NZ Transport Agency

Northland Regional Forestry Framework Report

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1 Executive Summary

Regionally, Northland has the second largest area of forestry planting across New Zealand. As a result, Northland's roads are subject to increasing accelerated damage as the plantings are harvested. This overview report seeks to summarise the evidence based programs which have been prepared by Northland's four road controlling authorities, in order to support funding requests for the 2015/18 Regional Land Transport Program (RLTP).

The funding requests are the result of recognising that additional funding arises from the increased forestry traffic in Northland, compared to funding at current levels which has not been based on increased forestry traffic demand.

A common approach was adopted by all Northland road controlling authorities in order to calculate the rough order of additional costs are divided into 3 separate phases:

- Phase 1: Forestry activity data gathering and initial analysis
- Phase 2: Assess forestry traffic demand, deterioration modelling & development of pavement strategies and renewal work programme
- Phase 3: Funding Impact Analysis and Options

As funding for maintenance is constrained, the application of the 3 phases was planned to allow the estimation of the shortfall (additional funding) for the 2015/18 period, with final outcomes to:

- Achieve overall best practice asset management;
- Improved understanding of forestry demand and cost impact;
- Production of optimised programs for forestry routes;
- Gain the ability to have flexibility within the optimised programmes;
- Improve communications between Road Controlling Authorities (RCA) and Forest Managers;
- Adopt a strategic approach to be embedded into the Activity Management Plan (AMP)

Regional Development Funding

The Regional Development Fund (RDF) was established in 2002 by the Ministry of Transport (MOT) and administered by the NZ Transport Agency for the purpose of stimulating economic growth and employment through funding the necessary infrastructure to transfer harvested logs to wood processing facilities and export port facilities. Northland received a share of the national RDF funding.

The network length that was treated under RDF funding from 2002 to 2010, together with the associated costs, (for each District Council (DC) in the Northland Area) is summarised in the following table:

Table 1: Breakdown of Upgraded Lengths and Costs for each District Council in Northland

Council	Length of Road Upgraded	Cost (Million)	$/km
Far North DC	106.80km	$36.27	$339.61k
Whangarei DC	82.67km	$32.76	$396.26k
Kaipara DC	71.87km	$18.3	$254.63k
Total	**261.3km**	**$88.17**	**$337.43k**

While acknowledging the benefit received from the historical RDF funding, it is also important to recognise that the demand that existed to prompt the initial funding has not gone away – if anything the need is more imperative. The level of forestry traffic in Northland is not expected to reduce in the short to medium future period. If the need for additional funding was apparent in 2002, it is more necessary now.

Forestry Harvesting (traffic) demand/forecasting

Since 1980, a number of reports have been prepared to predict the likely 'growth' of timber production in Northland.

- In 1980, the Northland Forestry Port Study forecast that timber production would rise from the 1980 value of 0.33 million tonnes to a value of 2.87 million tonnes per year in 2010
- In 2009, the age class verses planted area for Northland showed a significant gap at age 16 – 20 years.
- In 2010 the Ministry of Forestry predicted that the production would rise from "the current level of 2.3 million cu metres to around 3.6 million cubic meters by 2012" and possibly to around 4.6 million cubic meters by 2023. (Note 1 cubic metre is approximately 1 tonne). This report took the pure translation of age class and forecast a sustainable industry level.
- In 2014, the 'gapped' age class profile from 2009 has manifested into a similar gap for age 21 – 25 years. Pure translation of those age class profiles into available production (based on the historical average cutting age of 25 years,) results in a similar stepped production into the future.
- Historical production reached 4.2 million tonnes in 2014

Graphically these comments are shown in the two following charts.

Figure 1: Northland Forestry Port Study - 1980

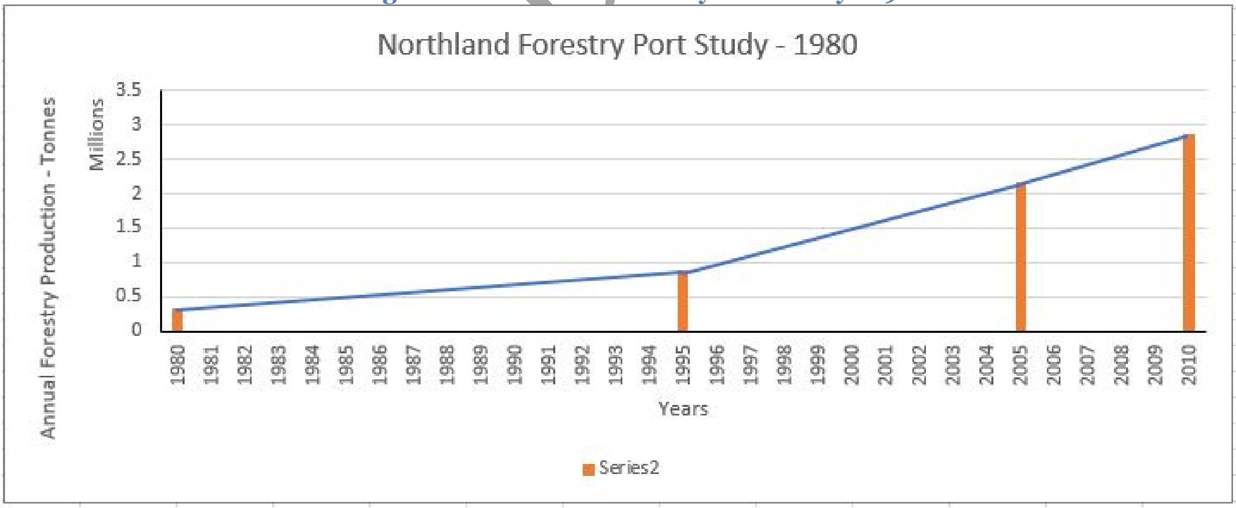
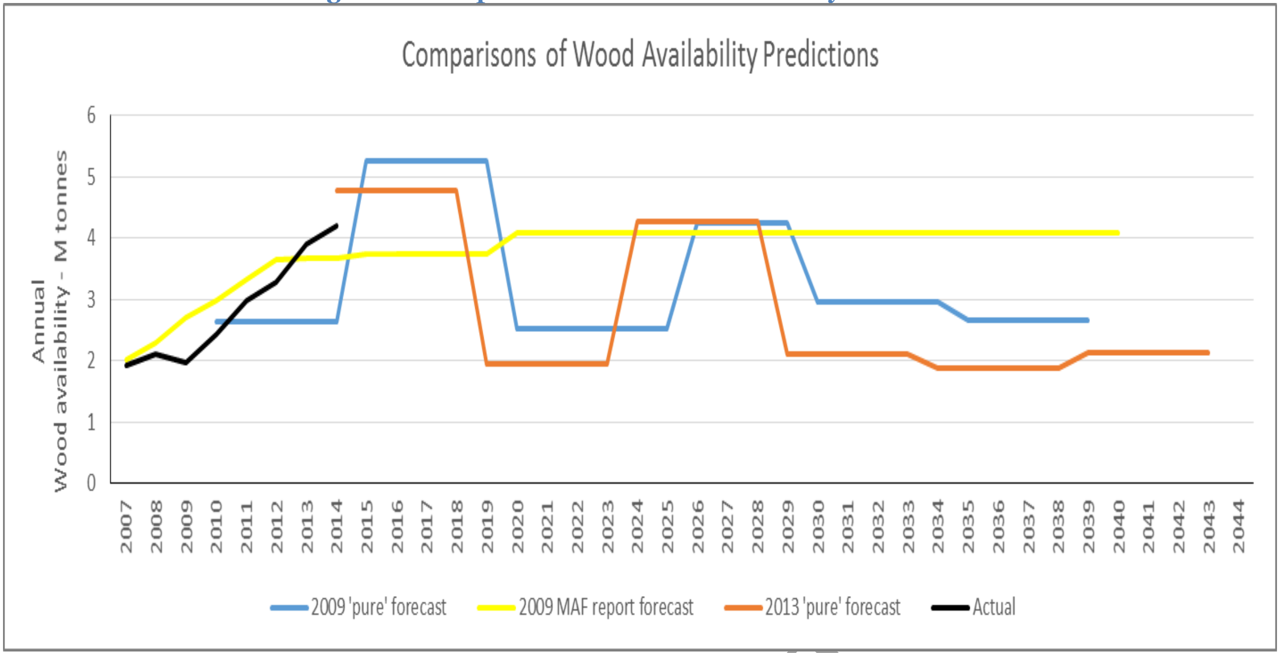


Figure 2: Comparisons of Wood Availability Predictions



Development of funding shortfall prediction

Each of the Northland local authorities adopted similar methodologies, with slight technical differences, in order to determine the additional funding required for maintenance and renewals as a result of the intensified forestry traffic compared to the parts of their network without identified forestry traffic.

NZTA used logging tonnages supplied by the local authorities, and adapted its 'normal' dTIMS model to account for the (general) one directional flow of loaded forestry traffic.

The methodology followed by each road controlling authority can be summarised in the following table:

Table 2: Summary of Methodologies adopted by each Local Authority and State Highway

Local Authority	Whangarei DC	Kaipara DC	Far North DC	State Highway
Area/Volume Assessment	GIS Analysis of planted areas and Consultation with forestry sector	KDC rates land-use database and maturity assessment, Liaison with major forestry managers	GIS (LUCAS) database, and industry consultation.	Tonnages onto State Highway used Tonnages from Local Authority Reports
Forestry Network	Approx 10% of WDC network, using a HCV threshold of > 5%	Approx 30% of KDC network, with no HCV threshold applied	Approx 43% of FNDC network, with no threshold applied	Whole of SH network
Assessing Road Strength	Falling Weight Deflectometer (FWD) Deflection curvature Driveover assessment	Falling Weight Deflectometer (FWD)	Local knowledge, maintenance cost history and drive over inspection	NZTA dTIMS
Modelling Used	NZ dTIMS Model	5 Grade Matrix	5 Grade Matrix	NZTA dTIMS
Basis of treatment Cost rates	Assessment of Historical cost rates	Assessment of Historical cost rates	Assessment of Historical cost rates	Normal dTIMS rates, based on maintenance contract rates

Funding impact assessment

The additional funding (shortfall) estimated by road controlling authorities, as total treatment costs per year from the additional forestry loading, over the 2015/18 period is shown in table 3 below.

Table 3: Shortfall (additional funding) per year for each local authority and overall state highway

Local Authority	Shortfall ($) per year in 2015/18	Average % Increase on Current Funding
Whangarei District Council (WDC)	*$1,272,593*	*11.66%*
Kaipara District Council (KDC)	*$1,082,490*	*16.03%*
Far North District Council (FNDC)	*$ 3,300,000*	*23.64%*
NZ Transport Agency (NZTA)	*$2,280,000*	*4.33%*

Confidence in report findings

The reports of each of the road controlling authorities have been assessed to assess a level of confidence in the final result – ie the level of additional funding needed for 2015/18.

The result of that assessment is shown in table 4 below, along with an indication of the areas of need for more study in the respective reports.

Table 4: Assessment of confidence in reporting outcome

Local Authority	Level of confidence	Areas of development need
Whangarei District Council (WDC)	*High*	*Alternative funding possibilities*
Kaipara District Council (KDC)	*Medium*	*Forestry network threshold* *Activity programme development* *Unit costs of renewals activity* *Alternative funding possibilities*
Far North District Council (FNDC)	*Medium*	*Forestry network threshold* *Activity programme development* *Unit costs of renewals activity* *Alternative funding possibilities*
NZ Transport Agency (NZTA)	*High*	*Directional modelling of network*

2 Background

2.1 RDF Project 2002 - 2012

The Regional Development Fund (RDF) was a project established in 2002 by the Ministry of Transport (MOT) and administered by the NZ Transport Agency (NZTA). The project was set up for the Northland and Tairawhiti (North Island East Coast) regions for the purpose of stimulating economic growth and employment opportunities through the funding of infrastructure required to transfer harvested logs to wood processing facilities. The aim of the project was "to upgrade infrastructure for the purpose of facilitating public road access for forest harvesting and the development of wood processing and exports in the two regions Northland and Tairawhiti".

The project involved evaluating local roads in both regions based on an evaluation criteria provided the MOT. The priority was based on predominant end use of harvested logs in the following descending order:

> Rural Development Funding to Northland from 2002 to 2012 recognised the extraordinary demand logging traffic has on rural roads

- Supply to new processing facilities;
- Supply to existing processing facilities;
- Supply for log export

From years 2002 to 2012, the achieved upgrades and costs are summarised in the following table:

Table 5: Overall Upgrade Achievement and Associated Costs for Northland and Tairawhiti

Region	Length of Road Upgraded	Cost (Million)
Northland	*261km*	*$87.33*
Tairawhiti	*338km*	*$53.5*
Total	***599km***	***$141.67***

The upgraded lengths and costs for Northland, broken down into their respective District Councils (DC), are summarised in Table 2 below:

Table 6: Further Breakdown of Upgraded Lengths and Costs for Northland

Council	Length of Road Upgraded	Cost (Million)	$/km
Far North DC	*106.80km*	*$36.27*	*$339.61k*
Whangarei DC	*82.67km*	*$32.76*	*$396.26k*
Kaipara DC	*71.87km*	*$18.3*	*$254.63k*
Total	***261.3km***	***$88.17***	***$337.43k***

A detailed map of the specific roads upgraded under the RDF project can be found in Appendix 9

2.2 Interface with REG

The Road Efficiency Group (REG) is a collaborative initiative by the road controlling authorities of New Zealand where the goals are to drive value for money and improve performance in maintenance, operations and renewals throughout the country[1].

REG focuses on three key areas:

- One Network Road Classification (ONRC) to standardise data and create a classification system which identifies the level of service, function and use of road networks and state highways;
- Best Practice Asset Management to share best practice planning and advice with road controlling authorities;
- Collaboration with the industry and between road controlling authorities to share information, staff and management practises.

The focus is to create a number of benefits:

- Improved performance of the industry and suppliers;
- Encouragement of improved collaboration and flexibility between road controlling authorities;
- Reduction in costs in the appropriate areas;
- Investment prioritisation on roads based on roads needing the most attention;
- Encouragement of best practice from suppliers, industry and road controlling authorities;
- Provide a more holistic, collective way of maintaining and operating state highways and local roads in the regions.

One of the three key areas of focus for the Road Efficiency Group is the idea of Best Practice Asset Management.

A number reviews were conducted, including one by the Road Maintenance Task Force, that suggest potential efficiency gains from use of high-quality asset management advice and mechanisms at a sector-wide level for continual improvement of the practice.

