SURFACE SOILS
of
MARANDOO
Temporary Reserve 5623-H
Western Australia

by

J. Alford

March 1980
Texasgulf Australia Ltd

This report is the sole reference used to write the soils chapter (chapter 1 in the "Marandoo Biological Report", 1982 (E95-100-7280-101).

This report also contains the results of the soil analysis (Appendix) listed in the 1982 "Marandoo Biological Report" as Table 1, as well as detailed field notes.

Fig. 2 (page 3 of this report) is the same as Fig. 2 in the "Marandoo Biological Report", & Fig. 3 (Surface Soils Map) is included in the "Marandoo Biological Report" as Fig. 3.

I have included these figures & Table 1 in this report, not in the "Marandoo Biological Report".

S.J.F.

C O N T E N T S

	Page Number
Introduction	1
Soil Types	1
Field Observations	4
References	17

A P P E N D I X

Results of soil analysis of samples tested by Agro-Nutritional Research Laboratory.

D R A W I N G S

Location Map, T.R. 5623-H

Diagrammatic Cross-Section, Marandoo

Surface Soils Map, Marandoo

INTRODUCTION

A surface soils map and six individual transects were produced for an area within T.R. 5623-H bounded by Marandoo camp and grid-line 15300E. Categories for the surface soils were chosen after grid-lines 4500E, 5700E and 7200E had been carefully examined at 25 metre intervals and the results compared with geological cross-sections, topographic maps and soil maps of the Hamersley Range. Five relatively distinct categories were selected although the mixing of groups and indistinct change points were common. Wide use of black and white and colour aerial photographs combined with ground reconnaissance helped establish boundaries between known change points on the six selected grid-lines and lines 8400E, 10,200E and 12,300E were all fully examined and all grid lines between 15,200E and Marandoo camp were surveyed to find approximate change points.

Regions designated on the map show only the major soil category of the area; small deviations within any area may occur but significant changes are shown wherever possible.

SOIL TYPES

The five categories chosen and their definitions and characteristics are as follows:-

1. OUTCROP - areas of low and sometimes extensive protrusion of either Banded Iron, Shale or Ore (Marra Mamba Iron Formation) or Jeerinah Formation associated usually with "scree" rocks approximately 0.5-5cm diameter and 70% + soil cover*. "Little subsoil" generally refers to areas of low incline such as present on the ridge top plateau where rock formation constitutes the uppermost layer.

*soil cover is referred to as density of stones present on surface.

SOIL TYPES Cont...

2. PEDIMENT - areas usually on steady or steep inclines where stability of weathered outcrop material is low; presence of large rocks and boulders in association with either prominent or low lying outcrops. Usually thick and dense rock cover, size range 0.5-30 +cm diameter. Very little subsoil. Areas of rapid water run-off.

3. QUATERNARY COLLUVIUM - fairly recent (geologically) loose and incoherent deposits at the foothills of the range slopes. Dense coverage (usually 70%+) of rocks sometimes manganese, approximately ½ - 5cm. Usually dense "scree" subsoil.

4. TERTIARY COLLUVIUM - the oldest colluvium deposited as valley fill - represents the lowest parts of the tertiary landform before it was rejuvenated. Characterized by stony to sandy subsoil, sparse to moderate soil cover (50%) described as "consolidated, uncemented valley-fill deposits containing boulders of limonite" (1). Often associated with patchy pebble cover.

5. ALLUVIUM - soft, sedimentary, loamy or clayey when moist; deposited by rivers, creeks or by flood waters. A layer of deposited colluvium-type stones may be present. Distinguished by general absence of stone cover or subsoil stones; if stones present then obviously situated via water-mediated deposition.

Two divisions separate from the five were also included because they had complex areas of more than one soil type within their recognized boundary - they are not actually separate categories:

(i) Tertiary Colluvium/Alluvium: where colluvium dominates but a dense matrix of alluvial soil infiltrates the area.

SOIL TYPES Cont...

5. ALLUVIUM Cont...

(ii) Quaternary Colluvium/Alluvium: an outwash fan where alluvial deposition has caused minor outwashing of quaternary colluvium.

Diagrammatic representation of the five major categories of surface soils and their correlation to each other is shown in Figure 2.

FIELD OBSERVATIONS: S/C = Soil Cover

(1) 4500 E (Tg)

(i) Baseline North

$3^{o}c$	0-25	Fine stones, intermittent 5-6cm ph = 6¼
	25-50	50:50 Mn, shallow cover, 50% ½ - 1½ cm 50% 1½ - 4 cm 75% s/c
	50-75	same
	75-100	Less dense-smaller rocks 55-60% S/C Elsewhere fine soil, non viscous
All	100-125	Creek bed, sedimented rocks, v. little stone cover on banks. ph = 6 soft alluvial undersoil ph = 6½ 5 - 10cm below.
Ped	125-150	½ way change very rocky, outcrops assoc. fragmented boulders graduating to finer rocks, v. few Mn.
	150-175	Same-small outcrops - 75% S/C v.small pebbles < 2mm between 1 - 5cm rocks.
out crop	175-200	Some rocky outcrops more dense S/C, 1 - 4cm rocky "scree" subsoil, Smooth fine paste when mixed in ph test ph = $5^{3}/4$. Rocky outcrops, v. little soil, 1/3 outcrop 60% stones ½ - 2cm shallow scree subsoil.
Ped	225-250	Sl. finer stones, small outcrops continued from 200 mN. 20% S/C road in between then continuous rocks - 4 cm, pebbles between.
	250-275	Large stones, between small pebbles (<mm) less compacted, v. few underground stones in areas of fine stones only.
	275-300	Stony then ~ 10m along-track
	300-325	Medium size rocks 1 - 4 cm.
	325-350	Less S/C, very fine soil, no "Scree" below. Like flood area.
	350-375	Same
$4^{o}c$	375-400	Same till ½ way then S/C increases to 80% sl. rockier below.
	400-425	Same pH = $5^{3}/4$.

(ii) Baseline South

0-25	Shallow cover of bluish Mn rocks, v. fine subsoil pH = 6
25-50	Mn rocks, dense cover, thicker 7 → 10 cm rocks. Outcrops ~ 5m from end pH = 6.
50-75	Outcrops & Large rocks
75-100	Outcrops -scattered, fewer loose large rocks.
100-125	Outcrops continue, sl. less dense rocks S/C
125-150	Larger rocks & outcrops
150-175	Outcrops, denser rock cover, few large rocks 70% < 2½cm.
175-200	No large outcrops, rocks ~ ½ → 3cm 70% pH = 6.

