

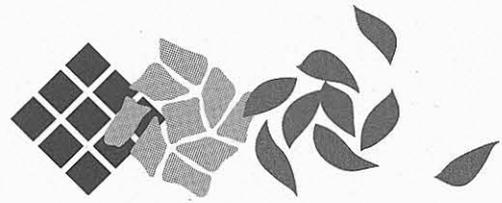
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**Land Management and
Rehabilitation Services Pty Ltd**

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ROSSARDEN MINE REHABILITATION

1997 REVEGETATION PROGRAMME SUMMARY

July 1997



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Mineral Resources Tasmania : Rossarden
Mine rehabilitation : 1997 revegetation
programme summary / Land Management
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1.0 INTRODUCTION

In November 1996, Land Management and Rehabilitation Services (LMRS) were engaged by Mineral Resources Tasmania to organise and implement revegetation works at the abandoned tailings deposits at Rossarden in north-eastern Tasmania.

The major earthworks involving tailings dam capping, was completed under a separate contract and was implemented by David Wagner under the direction of and based on a plan prepared by Thompson and Brett Consulting Engineers.

The resultant earthworks varied from the original plan in that wetlands were not as extensive as planned for the main clay borrow area, higher quality soils and clays were not used adjacent to the main road and the area for rehabilitation was increased to 21 ha and not the 15 ha originally estimated. With these plan alterations in mind, revegetation materials had to be recalculated and the site prescriptions altered. The suitable provenance native seed and propagated seedlings were ordered in November and could not be altered significantly to meet the varied conditions. The revegetation plan was altered to accommodate the existing conditions and involved dividing the site into three sections ;

- i) native plant species + cover crop
- ii) exotic grasses + Acacia seed
- iii) exotic grasses only (on existing Lease).

Exotic grass quantities were increased from the original design based on their availability at short notice and their ability to cope with difficult acid conditions identified in a broad assessment of the soil and clay pH, undertaken in April 1997. The pH of the exposed and capping clays varied greatly from isolated pockets of 8.2 to large areas of between 2.5 to 3.0 (approximately 8 ha). The majority of the clay had a pH of between 4.0 to 4.5.

In May 1997, the cost estimate was updated following a re-evaluation of the surface pH and the increase in the area covered by the clay capping.

2.0 TRIAL ESTABLISHMENT 1996

(refer June 1996 Trial Summary Report)

A revegetation trial was established in Autumn 1996 that aimed to identify the most cost effective treatment for the site, particularly on the naturally occurring clays. Approximately 1000 m² of clayed surface was exposed following the removal of overlying tailings. The clay surface was roughened with the an excavator rock bucket. On drying, the clay sets extremely hard. Additional cultivation was required to prepare the surface to a level suitable for plant establishment.

Two trial plots were established :

2.1 Trial Plot 1 Exotic Grasses + Native Seedlings

(Plot nearest Ben Lomond)

Approximate Area = 500 m²

- 500 kg of Ag Lime applied
- 30 kg 14:16:11 fertilizer applied

- Surface harrowed 3 times (2 times prior and 1 time following seed application)
- 35 kg of custom exotic grass seed mix applied
 - Browntop Bent grass
 - Hard Fescue
 - Sheep's Fescue
 - Ryegrass var Concorde
 - Ryegrass var Victorian
 - White Clover var Huia
 - Cereal Rye
- 0.5 kg of Acacia dealbata seed applied
- 300 seedlings planted, staked, guarded and fertilized

2.2 Trial Plot 2 Native Seed and Seedlings

Approximate Area = 500 m²

- 500 kg of Ag Lime applied
- 20 kg 14:16:11 fertilizer applied
- 1.2 kg of native seed mix applied
 - 0.5 kg Acacia dealbata
 - 0.4 kg Eucalyptus delegatensis
 - 0.3 kg Leptospermum scoparium
- 300 seedlings planted, staked, guarded and fertilized
- 20 Poa grass cutting planted.

