2-1990

Reconnaissance investigation of Fitzgerald location 1646 and new land adjacent Fitzgerald location 1998 Mt. Ridley

Tim D. Overheu
tim.overheu@dpird.wa.gov.au

RECONNAISSANCE INVESTIGATION

OF

FITZGERALD LOCATION 1646 AND

NEW LAND ADJACENT FITZGERALD

LOCATION 1998 MT RIDLEY

T.D. OVERHEU

FEBRUARY, 1990

CONTENTS

RECONNAISSANCE INVESTIGATION OF FITZGERALD LOCATION 1646 AND NEW LAND ADJACENT FITZGERALD LOCATION 1998, MT RIDLEY

INTRODUCTION

The investigated new land is located approximately 65km NNE of the township of Esperance. The new land consists of two, Vacant Crown Land blocks, one already surveyed by the Department of Land Administration, (Locality 1646) Lignite Road Mt Ridley, and the other, which is unsurveyed scrub situated off Bronzewing Road, Mt Ridley (figures 1 & 2). The size of each block surveyed is calculated to be approximately 2000ha.

The surrounding farms of the two blocks investigated (1643, 1644, 1645, 1648 and 1998) were released after 1978. Clearing on most of these farms began by 1981 and by 1984 most of the surrounding farms were totally cleared of native vegetation. Sheep grazing, cropping of wheat, barley, lupins, and hay cutting are the predominant land uses for the area. Locality 1645 carries no livestock and crops continually with lupins - barley - wheat (1:1 rotation). In 1988 some clover harvesting was conducted in the area which decreased the depth of sand over the clay by as much as 5cm. The average annual returns for crops in the area are: (i) lupins - 0.8 tonnes/ha, (ii) wheat - 2.0 tonnes/ha, (iii) barley - 2.0 tonnes/ha. These returns remain fairly static and do not appear to be improving with time. The landscape and distribution of soils, across the surrounding farms remain fairly constant with little variation. From initial observations of the surrounding farms, there appear to be no surface salt problems such as salt scalds or large denuded areas with barley grass, indicative of salt within the surface horizons of the profile. Most of the farms being only in their seventh or eighth year of operation, however, do illustrate potential land degradation hazards, detected from sub-surface observations and from the chemical data. Such hazards include water-logging, insitu salinity, water erosion, wind erosion and other soil toxicities. The salt lakes that are present are fairly well self contained, however, they are an expression of the water table for the area.

Access through the new land investigated was gained by survey tracks cleared by the Department of Land Administration and Western Colleries Pty Ltd. Both blocks are covered by natural mallee vegetation (documented in Appendix II, with the soil descriptions). The vegetation is undergoing slow regeneration after a fire which occurred approximately eight years ago. Crown cover and ground cover is therefore mid-dense to sparse.

The climate of the Mt Ridley area is reasonably dry. Rainfall predominantly occurs during winter and decreases rapidly before the summer months. The average annual rainfall is estimated to be 350 mm per year.

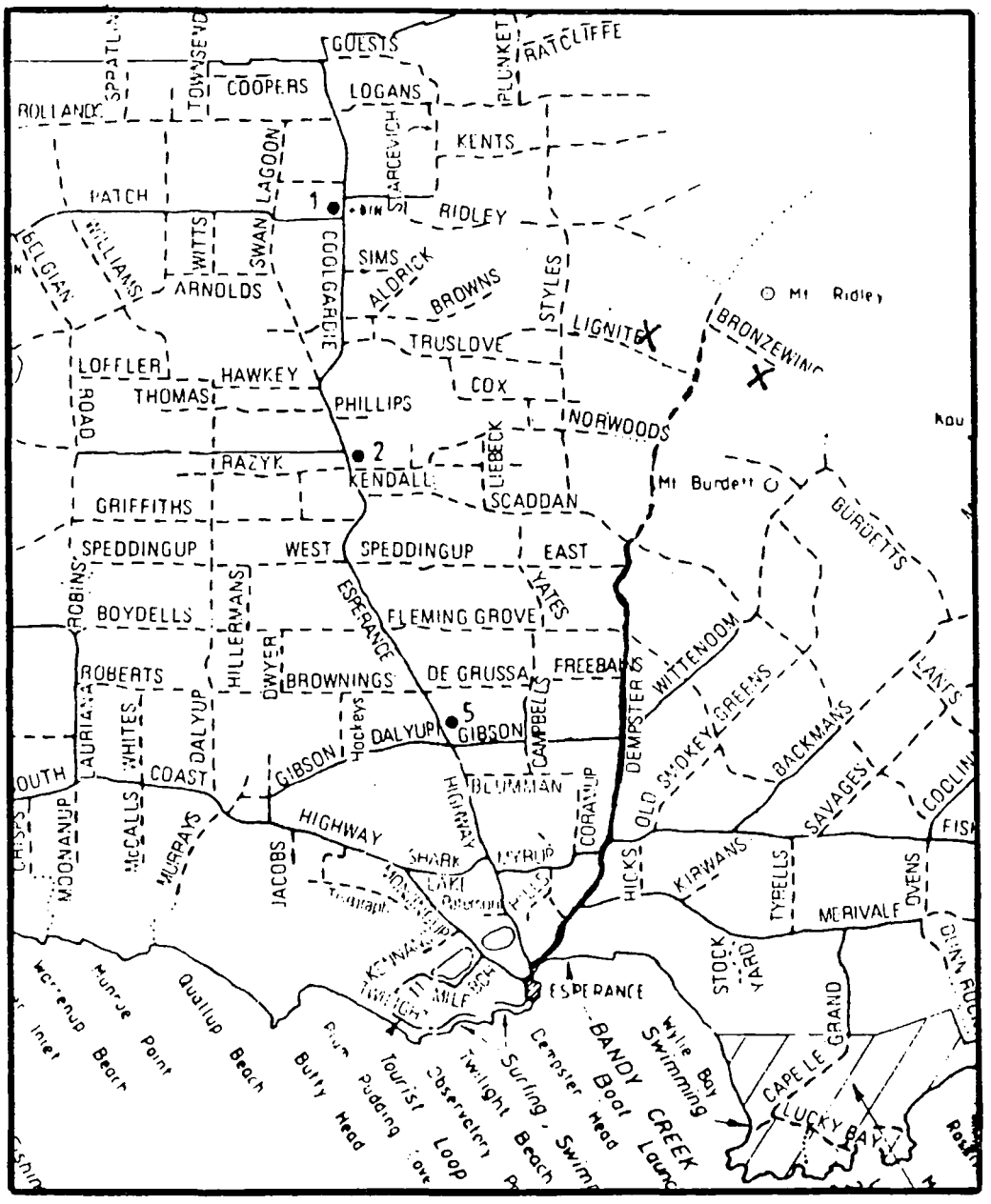


Figure 1. Regional location of the two blocks surveyed.