../4

4° C
200-225 Again constant rock size, shallow cover, Large No. v. small (<3mm)
225-250 patches or rocks (few Mn) some < 3mm, most 3 → 6mm very hard soil, some "scree" below.
250-275 Scattered patches Mn rocks between spinifex. Thin cover 1 → 1½ cm ~ 90% pH = 6 → 6½.
275-300 More rocks > 2cm. Distrubance
300-325 Scattered patches of v. small fine rocks < 3mm v.small outcrops.
325-350 Larger rocks, sl. denser cover, v. small outcrops some patches of no rock cover, compact cracked soil pH (stony areas) = 6½ (stoneless) 5¼.
350-375 Stony, mostly Mn loose stones size ½ → 4 cm (~60% cover) areas of sparse/no S/C (especially under leaf litter and spinfex centres).
375-400 same pH=6
400-425 Sl denser coverage
Ped.425-450 Larger rocks, dense cover, few small outcrops
450-475 more outcrops, large rocks
475-500 Fairly dense S/C, ~ 4cm deep v. hard soil under.
500-525 Still some outcrops, larger rocks (710 cm) plus 40% 3 → 5 cm. Near E, leucophloia pH= 6½
525-550 same
550-575 Rocky outcrops, pockets fine
out soil under.
crops575-600 Many outcrops, v. fine sub-soil pH = 6
600-625 Fragmented outcrops (extensive)
625-650 same
650-675 same
675-700 Larger rocks, dense coverage ~ 6 cm ext. outcrops pH = 6.
700-725 Mostly large & small rocks v. little soil showing
725-750 Scattered fine particles
750-775 Pysolite boulders /outcrops
775-800 same
800-825 pH = 5½.

(2) 5700 E (Tg)

(i) Baseline North

0-25 cleared,outcrops small pebbles Mn rocks pH = 6
25-50 "scree" small outcrops, stones 1-5 cm
50-75 Outcrops, large fragmented rocks, rocks 1-3 cm 80% gentle incline.
75-100 Loose rock, small amount exposed soil pockets pH = 5½ near Acacia aneura 5/4.
100-125 Wash away area - much exposed soil. Large stones, extensive outcropping. Valley slope.
125-150 Massive outcrops. A. aneura isolated on rocky ledge, pH = 5½.

../5

150-175 As before, less extensive outcrop some colluvial file.
175-200 Outcrops, some Mn ~ 80% S/C.
200-225 Extensive outcrops, less dense soil cover pH = 6.
225-250 Outcrops, small pebbles < 2mm v. small pockets exposed soil.
250-275 Fewer/smaller outcrops, "scree" under top stones (2 →3½ cm) few larger rocks.
275-300 Rocks, outcrops, "scree"
300-325 Distrubed area, outcrops & associated rocks. Weathered pysolite "scree" under.
325-350 Outcrops, some larger rocks and exposed soil. Outcrops low stones 2 → 6 cm near end.
350-375 Some outcrops, rock 2 → 6cm 80%
375-400 Stones ¼ - 4 cm (~ 90%) v. few large rocks or outcrops pH = 6.
400-425 Some outcrops ~85% S/C "scree" under rocks 1 → 5 cm (~ 70%) ~ 40% Mn, extensive around E. leuophloia. Growth around outcrops restricted. Near 425 mh. larger, loose rocks.
425-450 Still more outcrops (less extensive) soil sl. moister here than on either side of 25 m. pH = 5 3/4.
450-475 "Scree" under smaller stones 1 → 4mm between 5 → 7 cm (~ 70%). Few v. small outcrops near 475 ext. outcrops. Scree overlay.
475-500 Sl. denser S/C ~ 70% 1 → 4 cm scattered 5 → 8 cm. Low and ext. outcrops, ~ ½ way large loose rocks 10-30 cm outcrop. Large surface Area of outcrop.
500-525 V. rugged ext. outcropping loose stones 10-20 cm to 510 m. then ext. outcrops, 5-20 cm stones and 3 → 5 mm pebbles between.
525-550 continuation of 500-525 only small outcrop before main road 545.
550-575 disturbed area - "scree" loose thin soil stones 1-4 cm, pebbles ½ → 2 mm between. Very soft under.
575-600 Same - sedimentary - flood type area. pH = 6.
600-625 Same - Sl. more rocks 1 - 4 cm.
625-650 Loose thin soil cover, v. few stones 90% pebbles/fine.
650-675 Sl. larger pebbles - stones 1-4cm scattered patches. Soil under still soft/devoid of "scree".
675-700 Large patches of stones, esp. around Triodia.
700-725 Disturbance - same
725-750 More dense vegetation - same soil type even fewer stones near end 25m.
750-775 Almost devoid of stones
775-800 same pH = 6
800-825 same under soil full of roots no sigh of "scree"
825-850 same
850-875 same
875-900 same
900-925 same, disturbed along whole 25m.
925-950 same, disturbed for first 15 m heaped stones.
950-975 same
975-1000 same pH = 5½
1000-1200 same pH = 5½
1200-1225 same - disturbance-hole
1225-1250 same v. little S/C soft soil.

../6

(ii) Baseline South

0-25	Outcrops large rocks ~ 80% S/C pH = 5½.
25-50	Sl. smaller stones outcrops still extensive.
50-75	Sl. smaller stones/outcrops.
75-100	same - "Mn rocks" protusions
100-125	" smaller/more "Mn rocks".
125-150	Less protruding outcrops - very extensive.
150-175	Large fragmented rocks, Mn v. extensive ~ 90% S/C (4 cm thick) non-clayey, loamy sub-soil pH = 6.
175-200	Fewer "Mn rocks" more shale and scree. Pysolite and outcrops (large/flat) 4-6 cm stones 50% rocks 3-12 cm pH = 5½.
200-225	Ext. outcrops, large rocks dense cover going down gully. As descend stones decrease size. Fewer outcrops. None at bottom.
225-250	Up gully. Less dense S/C (60%).
250-275	Increasing size rocks (extensive disturbance).
275-300	Outcrops "Mn rock" ~ 30%
300-325	Outcrops, dense, loose rock cover.
325-350	More constant rock size, very few "Mn rocks", ½ → 4cm (~ 70%) low outcrops.
350-375	V. extensive outcrops, large rocks few pockets soft soil. Near end hit edge of valley. pH = 5 near base of Mini-Ritchie (Acacia).
375-400	Down Valley pH = 5¼, ext. outcrops, soil pockets.
400-425	Large v. loose stones, large outcrops "Mn coloured" ~60%.
425-450	Same No outcrops below 430 mark until 445. Patches of ¼ → 2 cm and 1 → 6 cm stones
450-475	Ext. outcrops on Nth & South sides of gully. Alluvial rocks deposited on bottom (1 → 6cm) pH = 6 under alluvium.
475-500	Fragmented rocks, outcrops small stones. Almost no soil uncovered. Valley face.
500-525	Deep gully-cut rock, outcrop faces.
525-550	Same, steeper stones less stable, large outcrop faces.
550-575	V. large boulders from outcrops.
575-600	Same - more outcrop rocks
600-625	pH = 5 3/4 low ext. outcrops.
625-650	Stones 1 → 4 cm 70%, ~ 60% S/C few low outcrops.
650-675	More "Mn rocks" pysolite rocks, less dense S/C. v. small stones between rocks, extensive outcrops resume near pegs.
675-700	Ext. outcrops rocks between approximately 1/3 outcrop face steep slope.