2.3 Seedling Mix

Seedlings planted in the trial plots included the following species :

Acacia dealbata

Eucalyptus amygdalina

Eucalyptus delegatensis

Eucalyptus rodwayii

Leptospermum lanigerum

Leptospermum scoparium

2.4 Results

The grasses readily established in the clays providing a satisfactory cover but they were unable to colonise coarse tailings deposits. The survival of the planted seedlings and those originating from sown seed were significantly affected by browsing animals. Browsing severely limited growth and survival. Germinating seedlings (3-5/m²) have been significantly reduced in number.

3.0 1997 REVEGETATION PROGRAMME

3.1 Treatments

3.1.1 pH and Lime Application (refer Figure 1)

Approximately 240 t of agricultural lime was applied, 9 tonnes /ha over 13 ha and 15 tonnes/ha over the remaining 8 ha.

3.1.2 Nutrient Application (refer Figure 2)

The N:P:K fertilizer 14:16:11 was applied at 500 kg/ha. A total of 10.5 tonnes and 0.6 tonnes of fertilizer was applied at Rossarden and Storeys Creel Precipitate Dam, respectively.

3.1.3 Vegetation Establishment

Revegetation treatments are located and identified on Figure 3 and include all established trial plots.

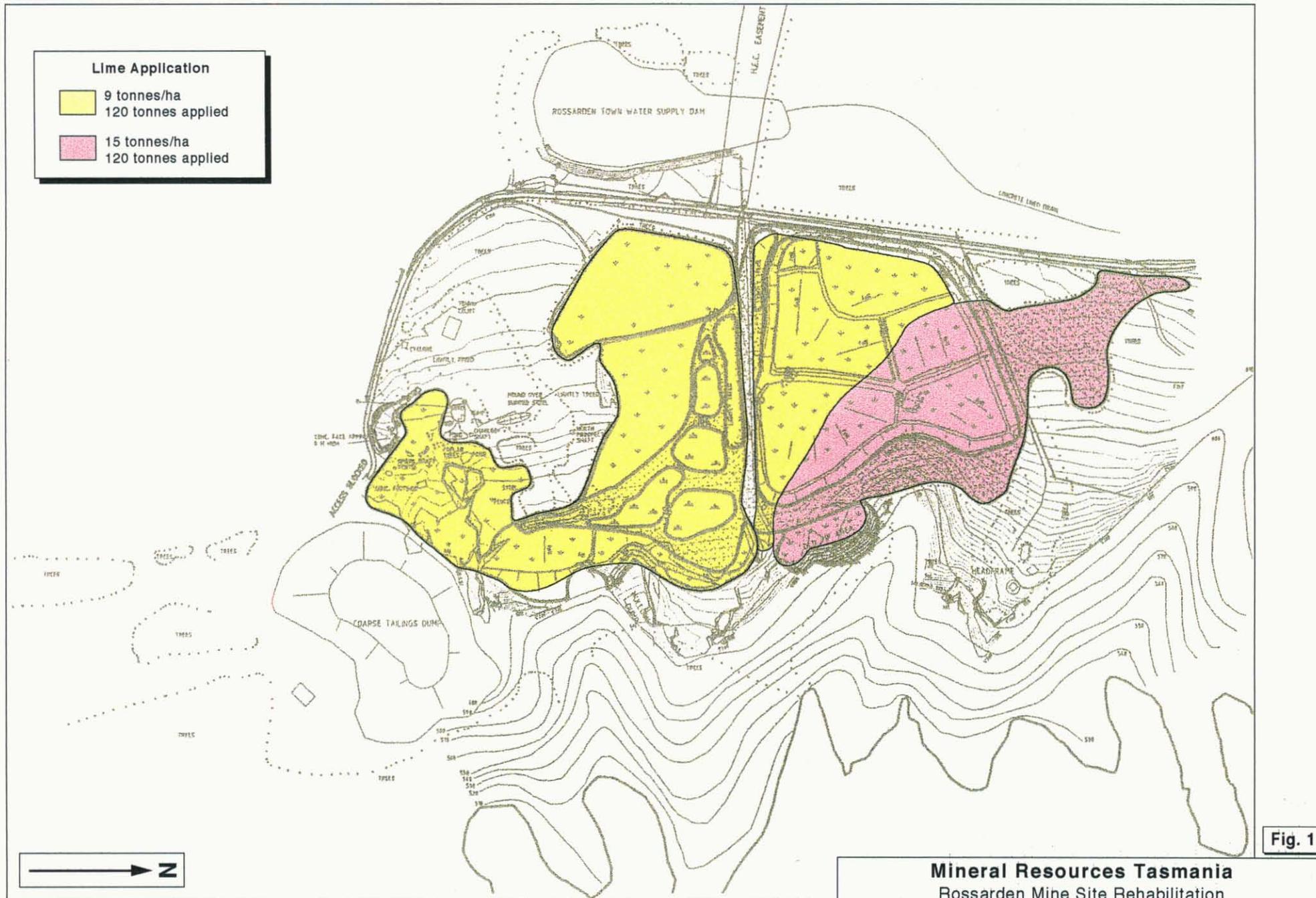
