

**NEW GENERATION TOPPLING TRIALS  
FOR WINCHING — ESTABLISHMENT REPORT**

**J.D. Tombleson**

**Report No. 72**

**UPDATED November 2000**

**FOREST & FARM PLANTATION  
MANAGEMENT COOPERATIVE**

# **FOREST & FARM PLANTATION MANAGEMENT COOPERATIVE**

## **EXECUTIVE SUMMARY**

### **NEW GENERATION TOPPLING TRIALS FOR WINCHING — ESTABLISHMENT REPORT**

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This updated report documents the establishment of nine new generation toppling trials for winching. The first trial was established at Horohoro, Rotorua in 1998, a further five trials were established in 1999 located at Kaukapakapa, Tauranga, Kaingaroa, Wairoa and Beaumont and three further trials were established in 2000 located at Rotorua, Mosgiel and Invercargill. Each trial incorporates bare-root seedlings and aged cuttings. Container-grown cuttings have been incorporated into the Kaukapakapa and Tauranga trials. Treatments for testing include; soil cultivation, planting quality, depth of planting and weed control. The static force required to topple each treatment will be quantified using a mini-winch and load cell. Trees will be winched at one, two and/or three years of age in both dry and wet soil conditions. A total of 5 418 trees have been established for winching. Results will quantify the contribution (if any) that each treatment has on the juvenile stability of radiata pine plant types tested across a range of soil types. The longer-term aim is to predict juvenile tree failure based on a digital terrain model.

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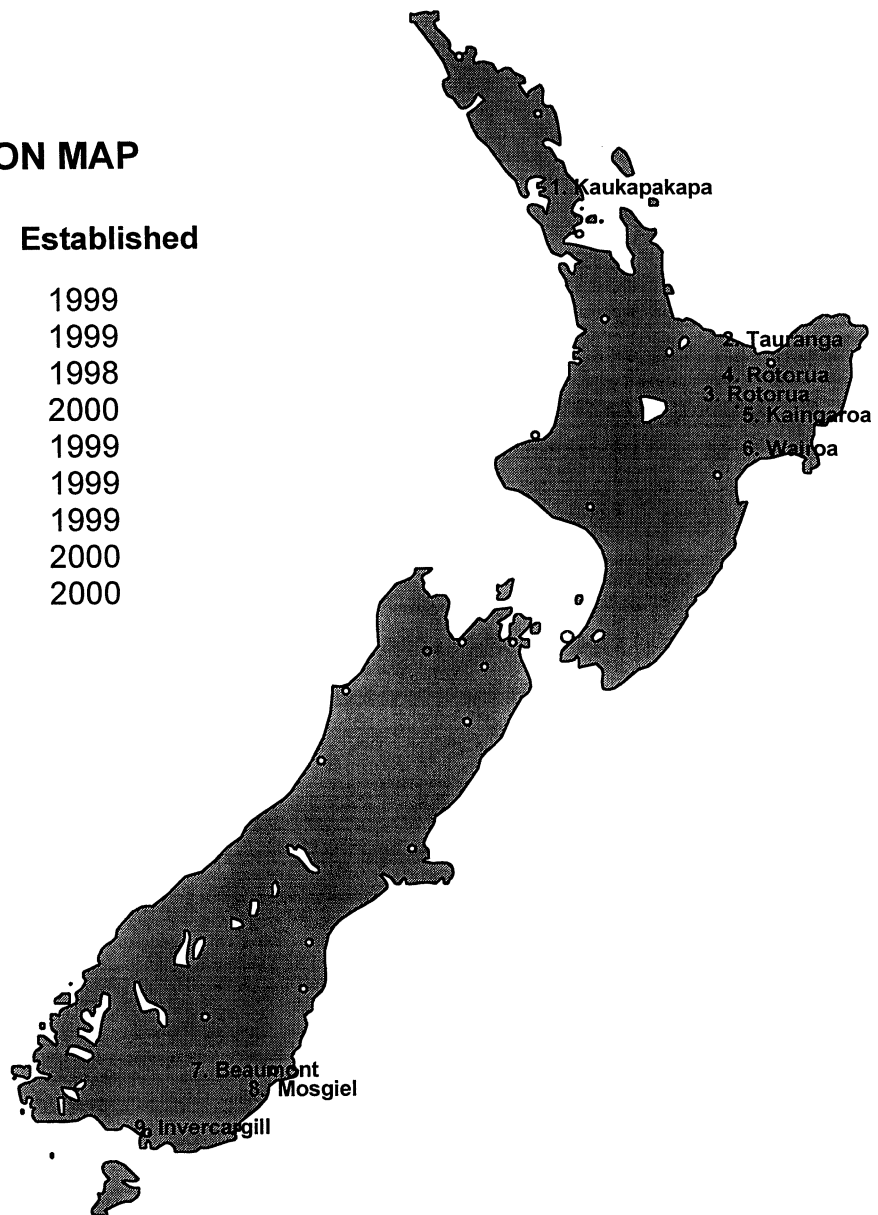
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## TRIAL LOCATION MAP

No.	Location	Established
1.	Kaukapakapa	1999
2.	Tauranga	1999
3.	Rotorua	1998
4.	Rotorua	2000
5.	Kaingaroa	1999
6.	Wairoa	1999
7.	Beaumont	1999
8.	Mosgiel	2000
9.	Invercargill	2000





SUMMARY - No OF TREES PER TREATMENT/SITE																						
Location	Year Estab	CONTROL			CULTIVATED			LESS WEED CTRL			SHALLOW PLANT			DEEP PLANT			SWEPT			SLIT & STUFF		
		Seedlings Bare-root	Cuttings Bare-root	Cuttings Container	Seedlings Bare-root	Cuttings Bare-root	Cuttings Container	Seedlings Bare-root	Cuttings Bare-root	Cuttings Bare-root	Seedlings Bare-root	Cuttings Bare-root	Cuttings Bare-root	Seedlings Bare-root	Cuttings Bare-root	Cuttings Bare-root	Seedlings Bare-root	Cuttings Bare-root	Seedlings Bare-root	Cuttings Bare-root		
Rotorua	1998	80	80					80	80										80	80		
Kaukapakapa	1999	132	132	99	132	132	99	80	80		80	80		80	80		80	80	80	80		
Tauranga	1999	120	120	120			120				44	44		44	44		44	44	44	44		
Kaingaroa	1999	176	176		176	176					176	176										
Wairoa	1999	92	92		92	92					92	92		44	44		44	44	44	44		
Beaumont	1999	176	176																			
Rotorua	2000	132	264		132	264																
Mosgiel	2000	132	132																			
Invercargill	2000	132	132																			
TOTALS		1172	1304	219	400	400	99	160	160	168	168	168	168	168	168	168	168	248	248	248		

**Total of 5,418 trees**

## **TOPPLING RESEARCH — ONGOING PROGRAMME OUTLINE**

### **BACKGROUND**

Toppling trials established in 1996, funded by the cooperative and FRST were aimed at evaluating a range of treatments to reduce the incidence of toppling. The treatments included severe lateral root trimming, topping, and crown lightening. Trials were also established to evaluate any effects of genetic improvement on the stability of radiata pine. Despite twelve trials being deliberately located on highly topple prone sites, only one site experienced a wind storm event.

It is now hypothesised that trees have a topple trigger point. Topple is believed to occur when one or more of the following factors are exceeded: wind force, tree size/permeability, critical site and establishment factors.

It has been realised that given the considerable resources invested in toppling trials, relying on natural random storm events to test the treatments is ineffective. It is acknowledged that when a storm event does hit, its velocity is unquantified, and therefore its force in relation to the topple trigger point unknown. In summary nature is considered an ineffective mechanism to evaluate toppling treatments.

A more effective means of quantifying factors likely to influence topple is to adopt a mechanistic approach.

### **OBJECTIVE**

The first stage will quantify the effects of plant type, tree size, permeability and critical site & establishment factors on the resistance of radiata pine to topple. In stage two this information is to be used to develop a digital based terrain model that will predict the incidence and severity of topple. The development of a juvenile tree failure model is to be based on the tree failure prototype model which has already been developed by John Moore. A spin-off from this project will be the development of national planting standards.

### **CURRENT STATUS**

As at the Cooperative meeting November 2000, nine new generation winching trials have been established incorporating over 5 400 trees. Trials established in 1998, 1999 and 2000 are aimed at quantifying the effect of the following factors on the resistance to topple:

- ◆ Plant type
- ◆ Tree size
- ◆ Soil type
- ◆ Soil moisture content
- ◆ Planting quality
- ◆ Planting depth
- ◆ Weed control
- ◆ Cultivation

## **ONGOING WORK**

It is anticipated that over the next two to three years the following tasks will be completed with ongoing funding from FRST and the Forest & Farm Plantation Management Cooperative:

### **Winching**

The static resistance of each of the treatments listed above will be quantified using a mini winch and load cell. This task will be time consuming as the trials are designed to yield trees over a range of ages and size, all of which require winching.

### **Root Excavations/Biomass/Root Architecture**

Above and below ground tree biomass allocation and root architectural characteristics of one-year radiata pine from the Tauranga Winching Trial will be completed during 2001. The results from these trees will compliment data collected from the two-year old trees assessed at the Taranaki Toppling Trial. No further root studies are anticipated.

### **Stem Stiffness**

The contribution of stem stiffness to resistance to topple may be considerable. It is proposed that stem stiffness across a range of diameter classes and plant types be quantified using a standard laboratory approach.

### **Conversion of Static to Dynamic Resistance**

A winch is to be used to quantify the static resistance of the various treatments. In reality toppling occurs during wind events of several hours, days or sometimes weeks. In practice toppling is a dynamic process which can involve swaying and damping of the stem and possibly associated socketing. The applied static force is an exaggerated value and thus reduction factors need to be applied to enable the calculation of the dynamic force causing stem movement during wind events.

### **Quantifying Applied Forces**

Forces applied during winching are termed applied forces and are representative of the wind force. Other important forces to be quantified can be termed the resistive forces and are related to the frontal area and are influenced by plant type, tree size and permeability. Another resistive force to be quantified is the *drag coefficient* and will most likely be obtained using a wind tunnel. The influence of water (rainfall) and possibly snow on the drag coefficient will also be investigated.

## KAUKAPAKAPA

**Location:** Tuhirangi Road, Kaukapakapa, Helensville

**Contact Person:** Rob Webster, Arbor Management Ltd, Parnell. Ph 09 529 3626

**Established:** September 1999

**Forest:** Tassenburg Forest

**Site Characteristics:** Winter **wet**, fertile, ex-farm site. Thick clay loam overlaying heavy clay. Prime toppling clay soils. The chance of winching this trial before nature topples it first may be slim.

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	98/464
	Cuttings Aged bare-root	GF 27	92/195
	Container-grown cuttings	GF 25 (juv.)	Ex-FORENZA

**Establishment Details:** Ripper/mounding was done with a D7 bulldozer with a 10cm single winged-rip to a depth of 75cm. A single disc on each side of the ripper cultivated and turned the soil back over the rip, allowing planting to occur over the rip line, after the top soil had settled.

