47,938	43,144	40,747	47,938	47,938	47,938
Picton	47,450	42,705	40,332	47,450	47,450	47,450
Christchurch	37,816	34,035	32,144	37,816	37,816	37,816
Timaru	25,142	22,628	21,371	25,142	25,142	25,142
Dunedin	63,123	56,811	53,655	63,123	63,123	63,123
Invercargill	34,428	30,985	29,264	34,428	34,428	34,428
Total	**1,194,281**	**1,074,853**	**1,015,139**	**1,194,281**	**1,194,281**	**1,194,281**

Appendix G – Shelterbelt turnover residuals

Shelter belt turnover residuals, Gross Volume; m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	2,100	2,100	2,100	2,100	2,100	2,100
Auckland	3,800	3,800	3,800	3,800	3,800	3,800
Waikato	9,000	9,000	9,000	9,000	9,000	9,000
Bay of Plenty	8,000	8,000	8,000	8,000	8,000	8,000
Gisborne	400	400	400	400	400	400
Hawkes Bay	5,200	5,200	5,200	5,200	5,200	5,200
Taranaki	1,900	1,900	1,900	1,900	1,900	1,900
Manawatu-Wanganui	6,600	6,600	6,600	6,600	6,600	6,600
Wellington	200	200	200	200	200	200
Wairarapa	4,000	4,000	4,000	4,000	4,000	4,000
Tasman-Nelson	700	700	700	700	700	700
Marlborough	2,400	2,400	2,400	2,400	2,400	2,400
West Coast	500	500	500	500	500	500
Canterbury	37,100	37,100	37,100	37,100	37,100	37,100
Otago	9,000	9,000	9,000	9,000	9,000	9,000
Southland	11,500	11,500	11,500	11,500	11,500	11,500
NZ Total	**102,400**	**102,400**	**102,400**	**102,400**	**102,400**	**102,400**

Shelter belt turnover residuals, Gross energy (GJ per annum)

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	14,490	14,490	14,490	14,490	14,490	14,490
Auckland	26,220	26,220	26,220	26,220	26,220	26,220
Waikato	62,100	62,100	62,100	62,100	62,100	62,100
Bay of Plenty	55,200	55,200	55,200	55,200	55,200	55,200
Gisborne	2,760	2,760	2,760	2,760	2,760	2,760
Hawkes Bay	35,880	35,880	35,880	35,880	35,880	35,880
Taranaki	13,110	13,110	13,110	13,110	13,110	13,110
Manawatu-Wanganui	45,540	45,540	45,540	45,540	45,540	45,540
Wellington	1,380	1,380	1,380	1,380	1,380	1,380
Wairarapa	27,600	27,600	27,600	27,600	27,600	27,600
Tasman-Nelson	4,830	4,830	4,830	4,830	4,830	4,830
Marlborough	16,560	16,560	16,560	16,560	16,560	16,560
West Coast	3,450	3,450	3,450	3,450	3,450	3,450
Canterbury	255,990	255,990	255,990	255,990	255,990	255,990
Otago	62,100	62,100	62,100	62,100	62,100	62,100
Southland	79,350	79,350	79,350	79,350	79,350	79,350
NZ Total	**706,560**	**706,560**	**706,560**	**706,560**	**706,560**	**706,560**

Shelter belt turnover residuals, Volume (m^3 p.a.) Recoverability Level 1 = 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,680	1,680	1,680	1,680	1,680	1,680
Auckland	3,040	3,040	3,040	3,040	3,040	3,040
Waikato	7,200	7,200	7,200	7,200	7,200	7,200
Bay of Plenty	6,400	6,400	6,400	6,400	6,400	6,400
Gisborne	320	320	320	320	320	320
Hawkes Bay	4,160	4,160	4,160	4,160	4,160	4,160
Taranaki	1,520	1,520	1,520	1,520	1,520	1,520
Manawatu-Wanganui	5,280	5,280	5,280	5,280	5,280	5,280
Wellington	160	160	160	160	160	160
Wairarapa	3,200	3,200	3,200	3,200	3,200	3,200
Tasman-Nelson	560	560	560	560	560	560
Marlborough	1,920	1,920	1,920	1,920	1,920	1,920
West Coast	400	400	400	400	400	400
Canterbury	29,680	29,680	29,680	29,680	29,680	29,680
Otago	7,200	7,200	7,200	7,200	7,200	7,200
Southland	9,200	9,200	9,200	9,200	9,200	9,200
NZ Total	**81,920**	**81,920**	**81,920**	**81,920**	**81,920**	**81,920**

Shelter belt turnover residuals, Energy (GJ p.a.) Recoverability Level 1 = 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	11,592	11,592	11,592	11,592	11,592	11,592
Auckland	20,976	20,976	20,976	20,976	20,976	20,976
Waikato	49,680	49,680	49,680	49,680	49,680	49,680
Bay of Plenty	44,160	44,160	44,160	44,160	44,160	44,160
Gisborne	2,208	2,208	2,208	2,208	2,208	2,208
Hawkes Bay	28,704	28,704	28,704	28,704	28,704	28,704
Taranaki	10,488	10,488	10,488	10,488	10,488	10,488
Manawatu-Wanganui	36,432	36,432	36,432	36,432	36,432	36,432
Wellington	1,104	1,104	1,104	1,104	1,104	1,104
Wairarapa	22,080	22,080	22,080	22,080	22,080	22,080
Tasman-Nelson	3,864	3,864	3,864	3,864	3,864	3,864
Marlborough	13,248	13,248	13,248	13,248	13,248	13,248
West Coast	2,760	2,760	2,760	2,760	2,760	2,760
Canterbury	204,792	204,792	204,792	204,792	204,792	204,792
Otago	49,680	49,680	49,680	49,680	49,680	49,680
Southland	63,480	63,480	63,480	63,480	63,480	63,480
NZ Total	**565,248**	**565,248**	**565,248**	**565,248**	**565,248**	**565,248**

Shelter belt turnover residuals, Volume (m^3 p.a.) Recoverability Level 2 = 60%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,260	1,260	1,260	1,260	1,260	1,260
Auckland	2,280	2,280	2,280	2,280	2,280	2,280
Waikato	5,400	5,400	5,400	5,400	5,400	5,400
Bay of Plenty	4,800	4,800	4,800	4,800	4,800	4,800
Gisborne	240	240	240	240	240	240
Hawkes Bay	3,120	3,120	3,120	3,120	3,120	3,120
Taranaki	1,140	1,140	1,140	1,140	1,140	1,140
Manawatu-Wanganui	3,960	3,960	3,960	3,960	3,960	3,960
Wellington	120	120	120	120	120	120
Wairarapa	2,400	2,400	2,400	2,400	2,400	2,400
Tasman-Nelson	420	420	420	420	420	420
Marlborough	1,440	1,440	1,440	1,440	1,440	1,440
West Coast	300	300	300	300	300	300
Canterbury	22,260	22,260	22,260	22,260	22,260	22,260
Otago	5,400	5,400	5,400	5,400	5,400	5,400
Southland	6,900	6,900	6,900	6,900	6,900	6,900
NZ Total	**61,440**	**61,440**	**61,440**	**61,440**	**61,440**	**61,440**

Shelter belt turnover residuals, Energy (GJ p.a.) Recoverability Level 2 = 60%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	8,694	8,694	8,694	8,694	8,694	8,694
Auckland	15,732	15,732	15,732	15,732	15,732	15,732
Waikato	37,260	37,260	37,260	37,260	37,260	37,260
Bay of Plenty	33,120	33,120	33,120	33,120	33,120	33,120
Gisborne	1,656	1,656	1,656	1,656	1,656	1,656
Hawkes Bay	21,528	21,528	21,528	21,528	21,528	21,528
Taranaki	7,866	7,866	7,866	7,866	7,866	7,866
Manawatu-Wanganui	27,324	27,324	27,324	27,324	27,324	27,324
Wellington	828	828	828	828	828	828
Wairarapa	16,560	16,560	16,560	16,560	16,560	16,560
Tasman-Nelson	2,898	2,898	2,898	2,898	2,898	2,898
Marlborough	9,936	9,936	9,936	9,936	9,936	9,936
West Coast	2,070	2,070	2,070	2,070	2,070	2,070
Canterbury	153,594	153,594	153,594	153,594	153,594	153,594
Otago	37,260	37,260	37,260	37,260	37,260	37,260
Southland	47,610	47,610	47,610	47,610	47,610	47,610
NZ Total	**423,936**	**423,936**	**423,936**	**423,936**	**423,936**	**423,936**

Appendix H – Pulp logs

Gross pulp log supply; m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	568,485	365,300	387,904	553,472	708,133	767,870
Auckland	198,856	163,195	113,024	78,217	67,989	71,973
Waikato	1,013,754	790,222	588,770	533,752	609,586	709,470
Bay of Plenty	1,361,944	1,569,818	1,418,804	1,523,260	1,512,885	1,415,888
Gisborne	841,037	391,144	311,111	343,979	346,859	381,756
Hawkes Bay	556,276	399,688	319,916	255,844	298,542	372,802
Taranaki	116,211	40,617	21,782	17,887	30,142	40,185
Manawatu-Wanganui	335,959	155,156	95,754	77,982	82,138	90,798
Wellington	310,541	162,001	90,637	94,532	146,907	199,784
Wairarapa	59,871	25,567	16,619	13,170	9,221	5,680
Tasman-Nelson	319,744	305,877	312,091	271,940	252,689	295,619
Marlborough	348,083	168,378	148,200	205,725	205,638	148,048
West Coast	30,597	30,469	41,104	43,103	38,559	31,686
Canterbury	314,723	204,914	180,206	156,665	136,041	117,573
Otago	399,527	277,416	365,336	367,412	309,291	354,436
Southland	252,318	226,084	292,828	268,480	173,997	160,855
NZ Total	**7,027,926**	**5,275,845**	**4,704,085**	**4,805,421**	**4,928,617**	**5,164,422**

Gross pulp log energy supply; GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	3,922,548	2,520,567	2,676,536	3,818,958	4,886,115	5,298,301
Auckland	1,372,109	1,126,042	779,865	539,697	469,128	496,616
Waikato	6,994,906	5,452,535	4,062,514	3,682,889	4,206,145	4,895,342
Bay of Plenty	9,397,411	10,831,743	9,789,749	10,510,491	10,438,908	9,769,626
Gisborne	5,803,155	2,698,892	2,146,665	2,373,456	2,393,325	2,634,115
Hawkes Bay	3,838,303	2,757,849	2,207,419	1,765,320	2,059,939	2,572,331
Taranaki	801,853	280,257	150,299	123,423	207,982	277,275
Manawatu-Wanganui	2,318,116	1,070,574	660,701	538,076	566,749	626,508
Wellington	2,142,736	1,117,807	625,393	652,271	1,013,659	1,378,509
Wairarapa	413,107	176,410	114,672	90,874	63,627	39,189
Tasman-Nelson	2,206,230	2,110,553	2,153,431	1,876,389	1,743,552	2,039,768
Marlborough	2,401,772	1,161,807	1,022,577	1,419,505	1,418,899	1,021,532
West Coast	211,117	210,239	283,617	297,414	266,056	218,635
Canterbury	2,171,591	1,413,903	1,243,423	1,080,989	938,686	811,255
Otago	2,756,739	1,914,169	2,520,816	2,535,141	2,134,109	2,445,608
Southland	1,740,996	1,559,980	2,020,512	1,852,510	1,200,579	1,109,899
NZ Total	**48,492,690**	**36,403,327**	**32,458,189**	**33,157,403**	**34,007,458**	**35,634,509**

Pulp log availability after incumbents' users supplied; m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	56,849	36,530	38,790	55,347	70,813	76,787
Auckland	19,886	16,319	11,302	7,822	6,799	7,197
Waikato						
Bay of Plenty						
Gisborne	805,130	588,948	294,106	313,654	384,957	314,689
Hawkes Bay						
Taranaki	110,258	66,026	29,729	18,262	22,037	26,290
Manawatu-Wanganui	277,368	201,509	71,890	52,285	62,453	57,280
Wellington	262,468	185,229	93,076	76,071	133,205	172,976
Wairarapa	54,001	26,611	19,268	14,642	11,937	9,063
Tasman-Nelson						
Marlborough	268,776	174,501				
West Coast	31,588	26,309				
Canterbury	303,157	238,194				
Otago	373,475	319,299	308,222	372,384	337,291	277,881
Southland						
NZ Total	**2,562,955**	**1,879,476**	**866,384**	**910,467**	**1,029,492**	**942,164**

Pulp log energy availability after incumbents' users supplied; GJ per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	392,255	252,057	267,654	381,896	488,611	529,830
Auckland	137,211	112,604	77,986	53,970	46,913	49,662
Waikato	-	-	-	-	-	-
Bay of Plenty	-	-	-	-	-	-
Gisborne	1,414,109	4,063,739	2,029,334	2,164,214	2,656,200	2,171,352
Hawkes Bay	-	-	-	-	-	-
Taranaki	760,782	455,579	205,132	126,008	152,057	181,400
Manawatu-Wanganui	1,913,841	1,390,414	496,040	360,767	430,927	395,233
Wellington	1,811,028	1,278,083	642,221	524,891	919,115	1,193,537
Wairarapa	372,609	183,616	132,948	101,027	82,369	62,537
Tasman-Nelson	-	-	-	-	-	-
Marlborough	1,854,555	1,204,059	-	-	-	-
West Coast	217,955	181,535	-	-	-	-
Canterbury	2,091,783	1,643,537	-	-	-	-
Otago	2,576,976	2,203,164	2,126,735	2,569,450	2,327,306	1,917,381
Southland	-	-	-	-	-	-
NZ Total	**17,684,389**	**12,968,387**	**5,978,050**	**6,282,223**	**7,103,498**	**6,500,931**

