INSTALLATION OF SHALLOW BORE RN 15704
AT
ROSS RIVER HOMESTEAD
TOURIST RESORT

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APPENDICES

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ABBREVIATIONS

AHD Australian Height Datum
L/s litres per second
kL kilolitres
1 ML = 1000 kL
mg/L milligrams per litre (parts per million)
RN registered number of bore
SWL standing water level (below ground)

DISTRIBUTION

Ross River Homestead Tourist Resort 2
Water Resources Branch Library Alice Springs 3
Water Library Darwin 1
Principal Engineer Groundwater 1
Author 1
1. INTRODUCTION

The management of Ross River Homestead tourist resort engaged the Water Resources Branch, PAWA, Alice Springs to provide a new water supply source works to replace their existing dug shallow well (Registered Number RN 3396) located in the bed of the Ross River. This timber-lined well is subject to surface water contamination and also to periodic burial whenever the river floods. It has been condemned as posing a health risk from bacterial pollution.

Ross River Homestead is situated approximately 85 km due east of Alice Springs on the Ross River Highway (see Figure 1). It operates as a tourist resort with chalets, a camp and a caravan site. It has restaurant, bar and swimming pool facilities. Therefore, it requires a wholesome, potable supply of water. The estimated water consumption is of the order of 180 kL/day. However, there are plans to expand the resort and the water demand should increase accordingly.

After discussion with the management it was agreed that an attempt should be made to complete the sinking of a partially installed concrete well. The construction of this well in the bed of the Ross River had been undertaken originally by a private engineering contractor.

The objectives of this project were two-fold, namely:

- to increase the yield available from the shallow alluvial aquifer commensurate with a projected increase in water demand for a planned expansion of the tourist facilities, and
to improve the bacterial quality of the water supply to provide a wholesome, potable water which meets with standard health requirements.
2. PHYSIOGRAPHY, GEOLOGY AND HYDROGEOLOGY

Ross River Homestead is situated on the outside (north-east) bank of a bend in the Ross River at an elevation of 500 m AHD. At this locality the Ross River, which is ephemeral, turns sharply and passes southwards through the eastern MacDonnell Ranges to form an un-named gorge. The existing well RN 3396, abandoned concrete well (refer to Section 3) and the newly installed shallow bore (Section 5) lie across the bend in the river where its alluvial bed is near its maximum width of approximately 220 m. Their locations are shown on Figure 2. There is a 750 m long expanse of re-worked alluvial loose coarse sand, gravel and cobble - size material upstream of the gorge. Immediately north of the Homestead two southerly flowing tributaries enter the Ross River where the outside bend is eroding the north bank. This expanse of alluvial gravel continues upstream for about another 750 m.

Upstream of the aforementioned bend, the Ross River parallels the strike of the northern limb of the Ross River Syncline before it turns south near the nose of this syncline and cuts through a succession of steeply - dipping Lower Proterozoic to early Cambrian dolomites, sandstones and siltstones of the Amadeus Basin sedimentary rock sequence. The bedrock underlying the Ross River Homestead is a more recessive sandstone (Pertatataka Formation) than the dolomites and siliceous sandstones which form the strike ridges. Two boreholes (RN 3397 and RN 3398) were drilled during 1957 at a location about 10 m from the north bank, at a distance of 60 m apart, probably into the Pertatataka Formation.
However they yielded only a maximum of 2.5 L/s with a fair water quality (total dissolved solids of 1600 mg/L and very hard). A third borehole (RN 3396) constructed only 6 m into the Ross River bed (and perhaps 60 m to the south of RN 3398) produced better quality water. Its static water level (SWL) was 5 m below ground level (b.g.l.) but it was not pump tested. The former two boreholes are abandoned, whilst RN 3396 presently supplies the resort.