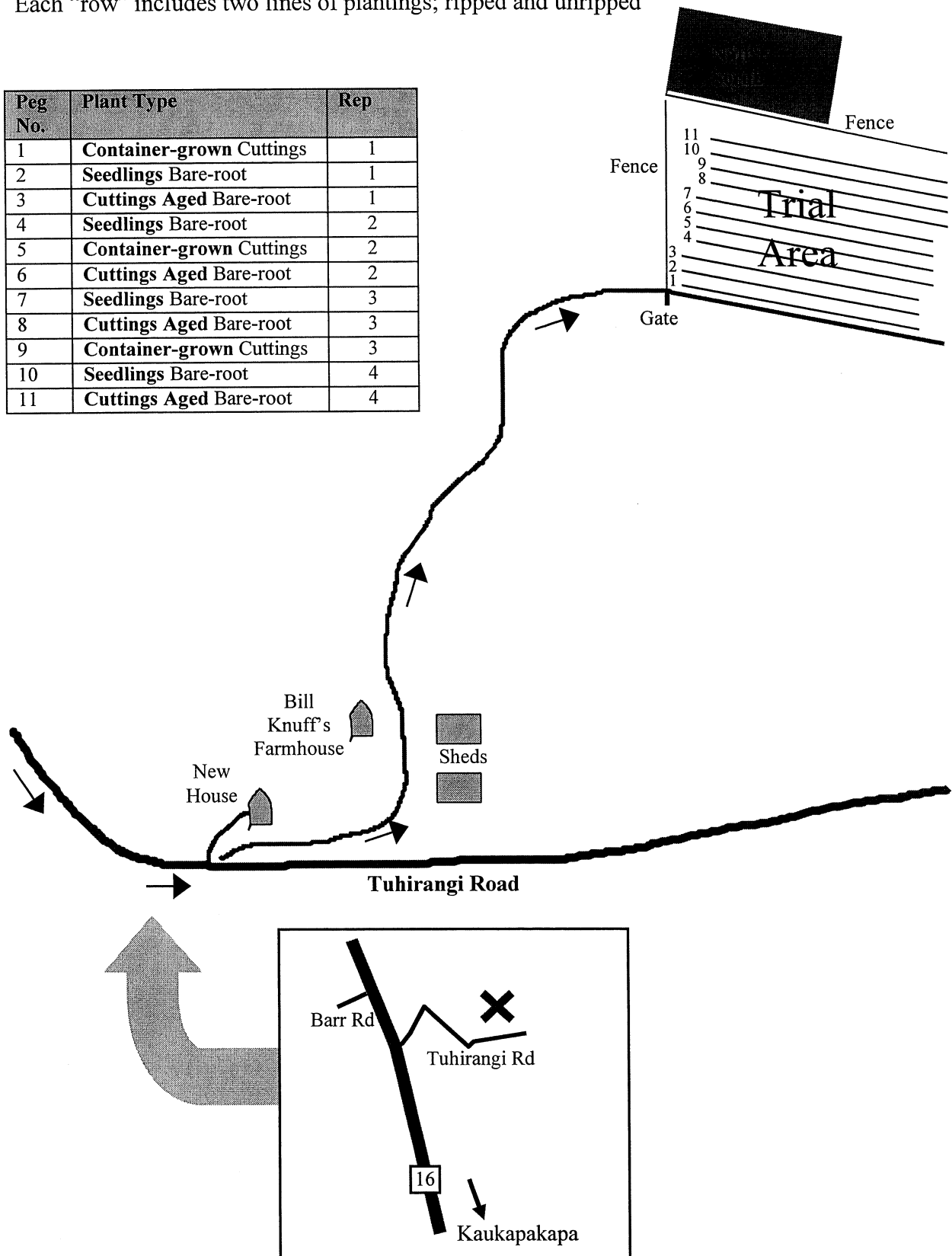
Planting of the trial (and plantation) was purposefully late to ensure soil conditions were not too wet.

The trial trees were planted in the rips mid-way between the existing plantation trees, while the control trees were planted along side on the (non-cultivated) bare ground. Care was taken to ensure the trees were paired to allow for latter identification of the trial versus the existing plantation grown trees.

All trees were post-plant released with *Valzine* herbicide

Trial established by Jeff Tombleson, John Barker and Barry Penellum  
 Tree spacing in block before trial established- 5m between rows, 3m within rows  
 Each "row" includes two lines of plantings; ripped and unripped

Peg No.	Plant Type	Rep
1	Container-grown Cuttings	1
2	Seedlings Bare-root	1
3	Cuttings Aged Bare-root	1
4	Seedlings Bare-root	2
5	Container-grown Cuttings	2
6	Cuttings Aged Bare-root	2
7	Seedlings Bare-root	3
8	Cuttings Aged Bare-root	3
9	Container-grown Cuttings	3
10	Seedlings Bare-root	4
11	Cuttings Aged Bare-root	4



# WINCHING TRIAL - Kaukapakapa, Established 1999

			NON-RIPPED (Control)	RIPPED
<b>SEEDLINGS Bare-Root</b>	Age 1 Assessment	Dry Soil	44	44
	Age 2 Assessment	Dry Soil	44	44
		Wet Soil	44	44
<b>CUTTINGS Bare-Root</b>	Age 1 Assessment	Dry Soil	44	44
	Age 2 Assessment	Dry Soil	44	44
		Wet Soil	44	44
<b>CUTTINGS Container-Grown</b>	Age 1 Assessment	Dry Soil	33	33
	Age 2 Assessment	Dry Soil	33	33
		Wet Soil	33	33

Four replications of the bare-root seedlings and cuttings were established

Three replications of the container-grown cuttings were established (due to limited tree stocks)

Sample size for winching based on 40 trees for the bare-root plant types (4 extra trees planted per sample) and 33 tree sample for the container-grown plant type



Kaukapakapa Trial site soon after ripping and mounding. Trial was established in top left of photo.

## TAURANGA

**Location:** Kaiwha Road, Welcome Bay, Tauranga

**Forest Owner:** Nga Peke A2B Trust/Welcome Bay Forest Partnership

**Contact Person:** Jim Gray, Rotorua, Ph 348 3323

**Established:** September 1999

**Site Characteristics:** Fertile ex-farm site. Warm, coastal Bay of Plenty site with excellent tree growth.

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	98/464
	Cuttings Aged bare-root	GF 27	92/195
	Container-grown cuttings	GF 25 (juv.)	Ex-FORENZA

**Establishment details:** Trees were planted in separate rows mid-way between existing plantation rows which resulted in a tree spacing of approximately 5 x 2m.

Trees received two herbicide applications except for the 'less weed control' which did not receive the second application for summer grasses and *paspalum*.



Tauranga Toppling Trial established 1999. Photo taken Jan 2000, tree age -four months.



# WINCHING TRIAL - Tauranga, Established 1999

		Control	Less Weed Ctrl	Shallow Plant	Deep Plant	Slit & Stuff	Swept
	<b>TREATMENT CODE</b>	<b>S1</b>	<b>S2</b>	<b>S6</b>	<b>S5</b>	<b>S4</b>	<b>S3</b>
<b>SEEDLINGS</b> <b>Bare-Root</b>	Age 1 Assessment	40	40	40	40	40	40
	Wet Soil						
	Age 2 Assessment	40	40	40	40	40	40
	Wet Soil	40					
	<b>TREATMENT CODE</b>	<b>C1</b>	<b>C2</b>	<b>C6</b>	<b>C5</b>	<b>C4</b>	<b>C3</b>
<b>CUTTINGS</b> <b>Bare-Root</b>	Age 1 Assessment	40	40	40	40	40	40
	Wet Soil						
	Age 2 Assessment	40	40	40	40	40	40
	Wet Soil	40					
	<b>TREATMENT CODE</b>	<b>Cont 1</b>					
<b>CUTTINGS</b> <b>Container-grown</b>	Age 1 Assessment	40					
	Wet Soil						
	Age 2 Assessment	40					
	Wet Soil	40					

Sample size for winching based on 40 trees per treatment (plus 4 extras planted for insurance)

Each treatment contains 80 trees. Four replications each of 20 trees (plus 2 extras)

Control (Treatment 1) contains 30/trees per rep to allow for a treatment involving winching in wet soil conditions

**Plant Type**  
**S** Seedling  
**C** Cutting  
**Cont** Container

**Treatments**  
**1** Control  
**2** Less weed control  
**3** Swept roots  
**4** Slit & stuff  
**5** Deep plant  
**6** Shallow plant

## TAURANGA TRIAL LAY-OUT

**Rep 1**  
**TRT** **Peg No.**

S 6	113
C 4	114
C 3	115
S 5	116
S 4	117
C 5	118
Cont 1	119
Cont 1	Blank
S 1	120
S 1	Blank
C 2	121
C 1	122
C 1	Blank
S 2	123
S 3	124
C 6	125

**Rep 3**  
**TRT** **Peg No.**

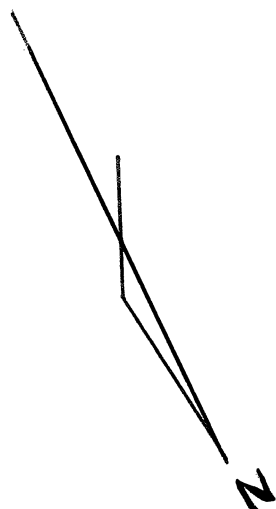
S 1	26
S 2	25
S 6	24
C 1	23
S 4	22
Cont 1	21
S 3	20
S 5	19
C 5	18
C 3	17
C 2	16
C 6	15
C 4	14

**Rep 2**  
**TRT** **Peg No.**

C 1	13
S 4	12
Cont 1	11
S 2	10
C 6	9
C 5	8
S 5	7
C 4	6
S 6	5
S 1	4
S 3	3
C 2	2
C 3	1

**Rep 4**  
**TRT** **Peg No**

S 6	100
C 2	101
C 5	102
C 3	103
S 1	104
S 5	105
S 2	106
Cont 1	107
S 4	108
C 6	109
C 4	110
C 1	111
S 3	112



## **ROTORUA**

**Location:** Keroa Road, off Apirana Road, Horohoro

**Forest Owner:** Horohoro Trust / Horohoro Forest Investment Ltd

**Established:** September 1998

**Site Characteristics:** Ex-farm site

**Tree Stocks:** Seedlings bare-root  
Cuttings Aged bare-root

WINCHING TRIAL - Horohoro, Established 1998

Treatment No		1		2		3	
		Well Planted		Less Weed Control		Slit & Stuff Weed Control	
SEEDLINGS	Age 1 Assess	Weed Control		Weed Control		Weed Control	
		15	10	15	10	15	10
	Age 2 Assess	15		15		15	
		15	10	15	10	15	10
CUTTINGS	Age 1 Assess	Weed Control		Weed Control		Weed Control	
		15	10	15	10	15	10
	Age 2 Assess	15		15		15	
		15	10	15	10	15	10
E. nitens	Age 1 Assess	15	10				
	Age 2 Assess	15	10				
C. lusitanica	Age 1 Assess	15	10				
	Age 2 Assess	15	10				

Factorial Design - four factors

- 3 Treatments
  - 2 Plant Types
  - 2 Ages
  - 2 Soil Moisture Contents
- 15 = trees for winching  
10 = trees for excavation
- 240 Seedlings bare-root  
240 Cuttings bare-root