Pulp log availability after incumbent supply; recoverability level 95%; m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	54,006	34,703	36,851	52,580	67,273	72,948
Auckland	18,891	15,503	10,737	7,431	6,459	6,837
Waikato	-	-	-	-	-	-
Bay of Plenty	-	-	-	-	-	-
Gisborne	764,873	559,500	279,401	297,972	365,709	298,954
Hawkes Bay	-	-	-	-	-	-
Taranaki	104,745	62,725	28,243	17,349	20,935	24,975
Manawatu-Wanganui	263,500	191,434	68,295	49,671	59,330	54,416
Wellington	249,344	175,968	88,422	72,268	126,545	164,328
Wairarapa	51,301	25,281	18,304	13,910	11,341	8,610
Tasman-Nelson	-	-	-	-	-	-
Marlborough	255,337	165,776	-	-	-	-
West Coast	30,008	24,994	-	-	-	-
Canterbury	287,999	226,284	-	-	-	-
Otago	354,801	303,334	292,811	353,765	320,426	263,987
Southland	-	-	-	-	-	-
NZ Total	**2,434,807**	**1,785,503**	**823,065**	**864,944**	**978,018**	**895,056**

Energy from pulp log availability after incumbent supply; recoverability level 95%; GJ per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	372,642	239,454	254,271	362,801	464,181	503,339
Auckland	130,350	106,974	74,087	51,271	44,567	47,178
Waikato	-	-	-	-	-	-
Bay of Plenty	-	-	-	-	-	-
Gisborne	5,277,625	3,860,552	1,927,868	2,056,004	2,523,390	2,062,784
Hawkes Bay	-	-	-	-	-	-
Taranaki	722,743	432,800	194,875	119,708	144,454	172,330
Manawatu-Wanganui	1,818,149	1,320,893	471,238	342,729	409,380	375,472
Wellington	1,720,477	1,214,179	610,110	498,646	873,159	1,133,860
Wairarapa	353,978	174,435	126,300	95,976	78,250	59,410
Tasman-Nelson	-	-	-	-	-	-
Marlborough	1,761,827	1,143,856	-	-	-	-
West Coast	207,058	172,458	-	-	-	-
Canterbury	1,987,194	1,561,360	-	-	-	-
Otago	2,448,127	2,093,006	2,020,398	2,440,978	2,210,941	1,821,512
Southland	-	-	-	-	-	-
NZ Total	**16,800,170**	**12,319,968**	**5,679,148**	**5,968,112**	**6,748,323**	**6,175,884**

Pulp log availability after incumbent supply; recoverability level 90%; m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	51,164	32,877	34,911	49,812	63,732	69,108
Auckland	17,897	14,688	10,172	7,040	6,119	6,478
Waikato	-	-	-	-	-	-
Bay of Plenty	-	-	-	-	-	-
Gisborne	724,617	530,053	264,696	282,289	346,461	283,220
Hawkes Bay	-	-	-	-	-	-
Taranaki	99,232	59,423	26,756	16,436	19,834	23,661
Manawatu-Wanganui	249,631	181,358	64,701	47,057	56,208	51,552
Wellington	236,221	166,706	83,768	68,464	119,885	155,679
Wairarapa	48,601	23,950	17,341	13,177	10,744	8,157
Tasman-Nelson	-	-	-	-	-	-
Marlborough	241,898	157,051	-	-	-	-
West Coast	28,429	23,678	-	-	-	-
Canterbury	272,841	214,374	-	-	-	-
Otago	336,127	287,369	277,400	335,146	303,562	250,093
Southland	-	-	-	-	-	-
NZ Total	**2,306,659**	**1,691,529**	**779,746**	**819,420**	**926,543**	**847,947**

Energy from pulp log availability after incumbent supply; recoverability level 90%; GJ per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	353,029	226,851	240,888	343,706	439,750	476,847
Auckland	123,490	101,344	70,188	48,573	42,221	44,695
Waikato	-	-	-	-	-	-
Bay of Plenty	-	-	-	-	-	-
Gisborne	4,999,856	3,657,365	1,826,401	1,947,793	2,390,580	1,954,217
Hawkes Bay	-	-	-	-	-	-
Taranaki	684,704	410,021	184,619	113,408	136,851	163,260
Manawatu-Wanganui	1,722,457	1,251,373	446,436	324,690	387,834	355,710
Wellington	1,629,925	1,150,274	577,999	472,402	827,203	1,074,183
Wairarapa	335,348	165,255	119,653	90,924	74,132	56,283
Tasman-Nelson	-	-	-	-	-	-
Marlborough	1,669,100	1,083,653	-	-	-	-
West Coast	196,160	163,381	-	-	-	-
Canterbury	1,882,605	1,479,184	-	-	-	-
Otago	2,319,278	1,982,848	1,914,062	2,312,505	2,094,576	1,725,642
Southland	-	-	-	-	-	-
NZ Total	**15,915,950**	**11,671,548**	**5,380,245**	**5,654,001**	**6,393,148**	**5,850,838**

Appendix I – Production thinnings

Gross residues from production thinnings, m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,050	1,464	23,049	31,751	10,744	1,627
Auckland	586	313	8,596	13,852	7,351	2,368
Waikato	1,237	1,013	17,444	29,969	16,675	4,373
Bay of Plenty	16,004	4,784	35,542	67,350	73,212	52,624
Gisborne	142	28	8,160	10,487	3,104	891
Hawkes Bay	6,769	14,136	31,889	28,321	7,139	3,340
Taranaki	1,033	736	10,752	15,849	6,733	1,932
Manawatu-Wanganui	4,145	3,897	41,778	57,355	24,644	9,316
Wellington	386	1,603	5,227	5,585	2,514	940
Wairarapa	431	146	3,511	6,122	3,555	1,229
Tasman-Nelson	201	219	6,322	7,596	2,000	709
Marlborough	2,053	2,018	13,431	17,072	5,655	2,050
West Coast	388	71	910	1,090	194	332
Canterbury	356	134	20,882	27,346	8,749	2,508
Otago	342	1,669	11,131	11,865	2,967	907
Southland	790	677	6,227	12,454	7,278	1,164
NZ Total	**35,915**	**32,910**	**244,852**	**344,063**	**182,515**	**86,308**

Gross energy from production thinnings, GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	7,242	10,105	159,040	219,080	74,131	11,228
Auckland	4,042	2,161	59,310	95,576	50,721	16,336
Waikato	8,533	6,989	120,361	206,786	115,056	30,174
Bay of Plenty	110,424	33,009	245,241	464,714	505,161	363,103
Gisborne	982	196	56,307	72,362	21,417	6,147
Hawkes Bay	46,707	97,540	220,034	195,418	49,261	23,045
Taranaki	7,130	5,081	74,187	109,358	46,455	13,333
Manawatu-Wanganui	28,603	26,890	288,271	395,748	170,043	64,278
Wellington	2,667	11,059	36,069	38,539	17,347	6,484
Wairarapa	2,975	1,010	24,224	42,244	24,532	8,477
Tasman-Nelson	1,388	1,509	43,623	52,411	13,803	4,893
Marlborough	14,168	13,924	92,675	117,797	39,022	14,143
West Coast	2,678	487	6,281	7,522	1,339	2,288
Canterbury	2,459	925	144,087	188,684	60,371	17,308
Otago	2,361	11,514	76,803	81,866	20,473	6,256
Southland	5,453	4,674	42,966	85,931	50,220	8,033
NZ Total	**247,811**	**227,076**	**1,689,477**	**2,374,035**	**1,259,351**	**595,528**

Residues from production thinnings, m^3 per annum, recoverability level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	840	1,172	18,439	25,401	8,595	1,302
Auckland	469	251	6,877	11,081	5,881	1,894
Waikato	989	810	13,955	23,975	13,340	3,498
Bay of Plenty	12,803	3,827	28,434	53,880	58,569	42,099
Gisborne	114	23	6,528	8,390	2,483	713
Hawkes Bay	5,415	11,309	25,511	22,657	5,711	2,672
Taranaki	827	589	8,601	12,679	5,386	1,546
Manawatu-Wanganui	3,316	3,118	33,423	45,884	19,715	7,453
Wellington	309	1,282	4,182	4,468	2,011	752
Wairarapa	345	117	2,809	4,898	2,844	983
Tasman-Nelson	161	175	5,058	6,077	1,600	567
Marlborough	1,643	1,614	10,745	13,658	4,524	1,640
West Coast	310	56	728	872	155	265
Canterbury	285	107	16,706	21,876	7,000	2,007
Otago	274	1,335	8,905	9,492	2,374	725
Southland	632	542	4,982	9,963	5,823	931
NZ Total	**28,732**	**26,328**	**195,881**	**275,250**	**146,012**	**69,047**

Residues from production thinnings, energy (GJ) per annum, recoverability level 1 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	5,793	8,084	127,232	175,264	59,305	8,982
Auckland	3,234	1,729	47,448	76,461	40,577	13,069
Waikato	6,826	5,591	96,289	165,429	92,045	24,140
Bay of Plenty	88,339	26,408	196,192	371,771	404,129	290,483
Gisborne	786	157	45,045	57,890	17,133	4,918
Hawkes Bay	37,366	78,032	176,028	156,334	39,409	18,436
Taranaki	5,704	4,064	59,350	87,486	37,164	10,666
Manawatu-Wanganui	22,882	21,512	230,617	316,598	136,035	51,423
Wellington	2,133	8,847	28,855	30,831	13,877	5,187
Wairarapa	2,380	808	19,379	33,795	19,626	6,782
Tasman-Nelson	1,110	1,207	34,898	41,929	11,042	3,914
Marlborough	11,334	11,139	74,140	94,237	31,218	11,315
West Coast	2,142	389	5,024	6,018	1,071	1,831
Canterbury	1,967	740	115,270	150,947	48,297	13,846
Otago	1,889	9,211	61,442	65,493	16,378	5,005
Southland	4,362	3,739	34,373	68,745	40,176	6,427
NZ Total	**198,248**	**181,661**	**1,351,582**	**1,899,228**	**1,007,481**	**476,422**

Residues from production thinnings, m^3 per annum, recoverability level 2, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	525	732	11,525	15,875	5,372	814
Auckland	293	157	4,298	6,926	3,675	1,184
Waikato	618	506	8,722	14,984	8,337	2,187
Bay of Plenty	8,002	2,392	17,771	33,675	36,606	26,312
Gisborne	71	14	4,080	5,244	1,552	445
Hawkes Bay	3,385	7,068	15,945	14,161	3,570	1,670
Taranaki	517	368	5,376	7,924	3,366	966
Manawatu-Wanganui	2,073	1,949	20,889	28,677	12,322	4,658
Wellington	193	801	2,614	2,793	1,257	470
Wairarapa	216	73	1,755	3,061	1,778	614
Tasman-Nelson	101	109	3,161	3,798	1,000	355
Marlborough	1,027	1,009	6,716	8,536	2,828	1,025
West Coast	194	35	455	545	97	166
Canterbury	178	67	10,441	13,673	4,375	1,254
Otago	171	834	5,565	5,932	1,484	453
Southland	395	339	3,113	6,227	3,639	582
NZ Total	**17,957**	**16,455**	**122,426**	**172,032**	**91,257**	**43,154**

Residues from production thinnings, energy (GJ) per annum, recoverability level 2, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	3,621	5,052	79,520	109,540	37,065	5,614
Auckland	2,021	1,081	29,655	47,788	25,361	8,168
Waikato	4,267	3,495	60,180	103,393	57,528	15,087
Bay of Plenty	55,212	16,505	122,620	232,357	252,581	181,552
Gisborne	491	98	28,153	36,181	10,708	3,074
Hawkes Bay	23,354	48,770	110,017	97,709	24,631	11,522
Taranaki	3,565	2,540	37,093	54,679	23,227	6,666
Manawatu-Wanganui	14,301	13,445	144,135	197,874	85,022	32,139
Wellington	1,333	5,530	18,034	19,270	8,673	3,242
Wairarapa	1,488	505	12,112	21,122	12,266	4,238
Tasman-Nelson	694	755	21,812	26,205	6,901	2,446
Marlborough	7,084	6,962	46,337	58,898	19,511	7,072
West Coast	1,339	243	3,140	3,761	669	1,144
Canterbury	1,229	463	72,044	94,342	30,186	8,654
Otago	1,181	5,757	38,401	40,933	10,236	3,128
Southland	2,726	2,337	21,483	42,966	25,110	4,017
NZ Total	**123,905**	**113,538**	**844,739**	**1,187,018**	**629,676**	**297,764**

Appendix J – Waste thinnings

Gross waste thinnings biomass, green tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	118,497	94,679	71,658	102,940	151,556	190,624
Auckland	31,829	41,539	30,657	21,219	14,957	17,039
Waikato	169,468	185,603	128,804	117,960	107,335	143,100
Bay of Plenty	151,093	332,759	250,241	282,194	302,084	190,069
Gisborne	113,575	70,693	32,073	50,408	41,906	52,541
Hawkes Bay	130,654	87,437	74,676	61,345	37,819	93,734
Taranaki	17,414	5,928	3,641	1,676	2,614	5,858
Manawatu-Wanganui	55,185	28,164	14,553	13,386	12,308	14,168
Wellington	77,475	57,102	22,963	30,407	28,967	51,964
Wairarapa	13,713	6,668	7,814	5,259	3,977	3,383
Tasman-Nelson	25,191	32,212	33,366	32,957	21,504	30,021
Marlborough	64,651	30,309	24,001	23,140	44,582	24,557
West Coast	13,163	18,140	26,308	16,842	18,743	22,495
Canterbury	88,660	62,829	34,455	25,187	31,917	29,734
Otago	87,331	75,394	42,760	42,823	46,578	73,324
Southland	63,462	64,160	34,337	30,112	32,790	38,085
NZ Total	**1,221,360**	**1,193,615**	**832,306**	**857,855**	**899,636**	**980,694**

