KULGERA POLICE STATION
Bore Completion Report
RN 16420 and RN 16421

COL GARNER
TECHNICAL OFFICER
WATER RESOURCES BRANCH, ALICE SPRINGS

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SYNOPSIS

A successful domestic water supply bore, RN 16421, was constructed for the Kulgera police station. It replaces Mono bore, RN 1881, in which the steel casing has deteriorated. The bore has a maximum recommended yield of 0.12 L/s.

The water is drawn from the weathered zone immediately above the harder granite and has a TDS of 1170 mg/L. The nitrate and fluoride levels are above the maximum recommended for drinking water. Recommendations for equipping and operation of the bore are included.

RN 16420, drilled in an attempt to enhance the overall yield for the Kulgera police station, was constructed as a monitoring bore due to inferior quality water.

KEYWORDS

SUBJECT Domestic water supply
Monitoring bore
Nitrate
Fluoride

GEOLOGY Weathered zone
Granite

LOCATION Kulgera
Kulgera Police Station
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ABBREVIATIONS

bgl  below ground level
ID  inside diameter
OD  outside diameter
km  kilometres
L/s  litres per second
m  metres
mg/L  milligrams per litre
RN  registered number
SWL  standing water level
TDS  total dissolved solids (in mg/L)
PAWA  Power and Water Authority
EC  electric conductivity
µS/cm  microsiemens per centimetre
GWP  galvanised water pipe

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AUTHOR 1
The Kulgera police station is located 275 km south of Alice Springs along the Stuart Highway next to the Kulgera Roadhouse (Figure 1).

Water for the police station is currently supplied by 2 bores, RN 1881 known as Mono bore, and RN 1884 known as Windmill bore. As far as can be determined, both bores were drilled during or before 1959. Tables 1 and 2 show the historical water quality data.

Following a request from the Northern Territory Construction Agency, 2 bores were drilled, 1 (one) as a replacement for RN 1881 and the other an attempt to enhance the overall water supply.

The current permanent population of the police station is 4 adults, 2 infants and 1 child. This will obviously fluctuate from time to time depending upon the personnel stationed there. It should also be noted that the station regularly has visitors.

In early 1993, water was carted to the police station to alleviate acute water shortages. This lead to an appraisal of the water supply by the Technical Support Branch of PAWA which recommended the immediate upgrading of the existing 2 bores to their maximum capacities and the subsequent replacement of RN 1881.

All depths are measured from natural ground level.

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2. GROUNDWATER HISTORY

Both bores supplying water to the police station were drilled during, or before, 1959. There is no data available on the construction of the bores except that they both have 142 mm ID steel casing.

RN 1881 was drilled to a depth of 51.8 m with a yield of 0.15 L/s while RN 1884 was drilled to a depth of 47.2 m with a yield of 0.2 L/s. Both bores were terminated in granite.

During maintenance work on RN 1881 in early 1993, it was noted that
the casing was in poor condition and that a considerable amount of rust scale and sand particles were being pumped. For this reason, it was recommended by Technical Support Branch that this bore be replaced, and another bore be drilled in the vicinity in an endeavour to enhance the overall water supply.

There has been no significant changes in the water quality since the bores were first sampled in 1959. Tables 1 and 2 contain the relevant chemical data. However, it should be noted that in both bores, the nitrate and fluoride levels exceed the National Health and Medical Research Council "Guidelines for Drinking Water Quality in Australia".

In 1959, the SWL in both bores was recorded at around 10.5 m. On 16.11.93, after the pump in RN 1881 had been off for approximately 24 hours, a SWL of 17.0 m was recorded, but the bore was observed to be still recovering. The deficit in the water level is not considered to be of significance due to the length of time that the bores have been operating.

3. HYDROGEOLOGY

Kulgera township lies on rocks of the Kulgera Adamellite. See Figure 3 for a map of the local geology.

The Kulgera Adamellite crops out as low rounded inselbergs 1 km east of Kulgera, and also to the west of Kulgera. The adamellite is typically red and consists of porphyritic and equigranular granites with associated microgranites and pegmatite dykes.