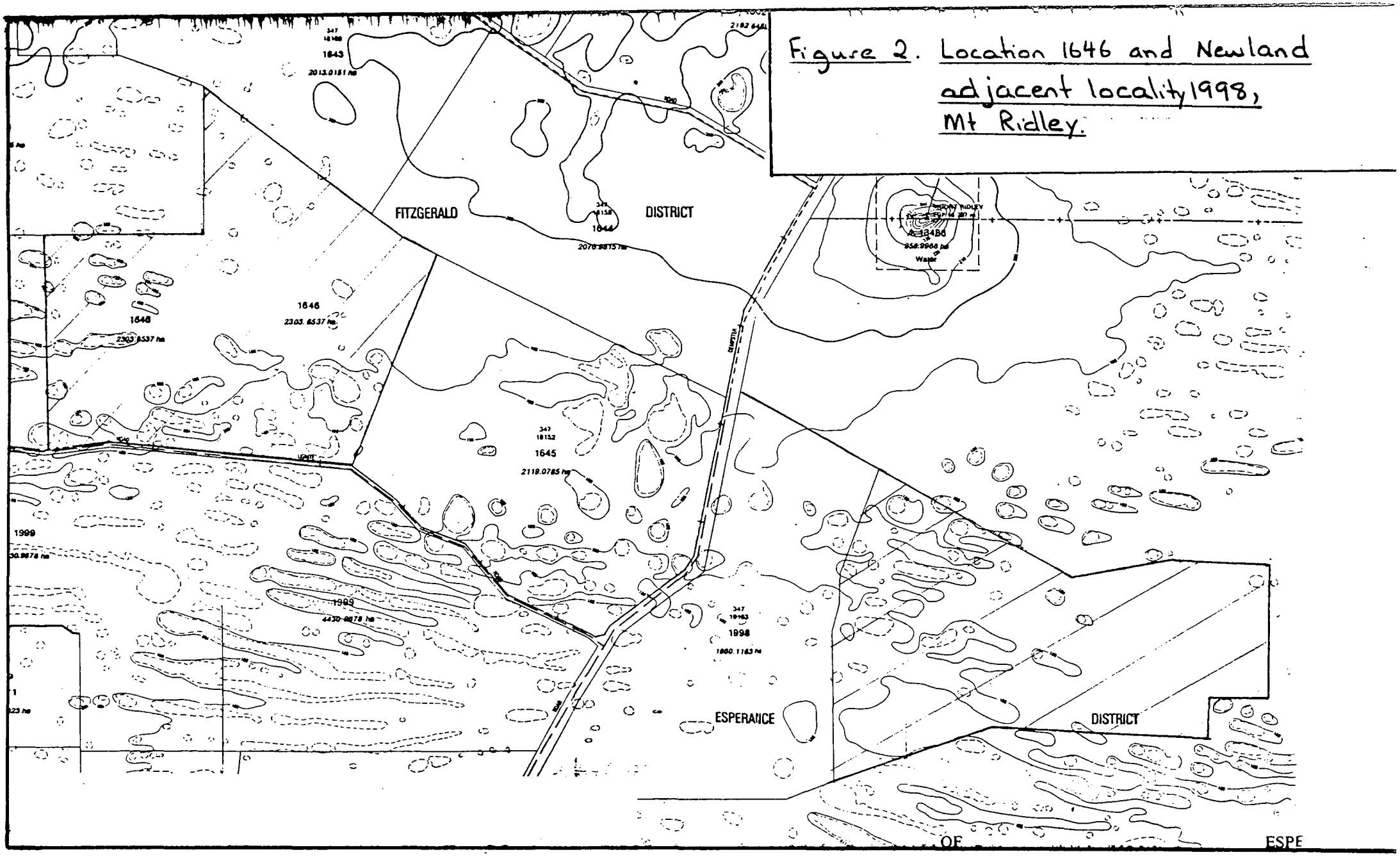


Figure 2. Location 1646 and Newland adjacent locality 1998, Mt Ridley.

LANDSCAPE

Aerial photography of the Mt Ridley area shows that the landscape is complex, with extensive sand dunes, playa/salt lakes and deposits of Kopi (Beete). The landscape of location 1646 is characterized by longitudinal salt lakes and depression systems with clay/limestone ridges running parallel to the salt lakes, on the western half of the block. The depression - ridge system has created short intermittent undulations through that area. The depressions are prone to water-logging which would increase if the rainfall intercepting vegetation was removed from the adjacent ridges. The ridge areas are too small to farm. Although no salt lakes occur in the depressions, their longitudinal nature would suggest that the lakes would join up as observed on the vacant crown land block to the south of location 1646. Towards the eastern side of location 1646, although numerous salt lakes are present, the topography becomes less complex and opens out into broad undulations and plateau areas. This eastern area is also extensively covered by a soil association of Kumarl sandy loam and Beete sandy loam ("Red fluff"), which shows a hummock micro-relief.

The landscape of the new land adjacent location 1998 is similar to location 1646 on the western boundary, with longitudinal salt lake and depression systems. However, the clay ridges that run parallel to these depressions appear to be buried under deep deposits of sand as either lunettes or longitudinal dunes. It could be expected again, that if the vegetation was cleared from this area, the lakes would join, in the longitudinal depressions over time and present a significant access problem to the cleared property. For the rest of the block within the arbitrary fence line (Appendix I - Figure 10), the topography is controlled by a broad undulating landscape and by the deposition of deep sand in some areas, which has a high relief in the landscape.

THE SOILS

Seven major soil types were found to occur within the study area. Their principal profile form (PPF) according to Northcote (1979) are; (i) Gc 1.12, (ii) Gc 2.22, (iii) Dy 4.13, (iv) Dy 4.43, (v) Dy 5.43 (vi)Uc 1.21 and (vii) Uc 2.21. Detailed profile descriptions for these soils can be found in Appendix II. The first four of these soil types were found to occur in a complex pattern, particularly with the transition from one landscape feature to another. The PPF's Uc 1.21 and Dy 4.43 showed transitions only at the foot slopes of the sand dunes and lunettes where the sand sheets are less thick.

The soils on both blocks, except for the deep sands, were alkaline (pH >8.5) at shallow depth, the clays were all sodic, hardsetting and highly dispersible. Salt concentrations were variable across both blocks depending on the soil type, depth to clay and position within the landscape. In some areas the soils comprised a high percentage of rock fragments close to the surface suggesting depth to bedrock was quite shallow. Within the soils it can also be expected that other toxicities may be present. For example; boron toxicity; as was discovered on some

areas of cleared land cropped to wheat and barley. The deep sands consisted of very fine aeolian sand. The characteristics of the soils produce a poor prospect for sustainable agricultural use for the area as the problems that are likely to occur are; (i) water-logging, (ii) water erosion, (iii) salinity, (iv) wind erosion and (v) soil toxicities (figures 3 - 7).

The Distribution of the Soils

As illustrated in figure 8, the distribution of soil types over location 1646, is quite complex. Extensive areas, 1130ha out of 2000ha are covered by the less agriculturally favourable soil types of Beete sandy loam, Gc 1.12, with its association of Kumarl sandy loam, Dy 4.13 (690ha) and calcareous saline soils similar to the Beete soil, associated with salt lakes and their depressions (440ha). The remaining area consists of a shallow phase of the Circle Valley sandy loam, Dy 4.43 (780ha), and the lunettes, or pockets of deep sand, Uc 1.21 (80ha). Given a suitable position in the landscape and the management criteria listed in the following section, figure 9 illustrates the small but possible area (524ha) available for agriculture.

In figure 10, the distribution of soil types over the new land adjacent location 1998, appear to be less complex, with the bulk of the area being covered by Scaddan sand (625ha) and by Circle Valley sandy loam, Dy 4.43, (472ha). Approximately 400ha of the Scaddan sand occurred as a shallow phase soil type, with less than 8cm of sand over the clay. A large portion of the area (470ha), is also covered by deposits of deep sand, Uc 1.21 and Uc 2.21. The remaining area is taken up by salt lakes and associated depressions with calcareous saline soils (625ha) and small areas of the Beete soil type, Gc 1.21 (103ha). The available area of ariculturally favourable soil is significantly larger than that for location 1646, (Figure 11). .pa

ELECTROMAGNETIC INDUCTION MEASUREMENTS

For the determination of salinity in the field, electromagnetic induction measurements were carried out on both blocks with the EM 38. The electromagnetic conductivity was measured every 500m along the cleared tracks and where possible on cleared agricultural land adjacent the uncleared blocks. At every point a set of three measurements was made and the soil type at every recording point was determined. The electric conductivity (EC) was recorded in the vertical and horizontal position of the instrument. The results of measurements taken with the EM 38 and a description of the instrument is set out in Appendix III. Appendix III also sets out the chloride analysis for all recorded sites.

