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EYRE WATER RESOURCES STUDY
GROUNDWATER ASSESSMENT
POLDA BASIN

GEOLOGICAL SURVEY

by

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GROUNDWATER ASSESSMENT - POLDA BASIN

ABSTRACT

As part of the Engineering and Water Supply Department's State Water Resources Management Plan the South Australian Water Resources Council recommended in June 1981 a water resource assessment of the Eyre Region. This assessment of the groundwater resources of County Musgrave is one part the study.

Potable (<1000 mgL^{-1}) groundwater occurs in five lenses with the Polda Basin (hydrogeological).

Annual yield of the lenses totals 14000 to 19000 ML depending upon method used. Between 400 and 2500 ML yr^{-1} (seasonally dependent) is abstracted from the lenses for reticulation. Diffuse, unquantified extraction for stock and domestic purposes accounts for the balance of groundwater usage.

Identified groundwater issues include: groundwater salinity and salinity stratification, pollution (minor), naturally occurring nitrate, Lock coalfield dewatering and the unlikely potential for large scale irrigation development.

Recommendations include: initiation of water quality monitoring, re-valuation of aquifer test data, compilation of various hydrogeological maps preparatory to modelling and legislative controls to protect the groundwater resource.

INTRODUCTION

The South Australian Water Resources Council recommended at its meeting on the 19th June 1981 that a programme of evaluation and management of the Water Resources of Eyre Peninsula be developed and submitted to the Hon. the Minister of Water Resources.

To assist the Water Resources Branch, Engineering and Water Supply Department (EWS) in its study, this Department was asked to provide technical input on the groundwater resources.

The study outlined in this report was originally to have assessed the County Musgrave "basins". However, as will be elaborated upon later, this format was considered inappropriate and the hydrogeological entity known as the Polda Basin (Figs. 1 and 2) is considered.

Stage I of the study described herein is the Identification Stage in which available groundwater data are appraised and recommendations made on the direction of future investigations necessary to satisfy the aims and objectives of the study.

AIMS AND OBJECTIVES

Within the groundwater component of Stage I of the study brief, the following tasks require definition:

1. identify basin boundaries, recharge areas, safe yields and water quality.
2. identify constraints to the present and future management practices eg. lack of knowledge of the resources available, salinity and salinity trends of available groundwater, possible conjunctive use of water resources and protection of recharge areas etc.
3. identify improvements to the ongoing water resources assessment programmes: eg. rationalisation of existing monitoring programmes, development of additional data collection programmes, development of mathematical models for basin management etc.

The reporting of the tasks and recommending future strategies will complete Stage I.

PREVIOUS WORK

The basin was first outlined in 1911 by R.L. Jack and he prepared a Departmental report on the groundwater of the "Polda Water Area" in 1928 and used the chloride ion to calculate a recharge rate. He obtained a value of 2/3" (17mm) per year. The incursion of saline groundwater by overpumping was also recognized. Segnit (1934) recommended frequent water level monitoring to record seasonal fluctuation, collection of rainfall data, examination of lithologs, accurate well locations and salinity monitoring. He also recognized the existence of a Tertiary semi-confined aquifer beneath the Pleistocene aeolianite. Gibson (1958) and Shepherd (1960) undertook work on Elliston town water supply as a result of which a number of wells were drilled in the Pleistocene aeolianite.

Pumping from the Polda Trench commenced in December 1962 and indirectly initiated extensive groundwater exploration in County Musgrave. Initially, work was concentrated about the trench itself to monitor the effects of pumping both on water level and salinity as it was recognised that excessive abstraction could cause the migration of more saline ground water both laterally and vertically. Work expanded to cover most of County Musgrave and culminated in the production of about nineteen progress reports which are cited in Barnett (1980).

Extensive drilling was carried out (607 holes) to a cumulative depth of 11.15 km. All successful holes were completed as observation wells and have been regularly monitored for water level. Limited geological mapping, resistivity surveys (Hussin, 1967 & McPharlin 1967), establishment of meteorological stations, pumping tests for aquifer parameters (Shepherd, 1954, Bleys, 1965 & Painter 1970) were undertaken and documented in a concise report by Painter (1972). Attempts were made at estimating "safe yields" for the six freshwater "basins" which were delineated by the 1000 mgL^{-1} isohaline contour. D'arcy's Law and an estimation of recharge from rainfall were used in calculations.

The investigation was only partially successful in quantifying the available groundwater resource. The following work was recommended:

1. further cable tool drilling to determine the full extent of the "basins"
2. additional drilling within the basins to determine the interrelationship between the water table and (semi) confined aquifer(s)
3. additional pumping tests in basins more likely to be developed to assess aquifer properties
4. the appraisal of groundwater hydrographs
5. further geological mapping to define recharge areas
6. observation of rainfall and runoff phenomena.

Of the above recommendations only well hydrograph monitoring and collection of meteorological data have been carried out on a regular basis. Aquifer characteristics have been obtained irregularly from subsequent town water supply development (Williams, 1973) and by a re-assessment of Talia Basin (Bowering and Shepherd, 1975).

Yandell (1976) produced a report on future development of water supplies on Eyre Peninsula within which both surface and groundwater resources were discussed. Previously published "basin safe yields" (Painter, 1972 and Bowering & Shepherd, op. cit) were accepted uncritically, i.e. first order estimations were used in the assessment.

A well inventory of County Musgrave undertaken as a prelude to proposed proclamation of the County is documented in Herraman (1980). Well status data are shown in Appendix A.

In summary, most quantitative work has centred around Polda Trench, as it is the major abstraction point within County Musgrave (330-2500 $MLyr^{-1}$). First order assessments have been made of the available resources from the six low salinity (less than 1000 mgL^{-1}) "basins". Some recommendations for improving the data base have been implemented.

SOURCES OF DATA

Most data used in the assessment are available in Departmental unpublished reports a complete list of which is presented in the References.

Individual well data, both Departmental exploration holes and private wells are available on microfiche held within the Technical Information Section.

Data on the probable effect on the Polda Trench of dewatering and depressurising of the aquifers present within the Lock Coal field were obtained from the consultant reports (1981 & 1983) with permission from the Electricity Trust of South Australia.

Data manipulation was carried out by personnel of Water Resources Branch, EWS and this Department's Data Processing Section.

PHYSIOGRAPHY AND CLIMATE

The area considered (Fig. 1) comprises most of County Musgrave and portions of Counties Robinson and Jervois and is within the Eyre Planning Area. Major towns are Elliston and Lock. Information for much of this section is taken from Painter (1972).

In general, the area is flat to undulating with the land surface gradually rising to the east (Fig. 2).

The coastal area varies from mobile sand dunes up to 30 m high to steep or sub-vertical cliffs rising 30 to 120 m above sea level.

Ephemeral lakes and swamps occur in a broad depression which runs sub parallel to the coast and from 2 to 8 km inland.

East of the depression the land surface rises to elevation ranging from 45 to 75 m above sea level.

Mt. Wedge is a prominent topographic feature rising some 240 m above sea level and 210 m above the surrounding county.

Surface runoff is almost non existent being confined to minor ephemeral creeks in the upland areas. Any creeks developed soon disappear on the gentler slopes. Drainage is local into internal closed depressions.

The climate is Mediterranean with hot, dry summers and cool winters. Mean monthly rainfall figures for stations within the area are presented in Table 1 and rainfall isohyets and evaporation data are shown in Fig. 3.

Table 1. Mean Monthly Rainfall Data (May 1977).

Station	Years of Record	J	F	M	A	M	J	J	A	S	O	N	D	Year
Bramfield	83	7	12	12	24	52	75	71	57	37	28	17	14	406
Kappawanta	68	6	13	12	22	47	60	66	55	35	28	19	13	376
Lock	58	12	19	15	26	46	54	58	57	40	34	25	22	408
Mt Hope	42	10	16	17	34	61	71	88	70	46	31	26	20	490
Mt Wedge	92	9	13	14	24	48	67	62	56	37	29	17	14	390
Sheringa	61	9	17	14	26	56	72	77	66	43	39	21	16	450
Talia	66	7	12	13	20	44	59	59	52	35	24	21	13	359
Tooligie Hills	42	14	16	13	28	43	48	61	51	40	31	20	23	388

From data contained in Herraman and Barnett (1979), rainfall can exceed potential evapotranspiration for the months May to August inclusive. This rainfall is termed effective rainfall and is defined for the purpose of this report as that portion of annual rainfall available for groundwater recharge.

Cumulative deviation from the mean curves of effective rainfall for four of the stations cited in Table 1 and presented in Figures 4 to 7 inclusive show a cyclic pattern to rainfall. From Figure 5 (Mt. Wedge) major periods of declining rainfall occurred from about 1893 to 1910, 1924 to 1950 and there is evidence to suggest that from 1974 a further period of declining rainfall has commenced. During the period of major investigation into the groundwater resources of County Musgrave (1962 to 1969) rainfall was generally above average.

Much of the area has been cleared of native vegetation for agricultural use but substantial areas of native scrub remain (Fig. 8). A detailed description of the natural vegetation is given in Mowling (1979).

Land use (Fig. 9) is generally sheep grazing separately or in combination with cereal growing. In the late 1970's, total crop area was 75 400 ha and stock numbers were; cattle 6 900 head, 281 000 head of sheep and 1 100 pigs (Herraman, 1980). Three large conservation parks lie within the area of investigation or are peripheral to it.

GEOLOGY

General

The County Musgrave "freshwater basins" occur within the tectonic entity known as the Polda ?Basin/Trough which is about 360 km long (60% offshore), 10-30 km wide and may contain up to 5 000 m of sediments (thickest offshore). The period of sedimentation is from ?Middle Proterozoic to the Cainozoic (Cooper and Gatehouse, 1983).

A geological summary is presented in Table 2 and a geological map and rock relation diagram is shown in Figure 10.

Table: 2 Summary of Geology

Age	Unit	Range of Thickness (m)	Lithology	Depositional Environment
Holocene to Pleistocene	Bridgewater Formation	< 5 - 20	Calcareous Sand(stone): unconsolidated to well indurated calcite and broken shell fragments. Variable silt and clay. Calcreted surface - karstic in part.	Aeolian to littoral
?Pliocene	Unnamed	-	Sands: grey poorly sorted qtz., carbonaceous, interbedded green to grey clay. Lignitic, freq. pyrite. Rare feldspar. Recognised only in E end of basin.	Non marine - thought to coincide with more pluvial times.
Middle to Eocene	Poelpena Formation	10 - 150	Quartz sand, silt & clay: carbonaceous, micaceous and pyritic; frequence interbeds of dark brown lignite. A discontinuous stiff to plastic clay occurs at the top of the unit.	Paralic
Late Jurassic	Polda Formation	10 - 100	Sandstone/Claystone: dk brown grey qtz sand, minor pyrite, carbonaceous clay to lignite with siltstone interbedded.	Fluviatile
Permian/ Carboniferous	Coolardie Formation	<150	Mudstone: brown, grey green and white mudstone and sandstone with frequent large erratic fragments.	Glacial to fluvio-glacial
Middle Proterozoic	Blue Range Beds	<150	Sandstone & Conglomerates: basal pebble conglomerate to gritty sandstones. Crossbedded, micaceous, arkosic in part.	Fluvial
Archaean/ Lower Proterozoic		-	Basement: undifferentiated metasediments, gneisses, schists, quartzites, dolomites etc.	Various

The Polda Basin has been subjected to mild, intermittant tectonism concentrated along the boundary faults. Deformation of the sediments has been minimal.

There is a notable absence of marine Cretaceous and marine Tertiary sediments.

Basement

For the purposes of this report, basement is defined as the pre Permian sequence.

Metamorphics of Archaean-Lower Proterozoic age underlie the entire area at variable depth. Outcrop occurs in the vicinity of Bramfield.

The Polda Basin sediments (Middle Proterozoic - Holocene) have been deposited in an east-west graben formed within the older metamorphics.