The typical constituent minerals are K-feldspar, quartz, plagioclase, biotite and sphene. Accessory minerals include magnetite, apatite, zircon and epidote. The rock consists of large crystals of plagioclase and K-feldspar set in a finer grained groundmass.

The complex intrudes the Kalamurta and Outounya gneisses although the contact is usually obscured by Cainozoic sediments.
DRILLING AND TESTING

RN 16420 was drilled 120 m south of RN 1881 on the eastern bank of a shallow waterway (Figure 2) and struck about 0.1 L/s in weathered granite between 32 - 38 m. The annulus around the 5.0 m of 219 mm OD steel surface casing was grouted with cement slurry due to its proximity to the waterway.

Water was used as a drilling fluid from 33 m on due to the wet cuttings wadding up which prevented them from being cleared from the hole. Drilling foam was not used as the supplies were expected to be very small, and this would have masked them off. At the end of the last 2 rods, the air was turned off for 10 minutes to let the bore recover and then on again. This was carried out several times in order to develop the bore, remove any wall casing and to obtain a representative water sample. Each time the air was turned on, the volume of water lifted indicated that a small supply was present although continuous airlift produced nothing.

The EC of the water was measured at 3170 µS/cm which is considerably higher than the EC, around 2000 µS/cm, of the 2 current production bores. For this reason, the bore was constructed with 50 mm PVC and GWP (Appendix A) for use as a monitoring bore.

RN 16421 was drilled 12 m north-east of RN 1881 inside the bore compound. It was drilled to a depth of 52.8 m and cased with 52.0 m of 150 mm ID class 12 PVC (Appendix B) and 5.5 m of 219 mm OD steel surface casing. The annulus around the 219 mm casing was grouted with cement slurry. The water was struck in weathered granite between 40 - 45 m. The yield was estimated at 0.1 L/s and the EC was measured at 2040 µS/cm. The bore was constructed with perforated casing set between 40 m and 52 m.

Once again, foam was not used while drilling due to the expected small supply. However, it was used on the completion of drilling to clean the hole and help stabilise it prior to casing. Development work was carried out using the same method as outlined for RN 16420.
The completed depth of the hole was 52.0 m.

Test pumping consisted of a 500 minute preliminary step test at 0.1 L/s for 300 minutes and 0.15 L/s for the remainder. The following day, a 24 hour constant rate test was conducted at 0.13 L/s followed by 22 hours of recovery. The calculated transmissivity of RN 16421 was 0.6 m²/day while the calculated transmissivity of the observation bore, RN 1881, was 2 m²/day and the storage co-efficient 8.2 x 10⁻³. After 22 hours of recovery, the water levels in both bores had recovered slightly above the starting SWL. This was to be expected considering the length of time that both production bores had been operating prior to the test. Figure 5 is a predicted drawdown verses yield graph for pumping rates between 0.1 L/s and 0.15 L/s.

There was no significant change in water quality throughout the test with the final EC being 1790 μS/cm.

Table 3 contains the water quality data for both bores.

5. DISCUSSION

It is possible that the combined total yield of RN 16421 and RN 1884 may be insufficient to sustain the police community’s needs, especially in periods of heavy demand. In light of the recent drilling, testing and water quality data, it may be possible to construct another bore within 50 m of them. While there can be no guarantee that a supply could be established, the prospect of obtaining a similar supply and quality to that of RN 16421 is considered reasonable although it may require a couple of attempts. This bore would be a stand-by, and only used to supplement supply during periods of heavy demand. For instance, if a stand-by bore was constructed with a yield of 0.1 L/s, it would increase the overall yield by some 30 %.

The alternative to the above is to pipe the water in. There are three areas within a 15 km radius that have water of sufficient volume. One area is to the east where Ironwood bore has a yield of
1.0 L/s. This area has been discussed in a report on "Kulgara Police Complex Water Supply Review, January 1993" by the Technical Services Branch of PAWA. Drawbacks with this area are that the bore already supplies water to a rabbiters' community at the bore, as well as the Kulgara railway trucking yards. A water sample taken on 18.11.93 showed a TDS of 2450 mg/L and a nitrate level of 159 mg/L.

