RUDALL RIVER NATIONAL PARK

RESOURCE INVENTORY

AND RECOMMENDATIONS FOR MANAGEMENT

by B.G.MUIR.

A report to the National Parks Authority

of Western Australia

November 1982

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FOREWORD

This paper summarises the known resources of the Rudall River National Park area and presents recommendations for future management based on ecological grounds, but it is not a management plan. The Report establishes instead, the framework within which a plan can be developed.

Much of the compiled information is appropriate for publication in both scientific journals and national park information pamphlets. However, aspects of the Report which relate to sensitive ecological and anthropoligical sites and also to mining activity should remain confidential.

Matters which are considered to be sensitive are presented on pink pages. Moreover, for convenience, the recommendations developed are given on green pages both at the front and in the body of the Report.

B.G. MUIR
ECOLOGIST

20. RECOMMENDATIONS

20.1. The primary recommendation is that a management presence should be seen in the Park at least once a year, and preferably more often. It is recommended that a mobile or resident Ranger (possibly the Hamersley Ranger) enter and inspect the Park on a yearly basis, during the dry season. The Ranger would be required to camp and visit all major recreation areas and mining tenements.

20.2. While present in the Park, some rubbish disposal, minor weed control and destruction of feral animals be undertaken.

20.3. On a biennial basis (subject to review), the National Parks Authority's Regional Superintendent at Karratha and the Planning Officer and Ecologist visit the Park to monitor changes resulting from visitors and mining exploration. The inspection by professional staff should be in addition to the annual Ranger visit.

20.4. That the visiting Ranger, and professional officers produce a report, and recommendations to the Authority, following each examination of the Park.

20.5. Every effort be made to encourage scientific research into the area of the Park in order to identify locations of biological importance.

20.6. Consideration should be given to addition of land to the Park in order to protect important features. In the author's opinion, these features are Eagle Rockhole, the Dome, Christmas Pool and Christmas Pool Cave. Recommended additions to the Park are as follows:

20.6.1. Firstly, extension of the southern boundary of the National Park by addition of a rectangular block approximately 310 km^2 and with boundaries from 122° 50'00" E, 22° 50'00" S south to 122° 50'00" E 22° 55'00" S then west to 122° 30'00" E 22° 55'00" S then north to 122° 30'00" E 22° 50' 00" S.

20.6.2. Secondly, it is recommended that a reserve be created to protect Christmas Pool, Christmas Pool Cave, and to include the Paterson Range. This area comprises excellent exposures of the Early Permian glacial deposits of the Paterson Formation, which is poorly represented in the Rudall River National Park. Details of the proposed reserve are presented briefly in Appendix 4.

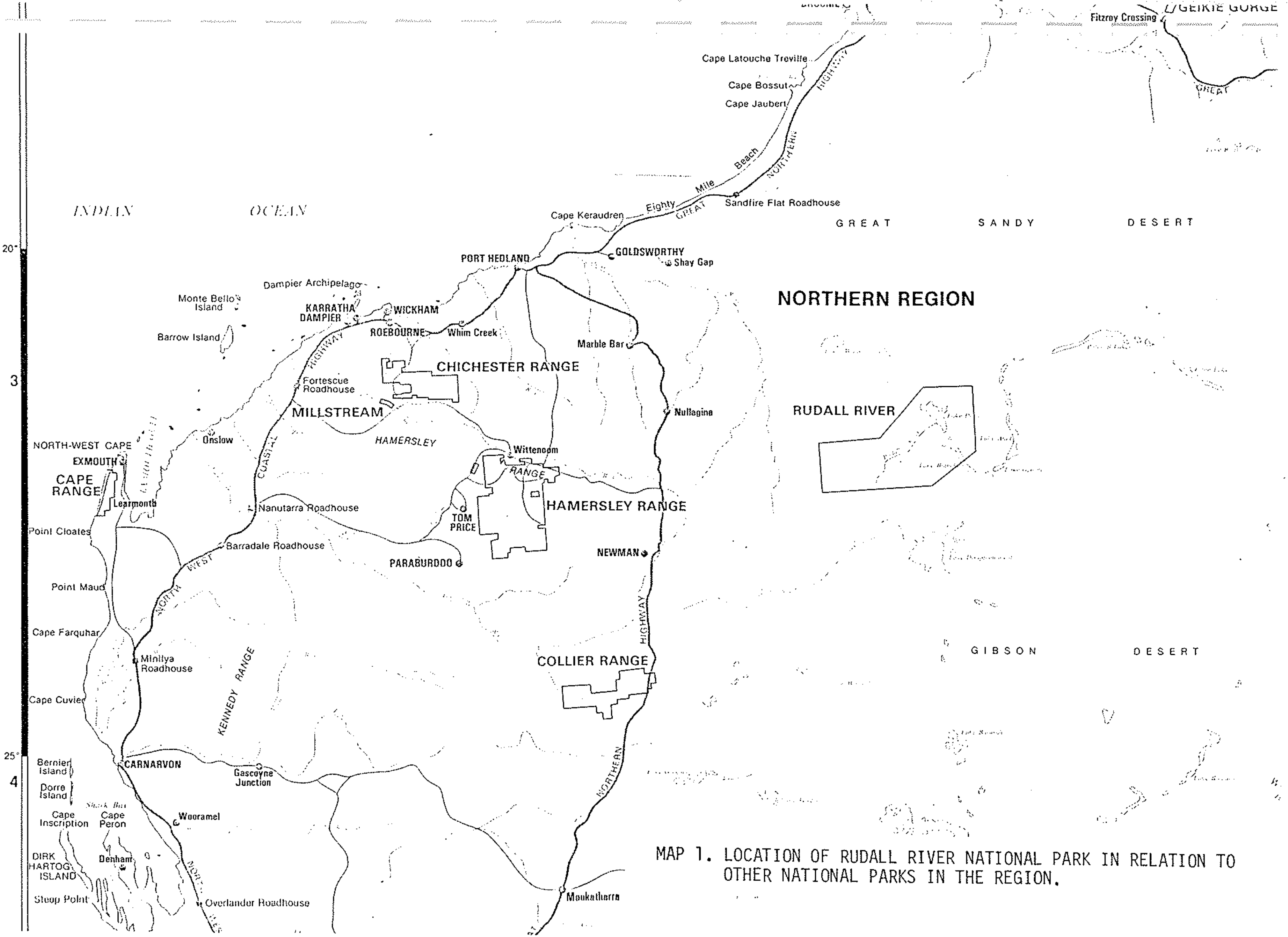
The reserve should be vested in the National Parks Authority, to be managed together with the Rudall River National Park.

20.6.3. Suggested boundaries for this proposed reserve are:

From a point at 122^{o} 00' 00E E 21^{o} 45' 00" S east to 122^{o} 15' 00" E 21^{o} 45' 00" S then south to 122^{o} 15' 00" E 22^{o} 00' 00" S, then west to 122^{o} 00' 00" E 22^{o} 00" S then north to the point of origin. The area contained therein is about 625 km^{2} (62500 ha).

20.7. Up to the present time the existence of the National Park has not affected exploration for minerals. It is suggested that creation of an extension to Rudall River National Park, or creation of a reserve at Paterson Range, similarly will in no way alter mining prospects in the area.

It is thus recommended that should item 20.6 be accepted, mineral exploration should be allowed to continue in the area consolidated with the Rudall River National Park, and also in the new reserve, under the same conditions as already apply.



MAP 1. LOCATION OF RUDALL RIVER NATIONAL PARK IN RELATION TO OTHER NATIONAL PARKS IN THE REGION.

2. CLIMATE

2.1. The climate of Rudall River National Park is not well known, because of the absence of meteorological stations in the vicinity.

The only major stations in the dry interior of Western Australia are Earaheedy Station (25° 33' S 121° 35' E) Giles (25° 02' S, 128° 18' E) Warburton (26° 05' S, 126° 36' E) and Wiluna (26° 35'S, 120° 13' E) all of which are several hundred kilometres from the National Park and all well to the south.

2.2. In 1974-75 this situation was improved by the establishment of a townsite at Telfer, a gold mine located at 21° 43' S, 122° 12' E, about 80 km due north of the Park. Data from establishment of the Telfer station in 1975, until 1980, has been analysed by the Bureau of Meteorology, and this data is presented below in Table 1.

2.3 It can be seen from the data that Rudall River National Park is in a climatic zone typified by a "wet season" continuing intermittently for three to four months, followed by a "dry season" normally extending from about June until December. The rainfall is however unreliable, with no greatly marked periodicity, and which is governed by the influence of the climatic systems of the south and north, including periodic cyclones.

2.4 It is probably reasonable to say that the western portion of the Park receives about 380mm (14 inches) of rain per year, and the eastern end considerably less. However, most rain falls in bursts connects with cyclonic activity; falls of 60 mm or more sometimes recorded on a single day and there are periods of up to three months with no recorded rain.

2.5 Temperatures are high, average daily maximum of the year being about 34° C, and average daily maximums of 46° C plus, being common in January and February. Average daily minimum for the year is about 19° C, with June-July minimums of only 2 - 3° C.

2.6 Humidity is generally low, mean daily humidity for the year being about 24%. Winds are predominantly from the south-eastern quadrant at all times of the year, although north-westerlies may be fairly common in October to January. Wind speeds are generally in the range 1-20 kph.

STATION NAME TELFER PERIOD OF RECORDS 1975-1980 WESTERN AUSTRALIA

Number 013030 Latitude 21 deg. 43 Min S Longitude 122 deg. 12 min. E. Elevation 303.0M

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9AM MEAN TEMPERATURES (℃) AND MEAN RELATIVE HUMIDITY (%)													
Dry Bulb	33.3	31.6.	31.6.	27.8	22.1	18.2	17.8	20.9	24.8	29.5	32.0	33.6	27
Humidity	38	45	37	28	38	38	37	31	20	16	18	22	31
3PM MEAN TEMPERATURES (℃) AND MEAN RELATIVE HUMIDITY (%)													
Dry bulb	39.4	37.8	37.0	33.4	27.7	24.7	24.2	27.5	31.2	35.2	37.9	39.1	33
Humidity	20	25	20	18	25	23	22	18	11	11	11	12	24
DAILY MAXIMUM TEMPERATURE (℃)													
Mean	41.0	38.6	38.1	34.1	28.4	25.2	24.8	28.0	31.8	35.9	39.1	40.2	34
Highest	47.4	46.0	44.5	40.5	35.0	32.4	32.5	35.4	38.8	41.4	45.0	46.2	40
Lowest	26.0	27.1	30.1	24.5	15.0	16.2	17.5	16.5	20.9	26.0	32.0	31.6	24
DAILY MINIMUM TEMPERATURE (℃)													
Mean	25.7	24.7	24.2	20.1	14.9	12.0	10.8	12.3	15.3	19.6	22.1	24.7	19
Highest	32.2	28.7	30.6	26.5	22.6	22.5	19.2	20.5	23.6	30.0	30.3	31.4	27
Lowest	19.0	20.0	16.0	11.5	7.9	2.5	3.5	2.5	7.3	12.8	14,5	18.3	11
RAINFALL (mm)													
Rainfall	53	179	40	11	38	5	22	15	0	3	11	9	386
Raindays	7	13	5	2	6	2	2	4	0	1	2	3	47
Top daily	30	68	27	20	30	7	44	25	0	12	20	9	68
WIND:MOST FREQUENT DIRECTION AND SPEED (kph)													
Direction	SE	SE	SE	SE	SE	SE	SE	SE	SE	NW SE	NW SE	SE	SE
Speed	1-20	1-20	6-20	1-20	1-10	1-20	1-20	1-20	1-30	6-20	1-20	1-20	1-20

TABLE 1: CLIMATIC DATA FROM TELFER 1975-1980.

2.7 The only other data available from the desert are periodic rainfall records taken by visitors at Wildlife Well, a CSIRO recording station. This gauge is entirely dependent on visitors for maintenance and accuracy, and is located on the Gary Highway at 25° 22' 10 E, 124° 10' 36" S, about 100 km south-east of the Park.

Data from Wildlife Well is probably unreliable, but may be a useful guide. A summary is presented below in Table 2.

YEAR	TOTAL RAINFALL RECORDED
1975	120 mm
1976	9 mm
1977	no record
1978	76 mm
1979	no record
1980	208 mm
1981	no record
1982 (up to July)	0.5 mm

TABLE 2: Summarised rainfall records from Wildlife Well 22° 22' 10E, 124° 10' 36" S)

The Wildlife Well data suggests a generally very low rainfall for this portion of the desert (probably less than 50 mm per year) with occasional heavy rains which boost the yearly total. The data may well reflect rainfall in the eastern portion of the Park. As an overall average, the Park as a whole probably receives about 200 mm of rain per year.

3. TOPOGRAPHY

3.1. Rudall River National Park straddles the boundary zone between the Great Sandy Desert and Little Sandy Deserts and includes the watershed of the Rudall River between.

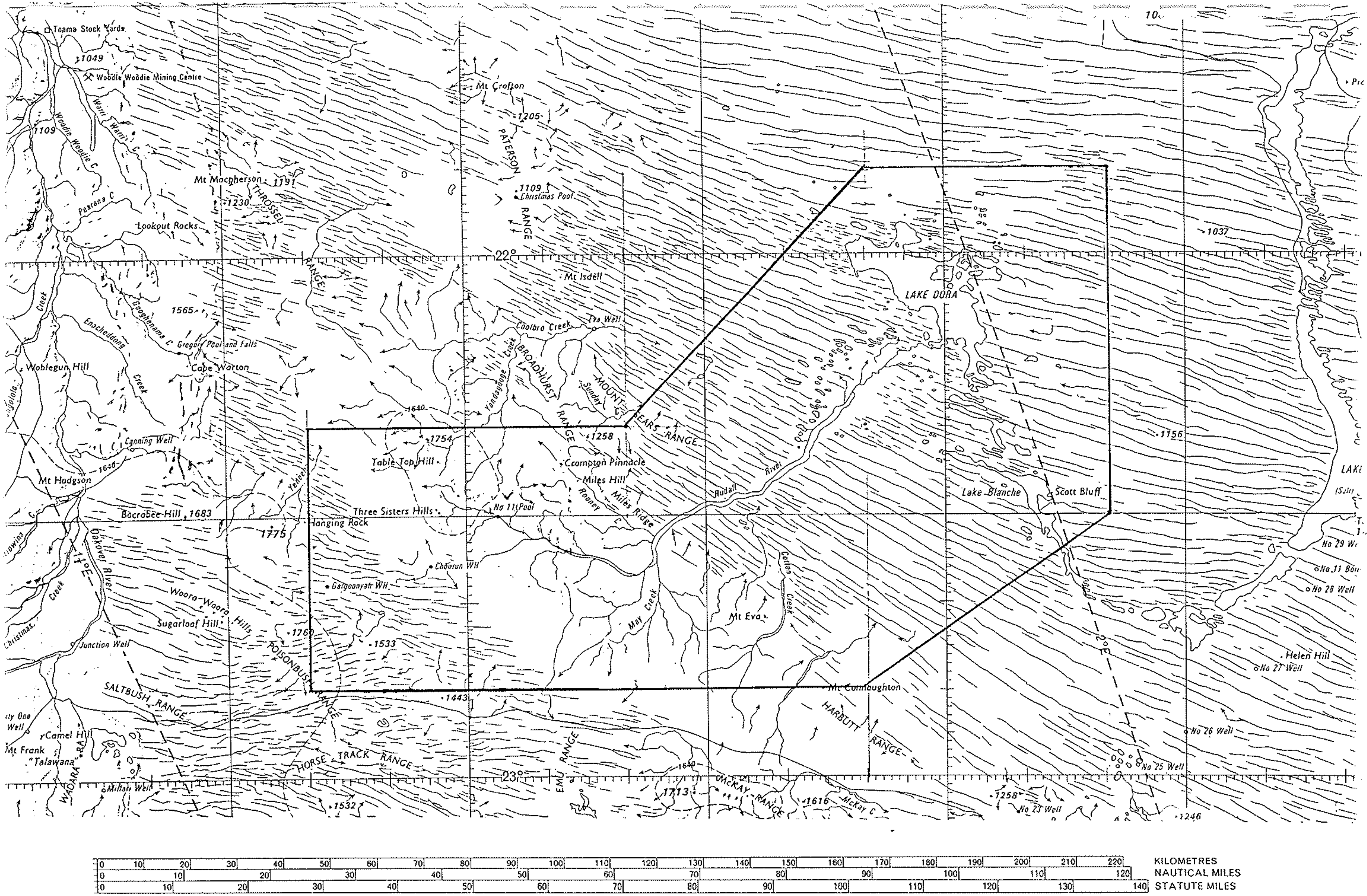
In the Park dissected hills rise abruptly to 90 - 175 m above the plains, forming isolated units such as the Paterson, Broadhurst and McKay Ranges. Topographic data is derived mainly from Chin *et. al*.1980, and Traves *et al*. 1956. See map 2.

3.2. Physiographic features suggest stability since ancient times. The intense weathering and erosion over this long period has produced a subdued landscape. Resistant rock types such as the sandstones north of the Rudall River and quartzite south of the river still retain the older plateau surface, incised by more recent streams. Other ancient rocks form low rocky areas largely covered by wind-blown sand.

3.3. The plateau surface dates from the Early Permian (about 280 million years ago) when it was carved out by glacial erosion. Glacially abraded bedrock, striated and polished pavements, and incised straight-sided U-shaped valleys are still preserved. Small outliers of water and glacier deposited rocks cap part of the plateau north and south of the Rudall River, showing that the surface was at least partly covered by sediments and has been exhumed during later periods. The intense Tertiary weathering under high rainfall and temperature conditions formed a flat duricrusted surface at the same level as the old glacial surface. Where the deep weathering profile developed below the duricrust, the plateau surface has been removed by recent erosion except for isolated flat-topped mesas. However, in broad valleys the Tertiary surface is preserved below the modern sediments.

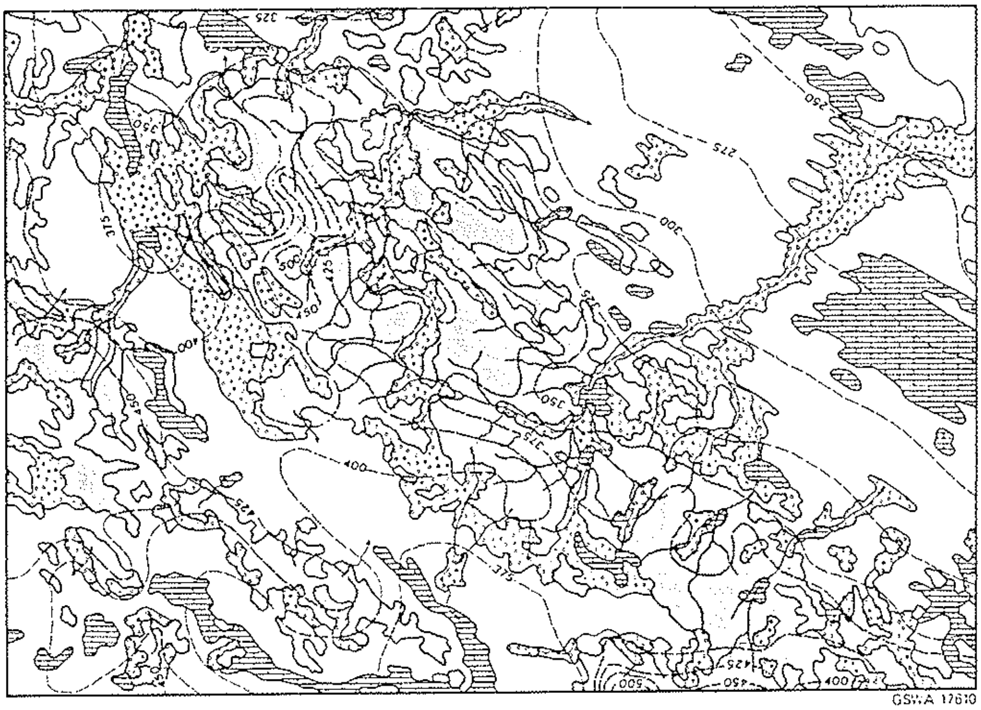
3.4. The present drainage system in the upland regions is intricately dendritic. Most of the streams terminate where the water soaks into the sandplain.