The electromagnetic readings showed that principal profile forms

Gc 1.12 (Beete), Dy 4.13 (Beete/Kumarl complex), Dy 4.43 (Circle Valley sandy loam) and Dy5.43 (Scaddan sand), had the highest salt readings (depending upon their position within the landscape). The readings also showed that both location 1646 and the new land adjacent location 1998 have a high salt content at a shallow depth as well as at 100cm depth. Readings taken from cleared agricultural land also has higher readings than the adjacent bush land.

DISCUSSION

Field observations have determined that both blocks are marginal for long-term sustainable agriculture. The problems with the soils when used for agriculture are quite diverse. It is the interaction of many systems that are responsible for the limitations on both 1646 and the new land adjacent location 1998. Even though the salt concentrations may not always be high enough to prevent clearing, (Appendix III), the soils are still sodic. Sodic soils tend to waterlog easily. A combination of water logging and salt (even in small concentrations) is severe enough to limit crop growth and prevent good crop yields. Sodic soils also tend to be highly dispersive soils and erode easily. On slightly sloping ground, rapid run-off causing severe soil erosion can occur. Adjacent farms to the two investigated blocks illustrate some of these problems in action. (Figures 3, 4, and 6).

The dry salt lake pans display blow-out geomorphology and as suggested by Scholz (1984), the material within the salt pans (which is calcareous, sodic and highly saline) is deflated and deposited as a thin mantle over the landscape. This thin mantle is believed to be "kopi" or "fluff" derivatives. Clearing of the existing natural vegetation would accelerate that process.

Wind erosion throughout the area is prominent, both on sparsely vegetated areas of fluff and deep sand on the two bush blocks and as observed on adjacent farm land. Observations at one site in particular, showed that the sand is being eroded gradually year after year. At site 34, the depth of sand over the clay equaled 30cm. On the adjacent cleared agricultural block (barley crop; 5 metres from site 34), the depth of sand over the clay equaled 5cm. In one year it was estimated that approximately 5cm of sand was lost due to clover harvesting, the remaining loss, however, could be quantified to a loss of 1cm/year of sand. Therefore, it could be assumed that in 5 years time, there will be little or no sand left to crop on.

Shallow clays present a problem in that (i) they are potential salt inducers and (ii) through cultivation, clay brought to the surface increases the risk of water logging erosion and salinity. At this same site (No. 34), it was also observed through using the EM 38 that the salt readings were significantly higher on the cleared land than in the virgin scrub, thus suggesting that the salinity levels have increased after clearing.

Of the two investigated blocks, location 1646 presents the most problems for farming. The nature of the landscape is very complex. The clays are sodic and dispersible. The depth to clay is shallow. "Fluff" takes up more than 35% of the property. The landscape is unsuitable for "whole farm" clearing. Location 1646 could not sustain long-term, broad-acre, intensive agriculture.

Even though an adjacent farm appears to be successfully cropping the land, it is important to remember that the landscape and soil types are less complex and less variable.

Continual ploughing and tillage of the soil can cause sub-soil compaction and degradation - which may prove to be not so beneficial. During paddock preparation, top soil can still be lost. Once compacted clay is brought to the surface, it creates an area which is primed for water logging, erosion and salinity.

The new land adjacent location 1998 is slightly more suitable for agriculture than locality 1646, however, the block is still considered to be marginal. On this block the limitation, apart from the depth to clay in some areas, are the deposits of deep sand. The salt lakes, depressions, and areas of "fluff" although numerous, are reasonably self contained within the north western corner of the block. The areas of deep sand, >30cm, are too deep to clear within a rainfall less than 350mm/year (Scholz, pers. com). Adequate vegetative cover must be maintained to reduce wind erosion. Crops on these areas would suffer from moisture stress and as a result could not maintain enough vegetative cover to prevent wind erosion. Even the process of cultivation would cause severe wind erosion of the areas of deep sand. The depth to clay over the bush block is variable with some areas having >20cm of top soil and others <5cm of top soil. The clays are still sodic and dispersible.

The advantage that the new land adjacent location 1998 has over location 1646, is that the land could be possibly farmed in the short term. However, there is no guarentee that farming the new land adjacent 1998 could be sustained in the longer term. If farm management was considered on this block, then the following would have to be required:-

(i) 300 metres of native vegetation should be maintained around the salt lakes and depressions. These areas should also be fenced off.

(ii) Natural areas should be left for shelter belts/ buffer zones.

(iii) Limestone ridges, areas of fluff, and areas of deep sand should be maintained under natural vegetation and fenced off.

(iv) Lane ways, access points, stock watering points, catchments and house location would all need to be carefully located.

CONCLUSION AND RECOMMENDATIONS

From reconnaissance observation, location 1646 is unsuitable for agriculture, since the areas of agriculturally favourable soils are small and the pattern of soils is complex. Small parts of the new land adjacent location 1998, could be farmed given strict management. It is therefore estimated that only 24% (524ha) of location 1646 and 39% (780ha) of the new land adjacent location

1998 are ecologically suitable for long term agriculture.

The two blocks may be more suited to farm build-up for adjacent farmers in the Mt Ridley area, rather than, as a "whole (new) farm" proposition to outside interests. Even then, the selected parcels of reasonable land should be resurveyed (fenced by soil type) and suitably managed, which again makes the proposition less economical for both the farmer and the Department of Land Administration.

Both location 1646 and the new land adjacent location 1998 are considered to be fairly representative of most vacant bush land blocks throughout the area, even though the effect of gilgai is absent. (The presence of gilgai would indicate poor drainage, and heavier textured soils). At the time of land release and land selection, the best land was allocated first. The remaining vacant crown land near Lignite Road and Bronzewing Road, including the two blocks investigated, are less favourable and are concluded to be unsuitable for sustainable agriculture due to the land degradation throughout the area.

Figure 3 Erosion gully on cleared land

Figure 4. Dispersive, shallow, clay. Erosion channels

Figure 5. Level landscape on an adjacent farm.

Figure 6. Water logged profile with soil toxicities

Figure 7. Illustration of ground cover on virgin soil.

REFERENCES

(i) Morgan, K.H., (1973), 1:250 000 Geological Serises - Explanatory Notes, Esperance - Mondrain Island, W.A. Geological Survey of W.A. A.G.P.S., Canberra.

(ii) Burvill, G.H., Johnston, D.A.W. (ed), (1988), The Soils of the Salmon Gums District - Western Australia Technical Bulletin No. 77, Department of Agriculture, Perth.

(iii) Northcotte, K.H. (1979) A Factual key for the Recognition of Australian soils CSIRO, Adelaide.

