DEPARTMENT OF MINES

SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENGINEERING DIVISION

GROUNDWATER RESOURCES IN THE DISTRICT COUNCIL OF CENTRAL YORKE PENINSULA

by

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ABSTRACT

Groundwater in Central Yorke Peninsula is generally poor in quality, salinity being commonly greater than 2000 mg/l, and small in supply, with individual wells yielding less than 250 kl/day. The few scattered wells are mainly used for livestock supplies.

Pollution of this saline groundwater resources is not considered to be a future problem.

INTRODUCTION

A request for comments on the groundwater resources and their relationship to urban and agricultural land use in Central Yorke Peninsula was received in September, 1977 from consultants BRUER, VOGT and HIGNETT on behalf of the District Council of Yorke Peninsula.

The council boundaries cover the hundreds of Kilkerran, Maitland, Cunningham, Wauralte and Muloowurtie. The two main townships are Maitland and Ardrossan. The topography of the region is mature, the terrain being flat and gently undulating, with a maximum elevation of 250 m near Arthurton.

The area is used mainly for the production of cereals, (wheat and barley and minor field peas) and wool. Prime lamb production is also important.

SURFACE HYDROLOGY

As typical of the whole of Yorke Peninsula, there are no permanent streams in Central Yorke Peninsula and drainage lines are poorly defined.

The average annual recorded rainfall at Maitland is 500 mm. This average decreases towards the coastlines (Ardrossan 356 mm). The monthly averages show a marked winter maximum, with almost two-thirds of the annual average falling in the period May-September.

There are no significant surface storage facilities in the area. In localities with suitable clay soils, small earth dams may be used to supplement either the reticulated water supply or groundwater.

HYDROGEOLOGY

Central Yorke Peninsula can be conveniently subdivided into five hydrogeological environments (Fig. 2):

(I) The Pre Cambrian hard rock areas consisting of mainly gneisses, schists, granites and pegmatites and minor quartz conglomerates and feldspathic sandstones.

(II) Cambrian limestone.

(III) Permian boulder till, claystone and fluvioglacial sands.

(IV) Tertiary shelly and sandy clays.

(V) Quaternary unconsolidated sediments.

Pre-Cambrian Hard Rock Areas (Basement)

Gneisses, schists, granites and other granitic variants are the most dominant rock types in Central Yorke Peninsula. These outcrop extensively in the Hd. of Maitland and, although covered by a thin deposit (less than 10m) of Quaternary sediments, are very widespread in other parts of the region.

Groundwater occurrence in these dense, strongly indurated rock types is not expected to be significant. Small yields of poor quality water may be obtained near major faults where fracturing of the indurated rock may occur. In the very few wells drilled into basement, yields are small and salinity generally greater than 3000 mg/l.

Cambrian Limestone

Lower to middle Cambrian limestone and dolomite occur mainly near the eastern coast of Central Yorke Peninsula. As for the basement area, the few wells drilled into this aquifer intersect generally very saline waters (greater than 6000 mg/l). Well yields are not expected to be greater than 250 kl/day.

Permian Sediments

This unit is very insignificant in Central Yorke Peninsula, being confined to the western portion of the Hundred of Wauraltee where it is mostly covered by Quaternary sediments. These sandy clays usually occupy depressions in the Pre-Cambrian basement and are generally regarded as confining beds. The more sandy variants may however contain small quantities of saline groundwater.

Tertiary shelly and sandy clays.

Tertiary shelly clays with discontinuous bands of dense fine grained sandstone occur mainly on the east coast near Pine Point, and ochreous sandy clay with lenses of fossiliferous sand (exceeding 120m near Price) have been similarly located on the east coast, north of Ardrossan. They are not significant sources of groundwater.

Quaternary sediments

Apart from the central portion of the area (Hd. Maitland) Quaternary calcareous and quartzitic sands, clays and calcrete occur as a thin blanket, generally less than 10m thick, over the whole region. This is the most commonly used aquifer but, apart from few localised areas of limited supply, the groundwater quality is generally greater than 2000mg/l (commonly greater than 6000mg/l) and individual well yields are less than 250 kl/day. Known occurrences of small pockets of good quality groundwater (less than 1500 mg/l) are shown in Fig. 2.

