DEPARTMENT OF TRANSPORT AND WORKS
NORTHERN TERRITORY

WILDMAN RIVER
GROUNDWATER INVESTIGATION - STAGE 1
EXECUTIVE SUMMARY

REPORT NO. H134/1-AC  OCTOBER, 1984

Coffey & Partners Pty Ltd
Consulting Engineers
in the geotechnical sciences
ATTENTION: MR. J. MILNE

Dear Sir,

RE: Executive Summary Report, Stage I
Wildman River Groundwater Investigation

We are pleased to submit 15 copies of the executive summary report on the above investigation. The study area is as defined in the original consultant's brief dated 6th March 1984.

This report precedes the draft final Stage I report which is due for completion by late November 1984. It briefly outlines the principal findings to be detailed in the more comprehensive final report.

A project brief, recommendations on proposed field activities and an estimate of costs for Stage II of the investigation are also included in this report.

We trust this satisfies your present requirements. Should you have any queries or if any points require clarification please advise.

Yours faithfully,

COFFEY & PARTNERS PTY. LTD.

B.C. BURMAN
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DRAWING NO. H134/1-1: SITE LOCATION
DRAWING NO. H134/1-2: BORE LOCATION PLAN
DRAWING NO. H134/1-3: SUMMARY STRATIGRAPHIC LOGS
EXECUTIVE SUMMARY

1.0 INTRODUCTION

On 18th July 1984 the Northern Territory Department of Transport and Works commissioned Coffey & Partners Pty. Ltd. to undertake a staged investigation designed to assess groundwater resources in the south-eastern part of the Wildman River Station, N.T., some 100 km east of Darwin. For locality plan of the study area see Drawing No. H134/1-1. The purpose of the investigation was to evaluate groundwater availability for a proposed large-scale horticultural industry in the area.

The scope of the Stage I investigation comprised:

- regional geological/hydrogeological appraisal based on available data from previous investigations
- geophysical surveys
- test drilling
- pumping tests
- water quality analyses
- data analysis and recommendations for Stage II investigations

This brief report summarises the results of the Stage I study carried out between July and September 1984. A more detailed final draft report will be completed in late November 1984.

2.0 TOPOGRAPHY AND GEOLOGY

The study area is located in gently undulating terrain with the highest elevation being along the southern boundary. Swim and Cattle Creek drain the catchment to the north. A large number of lagoons are located in low lying areas in the northern part of the study area.

Wildman River Station is located within the Pine Creek Geosyncline which contains Early Proterozoic metasediments overlain by Cretaceous and unconsolidated Cainozoic sediments. The two main rock types in the study area are the Proterozoic Mundogie Sandstone and Wildman Siltstone. The latter crops out in the south west corner of the study area and is obscured elsewhere by a cover of Cainozoic sediments. The Mundogie Sandstone crops out along the south eastern corner. These rock types are isoclinally folded and trend NNE.

The Cretaceous Petrel Formation crops out spasmodically over the Wildman Siltstone in the southern part of the study area. Superficial Cainozoic silt and sand deposits are located along Swim Creek.

3.0 PREVIOUS INVESTIGATIONS

Prior to the Stage I hydrogeological investigation being initiated, the Department of Transport and Works carried out a preliminary groundwater study in the south west corner of the study area. This involved a
resistivity survey (Furness, 1983) along a 7km section of the Point Stuart Road. That study considered the following geological structures to be potential aquifers in that area:

- Dolomitic and coarse grained arenaceous interbeds of the Wildman Siltstone;
- Possible brecciation and faulting within the Wildman Siltstone; and
- Coarse grained arenaceous sediments of the Petrel Formation.

Four exploratory bores were drilled by the Department, each of which had groundwater yields of less than 1 l/sec (Qureshi, 1983). The south west corner of the study area was therefore considered to have limited potential for significant irrigation development.

4.0 SCOPE OF STAGE I INVESTIGATION

After a thorough research of all available groundwater and mining exploration data, field activities commenced with a geophysical investigation followed by drilling and test pumping.

The geophysical survey consisted of 20 line km of multi-spaced profiling, plus 19 vertical electrical soundings at sites of high apparent resistivity. The locations of the profiles were chosen to obtain a broad coverage of the study area. Fourteen test bores were drilled at the sounding sites shown on Drawing H134/1-2. All test bores were airlifted to determine groundwater yield and to obtain water samples for analysis. Short-term test pumping was carried out on a number of the higher yielding bores.