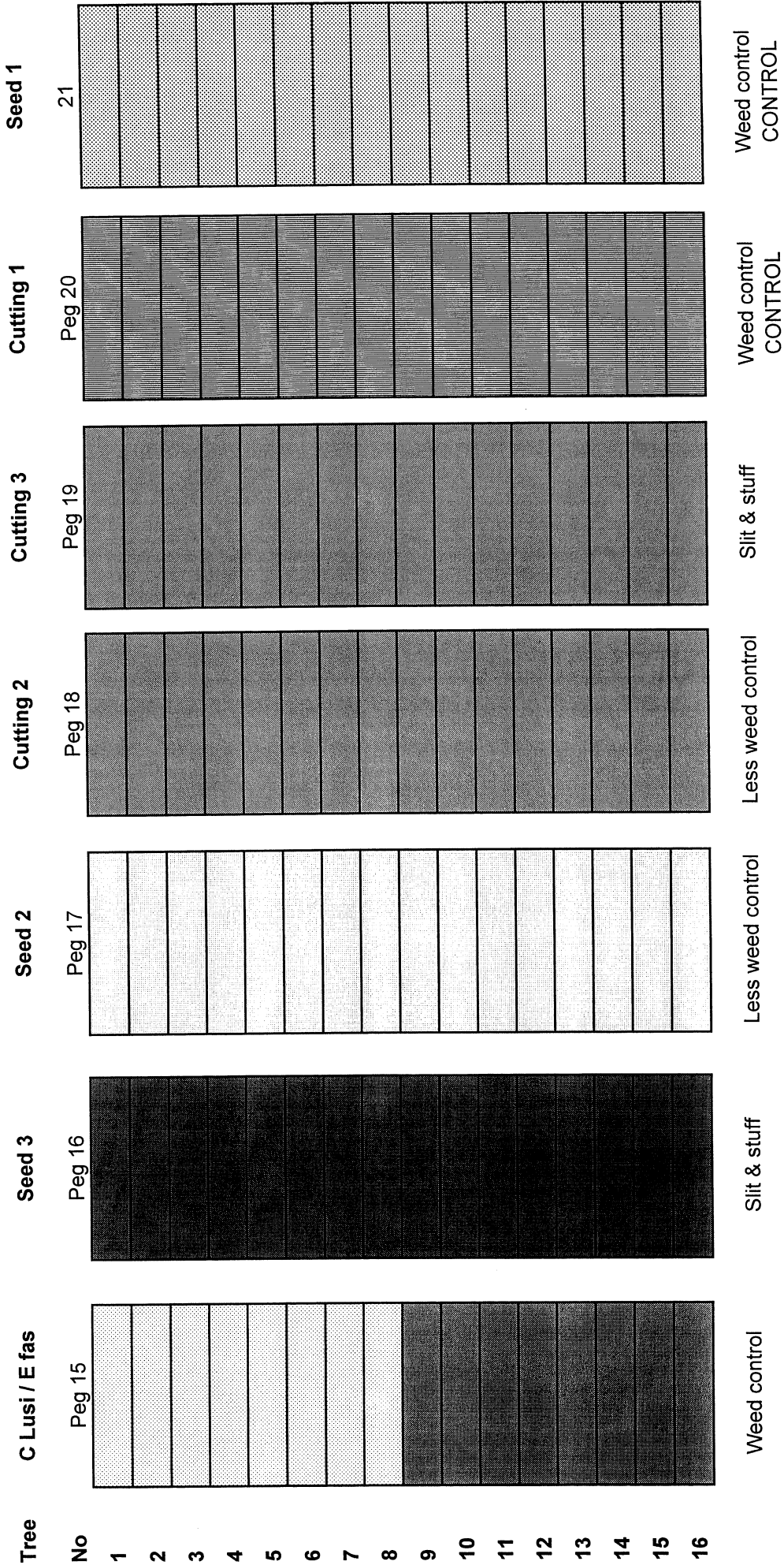
TRIAL LAYOUT - Horohoro

Rep 1							
Tree No	Cutting 2	Seed 3	Seed 1	Cutting 1	Cutting 3	C Lusi / E fas	Seed 2
	Peg 1	Peg 2	Peg 3	Peg 4	Peg 5	Peg 6	Peg 7
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
	Less weed control	Slit & stuff	Weed control CONTROL	Weed control CONTROL	Slit & stuff	Weed control	Less weed control

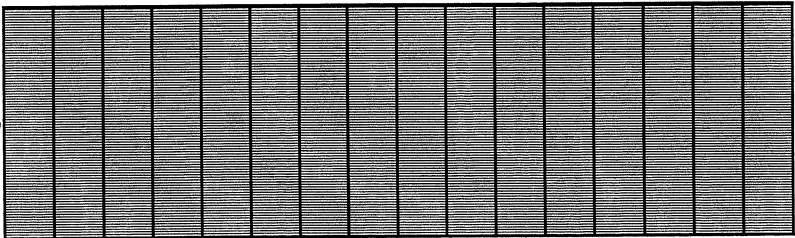
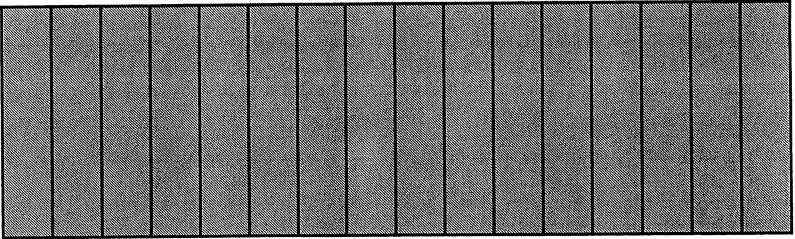
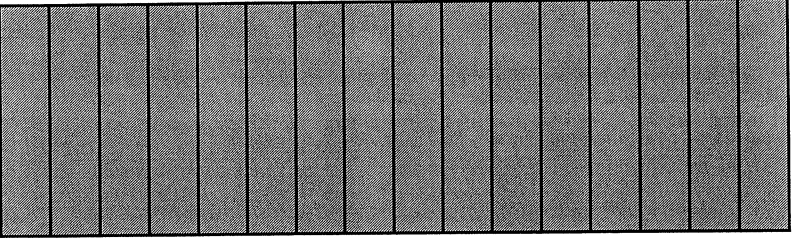


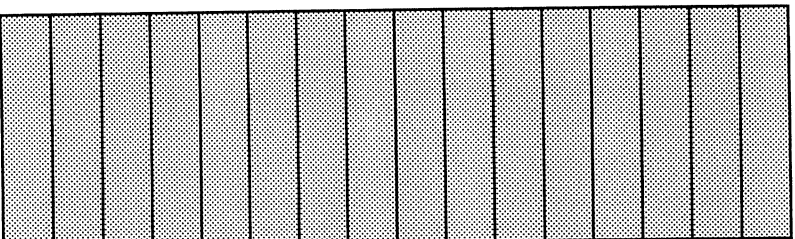
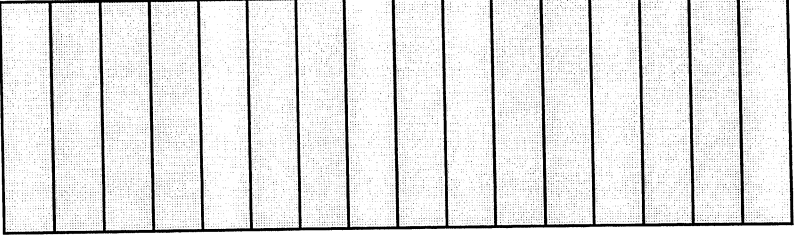
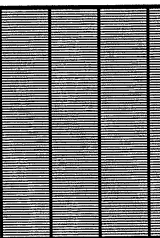
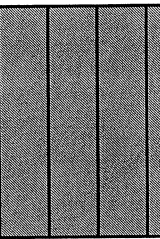
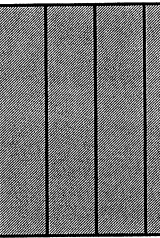
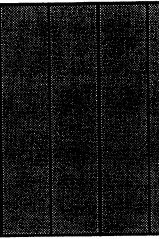
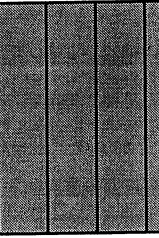
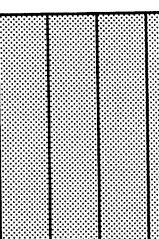
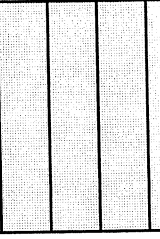

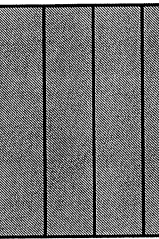
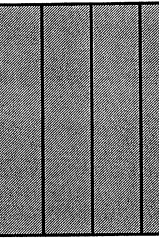
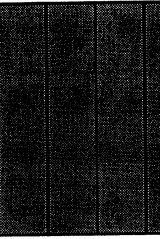
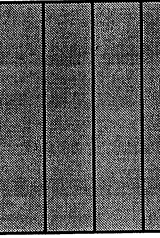
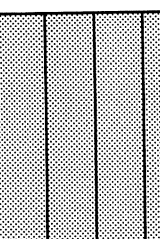
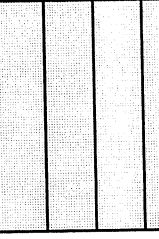
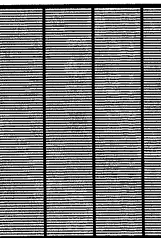
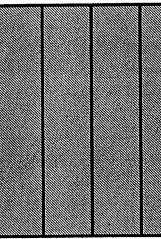
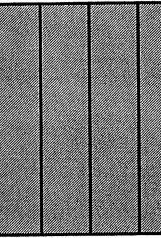

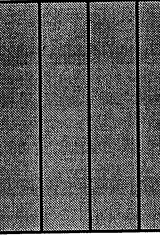
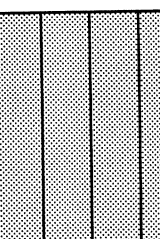
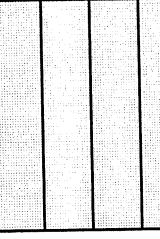
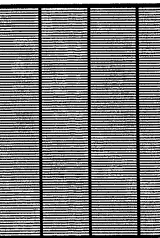
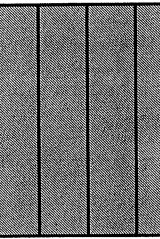
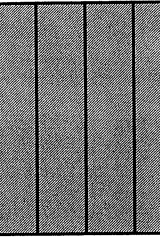

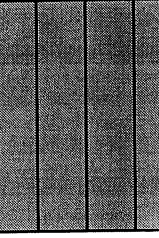
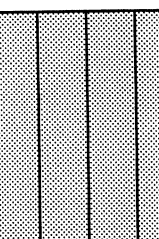
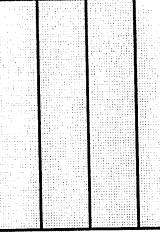
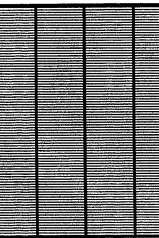
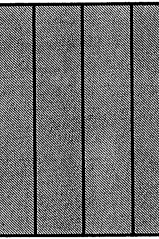
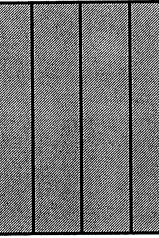

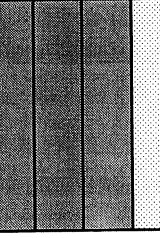
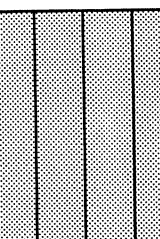
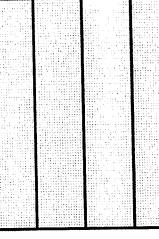
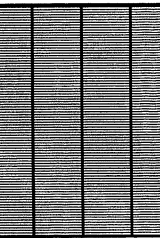
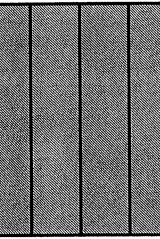
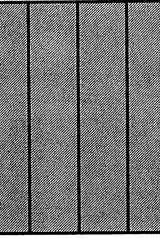