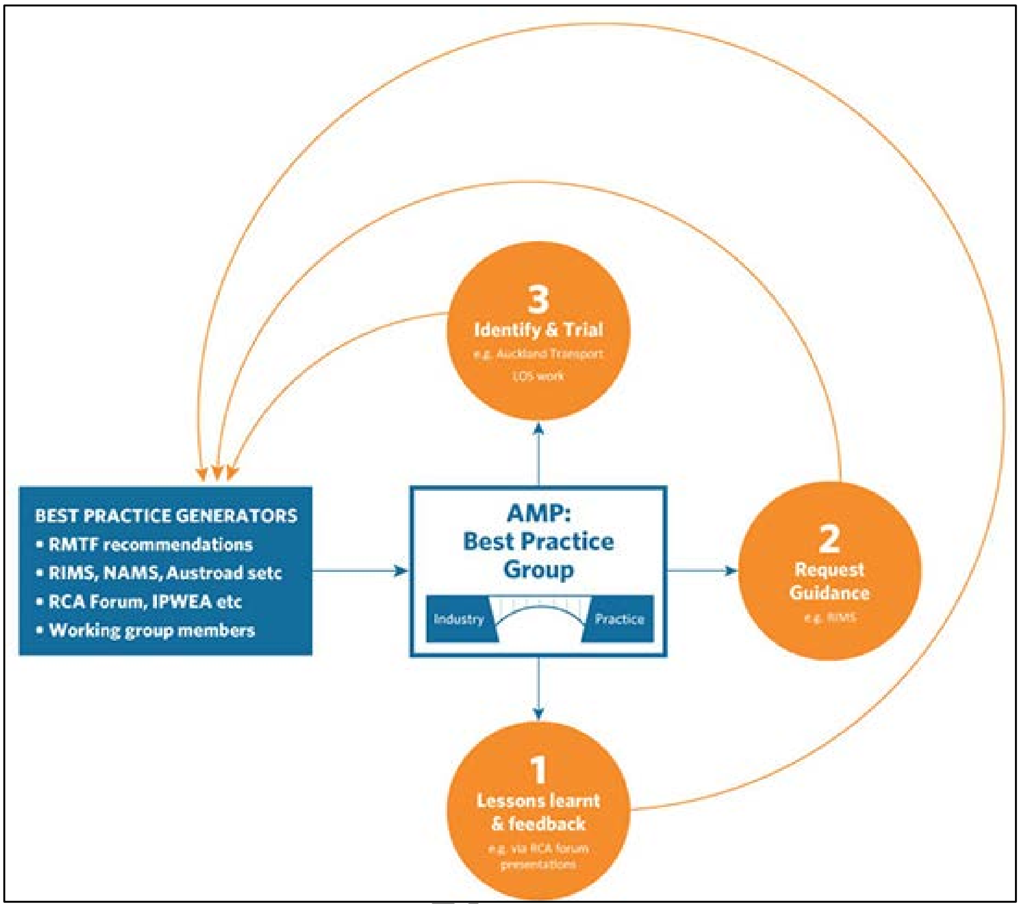
Despite the available guidance's and practices that exist in New Zealand, the implementation is inconsistent and there is a lack of knowledge sharing across the sector.

In order to harness and promote the existing body of good asset management practices, the Road Efficiency Group has established a dynamic representative working group, made up of representatives from eight road controlling authorities. Membership of the group will be cycled annually, with new members joining to replace outgoing members on an ongoing basis. The group are working collaboratively to identify and encourage best practice asset management planning among road controlling authorities.

[1] Road Efficiency Group - http://www.nzta.govt.nz/projects/road-efficiency-group/index.html

The aim of the Best Practice Asset Management Group is diagrammatically represented by the figure below:

Figure 3: AMP: Best Practice Group



Its goal is to ensure that existing asset management guidance and practices are identified, applied and refined for overall improved performance by:

- Identifying existing best practices that should be taken up by the industry
- Promoting of these best practices throughout the sector through sharing of case studies
- Identifying gaps in best practice guidance to existing industry bodies

Using existing guidance, organisations will develop examples of best practice asset management plans (AMP) and these will be delivered such that consistency of application can be applied across New Zealand. The AMPs will:

- Assist Asset Management Planners operating in urban, provincial and rural environments.
- Build on the best practice guidance currently provided by the industry.
- Be demonstrated through asset management approaches and plans of organisations participating in this working group.

Best Practice in asset management plans are to be identified and documented. These will show case studies and examples that road controlling authorities can use as models or templates, and that they can have confidence that the outcomes will be effective.

This forestry project clearly meets the 3rd key (REG) focus area of collaboration with the industry and between road controlling authorities.

2.2.1 Importance of Implementation of REG

Local authorities have been advised by NZ Transport Agency that funding is constrained and improved asset management practices are critical to assist management in these funding arena.

Evidence based programs are required to support funding requests for the 2015/28 Regional Land Transport Programme (RLTP). Programmes that form part of the National Land Transport Programme (NLTP) will need to demonstrate that they have been developed and optimised as part of a whole-of-transport system, one network approach.

Local authorities need to show that all desired steps to prioritise expenditure and achieve efficiency gains are being taken.

REG - KEY MESSAGE – Constrained Funding
This means that if there is an increased maintenance demand within networks, the first expectation is that programmes are critically analysed and reprioritised using engineering judgement and risk analysis techniques, so that current allocations will not be exceeded.

3 Study of forestry traffic in Northland

3.1 Overall Report Purpose

The purpose of this overview report is to be able to support the evidence based programmes for increased maintenance and renewals funding developed by each road controlling authority in Northland, as a result of continuing "higher than average" traffic loadings associated with the movement of forest product in Northland. Those programmes will then be used to support funding requests for the 2015/18 Regional Land Transport Program (RLTP). The funding requests are the result of the need for additional funding above current levels to account for the impact of forestry traffic on the roading networks.

Programmes that form part of the National Land Transport Program (NLTP) will need to demonstrate that they have been developed and optimised as part of the One Network approach. This will allow greater collaboration between each Road Controlling Authority (RCA) in Northland so that the accelerated network deterioration can be addressed in the most effective way and to leverage off each other.

The consistent study approach taken by 4 Road Controlling Authorities in Northland is in line with the aims of the Roading Efficiency Group

This overview report mirrors the common approach adopted by all Northland RCAs in order to calculate the estimated additional costs for Northland as a region.

The approach undertaken was divided into 3 separate phases:

Phase 1: Forestry Activity Data Gathering and Initial Analysis.

- Obtain forest resource, location and potential wood flow information. Ideally the period of prediction would cover approximately 35 years (an high-end average production cycle for Northland grown Pinus timber)
- Convert this information to forestry derived traffic loading on specific roads, over specific time periods.
- Identify roads that make up a 'Forestry Network' within the Northland roading network.
  - » Some roads will be removed from the forestry network, when the estimated HCV loading, including forestry traffic, falls below an established threshold level (e.g. Total HCV including forestry is < 5% of AADT.)
  - » Some roads are not expected to have constant loading as a result of forestry activity, while others will act as collector roads and have continual forestry traffic loading.

Phase 2: Forestry Impacts Modelling & Pavement Maintenance and Renewal Strategies for the forestry network.

- Assessment of current load carrying ability (at treatment length level) of the forestry network. This means establishing the strength of the current road structure.
- Model the need for, and timing of, maintenance and/or renewal activity across the forestry network. Modelling alternative range from the use of the national dTIMS model provided by the RIMS team, to more intuitive based matrix type models.
- Assess the maintenance and/or renewal activity level on the forestry network compared to maintenance and/or renewal activity on the non-forestry network.
- Assess the maintenance and/or renewal activity programme for a period of 20 to 30 years

Phase 3: Funding Impact Analysis and Options.

- Estimate the costing of suitable treatment options for the probable programme of works.
- Establish the additional funding required to meet the options, over the 'normal' funding levels required to maintain the non-forestry network.
- Establish a portfolio of alternative funding mechanisms for the forestry network. This could cover alternatives such as

  - 'Royalty' charging of forest operations to fund maintenance work
  - Passing maintenance of specific roads to forestry owners/managers/operators for the period of their logging operations
  - Establishing alternative levels of service for forestry roads, specifically for those roads identified as having only sporadic forestry loading

Overall Due to constraints on maintenance funding, the application of the 3 above phases has allowed the estimated shortfall (additional costs) for the 2015/18 period to be calculated by each RCA.

It is envisaged that the outcome of this study would be:

- To achieve overall best practice asset management;
- Improved understanding of impact of forestry derived traffic demand, the need for accelerated maintenance, and the increased cost impact;
- Production of 'Optimised' programs of maintenance and/or renewal activity for forestry routes;
- The ability to have flexibility within the optimised programs;
- Improved communications between RCAs and Forest Managers;
- Adoption of a strategic approach across Northland, to be embedded into the Activity Management Plan (AMP) of each RCA.

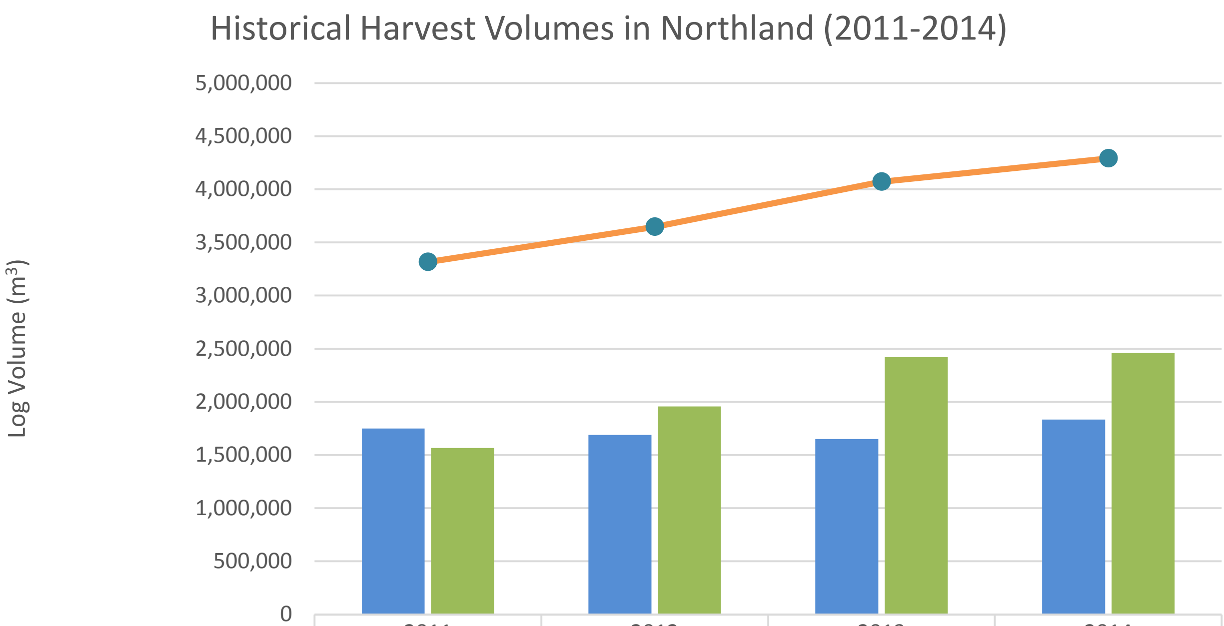
3.2 Forestry Industry Background

3.2.1 Historical Production Levels

Regionally, Northland has the second largest planted area in New Zealand, behind Central North Island region (NEFD 2013 report)

Forestry is a significant activity in Northland. The recent historical trend in processed and exported log volumes is shown in the figure below[1]:

Figure 4: Historical Harvest Volumes in Northland (2011-2014)



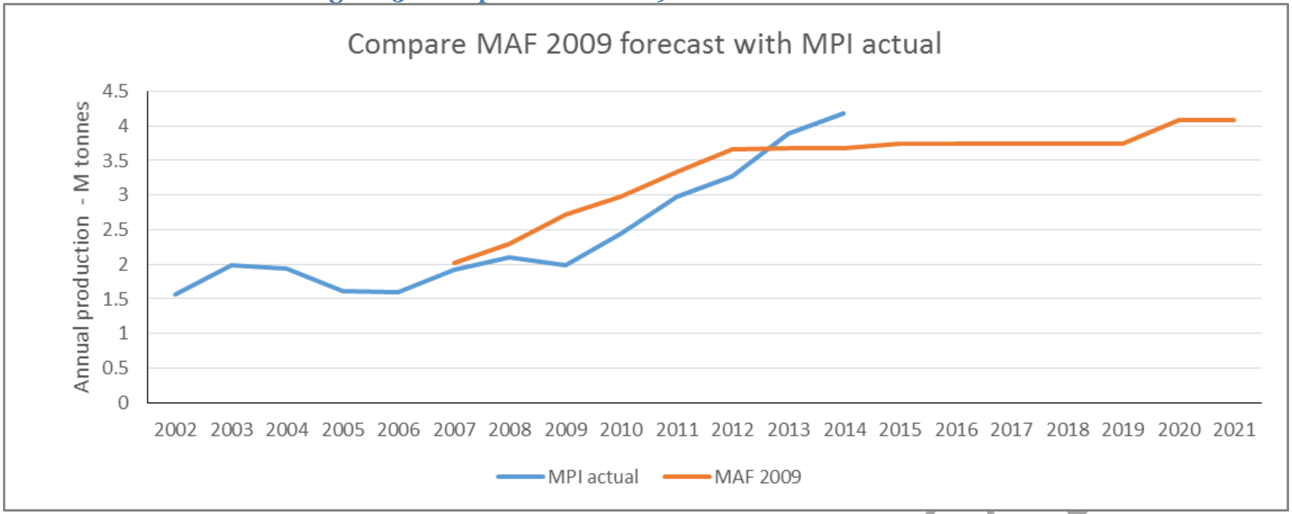
	2011	2012	2013	2014
Processed Log Volumes	1,750,000	1,690,000	1,650,000	1,832,435
Export Log Volumes	1,566,407	1,957,939	2,421,891	2,459,164
Overall Harvest Volume	3,316,407	3,647,939	4,071,891	4,291,599

In summary for 2013/14, approximately 4.3 million cubic metres of harvest volume was processed and/or exported through Northland mills and the port at Marsden Point. (Note - 1 cubic metre is approximately 1 tonne)

Several historical harvesting forecasts previously estimated that the Northland sustainable harvest volumes would be between 3.5 - 4.0 million cubic metres within the next ten years. In particular, a 2009 report by Ministry of Agriculture and Fisheries (MAF) provided the following output for Northland forestry (shown with recent actual production).

[1] Information on Forestry Export volumes supplied by Northport Limited.

Figure 5: Compare MAF 2009 Forecast with MPI Actual



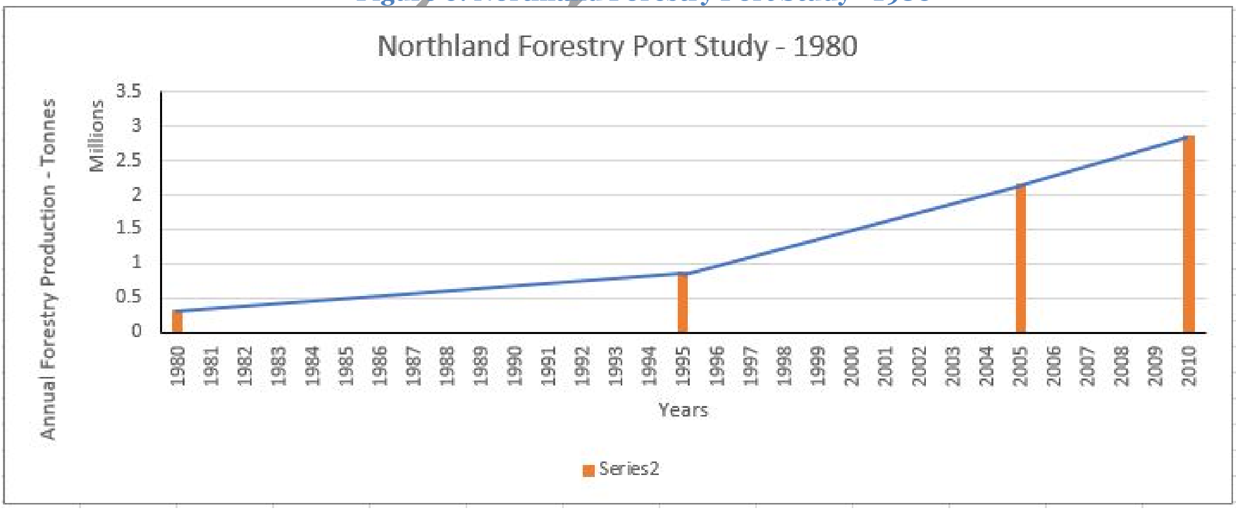
It is notable that the figures above demonstrate that the harvest volumes anticipated in the 2009 report for 2014 have been exceeded.