Because of financial considerations and the confidence that a suitable reserve of good quality groundwater saturates the alluvium in the Ross River the option of drilling deep boreholes was disregarded. Instead, attention was restricted to exploiting the shallow alluvial aquifer.
3. CONCRETE WELL: ATTEMPTED COMPLETION

The partially installed concrete well consisted of five lengths of 'Humes' concrete pipe, the lower four lengths of which had been perforated with 10 mm holes and the uppermost length had been left intact. The pipes' diameter was 1.22 m ID with a wall thickness of 70 mm and a length of 1.22 m each. Previously a private contractor had attempted a caisson construction method using a bucket on a rope to excavate the soil from within the pipe so that the pipe would sink under its own weight. Upon reaching the water table, progress slowed to an unacceptable pace owing to caving by saturated sand. Consequently, the well was abandoned, approximately 1.5 m proud of ground level with only the bottom 1 m of perforated pipe below the water table.

The test pump crew of the Water Resources Branch (WRB) PAWA attempted to sink the concrete well a further 2 m or so into the river bed using an air-jetting technique. (This technique not only ejects loose sediments from an annulus, but mobilises the saturated sediments thus lowering their viscosity and density so that the concrete pipes should sink more easily). A 'duo-pipe' jetting tool was used in an attempt to jet the well down to its final depth. It consisted of a 200 mm NB steel casing about 6 m long with a tee at the top end to direct the jetted sediment clear from the hole. A longer-length of 50 mm NB GI pipe was telescoped through the steel casing with its top end connected to an air compressor by a flexible hose. The whole assembly was suspended by 'sand-lines' using a truck-mounted 'Smeal' crane. A 350 CFM
compressor was used to introduce compressed air down the GI pipe. The duo-pipe was then worked around the inner circumference of the concrete pipe. Unfortunately, because of the large diameter of the concrete pipes the jetting could not cope with the areal extent of the sediments, even with the compressor at maximum output. Instead, the air escaped around the edges of the pipe and caused slumping around the outside of the concrete pipe which instigated upwelling of the sediment inside the pipe. As a result, although the Humes pipe sunk a little (at a rate of about 0.1 m per hour), effectively no extra depth was made below the water table.

After several hours the attempt to sink the well was aborted. Upon informing the Maintenance Manager of the lack of progress it was mutually agreed to conduct a soil survey across the river bed as detailed in WRB's proposal.
4. SURVEY OF RIVER ALLUVIUM

A survey to investigate the total depth, grain size and saturated thickness of the alluvium was undertaken by a traverse across the bed of the Ross River, offset from the site of the aborted concrete well along a magnetic bearing of 030°. Holes were put down at 20 m intervals using a medium diameter (100 mm) 'duo-tubo' air-jetting tool. Their locations are shown in Figure 2 and the results of the survey are summarised as Appendix A. The deepest alluvium was penetrated 40 m to the north-east of the concrete well. At this site air-jetting ejected coarse sand grading to gravel at depth; refusal occurred at 7.55 m b.g.l. owing to numerous cobbles which could not be lifted and bedrock was not reached. The water table was encountered at 2.77 m b.g.l. Because of the large saturated thickness of the alluvium at this site, it was decided to install a shallow bore here without recourse to further survey work along the river bed.
5. SHALLOW BORE INSTALLATION

A 6.3 m length of 250 mm NB steel casing was jetted into the ground using the smaller 'duo-tube' jetting tool. The bottom of the casing was serrated to give a cutting edge. Another 3.2 m of 250 mm NB casing was welded onto the top of the sunken pipe. Between 7.5 m and 9 m water-worn, well-rounded, platy cobbles of siltstone and sandstone and gravel were ejected. Below 9 m a muddy water return indicated the presence of a brown grey clay which was possibly extremely weathered bedrock. The jetting operation took only two hours to complete and it terminated just below 9 m b.g.l. A 1.5 m length of 219 mm OD stainless steel well screen was butt-welded to two lengths of 200 mm NB steel casing of lengths 1.86 m and 6.45 m respectively. A 0.3 m long sump was welded onto the bottom of the screen to collect any sediment. The screen had an aperture (water entrance slot width) of 3.5 mm. This casing and screen string of total length 10.17 m was telescoped into the 250 mm NB temporary casing until it rested on the bottom at 8.27 m b.g.l. with the top 1.9 m proud of ground level. The 250 mm NB temporary casing was then withdrawn from the ground using the crane thus exposing the screen to the aquifer. The screen is emplaced from 6.41 m to 7.97 m b.g.l. (see Figure 3). A 0.15 m'length of casing was cut from the top and a temporary cap welded on to prevent foreign matter from entering the bore.