LINE 7200E

(i) Baseline North

0-25	pH = 6 (615 cm under pH = 6). Soft almost devoid of stones in sub-soil, thin pebble cover, intermittent stone patches ½ → 3cm.
25-50	same, few more scattered stones esp. in second half.
50-75	Same little more S/C (~ 50%) "scree" under.
75-100	same - denser soil cover (~ 70%) rocks "2 → 4 cm. Near end decreases to 30% S/C.

100-125	patchy stones 1 → 4 cm many patches no S/C.
125-150	same, pH near A pruinocarpa base = 6½, elsewhere pH = 6.
150-175	pH = 6 same fairly stony under
175-200	pH = 6
200-225	same ~ 70% S/C by stones ½ → 4cm 80%
225-250	same except near centre, dense stand A pruinocarpa - virtually no stones in subsoil there.
250-275	Same as 200-225. Some much larger rocks near end, small outcrops? ~ 70% S/C rocks 2-8 cm.
275-300	Same, sl. less dense soil cover near end.
300-325	Patchy rock cover ½ → 4 cm ~ (70%)
325-350	More loamy.
350-375	Same, sl. smaller stones ¼ → 3 cm small patches exposed soil covered in fine Mn pebbles < ½ mm.
375-400	continued less soil cover (~ 60%) stones ¼ → 2cm pH = 6 stony subsoil.
400-425	Denser S/C ½ → 4 cm ~ &0% odd larger stones, patches virtually no S/C.
425-575	same
575-600	track ~ 3m along. v. thin soil cover widely spaced stones ½ → 5 cm 50%.
600-625	Even, dense cover 70-80% stones ½ → 5cm 95% pH = 6.
625-650	Almost same, less dense S/C stony subsoil.
650-675	same.
675-700	Scattered patches, subsoil almost devoid of rock.
700-750	same.
750-775	Less S/C, very few subsoil stones.
775-950	same.
950-975	same - a few more stony patches.
975-1000	same.
1000-1025	same, virtually no stones in subsoil, v. soft dusty soil pH = 6½.
1025-1125	same.

(ii) Baseline South

0-25	approximately 3 metres in from road, footsteps cause disturbance. Shallow scattered soil cover.
25-50	same, scree under.
50-75	More stone cover ~ 60% (½ → 4cm) v. few stones 4 → 6cm.
75-100	same.
100-125	same, smaller subsoil stones.
125-150	same.
150-175	a few larger stones.
175-200	Denser S/C stones 1 → 4cm (~ 70%)very few larger stones, 4-12cm pH = 6½.
200-225	15% large/loose rocks 6-10cm, rock outcrops, stones ½ → 4cm between.

../8

225-250	Disturbed, piles of large loose "scree" rocks 80-90% S/C large boulders. S/C ~4cm thick.
250-275	Large Boulders, loose pebbles and rocks between iron ore plants.
275-300	Yellow shale small stones 1-3cm and large boulders.
300-325	Track for about 1/3 way then steep slope scree and outcrops, loose stones - very unstable.
325-350	same.
350-375	continued soil type massive outcrops and boulders 2-4m little subsoil under S/C.
375-400	~ 1/3 way same then disturbance, rocks 5-20 cm (5%) ½ → 2cm (60%) pH=5.5
400-425	Sl. less dense S/C, stones closely associated with subsoil run off type area.
425-450	Very steep ext. outcrops and large stones between very little subsoil rocks 10-30cm (20%) ½ → 4cm (60%).
450-475	Top of ridge, large flat outcrop, very little S/C "scree" under pH=6.
475-500	Very extensive outcrops again very stony scree under little soil.
500-525	Still very ext. outcrops and stony. South downward slope pH = 6½ again ext. outcrops.

(4) LINE 8400 E (Tg)

(i) Baseline South

0-25	4^{O} patchy, v. stony under ¼ → 6cm (60%).
25-50	Less patchy, dense stone cover.
50-75	Stones 5-8 cm (10%) Dense cover.
75-100	Larger rocks.
100-125	Larger rocks fragmented down from gully.
125-150	Road for 1/3 then rocks ½ - 5cm 70% ~ NA 45.
150-175	Same, sl. denser coverage ~ 170 pediment begins (outcrops low fragmented rocks 1 → 7 cm).
175-200	Same, even larger rocks more SA outcrops (~2/3) not much subsoil stony "scree" pH = 6½.
200-225	Same, sl. less SA taken by outcrop.
225-250	Ext. outcrop (ped. type) steep drop - not much available soil.
250-275	Low outcrops (still ped.) very large loose stones. Outcrop SA at least 2/3.
275-300	Still large thick stone cover 1-6cm outcrops (ped.).
300-325	~NA 44 Ped. ends ~ 310 outcrop begins.
325-350	Stones ½ → 4 cm 70% v. low outcrop ~ 340 ped then outcrop again 360.
350-375	Outcrop
375-400	Outcrop (yellow/white) Ped. on western most edges, very thin soil layer. Stony"scree" under.
400-425	Pediment - loose stones pH = 6½.

../9

425-450 Pediment tan < buff shale, very steep inclination on West.
450-475 Ped-same outcrop on East.
475-500 Outcrop, ped on West.
500-525 Outcrop, pysolite dense stone ½ → 4cm 80%.
525-550 Outcrop many pysolitic rocks pH near base of E. Leucophloia.
Note very dark brown soil wouldn't mix easily for pH test. pH = 6½.