3.2.2 Historic predictions of wood availability in Northland

In February 1980, the Northland Forestry Port Steering Committee prepared a report looking at potential sites for a new deep water port servicing Northland. The main purpose of the new port was to provide services for the expected logging boom about to occur in Northland in 2000. At that time, logging production was in the order of 332000 t/year, and the report predicted the total productivity for Northland would be 2.174M t /yr in 2005, and rising to 2.878m t / yr by 2010.

In chart terms, this growth is as follows

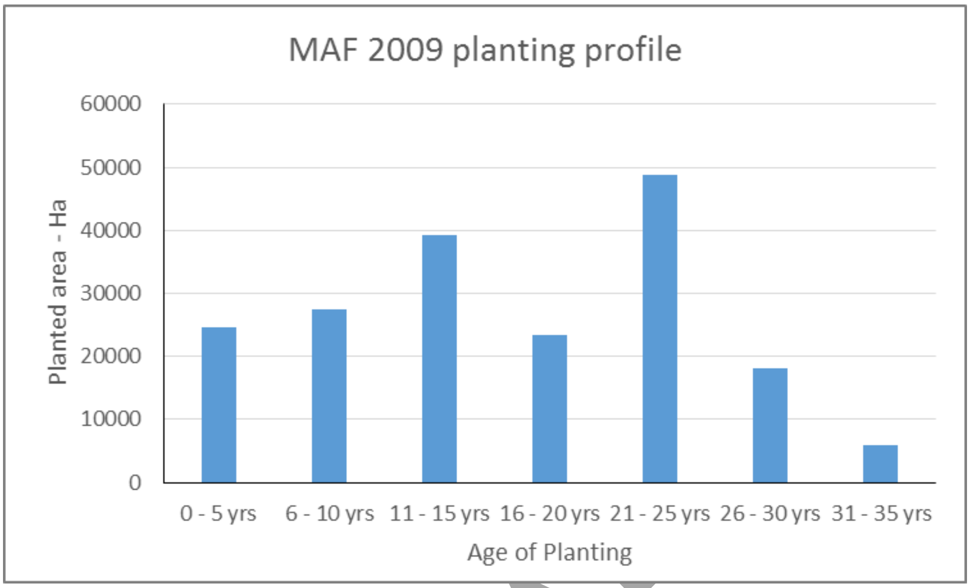
Figure 6: Northland Forestry Port Study - 1980



In 2009, MAF (Ministry of Forestry) (now part of MPI – Ministry of Primary Industries) published a report on Wood Availability in Northland.

The MAF 2009 profile of planted area by years planted (in 2008) is shown below.

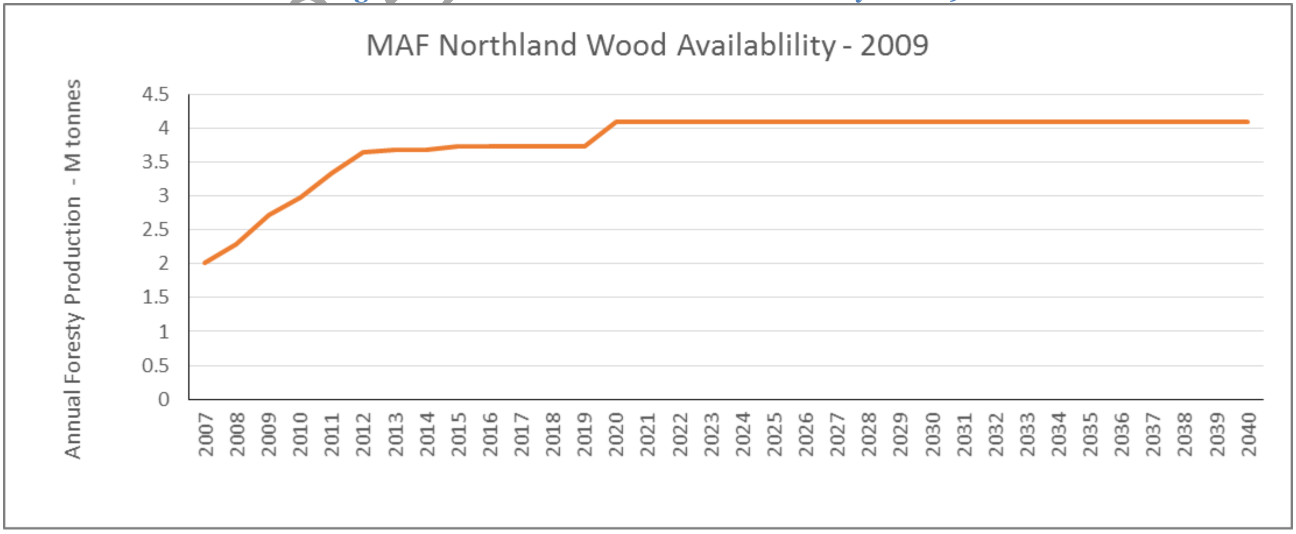
Figure 7: MAF 2009 Planting Profile



Trees in Northland appear to be of marketable maturity between 25 and 35 years. Without some form of management control, such a pure age-class distribution will translate into a similarly peaked wood availability profile.

MAF 2009 projections used 30 years as the target cutting age. The report developed 5 scenarios for 'cutting control', with the final one (Scenario 3 - non-declining yield (target rotation 30 yrs.)) resulting in the wood availability projection shown below.

Figure 8: MAF Northland Wood Availability – 2009



The report conclusion was: - “The forecasts indicate that the availability of radiata pine from the Northland forestry estate will increase steadily: from the current level of about 2.3 million cubic metres to around 3.6 million cubic metres per year by 2012. After that, wood availability remains fairly constant until about 2020, beyond which wood availability is expected to increase to around 4.7 million cubic metres per year after 2023.

Most of the potential increase in wood availability from 2008 to 2012 will come from the region’s large-scale growers, who established forests during the 1980s. However, from 2020 most of the increase will come from the region’s small scale growers who established forests in the 1990s. The actual timing of the harvest from these forests will depend on market conditions and on the decisions of a large number of small owners. Market conditions and logistical constraints (availability of logging crews, transport capacity, and wood processing capacity) will limit how quickly the additional available wood from the region’s forests can be harvested.”

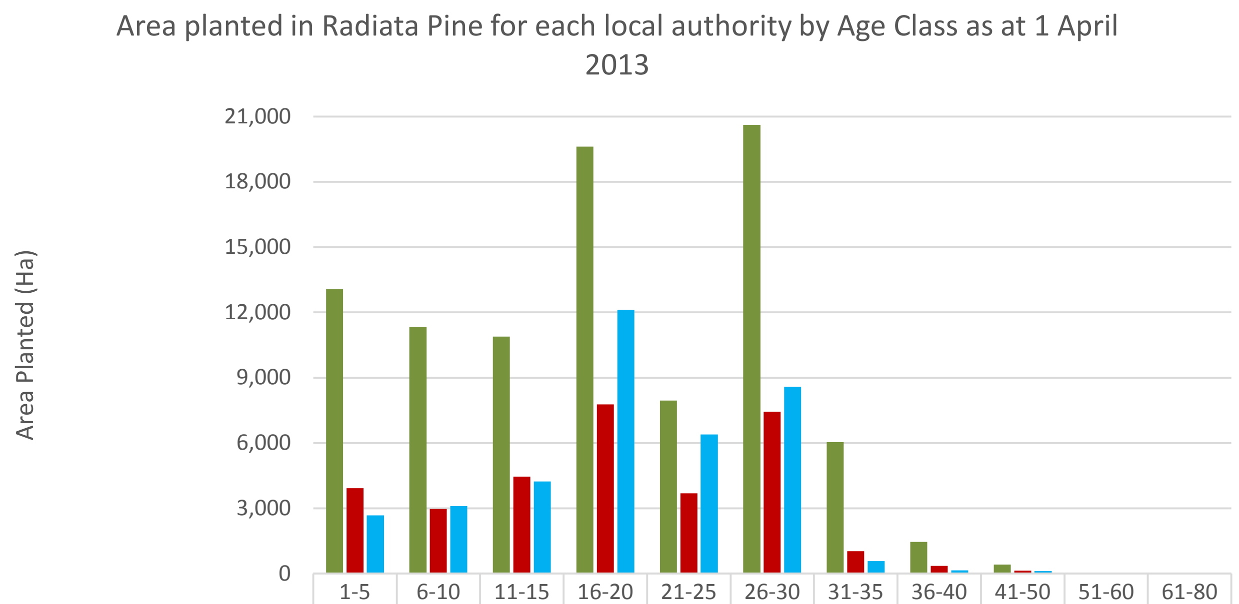
Note – the above MAF 2009 values include forests in Rodney district – all other yield values in this report do not include Rodney values. (1 cubic metre of wood is approximately 1 tonne)

3.2.3 NEFD 2013 Report and Other Publications

The Ministry for Primary Industries (MPI) (Previously this department was MAF) reports annually on the description of New Zealand’s planted production forests through the National Exotic Forest Description (NEFD). Forest owners and consultants who manage planted productions have been surveyed.

Figures 9 & 10 below (developed from the 2013 NEFD report) show the planted area figures for each local authority by age class, which initiates the potential wood availability into the future, at a TLA district level.

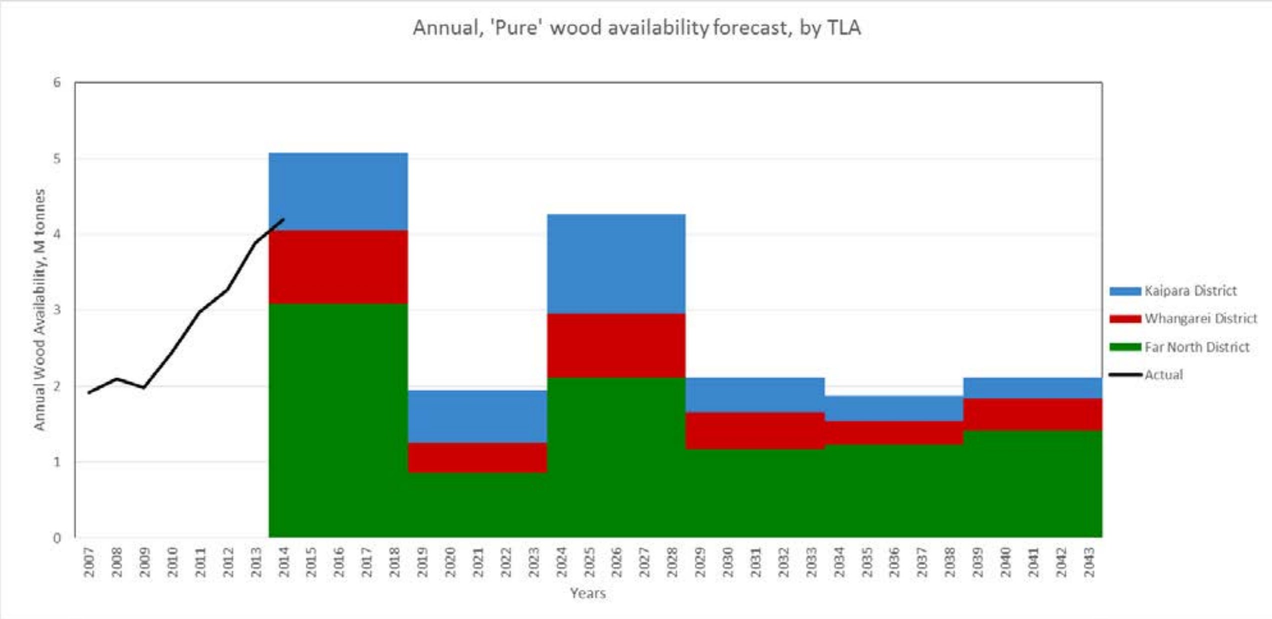
Figure 9: Planted area versus Age Class by TLA



	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-50	51-60	61-80
Far North District Council	13,057	11,329	10,896	19,609	7,944	20,613	6,036	1,455	407	14	39
Whangarei District Council	3,920	2,966	4,456	7,767	3,685	7,436	1,024	355	136	22	13
Kaipara District Council	2,678	3,105	4,227	12,123	6,397	8,577	578	148	113	8	24

Translation of this current (2013) age-class profile (based on the historical average cutting age for timber at 25 years), combined with the last 4 years of historical production gives a 'pure' timber availability profile shown below in figure 10.

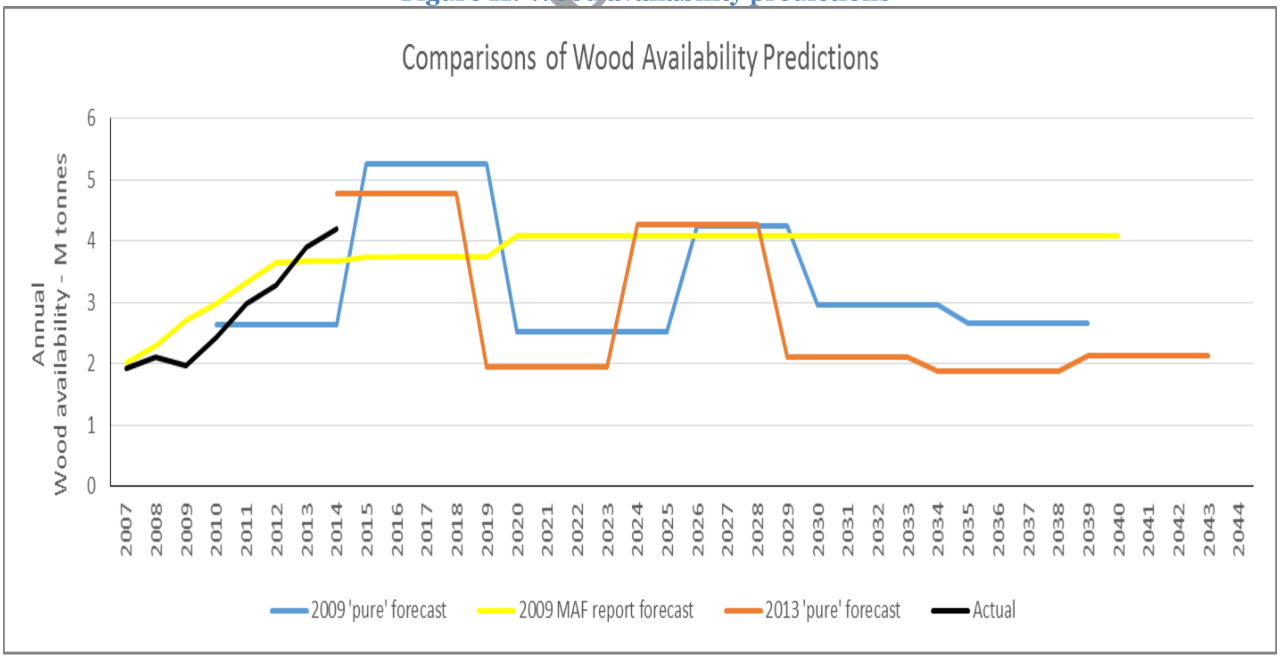
Figure 10: 'Pure' forecast of wood availability, by TLA, with historical actual production



3.2.4 Current forward projection of Wood Availability

Combining the 3 predictions of wood availability MAF 2009 pure, MAF 2009 scenario 3, NEFD 2013 derived pure prediction) with the historical values gives the following Figure 11.

