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AN APPRAISAL OF THE GROUND-WATER POTENTIAL OF THE DULCIE SANDSTONE CENTRAL AUSTRALIA

by

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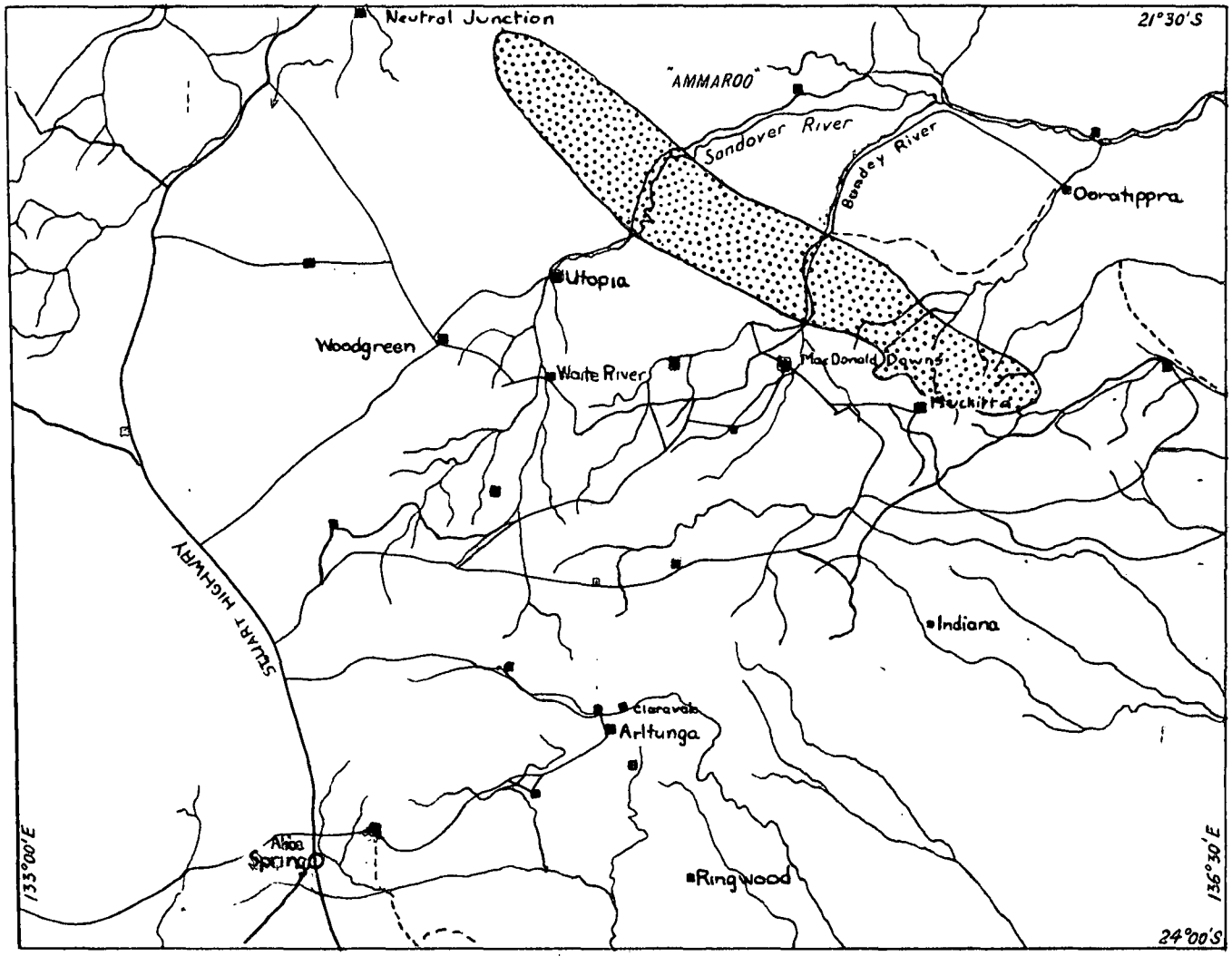
SUMMARY