Baseline North

0-25 4^{o}c stones ½ → 4cm 70% pH = 6.
25-50 very sl. less dense cover.
50-75 Same
75-100 Same
100-125 Thinning 1-4 cm ~ 50% exposed patches.
125-150 Same, even patchier 20% 1 → 3 cm.
150-175 V. soft, almost alluvial, some stone patches scattered.
175-200 Alluvial - lush vegetation covering of v. fine <<1mm "Mn" pebbles, soft dusty.
200-225 Same pH = 6 3/4.
225-250 Same till ½ way then patch of much stonier soil.
250-275 3^{o} mixed Lv. soft all.
275-300 Soft all. scattered stones on West 3^{o}c (4^{o}c?) not stony in subsoil.
300-325 ~ 2/3 way hit v. dense stone cover (4^{o}c) 3^{o}c? ½ → 5cm 70%.
325-350 3^{o}C more patchy ~ 60% cover, fairly consolidated with undersoil.
350-375 Sl. more like 3^{0}c.
375-400 Stones 1 → 6cm 50%, patchy pH = 5 3/4.
400-425 4^{o}c?? Stones 1-6cm 60% dense cover.
425-450 Sl. patchier, still like 3^{o}c.
450-475 Same, dense cover, stony under.
475-500 Same.
500-525 Same till ½ way then all? (virtually no stones >2cm) ~ 25% cover no subsoil stones.
525-550 Same, very stony to East side.
550-575 Same for 3/4 way then 3^{o}c again.
575-600 3^{o}c mixed with All. stony in places. pH = 6.
600-675 Same
675-700 More stony, v. similar to 4^{o}c stones ½ → 5cm 70%.
700-725 Same very dense stone cover.
725-750 Same, v. stony.
750-775 Same v. stony.
775-825 Same, 800m. pH = 6.
825-850 Same, very stony ½ → 4 cm 80%. Stony under also sparse patches.
850-875 Not many stones > 1 cm, much uncovered soil.
875-900 Fewer stones, v. soft, little evidence of stones in subsoil.
900-925 Disturbance, heaped rocks 3^{o}c.
925-950 3^{o}c scattered stones ½ → 5 cm.
950-975 Same.

../10

975-1000	Same, stony subsoil pH = 6.
1000-1025	3^{o}c, stones ½ → 4cm 70%.
1025-1150	Same.
1150-1175	Sl. less stones near end.
1175-1200	v. patchy, absence of much vegetation. Water or salt pan? Still 3^{o}c not quite All.
1200-1225	Same. pH = 6.
1225-1250	Patchier.
1250-1225	Very dense stones in patches to West. (All. on other side).
1275-1300	Same.
1300-1325	More patchy, ¼ → 3 cm Σ pebbles.
1325-1350	Alluvial pebble patches.
1350-1375	All, v. soft dusty, no subsoil stones.
1375-1400	Even fewer stones pH = 6.
1400-1425	Same.
	Note: this end of 8400 dryer than even baseline at 12300E.

(5) LINE 10200E (Tg)

(i) Baseline South

0-25	Very dense rock cover ½ → 5cm (80%) small pebbles between rocks & outcrops (Ped).
25-50	Ext. outcrop, rock coverage ~ 8 cm, stones ½ → 8 cm.
50-75	Same, gully cut on West very large boulders.
75-100	V. extensive outcrops & large fragmented rocks hardly any soil uncovered. As approach 125 mark less rocks loose (more like outcrop).
~ 125	Undersoil here loamy & stony. Stone cover 5-8cm thick. pH = 5 3/4.

(ii) Baseline North

0-25	(Road at 25) pH = 6. V. loose large stones ¼ → 6 cm 80% pediment.
25-50	Road takes 1/3 then 4^{o}c. Stones ½ → 5cm 70% stony, sandy under.
50-75	Denser vegetation, runoff area of creek? Soil less stony.
75-100	Continuation of 50-75 then 2/3 way 4^{o} again stones ½ → 5 cm 70%.
100-150	Same.
150-175	MNA 82 patchy, 3^{o}c, pebbles.
175-200	Same, soft soil, virtually no stones in subsoil pH = 5 3/4.
200-275	Same.
275-300	Sl. more stony,
300-325	Much 'stonier' ~ ¼ → 5 cm 50%.
325-350	Stony, like 4^{o}c patchy areas surround.
350-375	As previous to (250-275).
375-400	Even more patches, large number of minute pebbles pH = 5 3/4.
400-425	Soft sand v. small patches.
425-525	Same.
525-550	Like Alluvial soil.
550-600	Same, v. few subsoil stones pH = 6.

../11

600-750 Same.
750-775 Alluvial? very soft plasticy when wet, stones virtually non-existent.
775-800 very soft alluvial? pH = 5½.
800-975 Same.
975-1000 Very soft moist only tiny pebbles on soil surface pH = 5 3/4.
1000-1050 Same. pH = 6.

(6) LINE 12300E (Tg)

(i) Baseline South

0-25 Very small stones 0.1 → 1½ cm 90% some exposed patches pH = 5 3/4.
25-100 Same (0-100 like a washway).
100-200 Same, Sl. more rocks pH = 5½.
200-275 Same, even more rock patches.
275-300 Severe disturbance by drill clearing.
300-325 Same as previous.
325-350 4° coll. starts larger, denser rock cover 1 → 4 cm 70%. In between pebbles ½ → 2 mm.
350-375 Same, 4°c soft loamy undersoil "scree".
375-400 Same. pH = 5 3/4.
400-475 Same, not stony in subsoil.
475-500 Same, but washed away in places. Main Road between.
500-525 Same, vegetation more dense on East. Rocks denser on West (looks like patchy washway to East).
525-550 Same.
550-575 Vegetation thins, stone denser.
575-600 Stones denser (previous 3°c?) more like 4°c now. pH = 6 loamy.
600-675 70% cover stones ½ → 5 cm small pysolite pebbles.
675-700 Very dense stone cover ½ → 5 cm ~ 80% 3 → 5 cm thick over loamy sub.
700-725 Same,
725-750 Gully ~ 3' deep ~ ½ 25m ped. begins at ~ 740 mark.
750-775 Outcrops associated large stones 1-6cm 60%, 6-20cm ~ 5%. Rock fall ~ 1/3 SA, some subsoil stone overlay up to 8 cm thick.
775-800 Same, steeper, outcrop more prominent. pH = 6¼ stony underneath. No outcrop till int. other side of gully on top of ridge 'Mulga Scrub' begines near baseline.

(ii) Baseline North

0-25 Very soft no stones > 1cm soft sugsoil. pH = 5 3/4 (baseline).
25-50 Same - large areas of exposed soil.
50-200 Same alluvial. pH = 5 3/4.
200-225 Sl. dryer/pebble cover.
225-375 Very moist, plastic 'mud'.
375-400 Same pH = 5½.
400-600 Same, pH = 5½.
600-800 Same (no stones/ v. moist) pH = 5½.
800-825 Sl. different lusher vegetation cracked clayey type ground still alluvial.

../12

(7) LINE 4200E (Tg)

At end 4^{o} colluvium - then low outcrops then ped. Evidence of scattered 3^{o} colluvium near baseline.

(8) LINE 4500E (Tg)

Low outcrop again before ped. south, then continued 4^{o}c till hit foothills.

(i) North

Outcrops then ~ 80m along pediment ~ 150m along 4^{o}c on East pediment to West colluvium. ~ 300m North main road. On other side vegetation suggests 4^{o}c.

(ii) South

Outcrops, Mini-Ritchie 'stand' ~ 50m along on pediment, associated loose rocks till hit large creek bed (4^{o} coll. just before). Creek ~ 20m wide Alluvial-flooded type area for at least 50m. Track crosses at 150 mk. 4^{o}c starts again. Creek flows parallel to track. MNA64 4^{o}c still outcrop 1 ped. to East & West. Minor outcrops 450 mk. Ext. outcrops on both sides of track ~ 500, ~ 40m South of 600mk outcrop/pediment. 750 south almost end of ped. ~ 800m ext. outcrops.

