PART VII

THE WATER RESOURCES OF THE ALICE SPRINGS AREA

by

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1. INTRODUCTION

Prior to World War II, shallow wells and a small number of bores had been used to supplement the natural waters. Since 1945, there has been a rapid and continuing growth in the number of bores. New pastoral properties are being developed which are dependent on bores for permanent waters. There are approximately 125 pastoral watering points in the Alice Springs Area. Assuming that the feeding radius for stock is 3 miles, the area which can be grazed from the existing surface waters and bores is 375 square miles.

There are many surface waters in the Alice Springs Area, and these are particularly useful in areas where it is difficult to obtain supplies of underground water. They can also be used as supplementary waters to bores.

Groundwater conditions in the Alice Springs Area are varied, and in many cases, complex. Drilling has shown a relatively wide distribution of useful ground water, although the percentage of successful bores has probably been only of the order of 30 percent. Much information has been collected on the occurrence and salinity of ground water, but quantitative data on reserves are still lacking.

Included in the Alice Springs Area are portions of two large simple ground-water basins, the Great Artesian Basin and the basin which underlies the Barkly Tableland. Elsewhere individual aquifers are of limited areal extent, because of stratigraphic and structural complexity. The water table ranges in depth from 0 to 500 feet below the surface of the ground. Few bores have been drilled deeper than 600 feet.
salts have been dissolved from the limestones to the north. Tempe Downs Station depends almost entirely on natural waters of this type to water its stock.

(2) Seasonal waterholes occur along the main water-courses for varying periods following rain. Seepage waters in the shallow alluvium provide the supply for these holes. When this supply fails evaporation and consumption dry up the holes, and some but not all turn salty during the process. The 8 most important waterholes of this type occur in the beds of the Hugh and the Finke Rivers, which include Petre's Creek.

(3) There are small depressions, waterholes and claypans on almost all of the pastoral leases. These often hold water for limited periods after rainfall from which there has been run off. These may be useful temporary watering points for stock. In some instances, the storage capacity has been increased by excavation.

In addition to these natural waters artificial storages have been constructed on many properties. These are generally placed in areas where drilling for water has been unsuccessful. The life of these waters depends on their storage capacity, the amount of rainfall and evaporation, the stocking rate, and the quantity of water lost by seepage. A discussion of the optimum size, and some of the factors which should affect the selection of sites for catchment tanks is given elsewhere.

3. GROUND-WATER

(1) Occurrence

The occurrence of ground-water may be considered in terms of:

(a) Types of aquifers
(b) The water table
(c) Recharge
(d) Loss of ground-water
(e) Salinity

(a) Types of aquifers

Three main types of aquifers are recognised which closely correspond to the following groups of stratigraphic units:

(i) Pre-Upper Proterozoic metamorphic and igneous rocks
(ii) Upper Proterozoic - Middle Palaeozoic sediments, folded and consolidated.
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These are saturated with water) lies at varying depths below the land surface. This is important because even though a rock may be a good aquifer, in that it has many interstices which will hold water, it must be below the water table before it will actually hold water. The water table form lines shown on Plate indicate that the major topographic relief of the area is reflected in the relief of the water table. The highest points on the water table are in the McDonnell, Reynolds and Mungra Ranges, and there is a general fall towards Charlotte Waters in the south-east and towards the Barkly Tableland in the north-east.

Movement of ground-water is always toward a lower point. The rate of movement increases as the spacing of the form lines decreases, and this is generally accompanied by a decrease in the salinity of the water.

In hilly areas the depth of the water table below the surface of the ground varies greatly, mainly due to the lesser relief of the water table. A rise in the water table does occur below a hill, but apparently to a lesser degree than would be expected in hilly areas under similar geological conditions. In the Alice Springs area a rough correlation can be seen between the average depth to the water table (below the local base level of erosion) and the type of aquifer. This is partly because of the different degrees of aquifer interconnection common to each of the aquifer types. The water table is shallowest in and near the salt lakes and within most of the outcrop areas of the Quaternary limestones, usually at a depth of less than 30 feet. In the metamorphic rocks the water table (as represented by a series of standing water levels in discontinuous aquifers) is relatively shallow below the local base level of erosion. Depths greater than 100 feet are uncommon except where the metamorphics have a deep alluvial cover. In the areas of folded sediments the average depth to the water table is somewhat greater, but the actual depths are much more variable because of the influence of large geological structures. The areas of deepest water table are in the elevated margins of the large simple sedimentary basins. In the areas about the Goyder River and to the north-east of the Davenport Ranges, the water table is from 300 to 500 feet below the surface of the ground.

Both free and confined groundwaters are widespread and their areas of distribution commonly overlap. In many cases, particularly
in the alluvial aquifers, the presence of confined waters cannot be predicted. The only extensive artesian area is in the extreme south-east of the area, although local artesian conditions occur in other places, e.g. Tull's bore at Palm Valley. Perched water tables are common, particularly in the alluvium along the major streams. Commonly they are not permanent, but others constantly yield large quantities of good quality water to shallow wells. When the main ground-water is saline, the perched waters may provide supplies of the only useful ground-water available.