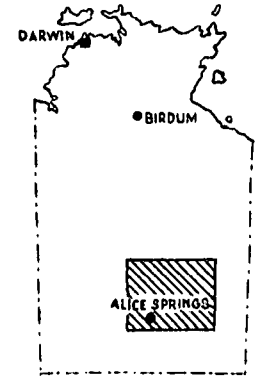
The Dulcie Sandstone crops out within a shallow syncline 120 miles long. There is evidence that bores having high yields and high specific capacities can be constructed in the sandstone. The quality of groundwater stored in the sandstone is very good, and the total volume stored is very large. In those areas which receive recharge from major rivers, the standing water levels are expected to be consistently less than 100 feet below the ground surface. An assessment of the groundwater potential of the area would be assisted by drilling a small number of holes to 500 feet, and carrying out pumping tests on them.

Fig 1 LOCALITY MAP



AREA OCCUPIED BY DULCIE SANDSTONE

0 10 20 30 40 50 100 miles



Resident Geologist's Office, Alice Springs, N.T. To accompany Record 1965/154 F 53/A/11

INTRODUCTION

This report has been prepared in order to draw attention to the considerable potential for development of groundwater stored in the Dulcie Sandstone. The conclusion that large reservoirs of water are present is based on a study of the information obtained from bores in the area that have been drilled to provide water for cattle.

The area is north-east of Alice Springs; the minimum distance from the town is about 160 road miles.

Location and Access

The Dulcie Sandstone crops out in a north-west trending belt 120 miles long and 20 to 25 miles wide, extending from 10 miles east of the old Huckitta homestead to 30 miles east of Neutral Junction homestead (see Fig. 1). This belt occupies part of each of the Barrow Creek, Elkedra, Huckitta and Alcoota 1:250,000 Sheet areas. The Sandover and Bundey Rivers flow across the outcrop north-east of Utopia homestead and north of McDonald Downs homestead.

Utopia homestead is 150 road-miles from Alice Springs; the road consists of 60 miles of sealed highway (Stuart Highway), 30 miles of formed and compacted earth "beef road" +, and 60 miles of graded earth road which generally has a good surface. The distance from Alice Springs to McDonald Downs is about 200 miles, including 40 miles of sealed highway, 45 miles of "beef road", and about 115 miles of good graded earth road.

Geology

The Dulcie Sandstone is folded into a very large shallow syncline (the Dulcie Syncline), the axis of which is parallel to the trend of the belt of outcrop (Fig. 1). The north-western two-thirds of the structure is of most interest for groundwater development, and is shown in Plate 1. In this part of the structure the sandstone crops out in two parallel strips about 20 miles apart; the strips are along the flanks of the syncline. The dips of the outcropping beds are generally less than 5 degrees. The centre of the structure is entirely sand-covered.

The formation consists predominantly of a medium-grained quartz sandstone. It is generally well sorted, with rounded grains, but some beds have a white kaolinitic matrix. The maximum exposed thickness of the formation is 2070 feet (Smith, Vine & Woolley, 1960). Very-large-scale cross-bedding is characteristically present. Fossil fish have been found in the sandstone at a small number of widely spaced localities, and these date the formation as Upper Devonian.

The Dulcie Sandstone is correlated with the Mereenie Sandstone because of:-

(a) The similarity of the lithology and the sedimentary structure of the formations.

(b) The occurrence of the fossil placoderm Bothriolepis in the upper portion of the Dulcie Sandstone, and near the base of the Pertnjara Formation (which conformably overlies the Mereenie Sandstone in the Mereenie Anticline).

Fluvial sediments of Upper Tertiary age occur along the Sandover River. They attain a maximum known thickness of 140 feet near Utopia homestead, where a sequence of creamy brown and khaki sand and sandy clay has been indicated by water bore samples (Woolley, 1965). The thickness and lithology of the fluvial deposits along the Sandover River, where it crosses the Dulcie Sandstone, are practically unknown.