5.0 RESULTS OF STAGE I INVESTIGATION

5.1 Geophysics

The geophysical survey showed that lateral and vertical resistivity variations within rock type were widespread and on the basis of the previous resistivity investigation the higher resistivity zones were inferred to represent primary groundwater drilling targets. Overall, subsequent test drilling in the high resistivity zones indicated that the nature of the siltstone was such that sandstone and dolomite interbeds could not be identified by the profiling method adopted. In particular, unexpected and inexplicable results were encountered on deep targets where accurate prediction of basement lithologies was not possible. Shallow targets consisting of quartzite, sandstone or quartz breccia horizons containing groundwater were successfully identified, notably near the pilot farm.

5.2 Test Drilling

The results of test drilling are summarised in Table 1 and stratigraphic logs on Drawing H134/1-3.
TABLE 1

Summary of Test Drilling Results - Wildman River N.T.

<table>
<thead>
<tr>
<th>Bore No.</th>
<th>Depth (m)</th>
<th>Aquifer Static Water Level (m)</th>
<th>Airlift Yield (l/sec)</th>
<th>Specific Conductance us.cm at 25°</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1-RN23152</td>
<td>65.15</td>
<td>58-60</td>
<td>6.43</td>
<td>-</td>
</tr>
<tr>
<td>WR 2-RN23153</td>
<td>67.7</td>
<td>50-50.5</td>
<td>6.02</td>
<td>0.2</td>
</tr>
<tr>
<td>WR 3-RN23154</td>
<td>62.5</td>
<td>25-26</td>
<td>5.25</td>
<td>0.8</td>
</tr>
<tr>
<td>WR 4-RN23155</td>
<td>74.7</td>
<td>40-40.5</td>
<td>9.85</td>
<td>6.0</td>
</tr>
<tr>
<td>WR 5-RN23156</td>
<td>116.0</td>
<td>60-69</td>
<td>12.13</td>
<td>2.0</td>
</tr>
<tr>
<td>WR 6-RN23157</td>
<td>104.0</td>
<td>40-48</td>
<td>6.73</td>
<td>5.0</td>
</tr>
<tr>
<td>WR 7-RN23158</td>
<td>44.2</td>
<td>28-44</td>
<td>6.10</td>
<td>30-40</td>
</tr>
<tr>
<td>WR 8-RN23159</td>
<td>72.0</td>
<td>18-32</td>
<td>7.10</td>
<td>1</td>
</tr>
<tr>
<td>WR 9-RN23230</td>
<td>31.1</td>
<td>9-31</td>
<td>5.15</td>
<td>30-40</td>
</tr>
<tr>
<td>WR10-RN23231</td>
<td>62.05</td>
<td>33-54</td>
<td>7.87</td>
<td>5</td>
</tr>
<tr>
<td>WR11-RN23232</td>
<td>61.4</td>
<td>8-26</td>
<td>Surface</td>
<td>1</td>
</tr>
<tr>
<td>WR12-RN23233</td>
<td>86.0</td>
<td>63-65</td>
<td>19.30</td>
<td>1</td>
</tr>
<tr>
<td>WR13-RN23234</td>
<td>44.0</td>
<td>35-40.5</td>
<td>8.26</td>
<td>5</td>
</tr>
<tr>
<td>WR14-RN23235</td>
<td>50.2</td>
<td>41-49</td>
<td>4.95</td>
<td>3</td>
</tr>
</tbody>
</table>

Most of the test bores penetrated unconsolidated silty sand of Cainozoic age unconformably overlying Proterozoic Wildman Siltstone, the latter consisting of laminated siltstone, shale and rarely sandstone. No dolomite lenses were intersected. The thickness of the unconsolidated sediment is variable, the maximum being 68m at Bore WR5 near the Twin Sisters Lagoon. In bores WR7 and WR9 a brecciated quartzite of unknown age was encountered from which high groundwater yields were airlifted (Plate 1). No bores intersected the Mundogie Sandstone.

5.3 Test Pumping

All bores were airlifted on completion to obtain an indication of potential groundwater yield. The results are given in Table 1. Eight bores yielded groundwater supplies in excess of 2 l/sec.

A multistage pumping test was carried out on Bore WR7 at yields varying from 15 to 80 l/sec, Plate 2. Two constant rate pumping tests at 60 l/sec and 30 l/sec were carried out for 900 and 2300 minutes respectively. Observation bores were located 150m north (WR9); 500m south (WR10) and 500m east (WR9). Drawdown response due to pumping indicated that the quartzite aquifer is probably an elongated, strip-type aquifer orientated along strike (13° N) and hydraulically connected to the overlying Cainozoic sediments. From interpretation of the pumping test data transmissivity and storage co-efficient values of 320 m²/day/m and 8.6 x 10⁻⁵ respectively were determined.

