Pumping for the
Alice Springs Water Supply.

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District Engineer,

April, 1964.
This report reviews the past pumping pattern drawing from bores established within or associated with the Alice Springs Town Basin groundwater storage.

It examines the hydraulics of the Town Basin and makes recommendations on future pumping patterns designed to draw on the deep Mereenie Sandstone aquifers as a base rate supply with the Town Basin bores utilized to supplement this base rate supply at times of peak loading. The recommendations are such as to permit the best possible recharge to the depleted aquifers of the Town Basin in particular those of the Inner Farm Area where early recharge is essential to the future of many leases.

HISTORY

Since its inception the Town of Alice Springs has drawn its water from the alluvial sands deposited along the course of the Todd River. Early supplies came from natural water holes in the bed of the river, these being supplemented in course of time by hand dug wells also in the natural river bed.

With the erection of buildings on the site of the present Alice Springs Township wells were sunk to tap the aquifers of the Town Basin remote from the immediate vicinity of the river channel but for many years little was known of the extent of potential of these aquifers.

The original well known as Town Well was sunk in the early thirties in a location which later proved to be in the centre of Hartley Street. In 1938 when Hartley Street was constructed the well was moved to the present location.

Pipes were erected on Billy Goat Hill in 1940 and limited reticulation was started to the hospital and close government residences.

Reticulation was extended in 1941 to Army installations and further residences. Investigational drilling was undertaken to establish suitable sites for three Army Wells which were sunk in 1942. One of these wells proved unsuitable and the whole supply depended on an enlarged Town Well and two Army Wells.

Reticulation was virtually complete by 1946.
The first Todd Well was excavated into the centre of the river bed in 1952. Bent Tree Well and another Todd Well were sunk simultaneously during December 1955/Jan 1956, and a large "feeder" trench was constructed in an effort to improve the yield of the latter. These wells in the course of time became insufficient to handle the growing needs of the town and in November 1956 Mr. Trevor Wilson of the Department of Works conducted a comprehensive investigation to prepare estimates of the quantity of water stored in the Basin and determine the nature and position of the better aquifers. At about this time four perforated casing bores (Nos. 21, 27, 28 & 36) were constructed to tap the water flowing from the northern part of the basin into the basin proper, one was constructed to draw from the storage in the lower part of the basin above Heavitree Gap (No. 110) and a screened bore was constructed to intercept water flowing through Heavitree Gap (No. 59). Bore No's 21 and 27 were to have a short life becoming unsuitable for pumping when collapses occurred seriously reducing their yield. The older wells were also affected by collapses and by 1960 only two wells (Army Well No. 2 and the Todd Well) were capable of being pumped for any useful yield. The Todd Well was abandoned because its yield was unreliable, declining rapidly after a river flow.

A fresh drilling programme was initiated to establish screened bores free from fear of collapse and capable of meeting the now rapidly rising town reticulation requirements. This drilling contributed significantly to knowledge of the Town Basin aquifers and succeeded in establishing the following screened bore:

- Todd Bore (adjacent to Todd Well)
- Todd Bore (adjacent to Town Well)
- Bent Tree No.1 Bore (adjacent to Bent Tree Well)
- Bent Tree No.2 Bore (adjacent to Bent Tree Well)
- Bore 59/11 (Immediately upstream and east of Heavitree Gap)
- Bore 61/33 (upstream and west of Heavitree Gap)
- Bore 62/9 (in the Todd River bed east of the Township)
- and one bore completed with perforated casing,
- Colloso Park Bore (on the west river bank just south east of the Township)

Improving knowledge of the hydrodynamics of flow in the Town Basin aquifers resulted in the re-equipping of the Todd Well and this well and Bore 62/9 are now pumped to gain an early benefit of a river flow and further to utilise the water held in the river.
sands and which percolates only very slowly into the deeper parts of the basin thus preparing these river sands to accept the recharge should another flow occur.

Prior to this recognition of the importance of preparing sands to accept recharge water very little system had been applied to the pumping of the basin, recurring water shortages forcing all available bores to be pumped at their maximum rate. During periods of reduced consumption, "ease of operation" had been the criterion when deciding which bores would be rested with the result that the base load had been carried by wells or bores of better than average yield situated in the centre of the basin. This pumping pattern did little to promote efficiency of recharge.

