

**SILVICULTURE X TRAITS TRIALS
- ESTABLISHMENT REPORT**

M. Dean

Report No. 87

May 2005

**PLANTATION MANAGEMENT
COOPERATIVE**

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EXECUTIVE SUMMARY

SILVICULTURE X TRAITS TRIALS — ESTABLISHMENT REPORT

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Six Silviculture x Traits Trials have been established to monitor the effect on tree growth and log quality of managing plantations to produce a target tree, i.e., how to grow trees that provide specific products on a given site.

Genetic material comprising three trait types are tested across a range of site productivity (high and low fertility), wood properties and silviculture treatments. The first type favouring structural (high stiffness) solid wood end-uses consists of high wood density, multinodal, small branched genotypes. The second type favouring appearance (clearwood) solid wood products, consists of longer internode genotypes. A third trait type selected primarily for volume production, similar to the current high GF breeds is also tested. Each breed type is comprised of cuttings from five families of control pollinated crosses. Each family has been kept separate and its position mapped within each plot.

Silviculture treatments include three final crop stockings of 270, 375 and 500 stems/ha with and without pruning.

A total of eighteen treatments are replicated twice in a factorial split-plot design on each site. The location of each trial is summarised in Table 1.

Table 1. Trial location, ownership and experiment number

Region	Location	Forest Owner	Expt	Site Index	Date Established
NSW	Uni of New England **	State Forests NSW	FR 441	?	2001
Central NI	Waiotapu **	KTL	FR 436	31	Sept 2002
Otago	Waipori **	City Forests Ltd	FR 437	22	Sept 2002
East Coast.	Wairoa	Juken NZ	FR 438	36	Sept 2003
Waikato	Taharoa	Taharoa Inc	FR 439	28	July 2004
Southland	Waimahaka	Craig Pine Timber	FR 440	27	Aug 2004

** These trials are currently not funded by the Plantation Management Cooperative.

Further details of the six trial sites including maps and tables showing the layout of individual families are included.

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SILVICULTURE X TRAITS TRIAL SERIES

Establishment Report 2001 – 2004

M. Dean & R. Dickson (Forests NSW)

INTRODUCTION

In 1996, a strategic plan for new and existing silvicultural trials was developed by a FFPM Cooperative working group (Coop report 35, West et al.1996). This group consisted of five volunteers from the Cooperative technical committee, one FR researcher, and contributions from other FR Cooperative managers and senior researchers. The working group asked "What silvicultural questions will the forest owner/manager want answered in 2010?" To address this the group developed a matrix of treatments for silvicultural trials that included genetics, site type, and silvicultural treatment. Each of these treatments or layers were further refined to provide a matrix of factors such as timing of thinning or final crop stocking.

To examine the interactions of silvicultural treatment and genetics, it was suggested that an alternative approach to following many years behind the testing of new breeds or genotypes was to study the interaction of individual traits such as internode length or wood density.

Based on these conclusions, the following trial series was developed to test the target tree concept, i.e., how to grow trees that provide specific products on specific sites.

TRIAL DESIGN

Three types of genetic material are tested across a range of site productivities (high and low) and silvicultural treatments. The first type favouring structural (high stiffness) solid wood end-uses will consist of high wood density, multinodal, small branched trees. The second type favouring appearance (clearwood) solid wood products, will consists of longer internode types. Extremes of both types are likely to involve some loss in growth performance, therefore, intermediate types similar to the current high GF breeds are also tested. These could be considered as satisfying future demands for fibre, rather than specific solid-wood markets. Plant material was obtained from select control-crossed families of each type. The parents crossed to produce each family are presented in Appendix 1. Silvicultural treatments include three final crop stockings with and without pruning, with two replicates of each treatment in a factorial split- plot design (see figs 1 and Table 1).

Figure 1: Treatment surface

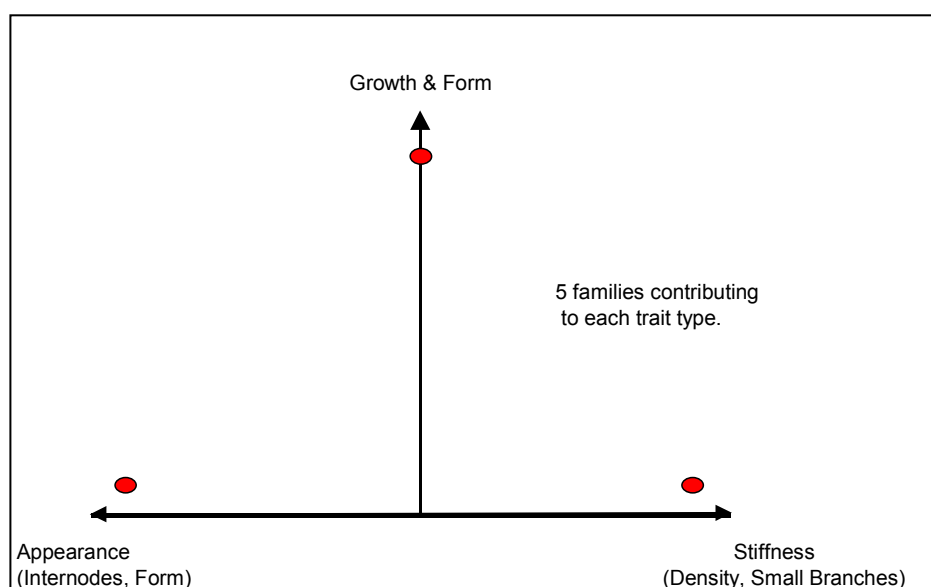


Table 1. Treatment Summary

Treatment	No.	Brief description
• Genetic type	3	Made up of 5 family crosses
• Final crop stocking	3	250, 375, 500 stems/ha (planted at 2:1 selection ratio)
• Pruning	2	unpruned, 5.5 m PRHT.
• Replicates	2	
• Number of plots/site	36	(5.7 hectares total area)
• Number of sites	6	

Each site was chosen to cover the usual range of growth as determined by site index and basal area level and also a range of wood properties as determined by the national wood density zones and internode lengths.

Each trial site is as homogeneous as possible and ideally will be free of serious weed problems, disease or nutrient deficiencies likely to result in serious tree form problems or mortality. A summary of the ownership, location and expected tree characteristics of the six sites is contained in Table 2.

Table 2: Site locations

Site no	Possible Region	Site index	BA	Density	Internode length
FR 438 - Wairoa (Juken NZ)	East Coast	high	high	med	med
FR 436 - Waiotapu (TMC)	BOP	med	med	med	med
FR 440 - Waimahaka (Craig Pine)	Southland	low	high	low	long
FR 437 Waipori (City Forests)	Otago	low	low	low	long
FR 439 - Taharoa (Taharoa Inc)	Sth. Auckland	low	low	high	short
FR 441 – Armidale NSW (State Forests NSW)	NSW	med	low	high	short

Full details of the trials installed are described on the pages following.

FR 436 – Waiotapu Silviculture x Traits Trial

Location:	Waiotapu – Central Kaingaroa Forest
Owner:	Timber Management Company Limited
Owner Contact Person:	Bob Boardman
Forest research Contact Person:	Mark Dean
Compartment:	34 Kaingaroa
Year Planted:	2002
Altitude:	500 metres
Geology and Soils	Kaingaroa silty sand (20d) of low natural fertility overlaying Kaingaroa ignembrite.
Annual Rainfall	1370 mm

Indicative Site productivity and wood property indicators

Site Index	20 – 26 m	27 – 30 m	>30 m
Fertility	Low	Medium	High
Wood density	Low	Medium	High
Internode length	Short	Moderate	Long

Description

The site is a flat to rolling second rotation radiata cutover on the edge of the Kaingaroa plateau. There were few residual weeds at the time of planting but the site may be prone to blackberry regrowth. The trial was planted by hand into line raked cutover in early September 2002 and spot release sprayed using Terbutylzine at 15 litres/ha in October 2002.

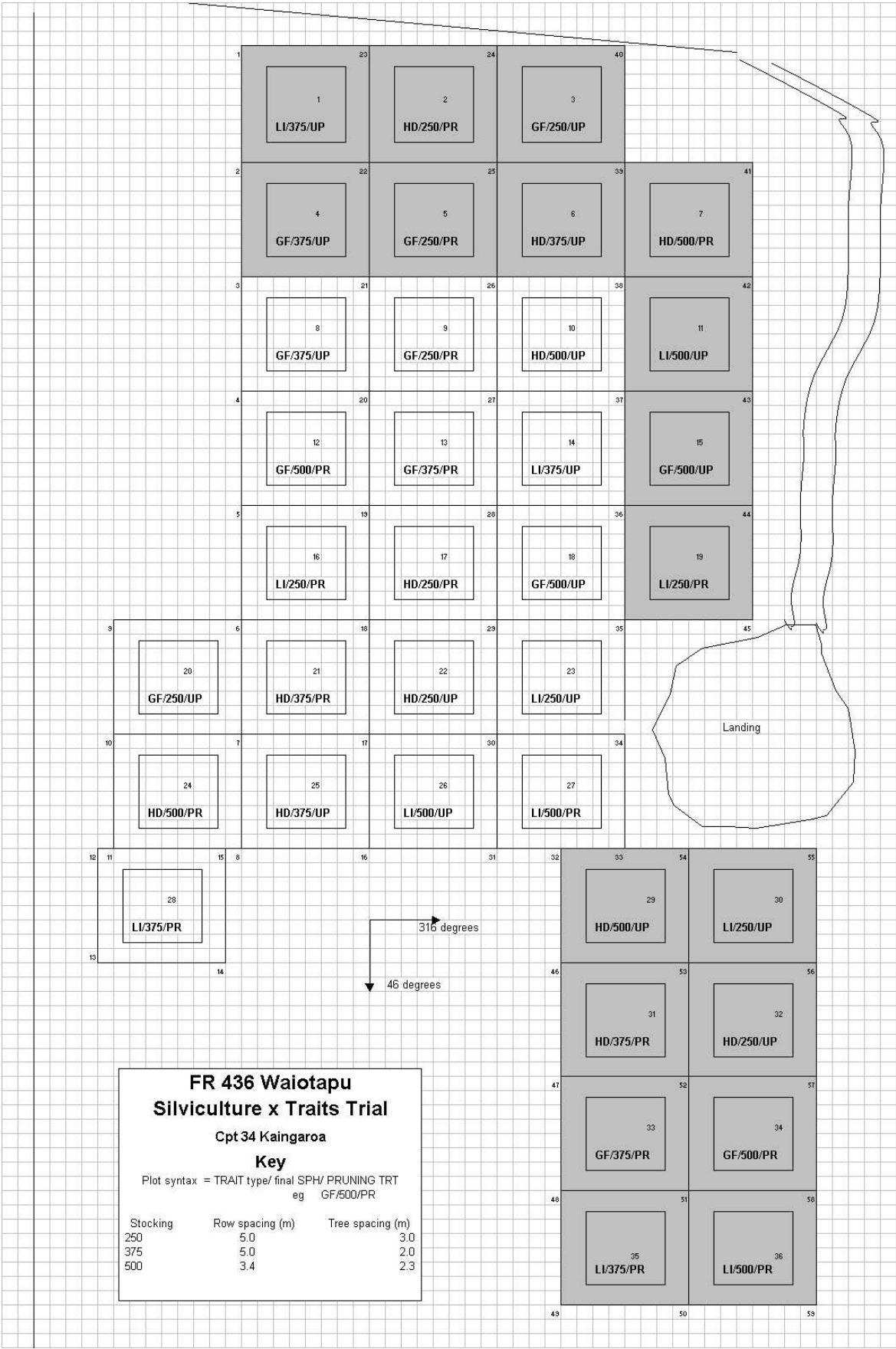
The trial location and plot layout are shown in Figures 2 & 3. Treatment allocation is listed in Appendix 2.