3.1.3.1 Native Seed Mixes

Seed from many of the species ordered in November 1996 was unavailable due to seasonally poor seed production. The following seed mixes were composed of seed collected within the local area and seed collected in previous seasons. Local provenance material was not available for some species particularly *Acacia dealbata*, which was obtained from other provenances within the state that were deemed suitable for the Rossarden area. Approximately 63 kg of native seed was applied.

Seed Mix 1

Applied to approximately 11 ha.

	kg
<i>Acacia dealbata</i>	12.0
<i>Acacia terminalis</i>	2.3
<i>Cassinia aculeata</i>	4.0
<i>Eucalyptus delegatensis</i>	5.0
<i>Eucalyptus dalrympleana</i>	1.2
<i>Eucalyptus gunnii</i>	0.95
<i>Eucalyptus amygdalina</i>	3.7
<i>Eucalyptus pauciflora</i>	1.2
<i>Hakea spp.</i>	0.125
<i>Leptospermum lanigerum</i>	12.0
<i>Leptospermum scoparium</i>	10.3



Original base plan from Thompson & Brett Pty Ltd drawing No. 96-1534-08

July 1997

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 Rossarden Mine Site Rehabilitation
 1997 Revegetation Programme - Lime Application
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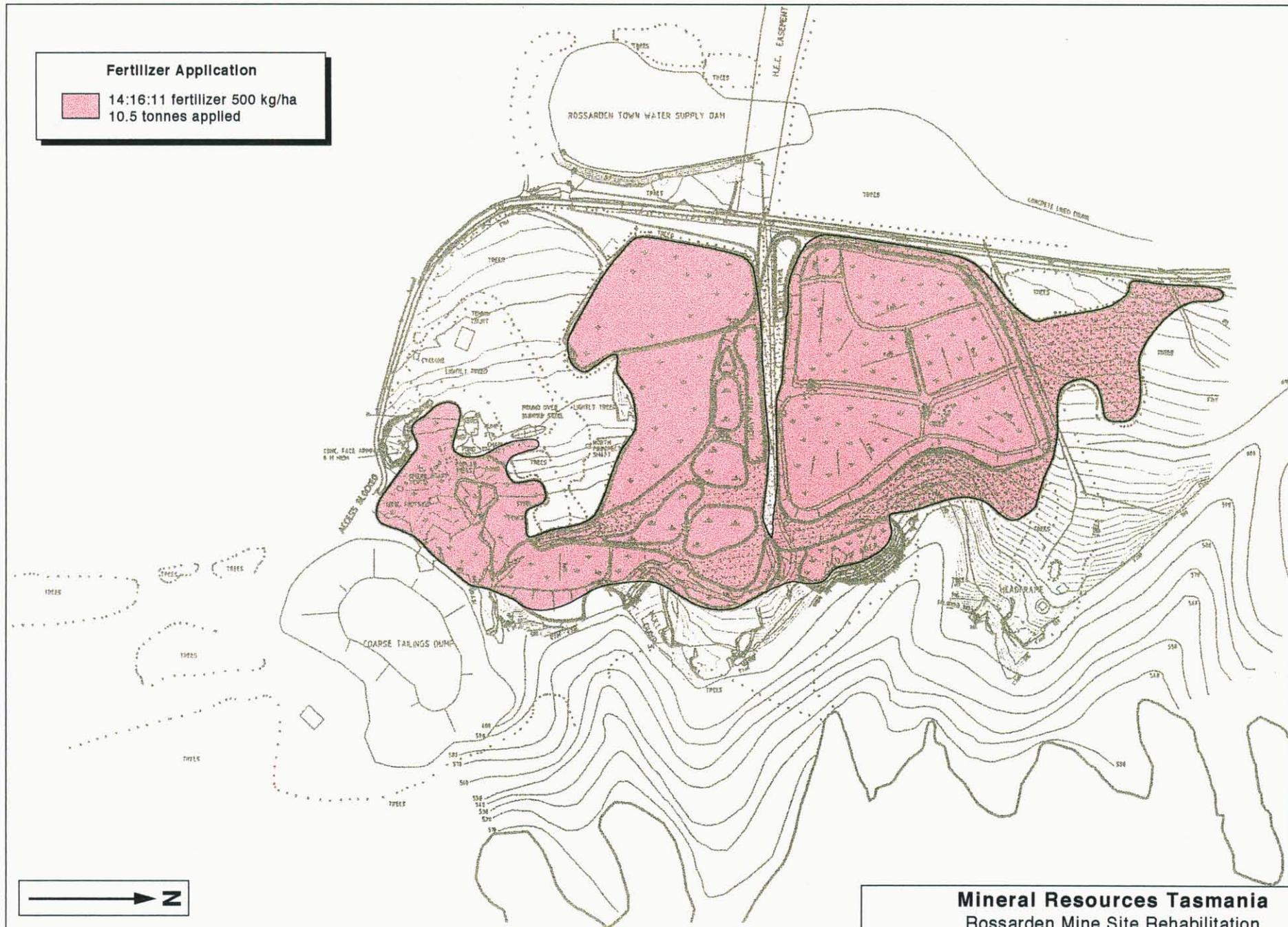


