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1. INTRODUCTION

The Department of Primary Industry and Fisheries has provided funds for the Singleton - Murray Downs Groundwater Resources Evaluation Project.

The project is intended to have two stages, these being:

1) Review of existing data, identification of areas with potential, and a field investigation of an area identified as having development potential.

2) Detailed evaluation of areas identified in (1) to obtain hydrogeological parameters which will enable selection of suitable sites for production bores.

The Singleton - Murray Downs - Warrabri (Ali Curung) - Wycliffe Well area has shown potential for horticultural development over time. The area has potential for the development of a rock-melon industry which produces during the period when melons are not available from the 'Top End' of the Northern Territory.

The primary aim of this stage of the project is to delineate groundwater resources in the study area that have potential to be developed to provide a water supply for a large scale, long term, horticultural development such as that postulated for the production of rock-melons.

This report presents preliminary findings of a desk and field study carried out by the Water Resources Branch of the Power and Water Authority in Alice Springs, aimed at identifying prospective aquifers and favourable areas for detailed groundwater investigation.
2. THE STUDY AREA

The study area is illustrated in Figure 1. The area effectively covers the southern half of the Bonney Well and the northern half of the Barrow Creek 1:250,000 topographic and geological sheets. It is delineated to the north-east by the foothills of the Davenport Range and to the south-west by the Osborne, Crawford and Watt Ranges. The majority of the area is represented by generally flat sandy plains with a gentle slope towards the north-west. The creeks issuing from all the ranges converge towards the centre of the plains and then swing to the north-west in a broad drainage depression.

The area is crossed by the Stuart Highway and comprises the pastoral leases of Murray Downs, Singleton and parts of Neutral Junction, McLaren Creek, and Stirling. In addition, some vacant crown land, the Wauchope Commonage, the Devil’s Marble Reserve, and the Warrabri settlement are also included.

3. AVAILABLE INFORMATION

A search of available information, data and records was carried out in the Department of Mines, the Department of Lands and the Conservation Commission.

The most important and relevant sources of information were the geological reports and the bore data files.
4. GEOLOGY

Only a brief outline of the geology of the area is given here, as this aspect will be described in greater detail in the final report.

The geology of the area under investigation can be described as a sequence of Cainozoic age sediments (Quaternary and Tertiary Periods) overlying rocks of Palaeozoic and Pre-Cambrian age. The latter rocks outcrop in the Davenport Range and in the Osborne, Crawford and Watt Ranges where they form steep-sided catchments draining to the south-west and north-east respectively.

Cainozoic sedimentary rocks form a broad band oriented north-west to south-east and fill a trough that in the past has represented a connection between two major sedimentary basins, the Wiso Basin to the north-west and the Georgina Basin to the south-east. These sedimentary rocks attain their maximum thickness (92m) approximately in the centre of the study area against the fault-controlled southern edge of the trough and become progressively shallower towards the Davenport Range in the north-east.

5. HYDROGEOLOGY

Important aquifers exist within the Cainozoic sedimentary rocks and the Upper Cambrian sedimentary rocks. Other aquifers occur within the older rocks, but normally they do not have the same characteristics of quality and yield as the aquifers in the younger formations. Both the Cainozoic and Cambrian aquifers generally contain carbonate and sandstone units, the latter comprising bands of siltstone and micaceous sandstone.
Although clay layers are present within these units, it is considered that, regionally, all aquifers are interconnected.

The conceptual hydrogeological model of the region is thought to be as exemplified in Figures 2 and 3 that illustrate the potentiometric surface contours and the salinity contours.

Recharge occurs through direct rainfall infiltration after substantial rain events and by concentrated run-off from the rocky catchment areas on the hills, particularly those of the Davenport Range.

The aquifers are semi-confined and regionally interconnected, so that inter-aquifer leakage represents an important mode of recharge. This is thought to occur from the younger to the older formations.