A second area is around Mulga bore some 15 km west-north-west. While the investigation bore RN 11823 drilled in 1978 has a yield of around 4.0 L/s, it has a fluoride level of 4.0 mg/L which is far above the maximum recommended.

The third area is approximately 15 km west-south-west. Investigation bore RN 12055, now known as Century bore, drilled in 1978 had a yield of 1.2 L/s. The water quality is the better of the three with a nitrate level around 35 mg/L and a fluoride level between 1.5 mg/L and 2 mg/L. This bore is constructed with 5.2 m of 219 mm surface casing only, and is currently used by Mount Cavenagh station for stock.

All three bores have been test pumped but it would require further drilling and testing to prove a suitable supply before pumping over this distance could be considered.

Table 4 shows the comparison in water quality at each of the above locations.

6. CONCLUSIONS

A successful domestic water supply bore, RN 16421, was constructed for the Kulgara police station complex to replace RN 1881. The maximum recommended yield is 0.12 L/s. It is critical that the maximum recommended pumping rate is not exceeded as it would result in the bore forking.

The water is drawn from the weathered zone immediately above fresher granite. The water quality does not meet the National Health and Medical Research Council criterion for drinking water due to
excessive nitrate and fluoride.

RN 16420, drilled in an endeavour to enhance the overall water supply was constructed as a monitoring bore due to inferior quality water.

When RN 16421 is brought on line, RN 1881 should be capped with a 50 mm GWP socket on top to enable it to be used as a monitoring bore.

If a stand-by bore was constructed in the vicinity of the present two production bores, a re-appraisal of the monitoring programme would be required to enable early detection of any detrimental effect on the aquifer.

7. RECOMMENDATIONS

1. RN 16421 has a maximum continuous pumping rate of 0.12 L/s which should not be exceeded.

2. Nitrate and Fluoride levels are both above the maximum recommended levels for human consumption, therefore, alternative drinking water must be made available to use for infants and children.

3. Provision to monitor water levels and obtain water samples should be incorporated when equipping the bore.

4. A water meter should be fitted to the bore and monthly readings taken by the operator.

5. The SWL and total depth of the bore should be recorded each time the pumping equipment is removed from the bore.

6. RN 1881 should be converted into a monitoring bore when RN 16421 is commissioned and not pumped simultaneously with it.

7. To minimise the risk of aquifer pollution, no development should occur within 100 - 200 m of the production bores.
8. The SWL in RN 16420 and RN 1881 should be monitored twice a year as well as the water meters checked and read. This could be carried out by staff from the monitoring section of PAWA on their twice yearly field trips to Ayers Rock.

8. ACKNOWLEDGMENTS

The author wishes to thank Ian Matthews (Hydrogeologist) for his contribution with the geology.
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NIMHC GUIDELINES → 1500 6.5-8.5 590 0.3 400 400 45 1.7 Maxima except pH range

WATER QUALITY DATA          KULGERA POLICE BORES

TABLE 1
### WATER QUALITY DATA

#### KULGERA POLICE BORES

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| NHMRC GUIDELINES        | 1500 | 6.5-7.5 | 100 | 0.3 | 400 | 400 | 45 | 1.7 | Maxima except pH range |

**Table 2**
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<td>280</td>
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</tr>
<tr>
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<td>1890</td>
<td>1150</td>
<td>7.3</td>
<td>303</td>
<td>11</td>
<td>57</td>
<td>32</td>
<td>274</td>
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<td>&lt;0.1</td>
<td>61</td>
<td>326</td>
<td>154</td>
<td>100</td>
<td>274</td>
<td>2.0</td>
<td>537</td>
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</tbody>
</table>

#### NHMRC Guidelines

- pH: 6.5-8.5
- Total hardness: 500
- Total alkalinity: 0.3
- Chloride: 400
- Sulfate: 400
- Nitrate: 45
- Bicarbonate: 1.7