Fig. 2

Mineral Resources Tasmania
 Rossarden Mine Site Rehabilitation
 1997 Revegetation Programme - Fertilizer Application
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	Poa. spp. "Virocell" trial
	Exotic grass mix only
	Exotic grass, Acacia & Cassinia mix
	Native seed, cover crop & native seedlings
	1996 Revegetation trial
	Fenced plot
	Lomandra cuttings
	Juncus introduction

- 3400 seedlings planted
- 1200 Poa. spp. "Virocells" planted
- 63 kg of native seed applied
- 1345 kg of exotic seed applied
- 50 Lomandra cuttings planted
- 200 Juncus cuttings planted

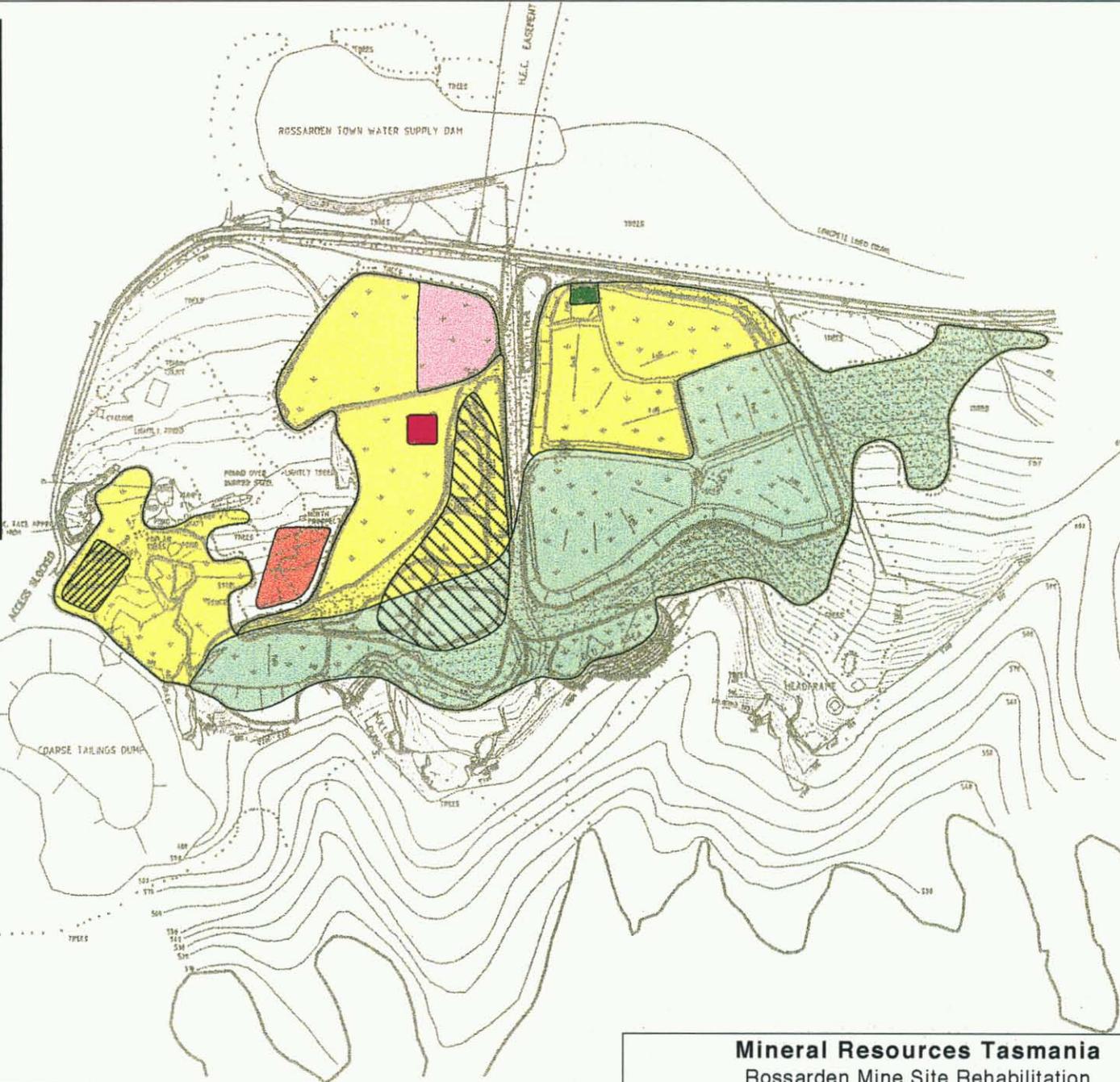


Fig. 3

Mineral Resources Tasmania
 Rossarden Mine Site Rehabilitation
 1997 Revegetation Programme - Vegetation Establishment
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Original base plan from Thompson & Brett Pty Ltd drawing No. 96-1534-08

5 cm

July 1997

Seed Mix 2

Applied in combination with the main exotic grass mix over 10 ha.

	kg
<i>Acacia dealbata</i>	7.0
<i>Acacia terminalis</i>	0.5
<i>Cassinia acculeata</i>	2.0

