POWER AND WATER AUTHORITY
REPORT NO 44/94

ASSESSMENT OF WATER SOURCES
MANMOYI OUTSTATION

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February 1994
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AMG</td>
<td>Australian Map Grid</td>
</tr>
<tr>
<td>°C</td>
<td>degree Celsius</td>
</tr>
<tr>
<td>ID</td>
<td>internal diameter</td>
</tr>
<tr>
<td>km</td>
<td>kilometre</td>
</tr>
<tr>
<td>L/s</td>
<td>litre per second</td>
</tr>
<tr>
<td>L/c/d</td>
<td>litre per capita per day</td>
</tr>
<tr>
<td>m</td>
<td>metre</td>
</tr>
<tr>
<td>m³/d</td>
<td>cubic metres per day</td>
</tr>
<tr>
<td>mm</td>
<td>millimetre</td>
</tr>
<tr>
<td>mg/L</td>
<td>milligrams per litre</td>
</tr>
<tr>
<td>pH</td>
<td>acidity and alkalinity index</td>
</tr>
<tr>
<td>SWL</td>
<td>standing water level</td>
</tr>
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</table>
Investigations are being undertaken by the Water Resources Division of PAWA for the development of the existing Manmoyi Outstation. Geofact, a groundwater consulting firm, was commissioned to carry out a preliminary evaluation of the water sources in the area with a view to supplying the requirements for the outstation.

A preliminary desktop study was undertaken. This entailed the use of hydrogeological information, interpretation of aerial photographs, hydrochemical information, the use of geological and topographical maps and other relevant information.

This report presents the results of the evaluation and the collection and study of the existing data in the area.

Manmoyi is an Oenpelli outstation, located approximately 120km to the east of Oenpelli (refer figure 1) at AMG co-ordinates 403500 -8613500 (Cadell 1:100 000 Sheet 5772). It is covered by aerial photographs 1:50 000 Arnhem Highway, Flight NTC 747 28/7/82 Run 7W frames 136 and 137. It is accessible by road throughout the year. The present population of the outstation is approximately 50.

Manmoyi has a humid climate with a mean rainfall of 1400 mm and a mean annual evaporation of 2400 mm. Most of the rain falls between November to April. Maximum daily temperatures range from 32°C to 35°C in December to about 26°C in June.

A previous investigation at Manmoyi was undertaken from August 1989 to May 1990 and resulted in the drilling of three bores, one of which (26757) was successful. This bore is being pumped in conjunction with a natural billabong which is equipped with a siphon windmill. Together they supply approximately 1.0 L/s or 25 Kl/d.

Manmoyi is situated on the Arnhem Land Plateau, which is a part of the physiographic unit known as the Arafura Fall. The Plateau is extremely dissected, with rivers and tributaries being incised along joints and faults. The intensity of the jointing in the sandstones...
of the Kombolgie Formation contributes to a very high permeability and helps control surface run-off.

The stratigraphy of the area consists of basement Archaean Gunbatgari Granite which is a gneissic adamellite. The only surface expression of this on the sheet area (Milingimbi 1:250 000 Geological Map) is its exposure as an inlier NE of the outstation.

The Gunbatgari Granite is unconformably overlain by the Proterozoic aged Kombolgie Sandstone which contains two volcanic members - the Goomadeer and the Nungbalgarri Volcanic Members. Numerous dolerite dykes and sills intrude the Kombolgie Sandstone and occur as isolated exposures throughout the Arnhem Land Plateau.

2.1 Aquifer Occurrence

No water is expected in the granite unit, due to its compact nature being unconducive to storage. Previous drilling (Reference 1) was unsuccessful in obtaining water in the dolerite but success was obtained in drilling on a lineament present in the Kombolgie Sandstone.

The best prospect for water would be in the Kombolgie Sandstone. The permeability in this unit is enhanced by fractures which also help control surface runoff. Previous drilling of this unit in the vicinity of Manmoyi resulted in production bore 26757 drilled in 1989/90 (Reference 1). This bore was recommended for 0.4 L/s but is currently pumping approximately 0.7 L/s, re-testing of the sustainable yield of this bore should be undertaken. Refer to Attachment A for the Completion Report of this bore. It was sited on a lineament located by geophysical techniques. Further drilling of this lineament, if undertaken, should be at least 300-500m from the current bore so as not to interfere with its extraction rate. Drilling a backup bore in case of failure of this bore is considered desirable, as this is the primary water source for this outstation.