(9) LINE 5100E (Tg)

Outcrop then ped. ~ 150 mk. steep descent Mini-Ritchie stand on ped. slope ~ 300m north.

(10) LINE 6000E (Tg)

MNA 12 Baseline.

(i) South

Outcrop to MN Gorge track then ped. for ~ 145m (150m MNA 40), outcrop here then ped. then outcrop ~ 420m south to 450 south then ped. very small outcrop area on ridge top. Rest distinct pediment. 4^{o}c in gully. Then pediment ~ 602 south. Outcrop on very top.

Note: incline of slope not necessarily related to pediment. At south end of Mn gorge outcrops on west (at least) lower than pediment. 4^{o}c extends up slope further.

(ii) North

Outcrop for about 20m then ped. to ~ 75m (ped. on East, 4^{o}c on West). Alluvium through centre creek crosses at ~ 120m. Large

fragmented alluvium. 150m (MNA 39) alluvium and 4°c between outcrop on West and Ped on East. Same till hit 5m wide track near MNA 2. After track Alluvium 1 colluvium mixture. Becomes 3°c before main road. Past MNA 3 3°c, past MNA 70 still 3°c very thin soil cover. At MNA 65 Alluvium mulga scrub etc.

(ii) LINE 6300E (Tg)

(i) North

Pediment for ~ 75m then 4°c for ~ 50m then ped. outcrop to at least 150 north then ~ 175 4° coll.

(ii) South MNA 16

4°c for ~ 75m then pediment to ~ 150m (MNA 29) then outcrop to proper ~ 180 pediment again, outcrop ~ 250m to ~ 275 South then type of plateau of 4°c wash-way type area, till ~ 50m past manhole then 4°c ~ 25m more to pediments, gully, ped. continues to ~ 150m more south.

(12) LINE 6600 E (Tg)

(i) South MNA 17

4°c to at least MNA 25 then outcrop on est 4°c on East (Outcrop for ~ 25m) then pediment starts ~ 250-300m (100m from 25) small outcrop area near 300m South. Then ped. into small gully, large outcrop faces on south side. Ped to MNA73 then out. Ped. starts again ~ 5m south past track (450 south).

(ii) North

4°c ends ~ 100m south of main road. 3°c to at least 500 north interrupted by sample pit stock pile.

(13) LINE 6900E (Tg)

(i) South

Washed out alluvial creek bed. 4°c from Adit to before baseline. Difficult to ascertain boundary.

(ii) North

Alluvium/colluvium starts near sample pit pile (150m from 67A) Alluvium starts ~ 10m past cerl. gauge dust sampler.

(14) LINE 7500E (Tg)

(i) North MNA 71 (Base)

4^{o} colluvium/alluvium to at least MNA72 ~ 700N Alluvium starts virtually no stones aside pebbles.

(ii) South

Creek bed ~ 15m south of baseline. MNA 54 4^{o}c to foothills... to main road.

(15) LINE 7800E (Tg)

MNAD 49 creek bed. Baseline North 3^{o}c to 150N then to MNA 69. Where alluvium begins. 3^{o}c to Main Road south then 4^{o}c till foothills.

(16) LINE 8100E (Tg)

(i) North

To West of Base Creek bed 4^{o}c on East. (Dense stone coverage) ~ 170 mark sl. less dense S/C (still very like 4^{o}c) patches of alluvial stones.

~200m N alluvial soil to E. soft subsoil Alluvial creek bed through grid lines. Dense All. Mulga Scrub along Western edge of grid line. ~ 300m crosses grid line.

(ii) South

3^{o}c or alluvium till Main Road then 4^{o}c to foothills.

(17) LINE 9000E (Tg)

(i) North

40^{o}c till at least 300N then 3^{o}c to just after last 150m peg then All.

(ii) South of MNA 78

4^{o}c for ~ 70m then huge outcrop of all (pediment).

(18) LINE 9600E (Tg)

3^{o}c to at least 750N from ~ 400N 4^{o}c ~ 400N to end of South line immediately hit ped. at base of hills on West. ~ 150-200 south.

(19) LINE 10800E (Tg)

Note All. near 11400 road area. Large dense mulga scrub larger

than in main alluvial flats.

450 S Top of ridge, peds either side-call whole edge pediment - since stones associated large & loose. Ped. almost to main road then 4^{o}c (~ to 40m south of road.) 3^{o}c starts goes to at least 400N.

(20) LINE 11400E (Tg)

Outcrop on ridge top then ped. to about 700s then 4^{o}c to approximately main road. 3^{o} to 150 N then Alluvium.

(21) LINE 11700E (Tg)

3^{o}c to at least 300m N of gridline (difficult to move further up gridline due to extensive growth and soft muddy conditions).

4^{o}c South approximately 450 S (3^{o}c previous) pediment approximately 500 S ~ 650 south outcrop proper.

(22) LINE 12900 E (Tg)

Definately Alluvium to just after MNA 100 North then 3^{o}c on West & all on East.

4^{o}c ~ 40m North of mainroad South to the foothills.

Note: Other observations were taken however they were purely "on the spot" notes or diagrams on maps which influenced choices of categories for areas where boundaries were ill defined.

REFERENCES:

1. "Mount Bruce W.A." 1:250000 Geological series - Explanatory Notes Sheet 5F 150-11.

2. "Atlas of Australian Soils" Explanatory Data for Sheet 6 - Meekathara/Hamersley Range Area, C.S.I.R.O. Australia. Melbourne Uni. Press.

3. "A Factual Key for the Recognition of Australian Soils" KH Northcote.

4. "Marandoo" Photos (colour) Nov. '76 scale 1:2000 (approx.) Runs 1 → 7.

5. "Mt. Bruce" Photos (B & W) 6-10-72 Runs 1 → 4 scale 1:10000.

6. Marandoo Geological X-sections. Lines 108000E to 4800E (Tg).

A P P E N D I X

Results of soil analysis of samples forwarded to Agro-Nutritional Research Laboratory.