Middle Proterozoic Blue Range Beds consisting of grits and sandstones cropout at Mt. Wedge.

Permian

Extensive on shore drilling has revealed a substantial thickness of Late Palaeozoic glacigene sediments (Cooper et. al 1982). These have been named the Coolardie Formation and are of no hydrogeological significance, hence will not be considered further.

Late Jurassic

Unconformably overlying the Permian sequence is the Polda Formation of thin clayey sands, interbedded carbonaceous clays and low grade coals. The coal deposits about 15 km west of Lock have been investigated by ETSA and are the subject of a number of reports defining reserves and estimating the effects of dewatering and depressurising relevant aquifers (Gatehouse, 1979; Eberhard & Waterhouse 1979 and ETSA 1981).

Previous work suggests the Polda Formation is continuous from Lock to west of Polda and restricted in occurrence to the Polda Trough. Geophysical work to date has not defined the margins of the Jurassic basins. However, geophysics has allowed the following observations:

1. the northern margin of the basin is faulted
2. the southern margin is probably a sloping shelf.
3. about 2000 m of sediments lie below the Polda Formation above crystalline basement (lower Proterozoic).

Middle-Late Eocene

Unconformably overlying the Polda Formation is the paralic Poelpena Formation of gravels, sands, silts, carbonaceous clays and lignites. The unit is extensive throughout the area and ranges in thickness from 10 to 150 m.

?Pliocene

These non-marine, lignitic sands are of restricted occurrence, are not important hydrogeologically and will not be considered further.

Pleistocene to Holocene

The Bridgewater Formation of calcareous sand(stones) and related sediments was deposited under aeolian and littoral conditions. Its karstic nature (in part) is important in determining recharge and hence the availability of usable groundwater resources. The unit blankets much of the study area and is not confined to the area of the Polda Basin. Its surface is generally calcreted.

Holocene

Recent deposits include alluvial silt soils, estuarinal deposits (St. Kilda Formation) and partially mobile calcareous dunes (Semaphore Sand).

Summary

Of hydrogeological importance is the sequence from and including the Polda, Poelpena and Bridgewater Formations.

GROUNDWATER RESOURCES

Preamble

The groundwater resources of County Musgrave were explored and assessed during the 1960's and summarised in a report by Painter (1972). The aquifer subdivision proposed is shown in Table 3.

Table 3 : Aquifer Subdivision (after Painter, 1972)

Aquifer	Age	Unit	Lithology	Type	Remarks
A	Pleistocence	Bridgewater Formation	Calcareous sand(stone) (karstic in part)	Unconfined	Named the "aeolianite"
B	Tertiary	Poelpena Formation	Unconsolidated sand	Unconfined and confined	Confined where overlain by Tertiary clay
C	Jurassic	Polda Formation	Unconsolidated sand	Confined	Ill-defined W of Lock coalfield

The three aquifer systems were recognised in six distinct "freshwater basins" (Fig. 11) with most work being concentrated on the water table aquifer because of its superior groundwater quality. Few holes fully penetrated the Tertiary sequence and fewer still intersected the Jurassic aquifers.

The six so-called basins were delineated by the 1 000 mgL^{-1} isohaline i.e. areas of low salinity groundwater caused by efficient recharge through the subcropping, partially karstic Bridgewater Formation.

To perpetuate the notion that these areas are basins will continue to mislead future workers. The definition of a basin is not satisfied by the hydrogeology of these low salinity areas and it is therefore proposed to rename the basins as lenses e.g. Polda Lens, etc.

Confusion has also existed on the area of the Polda Basin. For groundwater geologists the Polda Basin has been that low salinity groundwater area in County Musgrave from which the Polda Trench obtains its yield whilst for stratigraphers, etc. the Polda Basin is the area shown on Fig. 1. In fact the Polda Basin is still ill-defined and some workers would have it called the Polda Trough (Cooper & Gatehouse, 1983).

For the purpose of this and hopefully subsequent reports, the nomenclature proposed above for the low salinity groundwater areas will be used. The reason for the name change is not pedantic but is to give modellers in particular a clearer understanding of the morphology of the groundwater system.

It was thought inappropriate to restrict the area of the assessment to the cadastral subdivision of County Musgrave as was the original intention. Instead, the structural, hydrogeological entity, the Polda Basin, is the subject of the study, with emphasis however on the freshwater lenses occurring in County Musgrave. It is necessary to understand the overall hydrogeology of the Polda Basin when considering the possible dewatering etc. effects of the potential Lock coalfield for example.

All available aquifer parameters (transmissivity and storage coefficient) are shown in Appendix B.

<u>Jurassic Aquifer (Polda Formation)</u>

This aquifer system is poorly defined in the area of the low salinity lenses because of the paucity of drilling data (Painter, op. cit.) but is better documented in the Lock coalfield area (Eberhard & Waterhouse, 1979, ETSA, 1981).

The aquifer is restricted to the Polda Basin and is confined to semi-confined.

Water quality is poor with salinity in the range 30 000 to 50 000 mgL^{-1}. Because of the reducing environment caused by carbonaceous content of the sediments, dissolved hydrogen sulphide and iron occur as contaminants.

Recharge is thought to occur where the Polda Formation clays are thin or absent; probably toward the eastern limit of the Basin. Recharge according to ETSA (1981) is expected to be low because of low rainfall, vegetation cover and the anticipated small area available for intake.

Transmissivity is very low, 0.6 to 45 $m^3 day^{-1} m^{-1}$ and storage coefficient is in the range 10^{-4} to 10^{-6}.

Groundwater movement is by porous medium flow (consolidated sands) and is generally westward, subparallel to the long axis of the basin. Toward the basin margins flow direction is not well known.

The aquifer's hydraulic potential relative to other aquifers is poorly understood but for one hole in the Lock coalfield its head was about 12 m higher than the overlying Tertiary aquifer - indicating a recharge area topographically higher i.e. to the east.

Tertiary Aquifer (Poelpena Formation)

In the Painter (op. cit.) study many wells did not enter the lower sand section of the Tertiary sequence, therefore its full thickness in this area is not known. The Lock coalfield investigation holes, however, fully penetrated the Tertiary deposits with maximum permeable thickness being about 80 m. Thickness may increase westward but is modified by basement morphology.

The aquifer is not restricted to the Polda Basin but is likely to be thin north and south of the Basin.

ETSA (1981) describes the aquifer as complex with irregular interbeds of permeable sand in a generally finer, probably leaky matrix. As for the Jurassic aquifer, groundwater is high in hydrogen sulphide and iron.

Groundwater quality is poor with a salinity range between 35 000 and 50 000 mgL^{-1} in the vicinity of the Lock coalfield. However, in western County Musgrave where there is direct hydraulic connection with the overlying Pleistocene aquifer water quality is often potable.

Recharge is not well understood and most attempts to quantify it have been somewhat arbitrary e.g. 5% of effective rainfall (Painter, op. cit.). ETSA (1981) speculates that recharge could have increased subsequent to clearance of scrub for agricultural purposes. Transmissivity is generally low being in the range 2 to 80 $m^3day^{-1}m^{-1}$ with storage coefficient from 9 x 10^{-4} to 7 x 10^{-3}.

Painter (op. cit.) did not discriminate between the two aquifer systems when compiling his water table contour plan (Fig. 12).

Groundwater flow is expected to follow the flow pattern of the Pleistocene water table aquifer. This may well be the situation in the western County Musgrave area but the flow regime elsewhere in the basin is not known with certainty.

Pleistocene Aquifer (Bridgewater Formation)

The water table aquifer within the Bridgewater Formation, a calcreted, partially karstic calcareous sandstone is the best documented of the aquifers present in the study area. Most of the 607 holes of the 1960's investigation fully penetrated the unit and numerous observation wells have provided water level data. Several aquifer tests have been conducted in the low salinity lenses with a number concentrated around the Polda Trench (Shepherd, 1964; Bleys, 1965 & Painter, op. cit).

Thickness is variously reported between 1 and 12 m.

Like the Poelpena Formation the Pleistocene aquifer is not restricted to the Polda Basin but forms an ubiquitous veneer over western, coastal Eyre Peninsula. However, the development of low salinity groundwater lenses within it coincides with the western end of onshore Polda Basin.

Unlike the two older aquifer systems, flow within the Bridgewater Formation is both by porous media and conduit flow (karst development). This accounts for the high transmissivities obtained; from 800 to 3 450 $m^3day^{-1}m^{-1}$ with a median value of about 2 040 $m^3day^{-1}m^{-1}$. Specific yield ranges from 3 x 10^{-5} to 5.6 x 10^{-2} with a mean of 2.1 x 10^{-2}. The watertable aquifer is from two to three orders of magnitude more transmissive than the underlying semi-confined to confined aquifers.

Groundwater quality varies from less than 400 to about 45 000 mgL^{-1}. The "six basins" of Painter (1972) were defined by the 1000 mgL^{-1} isohaline and coincide with areas of Bridgewater Formation outcrop coupled with skeletal soils. During the 1960's investigation programme, water quality within the unit was found to be "constant through the full thickness of the aquifer".

High nitrate concentrations (up to 60 mgL^{-1} and frequently about 40 mgL^{-1}) have been obtained from the Polda Lens. The source of nitrate is probably botanic (Sheard, 1982). Further data are required on nitrate concentrations because some nitrate analyses performed during the 1960's investigation were only qualitative. High nitrate concentration in water abstracted from the Polda Trench is of immediate concern.

Recharge is by direct infiltration of rainfall through thin soil cover. Estimates have been made (Jack, 1928; Painter, op. cit.; Bowering and Shepherd, 1975 & E.T.S.A., 1981) on recharge rates which vary from 17 to 49 $mmyr^{-1}$. Painter, op. cit., in his estimates for recharge used a 30$mmyr^{-1}$ to compute "safe yield".

Groundwater flow is known only for the central and western areas of County Musgrave where flow lines are essentially radial away from a groundwater high (coincident with a topographic high) thence west toward the coast (Fig. 12). This flow regime was derived using both Pleistocene and Tertiary aquifer observation well data.

Low Salinity lenses

Painter's work during the 1960's delineated six "freshwater basins" within the County Musgrave investigation area. The criterion for defining these areas was the 1000 mgL^{-1} isohaline. The locations (Fig. 11) of the low salinity zones coincide with subcropping Bridgewater Formation with skeletal soil cover. No distinction was made between the Tertiary sand (Aquifer B) and the Pleistocene calcarenite (Aquifer A) aquifers in drawing the isohalines.

Although the lenses were defined purely on the basis of salinity, little follow-up water quality monitoring has taken place since the holes were drilled. The exception is Polda Lens where the quality of water abstracted for reticulation into the Tod Trunk Main and Lock-Kimba Pipelines is monitored.

Some complete chemical analyses for the Tertiary and Pleistocene aquifers are shown in Table 4.

Table 4: Hydrochemical Data

Tertiary Aquifer

Milligrams per Litre

Well	Cl	SO_4	HCO_3	NO_3	Na	Ca	Mg	TDS	pH	Lens
KPW14	235	24	333	0	132	88	20	842	7.5	Kappawanta-Bramfield
SQR31	267	61	352	Present	203	72	27	982	-	Polda
TAA41	130	50	230	Trace	136	35	10	591	-	Talia
WAY54	275	25	255	30	168	62	30	845	6.7	Sheringa A
				Pleistocene Aquifer						
KPW34	55	20	213	5	30	76	6	405	-	Kappawanta-Bramfield
PER1	80	10	190	40	52	61	12	445	6.4	Sheringa B
SQR15	253	81	169	Present	181	71	36	791	-	Polda
TAA20	181	39	320	0	119	78	25	762	6.4	Kappawanta-Bramfield
WAY15	315	48	317	Present	179	83	38	980	-	Sheringa A

In summary, within the low salinity lenses water quality is suitable for most purposes. However, this statement must be qualified in that nitrate is known to be high in some areas, and unquantified in others and no analyses have been made for trace constituents. Groundwater quality outside the low salinity lenses varies from marginally suitable for human consumption to totally unusable.