Figure 11: Wood availability predictions



The chart shows

- The 2009 MAF scenario 3 projection 'smooths' the 'pure' 2009 projection to provide a sustainable 30 yr rotation wood availability level.
- Historical wood production 'follows' the 2009 MAF report prediction, albeit with a lag of about 1 year, and with (March) 2014 15% higher than the 2009 MAF report projection. Continued production at this higher level must compromise the achievement of the sustainable 2009 MAF report long term values.
- The 2013 'pure' projection aligns with the 2009 'pure 'projection, and is consistent given the historical production has been higher than the 2009 'pure projection. (Because the actual production has been higher than the 2009 'pure' projection, it follows that the 2013 'pure' projection is both lower than and finishes earlier than the 2009 'pure' projection).

These projections indicate that the production increase which occurred from 2009 to 2014 is unlikely to continue for long into the future if the industry is to maintain a sustainable profile. Any increase in the short term will mean there must be a drop in production levels into the future.

> For a sustainable forest industry to exist, timber production in Northland needs to remain at a level similar to 2014 levels

More sophisticated modelling (such as was undertaken by MAF in 2009) is needed to give a better estimate of the likely forward forecast of wood availability in Northland.

3.2.5 Missing Sources

Wood availability from the local authorities have been based on available woodlot databases, mainly the Land Use Carbon Assessment System (LUCAS) GIS database, and consultation with the forestry industry. The LUCAS data is split into 2 broad age classes, including forests planted before 1990 and those planted after 1989.

It is known that there are other databases recording more data relating to the age class of woodlot plantings that were not accessible during the reporting preparation. Should they become accessible in the future, more accurate assessments of the timing of woodlot production would be possible, leading to more accurate predictions of the need for roading renewals.

3.3 RCA reports for Funding need 2015-18

The comments in this section of this report are based on the RCA reports below;

- Whangarei District Council
  Forestry Road management Strategy Analysis: Draft stage 1 Modelling Report on Revised Network, 10 Dec 2013
  And updated comparison of costs email dated 19 May 2014
- Kaipara District Council
  Forestry roads – KDC Forestry routes Submission, July 2014
- Far North District Council
  FNDC Forestry Road Management Study, Iteration 1 – Phase 1, 2 and 3 Outline Report, 12 Sept 2014
- NZ Transport Agency
  State Highway Forestry Study – 2014, December 2014

3.3.1 Network Table

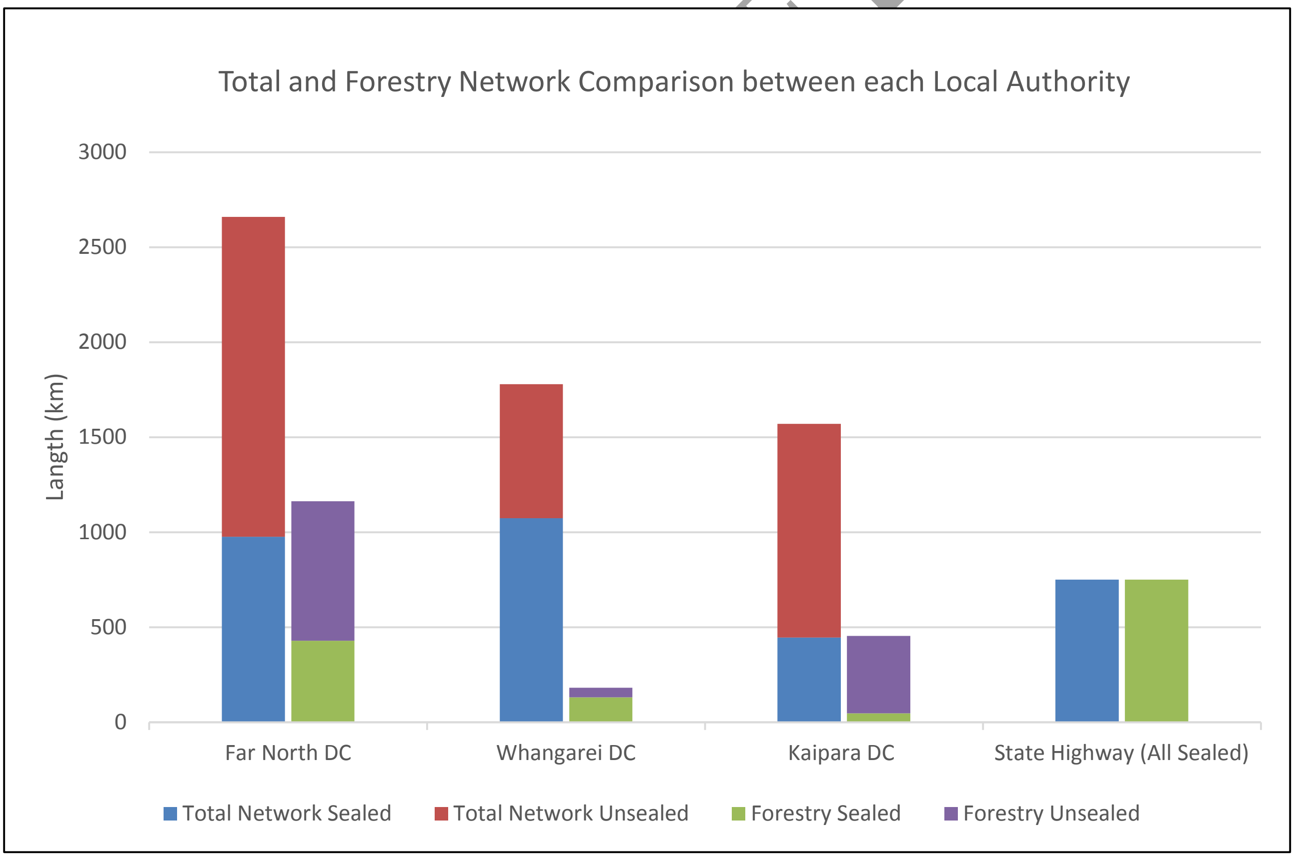
The road network for each RCA has been categorised into total road network and forestry network and further classified into sealed and unsealed roads.

The figures are summarised in the following table and diagrammatically represented in Table 6 below:

Table 7: Total and Forestry Network for each Local Authority and Northland State highway

	Road Type	Far North DC (Sep 2014)	Whangarei DC (Dec 2013)	Kaipara DC (Jul 2014)	State Highway (Dec 2014)
Total Network	Sealed (km)	976	1073.8	446	751 (All Sealed)
	Unsealed (km)	1683	705.1	1124	
	Total Network Length (km)	**2659**	**1778.9**	**1570**	751 (All Sealed)
Forestry Network	Sealed (km)	429	131.4	47	As above
	Unsealed (km)	734	50.3	408	
	Total Forestry Length (km)	**1163**	**181.7**	**455**	As Above

Figure 12: Total and Forestry Network Comparison between each Local Authority



Approximately 43% of Far North District Council's road network is part of the forestry network. This appears to be out of proportion as FNDC have not used a HCV percentage threshold to limit the extent of their forestry network.

The forestry network for the local authorities can involve up to 43% of their total network. Much of the forestry network is on unsealed roads.

Whangarei District Council has approximately 10% of their network as their forestry and have based their forestry routes on roads which have a HCV threshold of greater than 5%.

Kaipara District Council has approximately 30% of their road network as part of their forestry network, and have not used a HCV the percentage threshold to limit the extent of their network.

The whole of the Northland State Highway network carries forestry traffic.

The State Highway network is all sealed, and all of it is subject to forestry loading.

3.4 Study Methodologies

Each of the Northland local authorities adopted similar methodologies, with slight technical differences, in order to determine the shortfall (additional funding) resulting from the increase in forestry traffic in the near future relative to current levels of forestry loading. However they all follow the common approach divided into the 3 separate phases outlined in Section 2.1.

Methodologies from each of the road controlling authorities is summarised in the tables below:

Table 8: Summary Table of the Methodology Adopted by each Road Controlling Authority

Road Controlling Authority	Whangarei DC (Dec 2013)	Kaipara DC (Jul 2014)	Far North DC (Sep 2014)	NZ Transport Agency (Dec 2014)
Area/Volume Assessment	*Direct consultation and data collection from forestry sector.* *Includes GIS spatial analysis*	*Land use from Council's rating database. Some liaison with major forestry managers. Drive over of network to assess 'age-class' of visible forests*	*Forestry estimates derived from industry advice and spatial data analysis.*	*Tonnages on to State Highway used Tonnages from Local Authority reports.*
Assessing Road Strength	*Sealed roads:- (3 x 3) NZ dTIMS Model input data* *Unsealed roads:-* *Road Strength assessed by Falling Weight Deflectometer (FWD) to determine the Curvature. Depending on Curvature value, pavements were classed as:* ***Strong Moderate or Weak.***	*Falling Weight Deflectometer (FWD) tests on current roads identified as Forestry Routes to determine current strength.* *Results are combined with onsite test pits and scala penetrometer testing of subgrades to give an overall strength rating. Ratings are:* ***Strong, Moderate or Weak***	*Road Strength is assessed by drive over inspection, local knowledge and maintenance cost history.*	*NZTA dTIMS Model input data*

Road Controlling Authority	Whangarei DC (Dec 2013)	Kaipara DC (Jul 2014)	Far North DC (Sep 2014)	NZ Transport Agency (Dec 2014)
Modelling Used	*Sealed roads: - (3 x 3) NZ dTIMs Model.* *Unsealed roads: - Loading vs Strength (3 x 3) matrix determined need for, and type of, repair. Timing of repair determined from cutting assessment*	*No particular modelling used.* *Evaluation is completed using method developed and used for Far North DC.*	*No particular modelling used.* *5 grade matrix used which give a weighted overall score between 1 and 5. This will determine the intervention required.*	*NZTA dTIMS Model, modified to attribute south-bound nature of loaded logging traffic, with standard HCV growth*

Both Kaipara District and Far North District Council adopted a probabilistic approach where the cost rates and overall additional costs were dependant on the rating scores from the road evaluation and the probability of occurrence.

Whangarei District Council and the state highway adopted a more analytical approach through modelling using dTIMS and with the associated unit cost rates from the above tables, more accurate treatment costs can be determined.

> A consistent methodology approach was adopted by the Local Authorities, but differences in available network information has resulted in differences in the technical methods used

3.5 Treatment Cost Rates

The RCA's have reported treatment cost rates that have been used to develop their shortfall in costing, but they have not all used the same method. Where possible, these have been converted into average cost rates, either on a per km rate or on a per km per year rate. These results are reported in the following table

Table 9: Annual average cost rates for maintenance and renewals, by RCA

			Forestry Network	Non-forestry Network	RDF project
FAR NORTH DISTRICT COUNCIL (Sep 2014)	*Sealed Network*	*Routine maintenance*	*$4650/km/yr*	*$1750/km/yr*	*$339600/km*
		Resurfacing	*$50000/km*	*$50000'km*	
		Rehabilitation	*$377000/km*	*$377000/km*	
	Unsealed Network	*Routine maintenance*	*$5225/km/yr*	*$2875/km/yr*	
		Metalling/intervention	*$82500/km*	*$82500/km*	
WHANGAREI DISTRICT COUNCIL (Dec 2013)	*Sealed Network*	*Routine maintenance*	*$5100/km/yr*	*$2900/km/yr*	*$396000/km*
		Resurfacing	*$42800/km*	*$48000/km*	
		Rehabilitation	*$411800/km*	*$550000/km*	
	Unsealed Network	*Routine maintenance ave*	*$8250/km/yr*	*$1700/km/yr*	
		Metalling	*$100000/km/yr, when treated*	*$30000/km/yr, when treated*	

			Forestry Network	Non-forestry Network	RDF project
KAIPARA DISTRICT COUNCIL (Jul 2014)	*Sealed Network*	*Routine maintenance*	*Not available*	*Not available*	*$254000/km*
		Resurfacing	*$225000/km, not separable*	*$225000/km, not separable*	
		Rehabilitation			
	Unsealed Network	*Routine maintenance*	*Not available*	*Not available*	
		Metalling	*$325000/km*	*$325000/km*	
NEW ZEALAND TRANSPORT AGENCY (Dec 2014)	*Sealed network*	*Routine maintenance*	*Not calculated*	*Not relevant*	*Not relevant*
		Resurfacing		Not relevant	
		Rehabilitation		Not relevant	

Further summarised cost rate information is recorded in Appendix 3.5.