The bore was developed for nearly three hours by air-jetting inside the screen. After one hour the depth was tagged and a 0.5 m thickness of sediment had built up and was subsequently flushed out. The yield from the airlift development was estimated visually to be more than 10 L/s.

This bore has been designated RN 15704.
6. PUMPING TEST

6.1 OPERATION AND FIELD DATA COLLECTION

A 100 minute duration, constant rate pumping test was performed on the shallow bore, RN 15704 using a positive displacement 'Mono' pump. The discharge rate was 8.8 L/s (measured by a 65 mm diameter orifice plate). After one hour the drawdown stabilised at 1.88 m (that is 4.65 m b.g.l. with a SWL of 2.77 m b.g.l. before start of pumping). Owing to time constraints (the test was performed on the last working day prior to Christmas) the test could not be continued longer and the recovery of the water table was not monitored after cessation of pumping.

Prior to the completion of the test a water sample was taken for chemical analysis. The results of this analysis are unavailable at the time of writing, (see Section 8 for explanation; Appendix B gives the results of an analysis of a water sample taken from the dug well, RN 3396).

Observation drawdown readings were taken in the dug well 40 m away from the pumped well. However, the water table remained static in this well for the duration of the test. Hence the radius of influence of the pumped bore at a discharge rate of 8.8 L/s was less than 40 m.

During the test some sand and gravel particles continued to pass through the screen. Therefore, at the end of the test, surge pumping was performed for 50 minutes at different depths within the screen and the sump in order to clean the hole. However, owing to the large aperture of the screen occasional coarse sand particles are likely to be produced for some time to come.
measurements (relative to SWL before start of pumping), taken by means of an electrical contact gauge, at recorded times.

6.2 ANALYSIS

The 'Jacob straight line method' was used to analyse the data. The analysis is given in Appendix C.1.

The result of analysing the drawdown graph gives a transmissivity T value as follows:

\[ T = 1,070 \text{ m}^2/\text{day} \]

Taking a saturated thickness, D of 6 m then the hydraulic conductivity, \( k = 178 \text{ m/day} \).

This \( k \) value is indicative of a permeable gravel aquifer. A typical value for the specific yield, S of such an aquifer is 0.2 (Unable to calculate S owing to the lack of observation drawdown data).

Using the maximum measured drawdown value in Bore RN 15704 and the T and S values given above, a well efficiency of 35\%, at the test's discharge rate of 8.8 L/s, has been calculated (see Appendix C.2)
6.3 EVALUATION OF THE RESULTS

An analysis of the long-term pumping yield ensues. For the purpose of this analysis on-set of steady-state hydraulic conditions beyond one hour's pumping duration (where the drawdown established at 1.88 m b.g.l. for the remainder of the test) is ignored as this may be only a temporary manifestation of storage.

6.3.1 Maximum Production yield of Bore RN 15704

(Refer to Appendix C.3 for calculations supporting the results given in this Section).

As the top of the screen is set at 6.41 m b.g.l., the base setting for the suction intake of the pump should be approximately 6.3 m b.g.l. The shut-off level for production will be approximately 5.5 m b.g.l. The maximum permissible drawdown equals the shut-off level (5.5 m) minus the SWL (2.77 m) =2.7 m.

At this drawdown the maximum production yield should be achieved.

The maximum production yield for one year's continuous pumping should be about 7 L/s, allowing for a well efficiency of 35% and no aquifer recharge boundary.