Apart from a relatively small number of stock and domestic wells, three of the five lenses are undeveloped. Elliston town water supply (70-80 $MLyr^{-1}$) is obtained from the western end of Kappawanta-Bramfield Lens whilst from 330 to 2500 $MLyr^{-1}$ (dependent upon demand) is pumped for reticulation from Polda Trench.

A resume of the characteristics of the low salinity lenses as modified after Painter (op. cit.) is given in Table 5.

Table 5 : Summary of Lens Characteristics[6]

Lens Name	Total Area km^2	Aquifer Type[1]	Aquifer Area km^2	Aquifer Thickness m Range	Aquifer Thickness m Predom.	Unconfined-U Confined-C	Aquifer Parameters T $m^3 day^{-1} m^{-1}$	Aquifer Parameters S	Max. yield individual[3] wells-$Lsec^{-1}$	Lens Yield $MLyr^{-1}$ D'arcy	Lens Yield $MLyr^{-1}$ Rainfall[4]	Reliability of Yield Assessment[5]
Polda	111	Pleis.	75	2.5-11	5	U	2200	2.5×10^{-2}	55	2700	2250	Good
		Tertiary	36	4.5-9	9	U&C	-	-	-	220	540	Moderate
Kappawanta -Bramfield	321	Pleis.	101	2-5	7	U	1300-1400	$1\text{-}4.1 \times 10^{-2}$	50	6700	3030	Moderate
		Tertiary	220	12-43	25	U&C	80	10^{-3}	10	3060	3300	Moderate to poor
Sheringa A	51	Pleis.	41	1-12	6	U	3450	6.1×10^{-3}	60	3600	1230	Good
		Tertiary	10	8-15	10	C	-	-	-	180	150	Moderate
Sheringa B	80	Pleis.	80	1-14	6	U	800	10^{-2}	10	1800	2400	Poor
Talia	78	Pleis.	23	1-3	2.5	U	-	-	-	890	690	Moderate
		Tertiary	54	12-27	15	U	-	-	-	270	810	Moderate
							TOTALS	Pleistocene		15690	9600	
								Tertiary		3730	4800	
										19420	14400	

Note:

1. Pleistocene aquifer-Aquifer A (Painter, 1972)
   Tertiary aquifer -Aquifer B (Painter, 1972)

2. Tertiary aquifer thickness is probably greater than shown.

3. Data derived from limited number of aquifer tests.

4. Recharge from rainfall arbitarily taken as 10% of effective rainfall for Pleis. aquifer. (30 $mmyr^{-1}$) and 5% for Tertiary aquifer (15 $mmyr^{-1}$).

5. Good - aquifer test data from within lens.)
   Moderate - aquifer test data from similar material or other lenses) 1st order <u>estimate</u> only
   Poor - data unreliable.)

6. Groundwater quality <1 000 mgL^{-1} (T.D.S.).

Because of probable saline groundwater underflow and the nature of the low salinity groundwater resource, the usual methods of calculating safe yield are probably not applicable.

Painter (op. cit.) calculated total "basin" yield for his "six low salinity basins" within County Musgrave using D'arcian flow and rainfall to be 19 000 to 14 000 $MLyr^{-1}$ respectively (Table 4).

The locations of wells used for pumping tests (to derive aquifer parameters) together with the monthly water level observation well network are shown on Figure 13.

It is stressed that the lens safe yield (defined as the hydrogeologically sustainable groundwater resource) values are very much first order and this should be stated if the data are to be used for management purposes.

Groundwater Recharge

Various estimates/calculations have been made on the amount of rainfall available for aquifer replenishment. The values used by various workers are tabulated below (Table 6).

Table 6: Recharge Values (mm yr^{-1})

Pleistocene Aquifer	Tertiary Aquifer	Jurassic Aquifer	Reference
17	-	-	Jack (1928)
180	-	-	Malebe (1971)
30	15	-	Painter (1972)
30	-	-	Allison & Holmes (1973)
45-50	1 to 5	Very low	Waterhouse (1981)

Eliminating Malebe's value of 180 mm yr^{-1}, a mean recharge value of 30 mm yr^{-1} could apply to the Pleistocene aquifer whilst 10 mm yr^{-1} could be used for the Tertiary aquifer. Recharge to the Jurassic aquifer is unquantified but is assumed to be very low i.e. <5 mm yr^{-1}.

Reliable recharge data are required before mathematical modelling can be undertaken.

DATA COLLECTION AND PROCESSING REQUIREMENTS

Salinity Monitoring

Confirmation of the limits of the low salinity lenses identified within the County Musgrave portion of Polda Basin is necessary.

A sampling programme to determine present TDS nitrate and pH values has been initiated. Sampling of water level observation wells monitored monthly and selected from the 600 plus wells originally used for water level measurements constitutes the initial phase of the programme. Subsequent sampling may be required.

In addition, several wells within the former National Network on Water Quality (TCWQ) have been periodically sampled for complete analyses. These analyses have been included in the data base.

Regular monitoring for TDS and nitrate should be initiated or continued on each well (or other abstraction point) used for reticulated supply. Monitoring of any resultant blending of water does not allow for individual well problems to be identified.

All data should be computer stored for ease of retrieval and manipulation.

Water Level Monitoring

Monthly monitoring of the recently rationalised network of observation wells within Polda Basin should continue with data regularly appraised.

Continuous water level recorders may be required in areas where abstraction appears to be approaching "safe yield" e.g. Polda Lens in some high demand years.

Survey Data

Considerable problems in interpreting the large amount of water level data accumulated since the 1960's occurred because of observation well reference elevation inaccuracies. The generation of recent water level contour plans and hydrographs for the area of investigation has been frustrated by the above problem.

Most spurious values have been corrected but a limited amount of field work is required to re-level anomalous wells.

Aquifer Data

About 20 aquifer tests to determine values of Transmissivity (T) and Storage Coefficient or Specific Yield (S) for predominantly the Pleistocene aquifer have been carried out and analysed.

Re-analysis, using improved methods, of some tests within lenses being either actively used (Polda Lens) or to be potentially exploited (Kappawanta-Bramfield Lens) should be undertaken prior to computer simulation.

No additional testing is warranted now.

Meteorological Data

Following the 1960's investigation, several new rainfall observation etc. stations were established.

It is considered that adequate meteorological cover for the area is obtained from these stations and that present monitoring should continue.

Specific short term investigations to more adequately define recharge which will require precise rainfall, evaporation etc. information are necessary. The appropriate instrumentation can be installed if required.

Processing of Existing Data

Apart from the paucity of salinity information a large amount of data has been collected on the County Musgrave portion of Polda Basin. However, a significant part of the information has yet to be assessed. The following could be done with existing data:

1. statistical correlation of rainfall with water level data to provide more reliable recharge calculations.
2. preparation of water level contour plans, water level difference contours, etc.
3. compilation of isopach maps of saturated thickness for the Pleistocene aquifer and (unreliably) for the Tertiary aquifer.
4. preparation of depth to water maps.
5. re-analysis of aquifer data (as above).

Land use planning

Recharge areas, particularly the low salinity lenses (Fig. 1) require protection from both uncontrolled exploitation and pollution.

Three methods are available:

1. land use restrictions as defined under the Planning Act;
2. proclamation of the area as defined under the Water Resources Act;
3. issuing of individual Well and Water Quality Orders as defined under the Water Resources Act.

Each method has its advantages and disadvantages. Land use restrictions are broad but because of the structure of recent planning legislation may be modified by local influences.

Proclamation in the past has tended to be bureaucratic but less rigorous forms are available and could be considered.

Well Orders have not been used extensively for restricting individual well yield. Their widespread application to manage a water resource is to date untried and may be inappropriate.

Groundwater Modelling

Enough information exists to provide a preliminary model of groundwater flow in the Pleistocene aquifer. Weaknesses in the data include unreliable recharge values, widely spaced aquifer parameters (T&S values) and poorly defined hydraulic relationships between aquifers. Initial modelling would probably show other deficiencies and would help identify the direction of future work.

Polda Lens, for which abstraction rate approaches the first order estimate of safe yield in some seasons is of high priority for modelling.

Kappawanta-Bramfield Lens for which groundwater in the Pleistocene aquifer constitutes about 30% (using rainfall method) of the total low salinity groundwater from that aquifer in County Musgrave is likely to be exploited and should be modelled. Elliston T.W.S. currently withdraws about 75 $MLyr^{-1}$ which is about 1% of the "safe yield" from the western end of this lens.

A decision needs to be made on whether to undertake modelling "lens by lens" or to attempt to model the entire Polda Basin. Data are possibly inadequate for the latter but interpolation and extrapolation may enable coarse modelling to be carried out.

GROUNDWATER PROBLEMS AND ISSUES

Preamble

Currently groundwater abstraction from the low salinity lenses of County Musgrave is diffuse (stock and domestic wells of low yield) except for Elliston town water supply (70-80 $MLyr^{-1}$) and Polda Lens (330-2500 $MLyr^{-1}$). Groundwater is also used in the higher salinity areas for stock watering.

Salinity, salinity stratification, pollution, nitrate, Lock coalfield dewatering, irrigation and ill-defined management controls are all issues which could pose problems in the future.

Groundwater Quantity

As defined in Table 4 between 15 000 and 20 000 $MLyr^{-1}$ are available from the low salinity lenses in the County Musgrave portion of Polda Basin.

Polda Lens is the only area in which abstraction approaches "safe yield". However, pumping from Polda lens is seasonally dynamic and ranges from 12% to 90% of lens yield (as determined from rainfall data).

Elliston's town supply of about 75 $MLyr^{-1}$ removes about 1% of the estimated annual yield of Kappawanta-Bramfield Lens.

Groundwater outflow via stock, domestic wells etc. has not been quantified but is diffuse and of relatively low magnitude. Significant irrigation within the investigation area is not known to occur.

No water balance calculations or modelling (on a regional basis) have been undertaken. Lens yields should be regarded as first order and should only be used for management purposes if this qualification is made.

Groundwater Quality

Salinity

As stated in a previous section definition of the available low salinity groundwater has been made using the 1 000 mgL^{-1} isohaline. Water quality data were obtained at the completion of drilling of the holes constructed during the 1960's investigation. No follow-up sampling has been carried out since that time except for monitoring of the Elliston T.W.S. and Polda Trench withdrawals.

Changes in the morphology of the low salinity lenses with time are not known and further sampling is imperative.

Salinity Stratification

The Tertiary aquifer is prone to salinity stratification which imposes constraints upon large scale abstraction i.e. salinity increases with pumping time. As it is frequently in a semi-confined to confined state this problem is accentuated.

Salinity stratification within the Pleistocene aquifer has not been reported but both lateral and vertical migration of more saline groundwater can potentially occur in the stressed (pumped) state if well (field) design is inadequate or abstraction rates are too high.

Pollution

Pollution is a potential problem rather than one which has been recognised.

Such townships as Bramfield etc. where houses are relatively close together and the household water supply is generally in close proximity to its septic tank are potential areas of concern.

Future well fields for town supply purposes (if required) should be located up gradient of potential pollution sources e.g. septic tanks, common effluent schemes, industrial waste sites, stock yards etc.

Nitrate

Whereas the nitrate ion is a man generated pollutant in other areas of the State e.g. Mt. Gambier, its presence in the Polda Basin low salinity groundwater lenses is derived from natural (botanical) sources.

Values greater than the WHO (45 mgL^{-1}) and S.A. Health Commission (30 mgL^{-1}) limits for reticulated water supplies have been found in groundwater extracted from Polda Trench.

The 1960's analyses are incomplete with respect to the nitrate ion and additional sampling is required from within the delineated low salinity lenses.

Nitrate ion concentration is likely to be site specific and blending of water to obtain an acceptable value prior to reticulation may be necessary.