The map is a detailed topographic representation of the Rotomahana region. It features a grid system with numerical labels (e.g., 11, 12, 13, 14, 15, 16) along the vertical axis and letters (e.g., A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z) along the horizontal axis. Key geographical features include:

- Mountains and Hills:** Rainbow Mountain (743m), Maungakakamea (743m), and various other peaks with elevations like 8531m, 487m, 471m, 475m, 538m, 532m, and 534m.
- Lakes and Water Bodies:** Lake Ngahewa, Opai Lake, Rotomahana (Green Lake), Lake Whangioterangi (Echo Lake), and several reservoirs.
- Roads:** A network of roads including Rainbow Road, Old Mill Road, Waikokomuka Road, Waikaremoana Road, Waiootapu Valley Road, Waikaremoana Road, Waiootapu Road, and others.
- Other Features:** Thermal Areas, Lookout Station, Airstrip, and various smaller streams and valleys.

 A white rectangular box with the text 'FR 436' is positioned in the lower right quadrant of the map, indicating the specific area of study. The map uses a color-coded system to represent different elevations and land features, with brown lines for contour lines and green areas for vegetation or lower elevations.

Figure 3: FR436 Plot layout map



FR 437– Waipori Silviculture x Traits Trial

Location:	Waipori Falls Forest
Owner:	City Forests Limited
Owner Contact Person:	John Speirs – Forest Manager. Ph (03) 455 5512
Forest research Contact Person:	Mark Dean
Compartment:	17
Year Planted:	2002
Geology and Soils	Waipori silt loam upland yellow brown earth (54f) of low natural fertility over Non foliated quatzo-feldspathic semi schist (Chlorite subzone III).
Altitude:	440 metres
Annual Rainfall	900 mm

Indicative Site productivity and wood property indicators

Site Index	20 – 26 m	27 – 30m	>30m
Fertility	Low	Medium	High
Wood density	Low	Medium	High
Internode length	Short	Moderate	Long

Description

This is a second rotation site and the trial was established on a line raked Radiata pine cutover on 7 September 2002. Because of the cultivation during site preparation and the low residual weed bank it was not considered necessary to release spray the trees.

The trial location and plot layout are shown in Figures 4 and 5. The treatment allocation is contained in Appendix 3.

Figure 4: FR 437 Trial location map

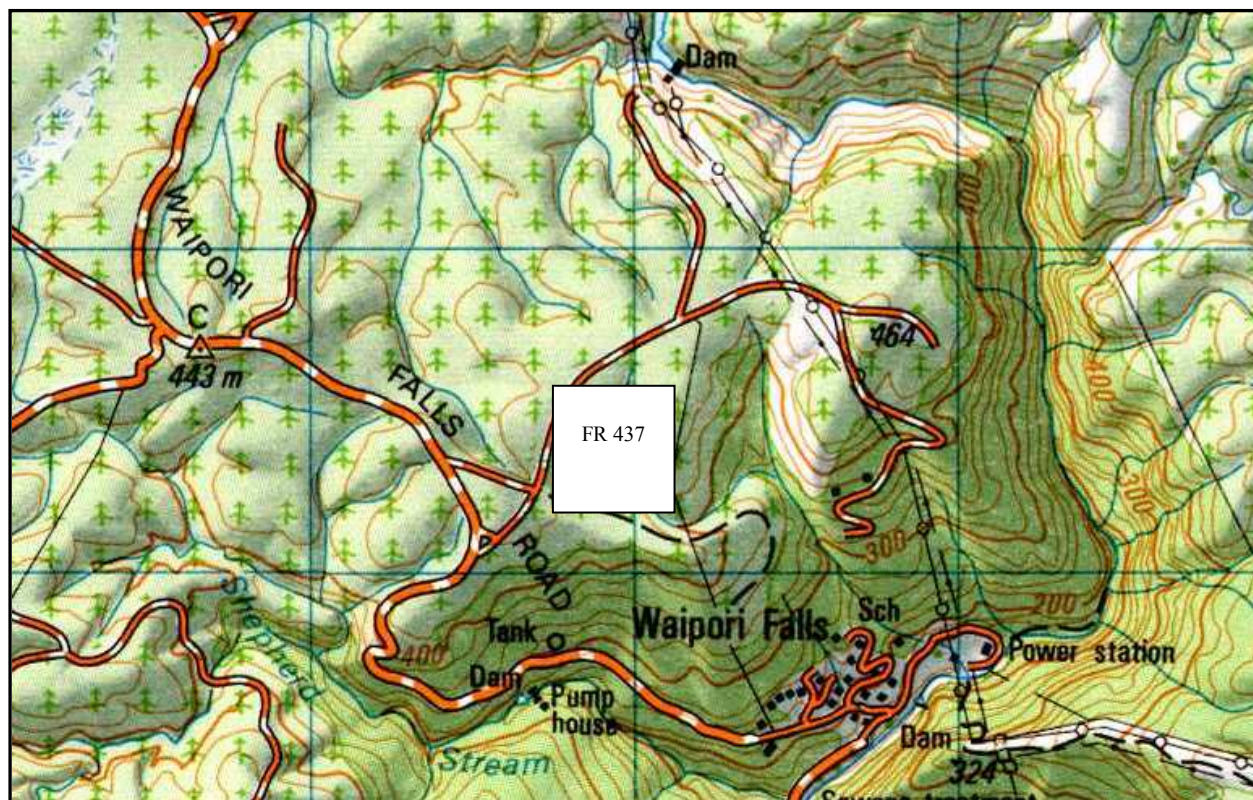


Figure 5: FR 437 Waipori. Plot layout map



FR 438 – Wairoa Silviculture x Traits Trial

Location:	Awaho Forest, Rapid Access No 1412 SHW 2 (approx 13 km south of Wairoa)
Owner:	Juken Nissho Limited
Owner Contact Person:	Martin Brown, Forest Superintendent.
Forest research Contact Person:	Mark Dean
Compartment:	
Year Planted:	2003
Geology and Soils	Pakare complex hill soil (29dH) of good natural fertility overlaying Taupo ash on mudstones.
Altitude:	60 metres
Annual Rainfall	1470 mm

Indicative Site productivity and wood property indicators

Site Index	20 – 26 m	27 – 30m	>30m
Fertility	Low	Medium	High
Wood density	Low	Medium	High
Internode length	Short	Moderate	Long

Description

The Juken Nissho site was established into clean pasture on 17 September 2003. The soil conditions were wet and good rain followed in the week after planting. Although wet the site has strong spring clover growth indicating high fertility and excellent tree growth is expected. The site had isolated clumps of blackberry, which were cut and burnt. Regrowth will be treated with Grazon in December 2003. Tree releasing was carried out one week after planting as a 1.5 m diameter spot application using Valzine at 20 litres /ha. The trial location and plot layout are shown in Figures 6 and 7. Appendices Family allocation is contained in Appendix 4.

Figure 6: FR 438 Trial location

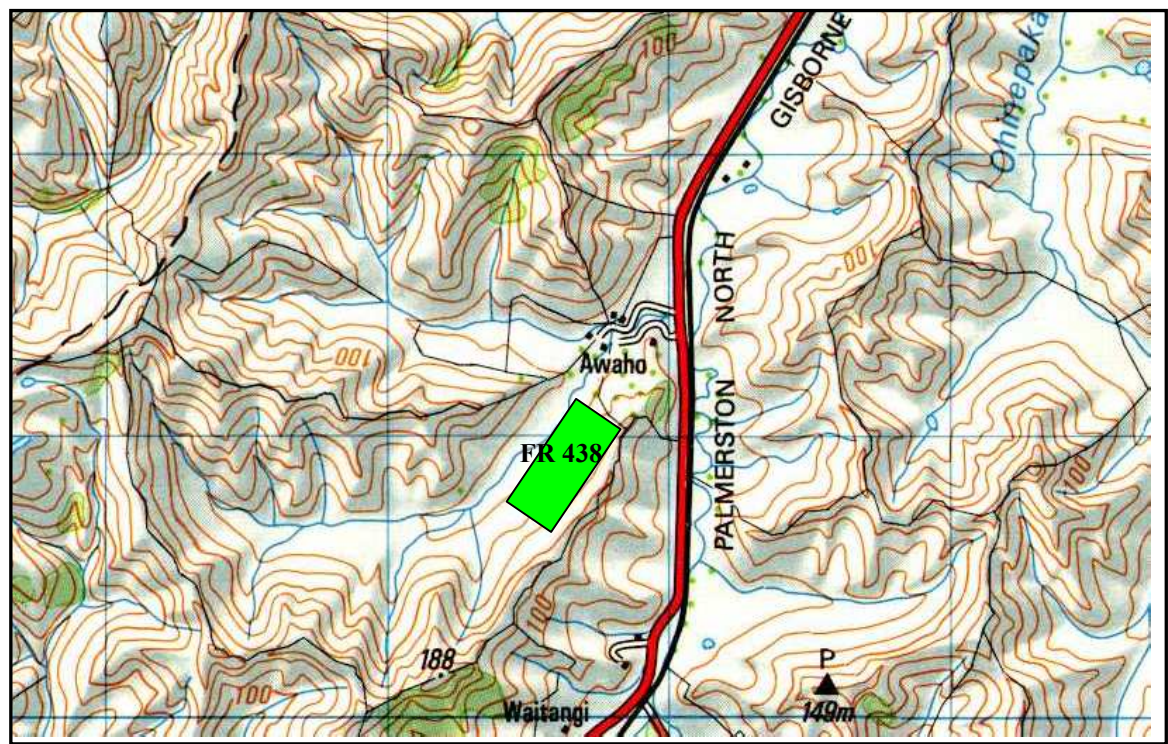
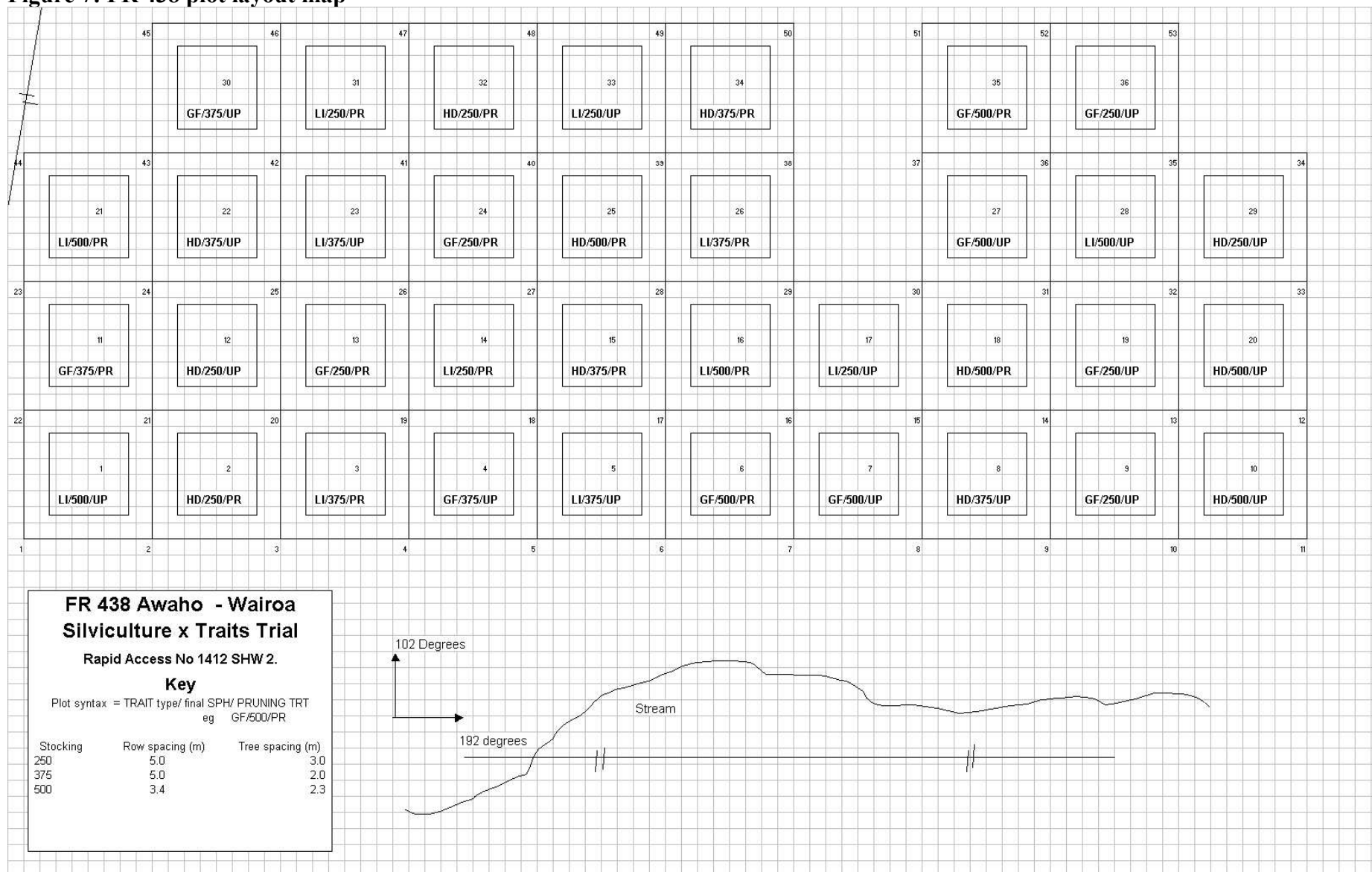