However, it must be considered that with natural depletion of the aquifer, a reduction in the saturated thickness (lowering of the water table) will decrease the transmissivity and available drawdown at Bore RN 15704. Therefore, in a run of dry years its maximum production yield will be curtailed. This is discussed further in Section 7.
6.3.2 Screen Entrance Velocity

At a maximum production yield of 7 L/s the screen entrance velocity would be about 0.015 m/sec. (refer to Appendix C.4) This is half the maximum allowable entrance velocity and would ensure that the water would not exhibit turbulent flow. (Turbulent flow can result in deleterious effects upon the soil formation close to the bore walls, such as sand cavitation, may enhance incrustation/corrosion effects and may produce more drawdown in the well).
7. ESTIMATED SAFE YIELD OF THE BORE

7.1 PEAK DEMAND FROM BORE RN 15704

Based upon earlier estimates of the water demand (refer to Section 1) a peak demand of 5 L/s may be anticipated to cope with instantaneous supply where storage is unavailable or empty. Therefore it is advised that a submersible pump of maximum capacity 5 L/s should be installed in Bore RN 15704.

Using the Theis equations (Appendix C.2) and the pumping test results; at a discharge rate of 5 L/s, a drawdown of 1.95 m after one year's pumping, at an efficiency of 35% may ensue. This would allow the SWL to deepen a further 0.8 m below 2.77 m, through groundwater storage depletion without affecting the pump's setting in the bore.

7.2 AQUIFER DEPLETION AT THE SAFE YIELD

The safe yield defines the rate at which water can be withdrawn from an aquifer perennially under specified operating conditions without progressively depleting groundwater storage. Because the alluvial aquifer at Ross River receives periodic recharge and has a shallow water table it is unlikely that degradation of water quality would occur after prolonged pumping. Neither is it possible that uneconomic pumping conditions would arise. Therefore we are concerned only with the reserve of groundwater available. Because it is a very small, unconfined basinal aquifer, storage rather than throughflow is the critical factor in deciding the safe yield.
To estimate the water available from storage a water balance study is necessary. However, this is beyond the scope of this report. The alluvial aquifer will be recharged only when the Ross River periodically floods. Therefore, a long, progressive decline in the water table, hence decrease in storage is the norm between infrequent floods.

At present, assuming that the alluvial aquifer has an average width of 200 m, a length of 1500 m, a saturated thickness of 4.5 m and a specific yield of 0.2 the aquifer has a storage volume of 270 ML. Simplistically, this volume could support just over 1.5 years' pumping at a production yield of 5 L/s with no recharge. (Assuming that all the groundwater is recoverable). This calculation does not account for decline in the water table (hence decreased saturated thickness and decreased transmissivity).

7.3 CONCLUSION

Section 7.2 appears to indicate a sustainable yield of 5 L/s providing that the aquifer is recharged by a flood occurring not less than once per year. Furthermore, as calculated above, a maximum production yield of 5 L/s is unlikely to de-water the pump.

On a daily operational basis it is suggested that the bore is pumped at no more than 3 L/s into a storage reservoir (100 kL capacity) that will balance peak demands in the supply system. This production yield will provide a margin of safety to conserve aquifer storage and prevent excessive drawdowns.

Nevertheless, after a prolonged severe drought period it might prove necessary to lower the pump close to the bottom of the bore so that its intake is within the screen.
A cut-off switch should be positioned approximately 0.8 m above the pump’s intake to automatically turn off the pump to prevent excessive drawdown de-watering and burning out its motor.

The installation of a second shallow bore approximately 40 m away from RN 15704 is recommended. This bore will act as a standby in case of malfunction in RN 15704.

A flow meter should be installed on the supply line to monitor and, if necessary, adjust the production yield.
8. WATER QUALITY

One pumped groundwater sample was taken from Bore RN 15704, at the close of the pumping test using a one litre plastic, air-tight bottle held below the discharge end of the orifice. Owing to the Christmas holidays the results of the analysis have not been forwarded from our Darwin laboratory in time for inclusion in this report. (It will be forwarded to you as an addendum).

In view of the above, the results of an analysis of a standing water sample taken from the dug well, RN 3396 are presented in Appendix B. Because RN 3396 is close to and in the same hydrogeological environment as RN 15704, the sample should represent adequately the chemical quality in the alluvial aquifer. (The sample from RN 15704 is expected to be of better quality owing to pumping induced throughflow).