Gross waste thinnings energy (GJ) per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	118,497	94,679	71,658	102,940	151,556	190,624
Auckland	31,829	41,539	30,657	21,219	14,957	17,039
Waikato	169,468	185,603	128,804	117,960	107,335	143,100
Bay of Plenty	151,093	332,759	250,241	282,194	302,084	190,069
Gisborne	113,575	70,693	32,073	50,408	41,906	52,541
Hawkes Bay	130,654	87,437	74,676	61,345	37,819	93,734
Taranaki	17,414	5,928	3,641	1,676	2,614	5,858
Manawatu-Wanganui	55,185	28,164	14,553	13,386	12,308	14,168
Wellington	77,475	57,102	22,963	30,407	28,967	51,964
Wairarapa	13,713	6,668	7,814	5,259	3,977	3,383
Tasman-Nelson	25,191	32,212	33,366	32,957	21,504	30,021
Marlborough	64,651	30,309	24,001	23,140	44,582	24,557
West Coast	13,163	18,140	26,308	16,842	18,743	22,495
Canterbury	88,660	62,829	34,455	25,187	31,917	29,734
Otago	87,331	75,394	42,760	42,823	46,578	73,324
Southland	63,462	64,160	34,337	30,112	32,790	38,085
NZ Total	**1,221,360**	**1,193,615**	**832,306**	**857,855**	**899,636**	**980,694**

Waste thinnings biomass (green tonnes per annum), recoverability level 1, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	47,399	37,872	28,663	41,176	60,622	76,250
Auckland	12,732	16,615	12,263	8,488	5,983	6,816
Waikato	67,787	74,241	51,521	47,184	42,934	57,240
Bay of Plenty	60,437	133,104	100,097	112,878	120,833	76,028
Gisborne	45,430	28,277	12,829	20,163	16,763	21,016
Hawkes Bay	52,262	34,975	29,870	24,538	15,128	37,494
Taranaki	6,965	2,371	1,456	670	1,046	2,343
Manawatu-Wanganui	22,074	11,265	5,821	5,354	4,923	5,667
Wellington	30,990	22,841	9,185	12,163	11,587	20,786
Wairarapa	5,485	2,667	3,125	2,103	1,591	1,353
Tasman-Nelson	10,076	12,885	13,346	13,183	8,602	12,008
Marlborough	25,860	12,123	9,600	9,256	17,833	9,823
West Coast	5,265	7,256	10,523	6,737	7,497	8,998
Canterbury	35,464	25,132	13,782	10,075	12,767	11,893
Otago	34,932	30,158	17,104	17,129	18,631	29,329
Southland	25,385	25,664	13,735	12,045	13,116	15,234
NZ Total	**488,544**	**477,446**	**332,923**	**343,142**	**359,854**	**392,278**

Waste thinnings energy (GJ) per annum, recoverability level 1, 50%

	2021 - 2025	2026 - 2030	2031 - 2035	2036 - 2040	2041 - 2045	2046 - 2050
Northland	327,051	261,315	197,777	284,115	418,294	526,122
Auckland	87,848	114,647	84,613	58,565	41,282	47,028
Waikato	467,731	512,264	355,498	325,569	296,246	394,956
Bay of Plenty	417,017	918,416	690,667	778,856	833,751	524,590
Gisborne	313,467	195,112	88,521	139,126	115,661	145,012
Hawkes Bay	360,604	241,325	206,105	169,311	104,381	258,705
Taranaki	48,062	16,362	10,048	4,626	7,214	16,169
Manawatu-Wanganui	152,312	77,731	40,167	36,944	33,969	39,103
Wellington	213,830	157,602	63,377	83,924	79,948	143,420
Wairarapa	37,848	18,403	21,566	14,514	10,976	9,336
Tasman-Nelson	69,528	88,905	92,089	90,961	59,351	82,858
Marlborough	178,436	83,652	66,242	63,866	123,046	67,777
West Coast	36,330	50,066	72,610	46,485	51,730	62,086
Canterbury	244,703	173,409	95,096	69,517	88,090	82,065
Otago	241,032	208,088	118,018	118,192	128,555	202,373
Southland	175,155	177,081	94,771	83,109	90,502	105,114
NZ Total	**3,370,954**	**3,294,376**	**2,297,166**	**2,367,680**	**2,482,995**	**2,706,716**

Waste thinnings biomass (green tonnes per annum), recoverability level 2, 25%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	23,699	18,936	14,332	20,588	30,311	38,125
Auckland	6,366	8,308	6,131	4,244	2,991	3,408
Waikato	33,894	37,121	25,761	23,592	21,467	28,620
Bay of Plenty	30,219	66,552	50,048	56,439	60,417	38,014
Gisborne	22,715	14,139	6,415	10,082	8,381	10,508
Hawkes Bay	26,131	17,487	14,935	12,269	7,564	18,747
Taranaki	3,483	1,186	728	335	523	1,172
Manawatu-Wanganui	11,037	5,633	2,911	2,677	2,462	2,834
Wellington	15,495	11,420	4,593	6,081	5,793	10,393
Wairarapa	2,743	1,334	1,563	1,052	795	677
Tasman-Nelson	5,038	6,442	6,673	6,591	4,301	6,004
Marlborough	12,930	6,062	4,800	4,628	8,916	4,911
West Coast	2,633	3,628	5,262	3,368	3,749	4,499
Canterbury	17,732	12,566	6,891	5,037	6,383	5,947
Otago	17,466	15,079	8,552	8,565	9,316	14,665
Southland	12,692	12,832	6,867	6,022	6,558	7,617
NZ Total	**244,272**	**238,723**	**166,461**	**171,571**	**179,927**	**196,139**

Waste thinnings energy (GJ) per annum, recoverability level 2, 25%

	2021 - 2025	2026 - 2030	2031 - 2035	2036 - 2040	2041 - 2045	2046 - 2050
Northland	163,525	130,658	98,889	142,058	209,147	263,061
Auckland	43,924	57,323	42,307	29,283	20,641	23,514
Waikato	233,865	256,132	177,749	162,785	148,123	197,478
Bay of Plenty	208,509	459,208	345,333	389,428	416,875	262,295
Gisborne	156,734	97,556	44,261	69,563	57,831	72,506
Hawkes Bay	180,302	120,662	103,052	84,656	52,190	129,353
Taranaki	24,031	8,181	5,024	2,313	3,607	8,085
Manawatu-Wanganui	76,156	38,866	20,084	18,472	16,984	19,552
Wellington	106,915	78,801	31,688	41,962	39,974	71,710
Wairarapa	18,924	9,201	10,783	7,257	5,488	4,668
Tasman-Nelson	34,764	44,452	46,045	45,480	29,676	41,429
Marlborough	89,218	41,826	33,121	31,933	61,523	33,888
West Coast	18,165	25,033	36,305	23,242	25,865	31,043
Canterbury	122,351	86,705	47,548	34,759	44,045	41,032
Otago	120,516	104,044	59,009	59,096	64,278	101,187
Southland	87,577	88,541	47,385	41,554	45,251	52,557
NZ Total	**1,685,477**	**1,647,188**	**1,148,583**	**1,183,840**	**1,241,498**	**1,353,358**

Appendix K – Pruning residues

Gross pruning biomass, odt per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,665	15,445	7,233	2,818	1,627	1,665
Auckland	183	4,047	2,063	1,026	457	183
Waikato	3,494	18,210	9,574	3,078	1,584	3,494
Bay of Plenty	8,255	29,560	31,011	23,400	13,482	8,255
Gisborne	5,682	27,487	12,796	7,145	6,677	5,682
Hawkes Bay	9,236	25,337	14,253	10,316	8,407	9,236
Taranaki	335	4,988	1,705	528	361	335
Manawatu-Wanganui	1,184	13,272	5,716	2,082	1,292	1,184
Wellington	4,133	10,311	4,929	4,043	4,046	4,133
Wairarapa	75	1,602	855	401	128	75
Tasman-Nelson	552	6,348	2,597	517	602	552
Marlborough	1,787	11,226	4,182	1,844	1,865	1,787
West Coast	19	2,294	2,038	978	118	19
Canterbury	602	9,694	3,729	1,609	996	602
Otago	7,042	17,315	9,223	3,641	3,859	7,042
Southland	1,640	7,384	4,461	2,800	2,617	1,640
NZ Total	**45,882**	**204,520**	**116,364**	**66,227**	**48,118**	**45,882**

Gross Prunings, energy (GJ) per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	11,487	106,572	49,905	19,447	11,229	11,487
Auckland	1,264	27,927	14,236	7,078	3,152	1,264
Waikato	24,106	125,649	66,062	21,237	10,927	24,106
Bay of Plenty	56,958	203,964	213,976	161,460	93,027	56,958
Gisborne	39,203	189,659	88,291	49,302	46,070	39,203
Hawkes Bay	63,727	174,824	98,347	71,183	58,007	63,727
Taranaki	2,310	34,416	11,763	3,642	2,491	2,310
Manawatu-Wanganui	8,167	91,578	39,443	14,367	8,916	8,167
Wellington	28,515	71,146	34,010	27,898	27,916	28,515
Wairarapa	519	11,051	5,898	2,764	886	519
Tasman-Nelson	3,806	43,804	17,918	3,566	4,151	3,806
Marlborough	12,333	77,462	28,853	12,725	12,867	12,333
West Coast	131	15,830	14,061	6,751	817	131
Canterbury	4,151	66,886	25,730	11,105	6,871	4,151
Otago	48,591	119,472	63,640	25,120	26,630	48,591
Southland	11,316	50,947	30,778	19,320	18,056	11,316
NZ Total	**316,583**	**1,411,188**	**802,909**	**456,965**	**332,013**	**316,583**

Pruning biomass residues, green tonnes per annum, recovery level 1, 30%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	499	4,634	2,170	846	488	499
Auckland	55	1,214	619	308	137	55
Waikato	1,048	5,463	2,872	923	475	1,048
Bay of Plenty	2,476	8,868	9,303	7,020	4,045	2,476
Gisborne	1,704	8,246	3,839	2,144	2,003	1,704
Hawkes Bay	2,771	7,601	4,276	3,095	2,522	2,771
Taranaki	100	1,496	511	158	108	100
Manawatu-Wanganui	355	3,982	1,715	625	388	355
Wellington	1,240	3,093	1,479	1,213	1,214	1,240
Wairarapa	23	480	256	120	39	23
Tasman-Nelson	165	1,905	779	155	180	165
Marlborough	536	3,368	1,254	553	559	536
West Coast	6	688	611	294	36	6
Canterbury	180	2,908	1,119	483	299	180
Otago	2,113	5,194	2,767	1,092	1,158	2,113
Southland	492	2,215	1,338	840	785	492
NZ Total	**13,764**	**61,356**	**34,909**	**19,868**	**14,435**	**13,764**

Pruning biomass energy (GJ) per annum, recovery level 1, 30%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	3,446	31,972	14,972	5,834	3,369	3,446
Auckland	379	8,378	4,271	2,123	946	379
Waikato	7,232	37,695	19,819	6,371	3,278	7,232
Bay of Plenty	17,087	61,189	64,193	48,438	27,908	17,087
Gisborne	11,761	56,898	26,487	14,791	13,821	11,761
Hawkes Bay	19,118	52,447	29,504	21,355	17,402	19,118
Taranaki	693	10,325	3,529	1,093	747	693
Manawatu-Wanganui	2,450	27,473	11,833	4,310	2,675	2,450
Wellington	8,555	21,344	10,203	8,369	8,375	8,555
Wairarapa	156	3,315	1,769	829	266	156
Tasman-Nelson	1,142	13,141	5,375	1,070	1,245	1,142
Marlborough	3,700	23,238	8,656	3,818	3,860	3,700
West Coast	39	4,749	4,218	2,025	245	39
Canterbury	1,245	20,066	7,719	3,332	2,061	1,245
Otago	14,577	35,842	19,092	7,536	7,989	14,577
Southland	3,395	15,284	9,233	5,796	5,417	3,395
NZ Total	**94,975**	**423,356**	**240,873**	**137,090**	**99,604**	**94,975**

Pruning biomass residues, green tonnes per annum, recovery level 2, 15%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	250	2,317	1,085	423	244	250
Auckland	27	607	309	154	69	27
Waikato	524	2,732	1,436	462	238	524
Bay of Plenty	1,238	4,434	4,652	3,510	2,022	1,238
Gisborne	852	4,123	1,919	1,072	1,002	852
Hawkes Bay	1,385	3,801	2,138	1,547	1,261	1,385
Taranaki	50	748	256	79	54	50
Manawatu-Wanganui	178	1,991	857	312	194	178
Wellington	620	1,547	739	606	607	620
Wairarapa	11	240	128	60	19	11
Tasman-Nelson	83	952	390	78	90	83
Marlborough	268	1,684	627	277	280	268
West Coast	3	344	306	147	18	3
Canterbury	90	1,454	559	241	149	90
Otago	1,056	2,597	1,383	546	579	1,056
Southland	246	1,108	669	420	393	246
NZ Total	**6,882**	**30,678**	**17,455**	**9,934**	**7,218**	**6,882**