Figure 7: FR 438 plot layout map



FR 439 – Taharoa Silviculture x Traits Trial

Location:	Taharoa Forest, adjacent to Taharoa Iron Sand mine (approx 13 km south of Wairoa)
Owner:	Taharoa Incorporation
Owner Contact Person:	Peter Brown – IFS ltd, Forest Consultant / Manager.
Forest research Contact Person:	Mark Dean
Compartment:	5.06
Year Planted:	2004
Geology and Soils	Recent dune sand of volcanic origin
Altitude:	20 metres
Annual Rainfall	~1000 mm

Indicative Site productivity and wood property indicators

Site Index	20 – 26 m	27 – 30m	>30m
Fertility	Low	Medium	High
Wood density	Low	Medium	High
Internode length	Short	Moderate	Long

Description

The site was strip mined for iron ore extraction between 1997 and 1999. Following mining the site was contoured to a near level state and restored by planting of marram grass (*Ammophila arenaria*) and aerial seeding with Serradella, (*Ornithopus sativus*), an annual legume species. At the time of the trial establishment the ground cover was assessed to be the following broad proportions; scattered Marram (50%), serradella (25%), annual weeds (10%) and bare sand 15%.

The trial was planted by local contractors, Clarry Iti, on 14 July 2004. The soil conditions were moist.

Standard practice at Taharoa is to not release spray. This policy is designed to prevent ‘blow outs’ of drifting sand initiated on bare sand around the trees.

The trial location and plot layout are shown in Figures 8 and 9. Appendices Family allocation is contained in Appendix 5.

Figure 8: FR 439 – Taharua trial location map

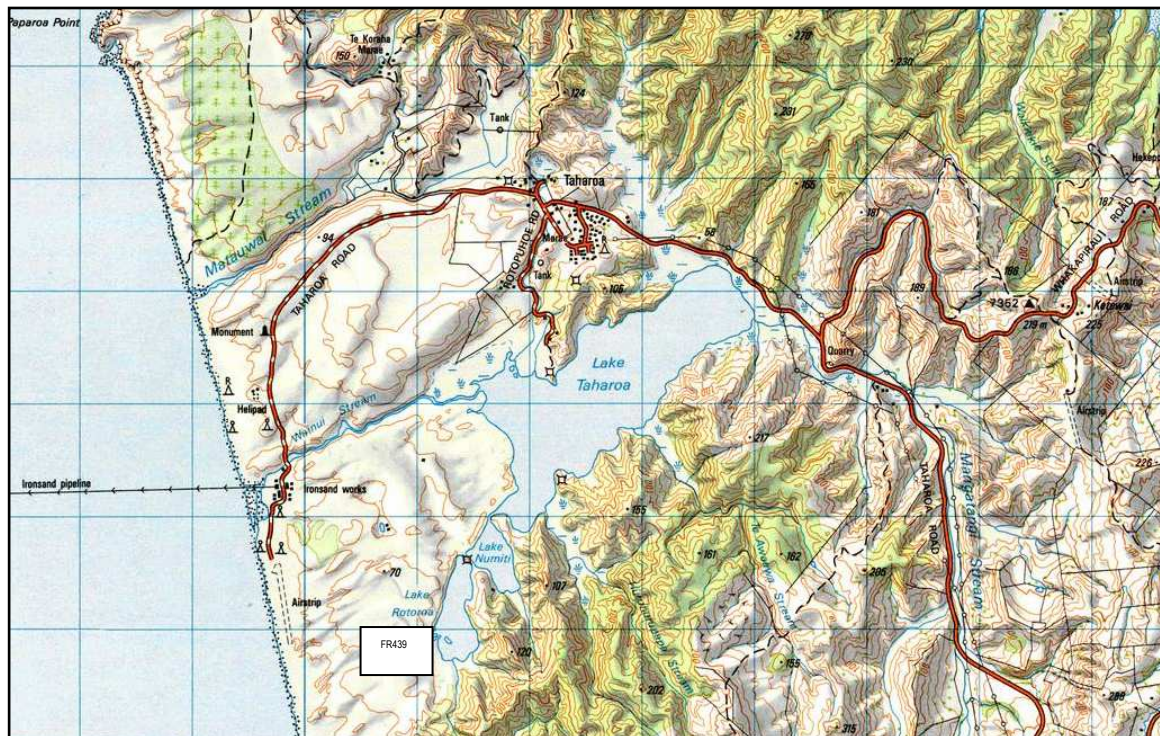
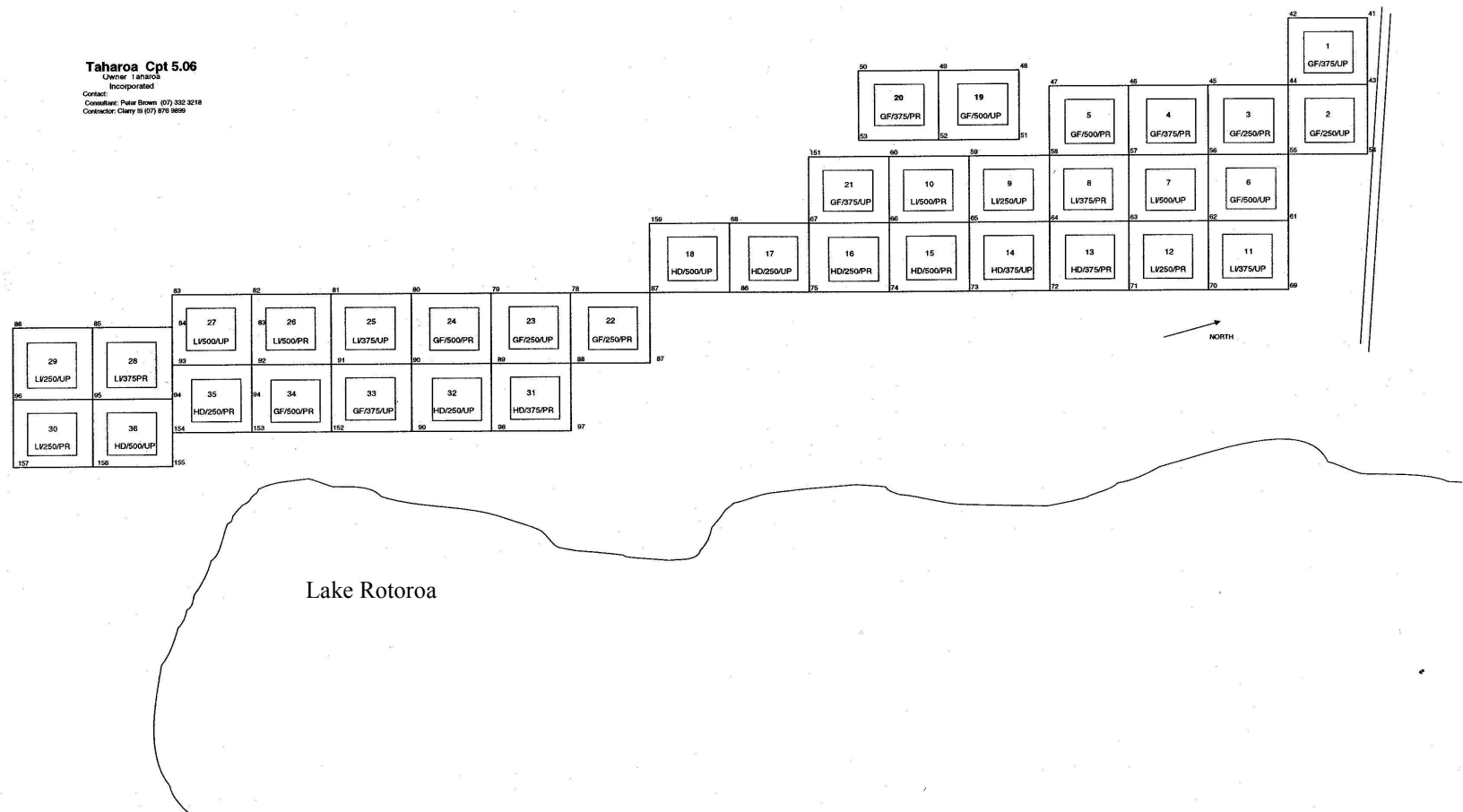


Figure 9: FR 439 – Taharoa. Plot layout map



FR 440 – Waimahaka Silviculture x Traits Trial

Location: Hillfort Forest, Rapid Access No 1000 Fox Road (approx 7 km north of Waimahaka)

Owner: Craig Pine Timber Limited

Owner Contact Person: Nathan Keoghan, Forest Manager.

Forest research Contact Person: Mark Dean

Compartment:

Year Planted: 2003

Geology and Soils

Altitude: 110 metres

Annual Rainfall ??mm

Indicative Site productivity and wood property indicators

Site Index	20 – 26 m	27 – 30m	>30m
Fertility	Low	Medium	High
Wood density	Low	Medium	High
Internode length	Short	Moderate	Long

Description

The trial was established into clean pasture on 11 August 2004. The soil conditions were wet and good rain followed along with 150mm of snow in the weeks after planting.

The site has strong cocksfoot grass growth indicating good fertility. Excellent basal area growth is expected on this site. Tree releasing was carried out in October as a 1.5 m diameter spot application using Liberate at 25 litres /ha. The trial location and plot layout are shown in Figures 10 and 11. Appendices Family allocation is contained in Appendix 6.