Without an appreciation of the quantity of water available from the basin a policy of constructing more extraction works, still within the Town Basin, to provide more pumping capacity to meet each increase in demand had come to be adopted. The early estimates of the availability of water from the basin clearly pointed to shortcomings in the extraction works as being the reason for frequent shortages of water to the reticulation. Failure to recognize the alluvium underlying the Inner Farm Area as an integral part of the Town Basin Hydrological unit had prompted continuous pumping of the Gap Bore (59) in an effort to reduce what was thought to be the outflow from the basin at this point.

It was not until 1962 when C.F. Forbes of this Branch prepared the first reliable estimate of the safe yield of the basin that it was established that the basin was being severely over pumped. The consequences of this over pumping were already apparent however as the rapid decline of the level of stored water in the basin caused reduced yield from some pumps. By the end of 1962 pumping from Bore 59/11 and from the No.2 Army Well had ceased and but for restrictions on water usage the supply from the bores could not have met the demands for water from the reticulated supply.

Private bores and wells had been sunk wherever useful supplies exist and these added to the draft on the Town Basin. Forbes estimated a total draft of 240,464,000 in 1961, some 120,000,000 gallons in excess of the safe yield of 120,000,000 gallons annually. Work was already in hand investigating possible supplements to the supply from external to the Town Basin.
It was now recognised that the Town Basin hydrological unit extended downstream through the inner farm area to just past Mt. Blatherskite and investigations established that there is a continual sub-surface flow from the Town Basin past Mt. Blatherskite into the deep Farm Basin.

To tap this underflow a bore was drilled into the limestone aquifer existing at this point and this bore (Outflow Bore - south east of Mt. Blatherskite) was added to the town pumping strength in January 1964.

At the present date the town is expecting to receive a further supplement, this time from deep aquifers existing on the Southern Rim of the Farm Basin in the Mereenie Sandstone. A contribution at the rate of 6 million gallons per week is planned in the initial stages with this contribution to be increased in 2 m.g/w steps to 10 m.g/w.

Plate I shows the location of bores tapping the Town Basin waters and Plate II shows the relative position of the Mereenie Aquifers.

PRESENT AND POSSIBLE YIELDS FROM TOWN BASIN BORES.

The tabulation in Figure I sets out the yield of the bores (or wells) at April 1960 or at the date of construction if later than April, 1960, compared with the present yield or status of the extraction works.

Plate III shows the variation in weekly consumption through the period January 1961 to June 1962 which period includes the 1961/62 Summer, the last one during which no restrictions were imposed on water usage.

Figure 2 portrays the trend of annual and maximum weekly water consumption.

Plate IV shows the contours on the piezometric surface in April 1960.

Plate V shows the contours on the piezometric surface at the present date, April 1964.

At the present date, quite clearly, the availability of water from Town Basin extraction works is insufficient to meet the
unrestricted demand. Further to this many private bores particularly those in the outflow area of the basin (The Inner Farm Area) have failed and projects dependent upon these private bores or wells are being abandoned.

To enable the understanding of the flow paths of higher permeability opposed to the areas of low permeability but large storage particularly from the long term point of view, and the selection of sites suitable for extraction works which will not interfere with the progress of recharge waters to the long term storage zones, information from the many programmes of investigation has been compiled and is presented on Plate VI. The evidence considered in preparing this map included:

(a) Monthly changes in the contours on the piezometric surface following a river flow and again at times of prolonged effluent flow from storage.

(b) Time elapsed for response to recharge at observation points remote from the river.

(c) Points of termination of flows in the river.

(d) Transmissibilities determined from pump tests conducted in the various production bores, and reflections during these tests.

(e) Lithologies of aquifer types as determined by the examination of drill cuttings.

The information presented on Plate VII is qualitative and should be considered together with quantitative data compiled by Forbes.

By noting that against the available yield of 120,000,000 gallons the basin must supply annually an amount of the order of 70,000,000 gallons to private pumping and natural outflow (from Forbes 1962) it is derived that approximately 50,000,000 gallons will be available annually for recharge of storage or a lesser figure, say 15,000,000 gallons annually if it is necessary for some pumping from the Basin above Mt. Slaterskite as suggested in "Schedule II" below.

