GROUNDWATER SURVEY
of the proposed
PALM VALLEY TO WINGELINNA
NATURAL GAS PIPELINE ROUTE

by

AUSTRALIAN GROUNDWATER CONSULTANTS
PTY.LIMITED

in association with

MACDONALD, WAGNER & PRIDDLE

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2. GROUNDWATER SURVEY OF THE PROPOSED PALM VALLEY TO WINGELINNA NATURAL GAS PIPELINE ROUTE
SUMMARY.

The selected route for the natural gas pipeline from Palm Valley to Wingelinna, traverses country in which the hydrogeological potential is only known in general and by comparison to other areas, which are frequently some distance away.

It appears that adequate water supplies can be located at various points for camp supply and testing purposes, but that supplies for construction purposes will be severely limited.

Geological and photogrammetric studies are necessary before drilling sites are located and then drilling should be carried out to establish the supply points prior to the commencement of construction.

It is anticipated that cartage of up to 70 miles will be necessary for camp supplies, and that offset supply points will be necessary in certain areas.

With adequate investigations and a substantial time provision prior to construction to permit drilling, water supply should not be a problem in this project.
1. INTRODUCTION.

Australian Groundwater Consultants Pty. Limited were requested by Macdonald, Wagner & Priddle of Sydney to join representatives of Brambles Industrial Services of Sydney, Snam Progetti Australia Pty. Limited of Melbourne, and Macdonald, Wagner & Priddle, for a brief exploratory survey of the proposed natural gas pipeline from Magellan Petroleum Palm Valley No.2 gas field near Hermannsburg Mission, Northern Territory, to the nickel deposits at Wingelinna, Western Australia, of International Nickel.

The party was composed of:

- Mr. S. Maffozzini - Snam Progetti
- Mr. D. Hamlyn - Snam Progetti
- Mr. J. Zannelli - Brambles
- Mr. D. Johnson - Brambles
- Mr. P. Fowler - Macdonald, Wagner & Priddle
- Mr. P. Mewkill - Australian Groundwater Consultants

The inspection was made from Alice Springs between Tuesday, 10th and Friday, 15th March, 1970.

This report is concerned with requirements of water for industrial, camp supplies and pipeline testing along the route, and the availability and supply of this water to site.

2. PIPELINE ROUTE.

Initially a pipeline route was selected passing south from Palm Valley No.1, 40 miles through the Gardiner Range, through Tempe and Angus Downs, then west south west through the Ayers Rock - Mount Olga area to Wingelinna. This route was inspected from the air and was abandoned due to potential engineering problems over the initial 40 miles.

A second route was selected running north from Palm Valley No.2 for approximately 4 miles, then west north west between the Gardiner and Macdonnell Ranges along Missionary Plain. This route swings south west to a locality known as Camel's Hump, subsequently passing between Lakes Neale and Amadeus, then through the Chimside Creek area at the eastern end of the Petermann ranges, thence to Wingelinna. The latter route forms the subject of this report.

3. WATER REQUIREMENTS.

3.1 General.

The water requirement along the pipeline can be subdivided into
three major groups, namely -

(i) water for pipeline testing
(ii) construction camp supplies
(iii) water for construction purposes.

These requirements are essentially considered to be separate.

3.2 Pipeline Testing Requirements.

The water supply for testing purposes is a total volume requirement which varies, dependent on the pipe diameter, e.g. 14" diameter pipeline requires 12 million gallons total approximately.

This requirement needs to be met at various locations determined during construction along the pipeline route. The quality of the water is not important, though naturally non corrosive waters would be preferred.

3.3 Construction Camp Supplies.

Two separately operated camps would be involved in the construction pipeline, namely -

supplies for the Contracting Contractors Camp, and
supplies for the Cartage Contractor.

It is estimated that the Construction Contractors Camp will have to support 250 men at say 40 gallons per man per day, i.e. 10,000 gallons per day. This water could either be supplied on site or be carted a distance of up to 80 miles. It is anticipated that the project will be carried out from five camps along the route, thus a minimum of three water points are required.

The Cartage Contractor's Camp will be significantly smaller, and could possibly draw its supplies from the same sources as the construction contractor. It is anticipated that more camps will be established but of smaller size and of shorter duration. It would only be practical to establish points of supply from which they could cart their requirements.

3.4 Construction Supplies.

The inspecting Contractor has advised that any water supply, of any quality, is usable, but it is not practical to cart water more than 10 miles. In the event that little, or no water supply is available, then construction can still proceed without. However, with ample supplies available perhaps 20,000 gallons per day might be used.

This value is an estimate by the writers.
3.

GEOLOGY OF PIPELINE ROUTE.

4.1 Palm Valley - Camels Hump.

The Missionary Plain area is a strike valley formed along a syncline which bears its name. The syncline is formed in the upper Palaeozoic sediments of the Mereenie Formation, which are overlain by the Pernjara Formation. These in turn are unconformably overlain by a thin veneer of colluvium, alluvium and aeolianites.