+ Road constructed with Commonwealth funds and designed to aid the development of the beef cattle industry in Northern Australia.

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Hydrology

The lithological similarity of the Dulcie Sandstone and the Mereenie Sandstone suggests that the former may be capable of producing large supplies of groundwater. Bores drilled in the Mereenie Sandstone, south of Alice Springs, for town supply purposes have yielded supplies of 12,000 gallons per hour (g.p.h.), with specific capacities in excess of 500 g.p.h./foot drawdown. The water is of excellent quality, having less than 500 parts per million (p.p.m.) of total dissolved salts (t.d.s.).

Very few existing bores obtain water from the Dulcie Sandstone, but the small amount of information available supports the view that the formation may produce large quantities of good quality water. The available information is summarised in Table 1, and locations of all bores are shown in Plate 1.

TABLE 1

Bore Name	Mosquito	Soakage	No.8 S.R.	No. 4
Total depth	160'	?	107'	216'
Standing water level	145'	?	80'	160'
Supply (g.p.h.)	4,000	Good	1,000	1,000 +
Salinity (p.p.m.)	400	800	769	?
Pastoral lease	Utopia	Utopia	Sandover S.R.	McDonald Downs
R.L. of surface piezometric	?	?	1,320	1,290

Carbine Bore, on McDonald Downs, probably produces water from the Dulcie Sandstone, but no information is available. Several other bores within the area underlain by the Dulcie Sandstone are thought to obtain water from younger, probably Tertiary, deposits. These are No. 7 Stock Route, No. 14 and Soapy (Utopia), and Raida Well (McDonald Downs).

Available Yields

Mosquito Bore (Plate 1) has been pumped at 4,000 g.p.h. without forking. Since the standing water level in this bore is only 15 feet above the bottom, the drawdown must have been no more than 10 feet. The specific capacity of the bore is therefore at least 400 gph/foot drawdown. The water contains 400 p.p.m. of total dissolved salts. It is apparent that bores in this formation are capable of producing large quantities of good quality groundwater and can have high specific capacities.

Standing Water Levels

Insufficient information is available on topographic levels and standing water levels to allow construction of form lines on the piezometric surface, but a general idea of conditions can be obtained from existing bores. The only bore drilled in the Dulcie Sandstone near an obvious source of major recharge is the No. 8 Stock Route Bore, drilled on the bank of the Sandover River, where the standing water level is 80 feet below ground surface. Mosquito Bore is located within the floodout area of a small (un-named) creek about 10 miles from the Sandover River, and the good quality of the water it produces suggests that recharge conditions are good. The standing water level at this locality is 145 feet below ground surface. No. 4 Bore on McDonald Downs is located on a very extensive sand plain, about eight miles from the nearest apparent source of recharge (the Bundey River). Standing water level is 160 feet below ground surface. It is presumed from the evidence that shallow water levels (less than 100 feet) can be expected in the vicinity of the Sandover and Bundey Rivers; and that moderately shallow (100-200 feet) water levels are likely to occur in areas away from these watercourses.

Groundwater Movement

Data available are insufficient to permit any assessment of groundwater movement within the formation. The occurrence of several springs at the base of

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the Dulcie Sandstone along the south-eastern flank of the Dulcie Range suggests that groundwater movement may be to the south-east. Reduced levels on the piezometric surface at No. 8 Stock Route Bore and No. 4 Bore (McDonald Downs) are consistent with this direction of movement, but the high reduced level at No. 8 may be due to a recharge mount.