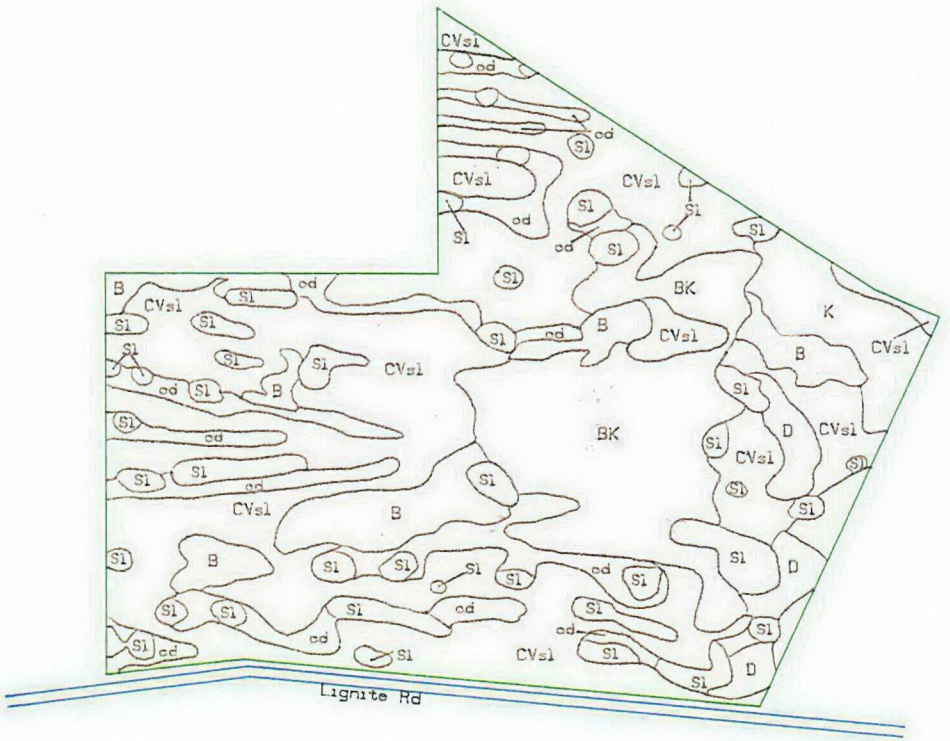
(iv) Rhodes, J.D. and Corwin, D.L. (1981) Determining soil Electrical Conductivity - Depth Relationships Using an Inductive Electromagnetic Soil Conductivity Meter. Soil Sci. Soc. Am. D. 45: 255 - 260.

(v) Scholz, G.G.H (1984) Mt Beaumont Land Release Area; Stage II: Final Report. (Internal Document). Soil Conservation Branch W.A. Department of Agriculture.

Acknowledgments

Thanks are expressed to; Mr S. T. Gee for assistance in the field and for the collation of the laboratory analysis: Mr F. Green and Mr W. Cooper for their time and machinery used to clear scrub from the existing survey tracks; Mr D. Hoskings and Mr A. Heinz for giving farm tours and a brief farm history; and to Dr G. Scholz for his help and interest in the survey area.

APPENDIX I - MAPS



LAND ASSESSMENT OF FITZGERALD LOCATION 1646

LEGEND

Existing fence

Approximate soil boundary

CVsl	Circle Valley sandy loam	Dy4.43
K	Kumarl sandy loam	Gc2.22
B	Beete sandy loam	Gc1.12
BK	Kumarl/Beete complex	Dy4.13
D	Deep sand (lunette)	Uc1.21
Sl	Salt lake	
cd	Closed depression	

N

SCALE 1:50 000

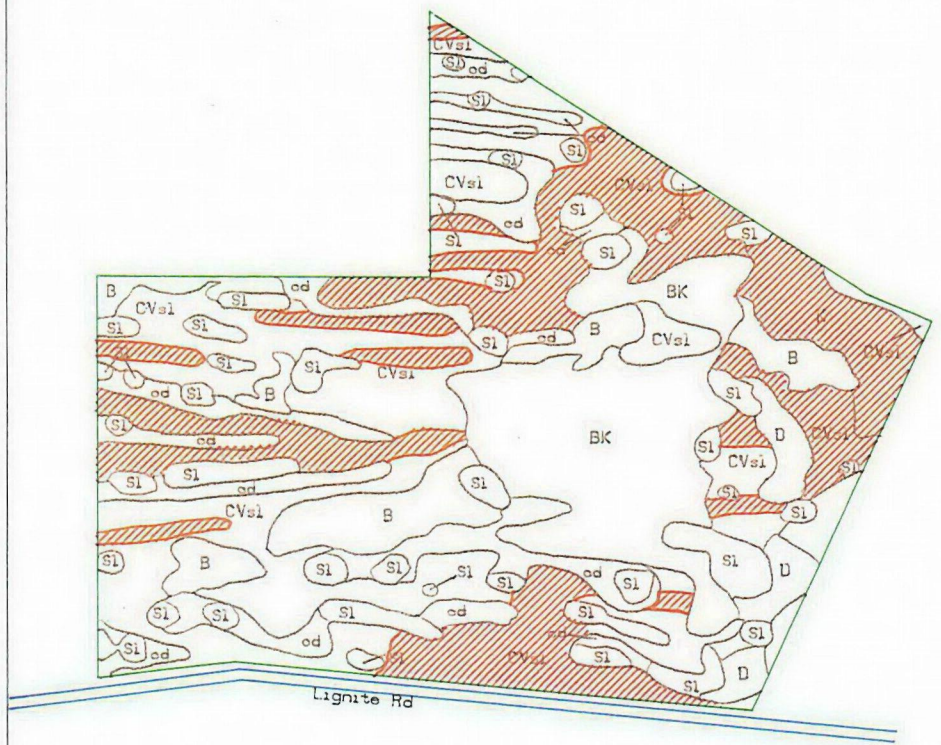
AERIAL PHOTO INFORMATION
Job No.: W.A. 2676
Run: 5
Frame: 5013
Date: 18.1.89
Shire: Esperance

Name	Date
T.D. Overheu	22.2.90

Map prepared and produced by the Western Australian Department of Agriculture Esperance District Office Division of Resource Management

Western Australian Department of Agriculture

C:\DGN\1646.DGN Jan. 04, 1980 00:15:02 TDO/90/RIDLEY



LAND ASSESSMENT OF FITZGERALD LOCATION 1646

LEGEND

	Existing fence	
	Approximate soil boundary	
	Agriculturally favourable soil	
CVsl	Circle Valley sandy loam	Dy4.43
K	Kumarl sandy loam	Gc2.22
B	Beete sandy loam	Gc1.12
BK	Kumarl/Beete complex	Dy4.13
D	Deep sand (lunette)	Uc1.21
Sl	Salt lake	
cd	Closed depression	

N

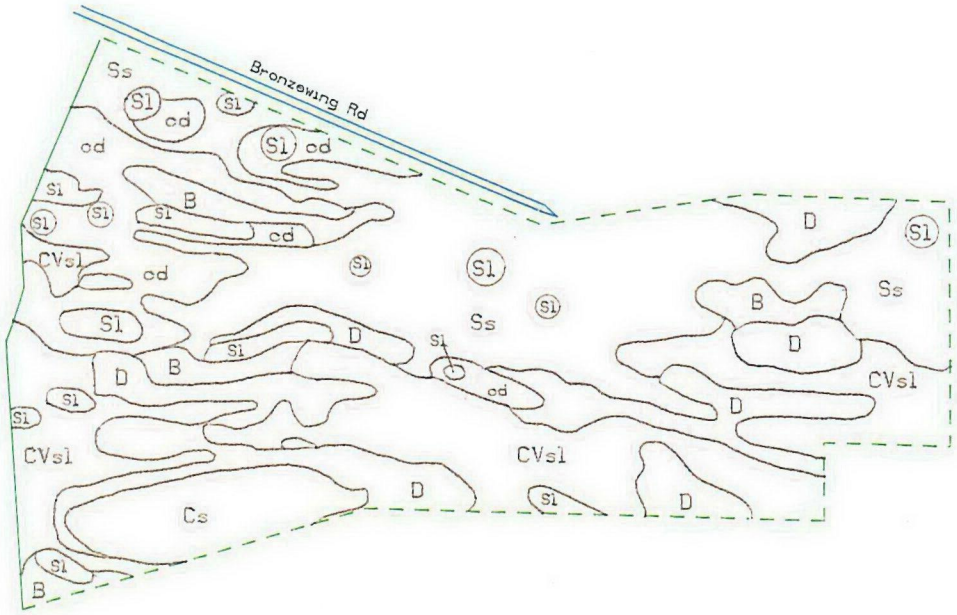
SCALE 1:50 000

AERIAL PHOTO INFORMATION
Job No.: W.A. 2676
Run: 5
Frame: 5013
Date: 16.1.89
Shire: Esperance