4.2 Camels Hump - Lake Amadeus.

The geology of the Camels Hump to Lake Amadeus section of the route is not well known. Over the first section to the west of the Gardiner Range upper Proterozoic sediments exist beneath surficial deposits. The Gardiner Range structure plunges to the west, with the remnant thickness of the Pernjara formation increasing to the west.

South of the Gardiner Range, a shallow syncline exists overlain by sand dunes, with outcrops of the Mereenie Formation occurring close to and parallel with the lakes.

4.3 Lake Amadeus - Bloods Range.

This section of the pipeline route passes over a monotonous aeolianite environment with rare solid outcrop. Geophysical investigations to the west, close to the Hull River suggest that a desert basin may exist in this area. The stratigraphy of this basin is unknown, but it is considered likely that it is Cambrian and Pre-Cambrian sediments, unconformably underling the southern margin.

4.4 Bloods Range - Chirnside Creek.

This area lies between two substantial horsts of Pre-Cambrian bedrock. The surface cover is one of aeolianites interpersed with laterites, in the form of buckshot gravels. It is probable that at depth the Bitter Springs Dolomites occur possibly some representatives of the Cambrian sediments.

For the southern margin of the area, alluvials have been formed along the course of the Shaw and Chirnside Creeks.

4.5 Chirnside Creek - Wingelinna.

Except at the northern and southern end of this sector, no solid crop is evident. The basin indicated as existing to the west of the pipeline route near the Giles-Mulga Park Road, is not expected to extend to the east as far as the pipeline route.
Possibly the Dixon Creek beds underlie the northern half of this area, but in general the geology must be considered unknown.

EXISTING WATER SUPPLIES.

5.1 Hermannsburg Mission.

A shallow bore in the Finke alluvials supplies potable water to the Mission, and is currently used by Magellan to obtain their camp site requirements. This bore is, however, not capable of supplying a sustained yield and on occasions it has been necessary to cart water from Alice Springs.

5.2 Finke River.

Magellan have bulldozed a soak in the river and this supplies their drilling requirements. The supply is sufficient for their purposes which is estimated at about 10,000 gallons per day.

5.3 Missionary Plain.

Vernial springs are marked as existing along the margins of the Garriiner Range for the first 16 miles of the pipeline route. These springs probably rise from the Hermannsburg Sandstones though they are located a minimum of 4 miles from the pipeline route, they could be useful sources of supply.

5.4 Chirnside Creek.

Recent Government drilling has located a number of water points in the Chirnside Creek-Hull River area.

The water is barely potable, but supplies are adequate.

Other existing supplies are known in the area.

GROUNDWATER POTENTIAL.

6.1 General.

A number of known aquifers exist along the route of the pipeline, July -

River Alluvials
Younger Basin Deposits
Mereenie Formation
Winall and Ininda Beds
Bitter Springs Formation
Dean Quartzites.
5.

Poorly developed aquifers exist in isolated areas in other formations, e.g. fractured zones in the Arunta Complex, local calcrites, etc.

6.2 River Alluvials.

Small supplies of water are likely to be available to bores or trenches constructed across the channel sand deposits of the major stream courses close to the ranges. Salinities will be variable and will generally increase downstream. Away from the ranges, out on the plains, only the major streams such as the Finke River are likely to have any potential at all, except after periods of flow.

Younger Basin Deposits.

These deposits, in the only area identified, are largely arenaceous and are capable of yielding large supplies. The water table is deep and bores up to 300 or 400 feet may have to be constructed, in order to obtain satisfactory supplies.

North of Bloods Range, if these deposits exist, the salinity is expected to be sufficiently low to be usable for all purposes, however, close to Lakes Neale and Amadeus the water will be at least non potable.

6.3 Mereenie Formation.

The upper zone of Mereenie Formation is a proven aquifer near Alice Springs and Palm Valley. Elsewhere dry bores have been drilled, e.g. Tyler No.1. The formation, however, generally has a good groundwater potential.

At Palm Valley, the Mereenie exists at about 1,000 feet and has produced large supplies of good quality water. On the southern limb of the Missionary Plain Syncline, the Mereenie exists at depths up to 4,000 feet, and deepens with the structure further west. At the western end of the Gardiner Range, it is certain that the depth is too great to be practical for this programme.

Near Lakes Neale and Amadeus, mention was made of bores drilled into the Mereenie obtaining only saline supplies. These bores were undoubtedly well to the east of the pipeline route, but it is probable that similar conditions exist along strike to the west.

6.4 Lower Cambrian-Winall Beds.

The Winall Beds are described as friable sandstones, and while they have never been drilled for water supply in the area. On the basis of their lithological descriptions, they are considered to have some groundwater potential.
These rocks are expected to exist parallel with the north face of Bloods Range and could also exist between Bloods Range and the Petermann Ranges.

6.5 Bitter Springs Formation.

The Bitter Springs Formation consists of a sequence of dolomites and shales and is thought to have distinct salt bands in the form of halite and anhydrite. As a result, the formation forms cavernous dolomite aquifers containing highly saline, sulphate rich waters which can contaminate groundwaters in both adjacent aquifers and alluvials downstream of their suboutcrop.