Figure 10. FR440 Trial location map

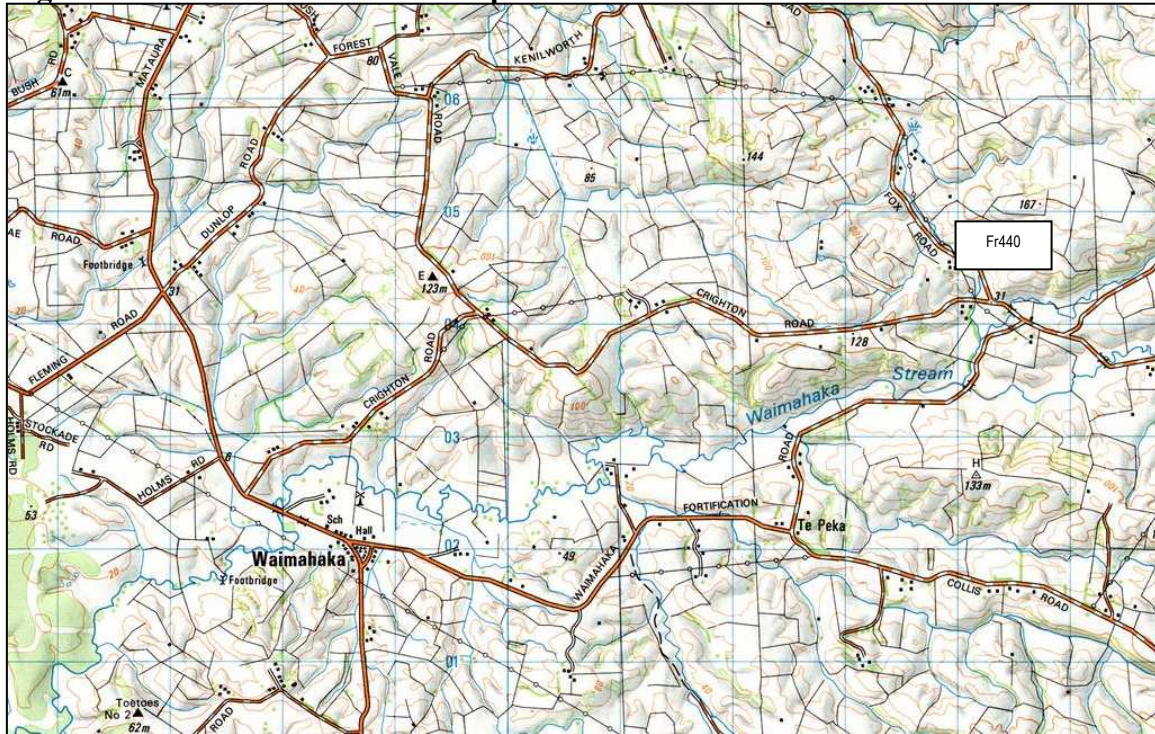
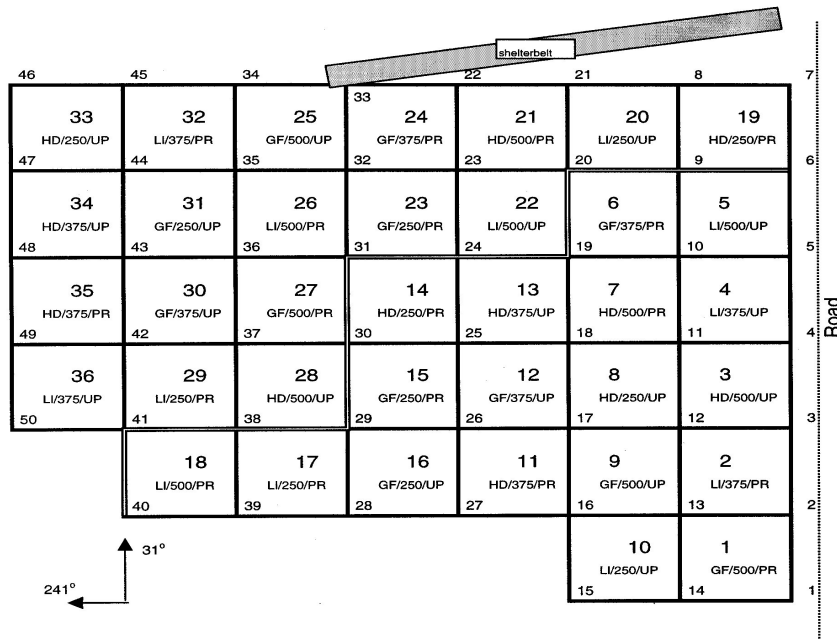


Figure 11. FR440 plot layout map

FR 440 - Hillfort Forest - Waimahaka , Craig Pine Ltd

planted 2004



Contact:
Craig Pine Timber Ltd
Nathan Keoghan
(027) 220 2338

FR 441 – NSW Silviculture x Traits Trial

Location: University of New England, Armidale NSW

Owner: State Forest of New South Wales

Owner Contact Person: Ross Dickson, Forests NSW, Albury.
Ph 0061 2 69814201.

Forest Research Contact Person: Mark Dean

Latitude/Longitude: 30°31'41"S,; 151°37'02"E.

Year Planted: 2001

Geology and Soils Moderately drained sandy clay loam over granitic substrate.

Altitude: 980 metres

Annual Rainfall 788

Indicative Site productivity and wood property indicators

Site Index	20 – 26 m	27 – 30m	>30m
Fertility	Low	Medium	High
Wood density	Low	Medium	High
Internode length	Short	Moderate	Long

Description

The climate at the Armidale site is typified by warm summers and cold winters. Daytime temperatures range from 15 to 28 degrees (Celsius) in the warmer months and from 10 to 16 degrees (Celsius) in the cooler months. Armidale has an average of 97 frost days per year. Rainfall is highest in summer and averages 788mm annually.

This trial does not replicate the NZ trials totally but does have the same breeds represented and an additional GF 16 treatment at two stockings 300 and 900 stems/ha.

Figure 9. FR441. Site location map

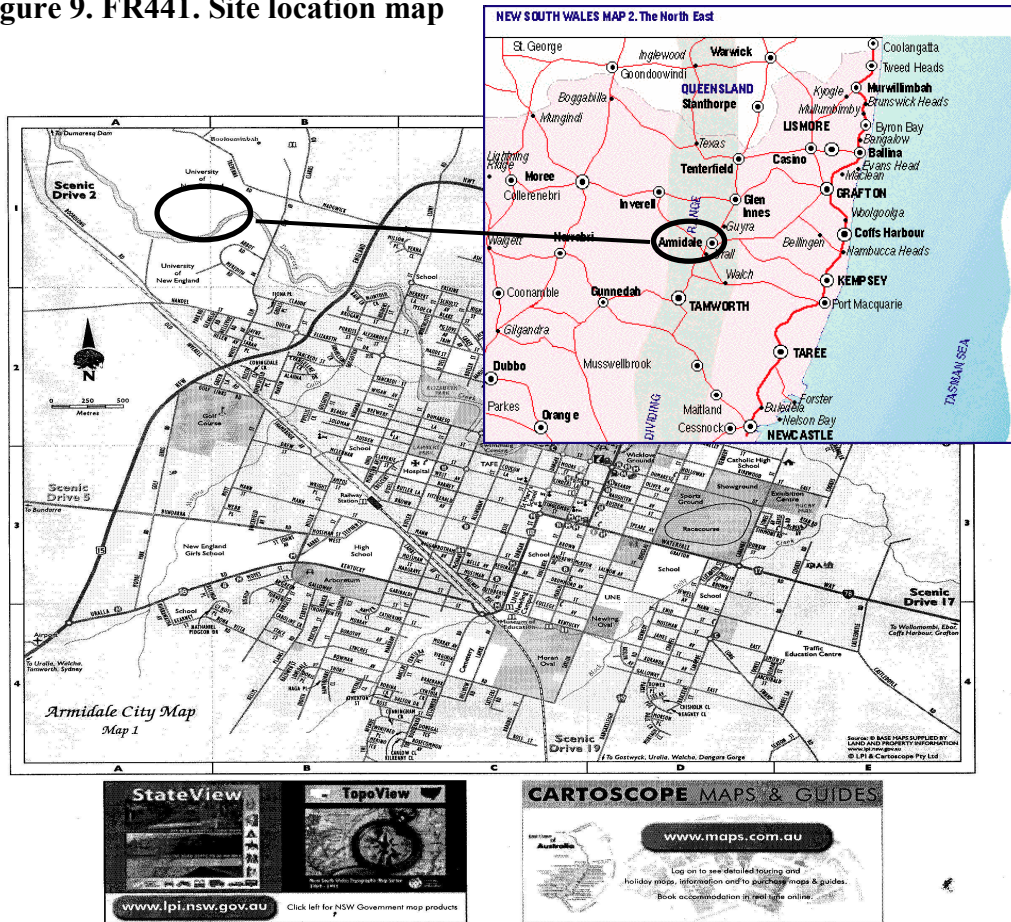


Figure 10. FR441 Site detail map

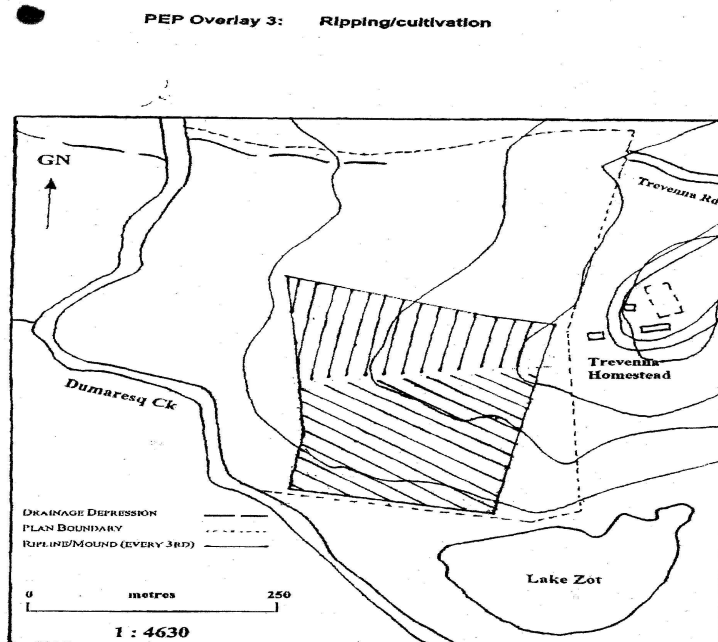
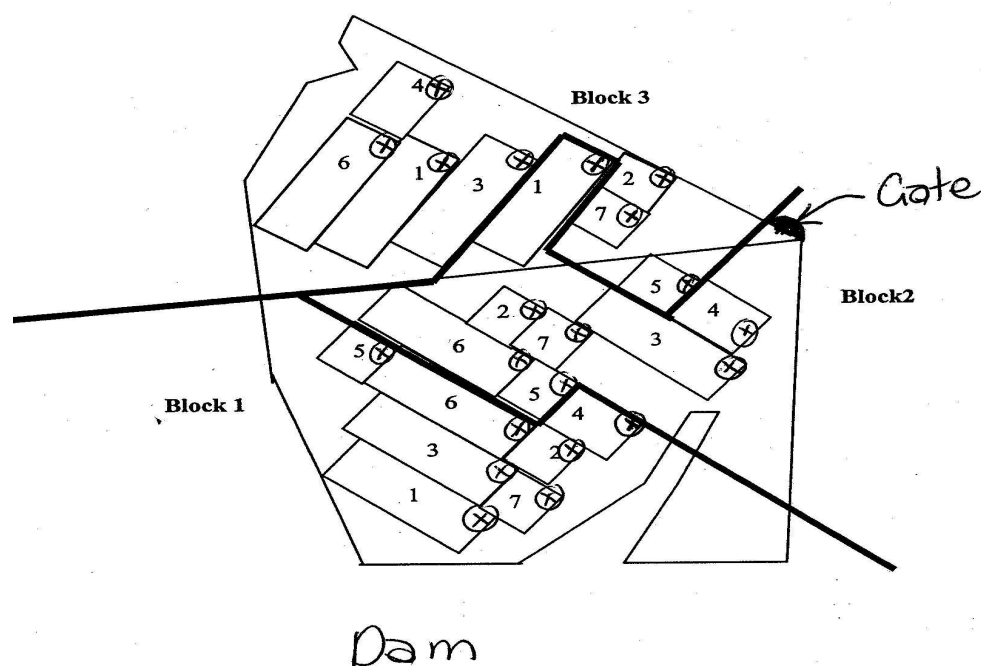


Figure 11: FR441 Plot layout



Treatment Number	Breed	Stocking (stems/ha)
1	GF 16	300
2	GF 16	900
3	GF 27	300
4	GF 27	600
5	GF 27	900
6	HD	300
7	HD	900

APPENDIX 1: SEEDLOTS USED

Family number	Seedlot	Type	Parents
1	883.58 x 870.613	Long Internode	883.58 x 870.613
2	883.71 x 870.529	Long Internode	883.71 x 870.529
3	883.21 x 870.613	Long Internode	883.21 x 870.613
4	883.47 x 870.588	Long Internode	883.47 x 870.588
5	883.64 x 870.568	Long Internode	883.64 x 870.568
6	99/312	Growth & Form	268.323 x 875.242
7	98/738	Growth & Form	268.109 X 880.728
8	99/304	Growth & Form	268.109 x 875.242
9	98/739*	Growth & Form	268.169 x 268.41
10	99/173	Growth & Form	268.539 x 880.728
11	99/190	High density	268. 54 x 880.729
12	99/358	High density	875.293 x 875. 76
13	99/345	High density	875. 76 x 875.242
14	99/355	High density	875.293 x 268.262
15	99/187	High density	268. 54 x 875. 76
20		Mixed LI & HD	

* This seedlot number may not be correct.