Broad valleys which lie between the hilly regions form an interconnected palaeodrainage system which once carried the run-off from the higher rainfall during the Tertiary (van de Graaff and others, 1977). While duricrusts were forming over adjoining bedrock, the drainage was infilled with colluvium and alluvium which became part of the widespread pebbly laterite now underlying the sandplain. The main trunk palaeo-drainage passed through Lake Dora and discharged into the sea through what is now the De Grey River. The old valleys choked with sediment as the rainfall and stream discharge decreased, and caused the present drainage to pond in areas of playa lakes where evaporation now concentrates salt. Cementation of the valley fill has formed large tracts of limestone-like calcrete. The Rudall River has incised its former Tertiary drainage course which is outlined by the remaining outcrops of calcrete and older consolidated colluvium.



MAP 2. (A) TOPOGRAPHIC FEATURES OF RUDALL RIVER NATIONAL PARK.

Altitudes in feet.



PHYSIOGRAPHIC FEATURES

RUDALL SHEET SF51-10

0 10 20 30 km

REFERENCE

ERODING AREAS

1 Upland flat topped hills and low outcrop

TRANSITIONAL AREAS

2a Sheet-wash slopes and plains adjacent to hills

2b Eolian sand plain with longitudinal dunes

SALINE DRAINAGES

3a Flat, unvegetated lake surface

3b Calcreted valley floors

Intermittent watercourse

300 Generalized topographic contour, in metres

(B) PHYSIOGRAPHIC FEATURES OF THE RUDALL SF 51-10 SHEET. DERIVED FROM CHIN *et al.* 1980.

3.5. For most months of the year no surface water flows in any of the drainage channels; the valleys of the streams in the Rudall area are narrow, almost V-shaped; where the valleys leave the hill country and enter the sand plains, short distributaries form, but very few extend far into the desert.

3.6. The desert area is characterised by innumerable seif dunes and playa lakes and the absence of any significant drainage channels. It has low relief. Small hills rise less than 150 feet above the level of the sand plain and numerous small rounded rises scattered throughout the area are no higher than the surrounding sand dunes.

3.7 Salt lakes formed by internal drainage are characteristic of the desert. Lakes Dora, Blanche, Winifred, George and Auld form a U-shaped group east of the Rudall River area.

Only after particularly heavy falls of rain is there an appreciable quantity of surface water in any of these lakes. Lake Dora is 198 m above sea level and Lake Auld 227 m. The margins of the lakes are irregular, particularly on the eastern edges of the lakes where their salt surface extends into the valleys between sand dunes, which form a serrated edge to the salt lake. The extensions between the sand dunes commonly break into a mass of small salt lakes and clay pans which represent remnants of the lake surface.

3.8. Sand dunes cover most of the desert and form parallel ridges, mostly 200m to 6 km apart and extending for more than 40 km in length, they vary only slightly in direction and generally trend west-northwest; the average height is about 20 m but dunes twice this height have been found.

The junction of otherwise parallel dunes is quite common; the point of the acute angle between the two in almost every case points west-northwest. They are commonly braided, giving three or four parallel crests to the one dune.

In some places small areas of perhaps 10 sq. km may consist of irregular short dunes of complex pattern, but their longer axes always trend in the same general direction as the others. Braiding is particularly noticeable near the western margin of the playa lakes; the dunes are generally absent in a small lane about half a km wide adjoining the western shore of the lake. On the eastern margins of the lakes, however, the dunes are well defined and only slightly braided, and abut on the lake surface.

The dunes end abruptly against the eastern margin of any obstruction such as small hills or mountain ranges. On the western margin of the larger ranges, they are absent from a half to two km. The dunes in places continue unobstructed over low rises.

The dunes have migrated in a west-northwesterly direction, but their movement is now somewhat restricted by the sparse vegetation which covers them.

3.9. A desert area almost completely lacks any drainage channels; the greater part of the drainage is subterranean. The Rudall River partly traverses the sand plain, but merges into a series of clay pans and small salt lakes in its lower reaches, its course being extremely braided. The channels reach Lake Dora, but flowing surface water seldom reaches the lake. Some drainage channels are present in small rises, monadnocks, and breakaways within the desert, but they rarely extend more than 100-200 m.

FIGURE 1. One of the more rugged sections of the Rudall River Catchment showing residual hills and outcrops with complex drainage patterns. Note the sparse *Triodia* cover with abundant shrubs along the drainage lines.

FIGURE 2. Sandy bed of the Rudall River midway along its length. Note rocky hill on the left (south), soft grasses along the bank and *Eucalyptus camaldulensis* trees.

FIGURE 3. Mt. Eva viewed from the south-west. This area is typical of the less rugged portions of the Rudall River Catchment. *Triodia* covered clayey plains with scattered shrubs (shrub steppe) are common.

FIGURE 4. Duck Pool, on Coolbro Creek, just north of the National Park boundary. This is the largest pool in the area, being up to half a kilometer long and quite deep. Rocky cliffs on the river bank are unusual, most pools having only sandy banks.

4. GEOLOGY

The geology of the Rudall River National Park and adjoining land, has been described and mapped in some detail by Chin *et al.*(1982). The account presented below is extracted from (partly verbatim) this report. Map 3 shows a simplified version of the Chin *et al* map.

4.1. EARLY GEOLOGICAL STUDIES

The first reports on the country was made by W.F. Rudall (1897) and F.H. Hann in the same year (see historical notes section).

4.1.1. In 1908-09, W.H.B.Talbot (1909, 1920) made the first geological reconnaissance of the area during his trip with A. W. Canning along the Canning Stock Route which passes to the southeast of the area. His results are presented in comprehensive maps at the scale of 1:253 440. F. Reeves (1949), in his investigation of the south-west part of the Canning Basin, also made observations on rocks of the Yeneena Group and Rudall Metamorphic Complex during a traverse from Mount Isdell to the Rudall River. Geologists from the Bureau of Mineral Resources (Traves, and others, 1956) also mapped a large part of the southwest Canning Basin in 1954.

4.1.2. In 1966 and 1969, L. E. de la Hunty and J. G. Blockley of the Western Australian Geological Survey made reconnaissance trips to assist in the preparation of the 1966 and 1973 editions of the State Geological Map. The results of an investigation into the alleged occurrence of platinum on the Rudall River were published by Blockley (1972).

4.2. BACKGROUND

The geology of the Rudall area falls into three provinces: Paterson Province, Bangemall Basin and Canning Basin.

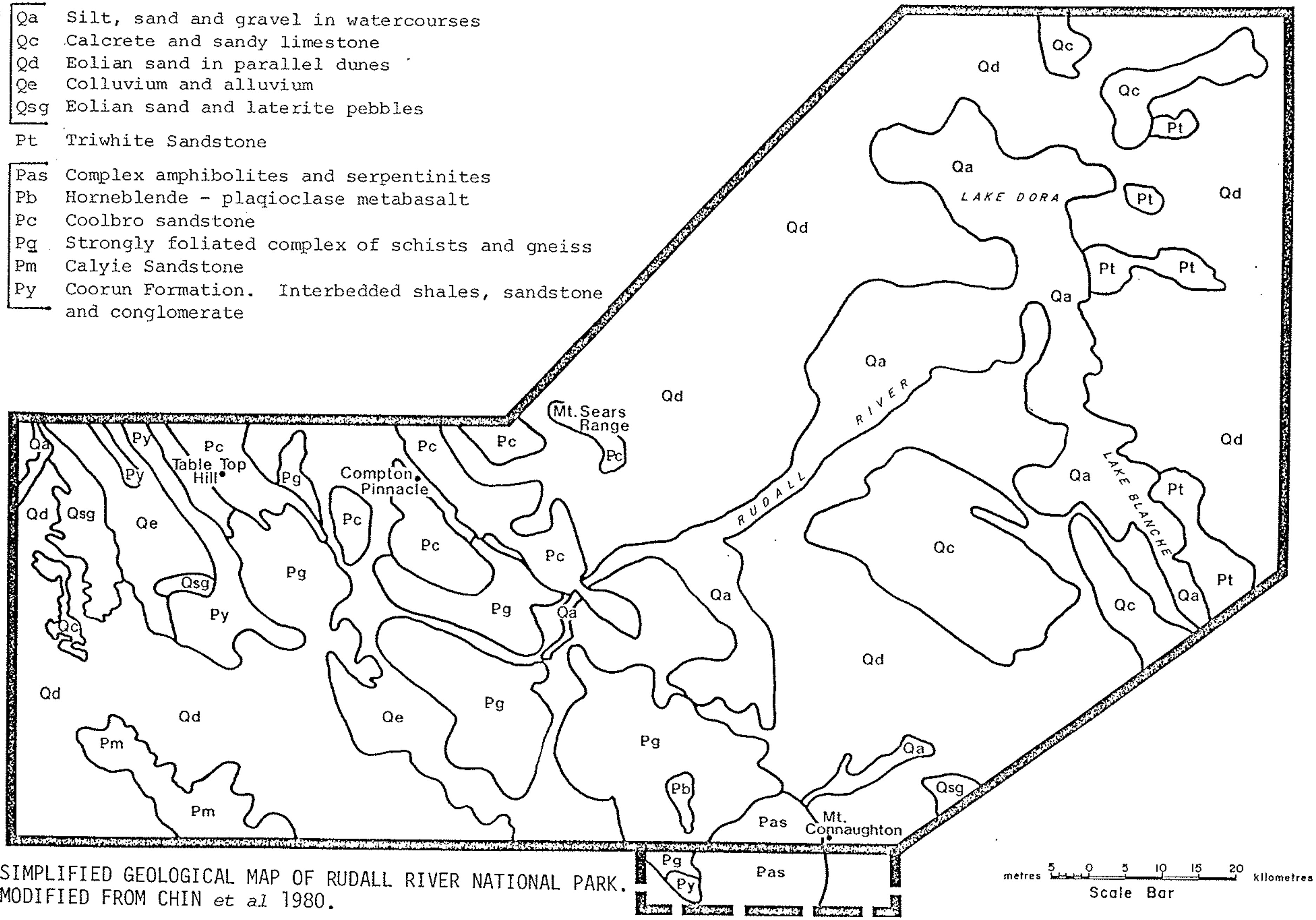
4.2.1. The Canning Basin underlies the extensive sand, calcrete, and saltlake deposits in the north-eastern parts. It contains undeformed marine and terrestrial sediments of early Permian to early Cretaceous age, known as the Paterson Formation.

4.2.2. In the southwest of the region,the Bangemall Basin is represented by the MacFadden and Calyie Sandstones, which unconformably overlie the rocks of the Paterson Province.

4.2.3. The Paterson Province lies diagonally northwest across the Park and consists of the Rudall Metamorphic Complex and the Yeneena Group. The Rudall Metamorphic Complex contains the oldest rocks of the area and forms the basement to the Yeneena Group.

LEGEND

Quaternary	Qa	Silt, sand and gravel in watercourses
	Qc	Calcrete and sandy limestone
	Qd	Eolian sand in parallel dunes
	Qe	Colluvium and alluvium
	Qsg	Eolian sand and laterite pebbles
Permian	Pt	Triwhite Sandstone
Pre-Cambrian	Pas	Complex amphibolites and serpentinites
	Pb	Horneblende - plaqioclase metabasalt
	Pc	Coolbro sandstone
	Pg	Strongly foliated complex of schists and gneiss
	Pm	Calyie Sandstone
	Py	Coorun Formation. Interbedded shales, sandstone and conglomerate



MAP 3. SIMPLIFIED GEOLOGICAL MAP OF RUDALL RIVER NATIONAL PARK. MODIFIED FROM CHIN *et al* 1980.

National Park boundary.
Boundary of proposed addition to Park.

4.3. PROTEROZOIC

4.3.1. RUDALL METAMORPHIC COMPLEX

Two interfoliated metamorphic sequences with different structural histories make up the Rudall Metamorphic Complex. The older sequence consists of strongly deformed and retrograded gneissic rocks which show structures that predate the formation of the younger sequence. The younger sequence is mainly quartzite and quartz-mica schist laid down as sediments on the older gneiss. The subsequent deformational and metamorphic events are prograde in the younger sequence but are responsible for the retrogression of the older sequence.

As yet there is no reliable age dating of the Rudall Metamorphic Complex. The older gneissic rocks closely resemble those in Archaean terrains in other parts of the State, eg. the Gregory Granitic complex 2 651 million years old.

4.4. PROTEROZOIC OR ARCHAEAN

4.4.1. The age of the younger quartzite and quartz-mica schist is inferred to be Proterozoic because there is a close similarity to rocks found in known Proterozoic basins. The older gneiss sequence consists of metasedimentary, mafic and ultramafic gneiss, and banded quartzite (metachert). The succession was extensively intruded by the granitic rocks which now form the quartz-feldspar-mica gneiss.

Also present are meta-banded iron formations, strongly (or weakly) foliated granite and adamellite, serpentine rocks and metamorphosed mica and quartz schists and various metamorphosed carbonate rocks.

4.4.2. YENEENA GROUP

The Yeneena Group (Williams *et al* 1976) is named after Yeneena Creek, which drains hills west of Hanging Rock. It is a thick, marine carbonate sequence, comprising shales, siltstones and dolomite assemblage not assigned to geological formations, and sandstones, shales, conglomerate and dolomite divided into distinct formation types.

4.4.3. BANGEMALL GROUP

These rocks are believed to be middle Proterozoic in age, that is, younger than the Rudall Metamorphics and Yeneena Group, but still ancient. The Bangemall Group consists of two distinct sandstone types, one with little clay and basically massive (Calyie sandstone), the other with a higher proportion of clay, abundant cross bedding and more flaggy structure (McFadden sandstone).

4.5. PERMIAN

4.5.1. PATERSON FORMATION

Throughout the area, the Paterson Formation overlies topography sculptured by the movement of Permian glaciers. Glacial palaeotopography is best preserved over the Coolbro sandstone which stands higher than the surrounding rocks. Gouged into this old surface are u-shaped valleys up to 1.5 m wide which show polished pavements. Gouge marks and chatter marks indicate ice movement along the valleys towards the northwest.

The basal unit of the Paterson Formation is poorly sorted and unstratified conglomerate and tillite with a matrix of clay and clayey sandstone. Clasts range from small pebbles to boulders up to 3 m in diameter. These are mainly of rock types derived locally. In valleys incised into the Coolbro Sandstone, well-rounded sandstone boulders with hard, silicified outer skin rarely striated, are most common. Immediately north of the McKay Range, just south of the National Park, a clast of pelletal iron-formation has been found. The source of this rock type is possibly the Nabberu Basin and suggests northern transport over a distance of at least 200 km.

Within the glaciated valleys are lacustrine deposits of laminated fine-grained sandstone, silt, and clay. Graded bedding in some of these deposits may indicate glacial varves. Ripple marks and trace fossils are common.

Spores and pollen from the Paterson formation indicate an Early Permian age and confirm the terrestrial origin of the sediments.

4.6. CAINOZOIC

4.6.1. Cainozoic rocks include various handpans, calcrete, laterite and silcretes, and associated Quaternary colluviums and alluviums, sands and lake deposits. The laterites include various ferruginized residual cappings on hill tops and various transported pebbly laterites or low-lying areas. Laterites generally underly sandplains adjacent to calcreted sediments.

4.6.2. CALCRETE

The valley calcrete consists of massive, vuggy or nodular sandy limestone which commonly interfingers with colluvium. It is formed by cementation of permeable colluvial and alluvial valley deposits. Vast tracts of calcrete lie between the main bedrock areas and along the Tertiary drainage systems. Silica replacement of calcrete has occurred in veins and in the caprock.

4.6.3. SILCRETE

This unit is related to the formation of the laterite, but results from silica cementation of angular, unsorted quartz sand which possibly was part of residual soil or colluvium. The sand grains are embayed by silica dissolution. Some silcrete is ferruginized.

4.6.4. DUNES

The Quaternary colluviums and alluviums are sands, gravel and silt deposits found in drainage channels, and those on hill slopes, e.g. scree and outwash fans. Additionally, Quaternary, eolian, quartz sand occurs in extensive sheets and longitudinal dunes. Individual grains are up to 0.5 mm in diameter, and are covered with a film of iron oxide. Sand movement is from southeast to northwest in the direction of the dominant wind. Major bedrock areas trap the sand on the windward side leaving the lee (western) side free from dunes for distances up to 20 km.

The dunes have been examined in detail by Crowe (1975) and are described as having three forms, simple and chain longitudinal types, and a net-like type. Crowe suggests the three types are an evolutionary sequence where there is an adequate supply of sand; the net-like dunes being the most evolved type. Crowe believes that over a flat plain, with consistent winds in predominantly one direction and where high temperatures are conducive to turbulent wind action, helicoidal air flow occurs. This forms simple longitudinal dunes where there is an ample supply of sand suitable for eolian transport. As the dunes get older and the supply of sand is maintained, these dunes become wider until they form the chain type. In depressions with still further sand available, the chain longitudinal dunes coalesce to form net-like dunes. In such a situation, convection takes over as the main dune-forming mechanism and helicoidal air flow has a reduced effect. If the supply of sand slows, or ceases, then the increase in complexity will stop. Thus, each of the three variations represents a stage in evolution of longitudinal dunes.

4.6.5. DEPOSITS

Silty, fine grained sediments occur as unvegetated lake-surface deposits of clay and silt in freshwater claypans, and as salt encrusted deposits in the Lake Dora system. Mixed deposits derived by wind action from salt lakes accumulate as dunes of kopi and quartz sand interspersed with claypans, on the western side of the salt lake. The kopi is generally yellow-white, friable, porous and contains appreciable amounts of gypsum.

4.7. ECONOMIC GEOLOGY

There is no recorded mineral production from the Rudall River area although exploration for gold, platinum, uranium and base metals has been under way since the mid 1960's. Small amounts of gold, platinum, copper, lead, zinc, graphite, rare-earths and gemstones have been found within the National Park, but all have proved to be only traces and none even approach economic viability. Some details of exploration are given in the section History of Mining.

4.8. THE DOME

South of the present National Park boundary lies a circular topographic and geological structure known unofficially to many as the Dome. It comprises concentric rings of banded quartz-magnetite gneiss, garnet-bearing-hornblende-plagioclase gneiss and a smaller part-ring of quartz-feldspar-mica schist. The structure was originally a dome from which the top has been eroded. The Dome is a well known feature of the area, and of considerable geologic interest; it would therefore be an excellent additon to the Park.

5. SOILS AND EROSION

5.1. As far as can be determined, the soils of the Rudall River catchment have not been described in detail. Most soils observed in the July 1982 survey, were skeletal clays, silts or grits derived from, and in close proximity to, the country rock.

Some detail is available on the sands, particularly the dunes, of the Sandy Deserts. This information is presented briefly under the headings Topography and Geology of this report.

The soils along the Rudall River itself, are often deep, either coarse quartz grits or layered colluvial and alluvial silts, clays, pebbles and grit.

5.2. During the July 1982 survey, a soil profile was described by Prof. A. Conacher at a location near Rudall Camp. This corresponded to a mammal trapline, hence its isolated character. As the location of the trapline was on a fairly typical rocky hill, it may be of value to present Conachers description in full.

5.3. SOIL PROFILE DESCRIPTION

Date: Friday 9 July 1982

Surveyor: A. J. Conacher

Location: Soil pit at trap line N side Rudall River ± 1000 m NE of campsite on second waterhole marked on 1:250 000 Rudall geol. map downstream of river crossing of Telfer track. Two slides show soil profile and location.

Aspect and slope: SE facing slope, northern valley-side of small tributary flowing NW into Rudall R. Slope angle 4^o midslope and at trapline position, steepening to max. 12^o downslope. Altitude between 350 and 375 m a.s.l. (Chin *et al.*, 1980, Fig. 1).

Climate: sub-arid, mean annual rainfall ± 200 mm (Chin *et al.*, 1980, p.1.). Weather - days warm and dry, probably no rain since March. Pool levels in Rudall R. low and drying rapidly. Cold night - near freezing. Clear sky.

Vegetation: Predominantly spinifex, some small white grass; a few low scattered shrubs; one stunted acacia (?); a few stunted white gums. High proportion (60-80%) bare ground between spinifex clumps.

Parent Material: Strongly foliated, retrograded quartz-feldspar-biotite (-muscovite) gneiss (1:250,000 Rudall geol. sheet). Part of Proterozoic Rudall Metamorphic Complex. Quartzite veins outcrop upslope - nearest to soil profile is 7 m away.

Soil Surface: Covered with numerous, small (> 5mm) to large (up to 10 cm +) angular to sub-angular quartzite stones, and quartzite, ironstone and weathered parent material gravels. Very little soil surface exposed. Has some black lichen/algal covering. No L, F or H layers. Soil surface well protected by stones especially, as well as by spinifex, from erosion by rainsplash, overland flow and wind. Removal of stone covering could leave soil highly susceptible to erosion by the above three agents.