A multistage test carried out on Bore WR4 at rates of 1.9 to 6.9 l/sec indicated a long term groundwater yield of 3 to 4 l/sec. A transmissivity
value of 25 m³/day/m was determined for this fractured siltstone aquifer system.

5.4 Water Quality

On-site conductivity measurements of groundwater from the test bores are given in Table 1. Water samples for full analysis were taken from WR7. The water from all test bores is of very low salinity and suitable for most horticultural purposes.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Stage I investigation located a high yielding brecciated quartzite aquifer system in close proximity to the pilot farm. It is estimated that the test/production bore (WR7) has a long term safe yield of 40 l/sec.

Airlifting of groundwater from test bores (WR5, WR6, WR10, WR13, WR14) located in the Proterozoic sandstone and quartzite in the central and north part of the study area yielded 2 to 5 l/sec. Properly constructed filter packed production bores may be capable of yielding groundwater supplies up to 10 l/sec.

Only one of the bores (WR4) intersecting shale or siltstone from the Wildman Siltstone in the southern half of the property yielded a groundwater supply in excess of 1 l/sec.

Re-interpretation of the resistivity results showed a similar anomaly to that of the brecciated quartzite to be located at line 6 (1650mE). A test bore located on this resistivity anomaly should be drilled as part of the Stage II investigation. If this hole is unsuccessful the groundwater potential of the southern part of the study area should be considered as poor.

The water quality was found to be of low salinity, suitable for most horticultural purposes.

7.0 STAGE II PROJECT BRIEF

Recommendations for the Stage II groundwater investigation will be fully described in the draft final report. This more detailed groundwater investigation will concentrate on the favourable groundwater areas identified by the Stage I regional study. This will involve further geophysics, test drilling, production bore construction, test pumping, water quality analysis and mathematical modelling.

The objective of the Stage II investigation will be to define the quantity and quality of water available for the potential areas already identified as suitable for horticultural development, so that appropriate groundwater extraction and borefield layout design may be determined.
The Stage II investigation will define the location and areal extent of the aquifer system, its hydrogeologic characteristics, groundwater yield and appropriate bore design from the brecciated quartzite in the pilot farm area and the Proterozoic sandstone and quartzite aquifer system north and south of WR13 and WR14.

Investigation methods will include resistivity and seismic refraction surveys, drilling of test/observation bores, construction of production bores, short and long term pumping tests, water sampling and aquifer modelling. Automatic level recorders will be required to monitor water level behaviour and aquifer response to recharge events.

A test/production bore should be drilled at line 6 (1650mE) on the resistivity anomaly similar to the brecciated quartzite at WR7.

During the Stage I study, a very good working relationship was established between the hydrogeologists and personnel from the Department of Transport and Works and a similar involvement is recommended in the next phase of investigation.

Hydrogeologists from Coffey & Partners Pty. Ltd. will supervise drilling, production bore design, test pumping, interpretation and modelling. If private drilling contractors are to be involved the consultant will prepare technical specifications and assist in letting of contracts as required.

7.1 Estimate of Costs

An itemized estimate of costs will be given in the final report. The costs are based on drilling at the 3 recommended sites.

7.1.1 Consulting Fees & Costs

a) Hydrogeological Investigation

FEES (Specifications, tendering, test drilling, production bores, test pumping, interpretation, modelling, reporting) $41,000.00

COSTS (Accom., air fares, vehicle hire, communications, etc.) $15,000.00

SUB TOTAL $56,000.00

b) Geophysical Investigation

(Resistivity profiling, seismic refraction, interpretation and reporting) $28,000.00

TOTAL CONSULTING FEES AND ASSOCIATED FEES $84,000.00
7.1.2 Drilling and Pumping Test Costs (Subject to tendering)

Pilot Farm Area (4 test bores, 2 production bores, two 7 days pumping tests) $ 50,000.00

Area near RN23234 and RN23235 (4 test bores, 2 production bores, two 7 day pumping tests) $ 50,000.00

1 Test bore at line 6 (1650mE) $ 7,000.00

$107,000.00

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8.0 REFERENCES


31st October 1984

PLATE 1 - Airlifting groundwater at a rate of 40 l/s from bore WR7 (RN 23158)

PLATE 2 - Test pumping WR7 at 80 l/s