APPENDIX 2: FR436 – WAIOTAPU FAMILY ALLOCATION

Row 1 is in top right hand corner (North west) of plot.

Plot	TRt #	subplot	Family	#trees	Plot	TRt #	subplot	Family	#trees
1	14	1	1	19	8	11	1	10	19
1	14	2	2	19	8	11	2	6	19
1	14	3	2	19	8	11	3	8	19
1	14	4	4	19	8	11	4	9	19
1	14	5	3	19	8	11	5	7	19
1	14	6	1	19	8	11	6	10	19
1	14	7	3	19	8	11	7	6	19
1	14	8	4	19	8	11	8	7	19
2	7	1	11	13	9	1	1	8	13
2	7	2	12	13	9	1	2	9	13
2	7	3	13	13	9	1	3	7	13
2	7	4	14	13	9	1	4	9	13
2	7	5	15	13	9	1	5	10	13
2	7	6	12	13	9	1	6	8	13
2	7	7	11	13	9	1	7	6	13
2	7	8	13	13	9	1	8	10	13
3	10	1	7	13	10	18	1	13	17
3	10	2	6	13	10	18	2	14	17
3	10	3	10	13	10	18	3	12	17
3	10	4	8	13	10	18	4	14	17
3	10	5	7	13	10	18	5	15	17
3	10	6	9	13	10	18	6	13	17
3	10	7	6	13	10	18	7	11	17
3	10	8	8	13	10	18	8	15	17
4	11	1	9	19	10	18	9	11	17
4	11	2	10	19	10	18	10	12	17
4	11	3	9	19	10	18	11	14	17
4	11	4	6	19	10	18	12	13	17
4	11	5	10	19	11	15	1	2	17
4	11	6	7	19	11	15	2	1	17
4	11	7	8	19	11	15	3	3	17
4	11	8	6	19	11	15	4	1	17
5	1	1	8	13	11	15	5	4	17
5	1	2	7	13	11	15	6	2	17
5	1	3	6	13	11	15	7	4	17
5	1	4	10	13	11	15	8	1	17
5	1	5	7	13	11	15	9	2	17
5	1	6	8	13	11	15	10	3	17
5	1	7	9	13	11	15	11	4	17
5	1	8	9	13	11	15	12	3	17
6	17	1	14	19	12	3	1	7	17
6	17	2	11	19	12	3	2	6	17
6	17	3	13	19	12	3	3	7	17
6	17	4	12	19	12	3	4	10	17
6	17	5	15	19	12	3	5	8	17
6	17	6	14	19	12	3	6	6	17
6	17	7	11	19	12	3	7	10	17
6	17	8	12	19	12	3	8	9	17
7	9	1	11	17	12	3	9	8	17
7	9	2	12	17	12	3	10	9	17
7	9	3	14	17	12	3	11	6	17
7	9	4	15	17	12	3	12	7	17
7	9	5	11	17	13	2	1	6	19
7	9	6	13	17	13	2	2	7	19
7	9	7	12	17	13	2	3	9	19

Plot	TRt #	subplot	Family	#trees	Plot	TRt #	subplot	Family	#trees
7	9	8	15	17	13	2	4	10	19
7	9	9	14	17	13	2	5	8	19
7	9	10	13	17	13	2	6	6	19
7	9	11	12	17	13	2	7	7	19
7	9	12	11	17	13	2	8	9	19
14	14	1	1	19	20	10	1	10	13
14	14	2	2	19	20	10	2	8	13
14	14	3	3	19	20	10	3	10	13
14	14	4	4	19	20	10	4	9	13
14	14	5	3	19	20	10	5	7	13
14	14	6	2	19	20	10	6	8	13
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15	12	4	10	17	21	8	4	12	19
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16	4	7	2	13	23	13	3	4	13
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17	7	4	13	13	23	13	8	4	13
17	7	5	12	13	24	9	1	11	17
17	7	6	15	13	24	9	2	12	17
17	7	7	14	13	24	9	3	13	17
17	7	8	11	13	24	9	4	15	17
18	12	1	6	17	24	9	5	12	17
18	12	2	10	17	24	9	6	14	17
18	12	3	7	17	24	9	7	14	17
18	12	4	10	17	24	9	8	13	17
18	12	5	9	17	24	9	9	15	17
18	12	6	8	17	24	9	10	11	17
18	12	7	7	17	24	9	11	12	17
18	12	8	8	17	24	9	12	11	17
18	12	9	9	17	25	17	1	14	19
18	12	10	6	17	25	17	2	11	19
18	12	11	10	17	25	17	3	12	19
18	12	12	6	17	25	17	4	11	19
19	4	1	2	13	25	17	5	14	19
19	4	2	1	13	25	17	6	15	19
19	4	3	2	13	25	17	7	13	19
19	4	4	1	13	25	17	8	12	19

Plot	TRt #	subplot	Family	#trees	Plot	TRt #	subplot	Family	#trees
19	4	5	3	13	31	8	1	14	19
19	4	6	3	13	31	8	2	13	19
19	4	7	4	13	31	8	3	12	19
19	4	8	4	13	31	8	4	13	19
26	15	1	1	17	31	8	5	14	19
26	15	2	2	17	31	8	6	11	19
26	15	3	2	17	31	8	7	15	19
26	15	4	1	17	31	8	8	11	19
26	15	5	1	17	32	16	1	12	13
26	15	6	4	17	32	16	2	13	13
26	15	7	3	17	32	16	3	15	13
26	15	8	4	17	32	16	4	11	13
26	15	9	3	17	32	16	5	12	13
26	15	10	2	17	32	16	6	13	13
26	15	11	3	17	32	16	7	14	13
26	15	12	4	17	32	16	8	14	13
27	6	1	2	17	33	2	1	7	19
27	6	2	1	17	33	2	2	8	19
27	6	3	2	17	33	2	3	9	19
27	6	4	1	17	33	2	4	6	19
27	6	5	4	17	33	2	5	7	19
27	6	6	3	17	33	2	6	10	19
27	6	7	3	17	33	2	7	8	19
27	6	8	4	17	33	2	8	9	19
27	6	9	1	17	34	3	1	7	17
27	6	10	2	17	34	3	2	8	17
27	6	11	4	17	34	3	3	10	17
27	6	12	3	17	34	3	4	6	17
28	5	1	1	19	34	3	5	6	17
28	5	2	2	19	34	3	6	10	17
28	5	3	4	19	34	3	7	7	17
28	5	4	2	19	34	3	8	8	17
28	5	5	3	19	34	3	9	9	17
28	5	6	1	19	34	3	10	9	17
28	5	7	3	19	34	3	11	8	17
28	5	8	4	19	34	3	12	7	17
29	18	1	14	17	35	5	1	2	19
29	18	2	13	17	35	5	2	1	19
29	18	3	12	17	35	5	3	3	19
29	18	4	13	17	35	5	4	1	19
29	18	5	13	17	35	5	5	3	19
29	18	6	11	17	35	5	6	4	19
29	18	7	15	17	35	5	7	2	19
29	18	8	11	17	35	5	8	4	19
29	18	9	14	17	36	6	1	1	17
29	18	10	12	17	36	6	2	2	17
29	18	11	15	17	36	6	3	1	17
29	18	12	14	17	36	6	4	2	17
30	13	1	1	13	36	6	5	2	17
30	13	2	2	13	36	6	6	4	17
30	13	3	3	13	36	6	7	4	17
30	13	4	4	13	36	6	8	1	17
30	13	5	3	13	36	6	9	3	17
30	13	6	1	13	36	6	10	3	17
30	13	7	2	13	36	6	11	3	17
30	13	8	4	13	36	6	12	4	17

APPENDIX 3: FR 437 – WAIPORI FAMILY ALLOCATION

Plot	TRt #	Row	Family	#trees	Plot	TRt #	subplot	Family	#trees
1	3	1	7	17	5	15	1	4	17
1	3	2	6	17	5	15	2	3	17
1	3	3	7	17	5	15	3	1	17
1	3	4	8	17	5	15	4	1	17
1	3	5	6	17	5	15	5	3	17
1	3	6	10	17	5	15	6	2	17
1	3	7	9	17	5	15	7	4	17
1	3	8	8	17	5	15	8	2	17
1	3	9	7	17	5	15	9	3	17
1	3	10	6	17	5	15	10	4	17
1	3	11	9	17	5	15	11	2	17
1	3	12	8	17	5	15	12	1	17
2	5	1	1	19	6	2	1	10	19
2	5	2	2	19	6	2	2	6	19
2	5	3	4	19	6	2	3	8	19
2	5	4	1	19	6	2	4	10	19
2	5	5	2	19	6	2	5	6	19
2	5	6	3	19	6	2	6	7	19
2	5	7	1	19	6	2	7	9	19
2	5	8	3	19	6	2	8	7	19
3	18	1	13	17	7	9	1	11	17
3	18	2	11	17	7	9	2	13	17
3	18	3	15	17	7	9	3	15	17
3	18	4	13	17	7	9	4	15	17
3	18	5	11	17	7	9	5	14	17
3	18	6	11	17	7	9	6	12	17
3	18	7	12	17	7	9	7	13	17
3	18	8	12	17	7	9	8	11	17
3	18	9	13	17	7	9	9	11	17
3	18	10	14	17	7	9	10	14	17
3	18	11	11	17	7	9	11	11	17
3	18	12	14	17	7	9	12	14	17
4	14	1	1	19	8	16	1	13	13
4	14	2	4	19	8	16	2	14	13
4	14	3	3	19	8	16	3	15	13
4	14	4	2	19	8	16	4	14	13
4	14	5	4	19	8	16	5	12	13
4	14	6	1	19	8	16	6	13	13
4	14	7	2	19	8	16	7	11	13
4	14	8	2	19	8	16	8	11	13