Pruning biomass energy (GJ) per annum, recovery level 2, 15%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,723	15,986	7,486	2,917	1,684	1,723
Auckland	190	4,189	2,135	1,062	473	190
Waikato	3,616	18,847	9,909	3,186	1,639	3,616
Bay of Plenty	8,544	30,595	32,096	24,219	13,954	8,544
Gisborne	5,880	28,449	13,244	7,395	6,911	5,880
Hawkes Bay	9,559	26,224	14,752	10,677	8,701	9,559
Taranaki	346	5,162	1,764	546	374	346
Manawatu-Wanganui	1,225	13,737	5,916	2,155	1,337	1,225
Wellington	4,277	10,672	5,101	4,185	4,187	4,277
Wairarapa	78	1,658	885	415	133	78
Tasman-Nelson	571	6,571	2,688	535	623	571
Marlborough	1,850	11,619	4,328	1,909	1,930	1,850
West Coast	20	2,375	2,109	1,013	123	20
Canterbury	623	10,033	3,859	1,666	1,031	623
Otago	7,289	17,921	9,546	3,768	3,995	7,289
Southland	1,697	7,642	4,617	2,898	2,708	1,697
NZ Total	**47,487**	**211,678**	**120,436**	**68,545**	**49,802**	**47,487**

Appendix L - In-forest residues by sub-category – Landing residues

Gross supply – in-forests residues, landings, m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	227,394	146,120	155,162	221,389	283,253	236,242
Auckland	79,543	65,278	45,210	31,287	27,196	52,949
Waikato	284,239	253,779	185,722	140,649	165,334	244,423
Bay of Plenty	666,040	690,238	617,308	682,156	683,655	720,522
Gisborne	336,415	156,458	124,444	137,592	138,743	183,564
Hawkes Bay	222,510	159,875	127,966	102,337	119,417	163,950
Taranaki	46,484	16,247	8,713	7,155	12,057	18,706
Manawatu-Wanganui	130,844	60,270	35,549	28,862	29,239	55,177
Wellington	23,948	10,227	6,648	5,268	3,689	7,430
Wairarapa	161,175	80,044	53,542	58,470	80,194	109,014
Tasman-Nelson	127,897	122,351	124,837	108,776	101,075	123,462
Marlborough	139,233	67,351	59,280	82,290	82,255	67,326
West Coast	12,239	12,188	16,442	17,241	15,424	10,239
Canterbury	125,889	81,965	72,082	62,666	54,417	65,162
Otago	159,811	110,966	146,134	146,965	123,716	129,855
Southland	100,927	90,434	117,131	107,392	69,599	75,438
NZ Total	**2,844,589**	**2,123,789**	**1,896,169**	**1,940,495**	**1,989,262**	**2,263,457**

Gross supply - in-forest residues, landings, energy (GJ) per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,569,019	1,008,227	1,070,615	1,527,583	1,954,446	1,630,070
Auckland	548,844	450,417	311,946	215,879	187,651	365,345
Waikato	1,961,248	1,751,072	1,281,479	970,478	1,140,801	1,686,522
Bay of Plenty	4,595,679	4,762,639	4,259,427	4,706,874	4,717,220	4,971,602
Gisborne	2,321,262	1,079,557	858,666	949,382	957,330	1,266,589
Hawkes Bay	1,535,321	1,103,140	882,967	706,128	823,976	1,131,257
Taranaki	320,741	112,103	60,120	49,369	83,193	129,070
Manawatu-Wanganui	902,820	415,863	245,286	199,148	201,752	380,718
Wellington	165,243	70,564	45,869	36,350	25,451	51,270
Wairarapa	1,112,108	552,302	369,441	403,445	553,337	752,198
Tasman-Nelson	882,492	844,221	861,372	750,556	697,421	851,891
Marlborough	960,709	464,723	409,031	567,802	567,560	464,547
West Coast	84,447	84,096	113,447	118,966	106,423	70,646
Canterbury	868,636	565,561	497,369	432,395	375,475	449,615
Otago	1,102,696	765,668	1,008,327	1,014,056	853,644	895,997
Southland	696,399	623,992	808,205	741,004	480,232	520,519
NZ Total	**19,627,664**	**14,654,143**	**13,083,565**	**13,389,415**	**13,725,908**	**15,617,856**

In-forest landing residues, volume (m^3) per annum), recoverability level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	181,915	116,896	124,129	177,111	226,602	188,994
Auckland	63,634	52,222	36,168	25,029	21,757	42,359
Waikato	227,391	203,023	148,577	112,519	132,267	195,539
Bay of Plenty	532,832	552,190	493,847	545,725	546,924	576,418
Gisborne	269,132	125,166	99,555	110,073	110,995	146,851
Hawkes Bay	178,008	127,900	102,373	81,870	95,533	131,160
Taranaki	37,187	12,997	6,970	5,724	9,646	14,965
Manawatu-Wanganui	104,675	48,216	28,439	23,090	23,392	44,141
Wellington	19,159	8,181	5,318	4,214	2,951	5,944
Wairarapa	128,940	64,035	42,834	46,776	64,155	87,211
Tasman-Nelson	102,318	97,881	99,869	87,021	80,860	98,770
Marlborough	111,387	53,881	47,424	65,832	65,804	53,861
West Coast	9,791	9,750	13,153	13,793	12,339	8,191
Canterbury	100,711	65,572	57,666	50,133	43,533	52,129
Otago	127,849	88,773	116,907	117,572	98,973	103,884
Southland	80,742	72,347	93,705	85,913	55,679	60,350
NZ Total	**2,275,671**	**1,699,031**	**1,516,935**	**1,552,396**	**1,591,410**	**1,810,766**

In-forest landing residues, energy (GJ) per annum, recoverability level 1, 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,255,215	806,582	856,492	1,222,067	1,563,557	1,304,056
Auckland	439,075	360,334	249,557	172,703	150,121	292,276
Waikato	1,568,998	1,400,857	1,025,183	776,382	912,641	1,349,218
Bay of Plenty	3,676,543	3,810,111	3,407,541	3,765,500	3,773,776	3,977,281
Gisborne	1,857,010	863,646	686,933	759,506	765,864	1,013,271
Hawkes Bay	1,228,257	882,512	706,374	564,903	659,180	905,006
Taranaki	256,593	89,682	48,096	39,495	66,554	103,256
Manawatu-Wanganui	722,256	332,690	196,229	159,318	161,401	304,574
Wellington	132,194	56,451	36,695	29,080	20,361	41,016
Wairarapa	889,687	441,842	295,553	322,756	442,669	601,758
Tasman-Nelson	705,994	675,377	689,098	600,444	557,937	681,513
Marlborough	768,567	371,778	327,225	454,242	454,048	371,638
West Coast	67,557	67,277	90,757	95,172	85,138	56,517
Canterbury	694,909	452,449	397,895	345,916	300,380	359,692
Otago	882,157	612,534	806,661	811,245	682,915	716,798
Southland	557,119	499,194	646,564	592,803	384,185	416,415
NZ Total	**15,702,131**	**11,723,315**	**10,466,852**	**10,711,532**	**10,980,727**	**12,494,285**

In-forest landing residues, volume (m^3) per annum), recoverability level 2, 65%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	147,806	94,978	100,855	143,903	184,114	153,557
Auckland	51,703	42,431	29,386	20,336	17,677	34,417
Waikato	184,755	164,956	120,719	91,422	107,467	158,875
Bay of Plenty	432,926	448,654	401,250	443,401	444,376	468,339
Gisborne	218,670	101,697	80,889	89,435	90,183	119,316
Hawkes Bay	144,632	103,919	83,178	66,519	77,621	106,568
Taranaki	30,215	10,560	5,663	4,651	7,837	12,159
Manawatu-Wanganui	85,048	39,175	23,107	18,760	19,006	35,865
Wellington	15,566	6,647	4,321	3,424	2,398	4,830
Wairarapa	104,764	52,028	34,802	38,006	52,126	70,859
Tasman-Nelson	83,133	79,528	81,144	70,705	65,699	80,251
Marlborough	90,502	43,778	38,532	53,489	53,466	43,762
West Coast	7,955	7,922	10,687	11,207	10,025	6,655
Canterbury	81,828	53,278	46,854	40,733	35,371	42,355
Otago	103,877	72,128	94,987	95,527	80,416	84,406
Southland	65,603	58,782	76,135	69,805	45,239	49,034
NZ Total	**1,848,983**	**1,380,463**	**1,232,510**	**1,261,322**	**1,293,020**	**1,471,247**

In-forest landing residues, energy (GJ) per annum, recoverability level 2, 65%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,019,862	655,347	695,899	992,929	1,270,390	1,059,546
Auckland	356,748	292,771	202,765	140,321	121,973	237,474
Waikato	1,274,811	1,138,197	832,961	630,811	741,521	1,096,239
Bay of Plenty	2,987,191	3,095,715	2,768,627	3,059,468	3,066,193	3,231,541
Gisborne	1,508,820	701,712	558,133	617,099	622,264	823,283
Hawkes Bay	997,959	717,041	573,929	458,983	535,584	735,317
Taranaki	208,482	72,867	39,078	32,090	54,075	83,896
Manawatu-Wanganui	586,833	270,311	159,436	129,446	131,139	247,467
Wellington	107,408	45,867	29,815	23,627	16,543	33,325
Wairarapa	722,870	358,996	240,137	262,239	359,669	488,929
Tasman-Nelson	573,620	548,744	559,892	487,861	453,323	553,729
Marlborough	624,461	302,070	265,870	369,071	368,914	301,956
West Coast	54,890	54,662	73,740	77,328	69,175	45,920
Canterbury	564,614	367,615	323,290	281,057	244,058	292,250
Otago	716,752	497,684	655,412	659,137	554,868	582,398
Southland	452,659	405,595	525,333	481,653	312,151	338,337
NZ Total	**12,757,982**	**9,525,193**	**8,504,317**	**8,703,120**	**8,921,840**	**10,151,606**

Appendix M - In-forest residues by sub-category – Cutover residues - ground-based harvest

Gross supply – in-forests residues, ground-based cutover, m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	196,453	120,199	122,904	170,372	211,334	182,278
Auckland	62,187	48,282	32,689	22,022	18,655	38,527
Waikato	194,505	171,741	135,453	102,923	105,107	159,104
Bay of Plenty	417,373	386,990	334,110	377,461	387,295	423,833
Gisborne	25,035	9,970	5,423	4,531	6,101	9,918
Hawkes Bay	132,766	61,975	50,413	55,979	55,459	72,956
Taranaki	140,410	89,470	70,602	54,945	78,263	106,118
Manawatu-Wanganui	120,000	53,681	35,819	30,190	30,421	52,013
Wellington	24,164	12,427	10,804	7,394	6,198	9,429
Wairarapa	94,614	47,731	31,154	34,172	42,293	60,986
Tasman-Nelson	34,285	30,157	29,903	24,310	22,521	28,425
Marlborough	39,563	17,639	13,923	19,572	21,068	18,736
West Coast	44,362	39,954	34,464	22,172	23,905	29,672
Canterbury	174,302	92,085	53,895	39,769	41,017	77,949
Otago	158,488	105,592	62,139	60,259	72,854	116,325
Southland	177,039	128,649	61,844	57,046	62,657	125,927
NZ Total	**2,035,545**	**1,416,542**	**1,085,539**	**1,083,115**	**1,185,151**	**1,512,196**

Gross supply – in-forest residues, ground-based cutover, energy (GJ) per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	1,355,528	829,376	848,038	1,175,569	1,458,204	1,257,721
Auckland	429,088	333,143	225,552	151,952	128,722	265,839
Waikato	1,342,084	1,185,014	934,628	710,166	725,240	1,097,821
Bay of Plenty	2,879,876	2,670,233	2,305,358	2,604,482	2,672,339	2,924,449
Gisborne	172,739	68,792	37,418	31,266	42,100	68,433
Hawkes Bay	916,083	427,630	347,850	386,254	382,665	503,393
Taranaki	968,829	617,341	487,151	379,119	540,018	732,213
Manawatu-Wanganui	827,999	370,400	247,150	208,309	209,908	358,889
Wellington	166,729	85,744	74,550	51,016	42,767	65,060
Wairarapa	652,834	329,345	214,959	235,786	291,819	420,806
Tasman-Nelson	236,565	208,083	206,331	167,736	155,397	196,132
Marlborough	272,987	121,711	96,070	135,046	145,371	129,279
West Coast	306,100	275,684	237,802	152,987	164,945	204,734
Canterbury	1,202,682	635,384	371,876	274,405	283,018	537,846
Otago	1,093,564	728,584	428,758	415,786	502,690	802,640
Southland	1,221,571	887,679	426,723	393,614	432,336	868,894
NZ Total	**14,045,258**	**9,774,142**	**7,490,216**	**7,473,494**	**8,177,540**	**10,434,151**

In-forests residues, ground-based cutover, m^3 per annum, recoverability level 1, 70%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	137,517	84,140	86,033	119,261	147,934	127,595
Auckland	43,531	33,797	22,882	15,415	13,059	26,969
Waikato	136,153	120,219	94,817	72,046	73,575	111,373
Bay of Plenty	292,161	270,893	233,877	264,223	271,107	296,683
Gisborne	17,524	6,979	3,796	3,172	4,271	6,942
Hawkes Bay	92,936	43,383	35,289	39,185	38,821	51,069
Taranaki	98,287	62,629	49,421	38,461	54,784	74,282
Manawatu-Wanganui	84,000	37,577	25,073	21,133	21,295	36,409
Wellington	16,915	8,699	7,563	5,176	4,339	6,600
Wairarapa	66,230	33,412	21,807	23,920	29,605	42,690
Tasman-Nelson	23,999	21,110	20,932	17,017	15,765	19,897
Marlborough	27,694	12,348	9,746	13,700	14,748	13,115
West Coast	31,054	27,968	24,125	15,520	16,734	20,770
Canterbury	122,011	64,459	37,727	27,838	28,712	54,564
Otago	110,941	73,914	43,497	42,181	50,998	81,427
Southland	123,927	90,054	43,291	39,932	43,860	88,149
NZ Total	**1,424,881**	**991,580**	**759,877**	**758,181**	**829,606**	**1,058,537**