Lock Coalfield

Eberhard & Waterhouse (op. cit.) concluded in their study that dewatering of the proposed pit over a 20 year period would induce a drawdown between 0 and 0.5 m at Polda Trench. However if hydraulic connection exists between the "upper" (Tertiary & Pleistocene) aquifer and the "lower" (Jurassic) aquifer between the coalfield and Polda Trench depressuring the lower aquifer may affect water levels at Polda to a degree not yet quantified.

Subsequent studies by consultants to ETSA, which holds the Exploration Licence for the coalfield, indicates that the interference of dewatering and depressuring should be minimal on Polda Lens.

However, lack of data on the hydraulic relationships between the three aquifers systems particularly in the area between the coalfield and Polda Lens requires that the above statements not be accepted without qualification.

Disposal of the high salinity water produced during dewatering etc. operations is an issue which would arise upon development of the coalfield.

Irrigation (large scale)

No irrigation on a large scale has been identified within County Musgrave.

Skeletal soils on subcropping, calcreted sandy limestone over much of the area of low salinity groundwater is a natural constraint upon extensive irrigation development.

However, any significant development adjacent to sensitive areas, Polda Trench for example, would produce intolerable interference to a fragile water resource.

Management controls to prevent such occurrences must be considered.

CONCLUSIONS AND RECOMMENDATIONS

Between 15 000 and 20 000 $MLyr^{-1}$ are available from the low salinity lenses in the County Musgrave portion of the Polda Basin. This estimate (of groundwater with a TDS of 1 000 mgL^{-1} or less) is a first order value and should not be used unqualified for management decisions. Depending on the method used rainfall or D'arcian flow, between 67 and 81% respectively of "safe yield" is obtained from the Pleistocene water table aquifer with the remainder available from the Tertiary unconfined to confined aquifer.

Of the five identified low salinity lenses only two are developed for reticulation. Polda Lens supplies between 330 to 2 500 $MLyr^{-1}$ (seasonally dynamic) to the Lock-Kimba pipeline whilst Kappawanta-Bramfield Lens provides about 75 $MLyr^{-1}$ to Elliston. Groundwater abstraction elsewhere is diffuse, for stock and domestic supplies.

Identified issues include: groundwater salinity and salinity stratification, pollution (minor), naturally occurring nitrate, Lock coalfield development and the potential for (unlikely) large scale irrigation development on a fragile water resource. It is recommended that:

1. the boundaries of the low salinity lenses be re-appraised by sampling selected wells for TDS and to obtain nitrate data.

2. monthly water level observation of selected wells be continued and that six monthly salinity and nitrate sampling of the current observation well network be initiated

3. spurious observation well network reference elevation values be rectified with (limited) field work

4. existing aquifer data (from pumping tests) be re-assessed using more appropriate analyses, particularly for Polda and Kappawanta-Bramfield Lenses

5. existing hydrogeological data be used to compile water level difference contour plans, isopachs of saturated thickness for the Pleistocene aquifer and depth to water maps preparatory to mathematical modelling

6. modelling of the Polda and to a lesser extent the Kappawanta-Bramfield Lens be undertaken, albeit with limited data, in order to ascertain information deficiencies

7. the low salinity lens recharge areas be protected both from uncontrolled exploitation and/or pollution using either; land use restrictions under the Planning Act, proclamation under the Water Resources Act or the issuing of individual Well or Water Quality Orders as defined under the Water Resources Act.

PCS:AF

P.C. SMITH

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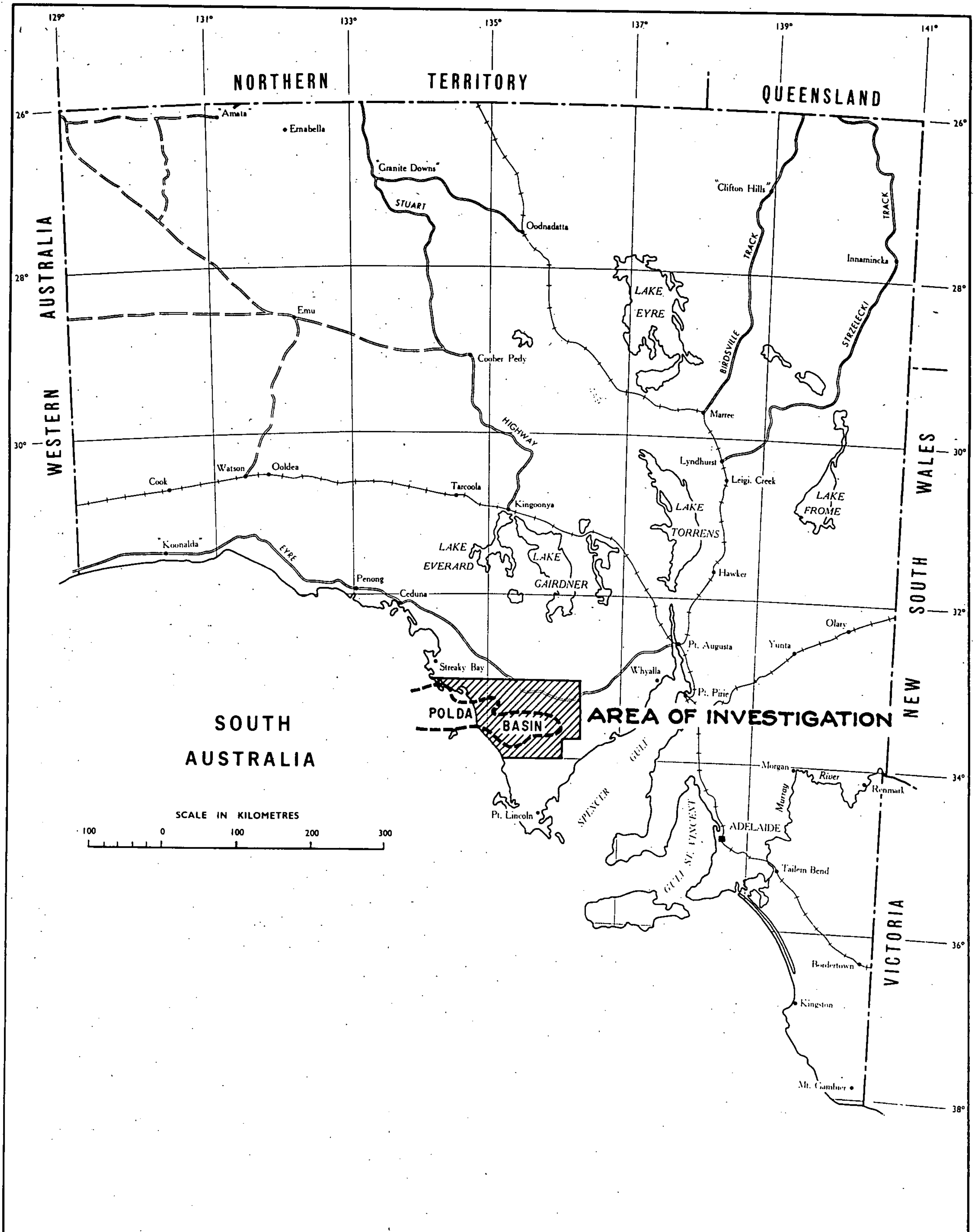