A horizon: Variable thickness $\pm$ 3-5 cm. Matrix reddish brown sand, dry single-grained (structureless). Firm but breaks easily in fingers. Some fine roots (extending to upper part of C horizon and then a few at 20+ cm). Numerous small stones and gravels - predominantly weathered parent material, not quartzite. No evidence of soil fauna. Porosity impossible to determine due to stones.

A horizon merges over 2 - 5 cm into C horizon (could identify an A/C horizon), and weathered parent material extended to the base of the pit at $\pm$ 38 cm, with roots to $\pm$ 20 cm. No quartzite. Matrix colour remains reddish brown; weathered parent material white/grey with green and yellow specks or mottles. Breaks easily in figers. Dry. There are very small specks of micaceous material throughout.

Soil Type: Lithosol, with surface quartzite stones transported probably by rainsplash-induced creep from upslope vein outcrops.

5.4. EROSION

The majority of erosion surfaces examined in the Park were natural, being the consequence of water flow during the periods of intense rainfall which occur annually.

The only man-made erosion surfaces were tracks, which may duct water along wheel ruts, eventually leading to gullying. This was observed at several locations within the Park. Also of consequence was secondary damage caused by vehicles bypassing eroded tracks, or in some cases badly made tracks.

Several tracks have been installed in the Park by mining companies (without permission) and have been installed by an inexperienced bulldozer driver pushing forwards rather than "back-blading". This results in lengths of track with wide, deep corrugations which make driving extremely uncomfortable. Naturally many visitors drive alongside the track rather than on it, the undisturbed bushland being easier to drive over. The result is numerous, braided and often parallel tracks.

Minor erosion is caused by camel pads down to pools in the River. Some of these present erosion surfaces, but most disappear after seasonal flooding, to be reformed the following dry season.

6. HYDROLOGY

The hydrology of the area may be conveniently divided into: natural surface water, catchments and rockholes; and subsurface waters.

6.1. SURFACE WATERS

There has been little research into the hydrology of the Rudall River area, the only records being from Traves, Casey and Wells (1956) who state the following:

6.1.1. "The Rudall River probably represented one of the major rivers draining inland into the lake system, but it is doubtful if this river still contributes much surface water to the lakes, as its mouth is now nearly barred by numerous small braided dunes. Isolated neighbouring low hills provide the run-off to fill the lakes after heavy rains, and this intake cannot compensate for the high evaporation rate and infilling by wind-blown detritus; the size of lakes must therefore decrease."

6.1.2. "Only a small portion of the rainfall falling in the desert will be evaporated through the sands, as the surface tension of the sand will not raise water more than 40 cm. Except for isolated low rock outcrops there is little run-off. Most of the rainfall therefore drains underground to lower portions of the desert, where it evaporates at the surface and probably forms some of the isolated travertine deposits. This ground-water would eventually reach the salt lakes and keep them in a very boggy state below the salt crust."

6.1.3. "In the Rudall area, there are semi-permanent large water-holes along the course of the Rudall River: The largest of these is Coondegoon Pool. Other rockholes exist at the headwaters of this river, in granite topography."

"Christmas Pool, a permanent rockhole in the Paterson Range (50 km NW of the Park) has been a marker and reliable water-supply point for early explorers and Aborigines. It is situated in a gully, at the base of the Paterson Formation, and is filled by natural catchment from the range, as well as soak-fed by the percolation of waters through the glacials to an underlying impervious clay bed."

6.1.4. "In the desert area, rockholes were found on the top of flat-topped hills in areas of Permian and Mesozoic outcrop; they form in the pale-brown leached, jointed, and partly laterized caps of the hills, and are about 2 feet by 4 feet deep and 1 foot wide; they contain a small supply of water varying from 0 to 40 gallons (0-180 litres). The supply is obtained by natural catchment of rain water. The natives try to hide and conserve this water by covering the opening with large flat rocks; these supplies would last only for several months after rain. The rockholes in granite and metamorphic country occur normally in stream and drainage channels."

6.1.5. "A number of soaks, yielding a good supply of fresh water, were found along the eastern margin of Lakes Dora and Blanche. Dunn Soak, three miles east of the northern portion of Lake Dora, yielded 60 gph (270 l/hr) of good water; this was an old native soak (evidence of old spears, coolamons, chippings, etc., in the debris) which was cleared out and cased with a 44 gal. drum."

"A large soak producing a permanent spring exists three miles (5 km) north of Scott Bluff on Lake Blanche, and a second soak occurs five miles (8 km) east of Scott Bluff. These soaks are formed by the percolation of underground water through permeable sandstone, emerging at topographically lower places where underlying impermeable shale directs the groundwater to the surface; The soak which is reported to occur in the centre of Lake George may originate in this way. All these soaks are conspicuous by the thick, tall, green, and sometimes flowering acacias (wattles) that surround them; the presence of birds, animals, animal pads, and old native habitations gives a strong lead to their whereabouts."

6.2. UNDERGROUND WATER

6.2.1. Traves, Casey and Wells (1956) go on to describe the underground water thus:

"In the settled western part of the area, the large sheep stations utilise sub-surface waters for their main water supplies. Bores located in granite, metamorphic, and Upper Proterozoic rocks are mostly successful, shallow (less than 150 feet) and yield large supplies of "hard" stock water."

6.2.2. "In the desert area the natives have constructed their own shallow wells; they are usually situated in travertinous country. The outcrops are low and dissected and covered with wild holly (Acacia) and stunted ti-tree scrub (Melaleuca sp). The early explorers always noted the association of native wells with "limestone country and stunted, not tall, ti-tree scrub." There may be some association between the tall ti-tree (not a good sign for native wells) and the greater depth to ground water. The native wells are about 8 to 10 feet (2-3 m) deep and after the well has been cleaned out yield supplies of potable water."

6.2.3. "The possibility of obtaining supplies of underground water in the desert area is extremely good, particularly in areas covered by Permian and Mesozoic sediments.

The Permian Dora Shale may prove impervious but it is probably not thick enough to hinder drilling. It is unlikely that artesian water would be encountered, but large supplies of sub-artesian water should be present."

"Wells along the Canning Stock Route mostly encountered good supplies of potable water; most of these wells are about 80 feet (24 m) deep and the water level stands at 20 to 40 feet (6-12 m)."

6.2.4. Apart from these comments, references to the water of the Rudall River area are scarce. Rudall himself mentioned "The Rudall River is a series of deep gulches 8-10 ft deep between banks and altogether is about 200 yards (180 m) wide. There must be large quntities of water run down it in a rainy season."

Most explorers in the area (see historical section) went from waterhole to waterhole, depending almost entirely on native guides, luck or "reading" the country to find water. Without the aid of camels, many of the explorers would have died for lack of surface water.

6.3. WATER ANALYSES

6.3.1. The National Parks Authority expedition to the region in July 1982 collected several water samples which had the characteristics given in Table 3.

	LOCATION	SOURCE TYPE	TOTAL DISS. SALTS	pH	TOTAL HARD-NESS	CHLORIDE
1.	NUMBER 11 POOL	River pool in headwaters	110	8.0	38	18
2.	POOMOONERLARRA POOL	Tributary Pool	67	7.5	37	15
3.	RUDALL CAMP POOL	River pool midcourse	198	5.8	92	51
4.	COONDEGOON POOL	River pool lower reaches.	103	5.9	53	26
5.	CURRAN CURRAN	Rockhole	78	6.1	18	25
6.	EAGLE	Rockhole	70	6.5	40	15
7.	SEPARATION WELL	Groundwater	963	7.6	153	262
8.	WILDLIFE WELL	Groundwater	638	7.2	302	185

TABLE 3: Location, source type and chemical characteristics of water samples collected July 1982. TDS is conductivity (mhos/cm) X 0.55, total hardness and chloride are expressed as mg/l.

6.3.2. These samples show interesting trends. For example, all the waters from the Rudall system, samples 1 to 4, were of low concentration of total dissolved salts, relatively "soft" and of low chloride concentration.pH ranged from slightly acid to slightly alkaline.

In contrast, water trapped in rockholes (samples 5 and 6) were lower in concentrations of total dissolved salts and chloride and were softer. This probably reflects their protection from evaporation and leaching into the water, being effectively basins of rainwater caught and held. Both rockholes had aquatic flora (particularly Curran Curran) which probably helped to maintain the slightly acid pH.

Groundwater samples, although not taken from the same immediate vicinity, showed a sharp contrast in composition, being high in salts, including chlorides, and very hard compared to the surface samples. Both were slightly alkaline.

These results reflect the travertinous, calcrete substrata for underground water supplies, opposed to the comparatively fresh surface waters which are simply pools of rain water.

6.3.3. Traves, Casey and Wells (1956) noted that -

"A vertical section dug through the salt crust at the north end of Lake Dora showed:

1/8" (3mm) white layer of salt;

2" - 3" (50-75mm) gypsum crystals and silt;

9" - 15" (230-380mm) sandstone with gypsum, salt water and foraminifera (derived);

3" (75mm) sandstone, fine grained, and shale.

"A chemical analysis by I.F. Reynolds of the 3-inch top layer showed it to consist of:

NaCl	48-49%
CaSO4	44-45%
Na_2SO_4	6%

"An analysis of consolidated travertine from near Lake Dora gave 21-25% CaSO4. "

"In places on the lake surface, 1/8" to 1/4" (3-6mm) cubic crystals of halite occur, and an analysis of a collection of these showed:

NaCl	59%
Na_2SO_4	4%
H_2O	37%

The absence of gypsum in the surface crust suggests that this mineral was precipitated before the halite; as gypsum and other less soluble salts were precipitated, the residual waters would cause precipitation of almost pure halite."

7. VEGETATION

7.1. INTRODUCTION

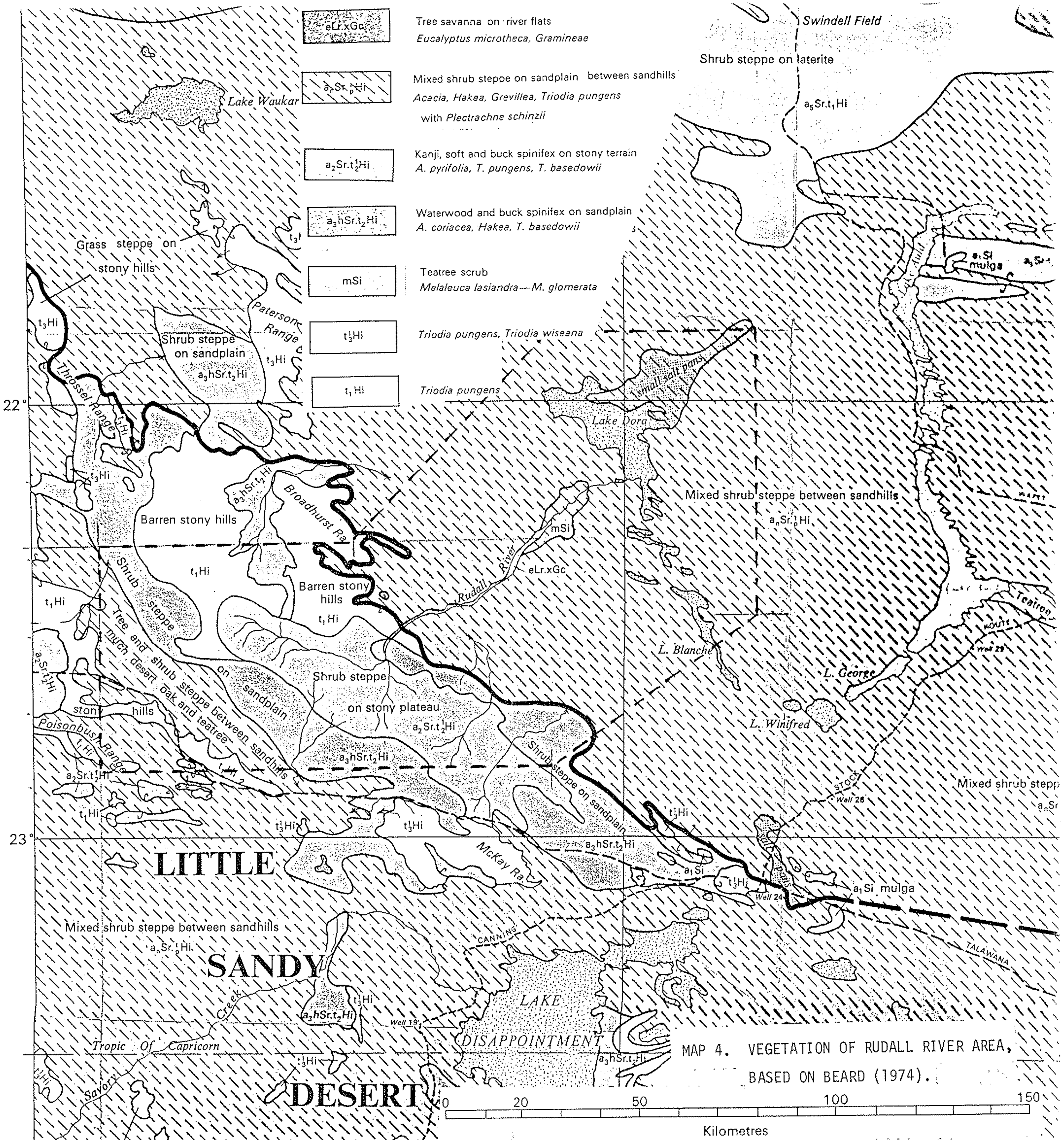
As can be seen from the accompanying vegetation map,(Map 4),the Park is divided into three basic areas. These are the Little Sandy Desert in the south-west, a central belt of stoney hills, and the Great Sandy Desert in the north-east.

The vegetation over the whole Park is basically a mosaic or variable mixture of tree and shrub steppe, either on sand dunes (in the Sandy Deserts) or on rocky hills as occur in the centre of the Park. The only variations of this assemblage of any consequence are the water courses with tree savanna, depressions with Tea-Tree scrub, and small patches of Mulga *(Acacia aneura)*.

The following description of the vegetation is derived almost entirely from Beard (1974) whose narrative cannot be improved upon.

7.2. GENERAL

Arid or semi-desert grasslands which may be termed steppe in Australia consists of 'hummock grasslands' in which the grass plants are organised into dense, rounded clumps better described as 'hummocks' than 'tussocks'. This is a peculiar life-form apparently confined to Australia. Grasses of this type are popularly know as spinifex and will be so referred to here, although they belong to the genera *Triodia* and *Plectrachne* and not to the genus *Spinifex*. The latter does occur in Western Australia, with two species, but they are confined to recent beach dunes and do not occur in the interior. In 'spinifex' steppe, each plant branches repeatedly into a great number of culms which intertwine to form the hummock and bear rigid, terete, pungent leaves presenting a serried phalanx to the exterior. When flowering takes place in the second half of the summer, given adequate rains, upright rigid inflorescenses are produced over the crown of the hummock, rising from 45-90 cm above it. The flowers quickly set seed, which is shed within two months, although this is the beginning of the dry season. The size of hummock varies considerably according to the site, from about 30 cm in height and diameter on the poorest, stoniest sites, up to about 90 cm in height and 2 m in diameter on some deep sands. One forms a visual impression that in the former case there are more clumps per unit area than in the latter, but no numerical surveys have been made. Old hummocks, if unburnt, tend to die out in the centre or on one side, leading to ring or crescentic growth. At this stage, the original root has died and the outer culms have rooted.themselves adventitiously in the soil. Individual hummocks do not touch, and there is much bare ground between, surfaced with a desert pavement in stony areas. Measurements to give the proportion of cover in spinifex vegetation would be interesting but have not been made in Western Australia. Winkworth (1967) has shown that the plant cover in spinifex grasslands in the Northern Territory ranges from 28-41 per cent. Shrubs and trees present, while conspicuous, account for 1-2 percent of the plant material.



MAP 4. VEGETATION OF RUDALL RIVER AREA, BASED ON BEARD (1974).

7.3. TREE STEPPE

7.3.1. Hummock grassland with scattered trees and shrubs. The trees reach 9m in height with spreading rounded crowns and occur erratically, often without any apparent logical pattern. The most consistent occurrence is along the upper flanks of the dunes, where a line of trees on each side of the bare top of the dune may frequently be distinguished on aerial photographs. Even these, however, are so erratic that no figures for average distribution can be given. On interdune flats, distribution varies from less than one per 2 km to groves almost forming local patches of woodland. Shrubs are always present, rather more commonly than trees, but are equally irregular. No doubt fire has much to do with the situation, coupled with difficulties of regeneration in an unreliable rainfall. Frequency of trees along the dune crests is apparently due to ability of the sand to absorb and retain moisture.. It is reported by those working in the area that the dunes are very retentive and that some 60 cm below the surface the sand remains moist almost throughout the year. On the other hand gregarious tree growth on interdune flats is said to be no indication of underground water.

7.3.2. Summits of sandridge are generally to a large extent bare and the sand there mobile, but the flanks are always well vegetated. The flora is limited. Feather-top spinifex *(Plectrachne schinzii)* is the universal plant cover, sparse to absent along the dune summits but dense on the flanks. Scattered trees of the desert bloodwood *(Eucalyptus sp*)* occur sparingly along the dune crests, mainly on either side of the bare area just within the spinifex cover. This pattern can be so pronounced that in many aerial photographs, the trees show as two parallel rows of dots along each sand ridge. This species very rarely occurs other than on dunes, but may sometimes do so on deep sand. It is a bloodwood of the woody-fruited group, allied to *E. dichromophloia,* reaching 9 m in height, with grey-white mostly smooth but partly scaly bark, and a slightly weeping habit with pendant, falcate leaves. Its distribution is highly irregular. A number of characteristic shrubs occur also. *Grevillea stenobotrya* is a large shrub to some 2 - 5 m with deeply divided sclerophyll leaves, which is so constant that it would be true to say that it will be found on every desert sandhill in Western Asutralia and is completely confined to this habitat. Other large shrubs may include, but more rarely, *Acacia salicina, Gyrostemon tepperi, Acacia stipuligera* and *A. lysiphloia.*

7.3.3. Another group of shrubs has broad, soft, silver-tomentose leaves and a spindly, little-branched habit. Typical is *Crotalaria cunninghamii* with *Newcastelia cladotricha, Sida sp., Psoralea martinii, Templetonia sp.* sub-shrubs *Dampiera cinerea, Desmodium* aff. *biarticulatum;* forbs *Trichodesma zeylanicum;* grasses include *Aristida browniana.*

Casual species from adjoining tree or shrub steppe may be found to invade the dunes.

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*The identity of this taxon is in doubt as it is summer-flowering and only fruiting material has been collected. Both Mr. C.A. Gardner & Dr. L.A. Johnston consider it a form of *E. dichromophloia.*

In the southern area a change begins to be apparent with the appearance of small ericoid shrubs, *Thryptomene maisonneuvii*, and less commonly *Calythrix longiflora* and *Micromyrtus flaviflora* among the spinifex on the south side of the dunes, presaging the complete dominance of ericoid shrubs at the expense of *Triodia* and *Plectrachne*, which becomes effective further south.

7.4. SHRUB STEPPE

In shrub steppe trees are absent or rare but there is a more prolific growth of shrubs. The shrub steppe is a 'drier' type than tree steppe and is characteristic of the desert below the 250 mm rainfall isohyet. Under higher rainfall it appears on stony ground.

7.4.1. The growth forms of the shrubs are diverse. In general they are sclerophyllous and from 1 - 2.5m in height, the majority being phyllodal *Acacia*, but the type of phyllode or leaf varies greatly between species. It is linear and shiny-surfaced in *A. pachycarpa*, broad and glaucous in *A. holosericea* and *Grevillea wickhamii*, small but flat in *A. impressa*, minute and terete in *A.lycopodifolia*, massive and terete in *Hakea suberea*. All are evergreen and leaf size is for most species mesophyll or microphyll. Disposition of the leaves is equally variable. *Hakea lorea* and *Acacia coriacea* have very thick, corky bark and resist fire, but most other species have thin, smooth bark and are killed by fire, regenerating from seed. The bark of *Acacia impressa* peels in small curling flakes like that of the well-known 'minniritchie' *A. grasbyi*.

7.4.2. Tree eucalypts, usually *E. dichromophloia* or *E. microtheca*, may occur on drainage or in depressions. *Triodia pungens* forms the ground layer mixed with *T. basedowii* down to latitude 23° south of which the latter replaces it completely. *Plectrachne schinzii* replaces *Triodia* on deeper and coarser sand. Where sandhills are present they continue to bear the same tree steppe association of desert bloodwood and spinifex as has been described previously. As most of the subsidiary species other than those which act as indicators tend to occur in an apparently indiscriminate manner throughout the various communities, it seems best to present a general initial list of components and to confine subsequent notes on communities to details of their distinctive characteristics. Otherwise there would be too much wearisome repitition.