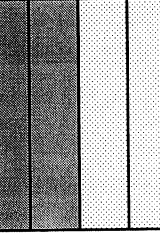
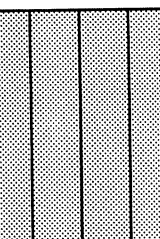
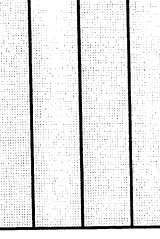
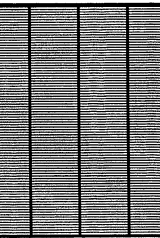
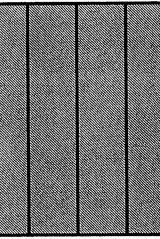
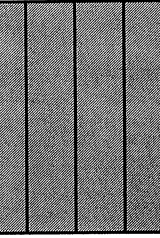
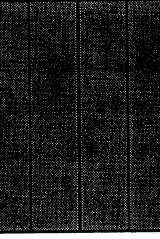
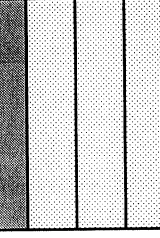
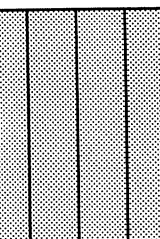
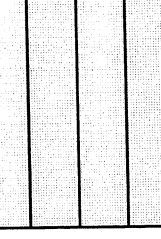
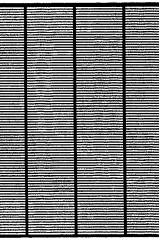
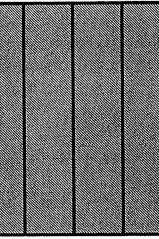
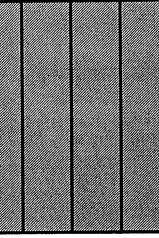

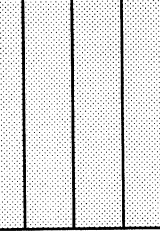
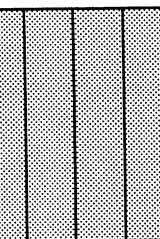
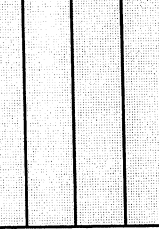
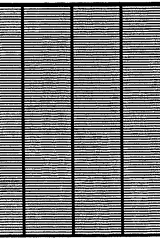
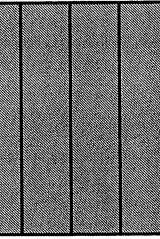
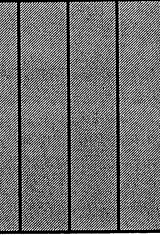

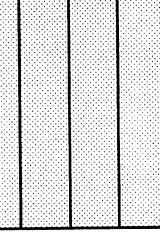
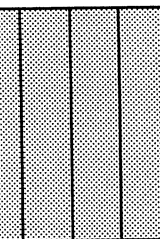
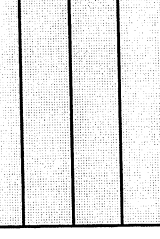
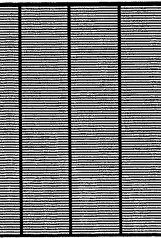
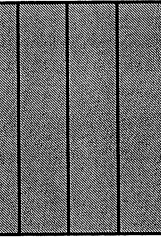
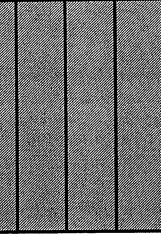

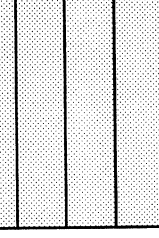
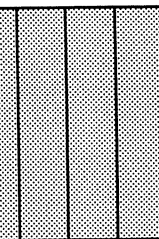
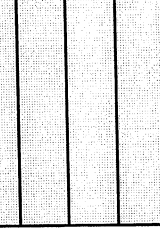
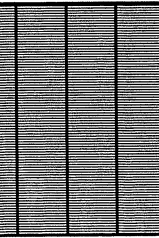
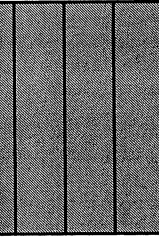
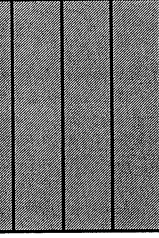

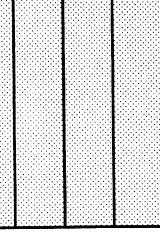
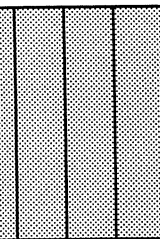
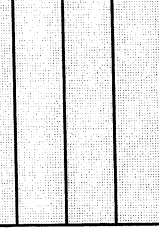
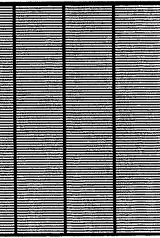
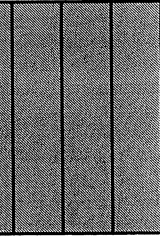
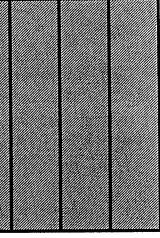

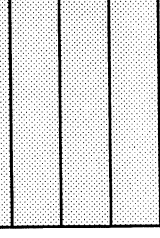
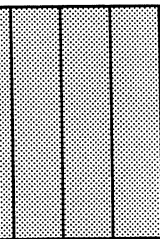
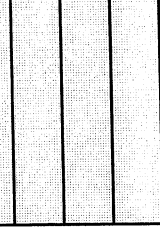
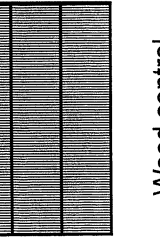
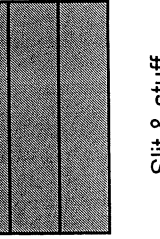
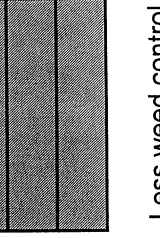
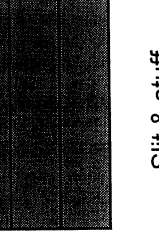


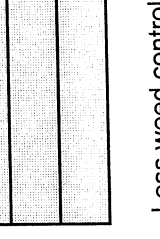

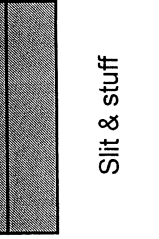
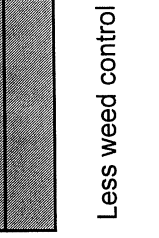
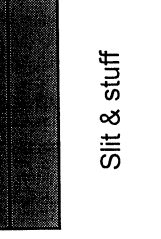


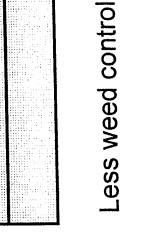

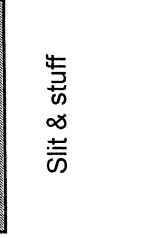
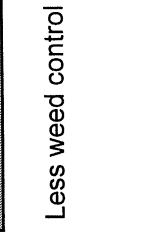
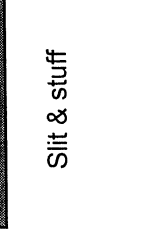
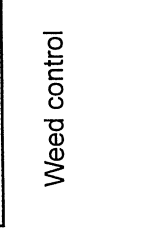

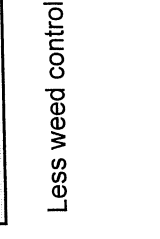
Rep 2

Tree	Cutting 3	Seed 2	Seed 1	E fas / C Lusi	Seed 3	Cutting 2	Cutting 1	
No	Peg 8	Peg 9	Peg 10	Peg 11	Peg 12	Peg 13	Peg 14	
1								Weed control
2								CONTROL
3								
4								Less weed control
5								
6								Slit & stuff
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								CONTROL

Rep 3





Rep 4							
Tree	Cutting 1	Cutting 3	Cutting 2	Seed 3	E fas / C Lusi	Seed 1	Seed 2
No	Peg 22	Peg 23	Peg 24	Peg 25	Peg 26	Peg 27	Peg 28
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
	Weed control CONTROL	Slit & stuff	Less weed control	Slit & stuff	Weed control	Weed control CONTROL	Less weed control



Rep 5

Tree	Cutting 2	C Lusi / E fas	Seed 3	Seed 2	Seed 1	Cutting 1	Cutting 3	
No	Peg 29	Peg 30	Peg 31	Peg 32	Peg 33	Peg 34	Peg 35	
1								Slit & stuff
2								Weed control
3								CONTROL
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
	Less weed control	Weed control	Slit & stuff	Less weed control	Weed control	CONTROL	Slit & stuff	

## KAINGAROA

**Location:** Cpt 1020, Kaingaroa Forest

**Forest Owner:** Fletcher Challenge Forests Ltd

**Contact Person:** Denis Albert, Ph 366 1000

**Established:** September 1999

**Site Characteristics:** Medium fertility forest site, third rotation cut-over. Spot mounded

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	998/464
	Cuttings Aged bare-root	GF 27	92/195



**Kaingaroa Toppling Trial.** Peter Roberts is standing on the cultivated (spot mounded) row. Three cultivated rows are present within each bay contained by wind-rows. The control (uncultivated) trees are planted in a row of their own between the cultivated rows. In this photo two rows of uncultivated trees are present — one behind Peter and one in front.

**WINCHING TRIAL - Kaingaroa, Established 1999**

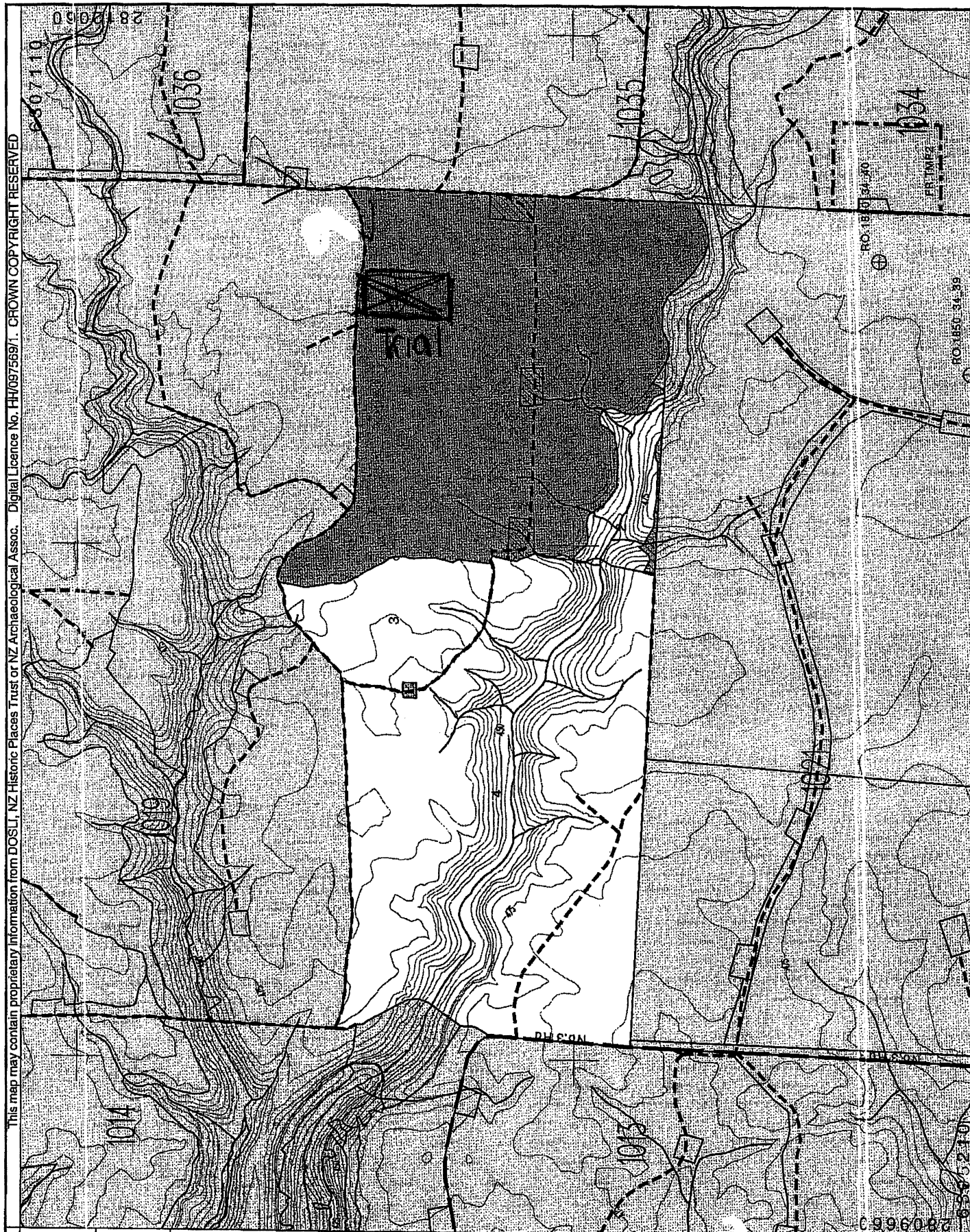
		CONTROL		Shallow Plant Non-Cult	Deep Plant Non-Cult	Slit & Stuff Non-Cult	Swept Non-Cult
		Non-Cult	Cultivated				
TREATMENT No.		3	1	7	8	6	5
SEEDLINGS Bare-Root	Age 1 Assessment	44	44				
	Wet Soil						
	Age 2 Assessment	44	44	44	44	44	44
	Wet Soil	44	44				
TREATMENT No.		4	2	11	12	10	9
CUTTINGS Bare-Root	Age 1 Assessment	44	44				
	Dry Soil						
	Age 2 Assessment	44	44	44	44	44	44
	Wet Soil	44	44				