A summary of the drinking water quality guidelines (NHMRC & AWRC, 1987) is presented in Appendix B for comparative purposes.

The groundwater as sampled is chemically suitable for domestic purposes. It is a fresh, very hard and alkaline water. It is chemically classified as a calcium bicarbonate water with a propensity for cation exchange with sodium.

Samples were not taken for bacteriological purposes. However, routine disinfection of the water supply is recommended but is beyond the scope of this report to comment upon.
Once the new bore RN 15704 has been equipped, the dug well, RN 3396 should be sterilised by super-chlorination and then backfilled to ground level with river sand to neutralise it as a source of bacterial pollution.

It is suggested that the bore should be equipped with an electro-submersible pump set inside the casing. This installation will ensure that no surface water is allowed to enter the bore as the borehead can be sealed. The pump's position in the bore is displayed schematically in Figure 3.
9. CONCLUSIONS

I An attempt to complete the sinking of a partially installed large diameter, concrete well (designed and abortively installed by a private contractor) failed. The well was left abandoned in the bed of the Ross River.

II A cross-river traverse was performed, using an air-jetting tool, to investigate the nature and depth of alluvium underlying the bed of the Ross River. From this survey a suitable site was identified to install a shallow bore, 40 m to the north-east of the abandoned concrete well.

III A 200 mm diameter shallow bore of total depth 8.27 m b.g.l. was installed in the alluvium by means of air-jetting.

It has been designated Bore RN 15704. Its details are shown in Figure 3 of this report.

IV From an analysis of a short duration aquifer pumping test in Bore RN 15704; a maximum continuous production yield of 7 L/s should be achieved. (This analysis assumes that no aquifer recharge boundaries come into fruition and that the bore has a calculated efficiency of 35%). However, the above quoted yield may not be sustainable with natural recession of the water table during droughts (depletion of aquifer storage).
V Based upon the aquifer's calculated storage volume a tentative estimate of the perennial safe yield of the aquifer is 5 L/s. This estimate does not account for a prolonged natural recession of the water table as it depends upon the aquifer being recharged by a flood occurring in the Ross River at a recurrence interval of not less than once per year.

VI Owing to the large aperture (3.5 mm) of the well screen (necessary to achieve a good inflow of groundwater), despite development by air-jetting and pumping the bore, occasional coarse sand particles are likely to be produced for some time. However, this condition is ameliorated by the screen entrance velocities achieved as a result of choosing this type of screen.

VII Although the results of a chemical analysis made on a pumped water sample from RN 15704 are unavailable at the time of writing, a water sample taken from the dug well, RN 3396 is reckoned to be representative of the quality of the alluvial aquifer. The groundwater is chemically suitable for domestic purposes. It is a fresh, very hard and alkaline water. Bacteriological analysis was not carried out.
10. RECOMMENDATIONS

I Although Bore RN 15704 is capable of yielding 7 L/s given the present water table level, it is recommended that the maximum production yield should not exceed 5 L/s.

II The bore may be equipped with an electro-submersible pump of maximum rated production capacity 5 L/s. The borehead should be sealed to prevent ingress of surface water during floods.

III Notwithstanding Recommendation I, a daily pumping rate of no more than 3 L/s is recommended. This production yield will provide a margin of safety to conserve aquifer storage and prevent excessive drawdowns.

IV An automatic electrical cut-off switch should be strapped to the rising main 0.8 m above the pump’s intake to prevent possible de-watering and burn-out of the pump’s motor. The occurrence and frequency of drawdown producing pump cut-out should be monitored and recorded; the production yield reduced accordingly.

V A bulk flow meter should be installed on the supply line to monitor and adjust the production yield.

VI A storage tank (the volume to be calculated and advised by a water supply installation contractor) should be utilised in order to balance peak demands in the supply system. It should also provide 24 hours’ storage for emergencies (e.g. pump breakdown).
VII A second shallow bore should be installed 40 m away from RN 15704 to act as a standby supply.