Groundwater underflow roughly parallels surface drainage, i.e. equipotential contours from the north-east and south-west converge towards the middle of the sandy plain and then swing towards the north-west with a general hydraulic gradient of 0.002.

On the basis of this conceptual model and because of the scant geological information on the age of the aquifers tapped by many registered bores in the area, the salinity and water level contour maps include all aquifers. Many bores have penetrated more than one aquifer and their water level is, therefore, representative of all aquifers. Furthermore, the water levels plotted relate to different years covering a long span of time and, therefore, substantial fluctuations due to exceptional rain events might also
be included. However, it is considered that these maps are representative of the overall hydrogeological regime in that they identify regional flow directions and water quality trends.

Ground elevations at bores have been estimated from topographic maps and may be inaccurate locally. Refinements should be achieved when a number of selected bores will be surveyed and levelled as part of the Stage 2 Investigation.

6. PROSPECTIVE INVESTIGATION AREAS

The relationship between the potentiometric and water quality contours presented in Figures 2 and 3 indicates that better areas for evaluation exist close to the recharge areas, as quality deteriorates in the direction of groundwater underflow. On the basis of these maps and assuming an upper limit of salinity of 1000mg/L above which the water would be unsuitable for irrigation, three areas warrant detailed investigation. In order of priority, these are (see Fig 4):

Area 1 - The broad foothills band running from Wauchope, through Singleton to Murray Downs. An area of approximately 550km².

Area 2 - The roughly circular area south-west of Murray Downs homestead. An area of approximately 500km².

Area 3 - The area along the Hanson River to the western edge of the study area. An area of approximately 160km².
The ranking of these areas has been made on the basis of hydrogeological considerations, of soil distribution, and of vicinity to infrastructures and to centres of population as sources of labour.

It should be noted that considerable localities within the study area are devoid of points of information. This is considered to be due to land use and access. However, these localities, towards the north-western and south-eastern extremities of the region, are remote and do not comply with many of the requirements of a prospective investigation area. No investigation is recommended for these localities for the foreseeable future, although at a later stage some control points located there would be helpful in improving the knowledge of these areas.

7. INVESTIGATION PROGRAM

The field investigation program will chiefly comprise of exploration bores. It is proposed that this investigation should concentrate on Areas 1 and 2, and that no drilling should be carried out in Area 3.

Approximately nine bores at selected localities should be drilled in Area 1 and two bores in Area 2, as shown in Fig 4.

The investigation bores will be drilled at a diameter suitable to accommodate 50mm PVC casing, for future monitoring and sampling. Careful logging of water intersections and salinities will be carried out at all times and drill cuttings will be kept for accurate geological description and correlation.
It is expected that most holes will be drilled to approximately 100m in order to intersect the Tertiary and Upper Cambrian aquifers. This depth may vary from site to site, but it is used as a guide for budget purposes.

A geophysical logger should be made available in order to run electric and gamma logs prior to casing. Should this not be possible, then a program of geophysical logging using gamma logs only should be carried out at the end of the drilling program.

No test production bores nor pumping tests are planned in this phase of the investigation.

8. PROGRAM COST AND TIMING

It is anticipated that the drilling program will be completed in four weeks, as it should be possible to drill and complete one bore in two days excluding site moves.

The drilling program cost is based on a cost per bore of approximately $5,600 giving a total cost of $61,600. It is possible that within this budget more than eleven bores could be drilled, as this will depend upon the ground conditions encountered and the total depth of the bores.
9. CONCLUSION

The present stage of the study aimed at the evaluation of the groundwater resources of the Singleton-Murray Downs area has identified three prospective areas warranting detailed investigation. A drilling program is recommended to obtain detailed geological, geophysical and hydrogeological information that will enable the formulation of Stage 2 of the investigation program.
PROPOSED STUDY AREA
FOR SINGLETON -
MURRAY DOWNS HORTICULTURAL
WATER SUPPLY INVESTIGATIONS

Figure 1
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