# KAINGAROA TRIAL

= wind-row

PEG No	TRT / REP	PEG No	TRT / REP	PEG No	TRT / REP
47	9/	48	8/		
44	7/	45	6/	46	5/
41	10/	42	12/	43	11/
31	10/2	32	11/2	33	12/3
30	1/4				
29	3/4				
28	2/4				
27	4/4				
25	5/2	26	9/2	34	7/3
24	1/3				
23	3/3				
21	2/3				
20	4/3				
19	8/2	22	12/2	40	9/4
17	7/2				
16	1/2				
15	3/2				
13	2/2				
12	4/2				
11	12/1	14	9/1	38	8/4
9	8/1	10	5/1	37	6/4
8	1/1				
7	3/1				
5	7/1	6	11/1	36	11/4
3	6/1	4	10/1	35	10/4
2	2/1				
1	4/1				

ROAD



denisa	 <b>FLETCHER CHALLENGE FORESTS</b>	1:10000 Printed on 27-Sep-1999	<table><tr><td>2</td><td>P.RAD</td><td>1967</td><td>3.3 ha</td></tr><tr><td>3</td><td>P.RAD</td><td>1979</td><td>7.8 ha</td></tr><tr><td>4</td><td>P.RAD</td><td>1980</td><td>47.7 ha</td></tr></table>	2	P.RAD	1967	3.3 ha	3	P.RAD	1979	7.8 ha	4	P.RAD	1980	47.7 ha	<b>Kaingaroa (KANG)</b>  Compt. 1020  <table><tr><td></td><td>Planted</td><td>58.8ha</td></tr><tr><td></td><td>Await Restock</td><td>41.8ha</td></tr><tr><td></td><td>Unplanted</td><td>1.5ha</td></tr><tr><td></td><td>Unplantable</td><td>0ha</td></tr></table>		Planted	58.8ha		Await Restock	41.8ha		Unplanted	1.5ha		Unplantable	0ha
2	P.RAD	1967	3.3 ha																									
3	P.RAD	1979	7.8 ha																									
4	P.RAD	1980	47.7 ha																									
	Planted	58.8ha																										
	Await Restock	41.8ha																										
	Unplanted	1.5ha																										
	Unplantable	0ha																										

## WAIROA

**Location:** Stanford Forest, Kakariki Road, Kotemaori, Wairoa

**Forest Owner:** Forest Enterprises Ltd

**Contact Person:** Dave Jervis, Ph 06-370 5065

**Established:** September 1999

**Site Characteristics:** Ex-farm site. Cultivated via discing vs non-cultivated

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	98/464
	Cuttings Aged bare-root	GF 27	92/195



Winching trial planted between existing plantation rows on uncultivated ground in foreground and cultivated ground (disced) in paddock to the right.

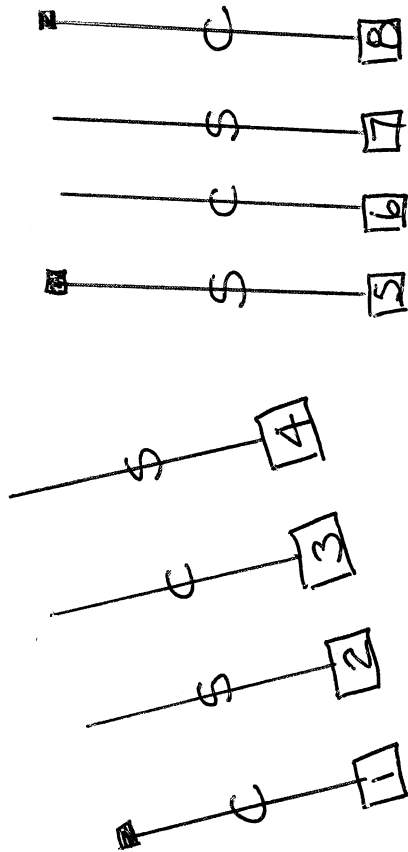
**WINCHING TRIAL - Wairoa, Established 1999**

<b>PLANT TYPE</b>		<b>NON-CULTIVATED (Control)</b>	<b>CULTIVATED (Disced)</b>
<b>SEEDLINGS Bare-Root</b>	Age 1 Assessment	46	46
	Age 2 Assessment	46	46
		46	46
<b>CUTTINGS Bare-Root</b>	Age 1 Assessment	46	46
	Age 2 Assessment	46	46
		46	46



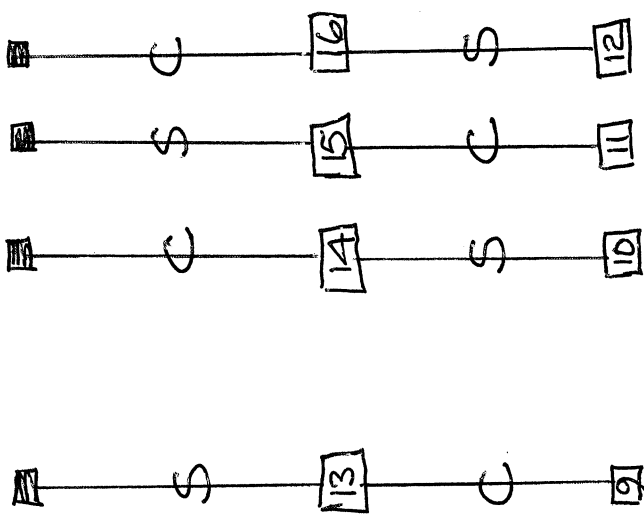
# WAIROA

## CULTIVATED



S = seedling bare-root  
C = cutting Aged bare-root

## NON-CULTIVATED



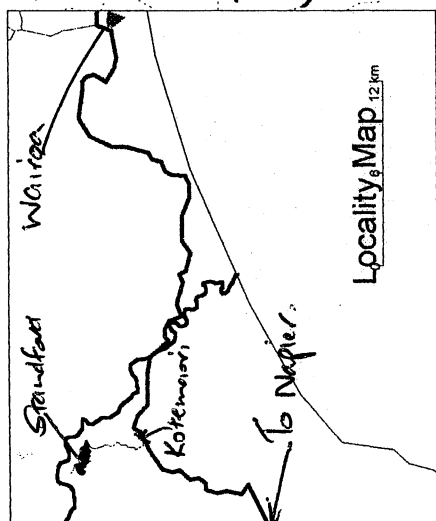
From SH



Shed

Entrance from road





## LEGEND

- P. radiata stands
- P. radiata Shelterbelts O/C
- Reserve
- Legal Bdy
- Stand Bdy
- Sealed Public Road
- Metal Public Road
- Forest Metalled Road
- Forest Unmetalled Track 4WD
- Limited Access Biketrack