Due to permeability in the Kombolgie Sandstone being enhanced by lineaments and fractures, siting of bores will need to be undertaken with the help of geophysical techniques. This will ensure more accurate placement of the bore (on a lineament and/or fracture) and hence increase the prospect for water.
2.2 Surface Water
There is a natural billabong located approximately 2km from the outstation. This is pumped to a 13.5 Xl storage tank by a windmill at a rate of approximately 0.25 L/s.

2.3 Water Quality
The water from production bore 26757 (refer Table 1) is within the recommended limits for drinking water as adopted by the Australian Water Resources Council/National health and medical Research Council (Reference 2). The pH is low, but does not pose a health risk. Water of approximately the same quality can be expected to be obtained from aquifers within the Kombolgie Sandstone in this vicinity.

Anecdotal evidence rates the quality of the surface water as good, deteriorating towards the end of the dry.

3. PROPOSED DRILLING LOCATIONS

The proposed drilling localities are shown on figure 2. Four localities were chosen; these are tabulated below in Table 2 in order of preference.

Table 2 Proposed Drilling Locations

<table>
<thead>
<tr>
<th>PREFERENCE</th>
<th>AMG EASTING</th>
<th>AMG NORTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>403150</td>
<td>8612350</td>
</tr>
<tr>
<td>2</td>
<td>402500</td>
<td>8611200</td>
</tr>
<tr>
<td>3</td>
<td>401800</td>
<td>8611750</td>
</tr>
<tr>
<td>4</td>
<td>401150</td>
<td>8612150</td>
</tr>
</tbody>
</table>

The water quality can be expected to be the same as in bore 26757, in section 2.3.

The depth to water in these holes can be expected to be in the order of 30 to 35m.

4. PREVIOUS DRILLING

From August 1989 to May 1990, three bores were drilled in the vicinity of Manmoyi. Only one, bore 26757, was successful. This was
### WATER QUALITY DATA

<table>
<thead>
<tr>
<th>Bare Registration Number (RN)</th>
<th>Date of Sampling</th>
<th>Specific Conductance (uS/cm)</th>
<th>Total Dissolved Solids (TDS)</th>
<th>pH</th>
<th>Sodium (Na)</th>
<th>Potassium (K)</th>
<th>Calcium (Ca)</th>
<th>Magnesium (Mg)</th>
<th>Total Hardness (as CaCO₃)</th>
<th>Total Alkalinity (as CaCO₃)</th>
<th>Iron (Total)</th>
<th>Silica (SiO₂)</th>
<th>Chloride (Cl)</th>
<th>Sulphate (SO₄)</th>
<th>Nitrate (NO₃)</th>
<th>Bicarbonate (HCO₃)</th>
<th>Fluoride (F)</th>
<th>(Calc from Chloride)</th>
<th>NaCl</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>26757</td>
<td>16-May-90</td>
<td>50</td>
<td>45</td>
<td>5.6</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>10</td>
<td>13</td>
<td>0.3</td>
<td>17</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>16</td>
<td>0.1</td>
<td>13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REGIONAL GEOLOGY MAP

LEGEND

PROSPECTIVE BORE SITE
WATERCOURSE
FAULT

QUATERNARY

CAINozoic

UNDIFFERENTIATED

MESOZOIC

LOWER CRETACEOUS

UPPER PROTEROZOIC

PRECAMBRIAN

LOWER PROTEROZOIC

ARCHAEOAN

CAINozoic

LOWER CRETACEOUS

UPPER PROTEROZOIC

ARCHAEOAN

REGIONAL GEOLOGY MAP

FIG. 2
constructed as a production bore with Class 9 PVC casing and stainless steel screens (refer Appendix A for composite log and bore completion report).

The pump test report indicated a maximum pumping rate of 0.4 L/s with a pump setting of 31m BGL (refer Appendix A and reference 1).

Water analyses should be taken bi-annually from this bore (26757).

5. WATER DEMAND

The present population at Manmoyi is estimated to be 50. The expected water demand will be 20 KI/d average and 30 KI/d peak, based on a rate of 400 L/c/d average and 600 L/c/d/ peak. The present supply is approximately 1.0 L/s (25 KI/d) utilising the production bore (26757), which is equipped with a solar pump and the billabong, which is equipped with a siphon windmill. The waters are pumped to a storage tank with a capacity of 13.5 KI.

There appears to be water wastage at Manmoyi. Introducing measures to counteract this may include spring loaded taps, smaller gauge reticulation, water education programmes and increasing storage capacity to alleviate problems during peak demand.