CONCLUSIONS

Apart from a very few small scattered areas where small supplies of reasonably good quality groundwater are obtained from Quaternary sands, the quality and quantity of groundwater in Central Yorke Peninsula is generally unsuitable for domestic and irrigation purposes. This is reflected in the small number of existing wells in the region. These few scattered wells are mainly used for stock. Water for domestic and other uses is mainly supplied by the Engineering and Water Supply Department from the Warren and Bundaleer Reservoirs.

Pollution of the minor groundwater resources in Central Yorke Peninsula is therefore not considered to be a future problem.

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REFERENCES

CRAWFORD, A.R., 1965: The geology of Yorke Peninsula. S.A. Dept. Mines, Bull. 39.

APPENDIX I

DEPARTMENT OF MINES
SOUTH AUSTRALIA

SUITABILITY OF UNDERGROUND WATER FOR AGRICULTURAL PURPOSES IN SOUTH AUSTRALIA

WATER FOR IRRIGATION

The use of groundwater for irrigation and domestic gardens influenced not only the type and amount of saline matter dissolved in the water, but also by the type of soil, drainage, climate and rainfall. The remarks and tables set out below should therefore be taken only as a general guide. Where the waters approach the maximum salinity for particular plants, or where special conditions of soil type or drainage, rainfall, etc., exist, you are advised to submit the analysis to the Department of Agriculture, or to your local Agricultural Adviser, for more definite guidance.

As the salinity increases, the use of water for irrigation becomes increasingly hazardous. The more saline waters can be used effectively if:-

(a) The soil has free drainage,

(b) Heavy and more frequent applications of water are used to wash excess salts through the soil beyond the reach of plant roots; normal winter rains will do this in the higher rainfall areas.

(c) The water is applied evenly; flooding is more effective than sprinklers, and also reduces the amount of evaporation and risk of leaf damage.

(d) Salt tolerant plants are used.

Saline water with salt content up to 10 000 mg/l has been used effectively for agriculture in many parts of the world: desert type climates and well drained clay free soils, particularly sandy soils are the essential factors.

SALINITY	VEGETABLES	TREES	ORNAMENTALS
	Ultra Sensitive		
150-300 Mg/l	Completely intolerant of salt Violets	Loquat	
	Sensitive		
425-700 Mg/l	French beans Strawberry Peas (not above 575)	Walnut	Dahlia Poinsettia Aster Rose Zinnia Bauhinia Gladiolus Fuschia Camelia Azalea Begonia
	Moderately Sensitive		
850 Mg/l	Beans - broad & field Celery Lettuce Potato - sweet Radish Raspberry Carrots (not above 1 000 for seedlings)	Apple Apricot Almonds Citrus - lemons, orange, grapefruit Quince Peach Pear Prune, Plum	Coprosma Vinca Bouginvillea Hibiscus Carnation
	Moderately Resistant		
1300 Mg/l	Onions Broccoli Cantaloup Cauliflower Cereals Carrot (after 3-4 fern leaves) Gherkins Cucumber Potatoes (must have good drainage) Sweet corn	Grape vines Fig Olive Pomegranate	Chrysanthemum Stock Oleander
	Resistant		
1700 Mg/l	Artichoke Tomato - furrow irrigated		
	Highly Tolerant		
2100 Mg/l	Asparagus Beetroot Cabbage Spinach		

IRRIGATED CROPS AND PASTURES

WATER QUALITY

0-1 000 mg/l	Water is suitable for all types of pastures.
1 000-2 000 mg/l	Water is suitable for more tolerant pastures, on well drained soil.
2 000-3 000 mg/l	Water is suitable for salt tolerant species on well drained soil.
Over 3 000+ mg/l	Marginal water-requires heavy application on well-drained soil. Suitable only for the most tolerant species.

TOLERANCE OF CROPS AND PASTURES TO SALT

LOW salt tolerant crops and pastures	MEDIUM salt tolerant crops and pastures	HIGH salt tolerant crops and pastures
Subterranean Clover	Strawberry Clover	Rhodes grass
White Clover	Perennial rye grass	Prairie grass
	Fodder crops	Lucerne

WATER FOR LIVESTOCK

Stock vary considerably in their ability to tolerate salt in their drinking water. The more important factors affecting tolerance are:

(a) Stock can tolerate higher salt levels when on green pastures rather than on dry feed or prepared rations.