Figure......1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

EYRE WATER RESOURCES STUDY
POLDA BASIN

LOCALITY PLAN

COMPILED P.C.Smith	C.D.O. DATE
DRAWN M.R.	SCALE 1:7000000
DATE Feb '84	PLAN NUMBER
CHECKED -	S 17199

3169

P.F. No. 55850 994.2

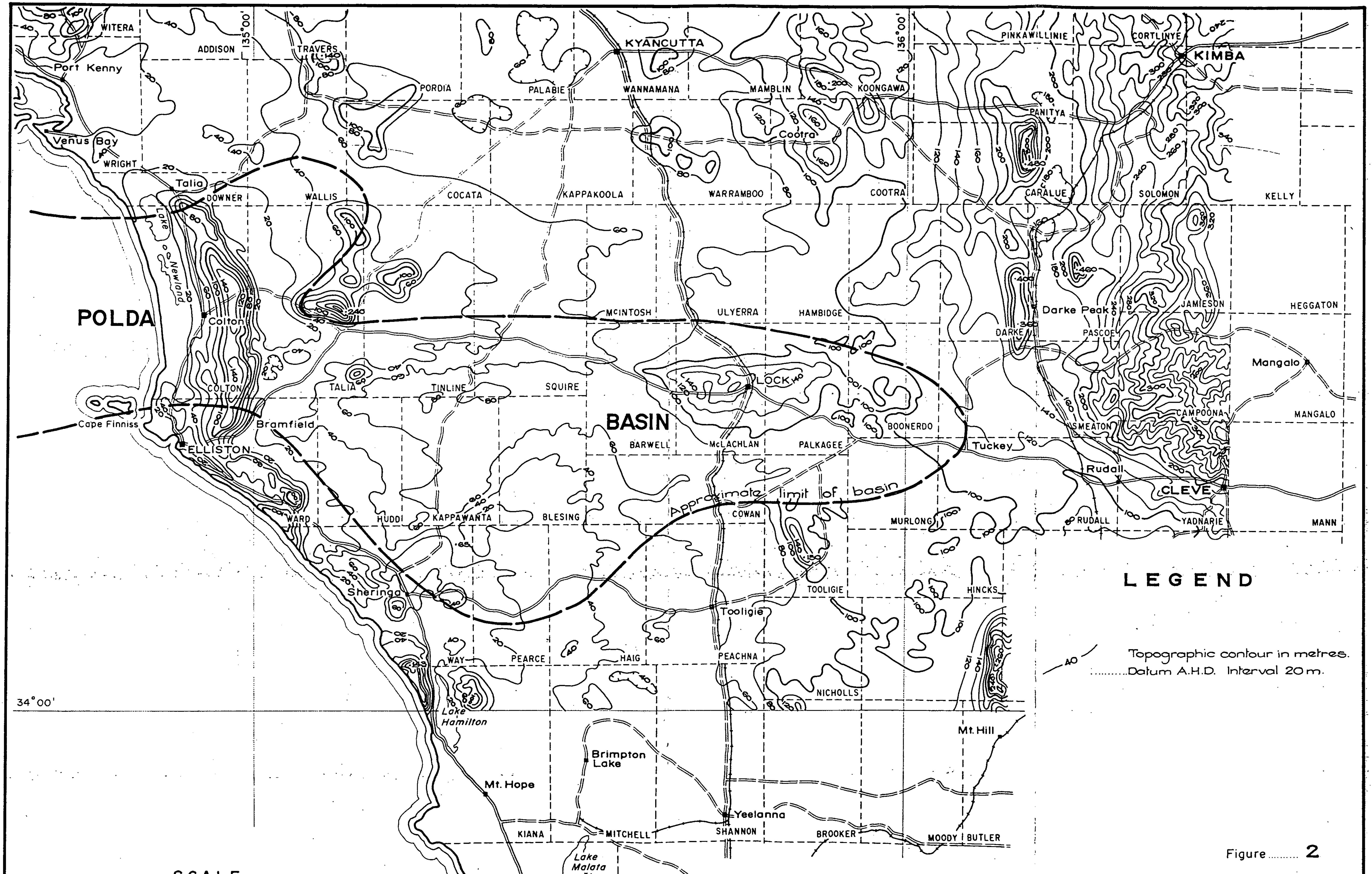


Figure 2

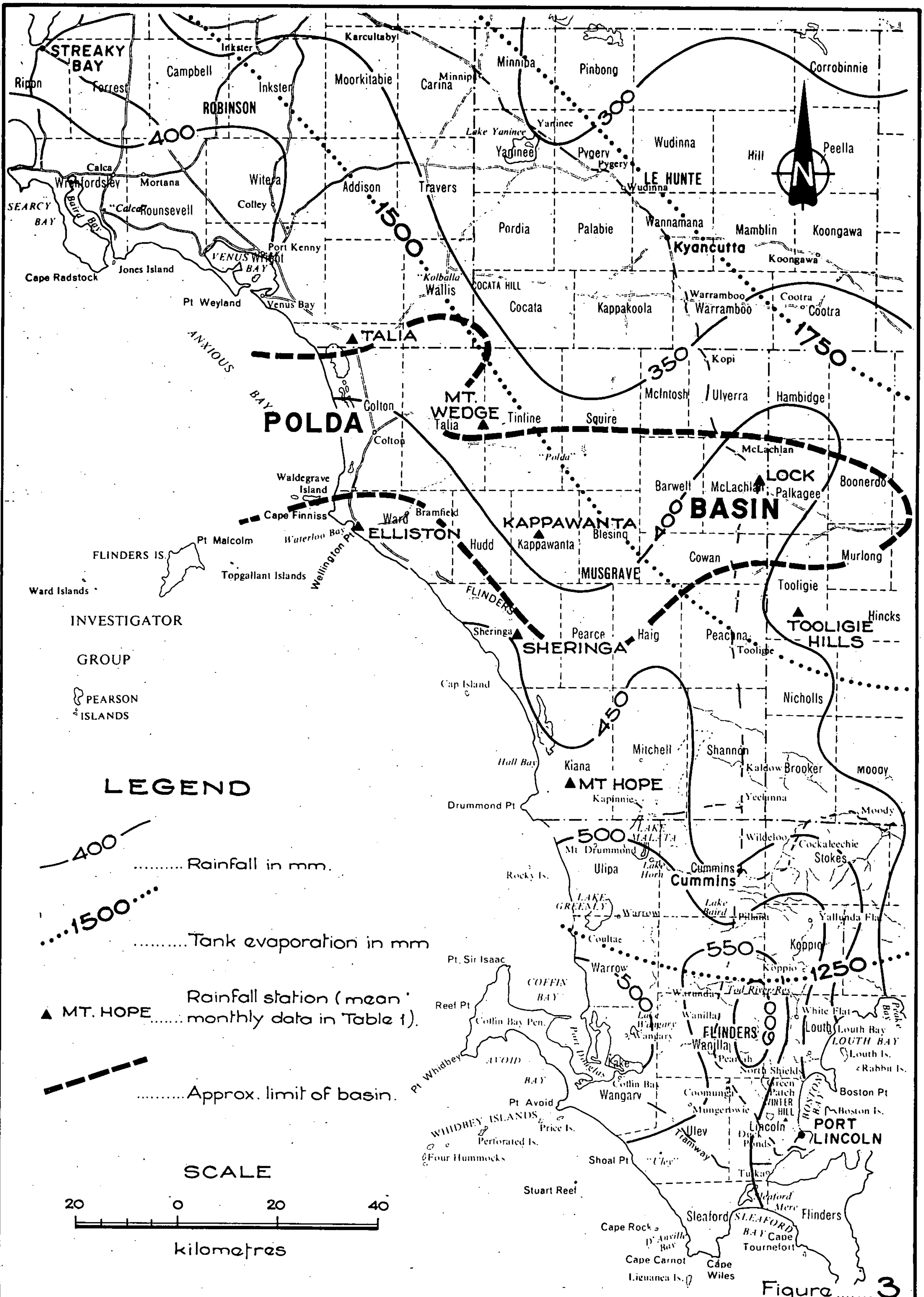
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

EYRE WATER RESOURCES STUDY
POLDA BASIN

TOPOGRAPHIC CONTOURS

COMPILED P.C.Smith	C.D.O.	DATE 7-6-84
DRAWN M.R.	SCALE 1 : 500,000	
DATE Apr '83	PLAN NUMBER	
CHECKED	84-37	

3169



DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

EYRE WATER RESOURCES STUDY
POLDA BASIN

RAINFALL AND EVAPORATION DATA

COMPILED P.C.Smith	C.D.O.	DATE
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DATE Feb. '84	PLAN NUMBER	
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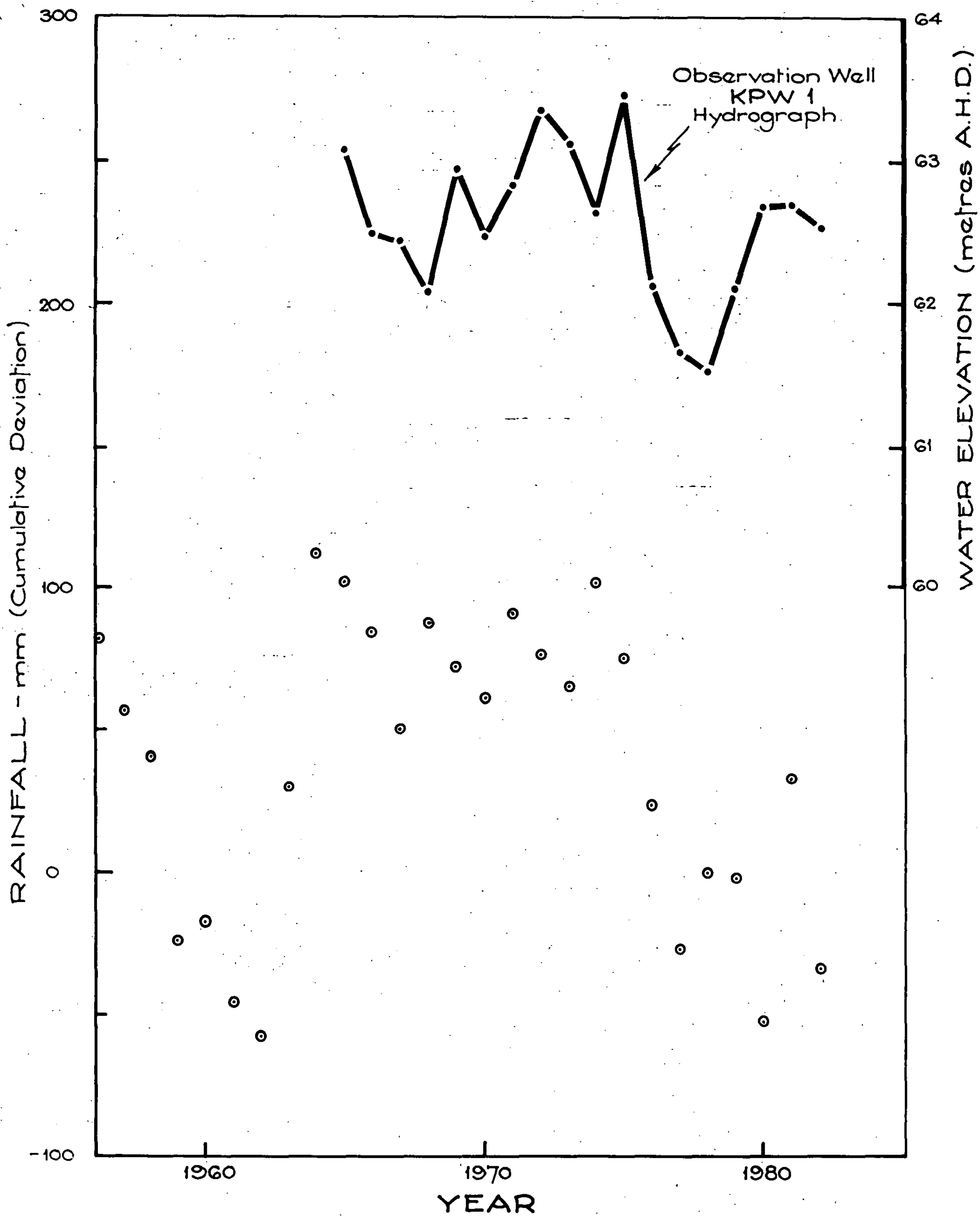
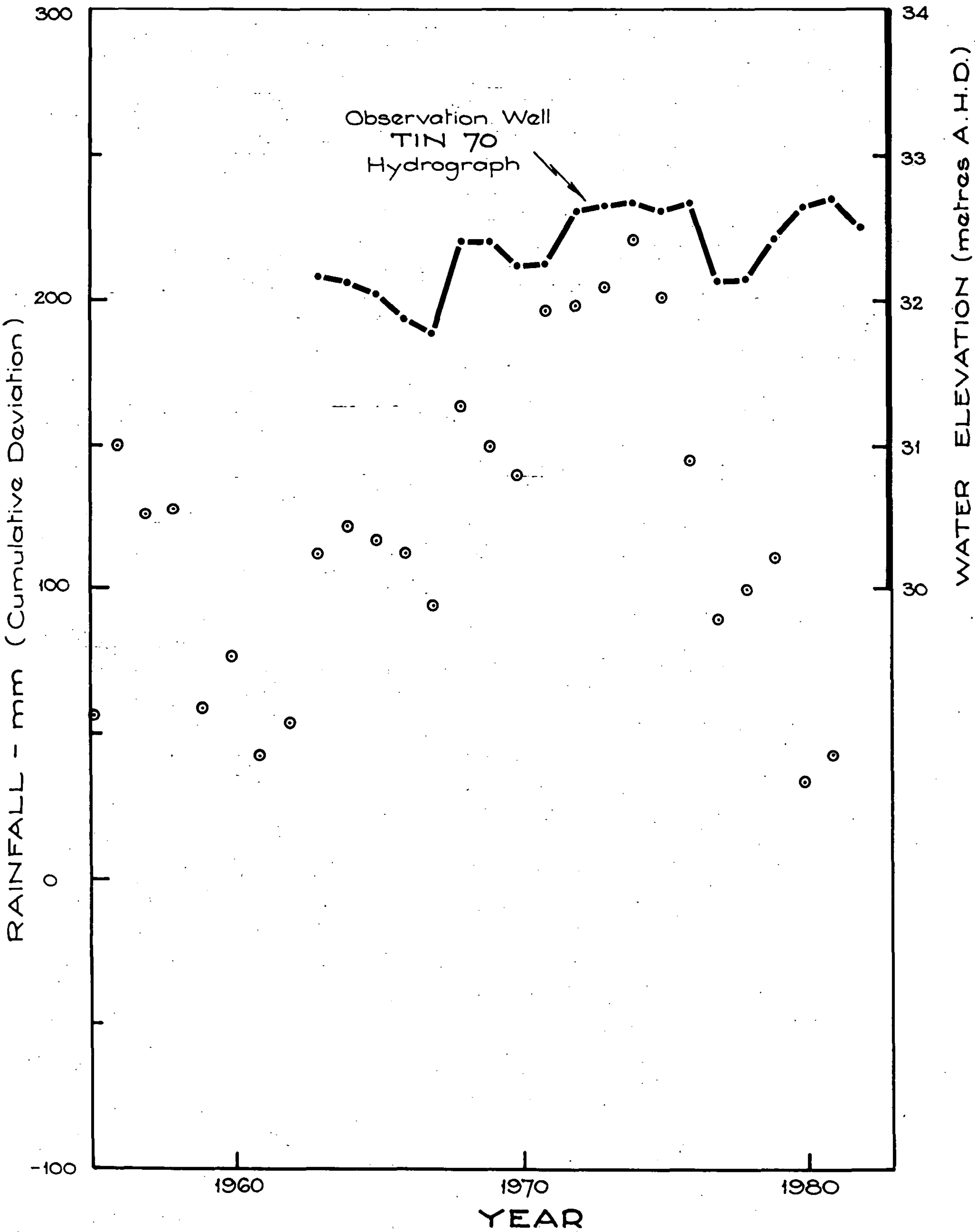


NOTE: Rainfall data are presented as cumulative deviation from the mean of effective rainfall (May to August rainfall)

Figure....4

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED P.C.Smith	C.D.O	DATE
EYRE WATER RESOURCES STUDY. POLDA BASIN	DRAWN M.R.	SCALE	
KAPPAWANTA	DATE Feb.'84	PLAN NUMBER	
RAINFALL/HYDROGRAPH CORRELATION	CHECKED	S 17201	