Name	Date
T.D. Overheu	22.2.90

Map prepared and produced by the Western Australian Department of Agriculture Esperance District Office Division of Resource Management

C:\DGN\1646A.DGN Jan. 04, 1980 00:35:35 TDO\90\RIDLEY



LAND ASSESSMENT OF NEWLAND ADJACENT FITZGERALD LOCATION 1998

LEGEND

———	Existing fence	
- - -	Arbitrary fence for new land	
———	Approximate soil boundary	
CVsl	Circle Valley sandy loam	Dy4.43
Ss	Scaddan sand	Dy5.43
B	Beete sandy loam	Gc1.12
D	Deep sand (lunette)	Uc1.21
Cs	Corinup sand	Uc2.21
Sl	Salt lake	
cd	Closed depression	

N

SCALE 1:50 000

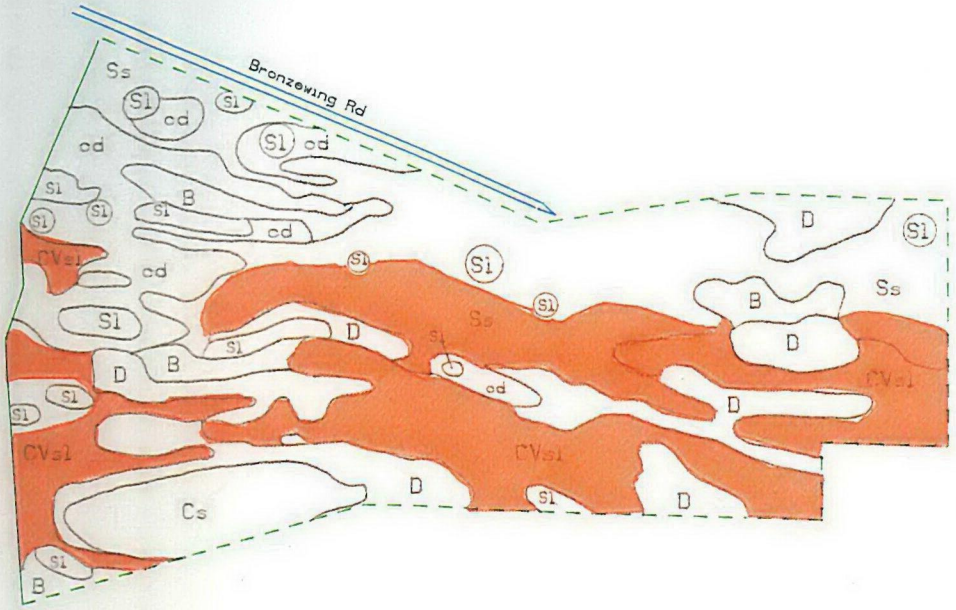
AERIAL PHOTO INFORMATION
Job No.: W.A. 2676
Run: 6
Frame: 5057
Date: 18.1.89
Shire: Esperance

Name	Date
T.D. Overheu	22.2.90

Map prepared and produced by the Western Australian Department of Agriculture Esperance District Office Division of Resource Management

Western Australian Department of Agriculture

C:\DGN\NEWLAND.DGN Jan. 04, 1980 06:41:34 TDO\90\RIDLEY



LAND ASSESSMENT OF NEWLAND ADJACENT FITZGERALD LOCATION 1998

N

LEGEND

- Existing fence
- Arbitrary fence for new land
- Approximate soil boundary
- Agriculturally favourable soils

CVsl	Circle Valley sandy loam	Dy4.43
Ss	Scaddan sand	Dy5.43
B	Beete sandy loam	Gc1.12
D	Deep sand (lunette)	Uc1.21
Cs	Corinup sand	Uc2.21
Sl	Salt lake	
cd	Closed depression	

SCALE 1:50 000

AERIAL PHOTO INFORMATION
Job No.: W.A. 2676
Run: 6
Frame: 5057
Date: 18.1.89
Shire: Esperance

Name	Date
T.D. Overheu	22.2.90

Map prepared and produced by the Western Australian Department of Agriculture Esperance District Office Division of Resource Management

C: \DGN\NEWLAND.DGN Jan. 04, 1980 07:37:27 TDO\90\RIDLEY

APPENDIX II - PROFILE DESCRIPTIONS

APPENDIX II - PROFILE DESCRIPTION Dy 4.13

LOCATION:

Mt Ridley, Location 1646, Lignite Road

CO-ORDINATES:

Longitude: 407000 Latitude: 6314000

TOPOGRAPHIC MAP:

Esperance series, 1:50 000, SI 51 - 6
Sheet No. 3231 - 11, 3331 - 11

AERIAL PHOTOGRAPH:

Esperance Run 5, frame No. 5013
Series No. W.A. 2672, scale 1:50 000

LANDFORM:

Level, with a hummock microrelief

SURFACE CONDITIONS:

Thin, weak crust (0.5cm thick) small polygonal cracks, but no open cracks

EROSION

None

DEPOSITION;

Sand and Calcareous silt (<1cm thick)

LAND USE:

Native Bushland

SOIL SERIES

B/K: Beete Sandy loam (B) in complex with Kumarl Sandy loam (K

K = Ksl = Brown sandy loam on clay

B = Bsl = light grey or brown powdery calcareous sandy loam over clay loam or light clay

GEOLOGICAL MAP;

Esperance - Mondrain Island, W.A.; Sheet SI 51-5, 1973, 1:250 000.

Map Unit : Qpi - red inland sandplain; deposits of red loamy sands over white limestone over grey to greenish clay

VEGETATION;

Stratum 1 - E.transcontinentalis E.eromophila E.conglobulata

Stratum 2 - Metaleuca pentagona, M. cucullata

GROUND COVER:

Sparse

DATE OF SAMPLING:

26/09/89

NAME;

T.D. Overheu

PRINCIPAL PROFILE FORM:

Dy 4.13

MAP SYMBOL;

BK

Horizon	Depth (cm)	Description
A1	0 - 5	5 YR 5/3 (moist; reddish brown), whole coloured sandy clay loam, FTGr = 4 apedal moist, weak consistence sandy fabric ph value : 7.0 slight reaction with HCl abundant roots small lime nodules (<20%) clear boundary to:
B21	5 - 13	7.5 YR 5/4 (moist; brown, V/C 2) whole coloured light clay : FTGr = 5 structureless dry, weak consistence ph value : 9.5 Strong reaction with HCl abundant roots medium sized limestone nodules (20%) Gradual boundary to:
pa		
B22	13 - 31	5 YR 4/6 (moist; yellowish red) pale, small streak/mottle, soft lime Light clay; FTGr = 5 dry moderate consistence pH value: 9.5 strong reaction with HCl some small fine roots (limestone) nodules (20 - 30%)

PROFILE DESCRIPTION Dy 1.53

LOCATION:

Mt Ridley, location 1646, Lignite road

CO-ORDINATES;

Longitude: 406000 Latitude: 6312500

TOPOGRAPHIC MAP:

Esperance Run 5, frame No. 5013
Series No. W.A. 2676, scale = 1:50 000.