6. CONCLUSIONS

There is sufficient water at Manmoyi for the outstation's demands. The supply problems being experienced at present appear to be due to wastage of the water. Measures need to be taken to counteract this. This may include introducing water awareness education, small gauge reticulation and spring loaded taps.

Any future bores should be drilled in the Kombolgie Sandstone south of the community, at the approximate locations indicated in Table 2 and on Figure 2. It will be necessary to employ geophysical techniques to ascertain exact bore sites, as any bores drilled need to be located on a fracture or lineament within the Kombolgie Sandstone, as this will enhance the supply. The present production bore is sited on a lineament which was located by geophysics and
siting of another production bore on this lineament should be at least 300-500m away from the current bore, as any closer may cause interference (and possibly decrease/or loss of supply) with bore 26757.

7. RECOMMENDATIONS

It is recommended to

- Initiate a water wastage survey.
- Try to increase the community’s awareness of the need to conserve water.
- Increase the storage capacity to alleviate any problems during peak usage.
- Take water samples for analysis from bore 26757 bi-annually.
- Drill future bores in the Kombolgie Sandstone to the south of the community, at or near the sites proposed in Table 2 Section 3.
- Use geophysical support in siting bores.
8. REFERENCES

   Bore Completion Report - Bore 26757 - Manmoyi Outstation.
   Water Resources Division, Darwin.

2. Australian Water Resources Council/National Health and Medical Research Council -
   Desirable Quality for Drinking Water in Australia.

3. Rix, P. 1965
   Milingimbi, NT 1:250 000 Sheet SD/53-2 Geological Series -
ATTACHMENT A

BORE COMPLETION REPORT
WATER RESOURCES DIVISION

TEST REPORT — BORE RN. 26757

Bore location: MANMOYI
Client/owner: AES
Client’s reference: DOMESTIC
Map: CADELL 1:100 000 SHEET 5772
Grid reference: 403100 - 8612400

RECOMMENDATIONS
Pumping rate: 0.4 L/s. Pump setting: 31 m below ground level
General recommendations are given on the reverse side.
The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short
periods in favourable seasons. Further advice can be obtained from: PAWA — WATER DIRECTORATE
SASCO HOUSE, DARWIN

BORE DATA
Finished depth: 36.57 m, Completion date: 24.11.89, Test date: 16.5.90
Standing water level 5.94 m on 16.5.90, Test rates: 0.8 L/s
Construction details:

<table>
<thead>
<tr>
<th>Interval (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>203 mm STEEL CASTING</td>
</tr>
<tr>
<td>0 – 32</td>
<td>146 mm ID PVC CLASS 9 CASING</td>
</tr>
<tr>
<td>32 – 36.15</td>
<td>154 mm ID S/S SCREEN WITH 1 mm SLOTS</td>
</tr>
</tbody>
</table>

Notes: 1. Top of casing as constructed was 0.7 m above ground
2. All depths are measured from natural ground level
3. Test rates are not indicative of safe long-term pumping rates.

WARNING: MINIMUM INTERNAL BORE DIAMETER IS 146 mm NOMINAL BORE

COMMENTS
1. The above recommendations are based on a constant discharge test at 0.8
for 8 hours, assume hydrological conditions will not change.
2. Provision to monitor water levels when bore is equipped should be
incorporated in any reticulation.

WATER QUALITY

See water laboratory report (Analysis No. 89/90/1410)
RECOMMENDATIONS FOR FINISHING, OPERATING AND PROTECTING GROUNDWATER BORES

Attention to the following points will ensure a long and safe life for the bore supply and help prevent pollution of a groundwater resource.

1. Construct a concrete apron around the bore head to prevent surface flow, seepage and waste from entering the bore.

2. Seal the space between the casing and pump equipment to prevent entry of vermin, dirt and pollutants.

3. Maintain pumping equipment in good order to prevent pollution. Prevent spillage of fuel and oil on the ground around the bore. Store fertilizer and other chemicals at least 50 m away.

4. Keep stock away from the bore head. Discourage domestic activity at the bore. The first tap on the pipeline should not be less than 5 m from the bore head.

5. Pumping the bore at higher than recommended rates may lork the bore leading to instability or pump maintenance problems. Seek the professional advice of an hydrogeologist or groundwater engineer.

6. If the bore is no longer required, the casing is to be removed or securely capped and the bore backfilled with clayey material. A cement plug may be required in some instances.

In addition, please ensure that the BORE IDENTIFICATION TAG is retained securely at all times. The registered bore number is Water Resources Division's only reference to the scientific and engineering data on this bore, and hence important to WRD's further advice to bore owners.