(e) Recharge

The recharge of ground-water in the Alice Springs Area comes entirely from the rain falling on the Area or the adjacent ranges. Most of it does not infiltrate immediately below the zone of soil moisture and is thus lost by evaporation and transpiration without adding to the ground-water reserves.

Penetration of water to the water table is, in general, dependent on concentration of water by run-off. The most effective recharge conditions are those, such as at Alice Springs, where run-off from a large hilly catchment area is channelled over a permeable bed with ready access to the water table. A study of the surface drainage system considered in relation to the distribution of aquifers may be expected to indicate the major ground-water recharge zones, as all streams are influent throughout their course.

However, the distribution of low-salinity waters suggests that significant recharge must also occur from local run-off concentrations, e.g. from dune crests to inter-dune depressions. In many cases the low permeability of the floor of the depression will inhibit recharge, but in general sufficient water must be added to maintain ground-water movement in many areas lacking a surface drainage system.

The only quantitative recharge data available is that for the Alice Springs Basin. This indicates that in favourable areas run-off may be in the order of 5 to 10 percent of the total rainfall, but much of this run-off will not be added to the ground-water. In unfavourable areas recharge must then be a very small part of the rainfall. An average recharge rate equal to one percent of rainfall would add some $10^8$ million gallons per year to the ground-water stored in the Alice Springs Area.
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shallow water table marginal to the salt lakes indicate the extent of exchange.

In the New Well and Tilmouth Well areas on the Burt Plain the better quality water appears to be present as a 'cren on the saline water. In other cases, such as Tarikon No. 2 bore, shallow water, which has become saline by evaporation, is separated from underlying good quality water by an impervious bed. In the Hanbury - Rodings area there are many cases of better quality ground-water adjacent to, and possibly overlying saline ground-water. They appear to be due to more favourable conditions of recharge in small areas. If bores in these areas are over-pumped, the quality of water obtained from them deteriorates rapidly with the encroachment of the main mass of saline ground-water, e.g. No Gooming bore on Hanbury Station.

Pollution of ground-water has not been a common problem in Central Australia. In general, the depth to the water table and the low concentration of organic material limit the possibilities of pollution, but some of the shallow soakage waters are polluted by cattle.

(2) Resources

The ground-water resources of the Alice Springs Area are, in total, more than adequate for likely pastoral development within the Area, although locally it may not be possible to obtain a suitable or a sufficient supply of ground-water. Where natural surface waters are lacking and conditions unsuitable for surface catchment and storage, the ground-water has a special value.

In many areas ground-water is suitable for town supplies or irrigation. However, such areas are commonly small and their resources may be limited in relation to possible requirements. Detailed investigation is necessary before heavy local ground-water development can be safely undertaken.

Insufficient basic data on water levels, permeability and recharge has yet been obtained to enable a quantitative assessment of ground-water resources. A qualitative assessment can be made using Ground-Water Provinces as a basis. Accordingly, the Alice Springs Area
has been divided into 15 provinces (cf. Plate ), and their prominent characteristics are outlined below.

(3) Ground-water Provinces

The provinces are defined principally by the types of aquifer present. Some generalizations of both boundaries and characteristics have been necessary. Accordingly some exceptions can always be found to the characteristics attributed to any one province.

Several qualitative terms are used to describe the characteristics of the provinces and arbitrary limits have been assigned to them. The depth to water or the drilling depth is referred to as shallow if it is less than 100 feet, moderate if it is between 100 and 250 feet and deep if it is more than 250 feet. Good quality water contains less than 1,500 parts per million of total dissolved solids, and it is suitable for use in a homestead. A moderate quality water has a content of total dissolved solids between 1,500 and 7,000 parts per million and is suitable for all stock. Above 7,000 parts per million the water is considered to be saline and it may not be suitable for stock.

(1) Davenport Province

Aquifers — Fractured quartzites and volcanics of Lower Proterozoic age in complex structures.

Depth — Water table is at shallow to moderate depth below the local base level of erosion. The depth to water is in part dependent on geological structure.

Salinity — Generally good to moderate but may be saline in areas of sediments of the Navajun Group.

Resources — Difficult to assess on available information, but may be moderate. Recharge for quartzite aquifers is probably inefficient. Availability moderate but commonly confined to topographically inconvenient locations.

(11) Markly Province

Aquifers — Fractures and solution cavities in limestone and dolomite and some porous sandstone, all of Cambrian age. The beds dip off the Davenport Range at very low angles.

Depth — The drilling depth and the depth to the water table are both deep.
Salinity - Moderate to good quality water throughout. Approximately
50 percent of the bores produce water which is suitable
only for stock.
Resources - Large quantities of ground-water are available throughout
except at the margins where basement rocks are present
above the water table.