7.4.3. Tall shrubs, 1 - 2.5m, sometimes taller: *Acacia pachycarpa, A. impressa, A. holosericea, A. ptychophylla, A. luerssenii, A. stipuligera, A. tumida, A. umbellata, A. dictyophleba, A. patens, Carissa lanceolata, Cassia desolata, C. glutinosa, Eremophila latrobei, E. platycalyx, E. leucophylla, Clarodendron tomentosum, Grevillea refracta, G. wickhamii, Gyrostemon tepperi, Hakea macrocarpa, H. suberea, Notoxylinon astrale, Petalostyles millefolium.*

Dwarf shrubs, low and spreading, 60 cm; *Acacia xylocarpa, A. translucens, A. lycopodifolia, Jacksonia aculeata, Cassia notabilis, Indigofera monophylla, Cleome spinosa, Hibiscus sturtii.*

Sub-shrubs, with soft stems and foliage rising from an underground rootstock: *Halgania solanacea, Goodenia azurea, Dicrastyles gilesii, D. exsuccosa, Goodenia ramelii, Newcastelia cladotricha, N. spodiotricha, Tephrosia uniovulata, T. brachycarpa, Dampiera candicans, Corchorus sidoides, Keraudrenia integrifolia, Ptilotus calostrachyrus, P. schwarzii, Psoralea martinii, Mollugo molluginis, Dampiera cinerea, Brachysema chambersii.*

Forbs: *Ptilotus exaltatus, P. asterolasius, P. alopecuriodeus, P. clementii, Gomphrena canescens, Brunonia australis, Trichodesma zeylanicum, Pterigeron macrocephalus.*

Grasses: *Eriachne* aff. *helmsii, Eragrostis eriopoda.*

Species of trees as noted in the descriptions of tree steppe can occur locally on drainage in shrub steppe country.

7.4.4. Other types of shrub steppe

7.4.4.1. *Acacia pyrifolia - Triodia* association

This association does not belong to the Great Sandy Desert, occurring typically on granite in the Pilbara further to the west. The 'kanji' bush, *A. pyrifolia*, is characteristic in association with *Grevillea pyramidalis* and *Hakea suberea*, and several species of *Triodia*, most commonly *T. pungens*. In the Great Sandy Desert the *A.pyrifolia* association occurs locally on and around the Throssell, Broadhurst and Mackay Ranges which represent an extension of Pilbara rocks into the desert.

7.4.4.2. *Acacia coriacea - Hakea suberea - Triodia* association

The first two character-species of this association are small trees or large shrubs attaining 3 - 3.5 m in height. They are both fire-resistant and thus less ephemeral than most desert shrubs. The occurrence is on low-lying sandplains, around the Mackay and Broadhurst Ranges. However, this is also a component of mixed shrub steppe. The ground layer is either *Triodia pungens* or *T. basedowii* or both, according to latitude. Associated plants noted are: *Acacia ptychophylla, A. pachycarpa, A. stipuligera, A. luerssenii, A. patens, Hakea macrocarpa, Melaleuca lasiandra, Petalostyles millefolium.*

7.5. TREE SAVANNA

Tree savanna, a grassland with a few scattered trees, occurs in the Great Sandy Desert only in association with active creeks and rivers and is thus restricted to a few particular localities such as along the Rudall River where it flows from the Broadhurst Range towards Lake Dora.

FIGURE 5. View south-west from crest of a sand ridge east of Mt. Eva. The dune is of soft red sand, well covered with vegetation on the slopes, but fairly open on the crests. There are several species of shrubs found only on the dune crests. The plain is covered with *Triodia* spp in the foreground (yellow) and *Plectrachne schinzii* (white) in the distance.

FIGURE 6. *Plectrachne schinzii* plain with scattered Coolibah and Grevillea spp. trees. Seed production from the *Plectrachne* is enormous, and is a major food source for granivorous fauna.

FIGURE 7. *Triodia pungens* plain with scattered Coolibah trees. Here the soils are more compact and clayey than on the *P. schinzii* plains. This assemblage of plants is more common along the base of hills (as above) where colluvium has accumulated.

FIGURE 8. Soft grass area(*Themeda australis)* with scattered trees and numerous shrubs, especially *Crotalaria cunninghami* and often *Grevillea wickhami*. This assemblage is often in sandy, but poorly drained, sites.

On stream banks and around permanent pools the river gum *(Eucalyptus camaldulensis)* is characteristic, replaced by coolibah *(E. microtheca)* on flats more removed from the river, on minor creeks and billabongs. These are both large, white-barked trees attaining some 18 m, bark of *E. camaldulensis* has a greenish tinge, while *E.microtheca,* north of the desert (but not south of it) bears a rough blackish bark on the butt. On clay-soil flats adjacent to creeks, smaller trees and shrubs replace the eucalypts., such as an unidentified *Acacia, A. stenophylla,* and *Eremophila bignoniiflora.*

7.6. TEATREE SCRUB *(Melaleuca lasiandra - M.glomerata* association)

This scrub association is found in valleys and depressions where there is some evidence of ground water. It typically surrounds, for example, the wells of the Canning Stock Route. Travertine is usually found below the sand at shallow depth in these areas. The shrubs rarely exceed 2 m in height, are very dense and spreading, and frequently almost touch one another. *Melaleuca lasiandra* . is the commonest species, with much *M. glomerata.* Frequently no other shrubs occur, but *Acacia salicina, Hakea microneura, Santalum acuminatum, Lamarchea sp., Cassia spp.* and even small trees of *Eucalyptus microtheca* may be found. The ground is usually well covered with spinifex plants, *Triodia pungens, T. basedowii,* or both. *Plectrachne schinzii* appears to avoid this habitat.

7.7. MULGA

Mulga *(Acacia aneura)* association is not common and only seen during this survey as a small area about 20 km south of Mt. Eva. and another small patch just south of the Dome. It is rarely found growing in sand and is typically associated with red loam soils overlying siliceous hardpan. The stands were too small to have typical associated understorey species.

FIGURE 9. Goondegoon Pool in the lower reaches of the Rudall River. Banks are clothed with *Eucalyptus camaldulensis* trees and scattered *Erythrina vespertilio*. The water, although shallow in some parts, has a great diversity of invertebrate fauna, as well as deeper areas with many birds.

FIGURE 10. Number 11 Pool, in the headwaters of the Rudall River. This is probably the only pool within the Park big enough to sustain a mobile ranger for any length of time.

8. FLORA

8.1. No detailed studies or collections of the flora have been made. However, Beard (1974) lists many typical species found in certain associations. These are presented in chapter 7 (Vegetation) in this report. Additionally, there is now available a book "Flora of Central Australia" (1982) which provides keys to most of the desert species and which undoubtedly covers the majority of flowering plants in the Park.

During the July 1982 survey, lower plants were examined extensively as these are generally poorly collected. Results are presented below.

8.2. LICHENS

The following species were collected in, or near the Park.

Parmelia aff. *globulifera* Kurokawa and Filson.

A green, crusty lichen collected from sandstone rocks at Christmas Pool, 50 km north of the Park. The *Parmelia* genus is currently under revision, thus the species name is uncertain. This is a new locality record for *P. globulifera* if the name is retained.

Peltula sp.

This non-fruiting specimen also from Christmas Pool, is common throughout semi-arid regions. Presently the most easterly record is at Giles Meteorological Station some 600 km south-east of Rudall River.

Spilonema sp.

This non-fruiting species was collected from Duck Pool, on Coolbro Creek, just north of the Park. It is common and widespread in the desert but is poorly collected as it is easily overlooked. It was growing on hard compact clay on the riverbank.

Lichenothelia sp

Again this specimen was not fruiting; precluding accurate identification. This collection was only the second record from Western Australia, the other being from the Pilbara. It was taken from a quartz pebble near Number 11 Pool, within the Park.

8.3. ALGAE

Freshwater algae were collected from various pools and waterholes in and near the Park.

Slime algae recorded were *Spirogyra* (2 species) from Number 11 Pool, and *Oodigonium* sp. from Eagle Rockhole. As there are no algologists in Australia proficient in these genera, specimens are being retained by the University of Western Australia for future examination. Brittle algae recorded were *Nitella* affin. *lhotzkyi* at Number 11 Pool, and *Chara* spp.at Curran Curran Rockhole and in pools along the Rudall River.

8.4. FUNGI

Despite extensive searches, only two fungi species were collected in the Rudall River National Park. This was not too surprising as the last previous heavy rains (Telfer data) were in late February, some four months before this survey.

Fungi collected were:

Dycnoporus sanguineus Scarlet Bracket Fungus
This common and widespread species was collected on a piece of rotting *Eucalyptus camaldulensis* wood at Rudall Camp.

Thelephoraceae - genus indet.
This white, cottony fungus was growing on a rotting *E. camaldulensis* log in the river bed at Rudall Camp.

Although fungi are undoubtedly scarce for most of the time in the desert areas, future searches may well produce interesting collections. For example, during the July 1982 trip, a *Boletus* sp. was collected in the Gibson Desert. This genus is generally restricted to much wetter climates and is extremely unusual for desert areas. Additionally, the *Boletus* may have been mycorrhizal on Coolibah, *Eucalyptus microtheca*, a relationship of considerable scientific importance. This discovery exemplifies the potential value of further fungal studies in desert regions.

9. FIRE HISTORY

The absence of visitors to the area means that records of fires are scanty. Examination of airphotographs shows large, old, fire patterns similar to those observed throughout the Pilbara. Anderson and Muir (1981) record that most fires in the Pilbara are caused by lightning strikes and burned on the average 3 - 4000 ha. There is every reason to suspect the situation is similar in the Rudall River National Park region.

Ground observations show traces of old fire scars on trees throughout the Park and recent small fires (less than two weeks old) were observed at several locations during the July 1982 survey.

The area is still visited occasionally by Aborigines who light spinifex fires, and mining companies light fires to burn away the spinifex to expose the underlying geology.

One must conclude that fires are not frequent, but when they occur they are generally widespread and fairly intense. Most would probably occur in summer (wet season) from lightning or in winter (dry season - May to October) from visitors.

It is of interest to note that a fire caused by lightning in May 1982 (G. Legge pers. comm.) burnt the spinifex country, but stopped on the edge, and did not penetrate into, a stand of Mulga trees *(Acacia aneura)* near Curran Curran Rockhole. Although the fire was fairly intense, this observation suggests that Mulga stands may be burnt less frequently in some circumstances.

10. WEEDS

Weeds are virtually absent from the Park. The only weed species noted were infrequent small clumps of Verbenaceous plant known locally as "camel plant" or "saddle bush". The species is reputed to be of Asian origin, being introduced in the stuffing of camel saddles. Some pastoralists report that it is only found along pathways used by early explorers, and along modern roadsides. Certainly the July 1982 expedition only noted it along tracks, even in isolated areas.

A single clump of plants of a water-melon-like species (probably *Cucumis sp)* was recorded near the northern boundary of the Park near the Telfer Track.

Along the banks of the Rudall River occasional thistles *(Sonchus sp)* were noted.

11. VERTEBRATE FAUNA

As there has been no comprehensive survey of Rudall River National Park, the information presented below is derived from private field notes, Western Australian Museum records and other sources.

11.1. Information on birds is fairly comprehensive, there having been several ornithologists visit the area. Up to the present, 72 species of birds have been recorded in the Park, and these are listed together with annotations, in Appendix 1.

Storr (1981) states that the Great Sandy Desert probably has an avifauna of fewer than 90 species, and feels that this low number reflects the extreme harshness of the environment; no other part of Australia being so inimical to birdlife as this land of great summer heat and little or no surface water.

11.2. Reptiles similarly have few records, only two frogs, 9 lizards and one snake being actually recorded in the Park, all in July 1982. However, from records of Lake Disappointment, in similar habitats, it is likely that 3 species of frog, 31 reptiles and 3 snakes may eventually be identified from the Park.

An annotated list of reptiles is presented in Appendix 2.

11.3. Mammals are also scarce, and again there are few records. Data from various sources e. g. McKenzie *et al.* (1979) suggests that up to 11 native mammals may eventually be recorded. An annotated list of mammals is presented in Appendix 3.

A most interesting and important record is that the Bilby or Rabbit-eared Bandicoot *(Macrotis lagotis)* may also still exist in the area. This once widespread animal is now restricted to a small population near the Northern Territory-Western Australian border. Its decline is believed to be a result of introduced disease and feral cats.

11.4. As suggested by Storr above, the low numbers of animals indicate the extreme harshness of the environment. High summer temperatures, and lack of rainfall throughout the year prevent most animals from surrounding regions to penetrate the desert. The opportunistic species e.g. Zebra Finch, those highly adapted e.g. Camels, and those specialised to tolerate extreme heat, eg. the lizard *Amphibolurs isolepis gularis* are the major inhabitants.

12. INVERTEBRATE FAUNA

12.1. There were no collections of invertebrates in the Rudall River area prior to the July 1982 expedition. At that time, effort was made to collect any terrestrial or aquatic invertebrates encountered, so that permanent records of species may be available to science. All specimens were lodged in the Western Australian Museum. It is expected that many, if not most of the animals collected will be new to science.

For general information, and to assist researchers, the following guide to collections is presented.

12.2. INSECTS

ORDER	NUMBER OF TAXA
Apterygota (wingless insects)	
Collembola (Springtails)	8+
Thysaneura(Silverfish)	4
Pterygota (winged insects)	
Odonata (Dragonflies etc.)	7
Dictyoptera (Cockroaches, Mantids)	7
Isoptera (Termites)	5
Orthoptera (Grasshoppers, Locusts)	8
Coleoptera (Beetles)	12+
Plannipennia (Antlions)	5
Trichoptera (Caddisflies)	3
Lepidoptera (Moths, Butterflies)	26
Diptera (Flies)	5
Hymenoptera (Wasps, Ants)	18
Heteroptera (Bugs)	5
	113 +

TABLE 4: Number of taxa of insects collected in Rudall River National Park - 6-12 July, 1982.

A total of 113 taxa of insects is not high despite careful searching and opportunistic collecting by 3 - 4 people. It can only be concluded that the insect population was not abundant.

12.3. MOLLUSCS (SNAILS, MUSSELS, ETC)

No land snails were recorded, but aquatic snails were collected from several waterholes and from pools along the Rudall River. Most were under stones, or crawling along the creek bed, or on rocks. All specimens collected were a previously undiscovered species of *Physastra*.

12.4. CRUSTACEA (SHRIMP, CRABS ETC)

No large Crustacea were collected, all being microscopic or up to a few millimetres in length. Many thousands of specimens were collected by hand net from various pools and rock holes, and years of work will be necessary for identification. It is expected most will be new to science. Crustacean groups represented include Cladocera (water-fleas), Ostracoda, Copepoda (Cyclopids) and Amphipoda (jumpers). The only aquatic crustacean so far determined from the collection was a new and undescribed species of *Cyzicus*, a small animal resembling an animated, swimming clam. They are about 3mm long.

Two specimens of terrestrial crustaceans; Isopods (woodlice) were collected under a stone. They are also new to science.

12.5. SPIDERS, CENTIPEDES ETC.

Only 13 species of spiders, centipedes, etc. were collected despite intensive searching. Like the insects, this reflects low numbers, probably because of the harsh environment. Material has been distributed to the appropriate specialists and details of taxa are awaited.

13. EXOTIC FAUNA

13.1. INTRODUCTION

There are no previous records available of vermin within the Rudall River National Park. Some historic records are of interest however, and suggest a long and well established presence of cats and camels in the area.

13.1.1. David Carnegie, for example, records the presence of feral cats in isolated parts of the desert in 1896, even recording one being found in a burrow of the Bilby or Rabbit-eared Bandicoot *(Macrotis lagotis)*. (Carnegie 1898). This now rare animal is believed to have declined in numbers partly as a consequence of predation by cats. Rudall also recorded seeing a cat about 40 km south-east of Braeside Station in 1897.

13.1.2. Camels also have a lengthy history, a few being imported by South Australia in 1840. Then in 1860, the Victoria Government brought in 24 animals from Karachi for use by the Burke and Wills expedition across the continent. The first large scale importation of camels was in 1866 when Thomas Elder imported 124, with the object of starting a camel stud. This operation was successful and eventually led to distribution of camels to all States (Frith, 1973).

Two camels from the Burke and Wills expedition escaped, and undoubtedly began the continual trickle of lost animals. Finally by 1920, railways and motor vehicles had reduced the value of the camels and many "kind-hearted" owners released the animals rather than destroy them. (Frith, 1973). In 1969, McKnight (1969) estimated a population of some 20,000 plus feral camels in central Australia.

13.2. EXOTIC FAUNA STATUS IN 1982

Staff of mining companies operating in the Park, residents of stations to the west, and past visitors were questioned on aspects of vermin. Additionally, the Park was examined in July, 1982. The following conclusions were reached:

13.2.1. Donkeys *(Equus asinus)*

There is no evidence of donkeys in the Park, although feral donkeys were sighted near Mt. Sydney, west of Telfer, and are reported to penetrate east from the station country to about the western boundary of the Park.

There is no requirement for control at present, but it is possible they may gradually penetrate into the headwaters of the Rudall River, thence eastwards.

13.2.2. Cattle *(Bos taurus)*

Feral cattle are reported to come to near the western boundary of the Park, but not to penetrate into it. It is conceivable that in conditions of a very wet year, stock may enter the headwaters of the Rudall River, then travel downstream, at least until dry years eradicate them.

13.2.3. Camel *(Camelus dromedarius)*

Camels are common in the Park, from single animals to herds of up to 60 being recorded, and tracks and faeces abundant. Their distribution appears to be mainly in rocky country near water but some preference for sandy country near water has been noted. All are wide ranging and nomadic.

The broad, flat foot of the camel appears to do little damage to the environment, except on pads to water holes. There is an obvious preference to running on vehicle tracks rather than across country. The main effects of camels are from the quantity of water they consume, and their browsing habits. A single individual may consume up to 78 litres (17 gallons) at a time (Carnegie, 1898), thus a large herd may empty a small waterhole on a single visit. Being nomadic and able to survive long periods without water, the herd will then move to another waterhole.

The diet of camels is non-selective, but Mulga *(Acacia aneura)*, and succulent water-containing species are favoured. Camels may tear branches from trees in order to gain the foliage.

In Rudall River National Park camels are sufficiently numerous to be competing with native fauna, especially for water. As the country has no value for domestic stock, control probably could not be undertaken by the Agriculture Protection Board, but would need to be done through the National Parks Authority.

13.2.4. Cat *(Felis cattus)*

Cats have been seen regularly by all visitors to the Park, either directly, or from skeletons, footprints or scats. Indications are that they tend to be commonest around waterholes, where they prey on birds coming to drink, or in rocky areas where they probably feed on native mice, reptiles and nesting birds.

Tabby and ginger cats are commonest, and may be of large size. Eradication is difficult, opportunistic shooting being the most effective.

13.2.5. House Mouse *(Mus musculus)*

House mouse not recorded in July 1982.

A geologist at AGIP camp mentioned "a mouse" which attacked foodstuffs, although he had not seen it. McKenzie *et al.* (1979) did not record house mice at Lake Disappointment during their surveys. It is yet to be determined if house mice have penetrated into the Rudall River National Park.

13.2.6. Fox *(Vulpes vulpes)*

There are no records of fox in the Park, but a set of tracks, possibly a fox, were noted near Curran Curran rockhole in July, 1982.

13.2.7. Rabbit *(Oryctolagus cuniculus)*

No evidence of rabbits was recorded anywhere in the Rudall River National Park. However, old scats were noted at Separation Well (22^{o} 51' 15" S, 124^{o} 00' 55" E) located some 30 km east of the Canning Stock Route in the most isolated of desert. If rabbits can penetrate to this most remote location, they almost certainly will eventually reach the moister locations along the Rudall River, at least in wet seasons.

14. ABORIGINAL OCCUPATION

14.1. Aboriginal people who once occupied the area of the present Rudall River National Park consisted almost entirely of the Warnman linguistic group. Warnman natives belonged to a tribe which ranged from the headwaters of the Rudall River south to about the 23° parallel, across to the Canning Stock Route then north to take in Lakes Dora, Blanche, George and Auld. Few Warnman people remain to-day, these being scattered between Jigalong, Strelley and La Grange missions. The natives still retain a strong interest in the area however, and have an appointed Aboriginal guardian to protect and maintain the sites within their tribal grounds.