Plot	TRt #	Row	Family	#trees	Plot	TRt #	subplot	Family	#trees
9	12	1	9	17	14	7	1	13	13
9	12	2	8	17	14	7	2	14	13
9	12	3	9	17	14	7	3	14	13
9	12	4	10	17	14	7	4	15	13
9	12	5	8	17	14	7	5	13	13
9	12	6	6	17	14	7	6	12	13
9	12	7	6	17	14	7	7	11	13
9	12	8	9	17	14	7	8	11	13
9	12	9	7	17	15	1	1	6	13
9	12	10	10	17	15	1	2	10	13
9	12	11	10	17	15	1	3	7	13
9	12	12	6	17	15	1	4	6	13
10	13	1	3	13	15	1	5	10	13
10	13	2	2	13	15	1	6	9	13
10	13	3	4	13	15	1	7	8	13
10	13	4	3	13	15	1	8	7	13
10	13	5	2	13	16	10	1	8	13
10	13	6	1	13	16	10	2	9	13
10	13	7	3	13	16	10	3	8	13
10	13	8	4	13	16	10	4	9	13
11	8	1	14	19	16	10	5	7	13
11	8	2	13	19	16	10	6	6	13
11	8	3	14	19	16	10	7	10	13
11	8	4	12	19	16	10	8	10	13
11	8	5	15	19	17	4	1	2	13
11	8	6	11	19	17	4	2	1	13
11	8	7	13	19	17	4	3	1	13
11	8	8	11	19	17	4	4	4	13
12	11	1	8	19	17	4	5	4	13
12	11	2	7	19	17	4	6	2	13
12	11	3	9	19	17	4	7	3	13
12	11	4	6	19	17	4	8	3	13
12	11	5	10	19	18	6	1	1	17
12	11	6	8	19	18	6	2	4	17
12	11	7	7	19	18	6	3	2	17
12	11	8	9	19	18	6	4	2	17
13	17	1	13	19	18	6	5	3	17
13	17	2	14	19	18	6	6	4	17
13	17	3	12	19	18	6	7	1	17
13	17	4	15	19	18	6	8	1	17
13	17	5	14	19	18	6	9	4	17
13	17	6	11	19	18	6	10	3	17
13	17	7	13	19	18	6	11	2	17
13	17	8	11	19	18	6	12	3	17
19	7	1	13	13	23	1	1	6	13

19	7	2	14	13	23	1	2	7	13
19	7	3	11	13	23	1	3	9	13
19	7	4	15	13	23	1	4	8	13
19	7	5	14	13	23	1	5	7	13
19	7	6	13	13	23	1	6	6	13
19	7	7	12	13	23	1	7	10	13
19	7	8	11	13	23	1	8	8	13
20	13	1	1	13	24	2	1	10	19
20	13	2	4	13	24	2	2	9	19
20	13	3	1	13	24	2	3	8	19
20	13	4	1	13	24	2	4	9	19
20	13	5	3	13	24	2	5	7	19
20	13	6	4	13	24	2	6	6	19
20	13	7	2	13	24	2	7	10	19
20	13	8	2	13	24	2	8	6	19
21	9	1	14	17	25	12	1	8	17
21	9	2	13	17	25	12	2	7	17
21	9	3	11	17	25	12	3	7	17
21	9	4	14	17	25	12	4	6	17
21	9	5	15	17	25	12	5	10	17
21	9	6	13	17	25	12	6	8	17
21	9	7	13	17	25	12	7	9	17
21	9	8	14	17	25	12	8	7	17
21	9	9	12	17	25	12	9	8	17
21	9	10	12	17	25	12	10	9	17
21	9	11	13	17	25	12	11	10	17
21	9	12	11	17	25	12	12	9	17
22	15	1	4	17	26	6	1	4	17
22	15	2	3	17	26	6	2	3	17
22	15	3	2	17	26	6	3	3	17
22	15	4	4	17	26	6	4	2	17
22	15	5	3	17	26	6	5	1	17
22	15	6	1	17	26	6	6	1	17
22	15	7	2	17	26	6	7	4	17
22	15	8	4	17	26	6	8	3	17
22	15	9	1	17	26	6	9	2	17
22	15	10	3	17	26	6	10	4	17
22	15	11	1	17	26	6	11	2	17
22	15	12	2	17	26	6	12	1	17
27	3	1	6	17	31	10	1	9	13
27	3	2	7	17	31	10	2	8	13
27	3	3	9	17	31	10	3	9	13
27	3	4	7	17	31	10	4	10	13
27	3	5	8	17	31	10	5	8	13
27	3	6	6	17	31	10	6	7	13
27	3	7	7	17	31	10	7	6	13
27	3	8	6	17	31	10	8	10	13

27	3	9	10	17	32	5	1	2	19
27	3	10	10	17	32	5	2	1	19
27	3	11	8	17	32	5	3	4	19
27	3	12	9	17	32	5	4	1	19
28	18	1	13	17	32	5	5	3	19
28	18	2	14	17	32	5	6	2	19
28	18	3	12	17	32	5	7	3	19
28	18	4	15	17	32	5	8	3	19
28	18	5	11	17	33	16	1	11	13
28	18	6	11	17	33	16	2	14	13
28	18	7	12	17	33	16	3	12	13
28	18	8	13	17	33	16	4	14	13
28	18	9	14	17	33	16	5	13	13
28	18	10	15	17	33	16	6	15	13
28	18	11	13	17	33	16	7	11	13
28	18	12	11	17	33	16	8	13	13
29	4	1	3	13	34	17	1	14	19
29	4	2	2	13	34	17	2	11	19
29	4	3	2	13	34	17	3	11	19
29	4	4	1	13	34	17	4	14	19
29	4	5	2	13	34	17	5	12	19
29	4	6	4	13	34	17	6	15	19
29	4	7	3	13	34	17	7	13	19
29	4	8	4	13	34	17	8	13	19
30	11	1	6	19	36	14	1	1	19
30	11	2	10	19	36	14	2	4	19
30	11	3	6	19	36	14	3	1	19
30	11	4	10	19	36	14	4	2	19
30	11	5	8	19	36	14	5	4	19
30	11	6	9	19	36	14	6	3	19
30	11	7	7	19	36	14	7	4	19
30	11	8	7	19	36	14	8	2	19

APPENDIX 4: FR 438 WAIROA FAMILY ALLOCATIONS

Plot	Row	Breed	TRt #	subplot	Family	Plot	Row	Breed	TRt #	subplot	Family
1	1 *	LI	3	1	s**	6	1	GF	2	1	s
1	2	LI	3	1	s	6	2	GF	2	1	s
1	3	LI	3	2	5	6	3	GF	2	2	6
1	4	LI	3	2	5	6	4	GF	2	2	7
1	5	LI	3	2	1	6	5	GF	2	2	8
1	6	LI	3	2	2	6	6	GF	2	2	9
1	7	LI	3	2	2	6	7	GF	2	2	10
1	8	LI	3	2	4	6	8	GF	2	3	s
1	9	LI	3	2	3	6	9	GF	2	3	s
1	10	LI	3	2	4	6	10	GF	2	3	s
1	11	LI	3	3	s	6	11	GF	2	3	s
1	12	LI	3	3	s	6	12	GF	2	3	s
2	1	HD	5	1	s	7	1	GF	9	1	s
2	2	HD	5	1	s	7	2	GF	9	1	s
2	3	HD	5	2	11	7	3	GF	9	2	6
2	4	HD	5	2	12	7	4	GF	9	2	7
2	5	HD	5	2	13	7	5	GF	9	2	8
2	6	HD	5	2	14	7	6	GF	9	2	9
2	7	HD	5	2	15	7	7	GF	9	2	10
2	8	HD	5	3	s	7	8	GF	9	2	6
3	1	LI	18	1	s	7	9	GF	9	2	7
3	2	LI	18	1	s	7	10	GF	9	2	8
3	3	LI	18	2	2	7	11	GF	9	3	s
3	4	LI	18	2	4	7	12	GF	9	3	s
3	5	LI	18	2	5	8	1	HD	16	1	s
3	6	LI	18	2	2	8	2	HD	16	1	s
3	7	LI	18	2	4	8	3	HD	16	2	11
3	8	LI	18	3	s	8	4	HD	16	2	12
4	1	GF	14	1	s	8	5	HD	16	2	13
4	2	GF	14	1	s	8	6	HD	16	2	14
4	3	GF	14	2	6	8	7	HD	16	2	15
4	4	GF	14	2	7	8	8	HD	16	3	s
4	5	GF	14	2	8	9	1	GF	12	1	s
4	6	GF	14	2	9	9	2	GF	12	1	s
4	7	GF	14	2	10	9	3	GF	12	2	9
4	8	GF	14	3	s	9	4	GF	12	2	10
5	1	LI	15	1	s	9	5	GF	12	2	6
5	2	LI	15	1	s	9	6	GF	12	2	7
5	3	LI	15	2	5	9	7	GF	12	2	8
5	4	LI	15	2	5	9	8	GF	12	3	s
5	5	LI	15	2	1	10	1	HD	13	1	s
5	6	LI	15	2	3	10	2	HD	13	1	s
5	7	LI	15	2	4	10	3	HD	13	2	11
5	8	LI	15	3	s	10	4	HD	13	2	12
						10	5	HD	13	2	13
						10	6	HD	13	2	14
						10	7	HD	13	2	15
						10	8	HD	13	2	14
						10	9	HD	13	2	11
						10	10	HD	13	2	12

Plot	Row	Breed	TRt #	subplot	Family	Plot	Row	Breed	TRt #	subplot	Family
						10	11	HD	13	3	s
						10	12	HD	13	3	s
11	1	GF	8	1	s	17	1	LI	4	1	s
11	2	GF	8	1	s	17	2	LI	4	1	s
11	3	GF	8	2	9	17	3	LI	4	2	3
11	4	GF	8	2	8	17	4	LI	4	2	2
11	5	GF	8	2	7	17	5	LI	4	2	3
11	6	GF	8	2	6	17	6	LI	4	2	4
11	7	GF	8	2	10	17	7	LI	4	2	5
11	8	GF	8	3	s	17	8	LI	4	3	s
12	1	HD	11	1	s	18	1	HD	6	1	s
12	2	HD	11	1	s	18	2	HD	6	1	s
12	3	HD	11	2	11	18	3	HD	6	2	11
12	4	HD	11	2	12	18	4	HD	6	2	12
12	5	HD	11	2	13	18	5	HD	6	2	13
12	6	HD	11	2	14	18	6	HD	6	2	14
12	7	HD	11	2	15	18	7	HD	6	2	15
12	8	HD	11	3	s	18	8	HD	6	2	11
13	1	GF	17	1	s	18	9	HD	6	2	12
13	2	GF	17	1	s	18	10	HD	6	2	13
13	3	GF	17	2	10	18	11	HD	6	3	s
13	4	GF	17	2	6	18	12	HD	6	3	s
13	5	GF	17	2	7	19	1	GF	7	1	s
13	6	GF	17	2	8	19	2	GF	7	1	s
13	7	GF	17	2	9	19	3	GF	7	2	10
13	8	GF	17	3	s	19	4	GF	7	2	6
14	1	LI	7	1	s	19	5	GF	7	2	7
14	2	LI	7	1	s	19	6	GF	7	2	8
14	3	LI	7	2	2	19	7	GF	7	2	9
14	4	LI	7	2	2	19	8	GF	7	3	s
14	5	LI	7	2	2	20	1	HD	13	1	s
14	6	LI	7	2	1	20	2	HD	13	1	s
14	7	LI	7	2	3	20	3	HD	13	2	14
14	8	LI	7	3	s	20	4	HD	13	2	15
15	1	HD	1	1	s	20	5	HD	13	2	11
15	2	HD	1	1	s	20	6	HD	13	2	12
15	3	HD	1	2	11	20	7	HD	13	2	13
15	4	HD	1	2	12	20	8	HD	13	2	14
15	5	HD	1	2	13	20	9	HD	13	2	13
15	6	HD	1	2	14	20	10	HD	13	2	15
15	7	HD	1	2	15	20	11	HD	13	3	s
15	8	HD	1	3	s	20	12	HD	13	3	s
16	1	LI	10	1	s	21	1	LI	9	1	s
16	2	LI	10	1	s	21	2	LI	9	1	s
16	3	LI	10	2	2	21	3	LI	9	2	1
16	4	LI	10	2	1	21	4	LI	9	2	3
16	5	LI	10	2	4	21	5	LI	9	2	3
16	6	LI	10	2	4	21	6	LI	9	2	1
16	7	LI	10	2	3	21	7	LI	9	2	4
16	8	LI	10	2	4	21	8	LI	9	2	4
16	9	LI	10	2	5	21	9	LI	9	2	1