Recharge, Outflow and Storage

Quinlan (1960) has estimated that an average of 4,000 acre-feet per year is added to groundwater storage by the Sandover River, from rainfall on the catchment upstream from Utopia. This figure is based on a catchment area of 1,800 square miles (of which 900 square miles is rock outcrop) and the assumption that 1% of the average of 10 inch rainfall on the catchment is eventually added to groundwater storage. The catchment of the Bundey River upstream from the Dulcie Sandstone is similar to the Sandover catchment, but about half the size. The Bundey is therefore estimated to add an average of 2,000 acre-feet per year to groundwater storage. Small creeks draining the outcrop areas of the Dulcie Sandstone probably add as much water to storage within the sandstone as does the Bundey River. Total water available for addition to groundwater storage is therefore possibly about 8,000 acre-feet per year, and a large proportion of this could be accepted by the Dulcie Sandstone. Present outflow by pumping from bores is negligible. The amount of natural outflow is unknown. The springs around the south-eastern margin of the Dulcie Plateau are estimated to produce a total flow of less than 5,000 gallons per hour. The Dulcie Sandstone may be effluent to the Tertiary sediments along the Sandover River, but insufficient data are available to confirm this or to estimate the volume of any outflow. Probably, under present conditions, aquifers within the Dulcie Sandstone are effectively full and some of the available recharge is being rejected. The total storage of water within the formation is not known but is certainly very large and possibly of the order of 100 million acre-feet.

Conclusions

1. Bores having high yields of good quality water, with high specific capacities, can be constructed in the Dulcie Sandstone.

2. Standing water levels in bores drilled in the Dulcie Sandstone close to major watercourses are expected to be less than 100 feet. In bores drilled away from the major watercourses it is expected that standing water levels will be between 100 and 200 feet below surface.

3. Available average annual recharge to the formation is probably of the order of 6,000 - 8,000 acre feet.

4. The volume of groundwater stored within the formation is enormous.

5. Several holes drilled to 400 or 500 feet, combined with controlled pumping tests on some of them, would assist in an overall assessment of the groundwater potential of the sandstone.

6. The best place to commence such an investigation would be between Kurrajong and Mosquito Bore, and/or near No. 8 Stock Route Bore.

REFERENCES

QUINLAN, T., 1960 - Proposed irrigation area on Utopia station (Unpublished letter)

SMITH, K., VINE, R. & WOOLLEY, D.R. 1960 - Geology of the Huckitta 4-mile Sheet area; second progress report. Bur. Miner. Resour. Aust. Rec. 1960/66 (unpubl.)

WOOLLEY, D.R., 1965 - The availability of groundwater at the Utopia irrigation area, N.T. Bur. Miner. Resour. Aust. Rec. 1965/9 (unpubl.)

PLATE I.

GEOLOGY OF THE DULCIE SYNCLINE

Scale

5 0 5 10 Miles

Reference

Palaeozoic — Devonian	Dulcie Sandstone	Dud	Quartz sandstone, pebble lenses
Palaeozoic — Lower Ordovician to Upper Cambrian	Tomahawk Beds	€-Ot	Sandstone, glauconitic sandstone, siltstone and dolomite

- Geological boundary
- Bedding, showing dip and strike
- Bedding trend, shallow dip
- " " step dip
- Bedding horizontal
- Concealed syncline
- Bore with windpump
- (Abd.) Abandoned bore
- Road, track
- Homestead
- Landing ground
- Temporary small watercourse which ends in sand

Air photo interpretation

135°00'

22°30'

Dud

Shady

Bluebush

Soapy

Soakage

Boundary

Lurapulla W.H.

Mosquito

"Kurrajong"

SANDOVER RIVER

No7 (Govt.)

No14

New Sandhill

Sandhill (Abd.)

Tomahawk

(Abd)

3 Mile

"Utopia"

Sandover

No6 (Govt.)

No4

Macs

Ravenswood

Ralda Wee

TENT HILL

"Derry Downs" (Abandoned)

Jacks

BUNDEY

Macdonald Downs 8miles

Compiled from B.M.R. 1:250,000 geological sheets: Elkedra, Barrow Creek, Alcoota and Huckitta

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