The extreme southern edge of the Park probably overlaps into the Gardudjara-Budidjara tribal area, although there is some debate as to location of the tribal boundaries.

14.2. Tonkinson (1974) says that:

"The Aborigines believe that the Western Desert was criss-crossed by a tremendous amount of Dreamtime traffic. An individual knows best the myths and songs involving sites in his own home territory.. Western Desert Aborigines attribute their cultural homogeneity to the fact that the ancestral beings roamed over wide areas and frequently came into contact with one another. During such meetings they exchanged sacred and non-sacred objects, song lines, rituals and decorations, thus spreading these cultural elements to the extremes of the desert and beyond."

14.3. Two of these Dreamtime traffic routes are in the Park area, one, Wadi Gudjara (Two men) journey following the Rudall River, the other, Two Snakes, involving Lakes Dora and Blanche. Lake Dora is, in fact, believed to be the place where the Two Snakes disappeared beneath the ground.

14.4. The National Park is at present known to contain within its boundaries 28 registered Aboriginal Sites, including 15 secret-sacred sites, as well as artefact scatters, rock art etc.

The Western Austalian Museum, and the National Parks Authority do all in their power to protect these sites, but isolation and difficulty of access make policing difficult. However, inspection of some of the sites in 1982 suggested that vandalism was minimal, probably because isolation filters out all but the more dedicated and interested of travellers.

14.5. EAGLE ROCKHOLE

Just south of the present National Park is a waterhole, cave and prominant hill known by the Aborigines as Bangu. Three important mythological sites and a sacred-hoard respository are associated with the waterhole. The abundance of Eagles noted by most visitors suggests the name Eagle Rockhole would be suitable. There would be advantages for protection of the Aboriginal sites if Eagle Rockhole was included in the National Park.

FIGURE 11. Part of a circular stone arrangement near Number 11 Pool. The Aboriginal Sites Department of the W.A. Museum had no previous record of this site prior to the July 1982 survey.

FIGURE 12. Mr. R. Sharpe, an expedition member replacing a copper plaque in memory of Mr. A.O.C. Ives, prospector. Refer to history section in this report for details.

15. HISTORY

15.1. INTRODUCTION

Pre-European history of the Rudall River area is briefly mentioned in Part 14, Aboriginal Occupation.

It is unlikely that any European visited the Rudall River area prior to 1896/1897 when W.F. Rudall and F.H. Hann visited it at the same time. It is possible however, that a traveller from one of the cattle stations in the region may have penetrated this far east, before this time; for example, Braeside Station, 200 km north-west of the Park was well established, and provided the starting off point for Rudall's journey in 1896.

The explorers who contributed most to naming of features within the Park were W.F. Rudall, and F.H. Hann. Some details of their journeys are presented below.

15.2. W. F. RUDALL

Rudall, on the request of the then Commissioner for Lands, Mr. A. N. Richardson, set out in search of members of the lost Calvert Expedition.

Rudall made two trips into the vicinity of the present National Park. On the first trip he arrived at, and named, Christmas Pool, located about 50 km due north-west of the Park, on Christmas Day, 1896. He then headed east and arrived near Lake Dora on 29 December, continued east for some distance, then returned to Christmas Pool on 7 January, 1897.

On the second trip, Rudall reached the headwaters of the Rudall River, naming Watrara Creek on 19 April, 1897, and apparently searching out from this area, as he named Hanging Rock on the western boundary of the Park, on 28 April, 1897.

From the headwaters, Rudall travelled downstream finding a large camp of natives at Poomenerlarra Creek on 3 May, 1897, then travelled towards Lake Dora, visiting several pools in the river along the way. He named Nimeragnarra (now Numeraguarra) Pool, Coonde Coora (now Coondegoon) Pool and Whylaggra Pool, camping at the latter.

Rudall stated in his diary that "The Rudall River is a series of deep gulches 8-10 ft. between banks and altogether is about 200 yards wide. There must be large quantities of water run down it in a rainy season."

After exploring along the River, Rudall went south-east blazing a tree "R3" somewhere near Mt. Eva. The location of this tree is uncertain.

Rudall reached Lake Dora on 27 May 1897, and circumnavigated it as it was too soft to cross. After further searches towards Separation Well, about 120 km east of the Park, he returned via Mt. Eva arriving back at the Oakover River on 20 July, 1897, meeting F. H. Hann on the way.

Some of the features named by Rudall are listed in Table 5.

15.3. F. H. HANN

F. H. Hann, a versatile and wide-ranging prospector, surveyor and explorer, passed through the area of the Rudall River National Park in 1897, naming many features as he went.

He entered the Broadhurst Range on 31 May, 1897, then went south to the Rudall River, thence north-east to Lake Misery arriving there on 10 April, 1897 (Hanns Lake Misery was later named Lake Dora by Rudall, after Rudall's fiancee Dora McPherson). Hann then back-tracked to somewhere near Miles Ridge, then turned south, reaching Mt. Eva on 15 April. After prospecting for gold near Mt. Eva, he headed south, leaving the Park and reaching the McKay Range on 19 April. From there he continued south and west and in fact, bumped into Rudall's party searching for the lost Calvert Expedition. Hann met Rudall and his assistants Connaughton and Crofton at Meeting Gorge, on 27 April, 1897, and stayed with them for a short time before continuing. Rudall described in his diary that F. H. Hann "was a hardy old bushman about 60". To traverse this desert country "a howling wilderness" as described by Carnegie, was indeed an incredible feat for a man of sixty.

The features Hann named are listed in Table 5.

15.4. It is of interest that A. C. Crofton and J. Connaughton, Rudall's assistants, carved their names in sandstone at Christmas Pool, together with the date 15 April, 1897. Other names carved at Christmas Pool include that of H.W.B. Talbot and the date 14 July 1911; the geologist who accompanied Canning on the Stock Route survey in 1908, and was F.H. Hann's assistant during the 1897 visit.

Another name, H.S. Trotman and the date 25 December 1896, is a record of Rudall's expedition, Trotman being his assistant on the Calvert search.

Two other names are present, those of J. Mathews and W.J.Grace, prospectors who visited Christmas Pool on 11 July, 1905. Grace was later killed by Aborigines in the McKay Range, just south of the Park.

Two later explorers have also left their mark on the exploration of the Rudall River area, A.O.C. Ives and G.S. Compton.

15.5. A.O.C. IVES

Little is recorded of Alfred Oliver Cromwell Ives, a prospector originally from Wimbledon in England, who came to Western Australia after the First World War and who visited the Rudall River area in 1937-1939.

At Number 11 Pool, a copper plaque bearing the following inscription was found partly embedded edge-on in the bark of a river gum.

> Erected by Noel Leslie Ives and
> Robert Dennis Ives, on the prospecting
> trip following maps and diaries of
> Alfred Oliver Cromwell Ives who
> prospected this area with camels in
> 1937, 1938, 1939
> Dated July 19, 1970 at Chingie-acha-jarrah Rockhole

Attempts to trace further information on A.O.C. Ives have largely been unsuccessful. Members of the July 1982 expedition removed the plaque from the tree, and replaced it flat on the tree trunk with stainless steel screws.

15.6. G. S. COMPTON

Mr. G. S. Compton was born on 6 May, 1891 at Southern Cross.

Between 1910-1915 he worked his way up from labourer to assayer and mill foreman in numerous mining areas, mostly in the Kalgoorlie goldfields.

He also graduated from the University of Western Australia, and the Western Australian School of Mines. His competency in geology was widely known, and he lectured at Perth Technical College and the W.A. School of Mines for many years.

Compton was widely travelled, and passed through the Rudall River area in 1955. Later in life his interests turned to history of mining and on 4 May 1971 (two days before his 80th birthday) he received an MBE for his contribution to the history of the Goldfields. Numerous publications are credited to his name.

When exploring and prospecting in the Rudall River area, Compton named Larry Creek, Poynton Creek, Clayton Gulley, Three Sisters Hill, Comptons Pinnacle, Number 11 Pool, Miles Ridge, Watrara Rockhole and Talbot Saok. Most are named after Compton's associates, and are listed in Table 5.

TABLE 5: LOCATION AND ORIGIN OF NAMES OF MAJOR FEATURES WITHIN RUDALL RIVER NATIONAL PARK

FEATURE	LAT.	LONG.	NAMED BY:	DATE	REMARKS
BLUFF, Scott	22^{o} 27'	123^{o} 14'	W.F. Rudall	1897	
CREEK, Cotten	22^{o} 48'	122^{o} 35'	F. H. Hann	1897	Not mentioned in diary
Larry	22^{o} 37'	122^{o} 17'	G.S. Compton	1955	
Poomenerlarra			W.F. Rudall	3.5.1897	Aboriginal name
Poynton	22^{o} 33'	122^{o} 20'	G. S. Compton	1955	
Watrara	22^{o} 30'	122^{o} 03'	W. F. Rudall	19.4.1897	Aboriginal name
GULLEY, Clayton	22^{o} 29'	121^{o} 59'	G. S. Compton	1955	
HILL, Tabletop	16^{o} 33'	125^{o} 10'	F. H. Hann	1898	Descriptive of hill.
Three Sisters	22^{o} 29'	121^{o} 57'	G. S. Compton	1955	
LAKE, Blanche	22^{o} 31'	123^{o} 12'	W. F. Rudall	1896	Taken from a letter from Mrs. Barbara Rennie (Great Grand neice of W.F. Rudall) named after Mrs. Robertson of Rosenthal (now Rosedale) near Gawler in South Australia.
Dora	22^{o} 02'	122^{o} 57'	W. F. Rudall	25.5.1897	Originally named Lake Misery by F.H.Hann 10 April, 1897. Renamed Lake Dora by Rudall, after his fianceė Dora McPherson.
Eva Broadhurst	22^{o} 13'	122^{o} 56'	F. H. Hann	9.4.1897	Frank Hann originally called this Eva Lake - see note on Broadhurst Range below. Mentioned by Rudall as Eva Lake on 6 May, 1897.

FEATURE	LAT.	LONG.	NAMED BY:	DATE:	REMARKS:
MOUNT Connaughton	22^{0} 49'	122^{0} 44'	W. F. Rudall	1897	Mr. Connaughton was one of Rudall's party while searching for the lost Calvert expedition. F. Hann shows Mt.Connaughton on his map (17 April 1897) but does not mention it in his diary.
Eva	22^{0} 42'	122^{0} 37'	F. H. Hann	1897	Originally called Mt. Eva Broadhurst. Later the name Mt. Eva was selected by the Dept. of Lands & Surveys, as there were numerous features named Eva Broadhurst by Hann, leading to confusion.
PINNACLE Comptons	22^{0} 24'	122^{0} 12'	G. S. Compton	1955	The only feature Compton named after himself.
POOL, Coondegoon	22^{0} 29'	122^{0} 31'	W. F. Rudall	4.5.1897	Aboriginal name: Rudall originally spelt it Coondecoon
Numeraguarra	22^{0} 29'	122^{0} 31'	W. F. Rudall	3.5.1897	Aboriginal name.
Number 11	22^{0} 30'	122^{0} 04'	G. S. Compton	1955	Found by Rudall 1897 but not named.
RANGE, Broadhurst	22^{0} 13'	122^{0} 10'	F. H. Hann	4.4.1897	Hann originally called the north end of this Range Broadhurst and the southern end Eva Broadhurst. The Dept. of Lands & Surveys had adopted the former name for the whole Range. Hann marked a tree $\frac{\text{F.H.}}{\text{XII}}$ in this vicinity.
Harbutt	22^{0} 54'	122^{0} 44'	F. H. Hann	17.4.1897	
Mt. Sears	22^{0} 20'	121^{0} 25'	F. H. Hann	3.4.1897	

F EATURE	LAT.	LONG.	NAMED BY:	DATE:	REMARKS
RANGE, Poison Bush	22^{o} 48'	121^{o} 39'	F. H. Hann	27.4.1897	On F.H. Hann map but not mentioned in journal.
Wells	22^{o} 54'	121^{o} 55'	F. H. Hann	25.4.1897	On F.H.Hann map, but not mentioned in journal. Named after L.A.Wells leader of the Calvert expidition 1896.
RIDGE, Miles	22^{o} 29'	122^{o} 20'	G.S. Compton	1955	
ROCK, Hanging	22^{o} 30'	121^{o} 40'	W. F. Rudall	28.4.1897	
ROCKHOLE, Watrara	22^{o} 30'	122^{o} 01'	G.S. Compton	1954	
Desert Queens Bath	22^{o} 28'	122^{o} 15'	J. P. Turcaud	1970	Mr. Turcaud, a prospector, named the secluded pool from a line from a poem which read "where the Queen of the desert comes to bath".
SOAK, Dunn	22^{o} 03'	123^{o} 09'	Bureau Min.Res.	1954	Named by Bureau of Mineral Resources after an Aboriginal Guide from Marble Bar.
Talbot	22^{o} 32'	122^{o} 24'	G.S. Compton	1955	Named after H.B. Talbot, a geologist.
TRACK, Talawana	Near S. boundary Park		See remarks		Talawana Pool named by Rudall 17.2.1897. A.W. Canning named Talawana Creek in reference to the pool in 1904. Name of track probably arose by reference to these two sites, which the track is near.

16. HISTORY OF MINING

16.1. A large temporary Reserve No. 6558 and several smaller tenements predate the gazettal of the National Park. The largest tenement was declared on 14 April, 1977, only eight days before the Natonal Park was gazetted. This sparked off a controversy when Conzinc Riotinto Australia Pty. Ltd. showed interest in the TR and led to considerable examination of the priorities of mining and reservation.

16.2. Nonetheless, the Rudall National Park was officially declared open to mining on 25 November, 1977 and led to CRA lodging Applications to Mine on 5 January, 1978. According to the Mines Department, although all National Parks are effectively open to mining under both the 1904 and 1978 Mining Acts, this is the only one officially declared so.

16.3. Meetings to establish the conditions under which CRA and other future mining companies should operate were established at a meeting held between interested parties on 9 June, 1978, and were publicly announced by the Premier, Sir Charles Court on 7 November, 1978.

16.4. Additionally, the then Hon. Minister for Mines in a memo. to the Minister for Conservation and the Environment, agreed on 8 March, 1979 that all future tenements within the park would be referred to the National Parks Authority. Subsequently, on 27 August, 1970, the Mines Department notified the National Parks Authority (with conditions enclosed) of a proposed tenement by Occidental Minerals Corporation. This illustrates that the Mines Department will notify us, and that the conditions of approval are known.

16.5. Dr. Start's investigations in September 1980 showed that interests in the Park were held by:

a) Occidental Minerals Corporation (as above)

b) Conzinc Riotino Australia Pty. Ltd. still showed interest and were exploring;

c) Mobil Energy Australia Pty. Ltd. (Geopeko):the companies held TR's 7770-7774. These were approved on 1 August, 1980. National Parks Authority was not notified.

d) Mr. D. O'Mara, a single small tenement. National Parks Authority was not notified.

Thus, of the four tenements existing at September 1980, two were not referred to the National Parks Authority.

16.6. Upon examination of the Park in July 1982, two additional companies Aquitane and Agip were found to have camps within the Park. Neither have had tenements referred to the National Parks Authority. Thus, of the six applications known to us, four have not been referred or approved. Map 5 shows existing tenements within the National Park.

16.7. CONSEQUENCES OF PAST MINING

The major consequences of past mining activities are the installation of tracks, and the CRA campsite near the Rudall River.

16.7.1. Tracks are numerous in several areas of the Park, forming anastomosing and frequently duplicated accessways to places of geological interest. Tracks usually deteriorate after use, resulting in numerous bypasses and severe erosion of old tracks, producing deep gullies. An airstrip has been installed in the Park and is in reasonable condition, but is not currently used.

16.7.2. A campsite, resulting from a mining tenement does not conform with the conditions set down by the Premier in November 1978.

Conditions included, for example:

a) no camping within 300 m of any river or rockpool;

The CRA camp was located *ca* 100m from a large pool in the Rudall River.

b) All exploration sites (eg. camps) to be left in a clean and tidy state and all garbage adequately buried.

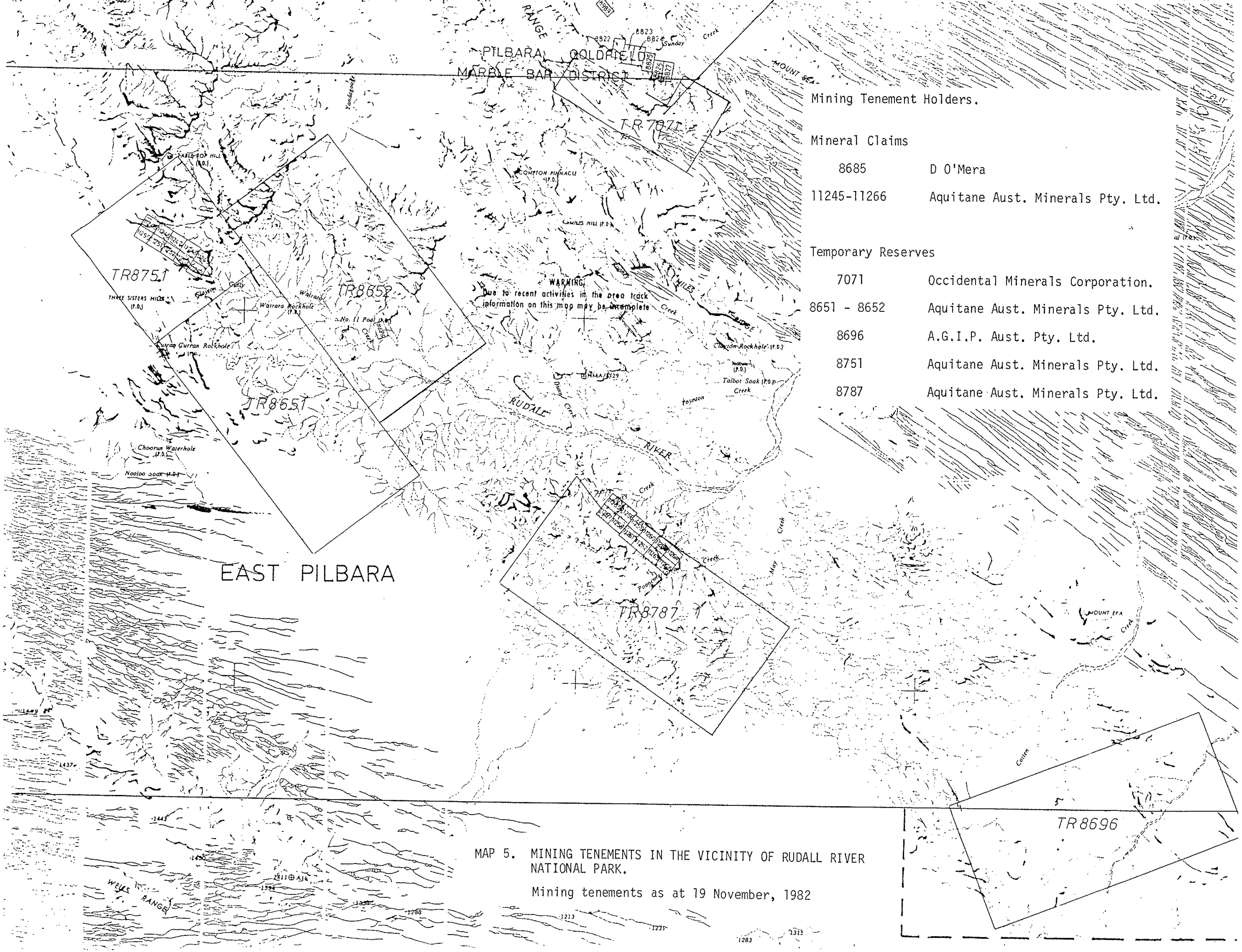
The campsite and surrounding rubbish covered about 4 ha, and spread to within 50 m of the pool in the river. Rubbish was strewn throughout and included numerous lengths of pipe, old 50 and 200 litre drums, tractor tyres, piles of hard concrete, sheets of metal, smashed porcelain toilets, an open sewage pit, broken bags of Quik-trol powder (a non-biodegradable non-toxic, carboxy-methyl-cellulose), a pile of drill cores, etc.

It was estimated that two men with a truck would take three to four days to clear and restore the site.

c) Construction of airstrips must be approved by the Department of Conservation and Environment. An airstrip was installed about 3-4 km west of the camp. There is no record of permission being granted.