Plot	Row	Breed	TRt #	subplot	Family	Plot	Row	Breed	TRt #	subplot	Family
16	10	LI	10	2	5	21	10	LI	9	2	1
16	11	LI	10	3	s	21	11	LI	9	3	s
16	12	LI	10	3	s	21	12	LI	9	3	s
22	1	HD	15	1	s	27	1	GF	3	1	s
22	2	HD	15	1	s	27	2	GF	3	1	s
22	3	HD	15	2	13	27	3	GF	3	2	10
22	4	HD	15	2	12	27	4	GF	3	2	6
22	5	HD	15	2	11	27	5	GF	3	2	7
22	6	HD	15	2	15	27	6	GF	3	2	8
22	7	HD	15	2	14	27	7	GF	3	2	9
22	8	HD	15	3	s	27	8	GF	3	2	10
23	1	LI	1	1	s	27	9	GF	3	2	6
23	2	LI	1	1	s	27	10	GF	3	2	7
23	3	LI	1	2	5	27	11	GF	3	3	s
23	4	LI	1	2	1	27	12	GF	3	3	s
23	5	LI	1	2	5	28	1	LI	18	1	s
23	6	LI	1	2	3	28	2	LI	18	1	s
23	7	LI	1	2	3	28	3	LI	18	2	1
23	8	LI	1	3	s	28	4	LI	18	2	4
24	1	GF	2	1	s	28	5	LI	18	2	3
24	2	GF	2	1	s	28	6	LI	18	2	5
24	3	GF	2	2	10	28	7	LI	18	2	5
24	4	GF	2	2	6	28	8	LI	18	2	1
24	5	GF	2	2	7	28	9	LI	18	2	1
24	6	GF	2	2	8	28	10	LI	18	2	2
24	7	GF	2	2	9	28	11	LI	18	3	s
24	8	GF	2	3	s	28	12	LI	18	3	s
25	1	HD	12	1	s	29	1	HD	4	1	s
25	2	HD	12	1	s	29	2	HD	4	1	s
25	3	HD	12	2	15	29	3	HD	4	2	13
25	4	HD	12	2	11	29	4	HD	4	2	14
25	5	HD	12	2	12	29	5	HD	4	2	15
25	6	HD	12	2	13	29	6	HD	4	2	11
25	7	HD	12	2	14	29	7	HD	4	2	12
25	8	HD	12	2	15	29	8	HD	4	3	s
25	9	HD	12	2	11	30	1	GF	11	1	s
25	10	HD	12	2	12	30	2	GF	11	1	s
25	11	HD	12	3	s	30	3	GF	11	2	7
25	12	HD	12	3	s	30	4	GF	11	2	6
26	1	LI	6	1	s	30	5	GF	11	2	10
26	2	LI	6	1	s	30	6	GF	11	2	9
26	3	LI	6	2	2	30	7	GF	11	2	8
26	4	LI	6	2	5	30	8	GF	11	3	s
26	5	LI	6	2	2	31	1	LI	10	1	s
26	6	LI	6	2	2	31	2	LI	10	1	s
26	7	LI	6	2	1	31	3	LI	10	2	2
26	8	LI	6	3	s	31	4	LI	10	2	3
						31	5	LI	10	2	3
						31	6	LI	10	2	2
						31	7	LI	10	2	3
						31	8	LI	10	3	s

Plot	Row	Breed	TRt #	subplot	Family	Plot	Row	Breed	TRt #	subplot	Family
32	1	HD	5	1	s	35	1	GF	8	1	s
32	2	HD	5	1	s	35	2	GF	8	1	s
32	3	HD	5	2	13	35	3	GF	8	2	8
32	4	HD	5	2	14	35	4	GF	8	2	9
32	5	HD	5	2	15	35	5	GF	8	2	10
32	6	HD	5	2	11	35	6	GF	8	2	6
32	7	HD	5	2	12	35	7	GF	8	2	7
32	8	HD	5	3	s	35	8	GF	8	2	8
33	1	LI	16	1	s	35	9	GF	8	2	8
33	2	LI	16	1	s	35	10	GF	8	2	9
33	3	LI	16	2	1	35	11	GF	8	3	s
33	4	LI	16	2	5	35	12	GF	8	3	s
33	5	LI	16	2	5	36	1	GF	14	1	s
33	6	LI	16	2	4	36	2	GF	14	1	s
33	7	LI	16	2	5	36	3	GF	14	2	8
33	8	LI	16	3	s	36	4	GF	14	2	9
34	1	HD	17	1	s	36	5	GF	14	2	10
34	2	HD	17	1	s	36	6	GF	14	2	6
34	3	HD	17	2	13	36	7	GF	14	2	7
34	4	HD	17	2	14	36	8	GF	14	3	s
34	5	HD	17	2	15						
34	6	HD	17	2	11						
34	7	HD	17	2	12						
34	8	HD	17	3	s						

*=Rows number from North East corner of plot.

** s = GF 28 seedling.

APPENDIX 5: FR 439 – TAHAROA FAMILY ALLOCATION

Plot	TRt #	subplot	Family	# trees	Plot	TRt #	subplot	Family	# trees
1	11	1	7	19	7	15	1	3	17
1	11	1	6	19	7	15	1	4	17
1	11	2	8	19	7	15	2	2	17
1	11	2	9	19	7	15	2	1	17
1	11	2	8	19	7	15	2	3	17
1	11	2	6	19	7	15	2	4	17
1	11	2	7	19	7	15	2	1	17
1	11	3	9	19	7	15	2	2	17
2	10	1	10	13	7	15	2	5	17
2	10	1	6	13	7	15	2	5	17
2	10	2	10	13	7	15	3	4	17
2	10	2	8	13	7	15	3	3	17
2	10	2	7	13	8	5	1	1	19
2	10	2	10	13	8	5	1	2	19
2	10	2	9	13	8	5	2	1	19
2	10	3	6	13	8	5	2	4	19
3	1	1	8	13	8	5	2	2	19
3	1	1	7	13	8	5	2	3	19
3	1	2	6	13	8	5	2	5	19
3	1	2	10	13	8	5	3	3	19
3	1	2	8	13	9	13	1	2	13
3	1	2	9	13	9	13	1	3	13
3	1	2	7	13	9	13	2	1	13
3	1	3	9	13	9	13	2	3	13
4	2	1	10	19	9	13	2	2	13
4	2	1	6	19	9	13	2	4	13
4	2	2	8	19	9	13	2	5	13
4	2	2	10	19	9	13	3	4	13
4	2	2	9	19	10	6	1	1	17
4	2	2	6	19	10	6	1	2	17
4	2	2	7	19	10	6	2	4	17
4	2	3	7	19	10	6	2	5	17
5	3	1	9	13	10	6	2	4	17
5	3	1	8	13	10	6	2	3	17
5	3	2	10	13	10	6	2	1	17
5	3	2	8	13	10	6	2	3	17
5	3	2	6	13	10	6	2	5	17
5	3	2	7	13	10	6	2	2	17
5	3	2	6	13	10	6	3	1	17
5	3	3	9	13	10	6	3	5	17
6	12	1	6	19	11	14	1	2	17
6	12	1	10	19	11	14	1	3	17
6	12	2	9	19	11	14	2	4	17
6	12	2	10	19	11	14	2	4	17
6	12	2	6	19	11	14	2	1	17
6	12	2	7	19	11	14	2	1	17
6	12	2	8	19	11	14	2	5	17
6	12	3	7	19	11	14	2	3	17
					11	14	2	2	17
					11	14	2	5	17
					11	14	3	3	17
					11	14	3	2	17

APPENDIX 5 (CONT): FR 439 – TAHAROA. FAMILY ALLOCATION

Plot	TRt #	subplot	Family	# trees	Plot	TRt #	subplot	Family	# trees
12	4	1	4	17	17	16	1	12	13
12	4	1	5	17	17	16	1	11	13
12	4	2	2	17	17	16	2	13	13
12	4	2	2	17	17	16	2	15	13
12	4	2	1	17	17	16	2	12	13
12	4	2	1	17	17	16	2	11	13
12	4	2	5	17	17	16	2	14	13
12	4	2	1	17	17	16	3	13	13
12	4	2	3	17	18	18	1	15	17
12	4	2	4	17	18	18	1	14	17
12	4	3	3	17	18	18	2	11	17
12	4	3	4	17	18	18	2	12	17
13	8	1	11	19	18	18	2	11	17
13	8	1	12	19	18	18	2	15	17
13	8	2	13	19	18	18	2	13	17
13	8	2	14	19	18	18	2	13	17
13	8	2	11	19	18	18	2	14	17
13	8	2	13	19	18	18	2	12	17
13	8	2	12	19	18	18	3	15	17
13	8	3	14	19	18	18	3	14	17
14	17	1	11	19	19	12	1	7	13
14	17	1	15	19	19	12	1	6	13
14	17	2	15	19	19	12	2	8	13
14	17	2	15	19	19	12	2	8	13
14	17	2	13	19	19	12	2	7	13
14	17	2	14	19	19	12	2	9	13
14	17	2	12	19	19	12	2	10	13
14	17	3	11	19	19	12	3	9	13
15	9	1	12	17	20	2	1	10	13
15	9	1	13	17	20	2	1	6	13
15	9	2	15	17	20	2	2	7	13
15	9	2	11	17	20	2	2	8	13
15	9	2	14	17	20	2	2	10	13
15	9	2	14	17	20	2	2	10	13
15	9	2	11	17	20	2	2	9	13
15	9	2	12	17	20	2	3	6	13
15	9	2	13	17	21	11	1	7	19
15	9	2	15	17	21	11	1	8	19
15	9	3	12	17	21	11	2	10	19
15	9	3	13	17	21	11	2	7	19
16	7	1	14	13	21	11	2	9	19
16	7	1	15	13	21	11	2	8	19
16	7	2	14	13	21	11	2	6	19
16	7	2	15	13	21	11	3	9	19
16	7	2	11	13	22	1	1	6	13
16	7	2	13	13	22	1	1	10	13
16	7	2	12	13	22	1	2	6	13

APPENDIX 5 (CONT): FR 439 – TAHAROA FAMILY ALLOCATION

Plot	TRt #	subplot	Family	# trees	Plot	TRt #	subplot	Family	# trees
16	7	3	11	13	22	1	2	9	13
					22	1	2	7	13
					22	1	2	8	13
					22	1	2	10	13
					22	1	3	7	13
23	10	1	9	13	28	5	1	4	19
23	10	1	8	13	28	5	1	5	19
23	10	2	8	13	28	5	2	3	19
23	10	2	6	13	28	5	2	4	19
23	10	2	10	13	28	5	2	5	19
23	10	2	6	13	28	5	2	2	19
23	10	2	7	13	28	5	2	1	19
23	10	3	9	13	28	5	3	1	19
24	3	1	6	17	29	13	1	3	17
24	3	1	10	17	29	13	1	2	17
24	3	2	9	17	29	13	2	4	17
24	3	2	10	17	29	13	2	5	17
24	3	2	6	17	29	13	2	4	17
24	3	2	9	17	29	13	2	2	17
24	3	2	7	17	29	13	2	2	17
24	3	2	8	17	29	13	2	5	17
24	3	2	7	17	29	13	2	3	17
24	3	2	8	17	29	13	2	1	17
24	3	3	9	17	29	13	3	3	17
24	3	3	10	17	29	13	3	4	17
25	14	1	5	19	30	4	1	1	13
25	14	1	1	19	30	4	1	5	13
25	14	2	2	19	30	4	2	3	13
25	14	2	1	19	30	4	2	3	13
25	14	2	5	19	30	4	2	2	13
25	14	2	2	19	30	4	2	4	13
25	14	2	3	19	30	4	2	2	13
25	14	3	4	19	30	4	3	5	13
26	6	1	2	17	31	8	1	12	19
26	6	1	1	17	31	8	1	11	19
26	6	2	5	17	31	8	2	14	19
26	6	2	5	17	31	8	2	13	19
26	6	2	1	17	31	8	2	13	19
26	6	2	2	17	31	8	2	11	19
26	6	2	4	17	31	8	2	12	19
26	6	2	3	17	31	8	3	14	19
26	6	2	4	17	32	16	1	15	13
26	6	2	3	17	32	16	1	11	13
26	6	3	1	17	32	16	2	15	13
26	6	3	5	17	32	16	2	14	13
27	15	1	2	17	32	16	2	12	13
27	15	1	3	17	32	16	2	13	13
27	15	2	3	17	32	16	2	15	13