LANDFORM:

Level and some depressions

SURFACE CONDITIONS:

Weakly crusted; (0.5cm thick) lime and lime concretions (up to 20% cover)

EROSION:

Wind erosion an uncovered ground

LAND USE:

Native bushland

SOIL SERIES:

Bsl = Beete sandy loam, light grey or powdery brown calcareous sandy loam over clay loam or light clay

GEOLOGICAL MAP:

Esperance - Mondrain Island, W.A.
Sheet SI 51 - 6, 1973, 1:250 000
Map Unit Qpi - red inland sandplain - deposits of red loamy sands over white limestone over grey to greenish clay

VEGETATION:

Stratum 1 - Eucalyptus eromophila, E leptocalyx
E. transcontinentalis

Stratum 2 - Melaleuca pentagona, M culcullata

GROUND COVER:

Dense with clear patches

DATE OF SAMPLING:

25/09/89

NAME:

T.D. OVERHEU

PRINCIPAL PROFILE FORM:

Dy 1.53

MAP SYMBOL:

B

HORIZON	DEPTH (CM)	DESCRIPTION
A1	0 - 5	10 YR 6/2 (moist; light brownish grey; V/C 2) whole coloured weak loamy fine sand FTGr = 1 structureless moderately moist, weak consistence ped fabric = sandy ph value: 8.0 Hydrophobic strong reaction with HCl, frequent lime concretions, abundant roots to 20cm, abundant mycelium and termites between 2 - 8cm Abrupt boundary to.

Horizon	Depth	Description
A12	5 - 25	10 YR 7/1 (moist; very pale brown VC3) whole coloured silty clay loam; FTGr = 4 structureless Ped fabric : sandy weak consistence, Dry ph value = 8.5 strong reaction with HCl, high % lime concretions; abundant roots to 20cm abundant mycelium Clear boundary to;
B21	25 - 45	2.5Y 6/4 (moist; light yellowish brown V/C 2)

		whole coloured silty clay; FTGr = 5 weak polyhedral structure weak consistence, moderately moist ped fabric = rough ph value = 9.5 strong reaction with HCL abundant lime concretions
	45+	Limestone blocks, 40cm across

PRINCIPAL PROFILE FORM: Gc1.12 (different PPF, same unit on map)

MAP SYMBOL:

B

HORIZON	DEPTH (CM)	DESCRIPTION
A1	0 - 5	10 YR 6/4 (moist; light yellowish brown V/C 2) whole coloured humus, weak loamy fine sand FTGr = 1 structureless moderately moist, weak consistence sandy fabric pH value = 9.5 strong reaction with HCl gradual boundary to:
A12	5 - 10	10 YR 7/4 (moist; pale brown V/C 3) whole coloured sandy clay loam FTGR = 3 structureless;
B21	10 - 25	7.5 YR 7/6 (moist; reddish yellow, V/C 4) whole coloured sandy clay loam, FTGr = 4 structureless very dispersive pH value = 9.5 strong reaction with HCl large limestone blocks increasing with depth few roots

PROFILE DESCRIPTION Gc 2.22

LOCATION:

Mt Ridley, location 1646, Lignite Road

CO-ORDINATES:

Longitude: 410000 Latitude: 6315000

TOPOGRAPHIC MAP;

Esperance 1:50 000, series SI 51 - 6
Sheet No. 3231 - 11

AERIAL PHOTOGRAPH:

Esperance Run 5, frame no; 5013
Series No. W.A. 2676; Scale = 1:50 000

LAND FORM;

Level plateau

SURFACE CONDITION:

Weakly crusted, (0 - 5cm thick) surface with a spongy nature

EROSION;

None

LAND USE;

Native bushland

SOIL SERIES:

KSL = Kumarl Sandy Loam; brown sandy loam on clay

GEOLOGICAL MAP:

Esperance - Mondrain Island, W.A.

Sheet SI 51 - 6, 1973, 1: 250 000, Map Unit, Qpi - red inland sandplain, deposits of red loamy sands over white limestone over grey to greenish clay. (Quarternary)

VEGETATION:

Stratum 1 - Eucalyptus Leptocalyx
E. transcontinentalis

Stratum 2 - Melaleuca pentagona M. preissiana

GROUND COVER:

Dense

DATE OF SAMPLING:

26/09/89

NAME:

T.D. OVERHEU

PRINCIPAL PROFILE FORM

Gc 2.22

MAP SYMBOL:

K

PROFILE DESCRIPTION Gc 2.22

HORIZON	DEPTH	DESCRIPTION
A1	0 - 5	5 YR 5/3 (moist; reddish brown) whole coloured humus, silty clay loam FTGr = 4 structureless moist, crumbly consistence pH value = 6.5 abundant roots Gradual boundary to
B21	5 - 15	7.5 YR 5/4 (moist; brown) whole coloured light clay, FTGr = 5 weak polyhedral structure weak consistence ped fabric, rough pH value = 8.5

		limestone concretions present strong reaction to HCl dense mycelium and termites 5 - 10 cm below the surface. abundant roots Gradual boundary to;
B22	15 - 30	5 YR 4/6 (moist; yellowish red =VC4) mottled upto 15% with a pale white slightly mottled light clay FTGr = 5 pH value = 9.0 strong reaction to HCl abundant limestone concretions moderately moist consistence

PROFILE DESCRIPTION Uc 2.21

LOCATION:

Mt Ridley, new land adjacent location 1998

CO-ORDINATES;

Longitude:	409300	Latitude:	6312000
"	418000	"	6308500

TOPOGRAPHIC MAP;

Esperance 1:50 000 series SI 51 - 6
Sheet No. 3331 - 111

AERIAL PHOTOGRAPH:

Esperance Run 6 frame No. 5057
Series No. W.A. 2676, scale 1:50 000

LAND FORM;

Broad dune

SURFACE CONDITIONS;

Loose, sandy

EROSION:

Wind erosion

LAND USE:

Native Bushland

SOIL SERIES

CS = Corinup Sand, grey to pale yellow sand >75cm

GEOLOGICAL MAP:

Esperance - Mondrain Island W.A.

Sheet SI 51 - 6, 1973, 1:250 000
Map unit = Qpi; red inland sandplain - deposits of red loamy sands over white limestone over grey to greenish clay.

VEGETATION:

Stratum 1 - Eucalyptus tetragona, Banksia media,

Stratum 2 - Melaleuca pentagona

GROUND COVER;

Dense with open patches

DATE OF SAMPLING:

26/09/89

NAME;

T.D. OVERHEU

PRINCIPAL PROFILE FORM: Uc 2.21

MAP SYMBOL: U

HORIZON	DEPTH (cm)	DESCRIPTION
A1	0 - 9	10 YR 6/2 (moist, light brown grey) whole coloured fine sand, FTGr = 1 apedal sandy fabric pH value = 6.5 abundant roots Sharp boundary to:

A12	9 - 84	10 YR 8/1 (Dry, white V/C=3) 10 YR 7/2 (Moist, light grey V/C=3) whole coloured fine Sand, FTGr = 1 apedal pH value = 6.5 frequent roots abrupt boundary to:
B2	84 - 120+	10 YR 6/8 (moist, brown yellow VC 4) whole coloured fine sand, FTGr = 1 apedal sandy fabric pH Value = 7.5 few roots at depth some pale mottling with depth

PROFILE DESCRIPTION Uc 1.21

LOCATION:

Mt Ridley, New land adjacent location 1998

CO-ORDINATES:

Easting : 418000 Northing: 6308000

TOPOGRAPHIC MAP:

Esperance 1:50 000 series SI 51 - 6
Series No. W.A. 2676, scale 1:50 000

LAND FORM:

Open sand sheet

SURFACE CONDITIONS:

Loose, sandy

EROSION:

None

LAND USE:

Native bushland

SOIL SERIES:

Gs = Gibson Sand, grey sand over white sand over clay

GEOLOGICAL MAP:

Esperance - Mondrain Island, W.A.
Sheet SI 51 - 6, 1973, 1:250 000
Unit Qpi - red inland sandplain - deposits of red loamy sands over white limestone, over grey to greenish clay.