FIGURE 13. Smashed toilet bowl, open sewage pit and other rubbish left at site of a mining exploration camp within the Rudall River National Park.

FIGURE 14. Canvas bags, cement, timber, lime and rotting bags of Quicktrol drilling compound left at a mining exploration site within the Rudall River National Park



MAP 5. MINING TENEMENTS IN THE VICINITY OF RUDALL RIVER NATIONAL PARK.

Mining tenements as at 19 November, 1982

16.8. PRESENT MINING EXPLORATION

16.8.1. AQUITANE - searching for uranium.

Personnel and location: Camp comprising three men in tents near Number 11 Pool. Camp was originally located right on edge of pool, but was relocated about 200 m from water when the team heard that an NPA representative was due to visit. This was apparent from newly erected camp at present location despite the camp supposedly being several weeks old. A caravan was towed into the camp while we were present.

Detergents - clothes, washing and showers were located right on the waters edge, although there were no obvious signs of pollution of the water. I suspect that the camp members may take some care to avoid polluting the pool as it is their source of drinking water.

Tracks and costeens - The company has installed innumerable tracks (several bulldozed) and dug at least one large costeen. Tracks on edge of pool numerous.

Rubbish - There were no obvious signs of rubbish and when questioned the geologist in charge, Mr. Graham Legge, said that all rubbish was buried.

16.8.2. AGIP - would not say what they were searching for.

Personnel and Location - Camp comprises four men in tents and large caravan near Cotten Creek. Camp is located right on rivers edge, but there are no nearby pools.

Detergents - clothes washing, showers etc. were all drained into a slit trench 1m deep by 15m long and located about 40m from the bank of the river, which was dry.

Water supply - Water was gravity fed from a 100 gallon tank mounted on a trailer. The trailer was filled from Eagle Rockhole which is located about 5 km south of the southern boundary of the Park.

Tracks and costeens - numerous tracks, mostly made only by frequent vehicle runs, although one or two were bulldozed. Much disturbance to river bank near camp, caused by water trailer access, installation of two-mast radio aerial, four 4 m x 4 m tents, generator and large caravan.

Rubbish - rubbish was buried in the river bank about 50 m back from the river edge and 150 m from the camp. It is unlikely it would washout, even in peak floods.

16.9. CONCLUSIONS:

1. The Mines Department is approving tenements within the Park without any reference to the National Parks Authority.

2. Conditions which should be imposed on the mining companies are either not being given to the companies by the Mines Department or are being ignored.

3. Management presence is vital in the Park if the current free-for-all situation is not to continue.

4. Despite the above problems, the companies appear basically environmentally aware and seem to be trying to do the right thing within their understanding. It is vital that conditions be imposed on other activities, not for discipline so much as for education.

17. ADJACENT LAND USE IMPACT

There is no development to the east, or south of the National Park. To the north there is no land development but the establishment of a mining community at Telfer has greatly increased visitation. The townsite, run strictly as a company enterprise, is controlled by Newmont Mining and permission is required to use both the access road and to pass through the town. Thus visitors from this area are restricted almost entirely to Newmont employees.

To the west of the Park lies station country, in particular Wandanya, Mt. Divide and Balfour Downs stations. Cattle have been reported as far east as the western boundary of the park, having strayed from the stations. The stations also run sheep, but these do not penetrate far to the east.

18. VISITATION

18.1. Visitation to Rudall River National Park falls into the basic categories of professional interest, day-trippers and expeditions.

Since the days of Rudall, Hann and others, there have probably been few visitors except occasional prospectors e.g. Ives - see Historic Records. It is known however, that naturalist J.H. Calaby visited the Rudall River in September 1955, zoologists J.R. Ford and G. M. Storr travelled the Talawana Track in 1966 and T. Fletcher visited the Rudall in December 1970. From this time on trips in the area became numerous. For example, The Royal Australasian Ornithologists Union mounted an expedition of a safari bus plus 13 private vehicles (total 48 people) into the area, but failed to reach it because of road conditions.

All the above more recent visits fall into the broad category of "professional" as all were researchers or interested parties studying the wildlife or flora.

Also in this category would be the geologists, originally in search of gold (as was F. H. Hann) and in more recent times, uranium, and other minerals. At the time of the July 1982 visit, there were two mining companies, totalling six field staff operating in the National Park. The Park was declared open for mining on 25 November, 1977.

18.2. Day-trippers come from Telfer, usually making the 80 km trip about once a month, as there are limited recreation facilities in the town.

Favoured picnic and barbecue sites are Christmas Pool, Duck Pool, Number 11 Pool and pools along the Rudall River. Overnight camps at Poonemerlarra Pool are common. At this location the bush has been flattened to make a camping area and carpark, several groundfires are visible, rubbish dumped and a rope swing has been provided for jumping into the pool.

When questioned, residents of Telfer stated there were 400 people in town and "most" would visit the Park at least 2 or 3 times a year; many more frequently. This would suggest 1,000 - 2,000 day trippers or weekend visitors use the Park each year. Despite the existence of Telfer since 1975, maximum occupation has only been over the last two or three years. The lack of visible impact is probably a consequence of the type of people involved. Most would have some appreciation for the bush, and in such a close-knit and small settlement, untidiness and desecration would almost certainly be dealt with by other users, who may work alongside the vandals during the week.

18.3. Expeditions, or large groups of people and vehicles are limited to scientific visits such as the July 1982 trip with four vehicles and ten people, or the R.A.O.U. expedition, or large tourist parties. As an example of tourist trips into isolated country, a visitor book installed at Well 26 on the Canning Stock Route by the Landrover Club was examined. This book, installed on 30 August

1980, contained signatures of about 100 visitors per year, in about 40 vehicles/year. It also contained references to four dogs and three cats amongst the visitors, lending weight to the theory that feral cats may be gaining new recruits (see Exotic Animals section).

The Canning Stock Route evidence suggests that tourism to remote areas may be higher than generally suspected. Based on circumstantial as well as recorded evidence, it is suggested that as many as 2000 people may visit the Rudall River National Park each year.

19. SUMMARY OF SALIENT POINTS DERIVED FROM RESOURCE STUDY

19.1. Extreme climatic conditions, isolation and strongly seasonal visitation indicate that a permanent resident ranger would be unsatisfactory.

19.2. Topographic and geologic considerations suggest that visitation to the Park will be almost entirely restricted to areas outside the dunefields. Management objectives would thus need to concentrate on the Rudall River Catchment, rather than the Sandy Deserts. The majority, but not all of the Rudall River Catchment is contained within the Park. A geologic feature of considerable interest (the Dome) is outside the Park.

19.3. The ancient, highly metamorphosed rock types in the Rudall River Catchment provide mineral potential, particularly for gold, other heavy metals and uranium. It can be anticipated that further exploration tenements will be applied for in the future. Damage done by previous mining exploration suggests that tighter conditions must be applied to future tenements, and that monitoring of exploration must be carried out.

19.4. Water resources of the Park are limited. Available water is restricted to surface pools of high quality, but seasonal and of limited amount, or from bores which would need to be installed. Bore water is of poor quality. The best surface pools are Number 11 Pool, Coondegoon Pool and Eagle Rockhole. Of these Coondegoon and Eagle Rockhole are isolated from the centre of the Park, and the latter is outside the existing boundary. Number 11 Pool is well located, access is easy, and the source is reasonably reliable. Duck Pool, is of high volume but is well north of the existing Park boundary, and isolated from the main area of the Rudall River.

19.5. Vegetation of the Park is representative of that found in the Little Sandy and Great Sandy Deserts as well as on exposed metamorphic complexes. The Park spans the boundary between the Keartland and Canning Botanic Districts of the Eremaean Botanical Province (Beard 1980). The Park is therefore an excellent representative area of this part of the desert, although the meta-complex areas are not as well represented as the dunefields.

19.6. Flora has been poorly examined, being only covered in large-scale regional mapping programmes. Several undescribed plants are known from the area, as are some disjunct populations of Pilbara species. Aquatic and semi-aquatic plants are worthy of particular study.

19.7. Fire history of the Park suggests infrequent, large-area burns of high intensity. Fire management would be impossible, particularly in the dunefields. Incidence of man-made fire could be reduced by a management presence in the Park.

19.8. Weeds are scarce within the Park except for occasional introductions, probably by Park visitors. Control of saddle-bush (by hand) would be of some value in one or two areas.

19.9. Vertebrate fauna is poorly known, but the Rudall River seems to be the northern limit of distribution of some Pilbara species. The area also seems to be the meeting place of at least two biogeographic regions; the desert and the Pilbara.

19.10. Invertebrate fauna appears to be of considerable interest, with undescribed species, range extensions, etc. being frequent. Further investigations are needed.

19.11. Exotic fauna control if predominantly that of reducing the camel population. Feral cat control would also be of value.

19.12. Aboriginal sites are abundant, and many have great significance to members of the Jigalong Community. There is little evidence that the Aborigines are maintaining the sites because of the difficulty of vehicle access. As visitor pressure increases, levels of damage to sites will rise. A management presence by the National Parks Authority would do much to curtail vandalism. Three sites worthy of protection, Christmas Pool, Christmas Pool cave and Eagle Rockhole are located outside the Park.

19.13. Several historic sites are located within the Park, both as topographic features, and as camp sites; and at Number 11 Pool, a commemorative plaque. Most sites cannot be vandalised but the plaque could be removed. Trees with the carved initials of early explorers may still exist within the Park but have not yet been located. Christmas Pool, outside the Park, is of great historic interest and requires protection from vandalism.

19.14. Visitation to the Park can be expected to increase in the future. Early traces of damage and vandalism are already apparent. Visitor pressure on Duck Pool and Christmas Pool, both outside the Park, is extremely high. Visitors are also frequent to Eagle Rockhole, Coondegoon Pool and Poonemerlarra Pool.

20. RECOMMENDATIONS

20.1. The primary recommendation is that a management presence should be seen in the Park at least once a year, and preferably more often. It is recommended that a mobile or resident Ranger (possibly the Hamersley Ranger) enter and inspect the Park on a yearly basis, during the dry season. The Ranger would be required to camp and visit all major recreation areas and mining tenements.

20.2. While present in the Park, some rubbish disposal, minor weed control and destruction of feral animals be undertaken.

20.3. On a biennial basis (subject to review), the National Parks Authority's Regional Superintendent at Karratha and the Planning Officer and Ecologist visit the Park to monitor changes resulting from visitors and mining exploration. The inspection by professional staff should be in addition to the annual Ranger visit.

20.4. That the visiting Ranger, and professional officers produce a report, and recommendations to the Authority, following each examination of the Park.

20.5. Every effort be made to encourage scientific research into the area of the Park in order to identify locations of biological importance.

20.6. Consideration should be given to addition of land to the Park in order to protect important features. In the author's opinion, these features are Eagle Rockhole, the Dome, Christmas Pool and Christmas Pool Cave. Recommended additions to the Park are as follows:

20.6.1. Firstly, extension of the southern boundary of the National Park by addition of a rectangular block approximately 310 km^2 and with boundaries from 122^o 50'00" E, 22^o 50'00" S south to 122^o 50'00" E 22^o 55'00" S then west to 122^o 30'00" E 22^o 55'00" S then north to 122^o 30'00" E 22^o 50' 00" S.

20.6.2. Secondly, it is recommended that a reserve be created to protect Christmas Pool, Christmas Pool Cave, and to include the Paterson Range. This area comprises excellent exposures of the Early Permian glacial deposits of the Paterson Formation, which is poorly represented in the Rudall River National Park. Details of the proposed reserve are presented briefly in Appendix 4.

The reserve should be vested in the National Parks Authority, to be managed together with the Rudall River National Park.

FIGURE 15. Northern edge of the Dome, looking west. This large circular structure is the remains of a dome-shaped formation made up of concentric bands of various lithologies.

FIGURE 16. Eagle Rockhole, just south of the Rudall River National Park boundary. The area has considerable geological interest, and is of great significance to the Aborigines. It is proposed the Rockhole be included within the National Park.

20.6.3. Suggested boundaries for this proposed reserve are:

From a point at 122° 00' 00E E 21° 45' 00" S east to 122° 15' 00" E 21° 45' 00" S then south to 122° 15' 00" E 22° 00' 00" S, then west to 122° 00' 00" E 22° 00" S then north to the point of origin. The area contained therein is about 625 km^2 (62500 ha).

20.7. Up to the present time the existence of the National Park has not affected exploration for minerals. It is suggested that creation of an extension to Rudall River National Park, or creation of a reserve at Paterson Range, similarly will in no way alter mining prospects in the area.

It is thus recommended that should item 20.6 be accepted, mineral exploration should be allowed to continue in the area consolidated with the Rudall River National Park, and also in the new reserve, under the same conditions as already apply.

21. APPENDICES

APPENDIX 1	ANNOTATED BIRD LIST- RUDALL RIVER NATIONAL PARK
APPENDIX 2	ANNOTATED LIST OF AMPHIBIANS AND REPTILES - RUDALL RIVER NATIONAL PARK
APPENDIX 3	ANNOTATED LIST OF MAMMALS - RUDALL RIVER NATIONAL PARK
APPENDIX 4	BRIEF DESCRIPTION OF PROPOSED PATERSON RANGE RESERVE

APPENDIX I

ANNOTATED BIRD LIST - RUDALL RIVER NATIONAL PARK

CASUARIDAE

EMU *Dromaius novaehollandiae* (Latham)

Uncommon but extends north as far as Rudall River. Usually around water sources. Fresh tracks seen 10 km due north of Mt. Eva, and a group of seven seen 20 km south of Mt. Eva in July 1982.

BLACK-THROATED GREBE *Podiceps novaehollandiae novaehollandiae* Stephens

Scarce, in ones, twos or small flocks. Two pairs with chicks observed by J.H. Calaby on Rudall River in mid-September 1955. Pairs on Duck and Poonemerlarra Pools and at Rudall Camp in July 1982. A group of 3 on Number 11 Pool (2 adults, 1 juvenile) which some geologists reported as having been there for over a month.

HOARY-HEADED GREBE *Podiceps poliocephalus* Jardine & Selby

One observed by A. N. Start *et al.* at Coongegoon Pool on 30 April, 1979 and a pair by M. Bamford in July 1982 at the same location.

PHALACROCORACIDAE

LITTLE PIED CORMORANT *Phalacrocorax melanoleucos melanoleucos* (Vieillot)

One seen by T. Fletcher on a pool in the Rudall River, December 1970.

ARDEIDAE

PACIFIC HERON *Ardea pacifica* Latham

Uncommon; a single bird has been recorded at Coondegoon Pool by a previous visitor.

WHITE-FACED HERON *Ardea novaehollandiae* Latham

Scarce visitor. Seen at Coondegoon Pool and Talbot Soak by previous visitor. Usually in ones, twos or small flocks.

ANATIDAE

BLACK DUCK *Anas superciliosa* Gmelin

Recorded in small flocks on pools along Rudall River. Breeding at Coondegoon Pool in March 1979.

GREY TEAL *Anas gibberifrons gracilis* Buller

Recorded on Rudall River in small to large flocks. Breeding in Rudall in July and August 1955. Twenty on Coondegoon Pool in July 1982.

PINK-EARED DUCK *Malacorhynchus membranaceus* (Latham)

Two seen by A. Start *et al.* at Coondegoon Pool on 30 April, 1979.

WOOD DUCK *Chenonetta jubata* (Latham)

Reported on Rudall River by J.H. Calaby in mid-September 1955, and T. Fletcher in December 1970.

ACCIPITRIDAE

BLACK KITE *Milvus migrans affinis* Gould

Three birds observed by T. Fletcher on the Rudall River in December 1970.

BROWN GOSHAWK *Accipiter fasciatus fasciatus* (Vigors & Horsfield)

One near Coondegoon Pool in July 1982.

LITTLE EAGLE *Aquila morphnoides morphanoides* Gould

Sighted at Telfer, and frequently along the Rudall River in July 1982.

SPOTTED HARRIER *Circus assimilis* Jardine & Selby

Single bird seen 20 km west of Well 26 on Canning Stock Route (ie 100 km south-east of the Park) in July 1982. The habitat was indistinguishable from that in the Sandy Desert portions of the Park.

WEDGE-TAILED EAGLE *Aquila audax* (Latham)

Few early records. Reported to once be plentiful but now scarce since the decline of the hare and nail-tail wallabies. Reported by R. Sharp and mining employees (pers. comm.) as being very common near Eagle rockhole.

FALCONIDAE

AUSTRALIAN HOBBY *Falco longipennis longipennis* Swainson

Two seen regularly by T. Fletcher along the Rudall River in December 1970.

BROWN FALCON *Falco berigora berigora* Vigors & Horsfield

Moderately common including in sandy desert.

AUSTRALIAN KESTRAL *Falco cenchroides cenchroides* Vigors & Horsfield

Nest in a hollow tree on the Rudall River found by J.H. Calaby in mid September 1955. Sighted in the Park in July 1982 at Coondegoon Pool and near Mt. Eva.

TURNICIDAE

LITTLE BUTTON-QUAIL *Turnix velox* (Gould)

Very common in good years, otherwise uncommon. Usually in sparsely wooded areas with spinifex. Breed from April to August.

RALLIDAE

BLACK-TAILED NATIVE HEN *Gallinula ventralis* Gould

One observed in April 1979 by A.N. Start *et al.* at Coondegoon Pool.

OTIDIDAE

AUSTRALIAN BUSTARD *Otis australis* Gray

Seasonally common in Rudall River area in December 1970. Recorded breeding in July and August. At least 10 pairs seen in the National Park and tracks common throughout Sandy Desert in July 1982.

CHARADRIIDAE

BLACK-FRONTED PLOVER *Charadrius melanops* Vieillot

In pairs or small parties at freshwater pools and rockholes in the Rudall River area. Three pairs seen along the Rudall in July 1982. Deep pools with steep banks seemed to be avoided.

AUSTRALIAN DOTTEREL *Peltohyas australis* (Gould)

On 1 May 1979 A. Start *et.al.* observed three birds on a sparsely vegetation, stony ridge north of the McKay Range, just south-east of the Park. In December 1970, T. Fletcher saw seven birds on a burnt-out plain near the Rudall River.

BURHINIDAE

BUSH STONE-CURLEW *Burhinus grallarius* (Latham)

In December 1970, T. Fletcher heard them calling each night at the Rudall River.

COLUMBIDAE

DIAMOND DOVE *Geopelia cuneata* (Latham)

Numerous along pools in Rudall River, but usually in pairs away from pools.

COMMON BRONZEWING *Phaps chalcoptera* (Latham)

Uncommon, usually single, or occasionally in twos. Vicinity of river pools along the Rudall.

SPINIFEX PIGEON *Geophaps plumifera* Gould

Usually in rocky country near water. Recorded at Harbutt Range, south-east of the Park in small parties, and in flocks of up to 50 birds along the Rudall River in July 1982.

CRESTED PIGEON *Ocyphaps lophotes* (Temminch)

Common in well-watered areas, particularly in lightly wooded country. Usually in ones, twos or small parties but congregating at waterholes at dawn and sunset.

PSITTACIDAE

RING-NECKED PARROT *Platycercus zonarius zonarius* (Shaw)

Common in river gums along water courses, usually in pairs.

BUDGERIGAR *Melopsittacus undulatus*(Shaw)

Common, usually in small parties but sometimes large flocks. Mainly in better-watered country, but also in ordinarily waterless deserts when ephemeral water and *Triodia* grass seeds are available after good rains. J.H. Calaby found them nesting in tree-hollows on the Rudall River, in mid September 1955. Numerous flocks of 2-50 birds sighted in July 1982, but not recorded breeding in the National Park, although many more nesting at wildlife well about 100 km south-east of the Park.

COCKATEIL *Nymphicus hollandicus* (Kerr)

Several seen along Rudall River near Pools in July 1982.

GALAH *Cacatua roseicapilla* Vieillot

Common in relatively well watered area. A flock of 200 birds seen near Eagle Rockhole (see map) in July 1982.

STRIGIDAE

BARN OWL *Tyto alba delicatula* (Gould)

In August 1976, P. de Rebeira found the remains of a Barn Owl at a pool on the Rudall River.

BOOBOOK OWL *Ninox novaeseelandiae boobook* (Latham)

Status uncertain but moderately common. No breeding records but heard calling throughout the year in well-watered country. A road kill found near Telfer in July 1982, was a pale brown/red in colour and smaller than birds of the southern part of the State.

AEGOTHELIDAE

AUSTRALIAN OWLET-NIGHTJAR *Aegotheles cristatus cristatus* (White)

Uncommon, recorded as far noth as the Rudall River, where two birds of the dark southern race were observed.in 1972. In July 1982 calls were frequently heard just before dawn at Rudall camp but no birds were seen.