VIII Routine disinfection of the water supply is recommended. The relevant state health authority should be consulted concerning this aspect.

IX The dug well, RN 3396 should be super-chlorinated and backfilled.
ROSS RIVER TOURIST RESORT
SITE PLAN

FIGURE 2
2857-16-1007
INSTALLATION OF SHALLOW BORE RN 15704
ROSS RIVER TOURIST RESORT
BOREHOLE CONSTRUCTION DETAILS

FIGURE 3
2855-16-1005
APPENDIX A

ALLUVIUM SAMPLING TRAVERSE ACROSS ROSS RIVER


**APPENDIX A**

**ALLUVIUM SAMPLING TRAVERSE ACROSS ROSS RIVER**

*(FROM CONCRETE WELL TO NORTH-EASTERN BANK)*

<table>
<thead>
<tr>
<th>CHAINAGE (m)</th>
<th>DEPTH OF REFUSAL (m b.g.l.)</th>
<th>SOIL MATERIAL</th>
<th>STATIC WATER LEVEL (m b.g.l.)</th>
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<tr>
<td></td>
<td>20</td>
<td>5.50</td>
<td>Clean gravel &amp; cobbles</td>
</tr>
<tr>
<td>Site of shallow bore (RN 15704)</td>
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<td></td>
<td>60</td>
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<td></td>
<td>80</td>
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<td>Very dirty red clay</td>
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<tr>
<td>East Bank</td>
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APPENDIX B

B. Results of Quality Analysis on Standing Water Sample from Well RN 3396.
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<th>COMPOUNDS</th>
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<td>Bi-carbonate, HCO₃⁻</td>
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<td>Sodium, Na</td>
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<td>Alkalinity (mg/L)</td>
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<td>Total Dissolved Solids</td>
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<td>Specific Conductance</td>
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**WATER QUALITY DATA**

| DATE OF SAMPLING         | 20/11/99 |
| CORE NUMBER               | 1236    |

Analysis is in milligrams per litre. All values are above detection limits.
APPENDICES C.1 TO C.4

C.1 Pumping Test Data and Jacob's Analysis of Drawdown Graph.

C.2 Calculation of Well Efficiency of Bore RN 15704.

C.3 Maximum Production Yield of Bore RN 15704.

C.4 Screen Entrance Velocity Calculation.
## PUMPING TEST DATA

**DATE:** 22-12-85  
**THE BORE BEING PUMPED IS:** ROSS RIVER, HOMEVILLE  
**THE DRAWDOWN DATA BELOW IS FROM THE PUMPED BORE:**  
**R.N.** 15704

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<th>DURATION</th>
<th>DRAWDOWN (m)</th>
<th>PUMPING RATE (l/s)</th>
<th>WATER SAMPLE IDENTIFICATION</th>
<th>REMARKS</th>
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<td>1</td>
<td>1.85</td>
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<td></td>
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<tr>
<td>2</td>
<td>1.86</td>
<td>PUMP SETTING 6.6 l/m</td>
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<tr>
<td>3</td>
<td>1.71</td>
<td>8.8</td>
<td>S.W.I.</td>
<td>2.77 m</td>
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<td>4</td>
<td>1.72</td>
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<td>AVALAIBLE DRAWDOWN 3.91</td>
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<td>5</td>
<td>1.74</td>
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<td>CASING ABOVE GROUND 1.05 m</td>
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</tr>
<tr>
<td>6</td>
<td>1.76</td>
<td></td>
<td>DIAMETRE OF CASING 200 mm</td>
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<td>7</td>
<td>1.76</td>
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<td></td>
<td></td>
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<td>20</td>
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<td>LIGHT BROWN DISCOLURATION</td>
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<tr>
<td>30</td>
<td>1.84</td>
<td>8.8</td>
<td>CLEAR; FEW GRAINS OF FINE SAND</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>1.86</td>
<td>TEMPARATE SAND SIZE S pH 8.660</td>
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<td>50</td>
<td>1.87</td>
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<td>1.88</td>
<td>pH 7.05 CLEAR V. F.G. E.S.</td>
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<tr>
<td>100</td>
<td>1.88</td>
<td>8.8</td>
<td>pH 7.03 CONO 101050-155</td>
<td></td>
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JACOB'S METHOD - ANALYSIS OF AQUIFER PUMPING TEST DATA