27	15	2	5	17	32	16	3	11	13
27	15	2	4	17	33	17	1	12	19
27	15	2	1	17	33	17	1	13	19
27	15	2	4	17	33	17	2	12	19
27	15	2	1	17	33	17	2	11	19
27	15	2	2	17	33	17	2	15	19
27	15	2	5	17	33	17	2	13	19
27	15	3	2	17	33	17	2	14	19
27	15	3	3	17	33	17	3	14	19

APPENDIX 5 (CONT): FR 439 – TAHAROA. FAMILY ALLOCATION

Plot	TRt #	subplot	Family	# trees
34	9	1	15	17
34	9	1	11	17
34	9	2	14	17
34	9	2	13	17
34	9	2	15	17
34	9	2	14	17
34	9	2	11	17
34	9	2	12	17
34	9	2	12	17
34	9	2	13	17
34	9	3	14	17
34	9	3	15	17
35	7	1	11	19
35	7	1	12	19
35	7	2	12	19
35	7	2	11	19
35	7	2	14	19
35	7	2	13	19
35	7	2	15	19
35	7	3	13	19
36	18	1	15	17
36	18	1	14	17
36	18	2	13	17
36	18	2	11	17
36	18	2	13	17
36	18	2	11	17
36	18	2	15	17
36	18	2	12	17
36	18	2	14	17
36	18	2	12	17
36	18	3	15	17
36	18	3	14	17

APPENDIX 6: FR440 WAIMAHAKA SEEDLOT ALLOCATION

Plot	TRt #	subplot	Family	#trees		Plot	TRt #	subplot	Family	#trees	
1	3	1	6	14		5	15	1	5	17	
1	3	1	7	14		5	15	1	1	17	
1	3	2	6	14		5	15	2	3	17	
1	3	2	10	15		5	15	2	1	17	
1	3	2	8	16		5	15	2	5	17	
1	3	2	8	16		5	15	2	2	17	
1	3	2	7	16		5	15	2	3	17	
1	3	2	9	16		5	15	2	2	17	
1	3	2	7	16		5	15	2	1	17	
1	3	2	6	14		5	15	2	4	17	
1	3	3	6	14		5	15	3	3	17	
1	3	3	20	17		5	15	3	2	17	
2	5	1	1	19		6	2	1	7	16	
2	5	1	2	19		6	2	1	8	16	
2	5	2	2	19		6	2	2	7	19	
2	5	2	4	19		6	2	2	10	17	
2	5	2	3	19		6	2	2	9	18	
2	5	2	1	19		6	2	2	6	16	
2	5	2	5	19		6	2	2	8	19	
2	5	3	5	19		6	2	3	7	16	
3	18	1	12	17		7	9	1	13	17	
3	18	1	11	14		7	9	1	14	17	
3	18	2	11	14		7	9	2	15	17	
3	18	2	13	17		7	9	2	15	17	
3	18	2	15	17		7	9	2	12	17	
3	18	2	12	17		7	9	2	11	14	
3	18	2	12	17		7	9	2	14	17	
3	18	2	14	17		7	9	2	11	14	
3	18	2	11	14		7	9	2	13	17	
3	18	2	13	17		7	9	2	14	17	
3	18	3	15	17		7	9	3	12	17	
3	18	3	14	14		7	9	3	13	17	
4	14	1	4	19		8	16	1	15	13	
4	14	1	3	19		8	16	1	11	11	
4	14	2	2	19		8	16	2	11	11	
4	14	2	5	19		8	16	2	12	13	
4	14	2	4	19		8	16	2	13	13	
4	14	2	1	19		8	16	2	15	13	
4	14	2	3	19		8	16	2	14	13	
4	14	3	1	19		8	16	3	14	13	

APPENDIX 6 (CONT): FR440 WAIMAHAKA SEEDLOT ALLOCATION

Plot	TRt #	subplot	Family	#trees		Plot	TRt #	subplot	Family	#trees
9	12	1	6	14		13	17	1	14	19
9	12	1	20	14		13	17	1	14	19
9	12	2	10	15		13	17	2	15	19
9	12	2	8	16		13	17	2	14	19
9	12	2	6	14		13	17	2	11	16
9	12	2	6	14		13	17	2	13	19
9	12	2	10	15		13	17	2	12	19
9	12	2	6	16		13	17	3	11	16
9	12	2	8	17		14	7	1	14	13
9	12	2	9	16		14	7	1	12	13
9	12	3	20	17		14	7	2	14	13
9	12	3	20	17		14	7	2	11	11
10	13	1	2	13		14	7	2	12	13
10	13	1	3	13		14	7	2	15	13
10	13	2	3	13		14	7	2	13	13
10	13	2	2	13		14	7	3	12	13
10	13	2	1	13		15	1	1	20	13
10	13	2	5	13		15	1	1	7	11
10	13	2	4	13		15	1	2	10	12
10	13	3	4	13		15	1	2	6	13
11	8	1	12	19		15	1	2	8	13
11	8	1	13	19		15	1	2	9	11
11	8	2	13	19		15	1	2	7	13
11	8	2	14	19		15	1	3	6	11
11	8	2	12	19		16	10	1	6	11
11	8	2	15	19		16	10	1	7	11
11	8	2	11	16		16	10	2	6	13
11	8	3	14	19		16	10	2	8	13
12	11	1	7	16		16	10	2	10	12
12	11	1	8	16		16	10	2	9	11
12	11	2	8	16		16	10	2	7	13
12	11	2	6	16		16	10	3	7	11
12	11	2	7	19		17	4	1	5	13
12	11	2	10	18		17	4	1	4	13
12	11	2	9	16		17	4	2	3	13
12	11	3	7	19		17	4	2	1	13
						17	4	2	5	13
						17	4	2	4	13
						17	4	2	2	13
						17	4	3	5	13

APPENDIX 6 (CONT): FR440 WAIMAHAKA SEEDLOT ALLOCATION

Plot	TRt #	subplot	Family	#trees		Plot	TRt #	subplot	Family	#trees
18	6	1	2	17		22	15	1	1	17
18	6	1	1	17		22	15	1	5	17
18	6	2	4	17		22	15	2	2	17
18	6	2	4	17		22	15	2	4	17
18	6	2	2	17		22	15	2	4	17
18	6	2	5	17		22	15	2	5	17
18	6	2	5	17		22	15	2	3	17
18	6	2	3	17		22	15	2	2	17
18	6	2	1	17		22	15	2	1	17
18	6	2	1	17		22	15	2	3	17
18	6	3	2	17		22	15	3	5	17
18	6	3	1	17		22	15	3	4	17
19	7	1	13	13		23	1	1	8	11
19	7	1	14	13		23	1	1	8	11
19	7	2	11	11		23	1	2	8	13
19	7	2	14	13		23	1	2	10	12
19	7	2	13	13		23	1	2	6	13
19	7	2	12	13		23	1	2	7	12
19	7	2	15	13		23	1	2	9	12
19	7	3	13	13		23	1	3	8	11
20	13	1	4	13		24	2	1	6	16
20	13	1	3	13		24	2	1	20	19
20	13	2	3	13		24	2	2	8	16
20	13	2	2	13		24	2	2	10	18
20	13	2	4	13		24	2	2	8	16
20	13	2	5	13		24	2	2	6	16
20	13	2	1	13		24	2	2	20	19
20	13	3	3	13		24	2	3	7	16
21	9	1	14	17		25	12	1	8	14
21	9	1	15	17		25	12	1	7	14
21	9	2	13	17		25	12	1	6	17
21	9	2	14	17		25	12	2	7	16
21	9	2	14	17		25	12	2	10	16
21	9	2	11	14		25	12	2	6	13
21	9	2	15	17		25	12	2	7	16
21	9	2	12	17		25	12	2	8	17
21	9	2	12	17		25	12	2	8	17
21	9	2	13	17		25	12	2	10	16
21	9	3	15	17		25	12	3	6	14
21	9	3	14	17		25	12	3	20	17

APPENDIX 6 (CONT): FR440 WAIMAHAKA SEEDLOT ALLOCATION

Plot	TRt #	subplot	Family	#trees		Plot	TRt #	subplot	Family	#trees
26	6	1	2	17		29	4	1	5	13
26	6	1	3	17		29	4	1	4	13
26	6	2	5	17		29	4	2	5	13
26	6	2	2	17		29	4	2	2	13
26	6	2	4	17		29	4	2	1	13
26	6	2	1	17		29	4	2	3	13
26	6	2	2	17		29	4	2	4	13
26	6	2	5	17		29	4	3	3	13
26	6	2	3	17		30	11	1	7	16
26	6	2	1	17		30	11	1	6	16
26	6	3	1	17		30	11	2	6	16
26	6	3	2	17		30	11	2	8	15
27	3	1	6	14		30	11	2	10	18
27	3	1	20	17		30	11	2	8	16
27	3	2	10	16		30	11	2	7	16
27	3	2	6	17		30	11	3	20	19
27	3	2	8	17		31	10	1	8	11
27	3	2	7	13		31	10	1	7	11
27	3	2	7	16		31	10	2	6	11
27	3	2	10	16		31	10	2	8	13
27	3	2	10	16		31	10	2	6	13
27	3	2	10	16		31	10	2	10	12
27	3	3	7	14		31	10	2	7	12
27	3	3	8	14		31	10	3	20	13
28	18	1	12	17		32	5	1	1	19
28	18	1	13	17		32	5	1	2	19
28	18	2	13	17		32	5	2	3	19
28	18	2	12	17		32	5	2	4	19
28	18	2	11	14		32	5	2	5	19
28	18	2	15	17		32	5	2	2	19
28	18	2	14	17		32	5	2	1	19
28	18	2	15	17		32	5	3	4	19
28	18	2	11	14		33	16	1	14	13
28	18	2	12	17		33	16	1	15	13
28	18	3	14	17		33	16	2	15	13
28	18	3	12	17		33	16	2	11	11

APPENDIX 6 (CONT): FR440 WAIMAHAKA SEEDLOT ALLOCATION.

Plot	TRt #	subplot	Family	#trees
34	17	1	14	19
34	17	2	11	16
34	17	2	15	19
34	17	2	12	19
34	17	2	13	19
34	17	2	14	19
34	17	3	14	19
35	8	1	14	19
35	8	1	13	19
35	8	2	12	19
35	8	2	14	19
35	8	2	11	16
35	8	2	14	19
35	8	2	13	19
35	8	3	15	19
36	14	1	4	19
36	14	1	3	19
36	14	2	1	19
36	14	2	4	19
36	14	2	3	19
36	14	2	5	19
36	14	2	2	19
36	14	3	5	19