ALLCEDINIDAE

RED-BACKED KINGFISHER *Halcyon pyrrhopygia* Gould

Two seen 5 km east of Coondegoon Pool in July 1982.

SACRED KINGFISHER *Halcyon sancta sancta* Vigors & Horsfield

Found on Rudall River. Always scarce, and recorded in April, June and September by previous visitors, and in July 1982. One was caught several times in a mist-net across a pool at Rudall Camp.

MEROPIDAE

RAINBOW BEE-EATER *Merops ornatus* Latham

Recorded along Rudall River where it is common, but scarce elsewhere. Parties of 5-10 birds seen at all pools along Rudall River in July 1982.

ALAUDIDAE

HORSFIELD'S BUSHLARK *Mirafra javanica* Horsfield

Found on Rudall River, where it is common, usually in ones or twos. Mostly in "soft" grasslands.

HIRUNDINIDAE

WHITE-BACKED SWALLOW *Cheramueca leucosterna* (Gould)

Groups of twos and threes near Christmas Pool in July 1982.

TREE MARTIN *Hirundo nigricans nigricans* Viellot

Moderately common in well-watered areas along Rudall River. Usually in small parties, and probably nest in hollows in river gums.

FAIRY MARTIN *Hirundo ariel* (Gould)

Not seen, but recently used nests in groups of 20-30 found in breakaways in the Rudall River National Park.

MOTACILLIDAE

RICHARD'S PIPIT *Anthus novaeseelandiae australis* Vieillot

Moderately common in well-watered areas. Usually in ones or twos; occasionally in small parties.

CAMPEHAGIDAE

BLACK-FACED CUCKOO-SHRIKE *Coracina novaehollandiae subpallida* Mathews

Moderately common in well-watered areas north to the Rudall River. Usually in ones or twos, mainly in river gums. Recorded from Coondegoon Pool and Talbot Soak by previous visitors. Flocks of 2-10 birds were sighted at Duck Pool and Rudall Camp in July 1982.

PACHYCEPHALIDAE

RED-CAPPED ROBIN *Petroica goodenovii* (Vigors & Horsfield)

Status uncertain, moderately common to the south, and penetrates as far north as the Rudall River.

HODDED ROBIN *Petroica cucullata* (Latham)

Scarce, usually in ones or twos, in lightly wooded country around the Rudall River.

RUFOUS WHISTLER *Pachycephala rufiventris rufiventris* (Latham)

Moderately common in well wooded areas. Usually single, and absent from sandy desert.

GREY SHRIKE-THRUSH (VARIETY) *Colluricincla harmonica rufiventris* Gould

This is a variety of c.l. harmonica. Recorded at Rudall River. Common in river gums and adjacent thickets.

CRESTED BELLBIRD *Oreoica gutturalis* (Vigors & Horsfield)

Moderately common as far north as the Rudall River. Usually in thickets. Heard calling along Rudall River in July 1982.

MONARCHIDAE

WILLIE WAGTAIL *Rhipidura leucophrys leucophrys* (Latham)

Status uncertain (No breeding records). Apparently a very common migrant and winter visitor to the Rudall River area. Usually single, but occasionally parties of up to six. May occasionally be resident over summer. Several pairs seen well away from water in the Rudall area but not seen in the Great Sandy Desert during the July 1982 trip.

ACANTHIZIDAE

WESTERN FLYEATER *Gerygone fusca fusca* (Gould)

Only record in the Park is a specimen collected on 23 August 1972 by W.H. Butler in sparse mulga at Curran Curran Rockhole. A. Start *et al.* collected two specimens on 24 April, 1979 in a mulga thicket 86 km east of Old Talawana just south of the Park.

BROAD-TAILED THORNBILL *Acanthiza apicalis* Gould

Recorded at Hanging Rock on western boundary of the Park in thickets of teatree *(Melaleuca lasiandra* and/or *M. glomeraxa)*.

MALURIDAE

WHITE-WINGED FAIRY-WREN *Malurus leucopterus leucanotus* Gould

Two parties, each with at least one coloured male in the Rudall River National Park, where low bushes grew amongst spinifex in July 1982.

DICAEIDAE

MISTLETOE-BIRD *Dicaeum hirundinaceum nirundinaceum* (Shaw)

Heard several places within the Park in July 1982 but only sighted at Coondegoon Pool (one bird).

PARDELOTIDAE

STRIATED PARDELOTE *Pardelotus striatus substriatus* Mathews

Autumn-winter visitor (May-September) as far north as the Rudall River. Usually as single birds in rivergums along watercourses.

MELIPHAGIDAE

BROWN HONEYEATER *Lichmera indistincta indistincta* (Vigors & Horsfield)

Locally common, but scarce generally, in ones, twos or small parties. Prefer thickets in well-watered places preferably where there are abundant flowers.

SINGING HONEYEATER *Meliphaga virescens* (Vieillot)

Widespread and very common, usually in ones or twos, occasionally in small flocks at source of nectar. Breed from June to August. Single birds and pairs in tall, open shrublands within the Park in July 1982.

GREY-HEADED HONEYEATER *Meliphaga keartlandi* (North)

Widespread and common, in ones, twos or small flocks. Mainly in eucalypt stands but also eslewhere when flowers are abundant.

WHITE-PLUMED HONEYEATER *Meliphaga penicillata* Gould

Common in well-watered areas north to the Rudall River. Usually in small parties, particularly in river gums. Adults seen feeding tree-flying young at Rudall Camp in July 1982. Juveniles were duller than adults, had no plume, and orange-brown rather than black beaks.

WHITE-FRONTED HONEYEATER *Phylidonyris albifrons* (Gould)

Widespread winter visitor in highly variable numbers. Attracted to flowering shrubs.

BLACK HONEYEATER *Certhionyx niger* Gould

At Duck Pool and near Mt. Eva in July 1982. All in sandy areas with spinifex and a few scattered shrubs. All males were calling from tops of dead branches.

YELLOW-THROATED MINOR *Manorina flavigula* (Gould)

Widespread in well-watered and well-wooded areas north to the Rudall River. Attracted to flowering shrubs. Small flocks at Duck Pool and Coondegoon Pool in July 1982.

SPINY-CHEEKED HONEYEATER *Acanthagenys rufogularis* Gould

Moderately common in ones, twos or small parties. Mainly in acacia associations or flowering thickets. During July 1982, recorded at Duck Pool but not seen elsewhere in the Rudall area.

PLOCEIDAE

PAINTED FINCH *Emblema pictum* Gould

Widespread but patchily distributed, usually in pairs or small parties. Sometimes in hundreds at water. Mainly spinifex in stony gullies and hills or locally in sandy desert. Breed from May to August. Common throughout in July 1982, particularly at Duck Pool on Coolbro Creek just north of the Park. A flock of 200 regularly visited the Pool near Rudall Camp each morning but were scarce at pools in sandy country, apparently preferring rocky ground.

ZEBRA FINCH *Peophila guttata castanotis* (Gould)

Very common, usually in flocks of various sizes. Lightly wooded country with spinifex and other grasses near water. Breed from March to September. A flock of 10,000 plus seen at Eagle Rockhole in July 1982, a flock of 1,000 plus at Coondegoon Pool and groups of 50 or more common at all pools in July 1982.

GRALLINIDAE

MAGPIE-LARK *Grallina cyanoleuca* (Latham)

Common, usually in pairs in lightly wooded country and along watercourses. Two, August breeding records have been made from the Rudall River. Pairs seen at Duck Pool, Rudall Camp and Coondegoon Pool in July 1982.

ARTAMIDAE

MASKED WOODSWALLOW *Artamus personatus* (Gould)

Nomadic and widespread, usually in small flocks but occasionally in thousands. Lightly wooded country and attracted to flowering trees and shrubs. Breeding recorded in August. A flock of 20 birds were recorded flying over sandy desert near Telfer in July 1982.

BLACK-FACED WOODSWALLOW *Artamus cinereus melanops* Gould

Very common; the most widespread and abundant bird in the region. In ones, twos or occasionally flocks up to 40, in lightly wooded country. Breeding recorded in August and September. Observed to be scarce in sandy desert country in July 1982.

LITTLE WOODSWALLOW *Artamus minor* Vieillot

Scarce and patchily distributed, usually around cliffs and breakaways.

CRACTICIDAE

PIED BUTCHERBIRD *Cracticus nigrogularis* (Gould)

Heard occasionally at Rudall Camp in July 1982. Absent from sandy desert.

AUSTRALIAN MAGPIE *Cracticus tibicen tibicen* (Latham)

Only recorded in the vicinity of the Park at the Harbutt and McKay Ranges just south of the southern boundary.

CORVIDAE

AUSTRALIAN CROW *Corbus orru salvadorii* Finsch

Moderately common in well-watered areas. Usually ones, twos or in small parties, in wooded regions, particularly along rivers. One specimen has been collected from Talbot Soak. Only a single bird was seen in July 1982, at Rudall Camp.

APPENDIX 2

ANNOTATED LIST OF AMPHIBIANS AND REPTILES - RUDALL RIVER NATIONAL PARK

Species recorded from Lake Disappointment (LD) 100 km south of the Park are included (Smith and Johnstone, 1979), and probably extend into the Park.

LEPTODACTYLIDAE (Ground Frogs)

Cyclorana maini Tyler

Adults recorded in pools in November in L.D.

Eperoleia sp.

Found in moist earth and leaf litter beside Rudall Camp in July 1982. The species is undescribed.

HYLIDAE (Tree Frogs)

Litoria rubella (Gray)

Common on most watercourses in the Park, in July 1982. Often found in hollow limbs of river gums, or under rocks.

GEKKONIDAE (Geckos)

Diplodactylus ciliaris Boulenger

At LD up to 2m above ground in dead or sparse, open shrubs.

Diplodactylus elderi Striling and Zeitz

Collected from LD where it was flushed from *Plectrachne* and *Triodia* clumps.

Gehyra variegata (Dumeril and Bibron)

Recorded by Smith and Johnstone (1979) at Lake Disappointment. Single specimen collected at CRA camp in July 1982, under a sheet of iron. Also seen at Separation Well, east of the Canning Stock Route, and similar to much of the Park.

Gehyra sp.

An undescribed species recorded by Smith and Johnstone at LD. It was collected from a sandstone cliff above a pool. This reptile may also occur in the Park.

Heteronotia binoei (Gray)

Collected at L.D.

Rhynchoedura ornata Günther

Found at LD on clayey soil at night.

PYGOPODIDAE (Legless-lizards)

Lialis burtonis Gray

Collected at LD. A single specimen was flushed from litter at Coondegoon Pool in July 1982.

Pygopus nigriceps (Fischer)

Recorded at LD.

AGAMIDAE (Dragon lizards)

Amphibolurus caudicinctus caudicinctus X mensarum

This hybrid species was collected by Smith and Johnstone at LD on bare areas of sandstone.

Amphibolurus inermis (de Vis)

Recorded at LD. A juvenile was collected at Curran Curran Rockhole.

Amphibolurus isolepis gularis Sternfield

Common at LD on sandy soil. Common throughout the Park on sandy soil in July 1982.

Amphibolurus minor Sternfield

Collected at LD.

Amphibolurus reticulatus(Gray)

Recorded at LD.

Diporiphora winneckei Lucas and Frost

Collected at LD. Fairly scarce in July 1982, only two being seen, one at Coondeggon Pool and one near the eastern boundary of the Park.

Moloch horridus Gray

Collected at LD.

Lophograthus longirostis Boulenger

Collected along watercourses at LD.

SCINCIDAE (Skinks)

Cryptoblepharus plagiocephalus (Cocteau)

Collected on tree trunks at LD.

Ctenotus grandis Storr
Collected on sandy soil by Smith and Johnstone at LD

Ctenotus helenae Storr

Recorded at LD.

Ctenotus leonhardii (Sternfeld)

Recorded at LD.

Ctenotus pantherinus ocellifer (Boulenger)

Recorded at LD associated with spinifex. None were seen in the Park but several were seen on sandplain between the Canning Stock Rou e and Wildlife Well in July 1982.

Ctenotus saxatilis Storr

Collected at LD associated with tangles of *Plectrachne* and low shrubs in gullies. In July 1982, a specimen was caught in a pit-trap on a coarse, gritty alluvial plain adjacent to the Rudall River.

Lerista vermicularis Storr

Single specimen collected on dune crest near Well 26 on the Canning Stock Rout in July 1982. Probably occurs throughout the sand dunes. Specimen lodged in Western Australian Museum.

Omolepida branchialis (Günther)

One collected on a low, gravelly rise near Curran Curran Rockhole in July 1982.

Proablepharis reginae (Glauert)

Single specimen found on a gravelly rise near Rudall Camp in July 1982.

S phenomorphus richardsonii (Gray)

Smith and Johnstone recorded this species from LD.

VARANIDAE (Goannas)

Varanus acanthurus Boulenger

Several seen in Rudall River area, usually in hollow limbs and under debris in July 1982.

Varanus giganters (Gray)

Recorded at LD.

Varanus gilleni Lucas and Frost

Single specimen found at Wildlife Well, east of the Rudall River National Park in July 1982.

Varanus tristis (Schlegel)

Found at LD in a dead tree. The July 1982 survey also found one in a dead tree near Nullagine.

TYPHLOPIDAE (Blind snakes)

Typhlina nigroterminata (Parker)

Recorded at LD.

BOIDAE (Pythons)

Liasis childreni (Gray)

Recorded at LD.

ELAPIDAE (Front-fanged snakes)

Furina christieana (Fry)

Recorded at LD.

Pseudonaja nuchalis Günther

A snake, probably this species, was seen near Poonemerlarra Pool in July 1982.

APPENDIX 3.

ANNOTATED LIST OF MAMMALS - RUDALL RIVER NATIONAL PARK

MACROPODIDAE

RED-KANGAROO *Megaleia rufa* (Desmarest)

Seen frequently near the Oakover River in July 1982, although old droppings were seen in several places along the Rudall River.

ROCK WALLABY *Petrogale* sp.

Old scats of this genus have been found near Lake Disappointment.

DASYURIDAE

MARSUPIAL MOUSE *Sminthopsis youngsoni* McKenzie & Archer

Two collected near Mt. Eva in July 1982.

PARAMELIDAE

BILBY *Macrotis lagotis* Reid.

An animal reported to be this species has been sighted by Mr. W. Shepherd near Hanging Rock about January 1982.

MURIDAE

SPINIFEX HOPPING-MOUSE *Notomys alexis* Thomas

McKenzie *et al.* (1979) collected three at Lake Disappointment, and three were caught in Elliot traps near Mt. Eva in July 1982.

SANDY MOUSE *Pseudomys hermannsburgensis* (Waite)

Recorded by McKenzie *et al.*(1979) at Lake Disappointment, and several caught in July 1982 near Mt. Eva.

TACHYGLOSSIDAE

ECHIDNA *Tachyglossus aculeatus* (Shaw)

W.H. Butler (1971) records "fresh Echidna trails" from the Lake Disappointment area.

MOLOSSIDAE

WHITE-STRIPED BAT *Tadarida australis* (Gray)

Caught in mist-nets at Rudall Camp in July 1982.

VESPERTILIONIDAE

LITTLE BROWN BAT *Eptesicus pumilis* (Gray)

Recorded at Lake Disappointment area in fissure of a cave. Also collected in mist-net at Rudall Camp in July 1982.

GOULD'S WATTLED BAT *Chalinolobus gouldi* (GRAY)

Collected in mist-net at Rudall Camp in July 1982.

LITTLE BROAD-NOSED BAT *Nycticeius greyi* (Gould)

Collected at Lake Disappointment area by McKenzie *et al*. (1979).

CANIDAE

DINGO *Canis familiaris dingo*

Although considered to be part of the indigenous fauna by the National Parks Authority, this animal is declared under the Agriculture and Related Resources Protection Act (1976-1980). Tracks, howls and other signs of dingo are uncommon in the Park, and it is suggested the population is not very high. As pastoral country lies well to the west there is no immediate danger of interference with stock, and dingo control measures are presently uncalled for.

APPENDIX 4

BRIEF DESCRIPTION OF PROPOSED PATERSON RANGE RESERVE

A. INTRODUCTION

The proposed reserve lies 400 km east of Nullagine, and just south of Telfer. It covers 625 square km. Its boundaries are described as follows:

From a point at 122° 00' 00" E, 21° 45' 00" S east to 122° 15' 00" E, 21° 45' 00" S then south to 122° 15' 00" E, 22° 00' 00" S then west to 122° 00' 00" E, 22° 00' 00" S then north to the point of origin. The location is given on map 6.

B. CLIMATE

As described for Rudall River National Park. Telfer data would apply closely to the proposed Reserve.

C. TOPOGRAPHY

As described for the Rudall River National Park. The Paterson Range is the highest point at 372 m above sea level. Another range, shown on the geological map (but not on the topographic map) as Karakutikati Range lies north-west of the Paterson Range. It has a high point of 338 m A.S.L. The eastern portion of the proposed reserve has numerous sand dunes. Map 7 shows a portion of the Paterson Range topographic map (SF 51-6) with the boundaries of the proposed reserve.

D. GEOLOGY

The Paterson Range contains large exposures of glacial deposits of the Paterson Formation. Additionally, the Karakutikati Range has exposures of Proterozoic Yeneena Group rocks; Telfer Formation (intercalated sandstone, siltstone and shales) and Isdell Formation (thinly bedded carbonate rocks including dolomite and shale). Neither of these formations are represented within the Rudall River National Park, and the Paterson Formation is only poorly represented. Map 8 shows the geology of the proposed reserve.

Mining tenements occur within the proposed reserve area, but there is no reason why these should interfere with gazettal or management of the reserve.

E. SOILS AND EROSION

As for Rudall River National Park.

MAP 6. LOCATION OF PROPOSED PATERSON RANGE RESERVE.