Location Of Samples Taken

Soil Type		Sample Number	Description
1.	Outcrop	9	Line 5700E 375S (Stand of "mini-ritchie" growing on shale band)
	Outcrop	4	Line 7200E 500S (Outcropping ore)
2.	Pediment	7	Line 5700E 325N
	Pediment	5	Line 7200E 425S (near CH-SH boulders)
3.	Quaternary Colluvium	3	Line 7200E 150S
	Quaternary Colluvium	6	Line 6850E 150N
4.	Tertiary Colluvium	10	Line 5700E 700N
	Tertiary Colluvium	8	Line 8400E 400N
5.	Alluvium	1	Line 6300E 1500N (Mulga Flats)
	Alluvium	2	Line 7200E 925N

SOIL ANALYSIS REPORT

By

AGRO-NUTRITIONAL RESEARCH LABORATORY

Date 27.2.80 Batch No. T.216

SAMPLE	Lab. No.	pH	Salinity (El. Cond)	Nitrate ppm	Phosphorus ppm	Potassium ppm	Sodium ppm	Copper ppm	Zinc ppm	Mangan ppm
Recommend. Levels		5.5-7.5	< 2	> 15	> 15	> 60	> 100	> 0.15	> 0.30	> 1
Sample Number 1	T.216.1	6.9 neutral	.12 normal	3 low	8 slightly low	850 v. good	10 normal	.88 good	1.3 good	7.6 good
Sample Number 2	.2	7.5 slightly alkaline	.14 normal	1 low	10 slightly low	280 good	19 normal	.62 good	.84 good	2.7 good
Sample Number 3		5.6 mod. acid	.30 normal	12 o.k.	2 low	150 good	11 normal	.52 good	.42 good	14. good
Sample Number 4	.4	5.7 mod. acid	.10 normal	1 low	2.5 low	96 good	5 normal	.76 good	.36 good	14. good
Sample Number 5	.5	5.1 mod.strongly acid	.12 normal	3 low	3.5 low	134 good	6 normal	.96 good	.42 good	21. good
Sample Number 6	.6	5.6 mod. acid	.10 normal	2 low	1.5 low	114 good	5 normal	.78 good	.58 good	22. good
Sample Number 7	.7	5.4 mod. acid	.06 normal	2 low	4.5 low	100 good	4 normal	.66 good	0.30 good	1. good
Sample Number 8	.8	6.2 slightly acid	.04 normal	1 low	1.5 low	141 good	5 normal	.84 good	.48 good	5.6 good

By

AGRO-NUTRITIONAL RESEARCH LABORATORY

Date 27.2.80 Batch No. T.216

SAMPLE	Lab. No.	pH	Salinity (El. Cond)	Nitrate ppm	Phosphorus ppm	Potassium ppm	Sodium ppm	Copper ppm	Zinc ppm	Manganese ppm
Recommend. Levels		5.5-7.5	< 2	> 15	> 15	> 60	> 100	> 0.15	> 0.30	> 1
Sample Number 9	T.216.9	4.8 strongly acid	.20 normal	11 o.k.	10 slightly low	93 good	5 normal	.64 good	.68 good	12. good
Sample Number 10	.10	5.5 mod. acid	.04 normal	1 low	3 low	47 slightly low	3 normal	.36 good	.10 low	14. good

Technical and Advisory Services
for Agriculture and Food Industries

2c Main Street,
OSBORNE PARK, W.A. 6017
Telephone: 444 6247

THA:JS

27th February, 1980

Mr. C. Dawe,
Texasgulf Australia Ltd.,
G.P.O. Box A.48,
PERTH. W.A. 6001

Dear Mr. Dawe,

PURCHASE ORDER NO. 5728

Enclosed are the results of the analyses of the 10 soil samples from the Marandoo area. My comments on these results are as follows:-

These soils are quite variable with regard to the soil reaction in that there was one soil that was slightly alkaline, one at neutral and one soil that was quite strongly acid in reaction. Most of the others were moderately acid in reaction. They all had a low salt content as indicated by the electrical conductivity data. They also all had low extractable sodium contents, which is good from the standpoint of the physical structure of the soil.

The various fertility factors are also quite variable in these soils. In most cases the nitrate/nitrogen is low. Also the available phosphorus is generally low - however a few of the soils had a significant amount of available phosphorus, but not anywhere near enough for good crop growth; Perhaps adequate or good for the growth of native shrubs and native plants. The available potassium content of most of the soils is good or very good and was only slightly low in one case.

The trace elements copper, zinc and manganese are generally at good levels for the growth of most plant species. In only one case did we find a slightly low zinc level.

Since I don't know what you plan to do with these soils or if in fact, you do plan to grow crops or encourage the return of native plant species, it is difficult to make any specific recommendations. However, if you do want to encourage the growth of plants, I would recommend the application of Phosphate fertilisers. Native plants are able to tolerate very low phosphorus in the soil nevertheless they will grow more vigorously if given better phosphorous supplies. Non-leguminous plants probably would also benefit from the application of fertiliser nitrogen. I doubt that any other fertiliser should be required for the healthy growth of most plants.

If you would like further discussions on these results in relation to your specific programme, please do not hesitate to contact me.