3169

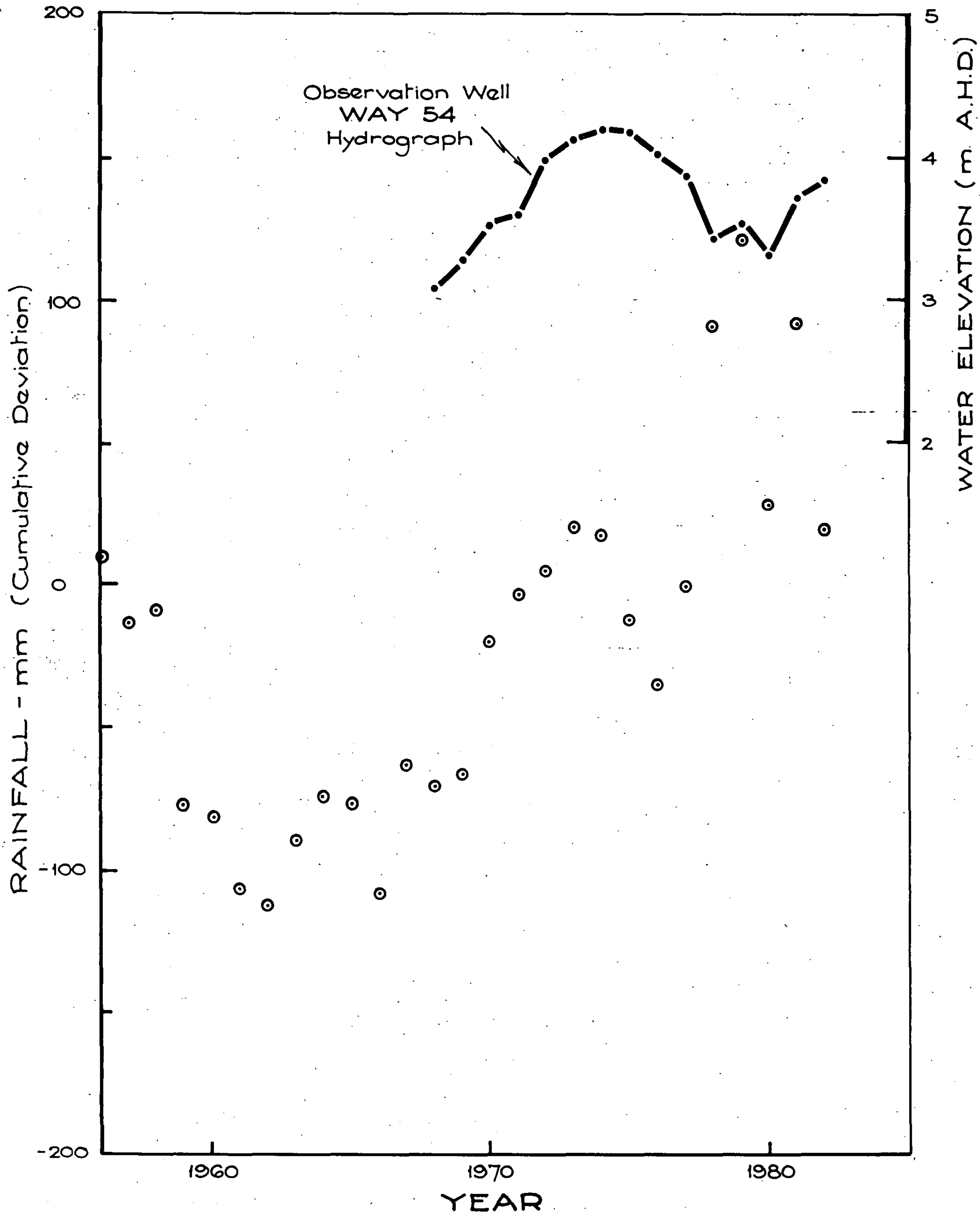


NOTE: Rainfall data are presented as cumulative deviation from the mean of effective rainfall (May to August rainfall).

Figure....5

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED P.C.Smith	C.D.O DATE
EYRE WATER RESOURCES STUDY POLDA BASIN MOUNT WEDGE RAINFALL/HYDROGRAPH CORRELATION	DRAWN M.R.	SCALE —
	DATE Feb '84	PLAN NUMBER
	CHECKED	S 17202

3169

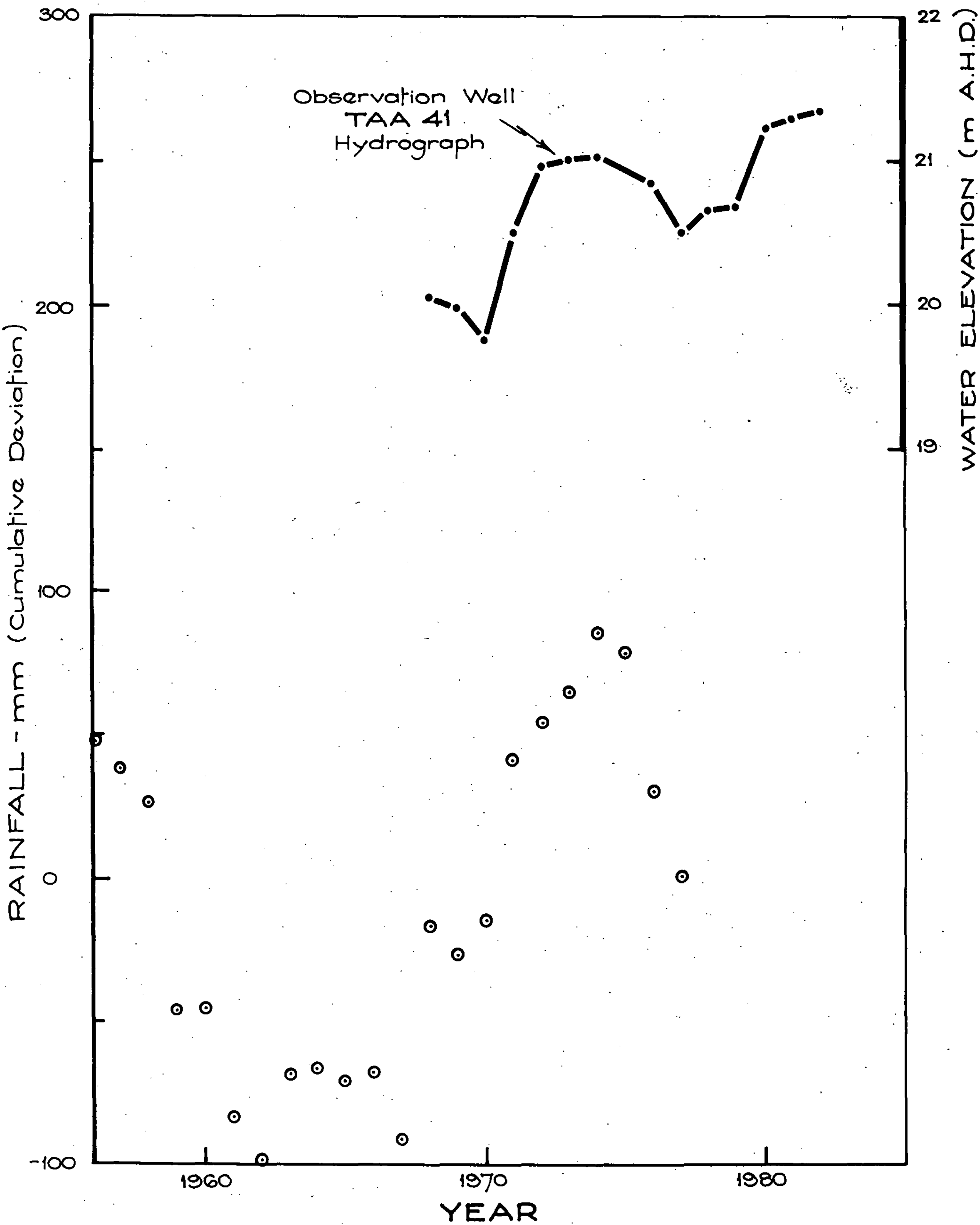


NOTE: Rainfall data are presented as cumulative deviation from the mean of effective rainfall (May to August rainfall).

Figure.....6

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED P.C.Smith	C.D.O DATE
EYRE WATER RESOURCES STUDY POLDA BASIN	DRAWN M.R.	SCALE
SHERINGA RAINFALL/HYDROGRAPH CORRELATION	DATE Feb '84	PLAN NUMBER S 17203
	CHECKED	

3169

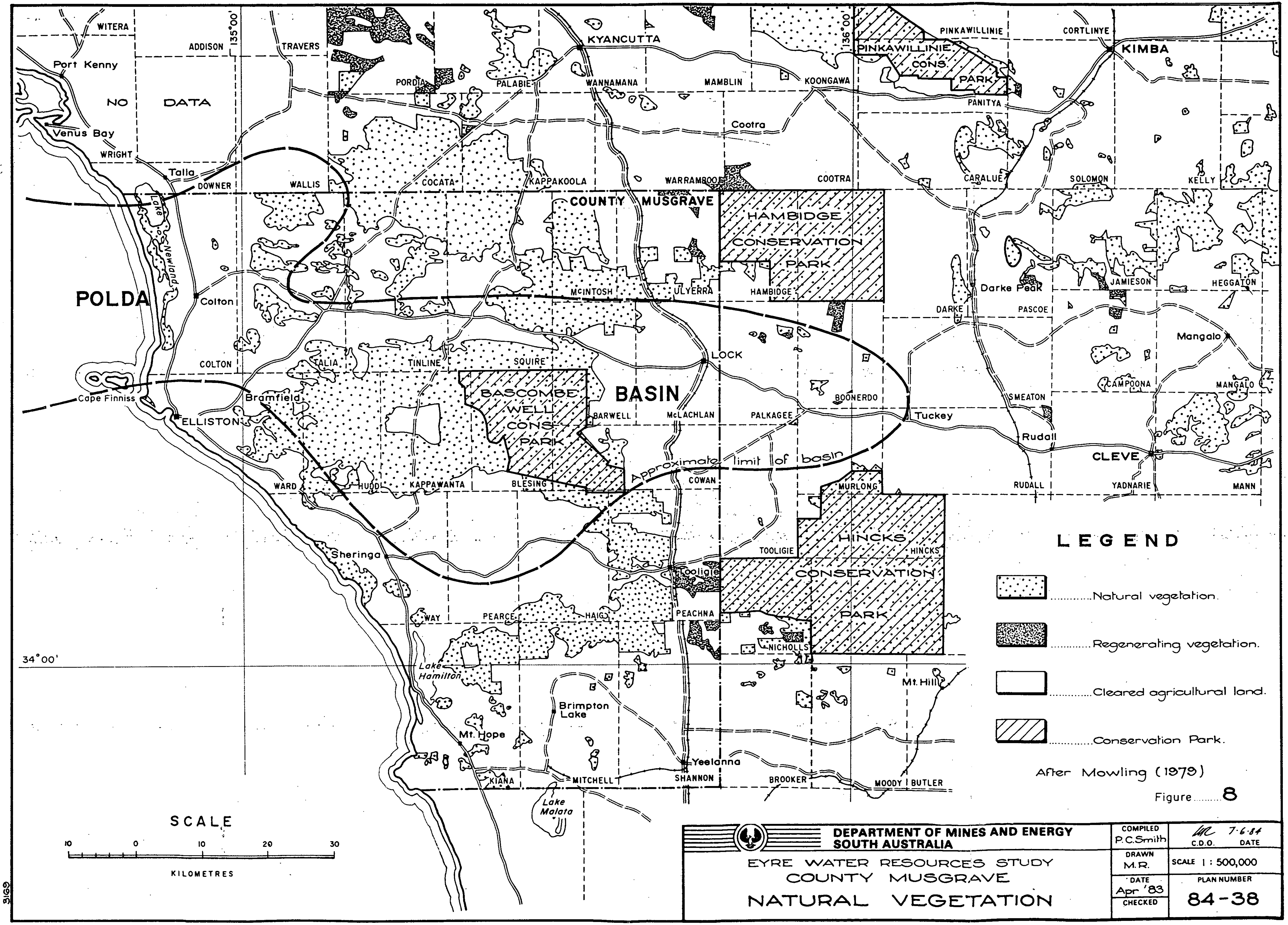


NOTE: Rainfall data are presented as cumulative deviation from the mean of effective rainfall (May to August rainfall).