Maxima except pH range.
## WATER QUALITY DATA

### KULGERA POLICE BORES

**TABLE 4**

<table>
<thead>
<tr>
<th>BORE REGISTERED NUMBER</th>
<th>DATE OF SAMPLING</th>
<th>SPECIFIC CONDUCTANCE</th>
<th>TOTAL DISSOLVED SOLIDS</th>
<th>SODIUM</th>
<th>POTASSIUM</th>
<th>CALCIUM</th>
<th>MAGNESIUM</th>
<th>TOTAL HARDNESS</th>
<th>TOTAL ALKALINITY</th>
<th>IRON (TOTAL)</th>
<th>SILICA</th>
<th>CHLORIDE</th>
<th>SULPHATE</th>
<th>NITRATE</th>
<th>BICARBONATE</th>
<th>PHOSPHATE</th>
<th>FLUORIDE</th>
<th>CALC (FROM CHLORIDE)</th>
<th>COMMENTS</th>
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<tr>
<td>2079</td>
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<td>4290</td>
<td>2450</td>
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<td>335</td>
<td>199</td>
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<td>24</td>
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<td>1460</td>
</tr>
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<td>11623</td>
<td>23.09.78</td>
<td>2300</td>
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<td>7.9</td>
<td>267</td>
<td>16</td>
<td>66</td>
<td>36</td>
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<td>16</td>
<td>66</td>
<td>36</td>
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<td>115</td>
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<td>295</td>
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<td>62</td>
<td>63</td>
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<td>84</td>
<td>60</td>
<td>456</td>
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<td>68</td>
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<td>95</td>
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<td>1240</td>
<td>7.6</td>
<td>222</td>
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<td>84</td>
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<td>68</td>
<td>66</td>
<td>95</td>
<td>295</td>
<td>29</td>
<td>116</td>
<td>1.7</td>
<td>653</td>
<td>Airlift from 45 m</td>
<td></td>
</tr>
<tr>
<td>14.03.79</td>
<td>1953</td>
<td>7.1</td>
<td>1240</td>
<td>7.6</td>
<td>222</td>
<td>37</td>
<td>84</td>
<td>60</td>
<td>456</td>
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<td>69</td>
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<td>128</td>
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<td>1240</td>
<td>7.6</td>
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<td>37</td>
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<td>456</td>
<td>105</td>
<td>36</td>
<td>36</td>
<td>69</td>
<td>36</td>
<td>128</td>
<td>2.0</td>
<td>652</td>
<td>Pumping test</td>
<td></td>
</tr>
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<td>1240</td>
<td>7.6</td>
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<td>60</td>
<td>456</td>
<td>105</td>
<td>36</td>
<td>36</td>
<td>69</td>
<td>36</td>
<td>128</td>
<td>2.0</td>
<td>652</td>
<td>Pumping test</td>
<td></td>
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<tr>
<td>NHMRC GUIDELINES</td>
<td>1500</td>
<td>8.5-8.5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maxima except pH range</td>
<td></td>
</tr>
</tbody>
</table>
Figures
KULGERA Police Station Bores
LOCAL GEOLOGY
(after Edgoose, Camacho, Wakelin-King and Simons, 1993)

FIGURE 3
FIGURE 4

KULGERA POLICE BORE
RN 16421
CONSTANT RATE DRAWDOWN GRAPH

Q = 0.13 L/s
Appendices
**COMPOSITE LOG OF BORE**

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>BORE CONSTRUCTION LOG</th>
<th>GRAPHIC STRATA DESCRIPTION</th>
<th>AQUIFERS (Water Struck)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2093mm ID blank steel casing</td>
<td>50mm blank PVC</td>
<td>Red/brown sandy CLAY.</td>
</tr>
<tr>
<td>5</td>
<td>50mm PVC with 8mm perforations</td>
<td>50mm GWP</td>
<td>White/grey calcareous sandy CLAY.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>White, calcareous clayey SAND.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>Highly weathered, quartz, feldspar, biotite GRANITE.</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>Feldspar completely altered to clay</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>Weathered GRANITE as above, chips to 10mm</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td>Slightly weathered GRANITE, as above.</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>Fresh, quartz, feldspar, biotite GRANITE</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>SWL 18-11-93</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>SEEPAGE</td>
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</table>