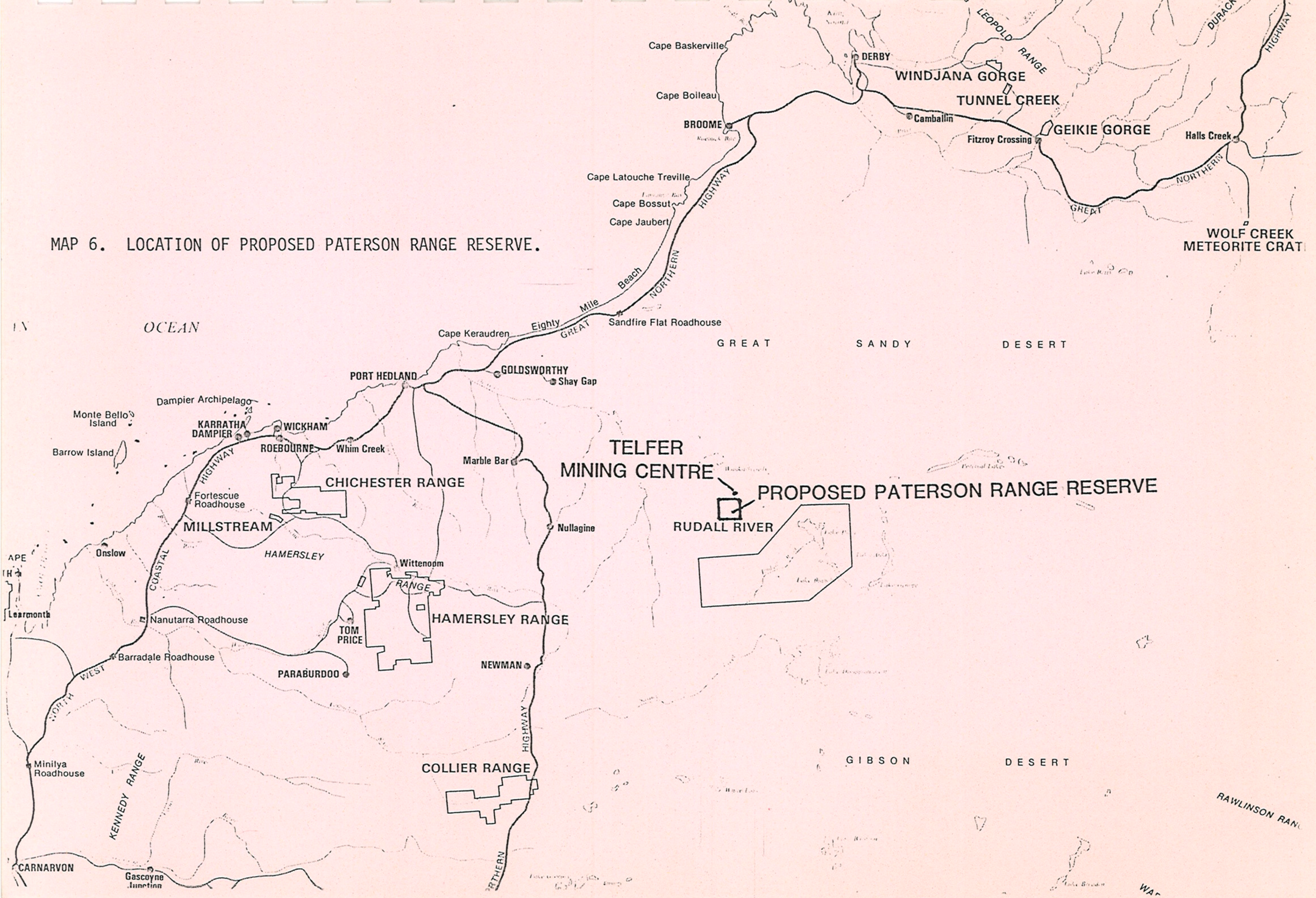
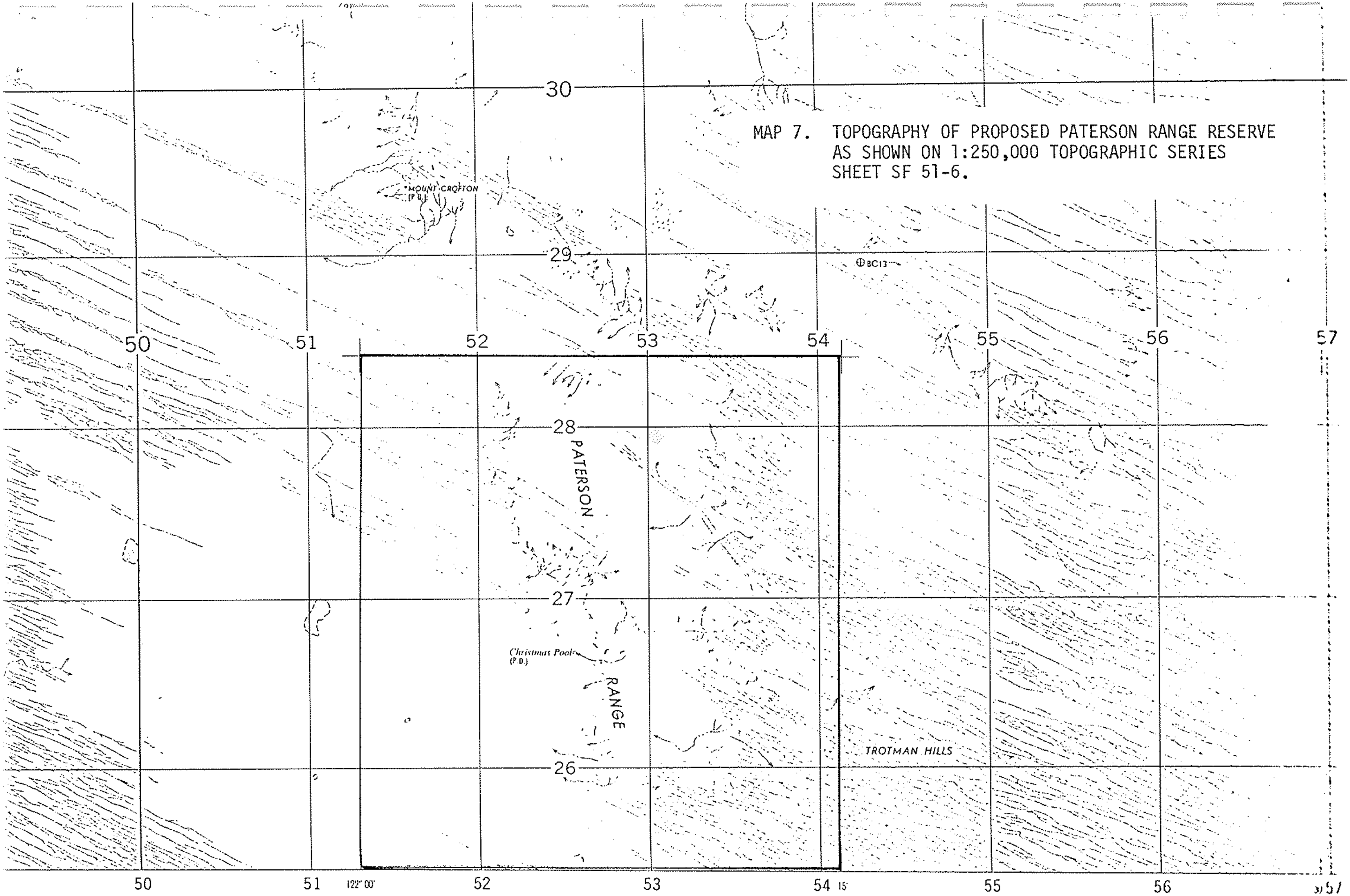
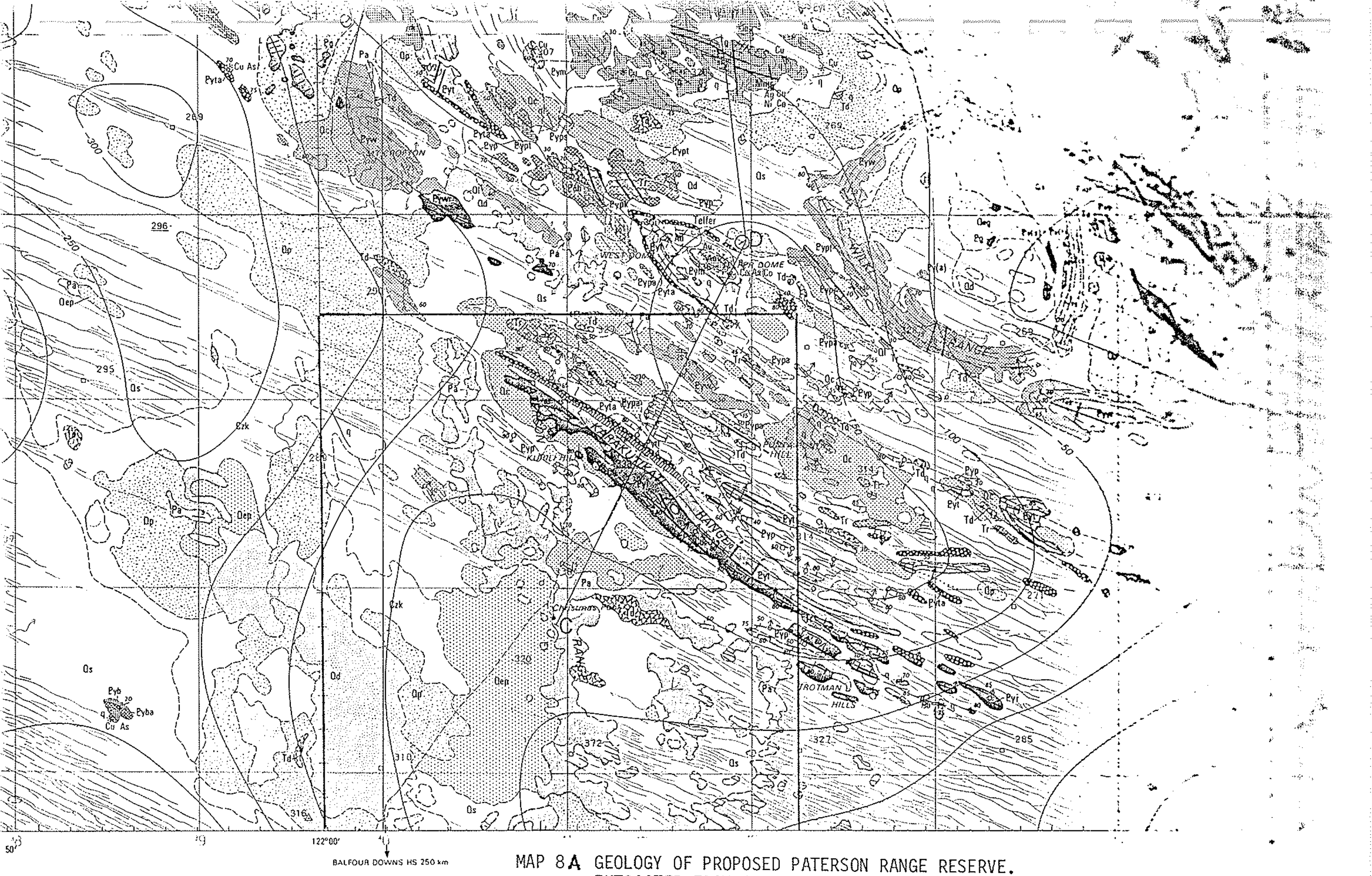


FIGURE 17. Paterson Range proposed reserve. The mesa-like areas are more distinct than in the National Park and are of glacial origin. Vegetation is mainly *Triodia wiseana* hummock-grassland.

FIGURE 18. Christmas Pool, in the proposed Paterson Range Reserve.

MAP 7. TOPOGRAPHY OF PROPOSED PATERSON RANGE RESERVE AS SHOWN ON 1:250,000 TOPOGRAPHIC SERIES SHEET SF 51-6.





MAP 8 A GEOLOGY OF PROPOSED PATERSON RANGE RESERVE.
EXTRACTED FROM CHIN, R.J. HICKMAN, A.H. &
TOWNER, R.R. (1982).
1:250,000 GEOLOGICAL SERIES PATERSON RANGE (2.ED.)

For details see text and refer to Rudall River Geological Map.

TR 6929

EL 31

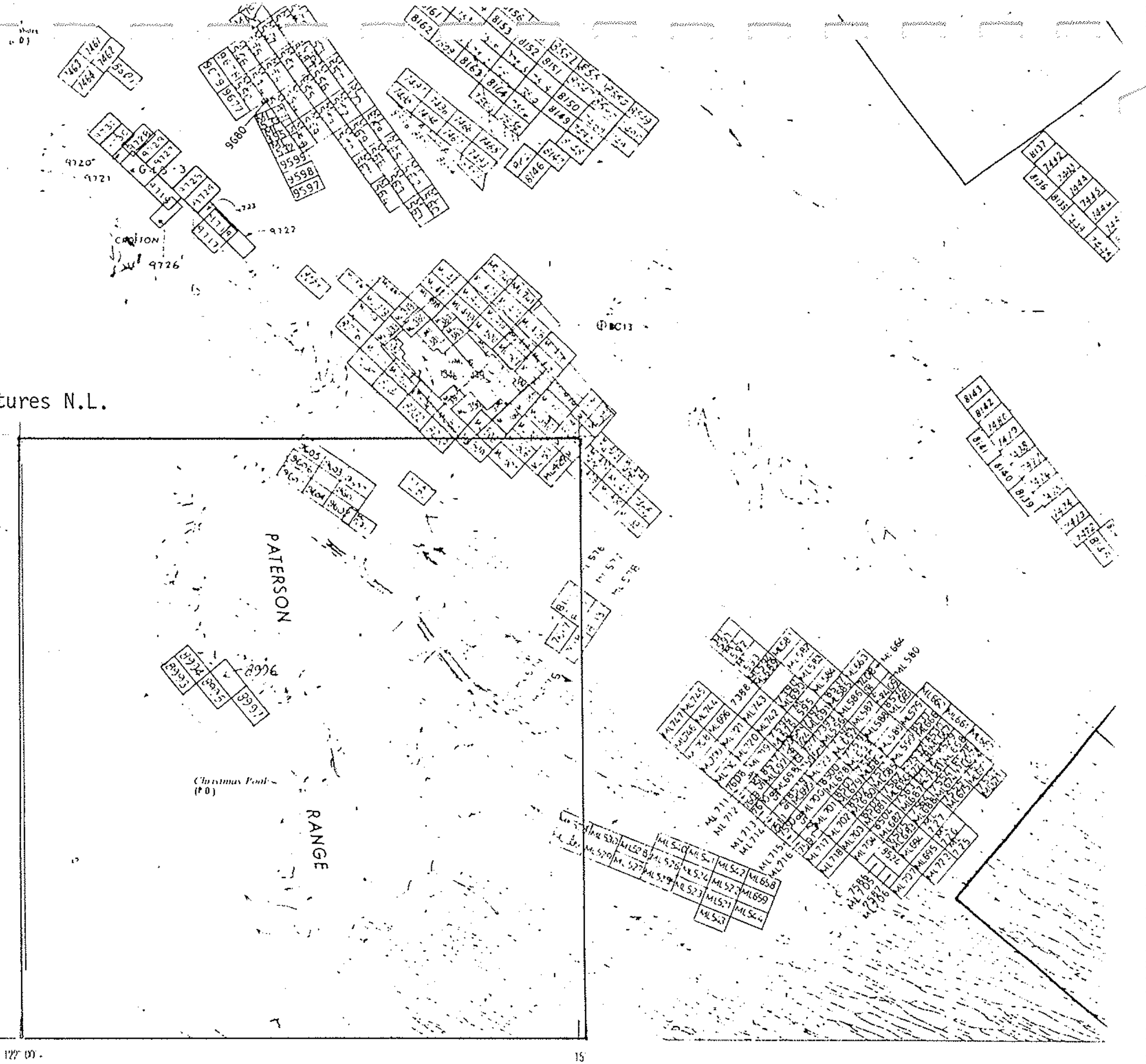
Mining Tenement Holders

Mineral Claims

7281	Newmont Pty. Ltd.
8993-8997	Auselex Mineral Ventures N.L.
9600-9607	Newmont Pty. Ltd.

Mineral Leases

427-429	Newmont Pty. Ltd.
505-509	Newmont Pty. Ltd.
528	Newmont Pty. Ltd.
531	Newmont Pty. Ltd.
539	Newmont Pty. Ltd.
574-578	Newmont Pty. Ltd.



MAP 8B - MINING TENEMENTS IN PROPOSED PATERSON RANGE RESERVE.

F. HYDROLOGY

Probably as for Rudall River National Park. Christmas Pool and a pool near Christmas Pool cave are semi-permanent, and derived from surface run-off.

G. VEGETATION

The proposed reserve contains an area of *Triodia wiseana* dominated vegetation in the Canning Botanical District. This association is not represented within the National Park. Map 9 shows the reserve in relation to the Rudall River National Park, and the vegetation of the area.

H. FLORA AND FAUNA

Little is known of these features, as no surveys have been undertaken. Some plant species associated with the glacial deposits may be much more abundant here than in the National Park.

I. ABORIGINAL OCCUPATION

Two features of Aboriginal occupation occur within the proposed reserve, and their preservation is a major reason for its proposal.

Christmas Pool was apparently a major water source, and artifact scatters are abundant. A feature of the Pool-side are numerous grooves in the rock made by natives sharpening and grinding stone or wooden tools. These grooves are well preserved, but could be easily vandalised.

A nearby cave, referred to as Christmas Pool Cave in this text, is a spectacular example of Aboriginal art. Elaborate paintings in ochres and pipeclay are present, as well as painting in blue. Blue plant dyes used in paintings are unusual. Near the cave is a well hidden rockhole some 2-3 m in diameter and 1 m deep. The native tobacco and narcotic *Nicotiana* sp. is abundant near the cave mouth. The cave and waterhole is a Registered Aboriginal Site with the Western Australian Museum.

J. EUROPEAN HISTORY

Christmas Pool is one of the campsites on Rudalls expedition; and several historic visitors have carved their names in the sandstone on the pool edge. The site is a landmark in the history of exploration in Western Australia, and worthy of protection.

K. VISITATION

Visitation is extremely high considering the isolation of the area. Its historic significance attracts many visitors from as far west as Nullagine, as well as tourists from Perth and day visitors from Telfer. It is estimated that up to 3000 visitors per year visit Christmas Pool, with many camping on-site. Rubbish control and other management is required.

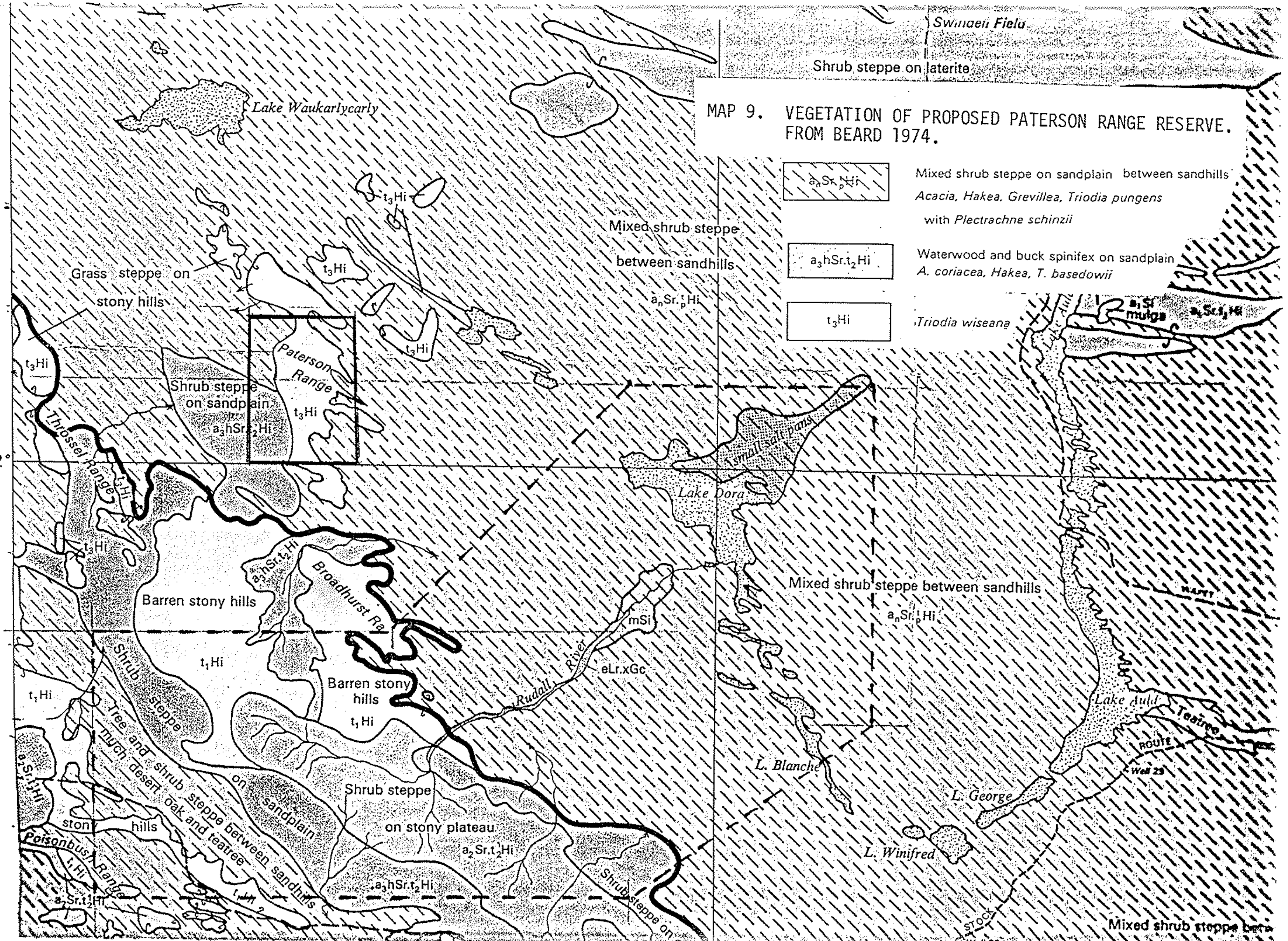
FIGURE 19. Carved names at Christmas Pool, of A.H. Crofton and J. Connaughton and the date 15 April, 1897. These gentlemen accompanied W.F. Rudall on his second trip in search of the lost Calvert Expedition.

FIGURE 20. Grooves made by Aborigines in sandstone at Christmas Pool in the proposed Paterson Range reserve. These marks are made by sharpening stone or wooden tools on the rock.

FIGURE 21. Aboriginal paintings in Christmas Pool cave within the proposed Paterson Range reserve. The cave is a Registered Aboriginal Site and worthy of protection.

FIGURE 22. Further paintings in Christmas Pool cave Aboriginal Site.

MAP 9. VEGETATION OF PROPOSED PATERSON RANGE RESERVE. FROM BEARD 1974.



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Ms. J. Muir criticised the drafts and Mrs. J. Christian typed the manuscript.

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