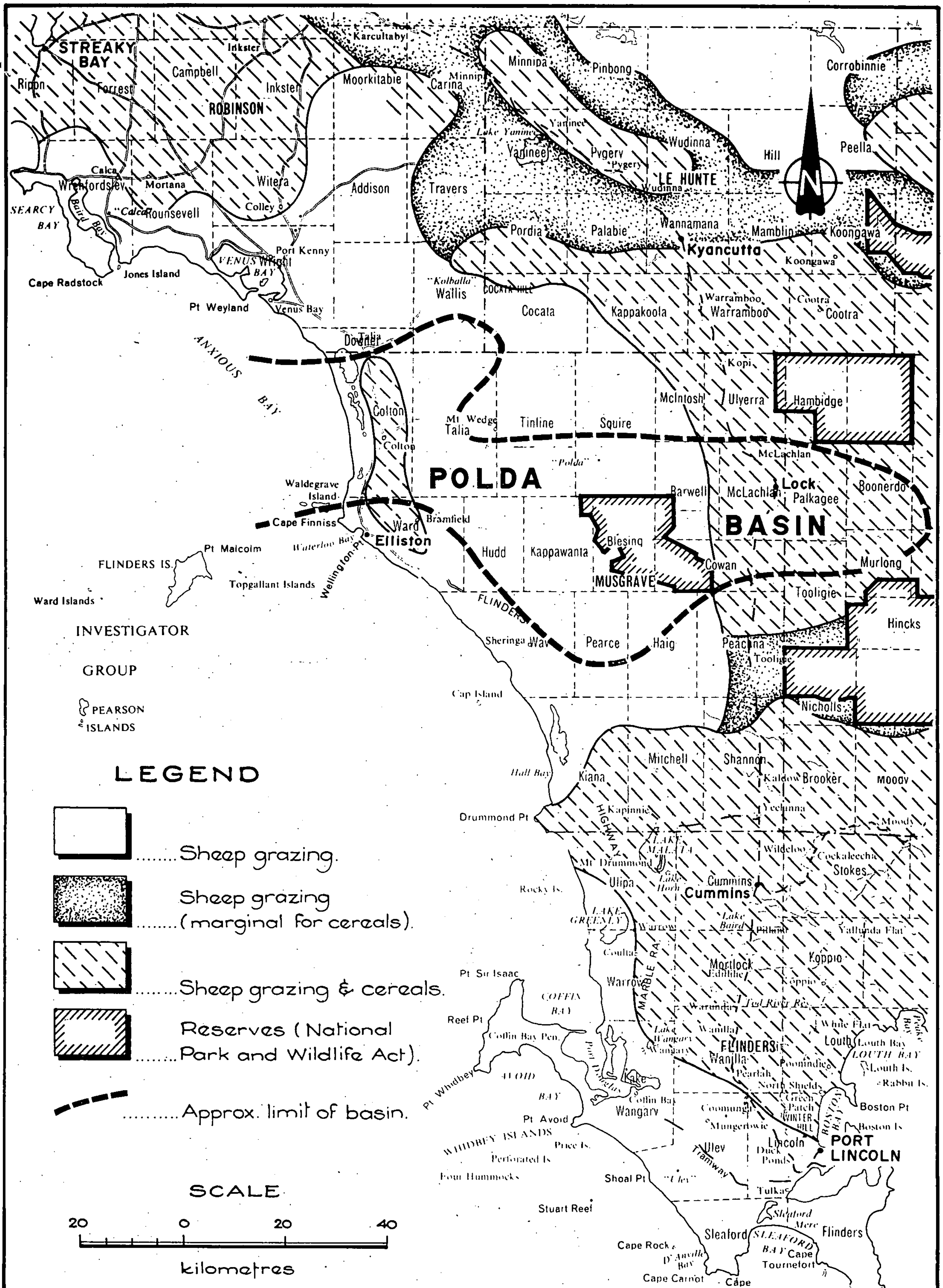
Figure......7

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED P.C.Smith	C.D.O. DATE
EYRE WATER RESOURCES STUDY POLDA BASIN TALIA RAINFALL/HYDROGRAPH CORRELATION	DRAWN M.R.	SCALE
	DATE Feb '84	PLAN NUMBER S 17204
	CHECKED	

3169



WITERA
ADDISON
135°00'
TRAVERS
KYANCUTTA
136°00'
PINKAWILLINIE
CORTLINYE
KIMBA
Port Kenny
NO DATA
PORDIA
PALABIE
WANNAMANA
MAMBLIN
KOONGAWA
PINKAWILLINIE CONS. PARK
PANITYA
Venus Bay
Cootra
WRIGHT
Talla
DOWNER
WALLIS
COCATA
KAPPAKOOLA
WARRAMBOO
COOTRA
CARALUE
SOLOMON
KELLY
Lake Newland
COUNTY MUSGRAVE
HAMBIDGE CONSERVATION PARK
POLDA
Colton
McINTOSH
ULYERRA
HAMBIDGE
Darke Peak
JAMIESON
HEGGATON
DARKE
PASCOE
Mangalo
COLTON
TALIA
TINLINE
SQUIRE
LOCK
CAMPOONA
MANGALO
Cape Finniss
Bramfield
BASCOMBE WELL CONS. PARK
BASIN
BOONERDO
SMEATON
ELLISTON
BARWELL
McLACHLAN
PALKAGEE
Tuckey
Rudall
Approximate limit of basin
CLEVE
WARD
HUDD
KAPPAWANTA
BLESING
COWAN
MURLONG
RUDALL
YADNARIE
MANN
HINCKS CONSERVATION PARK
TOOLIGIE
HINCKS
Sheringa
Tooligie
WAY
PEARCE
HAIG
PEACHNA
NICHOLLS
34°00'
Lake Hamilton
Mt. Hill
Brimpton Lake
Mt. Hope
Yeelanna
KIANA
MITCHELL
SHANNON
BROOKER
MOODY
BUTLER
Lake Malata
SCALE
10 0 10 20 30
KILOMETRES
LEGEND
Natural vegetation.
Regenerating vegetation.
Cleared agricultural land.
Conservation Park.
After Mowling (1979)
Figure 8
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA
EYRE WATER RESOURCES STUDY
COUNTY MUSGRAVE
NATURAL VEGETATION
COMPILED P.C.Smith
C.D.O. 7.6.84 DATE
DRAWN M.R.
SCALE 1 : 500,000
DATE Apr '83
CHECKED
PLAN NUMBER 84-38
3169



AFTER YANDELL 1976

Figure 9

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

EYRE WATER RESOURCES STUDY POLDA BASIN	COMPILED P.C.Smith	C.D.O. DATE
	DRAWN M.R.	SCALE 1:1,000,000
GENERALISED LAND USE - 1971	DATE Feb. '84 CHECKED	PLAN NUMBER S 17205