Yours sincerely,

F Ashley

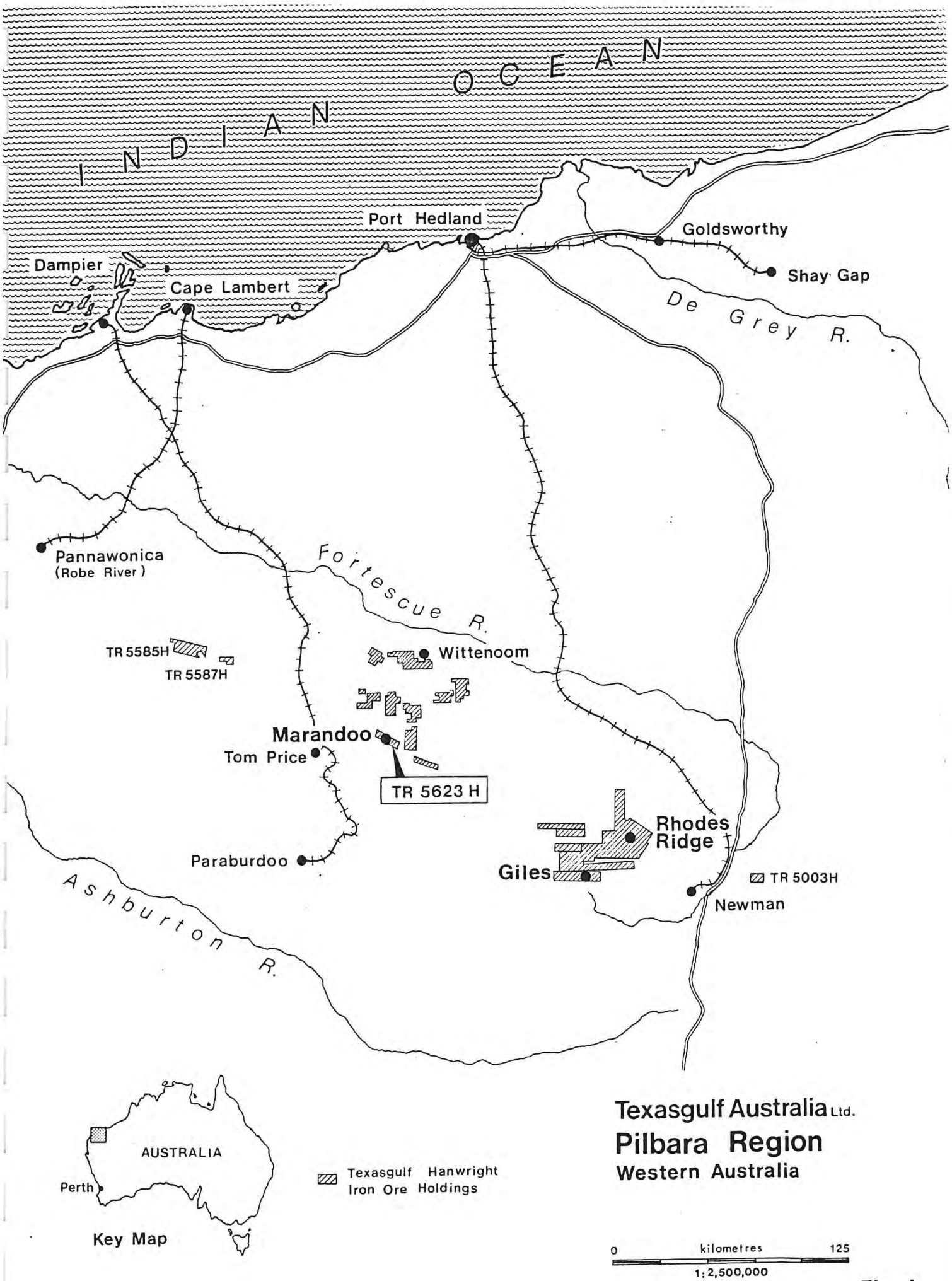
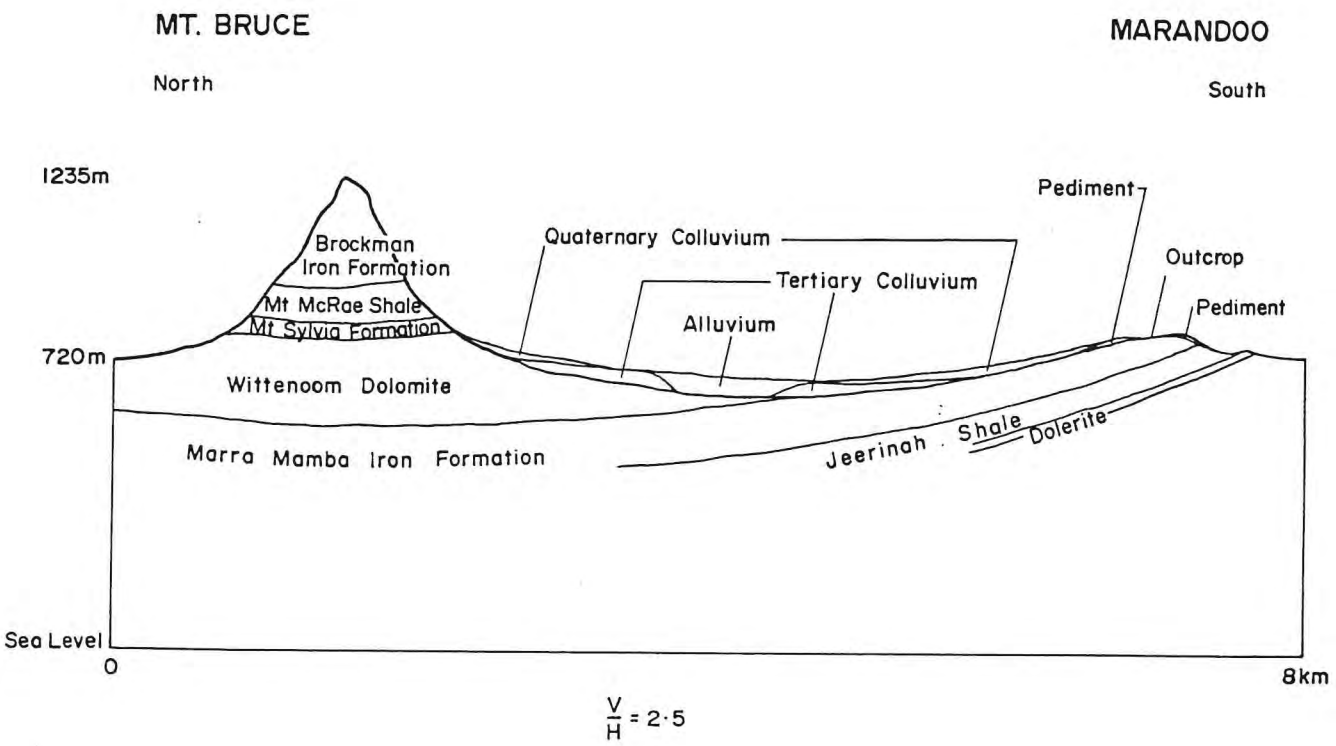

INDIAN OCEAN
Port Hedland
Goldsworthy
Shay Gap
Dampier
Cape Lambert
De Grey R.
Pannawonica
(Robe River)
Fortescue R.
TR 5585H
TR 5587H
Wittenoom
Marandoo
Tom Price
TR 5623 H
Paraburdoo
Rhodes Ridge
Giles
TR 5003H
Newman
Ashburton R.
AUSTRALIA
Perth
Key Map
Texasgulf Hanwright Iron Ore Holdings
Texasgulf Australia Ltd.
Pilbara Region
Western Australia
0 kilometres 125
1:2,500,000

Fig. 1



$\frac{V}{H} = 2 \cdot 5$

Texasgulf Australia Ltd.

Diagrammatic Cross-Section
Mt Bruce - Marandoo

Fig. 2

Texasgulf

Date 5th March, 1980 REF: E95-001-0100

To CHRIS DAWE Location MARANDOO

From JENI ALFORD Location MARANDOO

Subject REPORT ON MARANDOO WORK EXPERIENCE

During the period 10/12/1979 to the 26/2/1980 I was employed by Texasgulf as an environmental assistant at Marandoo. My first week was spent observing the current environmental projects and being introduced to the Marandoo and Duck Creek temporary reserves.

Over the Xmas/New Year break I remained at Marandoo to maintain the level of data collection. Weather at Marandoo was recorded twice daily and the water table sounded; pitfall traps were checked and any captures identified/registered. Meteorgraphs at Marandoo and the Townsite were changed weekly. Tables of maximum, minimum and average temperatures; plus a rainfall table for Marandoo 1973 to 1979, were drawn up and wind recorder data was tabulated. One day was spent assisting the return of vehicles and equipment from Duck Creek. Time was spent scrutinizing reports and books on the area and relevant environmental experiments.