Since April 1960 some _____ million gallons have been removed from storage. To re-establish the water levels in the critical areas namely the Inner Farm Area and the more permeable zones of the basin above Heavitree Gap, to the levels of
satisfactory operation of pumps, both public and private, as last seen in 1960 will require a total recharge of million gallons. This could be expected to bring the contours on the pizometric surface to approximate the hypothetic position shown in Plate VII.

An estimate of the time required to achieve the state shown in Plate VII can be set at a maximum of years.

This period will be affected by the volume of private pumping and, of course, by the frequency of flows in the Todd River. But, assuming that flows occur at a frequency sufficient to give the safe yield of gallon a annually then the steps which can be taken to ensure that this period is not exceeded but if possible reduced are set out in the following section.

FUTURE PUMPING SCHEDULES

The detailed knowledge of town basin aquifers and response to river flows and pumping stimulus now compiled enables schedules to be laid down to permit the early attainment of the desirable state illustrated in Plate VII.

Two recommended pumping schedules are set out. The first will apply when the available supply from the Neringie Bores is insufficient to supply the maximum week demand or after a satisfactory degree of recovery in the town basin has been achieved and it is desired to fully utilise the cheaper town basin water. The second will apply whilst the maximum rate of recovery of the Town Basin is desired and when Neringie Water is available in quantities sufficient to cover full maximum demands.

SCHEDULE I

Postulate--
Consumption - Maximum week - 9 million gallons.
Water availability from Neringie Bores - 6 m.g/w.
Under these conditions the 6 m.g/w from the Neringie source will easily cover the winter draft which would approximate 4 m.g/w. Foreseen of operation it will be desirable to operate two of the Neringie Bores drawing 4 m.g/w from that source and "topping up" by operating:--
1. Outflow Bore (WNB/AN)
   At such a rate as to maintain the storage tank at an even level.
   As the consumption rises, bores in the upper Todd zone should be introduced in the following order to supplement the
supply until such time as the consumption rises sufficiently for the third Mereenie bore to be introduced.

(2) Todd Well
(3) Bore 62/9
(4) Todd Bore
(5) Bore 86
(6) Colacag Park Bore

After the consumption passes 6 m.g/w the same procedure should be followed pumping Outflow Bore (WRE/AR) with others introduced as listed above when required.

This will cover consumptions up to 8 m.g/w. If more water is required consumptions up to 9 m.g/w can be handled by pumping:-

(7) Bore 61/23

If more bores are required to cover any emergent circumstance other bores can be pumped, introducing them in the following order with every effort being made to avoid pumping the three lowest priority bores.

(8) Bent Tree Bore No.1
(9) Bent Tree Bore No.2
(10) Bore 110
(11) Town Bore
(12) Gap Bore No.59

This assumes that the Abattoir Bore (59/11) and the Army Well No.2 will not be reconnected. Note the numbers e.g. (1) proceeding the bore name in the listing above are "priority numbers".

Schedule 2

Postulate

Consumption - Maximum week - 9 million gallons
Water availability from Mereenie Bores - 8 m.g/w. (minimum)

Under these conditions the Mereenie bores will carry all consumptions up to the maximum with the addition of only the No. (1) priority bore, Outflow Bore. However it may be necessary for brief periods of pumping from Bores with priority numbers (2) to (6) to handle intermediate consumptions without resorting to changing the pumping rates of the Mereenie Bores.
FUTURE DEVELOPMENT OF PUMPING INSTALLATIONS

A. Mereenie Bore Sites.

The proposed schedule of pump operation as set out above requires that all three of the first group of Mereenie production bores operate for 10 months of the year. During the remaining 2 months one bore can be shut down permitting all bores to be maintained in rotation.

This is in line with the original concept of pumping from the Mereenie Bores but has one serious short coming in that at no stage is there any margin for safety or unexpected failure.

To cover these contingencies it is recommended that the following programme for future development be adopted.

1. Rehabilitate (or replace) Bore P3. This could be achieved by fishing the installed screens and conducting a programme of air-lift development.

2. Test Bore P3 and if the design yield of 12,000 g.p.h. is proved to be available transfer the pump from Bore P2 to P3.

3. Further develop and test Bore P2. On the basis of results to date this bore probably will test at 30,000 g.p.h.

4. Re-equip Bore P2 at an increased rate.

5. Continue with Bore P3 and P6 as is indicated by analysis of tests on the other bores, moving the 12,000 g.p.h. pumps into these if the earlier bores can be proved to have greater yields.