3.1.3.2 Exotic Seed Mixes

Cover Crop

The cover crop was applied to 11 ha corresponding to the application of the main native seed mix.

Cereal Rye	220 kg
Tama Ryegrass	20 kg

Stabilising Grass Mix

This mix was applied to approximately 10 ha.

	kg
Cereal Rye	600
Ryegrass Concorde	155
Ryegrass Tama	200
Ryegrass Victorian	10
Fescue Sheep	5
Fescue hard	5
Fescue red creeping	25
Fescue chewing	25
Browntop Bent	45
White Clover	35

3.1.3.3 Seedlings

Approximately 4600 seedlings were planted and the species were as follows :

<i>Acacia dealbata</i>	530
<i>Acacia terminalis</i>	50
<i>Cassinia aculeata</i>	50
<i>Eucalyptus amygdalina</i>	50
<i>Eucalyptus dalrympleana</i>	50
<i>Eucalyptus delegatensis</i>	50
<i>Eucalyptus gunnii</i>	50
<i>Eucalyptus pauciflora</i>	50
<i>Eucalyptus rodwayii</i>	50
<i>Eucalyptus rubida</i>	50
<i>Hakea lissosperma</i>	170

<i>Leptospermum lanigerum</i>	450
<i>Leptospermum scoparium</i>	150
<i>Poa spp</i>	1650

Seedlings as "Virocells"

<i>Poa spp</i>	1200
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3.1.3.4 Revegetation Plan Variation.