3.6 Historical Treatments cost rates per year

The average maintenance expenditure rates for each local authority and state highway over the past 3 years are in the graphs below:

Figure 13: Northland State Highway Treatment Costs

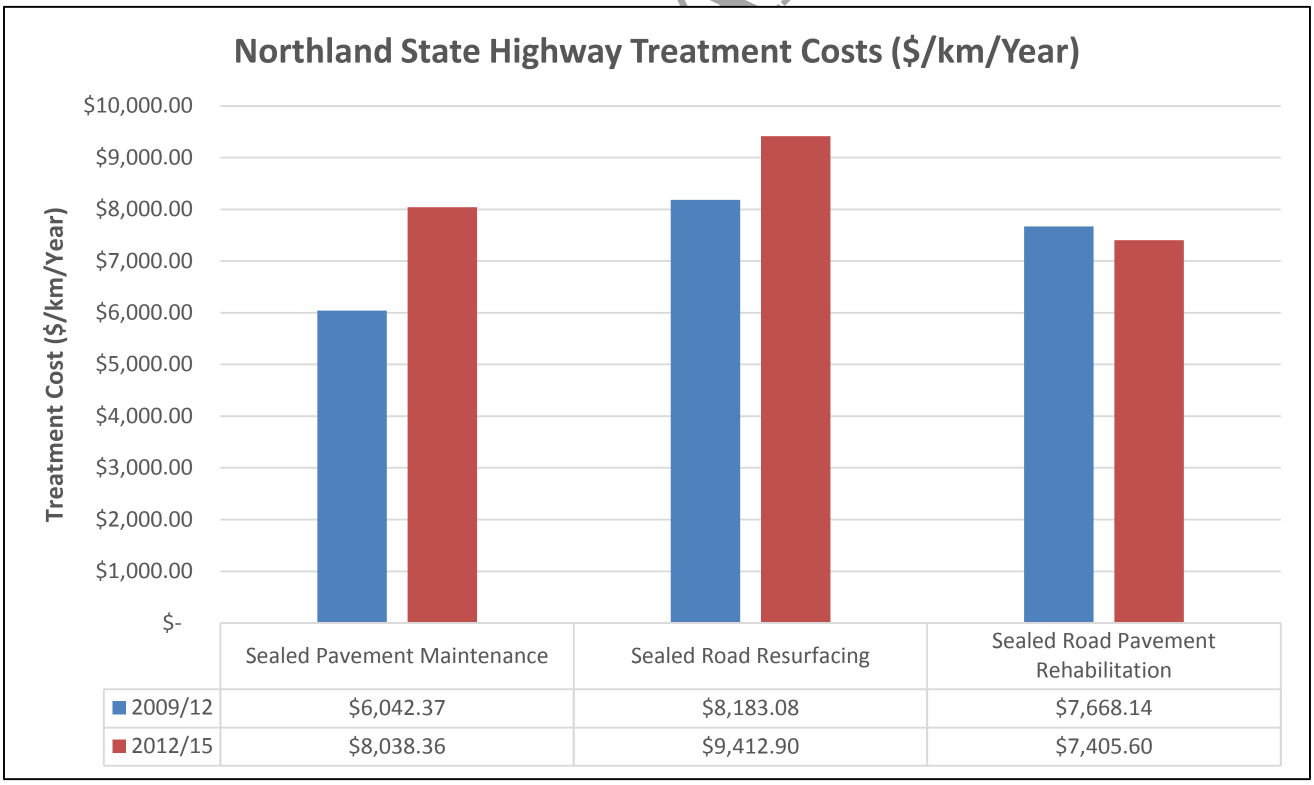
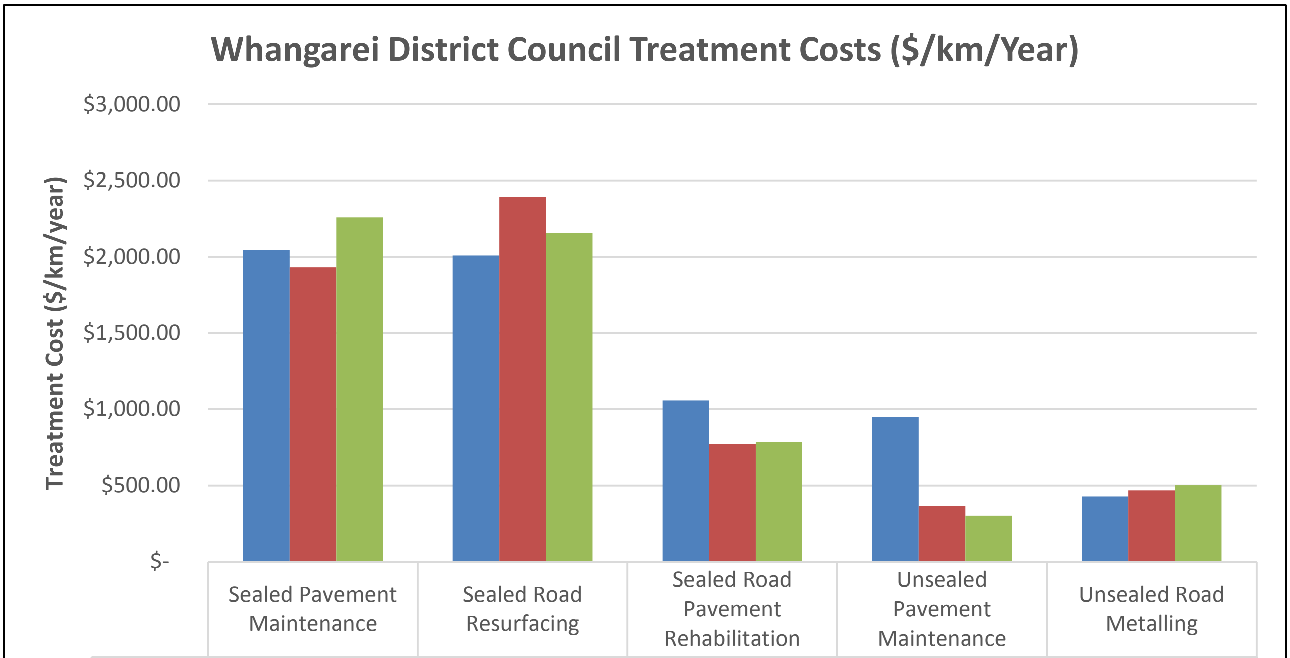
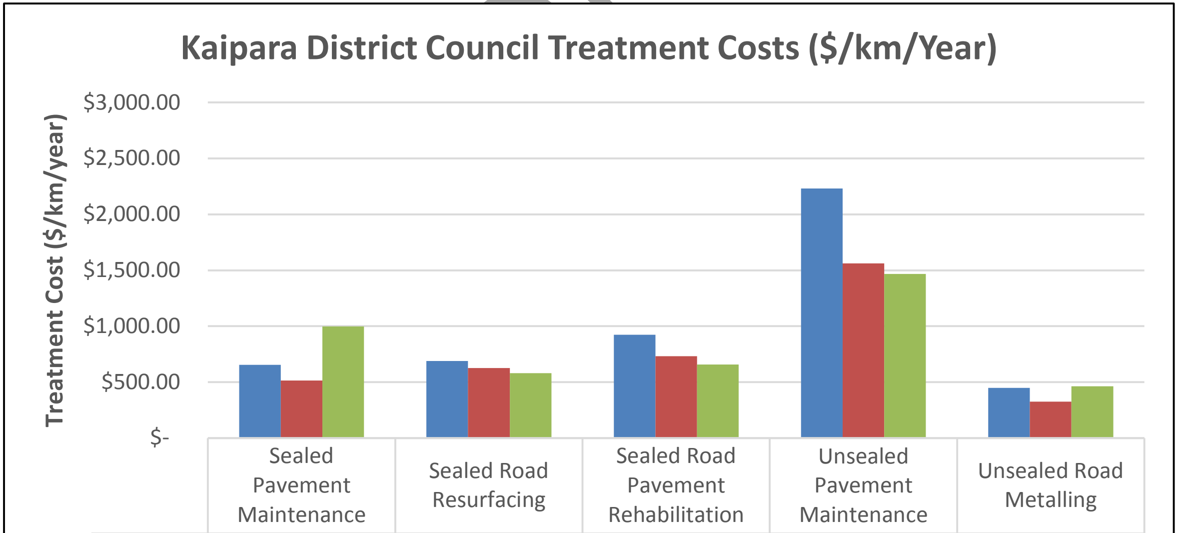


Figure 14: Whangarei District Council Treatment Costs



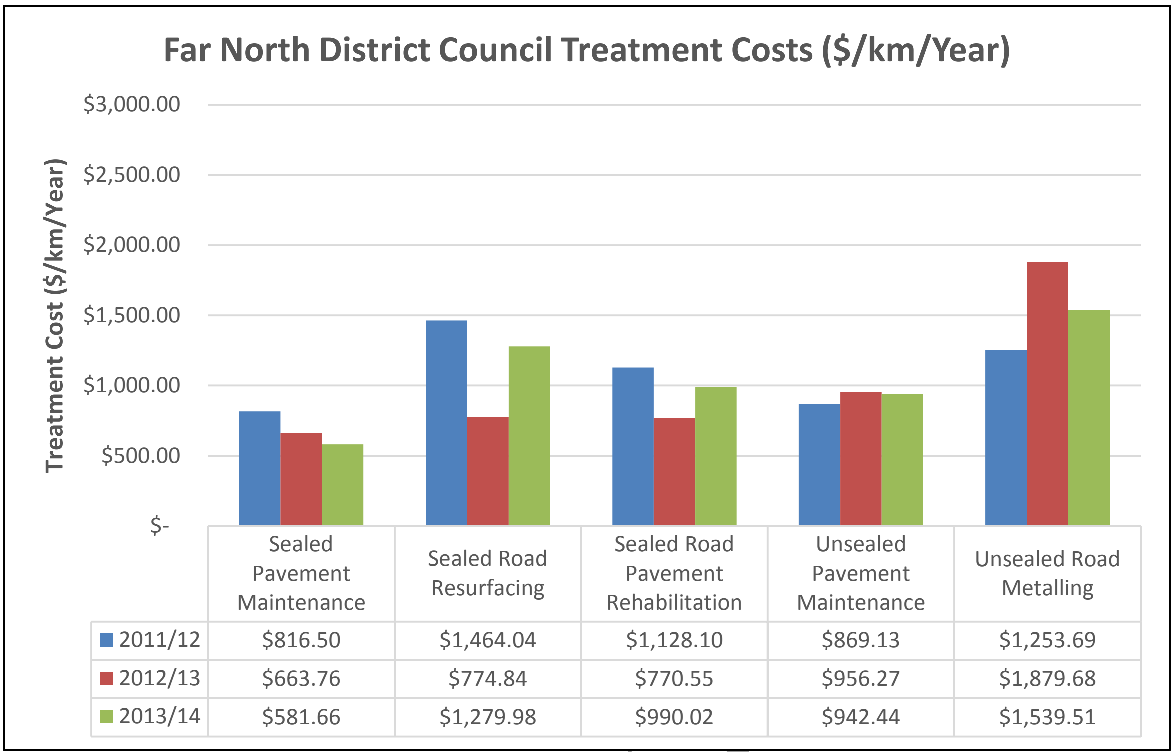
	Sealed Pavement Maintenance	Sealed Road Resurfacing	Sealed Road Pavement Rehabilitation	Unsealed Pavement Maintenance	Unsealed Road Metalling
2011/12	$2,043.97	$2,009.02	$1,058.20	$948.96	$427.93
2012/13	$1,930.02	$2,389.99	$772.57	$363.84	$466.91
2013/14	$2,257.92	$2,154.63	$784.87	$301.44	$500.87

Figure 15: Kaipara District Council Treatment Costs



	Sealed Pavement Maintenance	Sealed Road Resurfacing	Sealed Road Pavement Rehabilitation	Unsealed Pavement Maintenance	Unsealed Road Metalling
2011/12	$653.78	$687.55	$924.36	$2,230.08	$449.55
2012/13	$514.21	$624.57	$732.16	$1,561.68	$324.15
2013/14	$998.04	$580.09	$656.37	$1,468.22	$463.06

Figure 16: Far North District Council Treatment Costs



	Sealed Pavement Maintenance	Sealed Road Resurfacing	Sealed Road Pavement Rehabilitation	Unsealed Pavement Maintenance	Unsealed Road Metalling
2011/12	$816.50	$1,464.04	$1,128.10	$869.13	$1,253.69
2012/13	$663.76	$774.84	$770.55	$956.27	$1,879.68
2013/14	$581.66	$1,279.98	$990.02	$942.44	$1,539.51

By comparing all three local authorities and NZ Transport Agency's state highway network, it is noticeable that there are considerable differences in the maintenance and renewal costs recorded across the authorities.

3.7 Average treatment lengths, 2015/16 to 2017/18

The amount of renewal work needed across the forestry network for the 3 year 15/16 to 17/18 funding period has been reported in slightly different ways by each of the four roading authorities. The results of that reporting are summarised in the following table.

Table 10:Average annual renewal treatment activity, by RCA

Average Annual Renewal lengths on forestry network	'Pre-Forestry'		Forestry		Comments
Local Authority	Resurface	Rehab	Resurface	Rehab	
Whangarei District Council – May 2014	*11.4 km*	*0.1 km*	*15.4km*	*1.7 km*	*Average from 20 yr analysis period*
Kaipara District Council - Jul 2014	*Not reported*		*Not reported*	*.33km sealed 14.7km unsealed*	*Based on 6 years plan*
Far North District Council – September 2014	*Not Reported*		*Not Reported*		*.*
	Probability based prediction does not provide annual quantities				
NZ Transport Agency (Dec 2014)	*50km*	*22 km*	*59km*	*30km*	*Averaged from first 3 years from 20 yr analysis period*

3.8 Funding Request Statements

From the adopted methodologies by each Local Authority in Section 2.3, the shortfall amounts (additional funding) have been determined by the Authorities, and are summarised in the table below:

Table 11: Shortfall (additional funding) from each Road Controlling Authority

Local Authority	Shortfall ($) per year in 2015/18	Average % Increase on Current Funding
Whangarei District Council – May 2014	*$1,272,593*	*11.66%*
Kaipara District Council - Jul 2014	*$1,082,490*	*16.03%*
Far North District Council – September 2014	*$3,300,000*	*23.64%*
NZ Transport Agency (Dec 2014)	*$2,280,000*	*4.33%*

3.9 GIS

GIS maps have been plotted for 2 of the Northland Local Authority and for the State highway network.

These are included in Appendix 8.

3.10 Overall confidence in derived results

Overall assessment of the level of confidence in the results prepared by the 4 road controlling authorities is shown in the following table.

Table 12; Confidence assessment for RCA reported outcomes

	Description for scores					Local authority							NZTA		
						Assigned Score				Weighted Score			Assigned		Weighted
	1	2	3	4	5	FNDC	KDC	WDC	Weight	FNDC	KDC	WDC	Score	Weight	score
Demand (Logging)	Guess	Some consultation with no GIS, No timing considered	Moderate consultation with some GIS, some timing considered	High quality consultation with moderate graphics, some annualisation	High level demand analysis - With consultation and GIS, fully annualised	3	2	5	10.0%	0.3	0.2	0.5		NA	
Routes - with thresholds	No threshold, No GIS	Guess No threshold	GIS consistant with little justification to threshold	GIS plots + Some justification to threshold	Full GIS, Fully justified with threshold in analysis	3	2	5	10.0%	0.3	0.2	0.5	5	14.3%	0.71
Pavement Strength	Guess	Drive over inspection but no actual testing of strength and no local knowledge	Drive over Inspections, some testing of strength, some local knowledge	Drive over inspections, significant testing of strength with full local knowledge	dTIMS or Highly Detailed pavement strength assessment with drive over inspections, high level of strength testing and extensive local knowledge	3	4	5	10.0%	0.3	0.4	0.5	5	14.3%	0.71
Need for Intervention (Sealed)	Guess	Prioritisation matrix	Stochastic Model	Partial dTIMS / Calibrated dTIMS	Project Based Model	2	2	4.7	10.0%	0.2	0.2	0.47	4.7	14.3%	0.67
Need for Intervention (Unsealed)	Guess	Maintenance History	Some maintenance control	Grading + Metalling quantities	Project Based Model	1	1	2	10.0%	0.1	0.1	0.2		NA	
Programme of Intervention	No programme	Low quality programme developed (probability)	Moderately developed programme (with missing data)	Highly detailed programme - Model based	Fully detailed programme of intervention	2	2	5	10.0%	0.2	0.2	0.5	5	14.3%	0.71
Unit Costs Derivation	Guess	Historical average	RDF averages	dTIMS rates	Bottom up - by site review	3	2	4	10.0%	0.3	0.2	0.4	4	14.3%	0.57
Programme Cost	Guess	Little development of programme cost	Moderate development of programme cost	Detailed development of programme cost	Fully developed programme of cost	2	2	5	10.0%	0.2	0.2	0.5	5	14.3%	0.71
Term of analysis	Current only	Short term analysis (3 Years)	10 year term analysed	20 yr term analysed	30 yr term analysed	2	2	4	10.0%	0.2	0.2	0.4	5	14.3%	0.71
Alternative Funding	No Alternatives	Attempt at funding alternatives	Some alternatives	Developed alternatives with some consultation	Fully developed alternatives with full consultation	1	1	2	10.0%	0.1	0.1	0.2		NA	
									100.0%					100.0%	
									Confidence:	2.2	2.0	4.2	NZTA Confidence:		4.8

The maximum possible score achievable from the assessment method is 5.