In-forests residues, ground-based cutover, energy (GJ) per annum, recoverability level 1, 70%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	948,870	580,563	593,627	822,898	1,020,743	880,405
Auckland	300,361	233,200	157,886	106,367	90,106	186,088
Waikato	939,459	829,510	654,240	497,116	507,668	768,475
Bay of Plenty	2,015,914	1,869,163	1,613,751	1,823,137	1,870,637	2,047,115
Gisborne	120,917	48,154	26,192	21,886	29,470	47,903
Hawkes Bay	641,258	299,341	243,495	270,377	267,865	352,375
Taranaki	678,180	432,138	341,006	265,383	378,012	512,549
Manawatu-Wanganui	579,599	259,280	173,005	145,817	146,936	251,222
Wellington	116,710	60,021	52,185	35,711	29,937	45,542
Wairarapa	456,984	230,542	150,472	165,050	204,273	294,564
Tasman-Nelson	165,595	145,658	144,432	117,415	108,778	137,293
Marlborough	191,091	85,198	67,249	94,532	101,760	90,495
West Coast	214,270	192,979	166,461	107,091	115,462	143,314
Canterbury	841,877	444,769	260,313	192,083	198,112	376,493
Otago	765,495	510,009	300,131	291,051	351,883	561,848
Southland	855,100	621,375	298,706	275,530	302,635	608,226
NZ Total	**9,831,681**	**6,841,899**	**5,243,151**	**5,231,446**	**5,724,278**	**7,303,906**

In-forests residues, ground-based cutover, m^3 per annum, recoverability level 2, 55%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	108,049	66,110	67,597	93,705	116,234	100,253
Auckland	34,203	26,555	17,979	12,112	10,260	21,190
Waikato	106,978	94,458	74,499	56,607	57,809	87,507
Bay of Plenty	229,555	212,845	183,760	207,604	213,013	233,108
Gisborne	13,769	5,483	2,983	2,492	3,356	5,455
Hawkes Bay	73,021	34,086	27,727	30,788	30,502	40,126
Taranaki	77,225	49,208	38,831	30,220	43,045	58,365
Manawatu-Wanganui	66,000	29,525	19,700	16,604	16,732	28,607
Wellington	13,290	6,835	5,942	4,067	3,409	5,186
Wairarapa	52,038	26,252	17,134	18,795	23,261	33,542
Tasman-Nelson	18,857	16,586	16,447	13,370	12,387	15,634
Marlborough	21,760	9,702	7,658	10,765	11,588	10,305
West Coast	24,399	21,975	18,955	12,195	13,148	16,319
Canterbury	95,866	50,647	29,642	21,873	22,559	42,872
Otago	87,168	58,076	34,176	33,142	40,070	63,979
Southland	97,372	70,757	34,014	31,375	34,462	69,260
NZ Total	**1,119,550**	**779,098**	**597,046**	**595,713**	**651,833**	**831,708**

In-forests residues, ground-based cutover, energy (GJ) per annum, recoverability level 2, 55%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	745,541	456,157	466,421	646,563	802,012	691,747
Auckland	235,998	183,229	124,054	83,574	70,797	146,212
Waikato	738,146	651,758	514,045	390,591	398,882	603,802
Bay of Plenty	1,583,932	1,468,628	1,267,947	1,432,465	1,469,786	1,608,447
Gisborne	95,006	37,835	20,580	17,196	23,155	37,638
Hawkes Bay	503,846	235,197	191,318	212,439	210,466	276,866
Taranaki	532,856	339,537	267,933	208,516	297,010	402,717
Manawatu-Wanganui	455,399	203,720	135,932	114,570	115,449	197,389
Wellington	91,701	47,159	41,003	28,059	23,522	35,783
Wairarapa	359,059	181,140	118,228	129,682	160,500	231,443
Tasman-Nelson	130,111	114,446	113,482	92,255	85,469	107,873
Marlborough	150,143	66,941	52,838	74,275	79,954	71,103
West Coast	168,355	151,626	130,791	84,143	90,720	112,604
Canterbury	661,475	349,461	204,532	150,923	155,660	295,816
Otago	601,460	400,721	235,817	228,683	276,480	441,452
Southland	671,864	488,223	234,698	216,488	237,785	477,892
NZ Total	**7,724,892**	**5,375,778**	**4,119,619**	**4,110,422**	**4,497,647**	**5,738,783**

Appendix N - In-forest residues by sub-category – Cutover residues - hauler / cable harvest

Gross supply – in-forests residues, hauler cutover, m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	58,154	35,060	32,677	47,813	67,306	58,801
Auckland	24,191	18,782	12,716	8,567	7,257	14,987
Waikato	71,093	61,965	48,529	38,194	38,622	57,236
Bay of Plenty	219,998	230,006	208,752	231,737	242,851	237,621
Gisborne	224,788	104,932	85,356	94,779	93,898	123,523
Hawkes Bay	138,436	89,115	77,936	59,644	86,087	110,079
Taranaki	34,753	13,377	7,527	6,344	8,273	12,542
Manawatu-Wanganui	44,012	21,340	12,552	8,621	10,171	20,331
Wellington	9,117	3,360	2,038	1,553	1,017	2,470
Wairarapa	100,540	46,665	32,632	35,336	48,754	63,906
Tasman-Nelson	112,432	98,291	95,249	76,892	73,163	92,189
Marlborough	124,401	57,441	46,228	65,188	64,987	56,012
West Coast	7,970	7,424	6,745	5,292	5,901	6,477
Canterbury	77,346	38,876	22,887	17,753	17,664	33,687
Otago	140,963	94,668	58,872	58,179	68,692	103,847
Southland	35,723	25,877	12,053	10,899	12,170	25,478
NZ Total	**1,423,919**	**947,179**	**762,748**	**766,790**	**846,813**	**1,019,186**

Gross supply – in-forests residues, hauler cutover, energy (GJ) per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	401,260	241,917	225,468	329,907	464,408	405,730
Auckland	166,915	129,593	87,740	59,110	50,073	103,412
Waikato	490,543	427,559	334,849	263,542	266,490	394,928
Bay of Plenty	1,517,983	1,587,041	1,440,389	1,598,987	1,675,673	1,639,587
Gisborne	1,551,041	724,030	588,953	653,974	647,898	852,306
Hawkes Bay	955,210	614,892	537,761	411,541	594,003	759,548
Taranaki	239,799	92,301	51,939	43,777	57,084	86,543
Manawatu-Wanganui	303,683	147,247	86,608	59,485	70,181	140,283
Wellington	62,910	23,182	14,060	10,712	7,016	17,041
Wairarapa	693,729	321,990	225,161	243,821	336,401	440,952
Tasman-Nelson	775,780	678,208	657,217	530,555	504,825	636,101
Marlborough	858,364	396,340	318,972	449,798	448,410	386,484
West Coast	54,995	51,228	46,541	36,513	40,719	44,693
Canterbury	533,690	268,247	157,923	122,495	121,883	232,441
Otago	972,648	653,211	406,218	401,432	473,972	716,542
Southland	246,490	178,552	83,166	75,203	83,975	175,797
NZ Total	9,825,038	6,535,537	5,262,965	5,290,852	5,843,011	7,032,387

In-forests residues, hauler cutover, m^3 per annum, recoverability level 1, 10%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	5,815	3,506	3,268	4,781	6,731	5,880
Auckland	2,419	1,878	1,272	857	726	1,499
Waikato	7,109	6,197	4,853	3,819	3,862	5,724
Bay of Plenty	22,000	23,001	20,875	23,174	24,285	23,762
Gisborne	22,479	10,493	8,536	9,478	9,390	12,352
Hawkes Bay	13,844	8,911	7,794	5,964	8,609	11,008
Taranaki	3,475	1,338	753	634	827	1,254
Manawatu-Wanganui	4,401	2,134	1,255	862	1,017	2,033
Wellington	912	336	204	155	102	247
Wairarapa	10,054	4,667	3,263	3,534	4,875	6,391
Tasman-Nelson	11,243	9,829	9,525	7,689	7,316	9,219
Marlborough	12,440	5,744	4,623	6,519	6,499	5,601
West Coast	797	742	675	529	590	648
Canterbury	7,735	3,888	2,289	1,775	1,766	3,369
Otago	14,096	9,467	5,887	5,818	6,869	10,385
Southland	3,572	2,588	1,205	1,090	1,217	2,548
NZ Total	**142,392**	**94,718**	**76,275**	**76,679**	**84,681**	**101,919**

In-forests residues, hauler cutover, energy (GJ) per annum, recoverability level 1, 10%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	40,126	24,192	22,547	32,991	46,441	40,573
Auckland	16,692	12,959	8,774	5,911	5,007	10,341
Waikato	49,054	42,756	33,485	26,354	26,649	39,493
Bay of Plenty	151,798	158,704	144,039	159,899	167,567	163,959
Gisborne	155,104	72,403	58,895	65,397	64,790	85,231
Hawkes Bay	95,521	61,489	53,776	41,154	59,400	75,955
Taranaki	23,980	9,230	5,194	4,378	5,708	8,654
Manawatu-Wanganui	30,368	14,725	8,661	5,949	7,018	14,028
Wellington	6,291	2,318	1,406	1,071	702	1,704
Wairarapa	69,373	32,199	22,516	24,382	33,640	44,095
Tasman-Nelson	77,578	67,821	65,722	53,056	50,483	63,610
Marlborough	85,836	39,634	31,897	44,980	44,841	38,648
West Coast	5,499	5,123	4,654	3,651	4,072	4,469
Canterbury	53,369	26,825	15,792	12,250	12,188	23,244
Otago	97,265	65,321	40,622	40,143	47,397	71,654
Southland	24,649	17,855	8,317	7,520	8,397	17,580
NZ Total	**982,504**	**653,554**	**526,296**	**529,085**	**584,301**	**703,239**

In-forests residues, hauler cutover, m^3 per annum, recoverability level 2, 5%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	2,908	1,753	1,634	2,391	3,365	2,940
Auckland	1,210	939	636	428	363	749
Waikato	3,555	3,098	2,426	1,910	1,931	2,862
Bay of Plenty	11,000	11,500	10,438	11,587	12,143	11,881
Gisborne	11,239	5,247	4,268	4,739	4,695	6,176
Hawkes Bay	6,922	4,456	3,897	2,982	4,304	5,504
Taranaki	1,738	669	376	317	414	627
Manawatu-Wanganui	2,201	1,067	628	431	509	1,017
Wellington	456	168	102	78	51	123
Wairarapa	5,027	2,333	1,632	1,767	2,438	3,195
Tasman-Nelson	5,622	4,915	4,762	3,845	3,658	4,609
Marlborough	6,220	2,872	2,311	3,259	3,249	2,801
West Coast	399	371	337	265	295	324
Canterbury	3,867	1,944	1,144	888	883	1,684
Otago	7,048	4,733	2,944	2,909	3,435	5,192
Southland	1,786	1,294	603	545	609	1,274
NZ Total	**71,196**	**47,359**	**38,137**	**38,340**	**42,341**	**50,959**

In-forests residues, hauler cutover, energy (GJ) per annum, recoverability level 2, 5%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	20,063	12,096	11,273	16,495	23,220	20,287
Auckland	8,346	6,480	4,387	2,955	2,504	5,171
Waikato	24,527	21,378	16,742	13,177	13,325	19,746
Bay of Plenty	75,899	79,352	72,019	79,949	83,784	81,979
Gisborne	77,552	36,201	29,448	32,699	32,395	42,615
Hawkes Bay	47,760	30,745	26,888	20,577	29,700	37,977
Taranaki	11,990	4,615	2,597	2,189	2,854	4,327
Manawatu-Wanganui	15,184	7,362	4,330	2,974	3,509	7,014
Wellington	3,146	1,159	703	536	351	852
Wairarapa	34,686	16,100	11,258	12,191	16,820	22,048
Tasman-Nelson	38,789	33,910	32,861	26,528	25,241	31,805
Marlborough	42,918	19,817	15,949	22,490	22,421	19,324
West Coast	2,750	2,561	2,327	1,826	2,036	2,235
Canterbury	26,685	13,412	7,896	6,125	6,094	11,622
Otago	48,632	32,661	20,311	20,072	23,699	35,827
Southland	12,324	8,928	4,158	3,760	4,199	8,790
NZ Total	**491,252**	**326,777**	**263,148**	**264,543**	**292,151**	**351,619**

Appendix O – Sawmill chip

Sawmill chip is a by-product of the production of sawn lumber and is generally regarded as a by-product not a residue. The sale of chip is a small but important part of a sawmill's income. Typically, this material is sold to other wood processing industries; pulp, paper, MDF, particle board etc. The price is estimated at $70 per green tonne ex- the sawmill. Some sawmill chip exported, and some is sold for fuel and other uses and so it could be considered as a potential fuel feedstock at the current price.