## Legal Description :

Lot 1  
DP 27549  
Sec 50  
SO 7613  
Total Area: 165.76 ha

New Zealand Map Grid in metres

Mapping accuracy +/- 3%

Mapping by Manawatu Aerial Photo Services Palmerston North JI 06/99

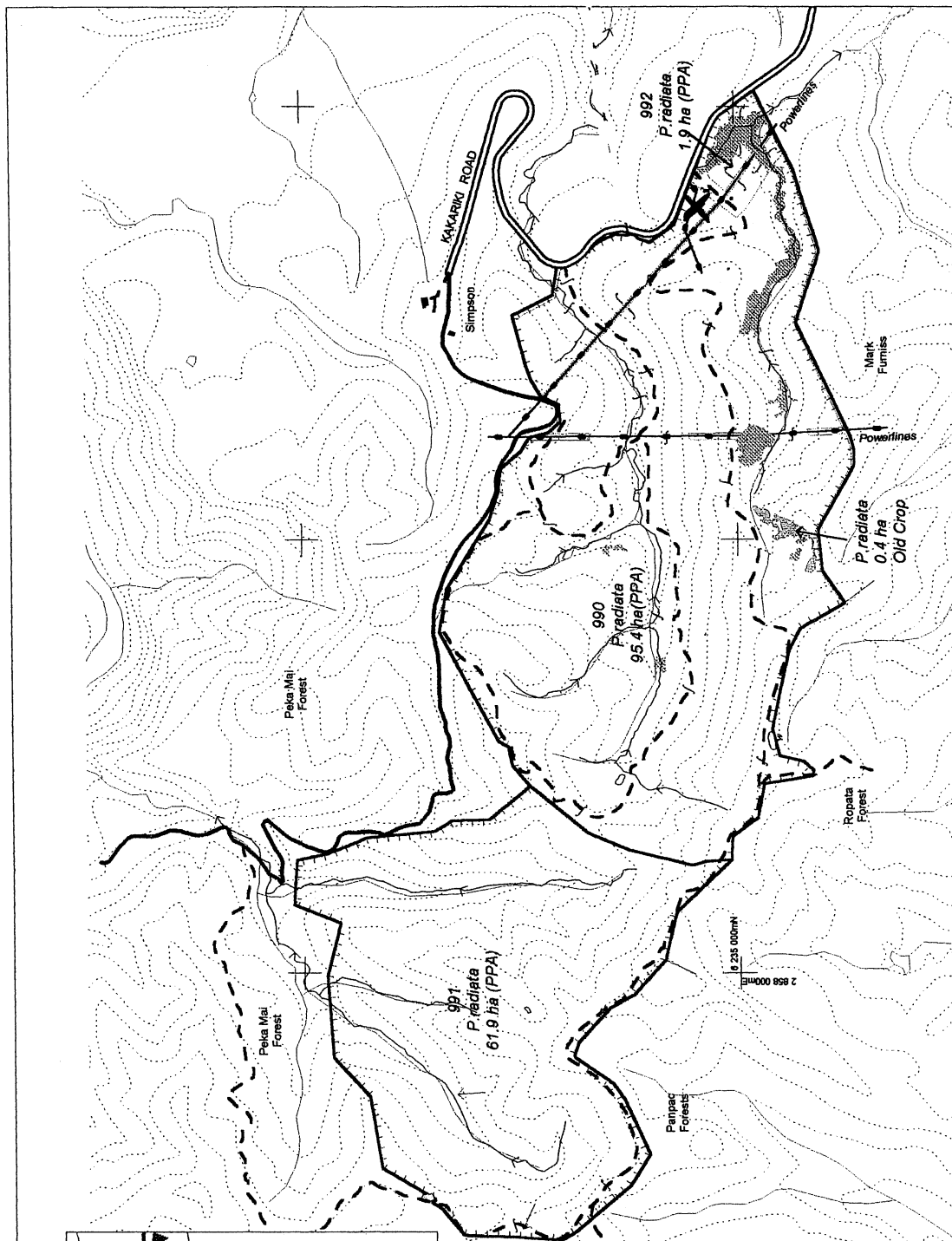
Contour Vertical Interval 20 metres

Land District: Gisborne

No Window

# STANDFORD FOREST

Scale 1:15 000



## BEAUMONT

**Location:** Belle Burn Forest, Access off SH 8, Beaumont, Otago

**Forest Owner:** Beaumont Forest Ltd

**Contact Person:** Forest Managers — Wrightson Forestry Services, Dennys Guild,  
Dunedin, Ph 03-471 9173

**Established:** September 1999

**Site Characteristics:** Ex-farm site.

**Tree Stocks:**

Seedlings bare-root	GF 17	97/567
Cuttings Aged bare-root	GF 19	98/464

**WINCHING TRIAL - Beaumont, Established 1999**

		Control	Shallow Plant	Deep Plant	Slit & Stuff	Swept
	<b>TREATMENT No.</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>9</b>
<b>SEEDLINGS</b> <b>Bare-Root</b>	Age 1 Assessment	44				
		44				
	Age 2 Assessment	44	44	44	44	44
		44				
	<b>TREATMENT No.</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>
<b>CUTTINGS</b> <b>Bare-Root</b>	Age 1 Assessment	44				
		44				
	Age 2 Assessment	44	44	44	44	44
		44				

Four Reps of each treatment

Control has 4 Reps each of 44 trees

Treatment Nos 3 to 10 have 4 Reps each of 11 trees

1 — ①/1 — 2 — ③/1 — 3 — ⑤/1 — 4 — ⑦/1

5 — ②/1

6 — ③/1 — 7 — ⑨/1 — 8 — ⑩/1 — 9 — ④/1

10 — ①/1

11 — ①/2

12 — ⑥/2 — 13 — ⑧/2 — 14 — ③/2 — 15 — ⑦/2

16 — ②/2

17 — ⑩/2 — 18 — ⑤/2 — 19 — ⑨/2 — 20 — ④/2

21 — ⑥/3 — 22 — ⑩/3 — 23 — ⑤/3 — 24 — ⑦/3

25 — ②/3

26 — ①/3

27 — ④/3 — 28 — ⑧/3 — 29 — ③/3 — 30 — ⑨/3

31 — ②/4

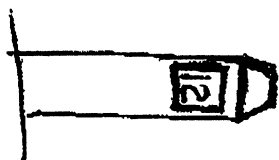
32 — ⑧/4 — 33 — ③/4 — 34 — ⑨/4 — 35 — ④/4

36 — ①/4

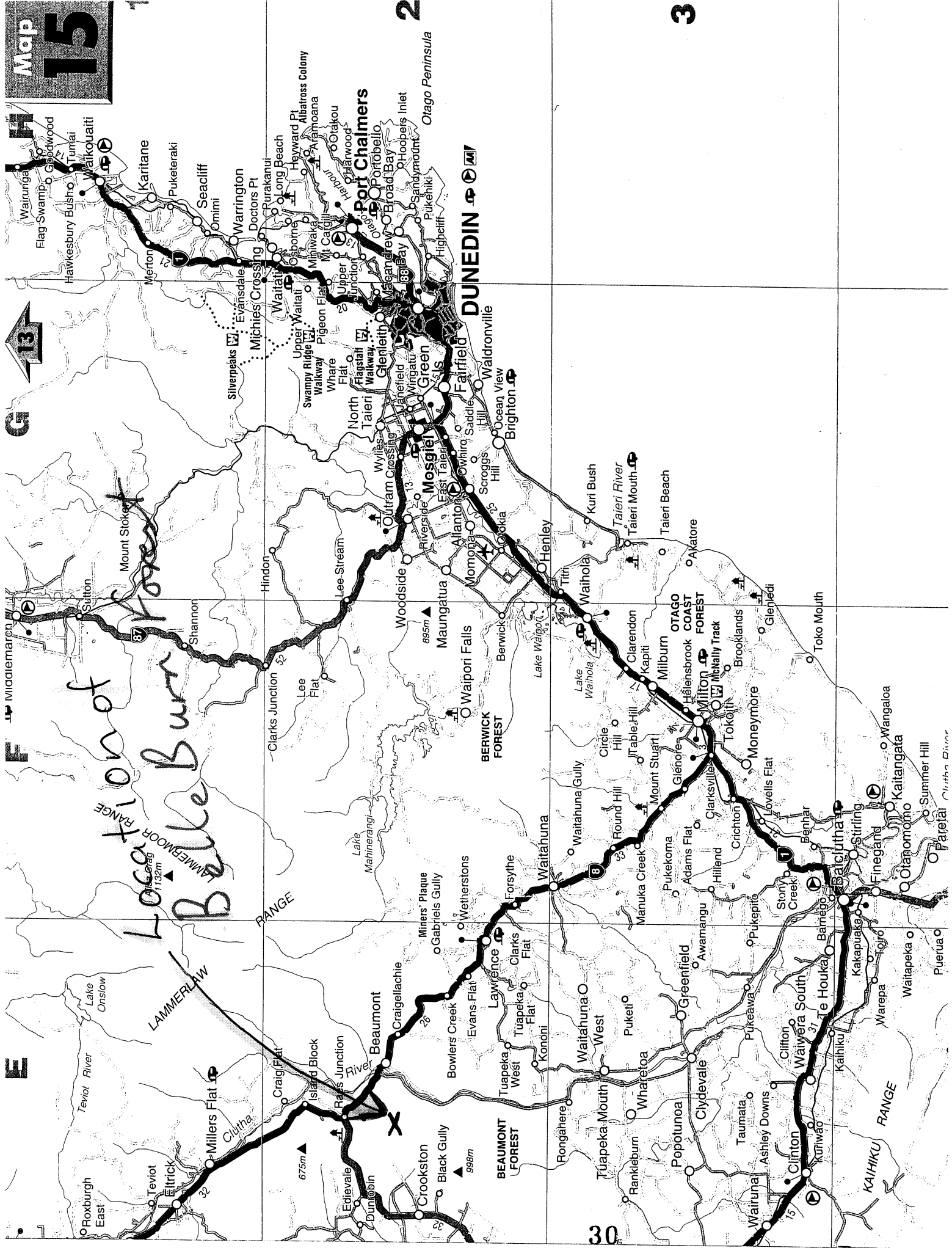
37 — ⑥/4 — 38 — ⑩/4 — 39 — ⑤/4 — 40 — ⑦/4