This formation is expected to exist adjacent to the Dean Quartzites, in the Bloods and Petermann Ranges and probably in between. It is likely that they will have contaminated waters in the Lower Cambrian Formations, but could supply substantial quantities of water for construction purposes.

6.6 Dean Quartzite.

The Dean Quartzites are ortho and metaquartzites and too hard to be drilled for water supply at outcrop. Friable bands have been mapped in them and fracture zones may still exist along major structures. Since they are chemically inert, they form a potential source of low salinity water.

6.7 Other Aquifers.

6.7.1 Permian Glacials.

North of Lake Neale, Permian Glacials exist as low mesas. These beds, known as the Ligertwood Beds, have given rise to coarse conglomerates, which at depth would be capable of yielding large supplies of water.

6.7.2 Arunta Group.

Fractures and jointing in the metamorphic rocks close to areas of high relief, have produced small supplies of a barely potable water, e.g. Giles water supply, 1,212 p.p.m.

These rocks would warrant drilling adjacent to the southern edge of the Petermann Ranges for construction and camp supplies.

6.7.3 Aeolianites.

Some water may exist shallow in the aeolianites between major dunes, particularly where the desert vegetation is strongly developed. The presence of this water will depend on the time since the last substantial rains, and on the presence of permeable strata to act as an aquifer.
7. POSSIBLE SUPPLY POINTS ALONG THE PIPELINE ROUTE.

The following table lists points from which it is considered supplied suitable for use in the programme of construction of the natural gas pipeline from Palm Valley to Wingelina via Camels Hump.

<table>
<thead>
<tr>
<th>Point</th>
<th>Section Serviced</th>
<th>Quantity</th>
<th>Quality</th>
<th>Depth</th>
<th>Formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm Valley</td>
<td>Palm Valley to Camels Hump</td>
<td>Ample</td>
<td>Potable</td>
<td>1,500'</td>
<td>Mereenie</td>
</tr>
<tr>
<td>Perennial Springs</td>
<td>Palm Valley to 30 mile peg</td>
<td>Limited</td>
<td>Potable</td>
<td>Nil</td>
<td>Hermannsburg Sandstone</td>
</tr>
<tr>
<td>North of Lakes</td>
<td>Camels Hump to Lakes (Limited(?))</td>
<td>Poor</td>
<td>?</td>
<td>Mereenie</td>
<td>Shallow Aeolianites</td>
</tr>
<tr>
<td>Bloods Range Area</td>
<td>Lakes to Bloods Range</td>
<td>Ample (?)</td>
<td>Potable(?)</td>
<td>500'</td>
<td>Basin Deposits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>?</td>
<td>?</td>
<td>500'</td>
<td>Lower Cambrian</td>
</tr>
<tr>
<td>Chirnside Creek</td>
<td>Range into Cobb Depression area</td>
<td>Ample</td>
<td>Potable</td>
<td>200'</td>
<td>Alluvium</td>
</tr>
<tr>
<td>Cobb Bores</td>
<td>Cobb Depression to Wingelina)</td>
<td>Ample</td>
<td>Potable</td>
<td>500'</td>
<td>Basin Deposits</td>
</tr>
<tr>
<td>Wingelina</td>
<td>Ample</td>
<td>Potable</td>
<td>250'</td>
<td>Gneiss</td>
<td></td>
</tr>
</tbody>
</table>

These possible sources of supply can be considered as follows:

All uses: Construction only:
Palm Valley Previous list
Perennial Springs North of Lakes
Bloods Range Bloods Range - Bitter Springs Formation
Chirnside Creek Cobb Bores
Wingelina and Wingelina.
On the forgoing basis, and using the cartage distance limits listed earlier, water would be available for:

Construction purposes over half the length of the pipeline;
Camp purposes over most of the pipeline length and for testing purposes at five points, namely:

Palm Valley
North of the Lakes
Bloods Range
Chirnside Creek and
Wingleinna (?)

8. INVESTIGATION.

Considering the short duration required for supplies and the relatively small amounts required, detailed investigation should be kept to a minimum. Photogeological and geological studies should permit the identification of sites north of the Lakes.

South of the Lakes Complex a combination of drilling and, if necessary, limited geophysical coverage at various points should locate adequate supplies. Between the Petermann Ranges and Wingleinna, a spaced drilling programme may locate sufficient water, if not offsets west into the Cobb Depression Basin would obtain the required volumes.

In addition to standard photogeological and geological studies, the use of infrared imagery will be warranted in areas where shallow supplies can be anticipated e.g. in minor alluvium, at the lakes sites and in aeolianites.

9. CONCLUSIONS.

It seems probable that water supplies can be located on or, close to, the Palm Valley to Wingleinna natural gas pipeline route, adequate for camp and testing requirements, but limited in respect to construction purposes.

10. RECOMMENDATIONS.

It is recommended that the investigation programmed outlined in this report be carried out subsequent to the establishment of an access track and the surveying of the route. The establishment of water supply points along the entire route must be completed prior to the commencement of construction of the pipeline.

AUSTRALIAN GROUNDWATER CONSULTANTS
PTY.LIMITED.

April, 1970.