(b) Lactating animals require lower levels than dry stock.

(c) Young animals have reduced tolerance.

(d) Changes from low to high salt levels must be made slowly. Stock become adjusted to lower levels and sudden changes can cause toxicity even though below maximum tolerance figures.

(e) Stock can become accustomed to high salt levels and thrive at above maximum levels quoted.

(f) When high salt level water is being used, storage tanks and troughs need frequent flushing to prevent excessive build up from evaporation.

(g) The composition of salts is important and some ions and radicles are much more toxic or unpalatable for stock than others.

(h) Better quality water is required during periods of high water intake (e.g. hot weather, high salt diets).

The table given, therefore, must be considered only as a guide and not fixed. Tests with the stock must always be done in cases of borderline waters.

TYPE OF STOCK	MAXIMUM SALINITY mg/l
Poultry (adults)	4 000
Chickens	3 000
Swine	3 000
Milking Cows	4 000
Horses	7 000
Dry Dairy Cows	7 000
Beef Cattle	10 000
Lambs	10 000
Sheep (dry feed)	12 000
Sheep (green feed	14 000

WATER FOR HUMAN CONSUMPTION

SUBSTANCE	MAXIMUM ALLOWABLE CONCENTRATION mg/litre (ppm)
Total soluble salts	1 500
Iron	1
Manganese	0.5
Copper	1.5
Zinc	15
Arsenic	0.05
Lead	0.05
Calcium	200
Sulphate	400
Magnesium	150
Chloride	600
Magnesium and sodium sulphates	1 000
Nitrate	45
Fluoride	1.5
Cyanide	0.2
pH	6.0-9.2

CONVERSION TABLES

Milligrams per litre (mg/l)	Grains/gallon	Grains/gallon	Milligrams/litre (mg/l)
250	17	25	357
500	35	50	714
1 000	70	100	1 428
2 000	140	200	2 856
5 000	350	500	7 140
10 000	700	750	10 700
15 000	1 050	1 000	14 300

Note: 1 grain/gallon = 14.28 milligrams per litre (mg/l)
1 ounce = 437.5 grains
1 p.p.m. = 1 mg/l