In addition to the original plan, several trial revegetation plots were established and they included the following :

- planting 1200 Virocell Poas
- placement of 200 *Juncus* transplants into poorly drained damp areas
- planting of 50 *Lomandra* cutting
- the establishment of a browsing animal proof fencing plot

The location of these plot are identified in Figure 3.

3.1.3.5 Revegetation Difficulties

Crows have been pulling the grass plants out of the ground. They appear to have pulled the grasses out in groups of 30-40 and approximately 500 seedlings have been disturbed in this fashion. They have all been replaced, unfortunately, many will die. The "Virocells" have not been affected.

Native animals have already started to browse planted seedlings. Shooting permits have been obtained from the Forestry Corporation in order to implement limited control. Browsing will slow down site recovery significantly.

4.0 MONITORING AND MAINTENANCE

4.1 Monitoring

Monitoring inspections should be conducted annually in early Autumn of any one year and should be conducted between representatives of DELM, TDR/Mines and LMRS. Future rehabilitation works will be discussed at that inspection along with any remedial and maintenance measures that are deemed necessary.

4.2 Photographs

Typical progressive rehabilitation photographs are attached and the location and direction of the photographs are identified in Figure 4.

4.3 Maintenance

Generally, the clays used for capping the tailings were deficient of all major nutrients. Fertilizer was applied as a "starter" mix for both the exotic and native species. Nutrient analysis will be required in the future to determine the maintenance fertilizer regime required to maintain vegetative growth.

Erosion problems may arise and will need to be addressed. Acid drainage problems may also arise and additional remedial measures may need to be undertaken following the maintenance inspection.

4.4 Weeds

Clay movement and associated earthworks were conducted in some areas already infested with weeds, particularly gorse and broom. Depending of the extent of earthworks and machinery movement within these areas, there will be a requirement to monitor and implement control on any establishing weeds.

5.0 FUTURE WORK

In addition to on-going maintenance, additional revegetation infill planting with Poa grasses is recommended. The levels of planting should be determined during the maintenance inspections and will involve a review of the "Virocell" and slim line grasses planted in 1997. *Lomandra* species, *Juncus* cutting and tea tree slash application should be considered in the maintenance programme for 1998.

The existing gorse and broom infestation requires treatment and this work should be programmed for 1998.