After the break I was assigned the task of producing a surface soils map of the area between Marandoo Camp and Line 15300E (Tg). Six grid lines were chosen for transects. Initially these lines were marked out at 25 metre intervals using a Topojil Chaix and plastic tape. Three of the lines were then closely surveyed for surface soils characteristics and the results of these used to select categories on which to base a map simultaneously the pH of the soil was measured using a C.S.I.R.O. test kit at intervals of 200 metres and at change points. It was substantiated that the surface soil was closely related to both the geology and topography, so extensive use was made of maps and x-sections in interpreting inter-grid line trends. All grid lines not covered as transects were surveyed and approximate change points located to allow correlation with aerial photographs. Ten samples of soil, representing two localities for each surface soil category were collected and sent to Perth for analysis.

Time between soil surveys was spent checking the alignment of the Marandoo and Duck Creek wind tower recorders to validate they were orientated to the North. I assisted Chris in making revegetation trial plot counts and with the Porometer 1 stomatal resistance readings.

../2

DATE FILE

One afternoon was spent at Giles calibrating the meteorgraph and checking the wind tower recorder setting. Mindi Springs/Turee Creek was visited twice, before and after cyclones Dean and Enid, to read the rain and bottles gauges. I also measured the Marandoo water table levels using the Ott contact gauge in early January and February.

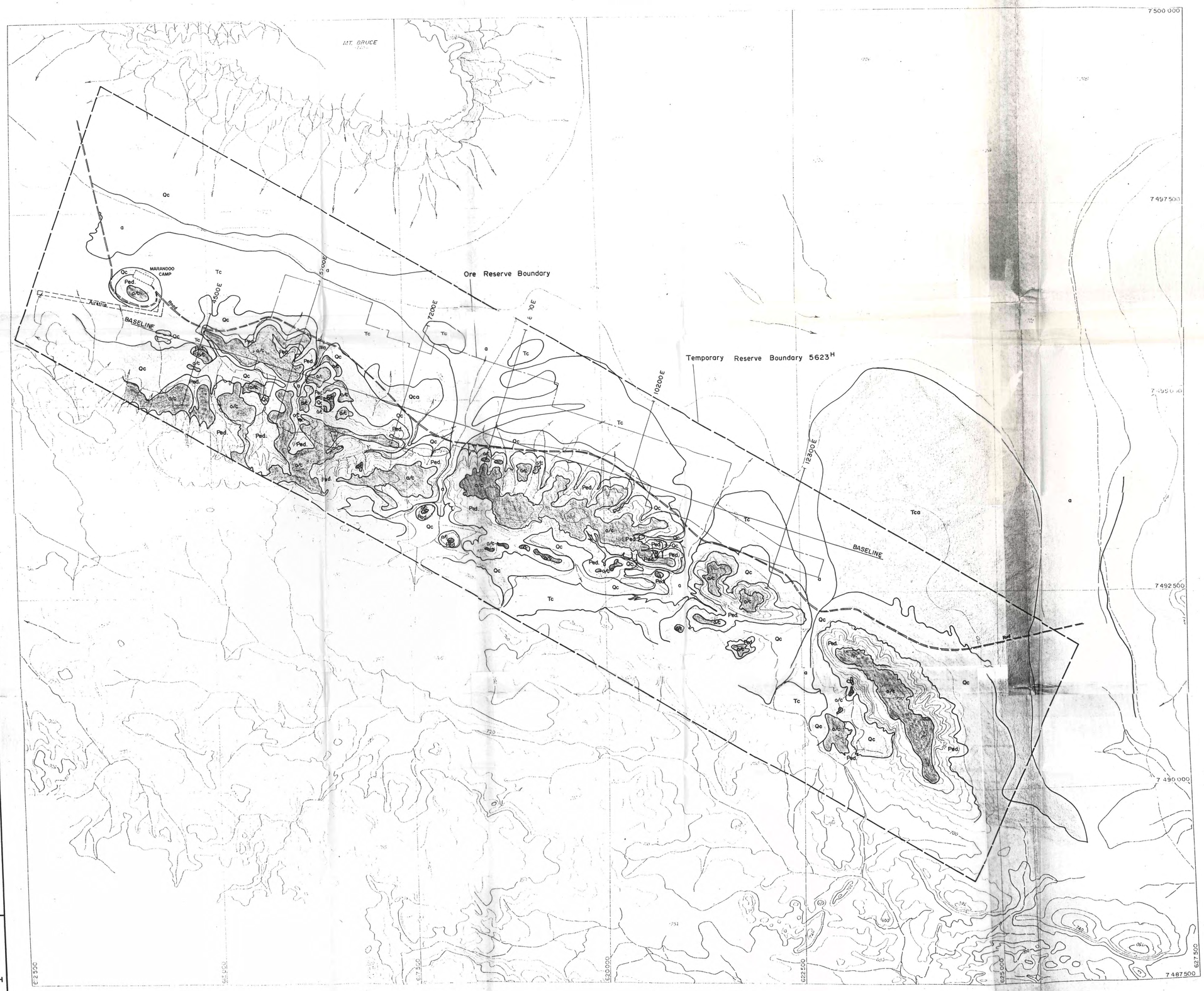
The experience I gained whilst working at Marandoo was valuable as an introduction to the problems and complexities of establishing an environmental programme and in accentuating the relevance of my studies at Murdoch University. Production of the surface soils map necessitated the investigation of some geology and history of the Hamersley Plateau; plus practice in using aerial photographs for recognition of ground characteristics. Extensive field work connected with the soil survey and revegetation plot counts has given me some insight into the climatic and physical problems associated with devising a scheme for repatriation or revegetation of the area that would be mined.

The current environmental projects are aimed at interconnecting the results of past schemes to cover nearly every available avenue for research into factors affecting the vegetation distributions susceptible to disturbance by mining operations. Once the newly prepared revegetation plots have attained a 'reasonable' maturity and the available information is collated then a viable environmental programme will be realizable.

In conclusion I would say my stay at Marandoo was worthwhile, not only as an introduction to the endemic species of the Marandoo Temporary Reserve, but as a practical introduction to the difficulties associated with designing the environmental programmes. Simultaneously the experience has promoted my enthusiasm for future studies.

Hopefully my stay will have been of assistance to the environmental projects generally and that the surface soils map will be useful in association with vegetation, geological and climatic data in determining the network of variables which influence the growth and distribution of the various plant species and communities.

JENI ALFORD.



SOIL TYPES

- a — Alluvium
- Qc — Quaternary Colluvium
- Qca — Quaternary Colluvium / Alluvium
- Tc — Tertiary Colluvium
- Tca — Tertiary Colluvium / Alluvium
- PED — ..... = Pediment
- o/c — Outcrop

Texasgulf Australia Ltd.

SURFACE SOILS MAP
MARANDOO

DATE	SCALE	DRAWING No.
March 1980	1 : 25 000	-
ORIGIN: J. Alford	DRAWN: H.G.	APPROVED

566 x 801 mm