Q = 8.8 l/s = 760 m³/day
Δs = 0.13 m
T = 2.3 Q

4πT Δs

∴ T = 1,070 m²/day

T = KD where D = 6m

∴ K = 178 m/d = 0.2 cm/sec

DRAWDOWN (metres)

0

0.5

1.0

1.5

2.0

2.5

3.0

3.5

4.0

TIME (minutes)

1

10

100

RN 15704
ROSS RIVER
TOURIST RESORT

TIME - DRAWDOWN PLOT

22nd December 1989

FIGURE C.1.
2856-16-1006
APPENDIX C.2

Calculation of Well Efficiency of Bore RN 15704

Using the Theis Equations:

\[ u = \frac{t^2 S}{4Tt} \]

and

\[ s = \frac{Q W(u)}{4\pi T} \]

Calculate the theoretical drawdown in the pumping bore after 1 hour, at the test pumping rate and assuming the bore is 100% efficient.

Where \( T = 1000 \text{ m}^3/\text{day} \), \( S = 0.2 \), \( r = 0.10 \text{ m} \)

\( t = 0.042 \text{ day} \), \( Q = 760 \text{ m}^3/\text{day} \) (8.8 L/s)

then \( u = 1.2 \times 10.5 \)

and \( W(u) = 10.75 \)

The theoretical drawdown, \( s_t = 0.65 \text{ m} \)

At 100% efficiency the specific capacity, \( SC \) of the bore would be:

\[ SC_{100} = \frac{Q}{s_t} = \frac{760}{0.65} = 1169 \text{ m}^3/\text{day/m} \]
However, the maximum drawdown, $s_{nw}$ experienced in the bore after 1 hour was 1.88 m.

Hence $SC = \frac{Q}{s_{nw}} = \frac{760}{1.88} = 404 \text{ m}^3/\text{day/m}$

The well efficiency of the bore is then:

\[
\frac{404 \times 100}{1,169} = 35\% \text{ at a discharge rate of } 8.8 \text{ L/s.}
\]
APPENDIX C.3

Maximum Production Yield of Bore RN 15704

To calculate the maximum yield from the bore, given a permissible drawdown of 2.7 m.

after one year’s continuous pumping:

\[ u = \frac{r^2S}{4Tt} \]

\[ u = 1.3 \times 10^{-9} \]

then \( W(u) = 19.9 \)

\[ Q_{\text{max}} = \frac{4\pi T.s}{W(u)} = 1,705 \text{ m}^3/\text{day} \]

\[ Q_{\text{max}} = 20 \text{ L/s at 100% efficiency.} \]

However assuming the well efficiency remains at 35% over time and a range of discharge rates then:

\[ Q_{\text{max}} = 20 \times 0.35 = 7 \text{ L/s} \]
APPENDIX C.4

Calculation of Screen Entrance Velocity

1. Surface area per 1 m length of screen

\[ \text{Area} = \pi d \quad \text{where} \quad d = 200 \text{ mm} \]
\[ = 3.14 \times 0.2 \times 1 \]
\[ = 0.628 \text{ m}^2/\text{m of screen} \]

2. Screen length is 1.5 m.

\[ 1.5 \times 0.628 = 0.942 \text{ m}^2. \]

3. From screen manufacture specifications:

3.5 mm aperture, 200 mm NB continuous slot screen has an open area of 51% of screen bulk.

4. Amount of open area, \( A = \) surface area x % open area

\[ = 0.942 \times 0.51 \]
\[ = 0.481 \text{ m}^2 \]

5. At a maximum production yield of 7 L/s the entrance velocity, \( V \) will be:

\[ V = \frac{Q}{A} \]
\[ = \frac{0.007}{0.481} \]
\[ V = 0.015 \text{ m/sec} \]