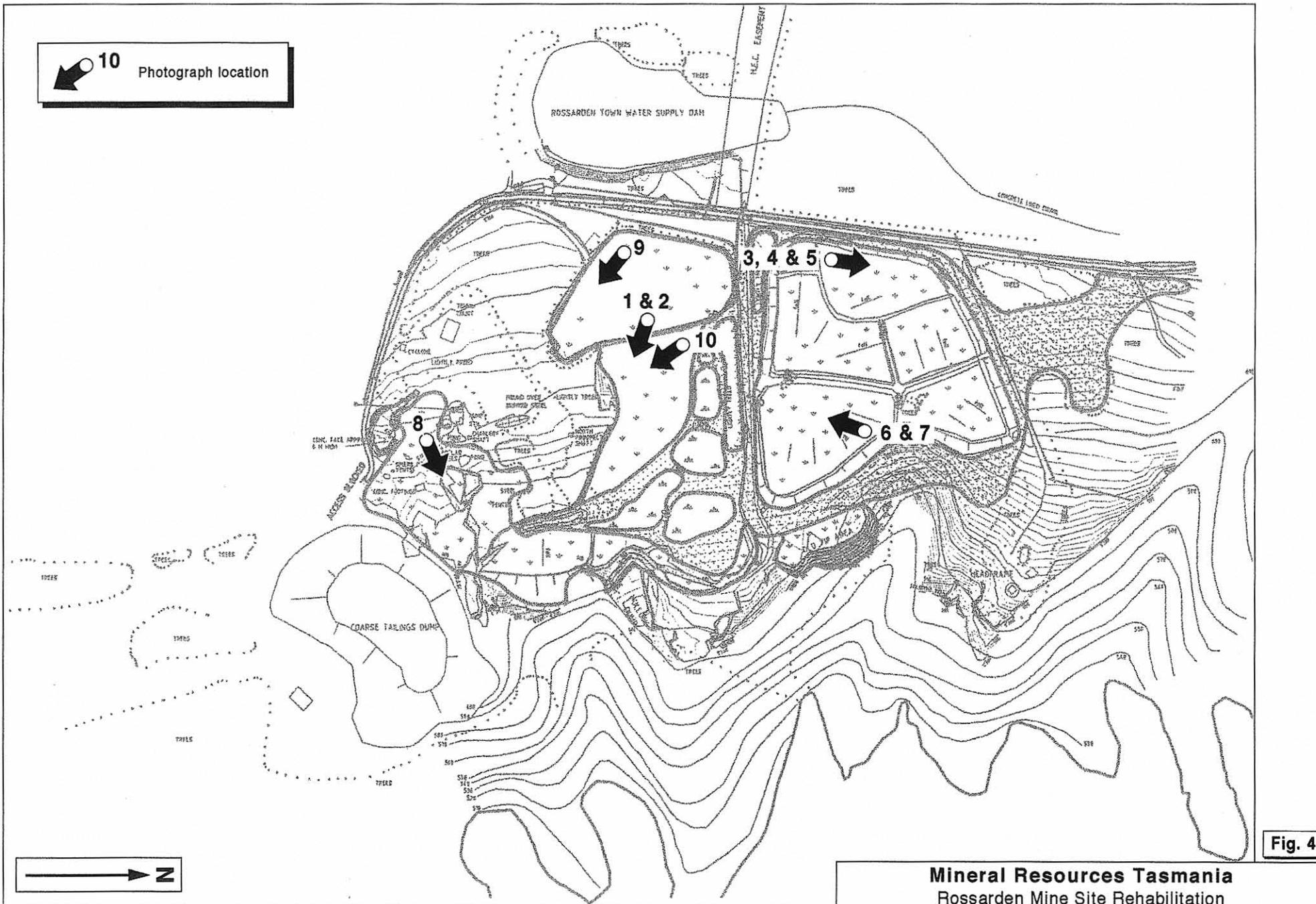


Fig. 4

Original base plan from Thompson & Brett Pty Ltd drawing No. 96-1534-08

Mineral Resources Tasmania
 Rossarden Mine Site Rehabilitation
 1997 Revegetation Programme - Photograph Locations
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MINERAL RESOURCES TASMANIA ROSSARDEN MINE SITE REHABILITATION



PHOTOGRAPH 1: COARSE TAILINGS DEPOSIT. OCTOBER 1994.



PHOTOGRAPH 2: COARSE TAILINGS DEPOSIT FOLLOWING CLAY COVERAGE AND REVEGETATION TREATMENTS. JULY 1997.

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PHOTOGRAPH 3: CLAY DAM AND TAILINGS. SEPTEMBER 1992.



PHOTOGRAPH 4: CLAY DAM AND TAILINGS FOLLOWING CLAY COVERAGE. MAY 1997.



PHOTOGRAPH 5: CLAY DAM AND TAILINGS FOLLOWING CLAY COVERAGE AND REVEGETATION TREATMENT. JULY 1997.

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PHOTOGRAPH 6: SLIME TAILINGS DEPOSIT. OCTOBER 1994.



PHOTOGRAPH 7: SLIME TAILINGS DEPOSIT FOLLOWING CLAY COVERAGE AND REVEGETATION TREATMENTS. JULY 1997.

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MINERAL RESOURCES TASMANIA ROSSARDEN MINE SITE REHABILITATION



PHOTOGRAPH 8: SURFACE CULTIVATION FOLLOWING LIME AND FERTILIZER APPLICATION. JUNE 1997.



PHOTOGRAPH 9: SEEDLING PLANTING. JULY 1997.



PHOTOGRAPH 10: BROWSING ANIMAL-PROOF FENCED PLOT. JULY 1997.