**KULGERA POLICE STATION**

**RN 16420**

*APPENDIX A*
**POWER AND WATER AUTHORITY**

**WATER RESOURCES**

**COMPOSITE LOG OF BORE**

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>BORE CONSTRUCTION LOG</th>
<th>GRAPHIC LOG CONSTRUCTION</th>
<th>STRATA DESCRIPTION</th>
<th>AQUIFERS (Water Struck)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>203mm ID blank steel casing</td>
<td></td>
<td>White sandy CALCITE, with minor red/brown quartz sand.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>150mm ID class 12 blank PVC casing</td>
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<td>White calcareous SAND with minor brown and grey mica.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>150mm ID class 12 PVC and 1mm slots</td>
<td></td>
<td>Highly weathered quartz, feldspar, biotite GRANITE.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>Weathered GRANITE as above</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>Slightly weathered GRANITE as above</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>Fresh, quartz, feldspar, biotite GRANITE</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td>0.1 L/s</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>SWL 16-11-93</td>
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</tr>
</tbody>
</table>

**KULGERA POLICE STATION RN 16421**

APPENDIX B
WATER RESOURCES DIVISION

TEST REPORT - BORE RN. 16421

Bore Location: KULGERA POLICE STATION
Client: NORTHERN TERRITORY CONSTRUCTION AGENCY
Intended Use: DOMESTIC WATER SUPPLY
Map: SG 51-5
Grid Reference: 329800 7141000

********************************************************************************

RECOMMENDATIONS

Pumping Rate: 0.12 L/s Pump Setting: 40.0 m below Ground Level.

General recommendations are given on the reverse side. The aquifer and bore can not
sustain higher pumping rates with deeper pump settings or for short periods.
Further advice can be obtained from:
Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870
(In all correspondence please refer to bore's RN number)

********************************************************************************

COMPLETION DETAILS

Finished depth: 52.0 m
Completion Date: 06.Nov.1993
Standing Water Level: 15.9 m on 16.Nov.1993

BORE CONSTRUCTION

<table>
<thead>
<tr>
<th>Interval (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 5.5</td>
<td>219 mm Blank steel casing</td>
</tr>
<tr>
<td>0.0 - 40.0</td>
<td>150 mm Class 12 blank PVC casing</td>
</tr>
<tr>
<td>40.0 - 52.0</td>
<td>150 mm Class 12 PVC with 9 mm drilled perforations and 1 mm slots</td>
</tr>
</tbody>
</table>

WARNING: Minimum internal bore diameter is 150 mm.

Notes: 1. Top of casing as constructed was 0.55 m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

********************************************************************************

COMMENTS

This bore was drilled to replace RN 1881, and therefore RN 1881 should be
de-commissioned when RN 16421 is bought on line and not pumped simultaneously with it.

It is critical that the maximum recommended pumping rate is not exceeded as it would
result in the bore forking.

When the pumping equipment is removed from RN 1881, the bore should be securely
capped and have a 50 mm GWP socket welded on top to enable it to be used as a
monitoring bore.

The recommendations in this report are based on a constant rate test at 0.13 L/s for
24 hours and assumes hydrogeological conditions remain constant.

Provision to monitor water levels and obtain water samples should be incorporated
when equipping the bore.

PTO

APPENDIX C
A water meter should be fitted to the bore and monthly readings taken by the operator. The SWL and total depth of the bore should be recorded each time the pumping equipment is removed from the bore.

WATER QUALITY

Nitrate, NO₃ (115 mg/L) and Fluoride, F (2.0 mg/L) are both above the maximum recommended level for human consumption. Alternative drinking water must be made available to use for infants and children.

Prepared by: Col Garner

RECOMMENDATIONS FOR FINISHING, OPERATING AND PROTECTING GROUNDWATER BORES

Attention the following points will ensure a long and safe life for the bore supply and help prevent pollution of the 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 fertiliser 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 a higher than recommended rates may fork 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.

BORE LOCATION MAP

boredata