DATE OF SAMPLING:

26/09/89

NAME:

T.D. OVERHEU

VEGETATION:

Stratum 1 - Eucalyptus tetragona, E. redunca
B. Media, Grevilia plujinga
E. forestiana

Stratum 2 - Melaleuca pentagona, Allohcasuarina
Campestris,

PRINCIPAL PROFILE FORM: Uc 1.21

Profile is the same as for Uc 2.21, except a yellowish brown sand is not encountered. Clay is often reached at 80 to 90cm under a grey to white fine sand

MAP SYMBOL: L

PROFILE DESCRIPTION Dy 4.43, Dy 4.53

LOCATION:

Mt Ridley, location 1646 and new land adjacent location 1998

CO-ORDINATES:

Easting : 422500 Northing : 6310000

TOPOGRAPHIC MAP:

Esperance 1:50 000; series SI 51 - 6
3231 - 11 and 3331 - 111

AERIAL PHOTOGRAPH:

Esperance Run 5 frame No. 5013
Esperance Run 6 frame No. 5057
Series No. W.A. 2676, scale = 1:50 000

LANDFORM:

Level to gently undulating plain

SURFACE CONDITIONS:

Weakly crusted

EROSION:

Slight water erosion on any small gradient

LAND USE:

Native bushland

SOIL SERIES:

CVsl = Circle Valley sandy loam

GEOLOGICAL MAP:

Esperance - Mondrain Island W.A.
Sheet SI 51 - 6, 1973, 1:250 000 : Map Unit = Qpi = red inland sandplain; deposits of red loamy sands over white limestone over grey to greenish clay.

DATE OF SAMPLING:

25/09/89

NAME:

T.D. OVERHEU

P.P.F. Dy 4.43, Dy 4.53.

MAP SYMBOL: CVs1

VEGETATION:

Fire burn area

Stratum 1 - Eucalyptus leptacalyx, E. eromophila E. forestiana, E.goniantha E.redunca

Stratum 2 - Melaleuca pentagona Allohcasuarina Campestris, Grevilia plujinga

Stratum 3 - Micorys glabra, Eromophila calohabdos, Podolepis canesceus

HORIZON	DEPTH (CM)	DESCRIPTION
A1	0 - 5	10 YR 5/2 (moist, grey V/C=2) whole coloured loamy fine sand; FTGr = 1 dry consistence pH value = 6.0 abundant roots Abrupt boundary to:
A2	5 - 15	10 YR 7/3 (moist, light grey white) whole coloured fine sand: FTGr = 1 structureless pH Value = 7.0 abundant roots Abrupt boundary to:
B21	15 - 35	2.5Y 6.6 (moist; olive yellow V/C=4) whole coloured sandy clay FTGr = 5 strong columnar 20cm x 15 cm hard setting clay, very firm consistence ped fabric = smooth pH Value = 9.0 roots concentrated on tops of domes,

along sand seams,
tops of domes cemented and stained
with organic matter

35+ Limestone fragments, angular
20cm x 20 cm
pH Value = 9.5 to 10.0

PROFILE DESCRIPTION Dy 5.43,

LOCATION:

Mt Ridley, new land adjacent location 1998

CO-ORDINATES:

Easting : **Northing :**

TOPOGRAPHIC MAP:

Esperance 1:50 000; series SI 51 - 6
3331 - 111

AERIAL PHOTOGRAPH:

Esperance Run 6 frame No. 5057
Series No. W.A. 2676, scale = 1:50 000

LANDFORM:

Level to gently undulating plain

SURFACE CONDITIONS:

Loose fine sand

EROSION:

Wind erosion in exposed areas

LAND USE:

Native bushland

SOIL SERIES:

Ss = Scaddan sand

GEOLOGICAL MAP:

Esperance - Mondrain Island W.A.
Sheet SI 51 - 6, 1973, 1:250 000 : Map Unit = Qpi = red inland sandplain; deposits of red loamy sands over white limestone over grey to greenish clay.

DATE OF SAMPLING:

25/09/89

NAME:

T.D. OVERHEU

Principal Profile Form Dy 5.43.

MAP SYMBOL: Ss

VEGETATION:

Fire burn area

Stratum 1 - E. forestiana,

Stratum 2 - Grevilia plujinga Melaleuca pentagona

HORIZON	DEPTH (CM)	DESCRIPTION
A1	0 - 8	10 YR 6/2 (moist, grey V/C=2) whole coloured loamy fine sand; FTGr = 1 dry consistence pH value = 6.0 abundant roots Abrupt boundary to:
A2	8 - 19 19 - 35	10 YR 7/2 (moist, light grey) whole coloured fine sand: FTGr = 1 structureless pH Value = 7.0 abundant roots Abrupt boundary to: sand extends to 35cm between domes of subsoil clay
B21	35+	10 YR 6/6 (moist; brown yellow V/C=4) strongly mottled sandy clay FTGr = 5 strong columnar 20cm x 15 cm hard setting clay, very firm consistence ped fabric = smooth pH Value = 9.0 roots concentrated on tops of domes, little penetration tops of domes cemented and stained with organic matter

APPENDIX III - CHEMICAL DATA

- EM 38 Induction Measurements

- CHLORIDE TITRATIONS

Compiled by S.T. Gee.

E.M. 38 INDUCTION MEASUREMENTS

The Em 38 is an instrument that integrates in the horizontal position, the electrical conductivity in the soil from the surface to a depth of 120cm. In the vertical position the instrument reads the electrical conductivity at a depth greater than 120cm. The depth interval 0 - 120cm contributes most to each reading. (Rhodes and Corwin, (1981).

Three measurements were taken at each site (roughly 50m apart). Vertical induction measurements were recorded first as they are recorded on the data sheet. For example; 180/90

Vertical Horizontal

The following table illustrates the approximate values for correlation of EM 38 measurements to % NaCl.

EM 38 VALUES	NaCl %	SUIABILITY FOR CEREAL PRODUCTION
<30	<0.10	Adequate
30 - 45	0.10 - 0.15	Adequate
45 - 60	0.15 - 0.20	Adequate to Marginal
60 - 75	0.20 - 0.25	*Adequate to Marginal
75 - 100	0.25 - 0.35	Marginal
100 - 150	0.35 - 0.45	Marginal to toxic
150 - 300	0.45 - 0.65	Toxic
>300	>0.65	Toxic

* In clays a value of 0.2% is not too high, but a strong increase

can be expected in the clay after clearing, particularly when the top sand cover is lost (Scholz, pers comm).