Both NZTA and WDC scored above 4 out of 5, although the demand on the SH network from forestry transport (number of trucks accessing the SH) is based on outputs from the 3 TLAs, and is not assigned a score. FNDC and KDC each achieved a score close to 2 out of 5.

> The WDC report and the NZTA SH reports scored higher for confidence in their results than the FNDC or the KDC reports

WDC have spent more than 2 years developing their models and reporting, while both FNDC and KDC have achieved their result over approximately 8 months.

3.11 Conclusions

3.11.1 Summary by Road Controlling Authority Reports

- **Whangarei District Council** (Dec 2013 and May 2014)
  - » First TLA to report, with the demand analysis incorporating GIS with a high level of consultation with logging companies.
  - » The forestry network was constrained to only include roads with greater than 5% Heavy Commercial Vehicles (HCV) as the threshold for the analysis.
  - » For sealed roads, dTIMS modelling was adapted to identify the forestry network within the model. There is a good comparison with equivalent forestry/non-forestry levels.
  - » Unsealed roads have been based on a drive over of the network. A 3x3 matrix of strength versus truck loading was developed to identify the needs of the pavement repairs only.
  - » A detailed annualised programme of forward work (by road name) has been prepared
  - » Unit costs for renewal work appear to be of a similar order to that achieved under the previous RDF funding
  - » Prediction for increased funding need appears to be reasonable at $1,272,593 per year.
  - » No alternative funding strategies have been reported.

- **Kaipara District Council** (July 2014)
  - » Forestry demand analysis was based on mail survey contact with the owners on the property rates list, for lots which have a land use containing "forestry". Demand analysis incorporated consultation with forest managers regarding harvest programmes and cycles, as well as a drive over survey to assess maturity of forest blocks.
  - » The analysis did not use thresholds of HCV volume to limit the forestry network to exclude roads with a low proportion of total HCV.
  - » For both sealed and unsealed roads, modelling was based on the development of a matrix of loading demand factors and pavement strength assessments. The factors depended on harvest predictions, maps, local knowledge, RAMM databases and drive over inspections.
  - » A detailed programme of forward work (by road name) has not been prepared – rather a probability based assessment of a road failing, leading to a proportional cost over the 3 year funding period, has been adopted.
  - » Unit costs for renewal work have been based on historical cost rates
  - » Predicted increased funding need at $1,082,490 per year during 2015/18 is considered to be high and should be revised.
  - » No alternative funding strategies have been reported

- **Far North District Council** (Sept 2014)
  - » Analysis of forestry loading demand was derived from available spatial data (LUCAS), aerial photography, and industry advice. Demand on roads was developed from estimated cutting time, and the most direct route to the state highway.
  - » For both sealed and unsealed roads, modelling was based on the development of a matrix of loading demand factors and pavement strength assessments. The factors depended on harvest predictions, maps, local knowledge, RAMM databases and drive over inspections.
  - » The analysis did not use thresholds of HCV volume to limit the forestry network to exclude roads with a low proportion of total HCV.
  - » A detailed programme of forward work (by road name) has not been prepared – rather a probability based assessment of a road failing, leading to a proportional cost over the 3 year funding period, has been adopted.
  - » Unit costs for renewal work have been based on historical rates and include alignment improvements which are considered to be outside the remit of this study
  - » Prediction for the increased funding need at $10,000,000 across 3 years (3.3 million annually) during 2015/18 is considered to be high and should be revised.
  - » No alternative funding strategies have been reported.

- **New Zealand Transport Agency** (Nov 2014)
  - » Analysis of forestry loading demand incorporated the predicted trucks entering the state highways from each of the TLA reports, supplemented by the addition of trucks from woodlots that border the state highway (for the 2015/18 period). Travel direction was generally assessed as heading towards Northport, with allowance for vehicles exiting to local processing plants.
  - » Forestry traffic growth was assessed and not growing more than normal HCV, based on some analysis of age class of total Northland plantings.
  - » No HCV thresholds were applied to the state highway network.
  - » The normal dTIMs model was adapted to account for the uni-directional nature of travel for loaded forestry trucks
  - » As an outcome from dTIMS, a detailed forward works programme has been produced
  - » Unit costs are the normal contract-based costs from the dTIMs model
  - » Prediction for the increased funding need at $2,280,000 per year during 2015/18 is considered to be appropriate.
  - » No alternative funding strategies have been reported.

3.12 Next Steps

Potential next steps for the improving this forestry study in the future have been identified and are listed below;

- Updating the network thresholds, work programme, and unit costs is needed for the KDC and FNDC reports.
- Additional work should be completed for the next block (2018-21) of funding for both KDC and FNDC reports.
- Development of alternative funding options by each Local Authority.
- Further development of each Local Authority models with more industry consultation for expected demand and refinement on demand/strength matrix models
- Increased frequency in reviews – Annual or Bi-annual review of actual cutting/harvesting and compare with predictions made in 2014.
- A larger coverage for state highway commodity surveys should be done. There were only two sites in which commodity surveys were conducted for this study.
- Gravity Model and Directional Modelling for the State Highway.
- Development of GIS Model for the overall Northland road network.
- Cashflow planning for each year which will enable budget forecasts. This will allow discussions with stakeholders earlier and have good programmes for the construction season.

Appendix 1 – Whangarei District Council - Executive Summary

WHANGAREI
DISTRICT COUNCIL

Report

Forestry Road Management Strategy Analysis: Draft Stage 1 Modelling Report on Revised Network

Prepared for Whangarei District Council (Client)

By Beca Ltd (Beca)

10 December 2013

1 Executive Summary

1.1 Background

In 2012 Whangarei District Council (WDC) initiated a project to investigate and potentially develop a Forestry Roads Management Strategy (FRMS). The first stage of forestry activity data gathering has been completed by WDC.

Key findings were:

- Several recent harvesting forecasts have estimated that Northland harvest volumes could increase to between 3.5 and 4 million cubic metres per year within the next ten years. In 2011 it is estimated that approximately 2.6 million cubic metres of harvest volume was processed and/or exported through mills and the port facilities located in the Whangarei District.
- For 2012/13, approximately 1.5 million cubic metres of logs will travel through Whangarei District using roads maintained by WDC. 41% of logging trucks using WDC roads will come from forests located in either Kaipara or Far North Districts.
- 1.28 million cubic meters (84%) of logs will travel on trucks using Otaika Valley Road and Loop Road. This averages to 195 truckloads per day, or 1 truck every 3 minutes. 49% of trucks using Otaika Valley Road will originate from forests located in either Kaipara or Far North Districts.
- Over 820,000 cubic meters of logs will travel on trucks using Mangakahia Road. This averages to 125 truckloads per day, or 1 truck every 5 minutes.
- Over the past 6 years the proportion of heavy vehicles has increased significantly on Mangakahia Road from 5% to 20% of road users. The current forecasts indicate this increasing heavy traffic volume will continue in coming years.

Phase 1 of the strategy has involved direct consultation and data collection from the forestry sector. Phase 1 of the strategy has been issued to all stakeholders for their feedback.

The second stage is to take the data collected and calculate associated impact and subsequent maintenance, renewal and improvement costs to the 30 year Roading FWP. WDC has provided details as to the specific conditions of the routes to be taken, the predicted volume of logging trucks that will utilise the routes and how long they will be using the route. This report, undertaken by Beca, covers this stage of the FRMS. The scope covers as follows:

- Beca develops draft models and scenarios that will allow development of maintenance, renewals and improvement strategies assessing the cost impact of the forestry logging activities.
- Confirm the methodology, models and scenarios with WDC
- Prepare and confirm with WDC the 5% HCV baseline model.
- Complete the remaining modelling and analysis
- Reviewing findings with WDC
- Prepare and submit Stage 1 Modelling Report (this report).

1.2 Analysis Methodology for Sealed Roads

The forestry case scenarios are based on the traffic figures supplied by Council unless any other information comes to light that should be included. The initial non-forestry case is based on a 5% HCV content for each road section.

The analysis methodology is as follows

- Sectioning the road sections based on existing treatment lengths.
- Identifying road sections previously treated under the roading improvements undertaken in the last 10 years to deal with the forestry traffic. The model was calibrated such that the performance of these sections was reflected in the model outputs.
- Identifying which treatment lengths are likely to require rehabilitation works over the 30 year period. This will to some extent be a risk based analysis. This will be based on criteria including:
  - Existing and future traffic flows i.e. has the road section handled forestry traffic in the past, is it likely to significantly increase in the future, is the forestry traffic loading a significant proportion or only a small proportion of current and/or future loadings
  - Past and future pavement and surfacing performance and condition i.e. are surfacing lives shorter than would be expected indicating pavement stress, is condition indicators decreasing or remaining stable, are maintenance costs increasing or remaining stable
  - Pavement strength information such as test pit or FWD surveys available to give information on material depths and properties. A key outcome maybe identifying those road sections at risk that may require further testing to better understand future behaviour. Curvature was found to form a particularly strong relationship with pavement performance
- Identifying the remaining road sections to confirm the impact will be relatively low level and that any investigation on these road sections will be of a lower necessity. Again information will be still need to be gathered on traffic flows, pavement and surfacing performance and pavement layer and characteristics where available, as described above.
- Driveover survey of the majority of the forestry road network including all sections with a significant forestry loading compared to existing traffic volumes.

A basic maintenance costs model was created. The roads were categorised into 9 categories, formed from a matrix of three traffic loading categories based on ESAs and three pavement strength categories determined from the FWD curvature data.

The modelling analysis is done in a simple dTIMS model with renewal timings relatively well prescribed dependent on traffic flows and pavement characteristics, predominantly curvature.

1.3 Analysis Findings for the Sealed Road Forestry Network

1.3.1 Forestry Traffic Loading Scenario

Table 1.1 details the average quantities by kilometre for the 20 year analysis period.

Table 1.1 - Average Annual Quantities by Length (km)

Activity	Average Annual Demand (km)	Percentage of Forestry Network (131.4 km)
Second Coat	2.1 km	1.6%
Chipseal Reseal	13.2 km	10.0%
Asphaltic Surfacing	0.1 km	0.0%
Resurfacing Total	**15.4 km**	**11.6%**
Rehabilitation	**1.7 km**	**1.3%**

Table 1.2 details average expenditure across the 20 year analysis period for each activity.

Table 1.2- Average Annual Expenditure by Activity)

Activity	Average Annual Expenditure ($)
Second Coat	$60,000
Chipseal Reseal	$570,000
Asphaltic Surfacing	$30,000
Resurfacing Total	**$660,000**
Rehabilitation	**$700,000**
Routine Mtce	**$670,000**
Total	**$2,030,000**

1.4 Model Scenario B: Non-Forestry Traffic with the Maintenance Cost Model

Model Scenario B resulted in an initial 20 year FWP as detailed below in Table 1.3.

Table 1.3 - Average Annual Quantities by Length (km)

Activity	Average Annual Demand (km)	Percentage of Forestry Network (131.4km)
Second Coat	0.5 km	0.4%
Chipseal Reseal	10.8 km	8.0%
Asphaltic Surfacing	0.1 km	0.1%
Resurfacing Total	**11.4 km**	**8.5%**
Rehabilitation	**0.1 km**	**0.1%**

As expected, the quantities are lower than the with forestry scenario. Resurfacings have decreased by nearly 4km per year with rehabilitation treatments by 1.5 km per year.

Table 1.4 details average expenditure across the 20 year analysis period for each activity.

Table 1.4- Average Annual Expenditure by Activity)

Activity	Average Annual Expenditure ($)
Second Coat	$20,000
Chipseal Reseal	$520,000
Asphaltic Surfacing	$15,000
Resurfacing Total	**$555,000**
Rehabilitation	**$55,000**
Routine Mtce	**$380,000**
Total	**$990,000**

Average annual resurfacing costs are $140K less than Scenario A, rehabilitation costs $600K less and routine maintenance costs $300K less. This represents an additional $1M cost impact in maintenance and renewal costs from the forestry traffic per year.

1.5 Summary of Unsealed Maintenance Costs

1.5.1 Low Volume Roads

The predicted maintenance cost summary for a 30 year period is detailed below:

Table 1.5 - Maintenance Cost Summary for low volume roads

Activity	Unit	Forestry	Non-Forestry	Non-Forestry
Routine Maintenance	$ per km per year	$2,500	$1,000	
Re-metalling over 30 year period	$ per km	$30,000 x 2	$30,000	

Significant drainage and widening improvements will not be required on these road sections, as was completed on the likes of McCardle Road. Some minor drainage improvements and remetalling, say 50mm at approximately $30,000 per km would be sufficient to prepare the road sections for forestry traffic. The metalling with regular grading and maintenance metalling would be expected to last up to 15 years.

In comparison for non-forestry traffic, the need for maintenance metalling and grading will reduce as the lighter traffic will not be as damaging to the vulnerable sections where metal depth is low or non-existent. One would expect maintenance costs to be closer to $1,000 per km and the remetalling perhaps required only once in the 30 year life as opposed to twice in a forestry harvesting scenario.

1.5.2 Medium Volume Roads

The predicted maintenance cost summary for a 30 year period is detailed below:

Table 1.6 - Maintenance Cost Summary for medium volume roads

Activity	Unit	Forestry	Non-Forestry	Non-Forestry
Routine Maintenance	$ per km per year	$5,000	$2,000	
Re-metalling over 30 year period	$ per km	$50,000 1or 2 times	$30,000	

Significant drainage and widening improvements will not be required on these road sections, as was completed on the likes of McCardle Road. Many of the road sections are already suitable for carrying forestry traffic and future replenishment of the basecourse metal is all that is required over and above regular grading and maintenance metalling.

Some minor drainage improvements and remetalling, say 100mm at approximately $50,000 per km would be sufficient to prepare the road sections for forestry traffic. The metalling with regular grading and maintenance metalling would be expected to last up to 20 years depending on terrain and traffic. Effective maintenance would be at the $5,000 km per year.

In comparison for non-forestry traffic, the need for maintenance metalling and grading will reduce. One would expect maintenance costs to be closer to $2,000 per km and the remetalling perhaps required only once in the 30 year life as opposed to twice in a forestry harvesting scenario.

1.5.3 High Volume Roads

The predicted maintenance cost summary for a 30 year period is detailed below:

1.5 Summary of Unsealed Maintenance Costs

1.5.1 Low Volume Roads

The predicted maintenance cost summary for a 30 year period is detailed below:

Table 1.5 - Maintenance Cost Summary for low volume roads

Activity	Unit	Forestry	Non-Forestry	Non-Forestry
Routine Maintenance	$ per km per year	$2,500	$1,000	
Re-metalling over 30 year period	$ per km	$30,000 x 2	$30,000	

Significant drainage and widening improvements will not be required on these road sections, as was completed on the likes of McCardle Road. Some minor drainage improvements and remetalling, say 50mm at approximately $30,000 per km would be sufficient to prepare the road sections for forestry traffic. The metalling with regular grading and maintenance metalling would be expected to last up to 15 years.

In comparison for non-forestry traffic, the need for maintenance metalling and grading will reduce as the lighter traffic will not be as damaging to the vulnerable sections where metal depth is low or non-existent. One would expect maintenance costs to be closer to $1,000 per km and the remetalling perhaps required only once in the 30 year life as opposed to twice in a forestry harvesting scenario.