Gross supply of sawmill chip, green tonnes per annum

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	103,740	103,740	103,740	103,740	103,740	103,740
Auckland	48,750	48,750	48,750	48,750	48,750	48,750
Waikato	260,420	260,420	260,420	260,420	260,420	260,420
Bay of Plenty	615,740	615,740	615,740	615,740	615,740	615,740
Gisborne	27,520	27,520	27,520	27,520	27,520	27,520
Hawkes Bay	372,080	372,080	372,080	372,080	372,080	372,080
Taranaki	29,170	29,170	29,170	29,170	29,170	29,170
Manawatu-Wanganui	27,170	27,170	27,170	27,170	27,170	27,170
Wellington	-	-	-	-	-	-
Wairarapa	56,350	56,350	56,350	56,350	56,350	56,350
Tasman-Nelson	187,920	187,920	187,920	187,920	187,920	187,920
Marlborough	56,790	56,790	56,790	56,790	56,790	56,790
West Coast	28,200	28,200	28,200	28,200	28,200	28,200
Canterbury	107,625	107,625	107,625	107,625	107,625	107,625
Otago	46,860	46,860	46,860	46,860	46,860	46,860
Southland	282,460	282,460	282,460	282,460	282,460	282,460
NZ Total	**2,250,795**	**2,250,795**	**2,250,795**	**2,250,795**	**2,250,795**	**2,250,795**

Sawmill chip, gross energy (GJ per annum)

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	715,806	715,806	715,806	715,806	715,806	715,806
Auckland	336,375	336,375	336,375	336,375	336,375	336,375
Waikato	1,796,898	1,796,898	1,796,898	1,796,898	1,796,898	1,796,898
Bay of Plenty	4,248,606	4,248,606	4,248,606	4,248,606	4,248,606	4,248,606
Gisborne	189,888	189,888	189,888	189,888	189,888	189,888
Hawkes Bay	2,567,352	2,567,352	2,567,352	2,567,352	2,567,352	2,567,352
Taranaki	201,273	201,273	201,273	201,273	201,273	201,273
Manawatu-Wanganui	187,473	187,473	187,473	187,473	187,473	187,473
Wellington	-	-	-	-	-	-
Wairarapa	388,815	388,815	388,815	388,815	388,815	388,815
Tasman-Nelson	1,296,648	1,296,648	1,296,648	1,296,648	1,296,648	1,296,648
Marlborough	391,851	391,851	391,851	391,851	391,851	391,851
West Coast	194,580	194,580	194,580	194,580	194,580	194,580
Canterbury	742,613	742,613	742,613	742,613	742,613	742,613
Otago	323,334	323,334	323,334	323,334	323,334	323,334
Southland	1,948,974	1,948,974	1,948,974	1,948,974	1,948,974	1,948,974
NZ Total	**15,530,486**	**15,530,486**	**15,530,486**	**15,530,486**	**15,530,486**	**15,530,486**

Sawmill chip volume (tonnes per annum) recovery level 1, 75%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	77,805	77,805	77,805	77,805	77,805	77,805
Auckland	36,563	36,563	36,563	36,563	36,563	36,563
Waikato	195,315	195,315	195,315	195,315	195,315	195,315
Bay of Plenty	461,805	461,805	461,805	461,805	461,805	461,805
Gisborne	20,640	20,640	20,640	20,640	20,640	20,640
Hawkes Bay	279,060	279,060	279,060	279,060	279,060	279,060
Taranaki	21,878	21,878	21,878	21,878	21,878	21,878
Manawatu-Wanganui	20,378	20,378	20,378	20,378	20,378	20,378
Wellington	-	-	-	-	-	-
Wairarapa	42,263	42,263	42,263	42,263	42,263	42,263
Tasman-Nelson	140,940	140,940	140,940	140,940	140,940	140,940
Marlborough	42,593	42,593	42,593	42,593	42,593	42,593
West Coast	21,150	21,150	21,150	21,150	21,150	21,150
Canterbury	80,719	80,719	80,719	80,719	80,719	80,719
Otago	35,145	35,145	35,145	35,145	35,145	35,145
Southland	211,845	211,845	211,845	211,845	211,845	211,845
NZ Total	**1,688,096**	**1,688,096**	**1,688,096**	**1,688,096**	**,688,096**	**1,688,096**

Sawmill chip, energy (GJ per annum) recovery level 1, 75%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	536,855	536,855	536,855	536,855	536,855	536,855
Auckland	252,281	252,281	252,281	252,281	252,281	252,281
Waikato	1,347,674	1,347,674	1,347,674	1,347,674	1,347,674	1,347,674
Bay of Plenty	3,186,455	3,186,455	3,186,455	3,186,455	3,186,455	3,186,455
Gisborne	142,416	142,416	142,416	142,416	142,416	142,416
Hawkes Bay	1,925,514	1,925,514	1,925,514	1,925,514	1,925,514	1,925,514
Taranaki	150,955	150,955	150,955	150,955	150,955	150,955
Manawatu-Wanganui	140,605	140,605	140,605	140,605	140,605	140,605
Wellington	-	-	-	-	-	-
Wairarapa	291,611	291,611	291,611	291,611	291,611	291,611
Tasman-Nelson	972,486	972,486	972,486	972,486	972,486	972,486
Marlborough	293,888	293,888	293,888	293,888	293,888	293,888
West Coast	145,935	145,935	145,935	145,935	145,935	145,935
Canterbury	556,959	556,959	556,959	556,959	556,959	556,959
Otago	242,501	242,501	242,501	242,501	242,501	242,501
Southland	1,461,731	1,461,731	1,461,731	1,461,731	1,461,731	1,461,731
NZ Total	**11,647,864**	**11,647,864**	**11,647,864**	**11,647,864**	**11,647,864**	**11,647,864**

Sawmill chip volume (tonnes per annum) recovery level 2, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	51,870	51,870	51,870	51,870	51,870	51,870
Auckland	24,375	24,375	24,375	24,375	24,375	24,375
Waikato	130,210	130,210	130,210	130,210	130,210	130,210
Bay of Plenty	307,870	307,870	307,870	307,870	307,870	307,870
Gisborne	13,760	13,760	13,760	13,760	13,760	13,760
Hawkes Bay	186,040	186,040	186,040	186,040	186,040	186,040
Taranaki	14,585	14,585	14,585	14,585	14,585	14,585
Manawatu-Wanganui	13,585	13,585	13,585	13,585	13,585	13,585
Wellington	-	-	-	-	-	-
Wairarapa	28,175	28,175	28,175	28,175	28,175	28,175
Tasman-Nelson	93,960	93,960	93,960	93,960	93,960	93,960
Marlborough	28,395	28,395	28,395	28,395	28,395	28,395
West Coast	14,100	14,100	14,100	14,100	14,100	14,100
Canterbury	53,813	53,813	53,813	53,813	53,813	53,813
Otago	23,430	23,430	23,430	23,430	23,430	23,430
Southland	141,230	141,230	141,230	141,230	141,230	141,230
NZ Total	**1,125,398**	**1,125,398**	**1,125,398**	**1,125,398**	**,125,398**	**1,125,398**

Sawmill chip, energy (GJ per annum) recovery level 2, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	357,903	357,903	357,903	357,903	357,903	357,903
Auckland	168,188	168,188	168,188	168,188	168,188	168,188
Waikato	898,449	898,449	898,449	898,449	898,449	898,449
Bay of Plenty	2,124,303	2,124,303	2,124,303	2,124,303	2,124,303	2,124,303
Gisborne	94,944	94,944	94,944	94,944	94,944	94,944
Hawkes Bay	1,283,676	1,283,676	1,283,676	1,283,676	1,283,676	1,283,676
Taranaki	100,637	100,637	100,637	100,637	100,637	100,637
Manawatu-Wanganui	93,737	93,737	93,737	93,737	93,737	93,737
Wellington	-	-	-	-	-	-
Wairarapa	194,408	194,408	194,408	194,408	194,408	194,408
Tasman-Nelson	648,324	648,324	648,324	648,324	648,324	648,324
Marlborough	195,926	195,926	195,926	195,926	195,926	195,926
West Coast	97,290	97,290	97,290	97,290	97,290	97,290
Canterbury	371,306	371,306	371,306	371,306	371,306	371,306
Otago	161,667	161,667	161,667	161,667	161,667	161,667
Southland	974,487	974,487	974,487	974,487	974,487	974,487
NZ Total	**7,765,243**	**7,765,243**	**7,765,243**	**7,765,243**	**7,765,243**	**7,765,243**

Appendix P – K grade logs

Note: K grade in this context includes all the variations of K grade, including KI, KS and KIS grades

Gross supply of K grade logs, green tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	817,646	675,489	815,645	1,050,795	1,137,948	1,044,955
Auckland	310,339	247,758	169,910	122,423	168,768	278,837
Waikato	910,460	903,796	613,763	422,073	526,027	724,381
Bay of Plenty	1,967,906	1,877,871	1,849,100	1,982,731	1,832,464	1,788,868
Gisborne	814,308	449,686	383,901	449,311	695,861	995,072
Hawkes Bay	978,886	670,764	511,015	444,400	700,888	1,075,625
Taranaki	116,093	46,363	25,424	31,762	94,084	157,475
Manawatu-Wanganui	326,856	167,955	110,394	101,555	223,181	390,921
Wellington	67,262	34,649	24,460	18,337	42,795	81,532
Wairarapa	497,551	262,435	202,125	274,673	465,144	627,712
Tasman-Nelson	426,301	460,687	432,665	371,105	376,564	403,739
Marlborough	354,406	215,031	240,521	287,595	372,044	464,345
West Coast	29,731	33,749	32,546	33,324	35,489	30,692
Canterbury	412,889	234,630	164,427	161,968	301,786	482,504
Otago	617,330	423,069	346,593	410,830	585,129	715,154
Southland	418,173	286,217	197,874	195,749	284,604	418,685
NZ Total	**9,066,138**	**6,990,147**	**6,120,363**	**6,358,632**	**7,842,776**	**9,680,497**

K grade logs, gross energy (GJ per annum)

	2021-2025	2026-2030	2031-2035	2036-2040	2024-2045	2046-2050
Northland	5,641,757	4,660,871	5,627,950	7,250,482	7,851,840	7,210,193
Auckland	2,141,341	1,709,527	1,172,381	844,720	1,164,498	1,923,972
Waikato	6,282,173	6,236,192	4,234,963	2,912,301	3,629,586	4,998,229
Bay of Plenty	13,578,553	12,957,309	12,758,790	13,680,844	12,644,000	12,343,190
Gisborne	5,618,725	3,102,834	2,648,917	3,100,246	4,801,438	6,865,999
Hawkes Bay	6,754,315	4,628,269	3,526,000	3,066,363	4,836,127	7,421,811
Taranaki	801,039	319,905	175,424	219,158	649,177	1,086,578
Manawatu-Wanganui	2,255,307	1,158,893	761,718	700,728	1,539,951	2,697,356
Wellington	464,109	239,076	168,776	126,529	295,288	562,568
Wairarapa	3,433,100	1,810,804	1,394,664	1,895,242	3,209,494	4,331,213
Tasman-Nelson	2,941,480	3,178,737	2,985,391	2,560,626	2,598,292	2,785,800
Marlborough	2,445,403	1,483,716	1,659,598	1,984,408	2,567,102	3,203,979
West Coast	205,145	232,870	224,569	229,939	244,872	211,778
Canterbury	2,848,933	1,618,946	1,134,544	1,117,582	2,082,325	3,329,275
Otago	4,259,580	2,919,173	2,391,488	2,834,728	4,037,392	4,934,560
Southland	2,885,391	1,974,894	1,365,330	1,350,669	1,963,771	2,888,928
NZ Total	**62,556,351**	**48,232,017**	**42,230,503**	**43,874,563**	**54,115,155**	**66,795,429**

K grade logs volume (tonnes per annum) recovery level 1, 95%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	776,764	641,714	774,863	998,255	1,081,050	992,708
Auckland	294,822	235,370	161,415	116,302	160,329	264,895
Waikato	864,937	858,606	583,075	400,969	499,726	688,162
Bay of Plenty	1,869,511	1,783,977	1,756,645	1,883,594	1,740,841	1,699,425
Gisborne	773,593	427,202	364,706	426,846	661,068	945,319
Hawkes Bay	929,942	637,225	485,464	422,180	665,844	1,021,843
Taranaki	110,288	44,045	24,153	30,174	89,379	149,601
Manawatu-Wanganui	310,513	159,558	104,874	96,477	212,022	371,375
Wellington	63,899	32,916	23,237	17,421	40,656	77,455
Wairarapa	472,673	249,314	192,019	260,939	441,887	596,326
Tasman-Nelson	404,986	437,652	411,032	352,550	357,736	383,552
Marlborough	336,686	204,280	228,495	273,216	353,442	441,128
West Coast	28,245	32,062	30,919	31,658	33,714	29,158
Canterbury	392,244	222,898	156,205	153,870	286,697	458,378
Otago	586,464	401,915	329,263	390,289	555,873	679,396
Southland	397,264	271,906	187,980	185,962	270,374	397,751
NZ Total	**8,612,831**	**6,640,640**	**5,814,345**	**6,040,701**	**7,450,637**	**9,196,472**

K grade logs, energy (GJ per annum) recovery level 1, 95%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	5,359,669	4,427,828	5,346,552	6,887,958	7,459,248	6,849,683
Auckland	2,034,274	1,624,051	1,113,762	802,484	1,106,273	1,827,774
Waikato	5,968,064	5,924,382	4,023,215	2,766,686	3,448,107	4,748,317
Bay of Plenty	12,899,626	12,309,444	12,120,51	12,996,801	12,011,800	11,726,031
Gisborne	5,337,789	2,947,692	2,516,471	2,945,234	4,561,366	6,522,700
Hawkes Bay	6,416,599	4,396,856	3,349,700	2,913,044	4,594,321	7,050,720
Taranaki	760,987	303,909	166,653	208,200	616,718	1,032,249
Manawatu-Wanganui	2,142,542	1,100,948	723,633	665,691	1,462,953	2,562,489
Wellington	440,903	227,122	160,337	120,202	280,523	534,440
Wairarapa	3,261,445	1,720,263	1,324,931	1,800,480	3,049,020	4,114,652
Tasman-Nelson	2,794,406	3,019,800	2,836,122	2,432,595	2,468,378	2,646,510
Marlborough	2,323,133	1,409,530	1,576,618	1,885,187	2,438,747	3,043,780
West Coast	194,888	221,226	213,340	218,442	232,628	201,189
Canterbury	2,706,486	1,537,999	1,077,817	1,061,702	1,978,209	3,162,811
Otago	4,046,601	2,773,215	2,271,914	2,692,991	3,835,523	4,687,832
Southland	2,741,121	1,876,150	1,297,063	1,283,136	1,865,582	2,744,482
NZ Total	**59,428,534**	**45,820,416**	**40,118,978**	**41,680,835**	**51,409,397**	**63,455,658**