□ - peg No

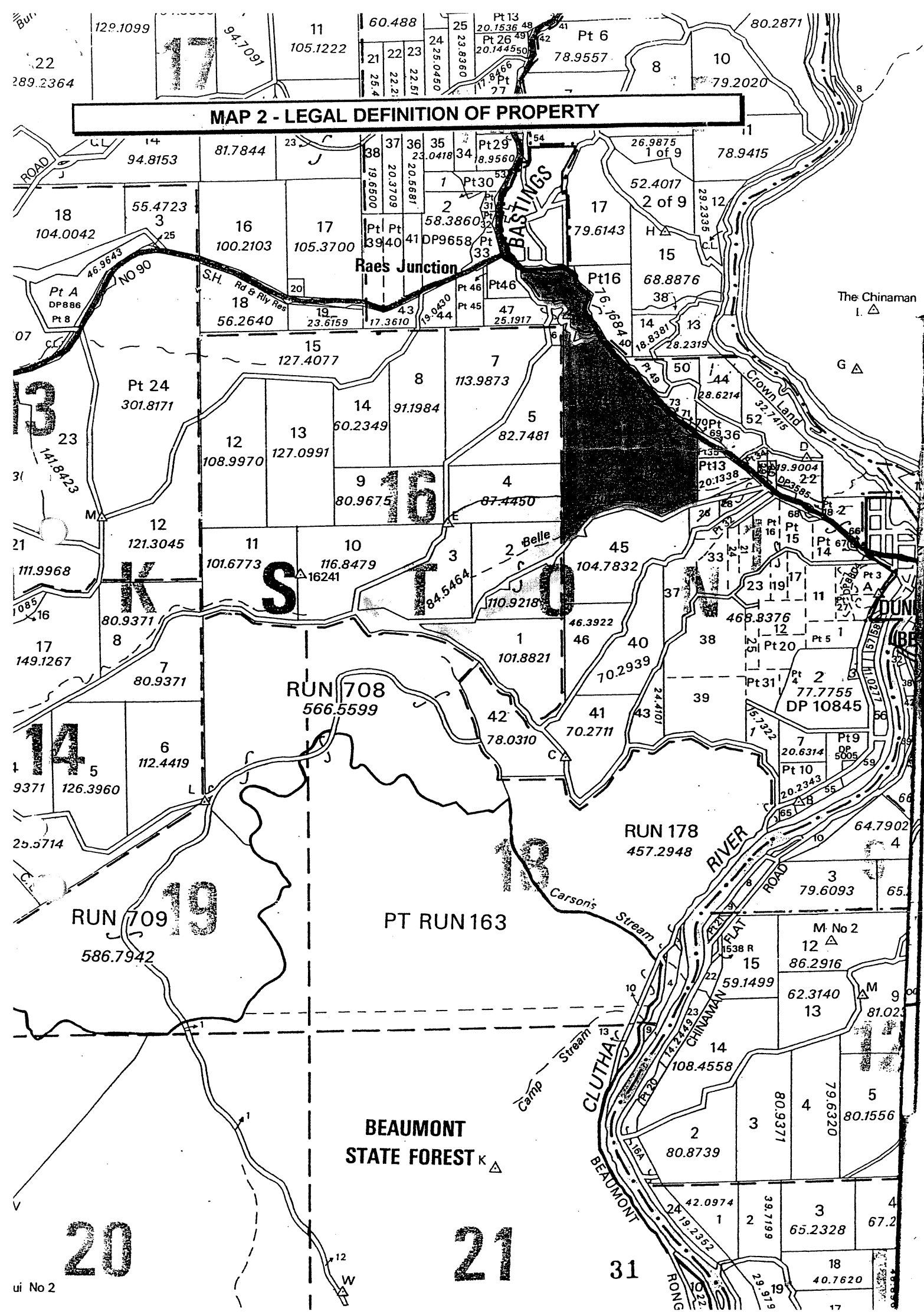
①/1 = Treatment No 1 / Rep 1



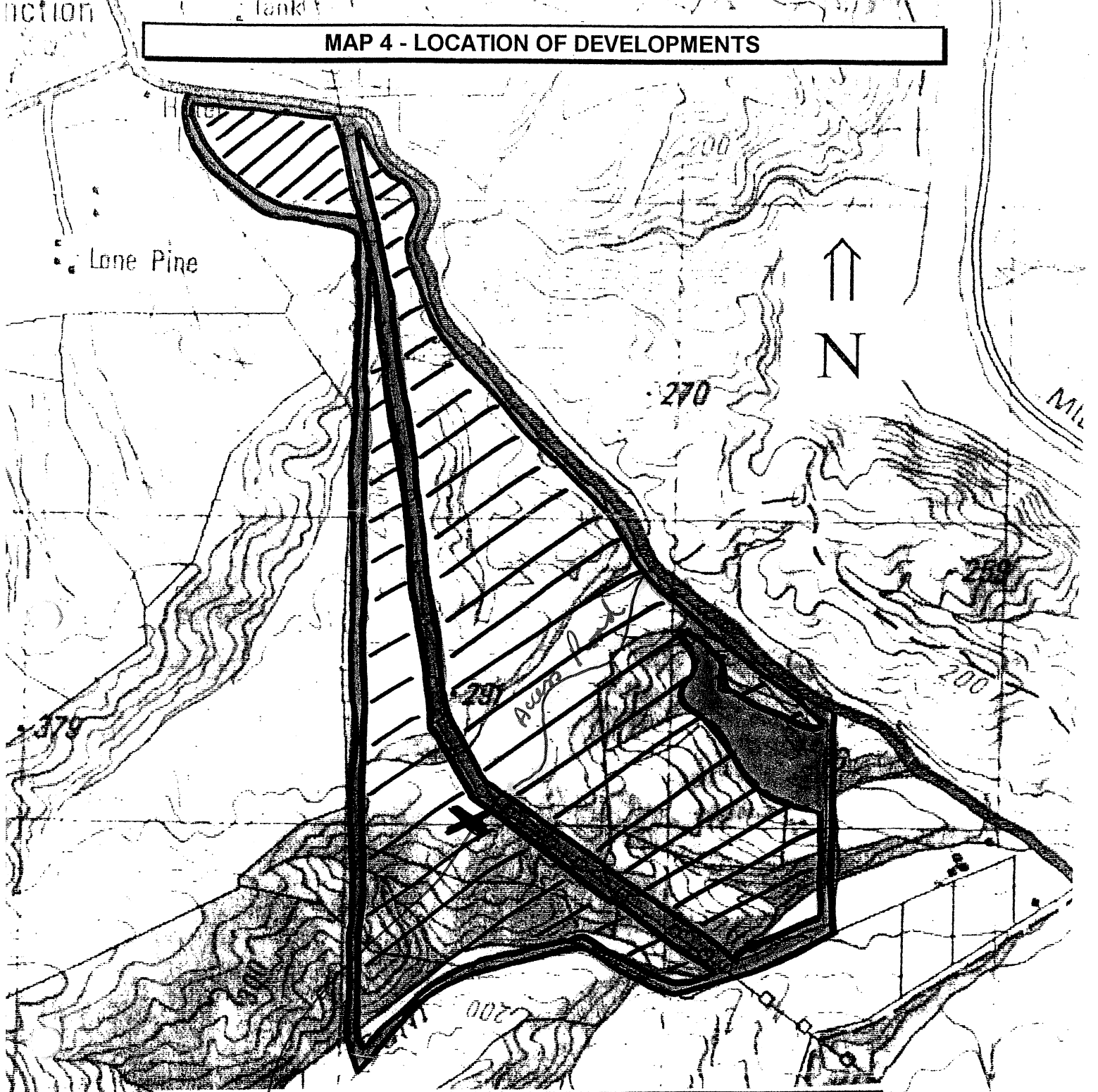
Trees relate to peg 12



## MAP 2 - LEGAL DEFINITION OF PROPERTY



# MAP 4 - LOCATION OF DEVELOPMENTS



## PLANTABLE AREA PLAN - BEAUMONT PROPERTY

*Access off SH 8 on top of hill  
Best place for trials = X*



Plantable area = 216.6 hectares



Unplantable areas include:

- Powerlines
- Boundaries
- Belle Burn
- Tracks
- Wet areas
- Existing forestry joint venture

Approximate Scale:

32

1:16,667

## ROTORUA

**Location:** Long Mile, *Forest Research* Campus, Rotorua

**Land Owner:** *Forest Research*

**Contact Person:** Jeff Tombleson, 07-343 5899

**Established:** August 2000

**Site Characteristics:** Ex stool-bed site, Medium fertility.

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	98/204
	Cuttings Juvenile bare-root (2yr)	GF 26	(tops off seedlings)
	Cuttings Aged bare-root (3yr)	GF 28	94/300

Trevor Faulds from the *Forest Research* Nursery verified that the Aged Cuttings had a physiological age of three+ years.



Trial established on ex-stoolbed site. In the center of the photo is a paired row of seedlings, on the left is a paired row of juvenile cuttings, and on the right is a paired row of 3-year aged cuttings.



# LONG MILE, ROTORUA WINCHING TRIAL, Established 2000

Winching Options			NON-CULTIVATED (Control)
<b>SEEDLINGS</b> Bare-Root	Age 1 Assessment	Dry Soil	44
	Age 2 Assessment	Dry Soil	44
		Wet Soil	44
<b>JUVENILE CUTTINGS</b> Bare-Root	Age 1 Assessment	Dry Soil	44
	Age 2 Assessment	Dry Soil	44
		Wet Soil	44
<b>AGED CUTTINGS</b> Bare-Root	Age 1 Assessment	Dry Soil	44
	Age 2 Assessment	Dry Soil	44
		Wet Soil	44

Four replications of the bare-root seedlings, juvenile cuttings and aged cuttings were established. (33 trees per plant type x 4 reps)

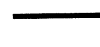
Sample size for winching based on 40 trees for the bare-root plant types (4 extra trees planted per sample)

The **objective** of establishing this trial is to provide a comparison of the resistance of seedlings, juvenile cuttings and aged cuttings. Most of the cuttings planted by the industry are juvenile not aged. All the cuttings incorporated into the winching trials are aged for the purpose of providing a contrast to seedlings. It may well be that only one or two winchings are required (say age one and two years) to establish any differences across the three plant types. A **further objective** of this trial is to provide plant material to evaluate stem stiffness across the plant types.

# **LONG MILE, *Forest Research* , ROTORUA TRIAL**

Compost Heap	Peg No		
	1	SEEDLINGS	Rep 1
	2	JUVENILE CUTTINGS	Rep 1
	3	AGED CUTTINGS	Rep 1
	4	JUVENILE CUTTINGS	Rep 2
	5	SEEDLINGS	Rep 2
	6	AGED CUTTINGS	Rep 2
	7	JUVENILE CUTTINGS	Rep 3
	8	AGED CUTTINGS	Rep 3
	9	SEEDLINGS	Rep 3

Peg No		
10	AGED CUTTINGS	Rep 4
11	SEEDLINGS	Rep 4
12	JUVENILE CUTTINGS	Rep 4

 = paired row containing 33+ trees

## MOSGIEL

**Location:** Cpt 133, Boundary Road, Akatore Block, Otago Coast Forest

**Forest Owner:** Wenita Forest Products Ltd

**Contact Person:** Wayne Lyndsay, Ph 03-489 3234

**Established:** September 2000

**Site Characteristics:** Cutover, second rotation forest site, previously an ex-farm site.

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	98/204
	Cuttings Aged bare-root	GF 30	95/290

**Establishment Details:** The site had been wind-rowed. Trees were given a post-plant spot spray application of *Velpar* herbicide.



Trial established on a cutover forest site, which was originally an ex-farm site



## WINCHING TRIAL - Otago Coast, Established 2000

Winching Options			NON-CULTIVATED (Control)
<b>SEEDLINGS</b> Bare-Root	Age 2 Assessment	Dry Soil	44
	Age 3 Assessment	Dry Soil	44
		Wet Soil	44
<b>AGED CUTTINGS</b> Bare-Root	Age 2 Assessment	Dry Soil	44
	Age 3 Assessment	Dry Soil	44
		Wet Soil	44

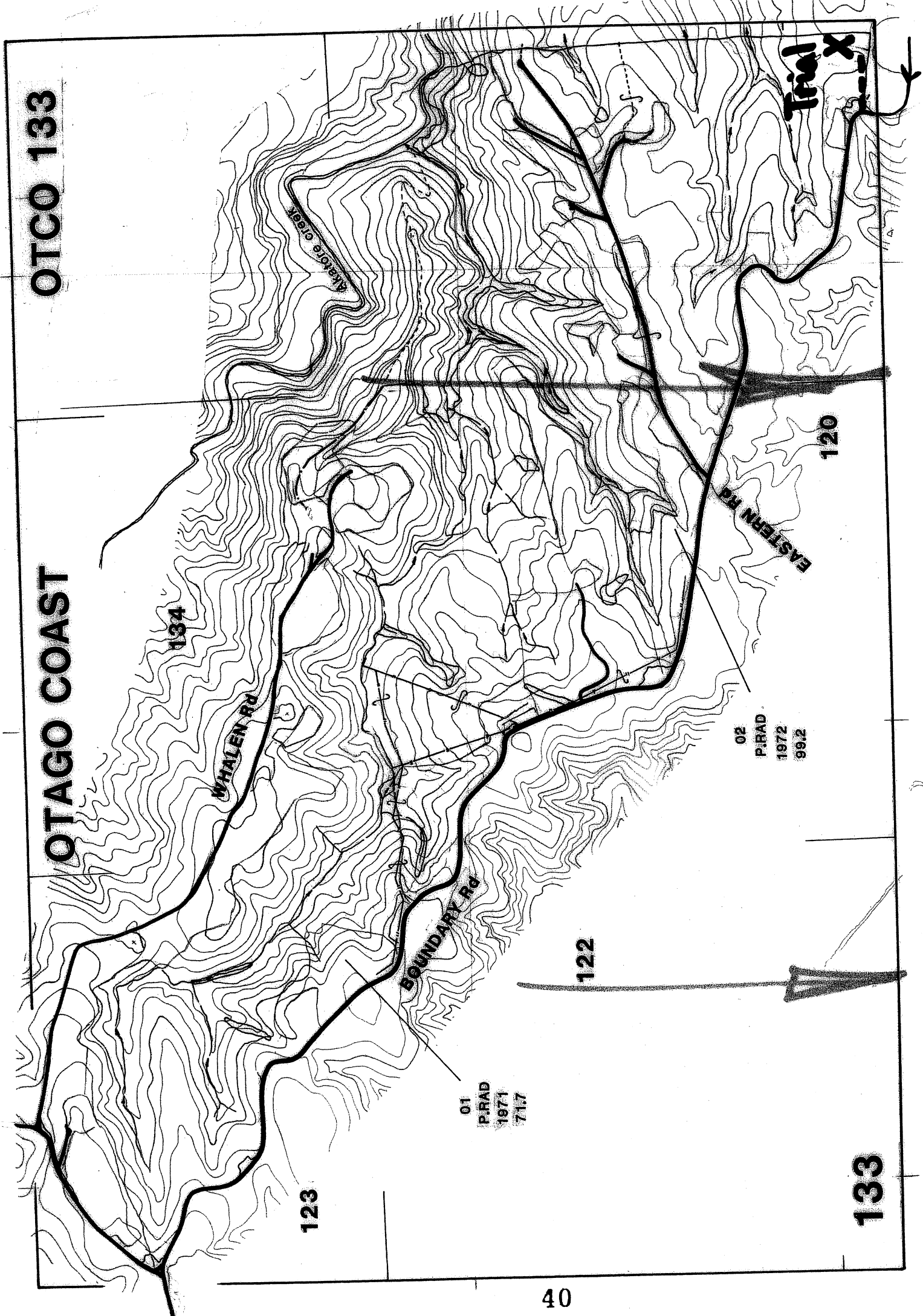
Four replications of the bare-root seedlings and cuttings were established

Sample size for winching based on 40 trees for the bare-root plant types (4 extra trees planted per sample)



OTCO 133

OTAGO COAST



Trial X

134

WHALEN RD

BOUNDARY RD

EASTERN RD

120

02  
P.RAD  
1972  
99.2

122

01  
P.RAD  
1971  
71.7

123

133

A horizontal line with three tick marks. The first tick mark on the left is labeled '0'. The second tick mark is labeled '1km'. The third tick mark on the right is labeled '2km'.