(iii) Wallee Province
Aquifers - Unconsolidated sands in alluvium; and Quaternary komat.
Depth - The water table is at a shallow to a moderate depth
throughout. The depth of drilling is also shallow to
moderate.
Salinity - Good to moderate quality water is available throughout most
of province, but the water may be saline to north-west.
Resources - Moderate to large. Water is available throughout except
near the margins of province.

(iv) Sandover Province
Aquifers - Fractured and porous sandstones, limestones and dolomites
with fractures and solution cavities. They are of Upper
Proterozoic or Palaeozoic age. The geological structures are complex to
the south but become more simple to the north. These areas of
sandy alluvium along the main streams.
Depth - The depth to the water table is generally moderate, rarely
shallow, in the south but may be deep in the north-curt.
Salinity - Moderate to good quality waters occur throughout.
Resources - Large for most of the area, and water is available throughout
except for limited areas underlain by thick shales.

(v) Sturt's Province
Aquifers - Porous and fractured Palaeozoic sandstones; Quaternary
sand, komat and calcrete; and fractured and weathered
zones in metamorphic rocks.
Depth - Depth to the water table and the drilling depth are both
shallow in areas of Quaternary and metamorphic rocks, but
may be moderate to deep in areas of sandstone.
Salinity - Good to moderate quality waters can be obtained from sandstone and kunkar aquifers, but metamorphic aquifers usually yield moderate quality or saline water.

Resources - Variable to moderate in sandstone and kunkar but poor in metamorphics. Availability is good where sandstones and kunkar extend below the water table, elsewhere it is poor.

(vi) Lander Province
Aquifers - Quaternary kunkar and sandy alluvium of doubtful age.

Depth - The water table is shallow in areas of kunkar; elsewhere it is at a shallow to a moderate depth. The depth at which water is struck is variable except in the areas of kunkar where it is shallow.

Salinity - Variable as it is dependent on recharge conditions and the freedom of ground-water movement.

Resources - Moderate to large in the areas of kunkar and 'Deep Alluvium', elsewhere they are small. Water is readily available in areas of kunkar and 'Deep Alluvium'; it is difficult to find aquifers in the metamorphic rocks. Little information is available for the western half of the province.

(vii) Pliny Province
Aquifers - Sand in valley fill and piedmont deposits, aquifers can also be found in the small areas of Pleistocene and Tertiary limestones and in weathered zones in the metamorphic rocks.

Depth - The drilling depths are shallow in the areas of limestone, and variable in the areas of 'Deep Alluvium'. The depth to the water table is shallow to moderate, except in areas of 'Deep Alluvium' close to outcrop of the bedrock where it may be deep.

Salinity - Variable, aquifers in the 'Deep Alluvium' yield good quality or saline water. Aquifers in the metamorphic rocks usually contain water of moderate quality.

Resources - Moderate to large in the areas of 'Deep Alluvium' and limestone, elsewhere generally poor. Water is readily available in the limestones, but it may be difficult to find aquifers in the
Resources - Probably large except in areas of shallow basement. Water is readily available except in the marginal areas where the basement is shallow.

(xi) Hermansburg Province

Aquifers - Consolidated and folded sandstones and limestones of Upper Proterozoic and Palaeozoic age, with pockets of Mesozoic and Quaternary sands. Some areas are underlain by impervious shales which continue to a considerable depth.

Depth - The depth at which water will be struck is dependent on the geological structure. The depth to the water table is largely controlled by the local topography but is generally less than 200 feet.

Salinity - Variable, depending on the extent of recharge and the presence of saline source rocks. In some areas almost all of the aquifers contain saline water.

Resources - Moderate to poor availability of water in the southern portion but it is readily available near the ranges. Large reserves are available in the sandstones and limestones, but the yield is dependent on permeability. The biggest reserves occur in country of poor pastoral potential.

(xii) MacDonnell Province

Aquifers - Fractured and weathered zones in the metamorphic rocks and unconsolidated sands in pockets of alluvium. The metamorphic aquifers are small, disconnected and irregular in distribution.

Depth - The water table is at shallow depths below the local topography of erosion. The depth at which water is struck is also generally shallow.

Salinity - Variable, depending on local recharge. A large quantity of recharge water is available but low permeability and poor interconnection of the aquifers limits intake from run-off water.

Resources - Small except in small alluvial pockets near the margins of the area. Availability is good in these pockets but is poor elsewhere, in part this is because of difficult drilling conditions.

(xiii) Karluka Province

Aquifers - Widespread mesozoic sands with small areas of Tertiary
Salinity - The water obtained is of good to moderate quality except in some marginal areas with poor recharge.

Resources - Large in the deeper aquifers. Small supplies only are available from the perched aquifers. Availability is good except near the margins of the province where good aquifers do not occur below the water table.

Investigations of the occurrence of ground-water in the Alice Springs Area are being continued by the Resident Geologists at Alice Springs. This work will lead to a better understanding of the ground-water resources and the distribution of saline water. This information will be of value in the future when bore sites are required in areas which, at the present, have poor prospects.