1.5.2 Medium Volume Roads

The predicted maintenance cost summary for a 30 year period is detailed below:

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Activity	Unit	Forestry	Non-Forestry	Non-Forestry
Routine Maintenance	$ per km per year	$5,000	$2,000	
Re-metalling over 30 year period	$ per km	$50,000 1or 2 times	$30,000	

Significant drainage and widening improvements will not be required on these road sections, as was completed on the likes of McCardle Road. Many of the road sections are already suitable for carrying forestry traffic and future replenishment of the basecourse metal is all that is required over and above regular grading and maintenance metalling.

Some minor drainage improvements and remetalling, say 100mm at approximately $50,000 per km would be sufficient to prepare the road sections for forestry traffic. The metalling with regular grading and maintenance metalling would be expected to last up to 20 years depending on terrain and traffic. Effective maintenance would be at the $5,000 km per year.

In comparison for non-forestry traffic, the need for maintenance metalling and grading will reduce. One would expect maintenance costs to be closer to $2,000 per km and the remetalling perhaps required only once in the 30 year life as opposed to twice in a forestry harvesting scenario.

1.5.3 High Volume Roads

The predicted maintenance cost summary for a 30 year period is detailed below:

The methodology used for this comparison was as follows:

(Email dated May 2014 - Update from WDC to confirm values for draft report)

1. Determine the actual road repair costs from RAMM for the last 3 full years (egg 2010/11 to 2012/13). Only work categories 111 (sealed pavement maint), 112 (unsealed pavement maint), 211 (unsealed road metalling), 212 (sealed road resurfacing), 214 (sealed pavement rehab) and 231 (associated improvements) were used to match the work categories used in the Beca report. Admin and Lump Sum costs were excluded from this calculation as these are largely common whether or not forestry is occurring.
2. These RAMM costs were then broken down into Rural and Urban costs and then analysed to calculate the $ per kilometer per year.
3. The Beca FRMS was used to calculate the average annual cost per Sealed and Unsealed Forestry Road.
4. The Actual Rural Road Costs were then used to compare with the Beca FRMS cost to determine the additional funding required over and above current levels. Only Rural Roads were used as 99% of the WDC forestry roads are Rural.

The results from this analysis are shown in the attached spreadsheet and are summarized in the table below:

Road Type	Rural RAMM $/km/yr	Beca FRMS $/km/yr	Difference $/km/yr	Forestry Road Length (km)	Total Increase $/yr
Sealed	$8,106	$15,449	$7,343	131.4	$964,919
Unsealed	$1,530	$7,647	$6,117	50.3	$307,674
Total				**181.7**	**$1,272,593**

Therefore, the net increase per year for forestry identified in the FRMS over current funding levels is $1,273,000 per annum.

WDC Actual pavement costs from RAMM Data (excludes admin & LS costs):

Road Type	2010/11	2011/12	2012/13	Grand Total	$/yr	Length (km)	$/km/yr
Sealed Roads							
Rural	$6,650,463.86	$6,862,704.49	$5,398,098.47	$18,911,266.82	$6,303,755.61	777.7	$8,105.64
Urban	$643,745.82	$1,275,645.81	$2,704,651.21	$4,624,042.84	$1,541,347.61	296.1	$5,205.50
Unsealed Roads							
Rural	$1,265,209.70	$1,327,429.44	$634,389.84	$3,227,028.98	$1,075,676.33	702.9	$1,530.34
Urban	$641.49	$539.88	$0.00	$1,181.37	$393.79	2.2	$179.00
Grand Total	**$8,560,060.87**	**$9,466,319.62**	**$8,737,139.52**	**$26,763,520.01**	**$8,921,173.34**	**1778.9**	

Beca FRMS Forestry Model (Excludes Admin & LS costs) & comparison to actual RAMM costs (Rural roads only):

Road Type	Traffic	$/yr	Length (km)	$/km/yr	Average $/km/yr	Less Avg Actual $/km/yr	$ Difference/km/yr	$ Difference/yr
Sealed	All	$2,030,000.00	131.4	$15,449.01	$15,449.01	$8,105.64	$7,343.37	$964,919.01
Unsealed	High		14.0	$11,500.00	$7,647.12	$1,530.34	$6,116.78	$307,673.87
	Medium		20.1	$7,500.00				
	Low		16.2	$4,500.00				
			181.7				**TOTAL**	**$1,272,592.88**

Appendix 2 – Kaipara District Council - Executive Summary

Kaipara te Oranganui

KAIPARA DISTRICT

Two Oceans Two Harbours

Forestry Roads
Kaipara District Council Forestry Routes Submission

July 2014

1 Executive Summary

The New Zealand Transport Agency (NZTA), Kaipara, Whangarei and Far North District Councils have embarked on a One Network approach, widely considered to be best practice for asset management, in the management of sections of the road network impacted by forestry cartage in Northland.

Table 1-1: Rural Network

	Sealed	Unsealed	Total
Urban Network	106km	12km	448km
Rural Network	342km	1,114km	1,126km
TLA Forestry roads	47km	408km	455km
Road lengths to be rehabilitated in next 6 years	2km	88km	90km

Forestry is an important resource grown in Northland and moved by logging truck to Whangarei port and at mills in Whangarei and Waipu. It is important for Northland to grow this resource economically, which means that efficient logging routes are established. Local roads are the key link between the high capacity roads and the forests. They are generally constructed of poor materials and lightly engineered, which make them vulnerable to heavy loads, especially when short term intensive harvests are undertaken. This analysis tries to evaluate the effects of forestry on local roads within the Kaipara district roading network. Due to the nature of the industry there are a number of assumptions made in part from data provided by the forestry industry and technical understanding of road deterioration provided by engineers and contractors.

In summary, forestry growth over the next 25 years is expected to be 75% above the 2010 planted forest areas in Northland. Most of the new growth will not be ready for harvest until 2035 onwards, so effects on the roading network for the increased truck movements will not start to be realised until 2035. However in the short term the amounts of harvest is set to increase over the next 6 years requiring strengthening of 90km of the network (2km of sealed and 88km of unsealed). These road sections are above the council's normal managed strengthen programme. It is expected that normal programmed renewals will be sufficient in the years between 2021 and 2035 to strengthen the remaining forestry routes identified as requiring intervention.

Table 1-2: Renewal costs per annum on identified forestry routes requiring intervention during 2015-2021 period

	Sealed	Unsealed
Normal programmed renewals	$8,803	$68,236
Required intervention	$68,792	$1,090,737
Shortfall	$59,989	$1,022,501

Appendix 3 – Far North District Council - Executive Summary

Report

FNDC Forestry Road Management Study Iteration 1 - Phase 1, 2 and 3 Outline Report

Prepared for Far North District Council (FNDC)

By Beca Ltd (Beca), Engineering Outcomes Ltd and FNDC.

12 September 2014

1 Executive Summary

1.1 Background

In 2013 Far North District Council (FNDC) commenced a study to determine the impact of forestry on their roading network. The period critically assessed is the 2015-18 Long Term Plan (LTP) period. This work will be used as an ongoing roading network management tool.

The study has been completed in three phases. Phase 1 was to assess the demand from the forestry activities on the Far North roading network. Phase 2 was to assess the financial impacts to the roading network from the forestry activities. Phase 3 considers the funding and intervention policy framework FNDC and associated stakeholders will use to pay for and manage the forestry impact. This process is iterative. If stakeholders are unable or unwilling to pay for the estimated assessed impacts, it is likely variables associated with phase 1 to 3 will be changed and the outputs reassessed.

Engineering Outcomes (EO) have completed the bulk of the assessment and analysis work. Beca have provided the framework for the study and subsequent report which was previously provided to Whangarei District Council (WDC). Beca have also provided expert overview, review, analysis and updating of work completed by EO.

Beca's overview role has been used to ensure the results of this study are comparable with similar phase 2 forestry management study work completed by WDC, Kaipara District Council (KDC) and the New Zealand Transport Agency (NZTA). This is intended to ensure a Northland regionwide approach to the roading management associated with the forestry impact.

1.2 Evaluation Methodology

The forestry loading estimates were derived from various sources including aerial photography, Land Use Carbon Assessment System (LUCAS) spatial data from the Ministry for the Environment (MfE), industry advice and subsequent spatial analysis methods. The forestry demand assessment work was undertaken by Engineering Outcomes Ltd.

The traffic estimates generated are based on an average of 550 tonnes of logs per hectare. Approximately 250 potential entry points of logging trucks onto public roads were identified from the major forests. Forests considered were generally 15 hectares or greater.

Because of uncertainties in parameters such as the timing of future harvests, a probabilistic approach to the evaluations of the costs of forestry impacts has been used. This is considered to result in a realistic estimate of the total impact over the entire Far North roading network.

For major interventions, the probability of intervention was assessed and multiplied by an estimated cost for each section of road on which forestry traffic is possible for the 2015-18 LTP period. From this, an "expected" cost of intervention has been calculated. This cost represents the impact of forestry traffic for both sealed and unsealed roads. Maintenance cost rates were calculated based on analyses of RAMM maintenance cost data.

1.3 Analysis Results

520 km of unsealed road were identified as potential forestry routes over the 2015-18 LTP period. The impact of capital and maintenance costs over this period, above current funding levels was assessed to be $4m and $2m respectively.

340km of sealed roads were identified as potential forestry routes over the 2015-18 LTP period. The impact of capital and maintenance costs over this period, above current funding levels was assessed to be $2m and $2m respectively.

1.4 Summary

The additional total capital expenditure amount assessed is $6m for sealed and unsealed potential forestry routes.

The additional maintenance expenditure amount calculated is $4m.

The additional capital and maintenance costs is based on a normal capital and maintenance expenditure of $4m per annum over the 2015-18 period.

The total additional expenditure required has been calculated to be just over $10m for the 2015-18 LTP period.

A detailed breakdown of assessed demand, existing road condition and strength and costs for each route is provided in Appendices A and B.

The data and modelling used to develop this study will require ongoing resourcing to ensure updating and reassessment work is completed. This is required to ensure the study and associated model remains a robust and powerful road management and planning tool.

Appendix 4 – NZ Transport Agency Report – Executive Summary

NZ TRANSPORT AGENCY
WAKA KOTAHI

Appendix 5 – Northport Report

Appendix 6 – Treatment cost details

Tables 13 – 16 illustrate the unit cost rates used to calculate the additional funding, where these have been made available.

Table 13: Whangarei District Council Treatment Costs (Dec 2013)

Pavement Type	Loadings		
Sealed Pavements	**Low**	**Medium**	**High**
Weak Pavement	$6,000	$8,000	$10,500
Moderate Pavement	$4,000	$5,000	$6,000
Strong Pavement	$1,200	$2,300	$3,000
Unsealed Pavements	$4,500	$7,500	$11,500

Table 14: Kaipara District Council Treatment Costs (Jul 2014)

Intervention Scores (From evaluation method)	Cost per km	
	Sealed	Unsealed
Rounded Score = 1 - No Intervention	-	-
Rounded Score = 2 - Intervention only after visual assessment	$150,000	$250,000
Rounded Score = 3	$150,000	$250,000
Rounded Score = 4	$250,000	$350,000
Rounded Score = 5	$350,000	$450,000

Table 15: Far North District Council Treatment Costs (Sep 2014)

Road Type	Intervention Costs			Maintenance Costs	
Unsealed Roads	Load Category	3 Year Tonnage	Cost per km	$/km with forestry	$/km without forestry
	Very High	>700,000 Tonnes	$150,000	$6,000	$3,300
	High	350,000-700,000 Tonnes	$90,000	$5,500	$3,000
	Moderate	110,000-350,000 Tonnes	$60,000	$4,900	$2,700
	Low	<110,000 Tonnes	$30,000	$4,500	$2,500
		Intervention Costs		Maintenance Costs	
Sealed Roads	Load Category	3 Year Tonnages	Cost per km	$/km with forestry	$/km without forestry
	Very High	>2,000,000 Tonnes	$700,000	$6,000	$2,300
	High	600,000-2,000,000 Tonnes	$500,000	$4,900	$1,800
	Moderate	200,000-600,000 Tonnes	$100,000	$4,200	$1,600
	Low	<200,000 Tonnes	$50,000	$3,500	$1,300

Table 16: State Highway Treatment Costs (Dec 2014)

Treatment	Unit Cost// m²/100mm depth
Place New AC	$71.90
Mill existing pavement	$10.90
Cut to Waste	$1.50
Granular Base (Smooth)	$14.40
Granular Base (Extra)	$6.30
Treatment	**Unit Cost/m²**
Single Coat Reseal	$5.00
Double Coat Reseal	$7.00

Appendix 7 – Northland Forestry Framework - Highlights

Northland Forestry Framework

Reasons:

- Strategy led, evidence based programs are required to support funding requests for the 2015/18 RLTP.
- Programmes that form part of the NLTP will need to demonstrate that they have been developed and optimised as part of a whole-of transport system, one network approach.

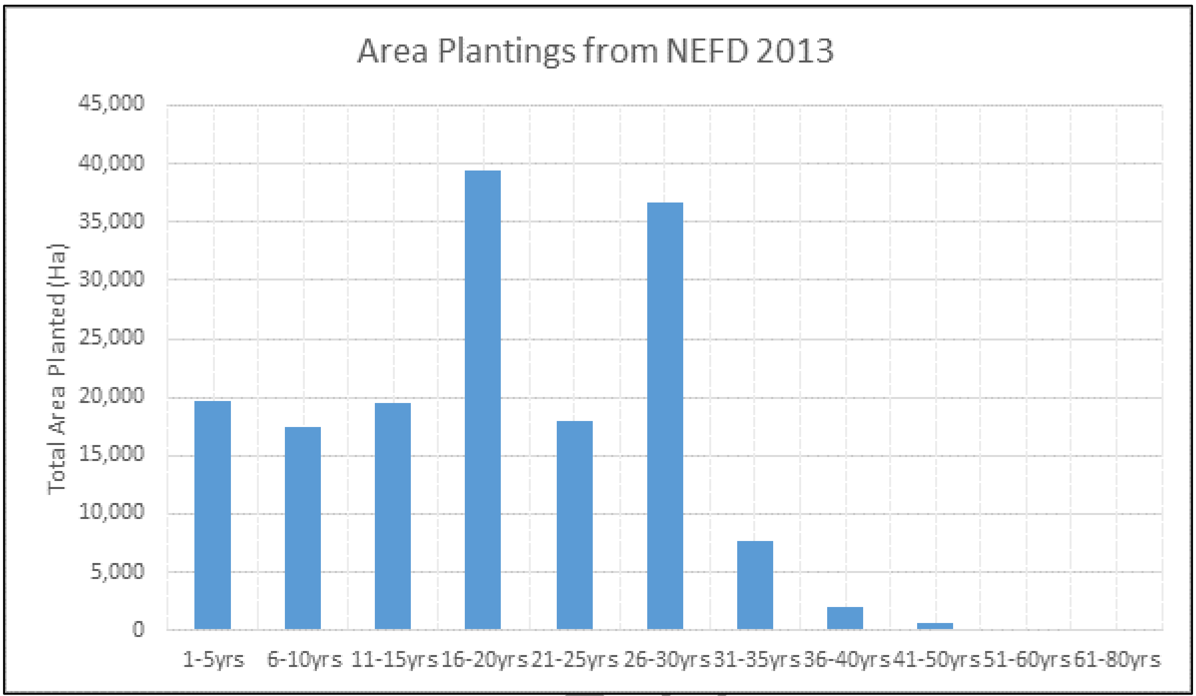
Outcomes:

Overall Best practice asset management

- Improved understanding of forestry demand and cost impact.
- Fit for purpose treatments
- Optimised programs for (forestry) routes. (RIGHT TIME, PLACE, COST)
- Ability to have flexibility within these programmes.
- Improved communications between RCA's and Forest managers
- Strategic approach embedded into AMP

<u>Timber Stock Availability</u>

<u>National Exotic Forest Description (NEFD) Planting Chart</u>
This data is for Far North DC, Kaipara DC and Whangarei DC planting areas



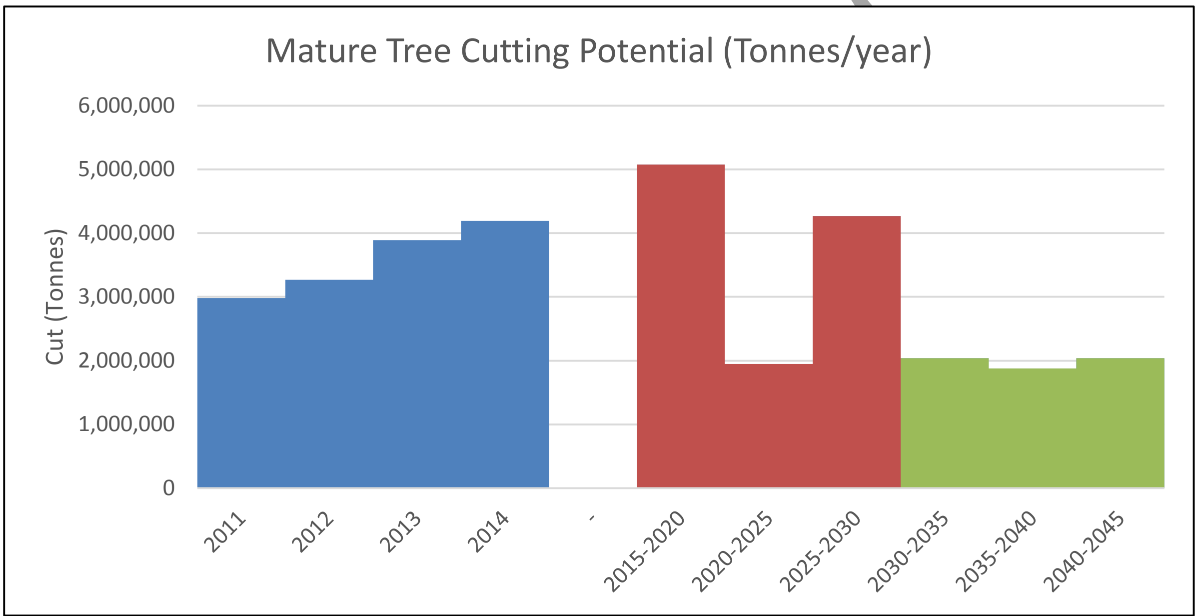
Assessed available roundwood production

The following charts are developed from information published on the MPI website, for Far North DC, Kaipara DC and Whangarei DC planting areas.
The blue block is annual cut tonnes as reported.
The red and green blocks are annualised totals in 5 year blocks. They have been developed by the following process

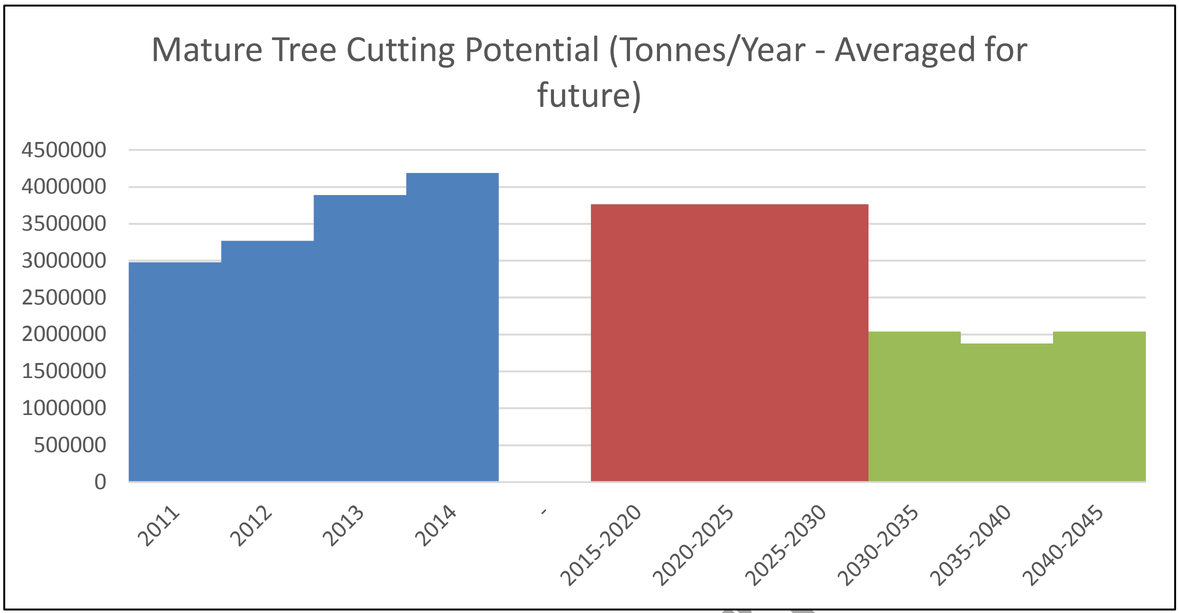
- Assumed cutting age is 26 to 30 years (national average of trees cut in 2013 was 27.7 years
- Trees that are 26 - 30 years old (or older) in 2013 NEFD database will be cut in 2015 - 2020, trees that are 21 – 25 years in 2013 will be cut in 2021 - 2025 and so on.
- Forests yield 540 tonne per Ha (nationally yield was 559 t/ha in ye April 2012, 530 t/ha in ye April 2013)

Source: MPI – Roundwood Removals

The following chart represents the above outcome



In the following chart, the total available in three 5 yr blocks 2015 to 2030 have been averaged to arrive at an annual total basis



These two charts indicate that forestry cutting in Northland at the 2014 level is not sustainable – there were insufficient trees (re)planted in Northland since 2000 to support the current level of production past 2030.

<u>Market Dynamics</u>

- Consumer needs drive Tonnage demand.
- Multiple ownership with multiple processors/exporters.
  - Create volatility in supply source = volatility in trucks to processors.
  - 60% of Northland forests owned/managed by 5 organizations.

<u>Current Forestry Reporting</u>
SH – Using TLA information as source information (Current report in preparation)

TLA – Varying industry input used in conjunction with GIS analysis.
- Concentrated on 15/18 figures with some view for 18-21

Northport – High level of industry consultation (report not published yet).
- Writers are aware of some issues in above diagrams.

<u>Network Impacts</u>

- Local roads – some are collectors → smooth usage profile for log trucks
  - Other local roads have 'lumpy' use profile.

- SH - all forest/log journeys end up on SH.
  -'General' trend (currently) is towards Marsden Point.

RDF History

Project was set up to upgrade infrastructure to facilitate public road access for forest harvesting and development of wood processing and exports for Northland (and Tairawhiti).

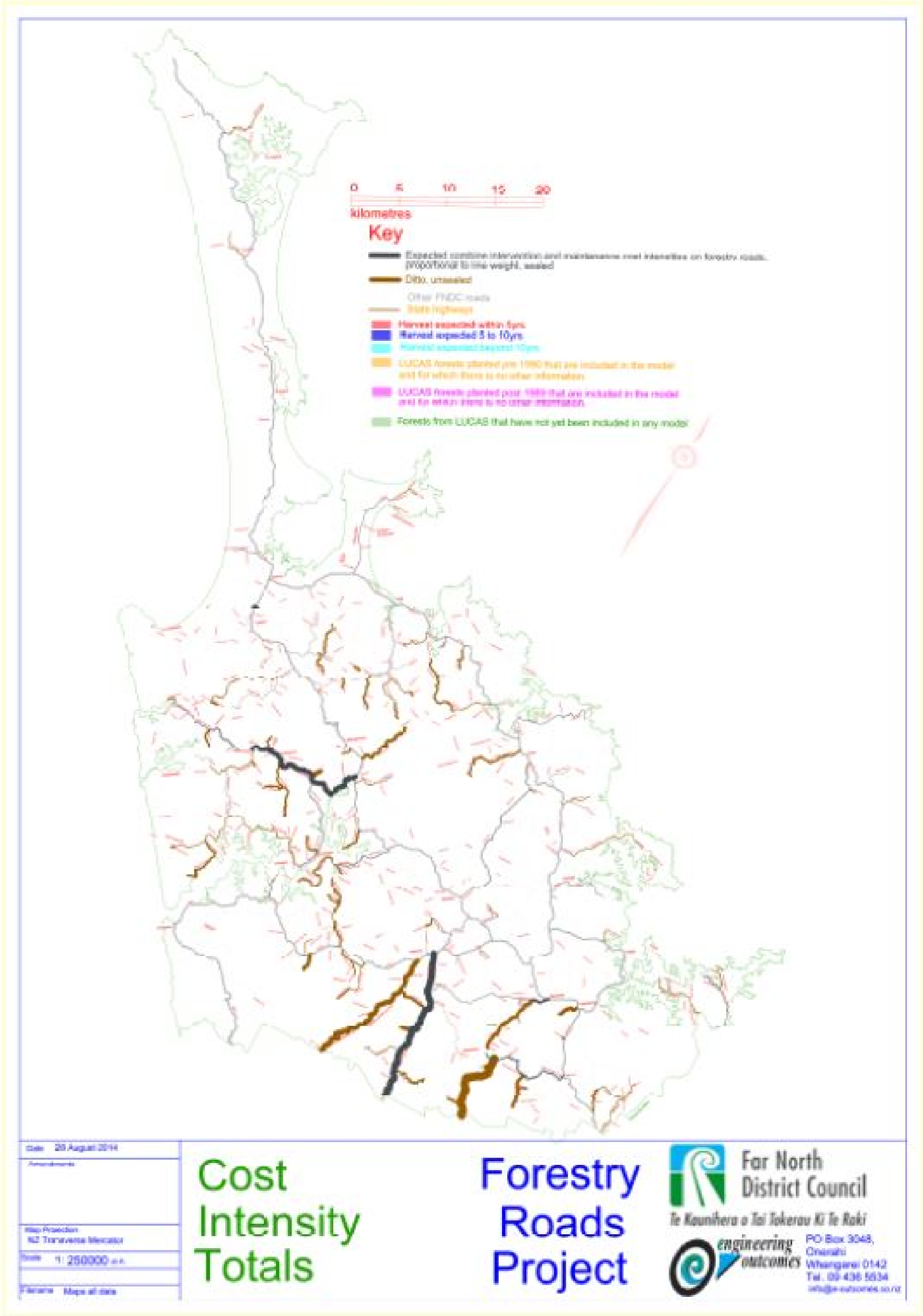
Funding made during 2002-2012 for the upgrade but has since stopped. Looking at reinstatement?

Total Expenditures:

- Whangarei District Council = $32.76 million
- Kaipara District Council = $18.3 million
- Far North District Council = $36.27 million

Appendix 8 – GIS Maps

Far North District – Forestry GIS map

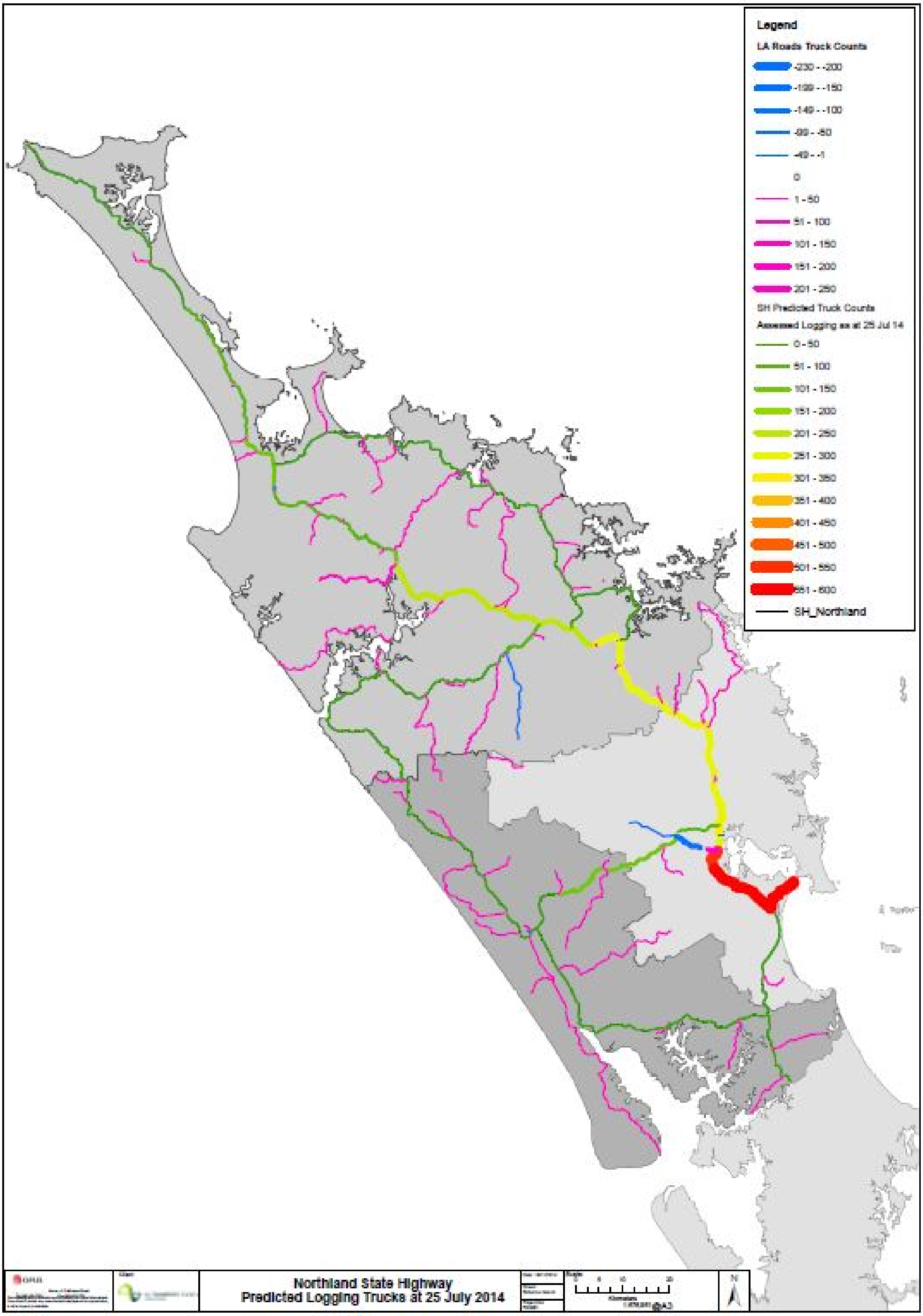


Whangarei District Council – Forestry GIS Map

Kaipara District Council – Forestry GIS Map

Not Available

State Highway – Forestry GIS Map



Appendix 9 – RDF Project Map

Figure 1 : Regional Development Fund 2002-2012 Northland Achievement

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