E.M. 38 MEASUREMENTS FOR NEW LAND

SITE	EM 38 MEASUREMENTS (V/H)			SOIL	COMMENTS
34 (1)	130/60	130/50	200/180		Cleared land (1645)
34 (2)	50/80	60/20	60/30	Uc 1.21	Uncleared land
35	150/100	150/100	120/70	Dy 4.43	pH = 9.5
36	72/28	110/90	110/70	Gc 2.22	Soil mosaic
37	62/25	78/42	78/38	Gc 1.12	Soil mosaic
38	64/36	62/38	-	Dy 4.13	Soil mosaic "Red fluff"
39	150/100	60/22	50/10	Gc 1.12	Salt lakes slope
40	60/50	5/0	-	Uc 1.21	Plateau
41	100/40	100/50	100/50	Gc 1.12	
42	76/44	66/38	140/90	Gc 2.22	Compacted surface
43	-	-	-	-	
44	110/80	160/100	120/80	Dy 4.43	
45	130/100	120/100	130/100	Dy 4.43	Domed clay;ridge

46	210/120	260/50	-	Uc 1.21	Depression; Deep sand
47	40/10	-		Uc 1.21	Deep sand
48	110/80	100/80	100/50	Dy 4.43	
49	0/0	0/0	0/00	Uc 2.21	Deep sand(>100cm)
50	110/80	100/60	100/80	Dy 4.43	Tyrells 170/100
51	190/140	160/120	120/100	Dy 4.43	
52	115/70	130/75	110/80	Dy 4.43	Very shallow clay
53	130/85	120/70	100/60	Dy 4.43	Very shallow clay
54	150/100	140/80	150/100	Dy 4.43	Broad depression
55	185/130	180/130	190/150	Dy 4.43	Broad depression
56	10/0	0/0	0/0	Uc 1.21	Deep sand;plateau
57	170/110	143/85	130/90	Dy 4.43	
58	180/100	180/100	160/90	Dy 4.43	Salt lake slope
59	100/40	140/60	140/75	Uc 2.21	Salt lake slope
60	120/70	110/70	90/50	Dy 4.43	Plateau

CHLORIDE TITRATIONS

SITE	DEPTH (cm)	EC^{25} (ms/m)	EC^{25} Cl	%Cl	%NaCl
1646					
1	0-5	8.46	.012	.001	.002
	12-14	65.15	.095	.058	.095
	34-40	202.5	.295	.264	.435
2	0-5	20.9	.031	.003	.005
	5-11	50.3	.073	.047	.073
	11-17	105.4	.154	.104	.171
3	0-5	10.34	.015	.001	.002
	7-15	107.4	.157	.092	.151
	17-25	223	.325	.276	.455
4	0-5	3.935	.006		
	5-15	5.35	.007		
	15-24	63.8	.093	.058	.092
	35-41	158.5	.231	.188	.311
5	0-5	9.67	.14		
	5-11	9.165	.014	.004	.007
	14-19	141.6	.206	.177	.292
	26-33	236.5	.345	.310	.512
6	0-5	16.475	.024	.018	.029
	5-17	7.265	.011		
	20-28	38.5	.057	.027	.045
	34-43	120.25	.175	.136	.224
7	0-5	7.33	.011		
	5-26	4.145	.006		
	28-39	111.1	.162	.126	.208
8	0-5	17.905	.026	.002	.003
	5-12	9.67	.014		
	12-23	114.15	.167	.094	.155
9	0-5	141.6	.206	.177	.292
	5-15	4.95	.007		
	16-26	111.65	.163	.118	.194
10	0-5	500	.007		
	5-22	5.685	.008		
	23-37	85.2	.124	.097	.16
11	0-5	4.655	.007		
	5-15	4.53	.007		
	16-24	129.35	.188	.150	.248
12	0-5	6.955	.01	.001	.001
	5-12	3.825	.006		
	12-28	86.5	.126	.071	.118
13	0-7	6.58	.010		
	15-25	53.35	.078	.015	.025

14	0-5	8.835	.013			
	5-15	8.17	.012			
	15-27	57.7	.084	.037	.061	
15	0-5	3.175	.005			
	5-16	4.56	.007			
	16-32	107.9	.157	.118	.194	
16	0-5	3.09	.005			
	5-18	7.42	.011			
	18-37	144.15	.209	.162	.266	
17	0-5	100.45	.487	.149	.246	
	5-12	65	.095	.088	.144	
	12-30	278	.405	.378	.623	
18	0-5	5.495	.008			
	5-18	5.53	.008			
	18-37	99.85	.147	.096	.157	
19	0-5	5.64	.008			
	5-14	7.38	.011			
	14-27	6.04	.009			
	27-41	94.7	.138	.094	.155	
20	0-5	7.295	.011			
	5-23	11.57	.017	.002	.004	
	23-37	126.5	.184	.130	.215	
21	0-5	8.57	.013	.007	.011	
	5-17	20.75	.03	.007	.115	
	17-34	137.55	.20	.148	.243	
22	0-5	6.74	.01			
	5-11	7.895	.012	.001	.001	
	11-30	128.8	.188	.133	.220	
23	0-5	3.035	.004			
	5-16	4.635	.007			
	16-32	99.9	.146	.11	.181	
24	0-5	37.95	.081	.002	.002	
	5-41	52.55	.077	.028	.047	
25	0-5	34.9	.051	.005	.007	
	5-36	76.5	.112	.060	.020	
26	0-5	6.56	.009			
	5-22	7.365	.011			
	22-36	56.5	.081	.051	.083	

SITE	DEPTH	Ec^{25}	Ec^{25}	Cl	%Cl	%NaCl
27	0-5	7.17	.010			
	5-23	9.375	.014			
	23-38	128.3	.187		.148	.243
28	0-5	25.8	.038		.002	.003
	5-9	43.25	.063		.005	.009
	9-22	51.4	.075		.018	.023

29	0-5	11.085	.016	.004	.007
	5-37	12.615	.018	.009	.014
30	0-5	18.35	.027	.002	.003
	5-20	76.75	.112	.056	.091
31	0-5	5.275	.008		
	5-22	13.94	.020	.008	.013
	22-43	148.05	.216	.166	.274
32	0-5	8.99	.013		
	5-54	4.075	.006		
	54-64	32.75	.048	.023	.037
33	0-5	6.105	.009		
	5-43	9.41	.014		
	43-53	81.45	.119	.088	.144
34	0-5	5.445	.008		
	5-49	5.02	.007		
	49-64	43.95	.064	.038	.063
35	0-5	5.75	.008		
	5-17	11.755	.017	.003	.005
	17-39	105.7	.155	.111	.183
36	0-5	7.105	.010		
	5-10	36.7	.054	.303	.05
	10-26	152	.221	.185	.304
37	0-5	7.69	.011		
	5-15	134.35	.120	.169	.287
38	0-5	4.74	.007		
	5-11	8.395	.012	.008	.001
	11-26	97.35	.142	.097	.159
39	0-5	32.2	.047	.005	.007
40	40-80	118	.196	.134	.220
41	5-30	137.2	.200	.142	.235
	30-50	346	.504	.486	.801
44	16-40	166.65	.243	.189	.306
45	0-5	6.035	.009		
	5-11	14.005	.021	.009	.014
	11-30	192	.279	.223	.368
46	80-90	52.7	.077	.053	.088
47	0-17	4.95	.007		
	17-53	3.09	.005		
	53-80	45.4	.066	.046	.076
48	8-30	168.7	.246	.201	.331

51	0-5	2.83	.004		
	5-15	6.265	.009		
	15-32	151.8	.220	.181	.298
52	0-5	2.91	.004		
	5-26	4.61	.007		
	32-38	168.8	.246	.205	.337
53	0-5	3.95	.006		
	5-7	11.47	.017	.007	.011
	7-17	72.3	.106	.061	.101
54	0-5	22.25	.033	.001	.001
	5-11	4.795	.007		
	18-25	119.25	.174	.117	.194
55	0-5	3.025	.004		
	5-17	108.95	.159	.122	.200
56	0-5	2.865	.004		
	5-72	2.97	.004		
	72-83	22.4	.033	.010	.016
57	0-5	5.54	.008		
	5-15	68.9	.101	.049	.081
58	0-5	4.33	.007		
	5-100	4.07	.006		
59	0-5	4.375	.006		
	5-60	20.85	.031	.023	.037
	61-75	79.55	.116	.090	.149
60	0-5	3.54	.005		
	5-22	4.94	.007		
	22-36	132.75	.193	.138	.227