K grade logs volume (tonnes per annum) recovery level 2, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**	**2044-2048**	**2049-2053**
Northland	654,117	540,391	652,516	840,636	910,358	835,964
Auckland	248,271	198,206	135,928	97,939	135,014	223,069
Waikato	728,368	723,037	491,010	337,658	420,822	579,505
Bay of Plenty	1,574,325	1,502,297	1,479,280	1,586,185	1,465,971	1,431,095
Gisborne	651,446	359,749	307,121	359,449	556,689	796,058
Hawkes Bay	783,109	536,611	408,812	355,520	560,710	860,500
Taranaki	92,874	37,090	20,339	25,410	75,267	125,980
Manawatu-Wanganui	261,485	134,364	88,315	81,244	178,545	312,737
Wellington	53,810	27,719	19,568	14,670	34,236	65,225
Wairarapa	398,041	209,948	161,700	219,738	372,115	502,170
Tasman-Nelson	341,041	368,549	346,132	296,884	301,251	322,991
Marlborough	283,525	172,025	192,417	230,076	297,635	371,476
West Coast	23,785	26,999	26,037	26,660	28,391	24,554
Canterbury	330,311	187,704	131,541	129,575	241,429	386,003
Otago	493,864	338,455	277,274	328,664	468,103	572,123
Southland	334,538	228,973	158,299	156,599	227,684	334,948
NZ Total	**7,252,910**	**5,592,118**	**4,896,290**	**5,086,906**	**6,274,221**	**7,744,398**

K grade logs, energy (GJ per annum) recovery level 2, 80%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	4,513,405	3,728,697	4,502,360	5,800,386	6,281,472	5,768,154
Auckland	1,713,073	1,367,622	937,905	675,776	931,598	1,539,178
Waikato	5,025,738	4,988,954	3,387,970	2,329,841	2,903,669	3,998,583
Bay of Plenty	10,862,843	10,365,847	10,207,032	10,944,675	10,115,200	9,874,552
Gisborne	4,494,980	2,482,267	2,119,133	2,480,197	3,841,151	5,492,800
Hawkes Bay	5,403,452	3,702,615	2,820,800	2,453,090	3,868,902	5,937,449
Taranaki	640,831	255,924	140,339	175,326	519,342	869,262
Manawatu-Wanganui	1,804,246	927,114	609,375	560,582	1,231,961	2,157,885
Wellington	371,287	191,261	135,021	101,223	236,230	450,054
Wairarapa	2,746,480	1,448,643	1,115,731	1,516,193	2,567,595	3,464,970
Tasman-Nelson	2,353,184	2,542,990	2,388,313	2,048,501	2,078,634	2,228,640
Marlborough	1,956,322	1,186,973	1,327,678	1,587,526	2,053,682	2,563,183
West Coast	164,116	186,296	179,655	183,951	195,898	169,422
Canterbury	2,279,146	1,295,157	907,635	894,065	1,665,860	2,663,420
Otago	3,407,664	2,335,339	1,913,191	2,267,782	3,229,914	3,947,648
Southland	2,308,313	1,579,915	1,092,264	1,080,535	1,571,017	2,311,143
NZ Total	**50,045,081**	**38,585,613**	**33,784,403**	**35,099,650**	**43,292,124**	**53,436,343**

Appendix Q – Douglas-fir production thinnings

Gross supply of Douglas-fir production thinnings, green tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043
Northland	0	0	40	0
Auckland	0	0	120	0
Waikato	5,580	5,280	1,300	40
Bay of Plenty	44,400	44,720	52,460	45,020
Gisborne	10,380	7,600	20	20
Hawkes Bay	1,260	2,780	500	200
Taranaki	40	0	0	0
Manawatu-Wanganui	960	1,680	240	380
Wairarapa	640	640	80	20
Wellington	160	120	20	60
Tasman-Nelson	12,600	30,360	23,220	22,320
Marlborough	640	10,340	760	5,520
West Coast	8,820	1,460	160	40
Canterbury	102,700	98,340	19,420	16,112
Otago	166,320	200,300	23,800	39,430
Southland	193,240	184,540	5,040	6,120
NZ Total	**547,740**	**588,140**	**127,180**	**135,622**

Douglas-fir production thinnings, gross energy (GJ per annum)

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**
Northland	0	0	276	0
Auckland	0	0	828	0
Waikato	38,502	36,432	8,970	276
Bay of Plenty	306,360	308,568	361,974	310,638
Gisborne	71,622	52,440	138	138
Hawkes Bay	8,694	19,182	3,450	1,380
Taranaki	276	0	0	0
Manawatu-Wanganui	6,624	11,592	1,656	2,622
Wairarapa	4,416	4,416	552	138
Wellington	1,104	828	138	414
Tasman-Nelson	86,940	209,484	160,218	154,008
Marlborough	4,416	71,346	5,244	38,088
West Coast	60,858	10,074	1,104	276
Canterbury	708,630	678,546	133,998	111,173
Otago	1,147,608	1,382,070	164,220	272,067
Southland	1,333,356	1,273,326	34,776	42,228
NZ Total	**3,779,406**	**4,058,166**	**877,542**	**935,792**

Douglas-fir production thinnings volume (tonnes per annum) recovery level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**
Northland	0	0	32	0
Auckland	0	0	96	0
Waikato	4,464	4,224	1,040	32
Bay of Plenty	35,520	35,776	41,968	36,016
Gisborne	8,304	6,080	16	16
Hawkes Bay	1,008	2,224	400	160
Taranaki	32	0	0	0
Manawatu-Wanganui	768	1,344	192	304
Wairarapa	512	512	64	16
Wellington	128	96	16	48
Tasman-Nelson	10,080	24,288	18,576	17,856
Marlborough	512	8,272	608	4,416
West Coast	7,056	1,168	128	32
Canterbury	82,160	78,672	15,536	12,890
Otago	133,056	160,240	19,040	31,544
Southland	154,592	147,632	4,032	4,896
NZ Total	**438,192**	**470,512**	**101,744**	**108,498**

Douglas-fir production thinnings, energy (GJ per annum) recovery level 1, 80%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**
Northland	0	0	221	0
Auckland	0	0	662	0
Waikato	30,802	29,146	7,176	221
Bay of Plenty	245,088	246,854	289,579	248,510
Gisborne	57,298	41,952	110	110
Hawkes Bay	6,955	15,346	2,760	1,104
Taranaki	221	0	0	0
Manawatu-Wanganui	5,299	9,274	1,325	2,098
Wairarapa	3,533	3,533	442	110
Wellington	883	662	110	331
Tasman-Nelson	69,552	167,587	128,174	123,206
Marlborough	3,533	57,077	4,195	30,470
West Coast	48,686	8,059	883	221
Canterbury	566,904	542,837	107,198	88,938
Otago	918,086	1,105,656	131,376	217,654
Southland	1,066,685	1,018,661	27,821	33,782
NZ Total	**3,023,525**	**3,246,533**	**702,034**	**748,633**

Douglas-fir production thinnings volume (tonnes per annum) recovery level 2, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**
Northland	0	0	20	0
Auckland	0	0	60	0
Waikato	2,790	2,640	650	20
Bay of Plenty	22,200	22,360	26,230	22,510
Gisborne	5,190	3,800	10	10
Hawkes Bay	630	1,390	250	100
Taranaki	20	0	0	0
Manawatu-Wanganui	480	840	120	190
Wairarapa	320	320	40	10
Wellington	80	60	10	30
Tasman-Nelson	6,300	15,180	11,610	11,160
Marlborough	320	5,170	380	2,760
West Coast	4,410	730	80	20
Canterbury	51,350	49,170	9,710	8,056
Otago	83,160	100,150	11,900	19,715
Southland	96,620	92,270	2,520	3,060
NZ Total	**273,870**	**294,070**	**63,590**	**67,811**

Douglas-fir production thinnings, energy (GJ per annum) recovery level 2, 50%

	2024-2028	**2029-2033**	**2034-2038**	**2039-2043**
Northland	0	0	138	0
Auckland	0	0	414	0
Waikato	19,251	18,216	4,485	138
Bay of Plenty	153,180	154,284	180,987	155,319
Gisborne	35,811	26,220	69	69
Hawkes Bay	4,347	9,591	1,725	690
Taranaki	138	0	0	0
Manawatu-Wanganui	3,312	5,796	828	1,311
Wairarapa	2,208	2,208	276	69
Wellington	552	414	69	207
Tasman-Nelson	43,470	104,742	80,109	77,004
Marlborough	2,208	35,673	2,622	19,044
West Coast	30,429	5,037	552	138
Canterbury	354,315	339,273	66,999	55,586
Otago	573,804	691,035	82,110	136,034
Southland	666,678	636,663	17,388	21,114
NZ Total	**1,889,703**	**2,029,083**	**438,771**	**467,896**

Appendix R – A grade logs

Gross supply of A grade logs, m^3 per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	698,719	878,429	616,921	598,027	835,780	1,063,911
Auckland	264,631	329,370	231,954	177,099	119,378	100,529
Waikato	919,625	1,248,994	990,945	704,538	520,409	597,303
Bay of Plenty	1,835,019	2,871,727	2,625,857	2,450,814	2,626,886	2,609,877
Gisborne	1,019,193	1,236,022	642,164	514,690	560,659	555,267
Hawkes Bay	820,419	1,096,877	704,057	557,464	440,561	510,687
Taranaki	149,534	169,946	71,197	31,914	24,108	42,044
Manawatu-Wanganui	562,923	609,939	309,505	226,099	205,516	205,957
Wellington	60,512	67,955	38,582	27,362	20,307	14,093
Wairarapa	369,887	431,132	219,162	160,445	168,619	249,744
Tasman / Nelson	399,967	613,521	560,149	487,514	397,548	376,354
Marlborough	457,435	496,928	282,329	221,821	311,929	317,669
West Coast	18,720	42,546	48,340	36,429	28,656	32,431
Canterbury	375,711	368,732	202,554	139,161	126,778	136,268
Otago	419,325	602,273	389,154	260,346	267,542	369,197
Southland	263,932	337,475	215,309	148,876	143,402	159,186
Total	**8,635,551**	**11,401,867**	**8,148,179**	**6,742,599**	**6,798,078**	**7,340,516**

Gross supply of energy from A grade logs, GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053	2054-2058
Northland	4,821,158	6,061,163	4,256,754	4,126,387	5,766,883	7,340,987	7,340,987
Auckland	1,825,957	2,272,651	1,600,484	,221,984	823,707	693,650	693,650
Waikato	6,345,413	8,618,055	6,837,523	4,861,315	3,590,820	4,121,389	4,121,389
Bay of Plenty	12,661,631	19,814,917	18,118,417	16,910,617	18,125,512	18,008,152	18,008,152
Gisborne	7,032,433	8,528,554	4,430,928	3,551,358	3,868,550	3,831,341	3,831,341
Hawkes Bay	5,660,891	7,568,450	4,857,993	3,846,504	3,039,870	3,523,739	3,523,739
Taranaki	1,031,783	1,172,629	491,263	220,204	166,345	290,106	290,106
Manawatu-Wanganui	3,884,170	4,208,582	2,135,586	1,560,083	1,418,058	1,421,102	1,421,102
Wellington	417,530	468,887	266,215	188,798	140,118	97,244	97,244
Wairarapa	2,552,221	2,974,813	1,512,215	1,107,071	1,163,469	1,723,233	1,723,233
Tasman / Nelson	2,759,771	4,233,293	3,865,027	3,363,845	2,743,079	2,596,840	2,596,840
Marlborough	3,156,300	3,428,805	1,948,069	1,530,568	2,152,311	2,191,919	2,191,919
West Coast	129,169	293,564	333,545	251,359	197,727	223,772	223,772
Canterbury	2,592,406	2,544,252	1,397,621	960,211	874,769	940,246	940,246
Otago	2,893,341	4,155,686	2,685,165	1,796,387	1,846,043	2,547,462	2,547,462
Southland	1,821,132	2,328,575	1,485,632	1,027,246	989,475	1,098,380	1,098,380
Total	59,585,305	78,672,879	56,222,438	46,523,936	46,906,736	50,649,562	50,64,562

A grade logs – m^3 per annum, recoverability level 1; 90%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	628,847	790,587	555,229	538,224	752,202	957,520
Auckland	238,168	296,433	208,759	159,389	107,440	90,476
Waikato	827,663	1,124,094	891,851	634,085	468,368	537,572
Bay of Plenty	1,651,517	2,584,554	2,363,272	2,205,733	2,364,197	2,348,889
Gisborne	917,274	1,112,420	577,947	463,221	504,594	499,740
Hawkes Bay	738,377	987,189	633,651	501,718	396,505	459,618
Taranaki	134,580	152,952	64,078	28,722	21,697	37,840
Manawatu-Wanganui	506,631	548,945	278,555	203,489	184,964	185,361
Wellington	54,460	61,159	34,724	24,626	18,276	12,684
Wairarapa	332,898	388,019	197,245	144,401	151,757	224,770
Tasman / Nelson	359,970	552,169	504,134	438,762	357,793	338,718
Marlborough	411,691	447,235	254,096	199,639	280,736	285,902
West Coast	16,848	38,291	43,506	32,786	25,790	29,188
Canterbury	338,140	331,859	182,298	125,245	114,100	122,641
Otago	377,392	542,046	350,239	234,311	240,788	332,278
Southland	237,539	303,727	193,778	133,989	129,062	143,267
Total	**7,771,996**	**10,261,680**	**7,333,361**	**6,068,339**	**6,118,270**	**6,606,465**