## INVERCARGILL

**Location:** Cpt 4, Christies Road, Sandy Point Forest

**Forest Owner:** Invercargill City Council

**Contact Person:** Forest Managers — Wrightson Forestry Services  
George Platts, PO Box 901, Invercargill  
Ph: 03-214 4301 Fax: 03-214 4266  
Eddress: Georgeplatts@wrightson.co.nz

**Established:** September 2000

**Site Characteristics:** Sheltered sand site

<b>Tree Stocks:</b>	Seedlings bare-root	GF 19	98/204
	Cuttings Aged bare-root	GF 30	95/290

**Establishment details:** The site had been wind-rowed and planted in the previous year (1999). The trial trees were planted between the existing rows. Grasses present at the time of planting were post plant spot spayed using *Liberate* herbicide.



The trial was established on a sheltered sand site that had a light covering of grasses at the time of planting

# WINCHING TRIAL - Invercargill, Established 2000

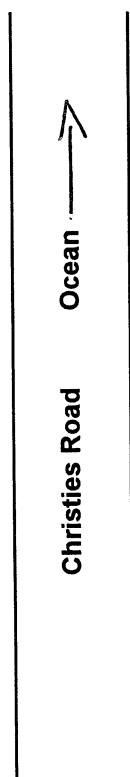
Winching Options			NON-CULTIVATED (Control)
<b>SEEDLINGS</b> Bare-Root	Age 2 Assessment	Dry Soil	44
	Age 3 Assessment	Dry Soil	44
		Wet Soil	44
<b>AGED CUTTINGS</b> Bare-Root	Age 2 Assessment	Dry Soil	44
	Age 3 Assessment	Dry Soil	44
		Wet Soil	44

Four replications of the bare-root seedlings and cuttings were established

Sample size for winching based on 40 trees for the bare-root plant types (4 extra trees planted per sample)

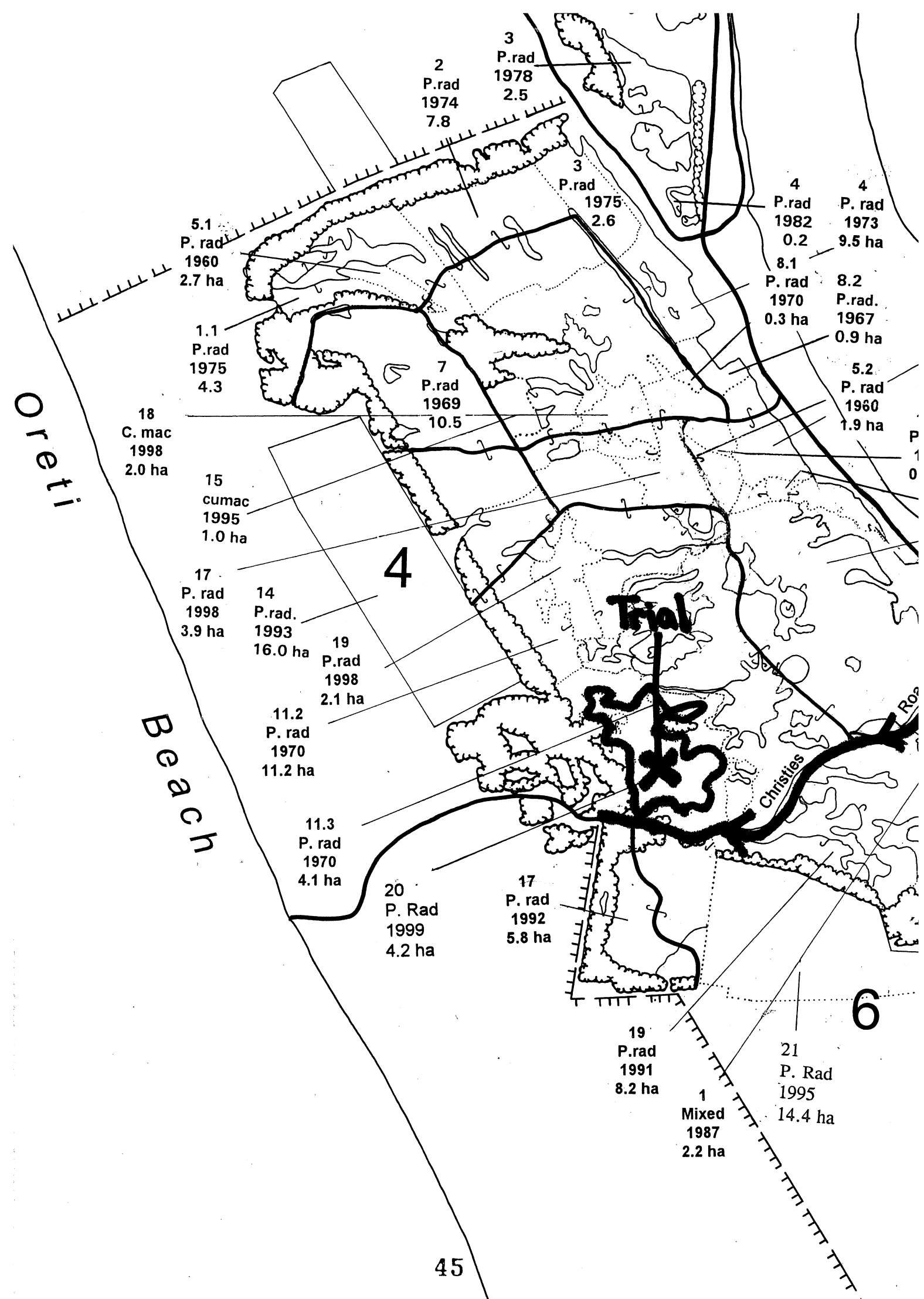
It is anticipated that tree growth will be slower on this sand site and thus winching may be delayed by one year commencing at age two.

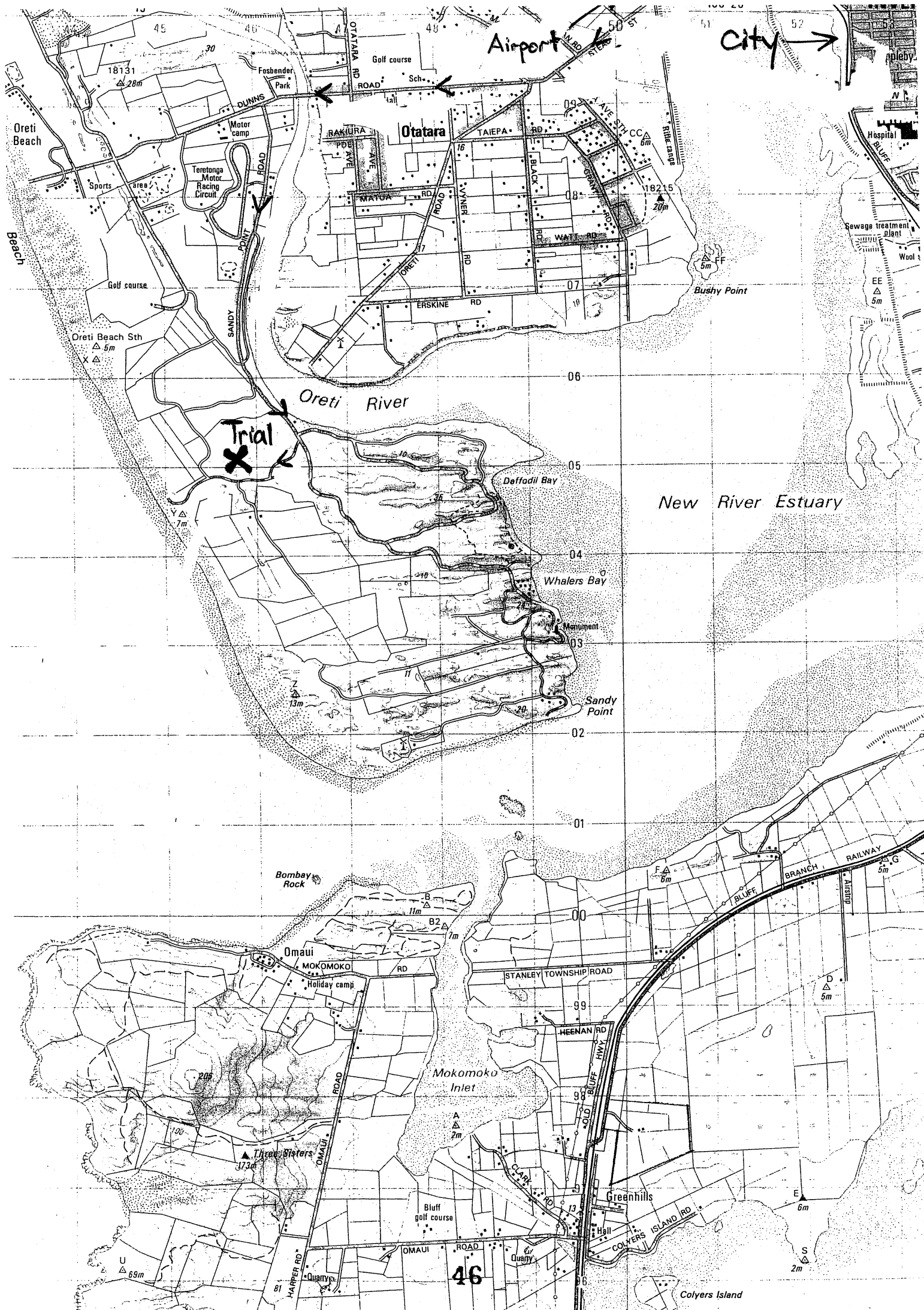
## SANDY POINT FOREST, INVERCARGILL TRIAL



Peg No		
8	SEEDLINGS	Rep 1
7	CUTTINGS	Rep 1
6	CUTTINGS	Rep 2
5	SEEDLINGS	Rep 2
4	CUTTINGS	Rep 3
3	SEEDLINGS	Rep 3
2	CUTTINGS	Rep 4
1	SEEDLINGS	Rep 4


 = paired row containing 33+ trees





## **ACKNOWLEDGEMENTS**

The author gratefully acknowledges the following for provision of trial sites and also assistance with preparation for trial establishment.

Rob Webster, Arbor Management Ltd, Kaukapakapa Trial.

Denis Albert, Fletcher Challenge Forests Ltd, Kaingaroa Forest Trial

Dave Jervis, Forest Enterprises Ltd, Wairoa Trial

Dennys Guild, Wrightson Forestry Services, Beaumont Forest Trial

George Platts, Wrightson Forestry Services, Sandy Point Forest Trial

Max Smith, Wenita Forest Products Ltd, Otago Coast Forest Trial

The contribution of the container-grown tree stocks by FORENZA is also gratefully acknowledged.