1 litre/second = 13.2 gallons/minute.
= 800 galls/hour

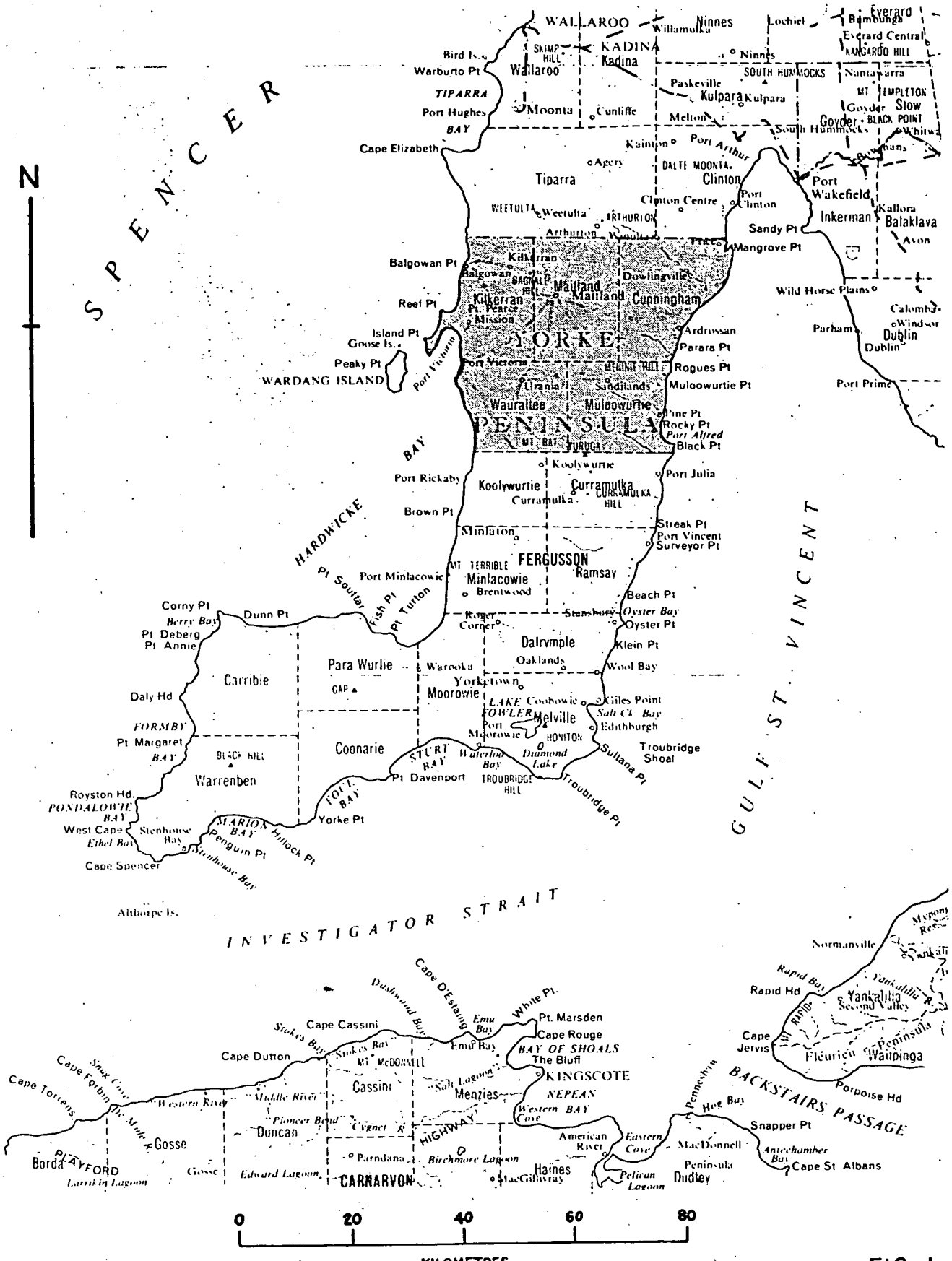
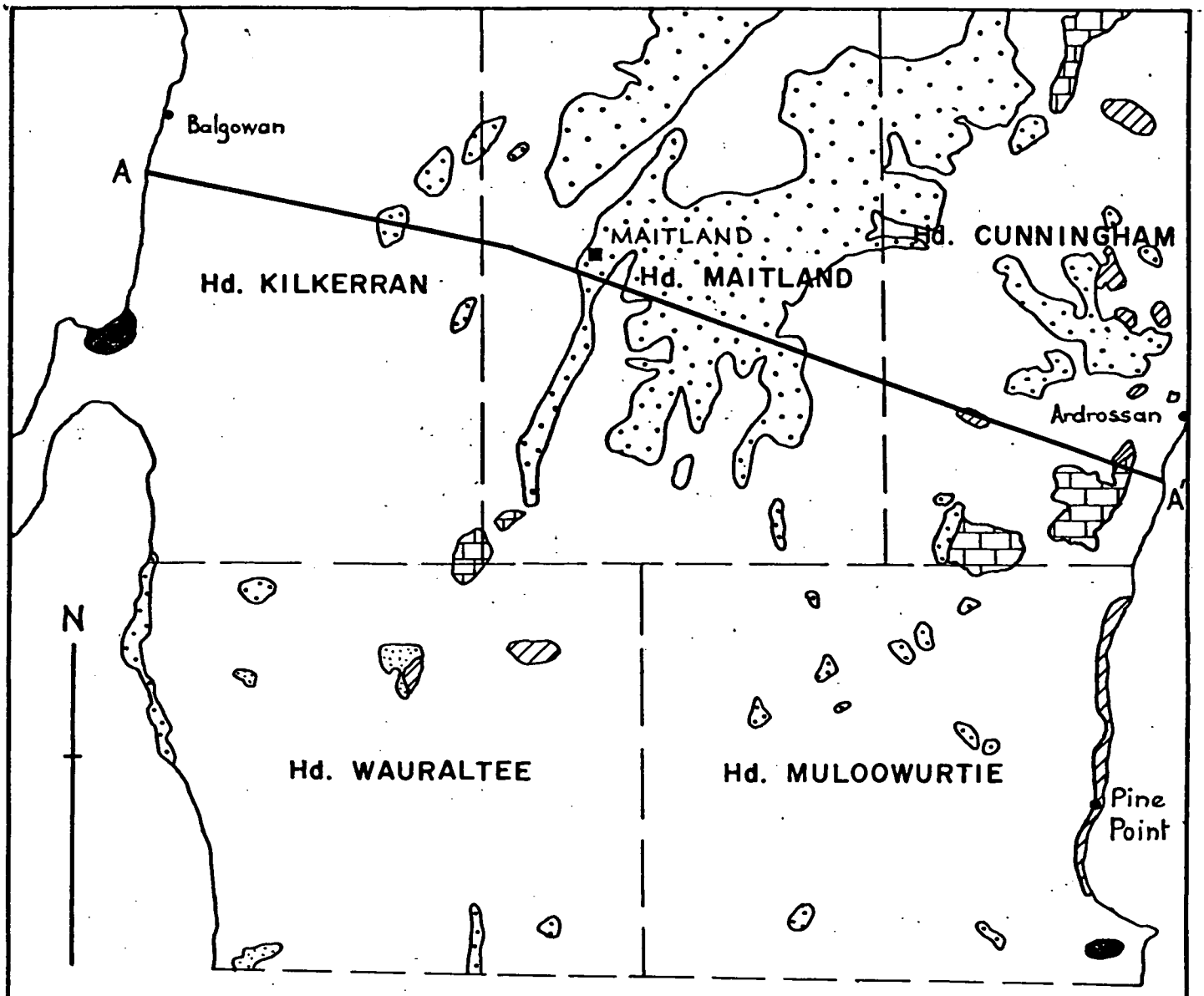
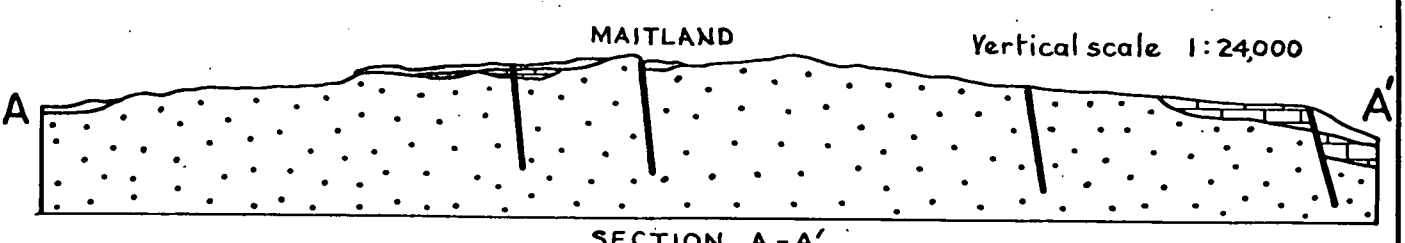


FIG. 1

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE 1:1,000,000
COMPILED X.P.S.	DISTRICT COUNCIL OF CENTRAL YORKE PENINSULA	DATE OCT. 77
DRAWN M.W. T.R. R.H.	LOCALITY PLAN	PLAN NUMBER S 13105

6428 - 6429





SECTION A-A'

Thin Quaternary sediments

Tertiary sandy clays with thin sand / limestone lenses

Permian sandy clays

Cambrian limestone

Pre-Cambrian basement

Hundred boundary

Known pocket of groundwater with salinity less than 1500 mg/l.

GEOLOGY FROM MAITLAND 1:250,000 GEOLOGICAL MAP

FIG. 2

	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE 1:250,000
COMPILED: X.P.S.	DISTRICT COUNCIL OF CENTRAL YORKE PENINSULA	DATE: OCT. 77
DRN M.W. CKD. R.H.	HYDROGEOLOGY	PLAN NUMBER: S 13106

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