A grade logs – energy available, GJ per annum recoverability level 1, 90%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	4,339,042	5,455,047	3,831,079	3,713,748	5,190,195	6,606,888
Auckland	1,643,361	2,045,386	1,440,435	1,099,786	741,337	624,285
Waikato	5,710,872	7,756,250	6,153,771	4,375,184	3,231,738	3,709,250
Bay of Plenty	11,395,467	17,833,425	16,306,575	15,219,555	16,312,960	16,207,337
Gisborne	6,329,190	7,675,698	3,987,835	3,196,222	3,481,695	3,448,207
Hawkes Bay	5,094,802	6,811,605	4,372,194	3,461,853	2,735,883	3,171,365
Taranaki	928,604	1,055,366	442,136	198,184	149,710	261,095
Manawatu-Wanganui	3,495,753	3,787,724	1,922,027	1,404,074	1,276,253	1,278,992
Wellington	375,777	421,999	239,594	169,918	126,106	87,520
Wairarapa	2,296,999	2,677,332	1,360,994	996,364	1,047,122	1,550,910
Tasman / Nelson	2,483,794	3,809,964	3,478,524	3,027,460	2,468,771	2,337,156
Marlborough	2,840,670	3,085,925	1,753,262	1,377,511	1,937,080	1,972,727
West Coast	116,252	264,208	300,191	226,223	177,954	201,395
Canterbury	2,333,166	2,289,827	1,257,858	864,190	787,292	846,222
Otago	2,604,007	3,740,118	2,416,649	1,616,749	1,661,438	2,292,716
Southland	1,639,019	2,095,718	1,337,069	924,521	890,528	988,542
Total	**53,626,774**	**70,805,591**	**50,600,194**	**41,871,542**	**42,216,062**	**45,584,605**

A grade logs – m^3 per annum, recoverability level 2; 50%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	349,359	439,215	308,460	299,014	417,890	531,956
Auckland	132,316	164,685	115,977	88,550	59,689	50,264
Waikato	459,813	624,497	495,473	352,269	260,204	298,651
Bay of Plenty	917,509	1,435,864	1,312,929	1,225,407	1,313,443	1,304,939
Gisborne	509,597	618,011	321,082	257,345	280,330	277,633
Hawkes Bay	410,210	548,438	352,028	278,732	220,280	255,343
Taranaki	74,767	84,973	35,599	15,957	12,054	21,022
Manawatu-Wanganui	281,462	304,970	154,753	113,049	102,758	102,978
Wellington	30,256	33,977	19,291	13,681	10,153	7,047
Wairarapa	184,944	215,566	109,581	80,223	84,309	124,872
Tasman / Nelson	199,983	306,760	280,074	243,757	198,774	188,177
Marlborough	228,717	248,464	141,164	110,911	155,965	158,835
West Coast	9,360	21,273	24,170	18,214	14,328	16,215
Canterbury	187,856	184,366	101,277	69,580	63,389	68,134
Otago	209,662	301,137	194,577	130,173	133,771	184,599
Southland	131,966	168,737	107,655	74,438	71,701	79,593
Total	**4,317,776**	**5,700,933**	**4,074,090**	**3,371,300**	**3,399,039**	**3,670,258**

A grade logs – GJ per annum, recoverability level 1; 50%

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	2,169,521	2,727,523	1,915,539	1,856,874	2,595,097	3,303,444
Auckland	821,680	1,022,693	720,218	549,893	370,668	312,142
Waikato	2,855,436	3,878,125	3,076,885	2,187,592	1,615,869	1,854,625
Bay of Plenty	5,697,734	8,916,713	8,153,287	7,609,777	8,156,480	8,103,668
Gisborne	3,164,595	3,837,849	1,993,918	1,598,111	1,740,848	1,724,103
Hawkes Bay	2,547,401	3,405,803	2,186,097	1,730,927	1,367,941	1,585,683
Taranaki	464,302	527,683	221,068	99,092	74,855	130,548
Manawatu-Wanganui	1,747,876	1,893,862	961,014	702,037	638,126	639,496
Wellington	187,888	210,999	119,797	84,959	63,053	43,760
Wairarapa	1,148,499	1,338,666	680,497	498,182	523,561	775,455
Tasman / Nelson	1,241,897	1,904,982	1,739,262	1,513,730	1,234,386	1,168,578
Marlborough	1,420,335	1,542,962	876,631	688,756	968,540	986,364
West Coast	58,126	132,104	150,095	113,111	88,977	100,697
Canterbury	1,166,583	1,144,913	628,929	432,095	393,646	423,111
Otago	1,302,003	1,870,059	1,208,324	808,374	830,719	1,146,358
Southland	819,509	1,047,859	668,535	462,261	445,264	494,271
Total	**26,813,387**	**35,402,796**	**25,300,097**	**20,935,771**	**21,108,031**	**22,792,303**

Appendix S – Stumps

Gross volume – green tonnes per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	30,696	18,781	19,204	26,621	33,021	35,304
Auckland	9,717	7,544	5,108	3,441	2,915	3,057
Waikato	30,391	26,835	21,165	16,082	16,423	19,532
Bay of Plenty	65,215	60,467	52,205	58,978	60,515	59,498
Gisborne	20,745	9,684	7,877	8,747	8,665	9,511
Hawkes Bay	21,939	13,980	11,031	8,585	12,229	17,276
Taranaki	3,912	1,558	847	708	953	1,085
Manawatu-Wanganui	17,551	7,912	5,454	4,621	4,664	5,327
Wairarapa	11,402	6,158	3,300	3,473	4,821	6,208
Wellington	3,173	1,383	835	665	469	276
Tasman / Nelson	5,357	4,712	4,672	3,798	3,519	4,122
Marlborough	6,182	2,756	2,175	3,058	3,292	2,581
West Coast	6,932	6,243	5,385	3,464	3,735	4,049
Canterbury	27,235	14,388	8,421	6,214	6,409	6,407
Otago	24,764	16,499	9,709	9,415	11,383	13,354
Southland	27,662	20,101	9,663	8,913	9,790	10,115
Total volume	**312,871**	**219,001**	**167,052**	**166,784**	**182,803**	**197,703**

Gross energy – GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	580,151	354,964	362,951	503,131	624,096	667,243
Auckland	183,645	142,581	96,534	65,034	55,092	57,786
Waikato	574,398	507,173	400,011	303,943	310,395	369,157
Bay of Plenty	1,232,556	1,142,831	986,668	1,114,690	1,143,732	1,124,512
Gisborne	392,074	183,021	148,876	165,312	163,776	179,766
Hawkes Bay	414,648	264,215	208,495	162,259	231,122	326,522
Taranaki	73,930	29,442	16,014	13,381	18,018	20,498
Manawatu-Wanganui	331,707	149,545	103,074	87,340	88,148	100,672
Wairarapa	215,489	116,386	62,370	65,639	91,109	117,333
Wellington	59,977	26,134	15,784	12,563	8,866	5,222
Tasman / Nelson	101,247	89,057	88,308	71,789	66,508	77,912
Marlborough	116,835	52,091	41,117	57,798	62,217	48,775
West Coast	131,007	117,990	101,777	65,477	70,595	76,529
Canterbury	514,735	271,937	159,159	117,442	121,128	121,100
Otago	468,034	311,826	183,504	177,952	215,146	252,393
Southland	522,819	379,917	182,633	168,463	185,035	191,166
Total volume	**5,913,253**	**4,139,111**	**3,157,274**	**3,152,214**	**3,454,983**	**3,736,587**

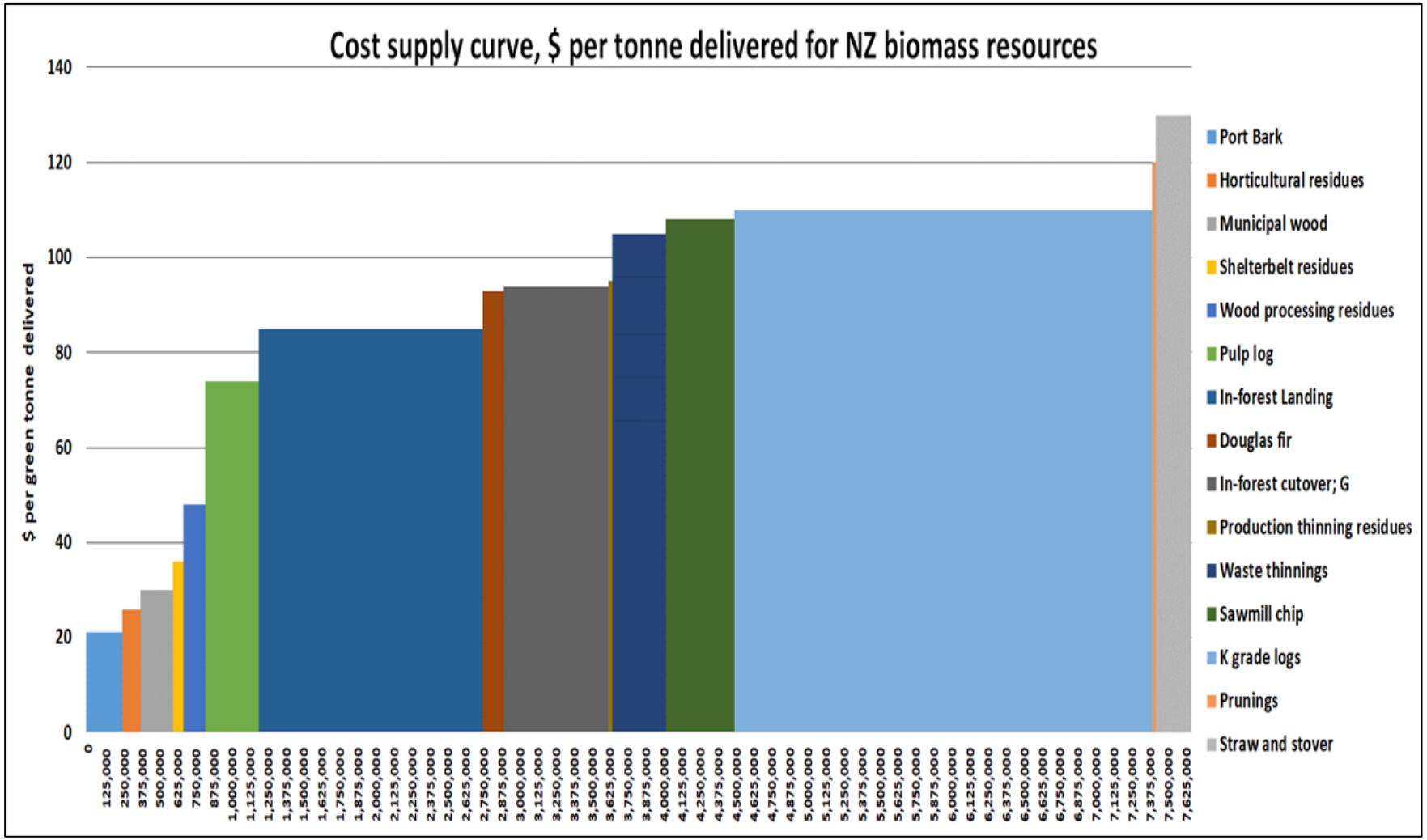
Estimated recoverable volume, green tonnes per annum – 50% of gross

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	15,348	9,391	9,602	13,310	16,510	17,652
Auckland	4,858	3,772	2,554	1,720	1,457	1,529
Waikato	15,196	13,417	10,582	8,041	8,212	9,766
Bay of Plenty	32,607	30,234	26,102	29,489	30,257	29,749
Gisborne	10,372	4,842	3,939	4,373	4,333	4,756
Hawkes Bay	10,970	6,990	5,516	4,293	6,114	8,638
Taranaki	1,956	779	424	354	477	542
Manawatu-Wanganui	8,775	3,956	2,727	2,311	2,332	2,663
Wairarapa	5,701	3,079	1,650	1,736	2,410	3,104
Wellington	1,587	691	418	332	235	138
Tasman / Nelson	2,678	2,356	2,336	1,899	1,759	2,061
Marlborough	3,091	1,378	1,088	1,529	1,646	1,290
West Coast	3,466	3,121	2,693	1,732	1,868	2,025
Canterbury	13,617	7,194	4,211	3,107	3,204	3,204
Otago	12,382	8,249	4,855	4,708	5,692	6,677
Southland	13,831	10,051	4,832	4,457	4,895	5,057
Total volume	156,435	109,500	83,526	83,392	91,402	98,852

Estimated recoverable energy, GJ per annum

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
Northland	290,076	177,482	181,476	251,565	312,048	333,622
Auckland	91,822	71,291	48,267	32,517	27,546	28,893
Waikato	287,199	253,586	200,005	151,972	155,198	184,579
Bay of Plenty	616,278	571,415	493,334	557,345	571,866	562,256
Gisborne	196,037	91,511	74,438	82,656	81,888	89,883
Hawkes Bay	207,324	132,108	104,248	81,129	115,561	163,261
Taranaki	36,965	14,721	8,007	6,691	9,009	10,249
Manawatu-Wanganui	165,854	74,772	51,537	43,670	44,074	50,336
Wairarapa	107,745	58,193	31,185	32,820	45,555	58,667
Wellington	29,989	13,067	7,892	6,281	4,433	2,611
Tasman / Nelson	50,624	44,529	44,154	35,895	33,254	38,956
Marlborough	58,418	26,046	20,558	28,899	31,109	24,387
West Coast	65,504	58,995	50,888	32,738	35,297	38,264
Canterbury	257,367	135,969	79,580	58,721	60,564	60,550
Otago	234,017	155,913	91,752	88,976	107,573	126,196
Southland	261,410	189,958	91,316	84,231	92,518	95,583
Total volume	**2,956,626**	**2,069,555**	**1,578,637**	**1,576,107**	**1,727,492**	**1,868,293**

Appendix T – National level cost supply curve ($'s per tonne and tonnage per annum)



Green tonnes per annum

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