B. Town Basin Bore Sites

If following successful experiments with artificial recharge the yield of the Town Basin can be increased consideration must be given to the most suitable points from which to extract this improved yield.

To permit the holding of maximum storage levels first priority pumping must be below the outflow point at Mt. Blatherskite. Outflow Bore (WRA/AR) is capable of greater yields when the underflow in the area is increased and other bores can be sited in the same vicinity should the underflow justify this action.
Pumping from the northern part of the basin should be confined to the immediate vicinity of the recharge mound so that maximum benefit is obtained from any one river flow and the body of the storage basin is only utilized in times of infrequent recharge. To achieve this most efficiently it may be necessary to construct another bore on the Todd River Bank either south east from the Amy Wells or east from Bore 53/11, in this latter case possibly on the eastern bank of the river.

ACKNOWLEDGEMENTS

I acknowledge the contribution made by earlier investigations and the people of Alice Springs who have co-operating in supplying information and private records. The report is only possible following the joint efforts of my officers of the Water Resources Branch and the Resident Geologists Section who have painstakingly compiled the records of many investigations conducted over many years.
**Figure 1.**

**TABULATION OF PRODUCTION RATES**

<table>
<thead>
<tr>
<th>BORE OR WELL</th>
<th>YIELD</th>
<th>GPH</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.21 Bore</td>
<td>-</td>
<td>-</td>
<td>abandoned Dec 4th 1960</td>
</tr>
<tr>
<td>Bent Tree Well</td>
<td>-</td>
<td>-</td>
<td>abandoned 1959</td>
</tr>
<tr>
<td>Army 11 Well</td>
<td>4560</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.59/11 Bore</td>
<td>3900(Feb)</td>
<td></td>
<td>abandoned Sept '61 @ 1470</td>
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<tr>
<td>Town Well</td>
<td>2820(March)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Todd Well</td>
<td>4580</td>
<td></td>
<td>pumped only after riverflow</td>
</tr>
<tr>
<td>No.59 (Gap) Bore</td>
<td>6900</td>
<td>2720</td>
<td></td>
</tr>
<tr>
<td>No.28</td>
<td>4220</td>
<td>1380</td>
<td></td>
</tr>
<tr>
<td>No.86</td>
<td>2180</td>
<td>-</td>
<td>abandoned Oct '63 @ 1570</td>
</tr>
<tr>
<td>Fo.110</td>
<td>6720</td>
<td>6240</td>
<td></td>
</tr>
<tr>
<td>Todd Bore</td>
<td>2690(June)</td>
<td>2000</td>
<td>commissioned in June 1960?</td>
</tr>
<tr>
<td>Bent Tree Bore I</td>
<td>2450(Oct)</td>
<td>1560</td>
<td>commissioned in Oct 1960?</td>
</tr>
<tr>
<td>Bent Tree Bore II</td>
<td>2200</td>
<td>1630</td>
<td>ready to com.23/10/61 @ (2500</td>
</tr>
<tr>
<td>Bore 61/33</td>
<td>6000</td>
<td>6070</td>
<td>rates at right.Put in op(7500</td>
</tr>
<tr>
<td>Colacarg Park Bore</td>
<td>3900</td>
<td>1420</td>
<td>Jan '62 at average rates (50000 shown</td>
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<tr>
<td>Town Bore</td>
<td>2560(Jan '61)</td>
<td>2450</td>
<td>commissioned Dec 13th 1963</td>
</tr>
<tr>
<td>Bore 62/9</td>
<td>2714(Dec '63)</td>
<td>-</td>
<td>abandoned Jan '64 at 1200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(to be pumped after a river flow)</td>
</tr>
<tr>
<td>Outflow Bore</td>
<td>6576(Jan '64)</td>
<td>4590</td>
<td>commissioned Jan 10th 1964.</td>
</tr>
<tr>
<td>(WRS/AR)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PLATE III

VARIATION IN WEEKLY CONSUMPTION DURING PERIOD JANUARY 1961 TO JUNE 1962

ALICE SPRINGS TOWN WATER SUPPLY

20th April 1966

Plan No. 7263.