3169

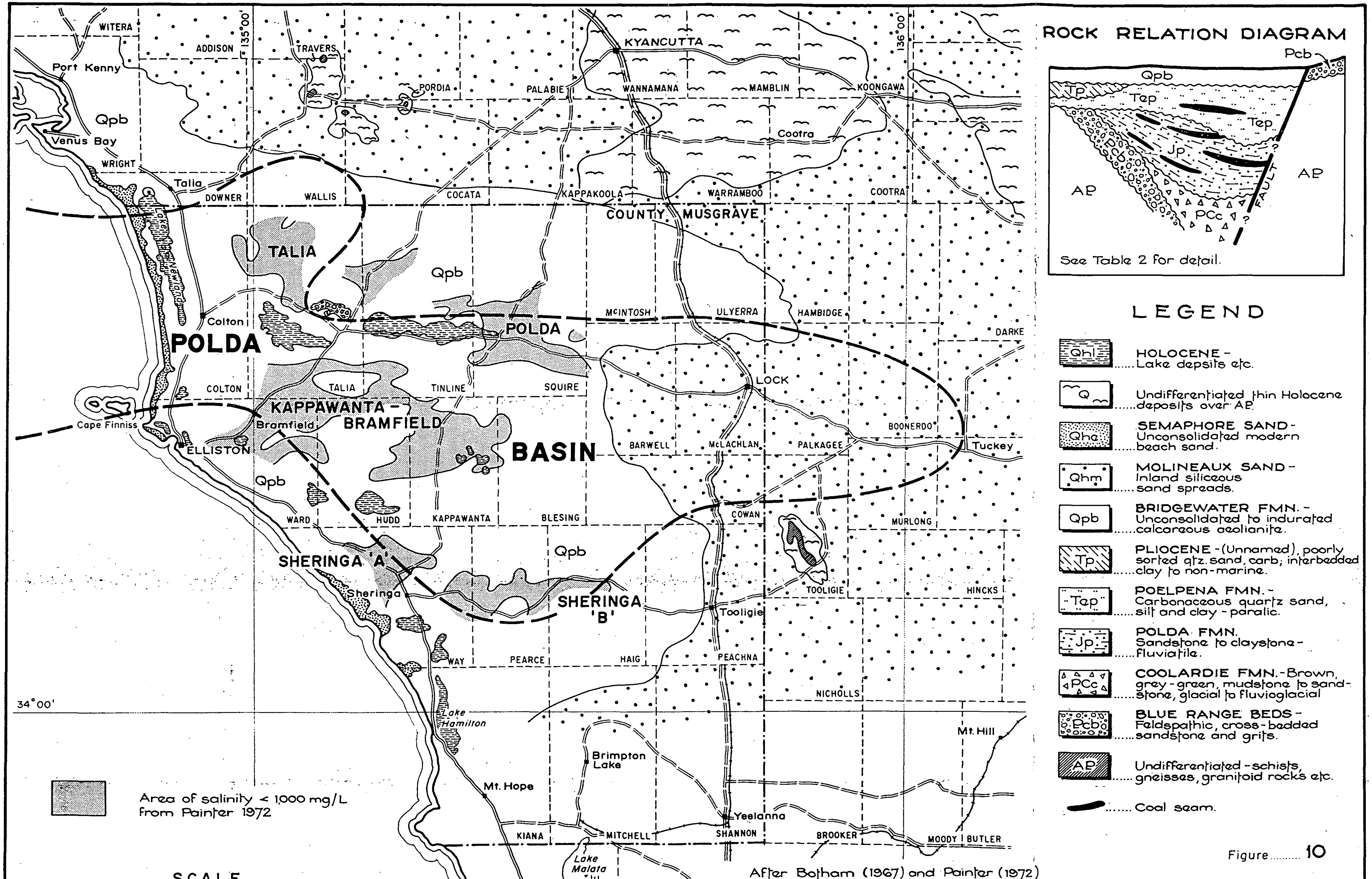


Figure 10

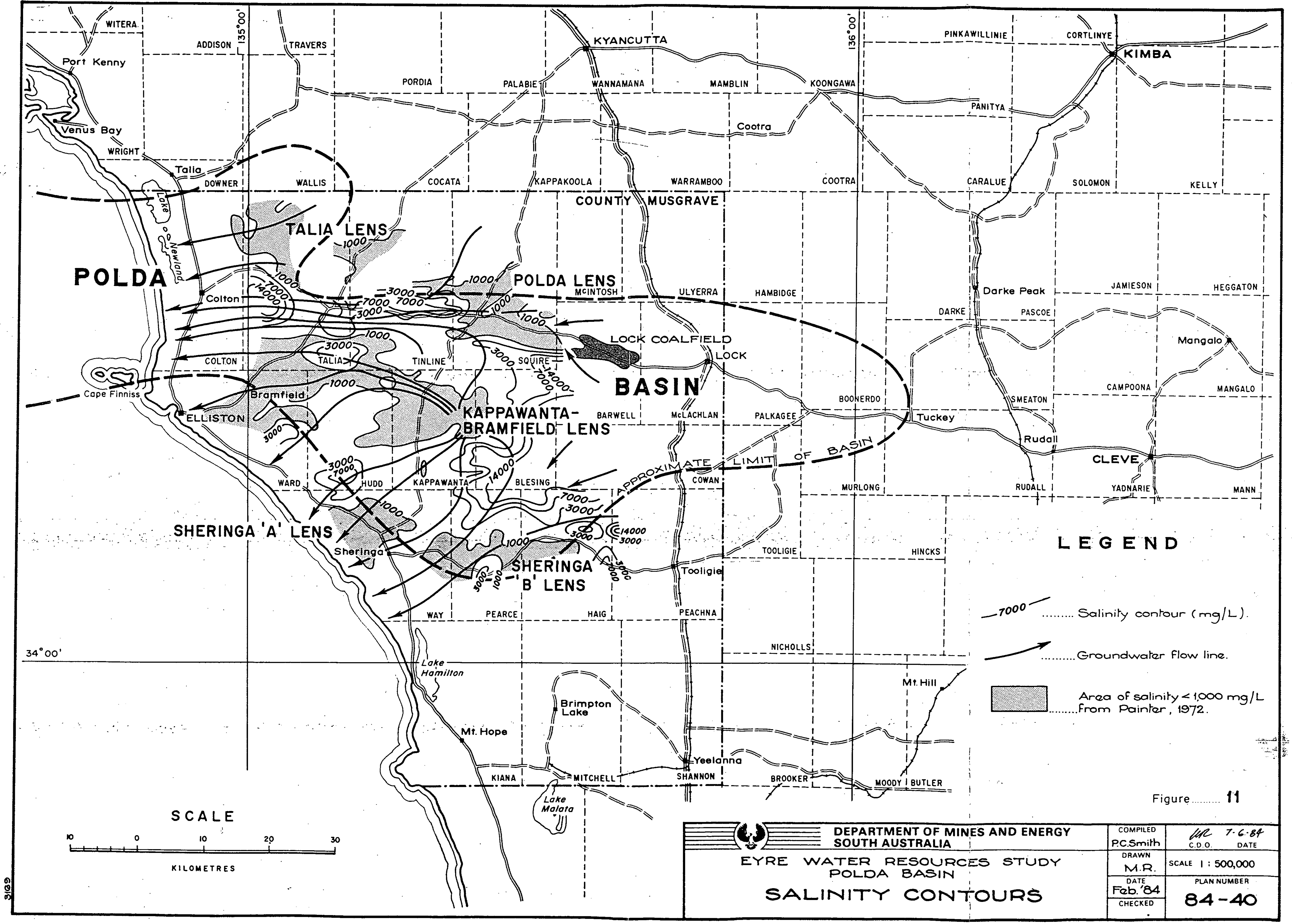
After Botham (1967) and Painter (1972)

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

EYRE WATER RESOURCES STUDY
POLDA BASIN

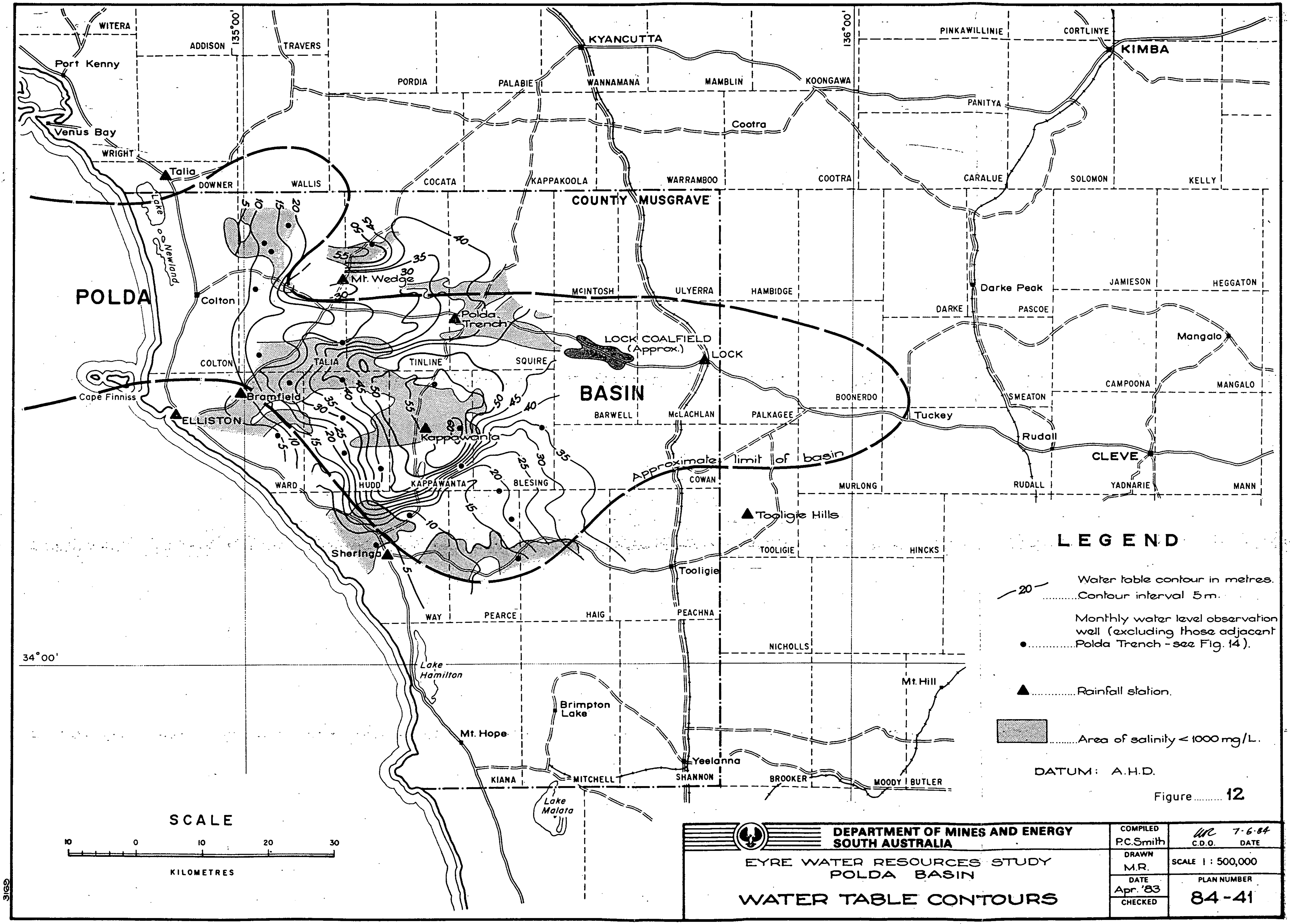
GENERALISED GEOLOGY

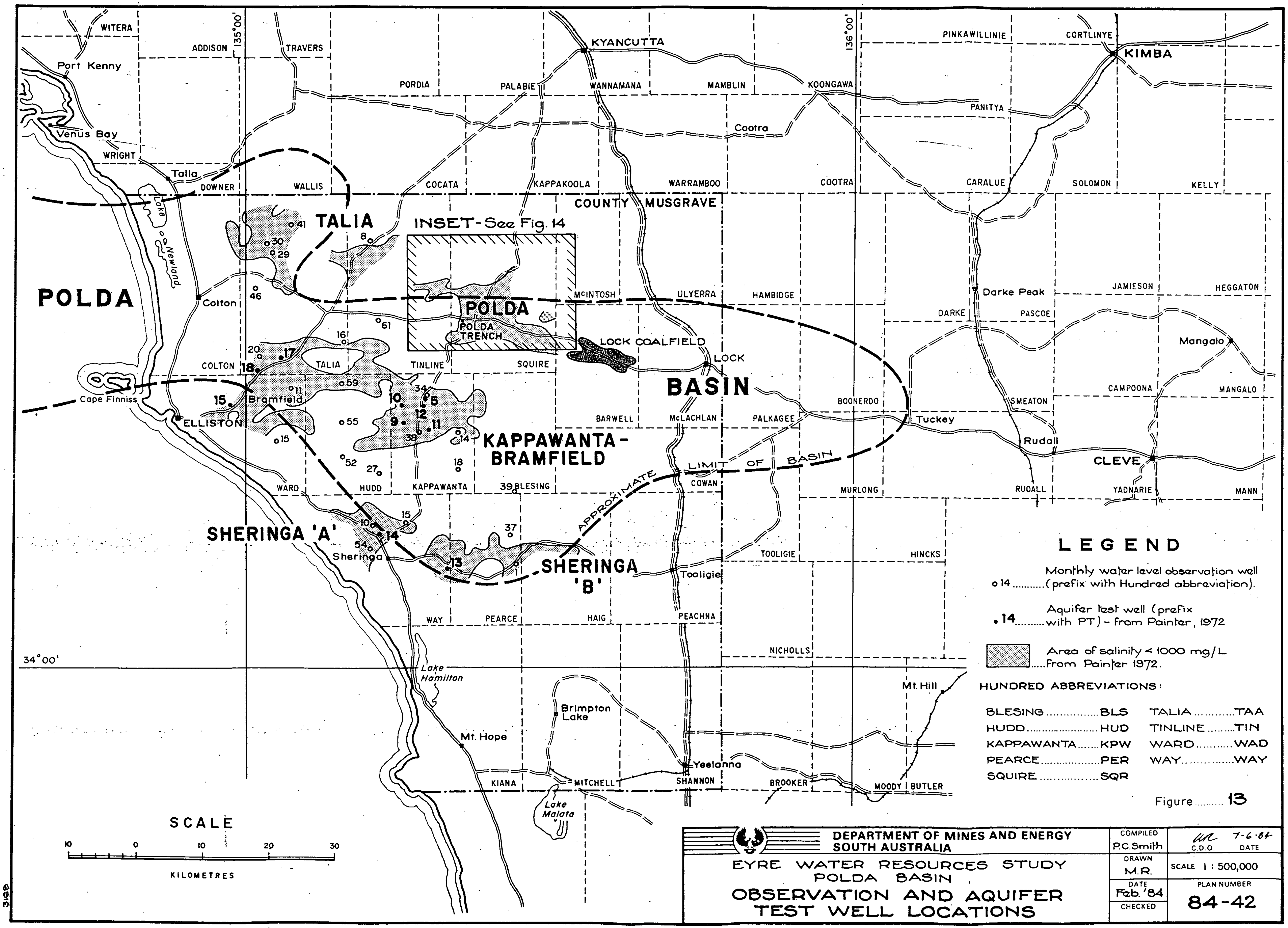
COMPILED P.C.Smith	C.D.O. 7-6-84	DATE
DRAWN M.R.	SCALE 1 : 500,000	
DATE Mar '84	PLAN NUMBER 84 - 39	
CHECKED		



WITERA
ADDISON
135°00'
TRAVERS
KYANCUTTA
136°00'
PINKAWILLINIE
CORTLINYE
KIMBA
Port Kenny
PORDIA
PALABIE
WANNAMANA
MAMBLIN
KOONGAWA
PANITYA
Venus Bay
Cootra
WRIGHT
Talia
DOWNER
WALLIS
COCATA
KAPPAKOOLA
WARRAMBOO
COOTRA
CARALUE
SOLOMON
KELLY
COUNTY MUSGRAVE
Lake Newland
TALIA LENS
POLDA
POLDA LENS
McINTOSH
ULYERRA
HAMBIDGE
Darke Peak
JAMIESON
HEGGATON
Colton
DARKE
PASCOE
LOCK COALFIELD
Mangalo
COLTON
TALIA
TINLINE
SQUIRE
LOCK
BASIN
CAMPOONA
MANGALO
Cape Finniss
Bramfield
KAPPAWANTA-BRAMFIELD LENS
BOONERDO
SMEATON
ELLISTON
BARWELL
McLACHLAN
PALKAGEE
Tuckey
Rudall
APPROXIMATE LIMIT OF BASIN
CLEVE
WARD
HUDD
KAPPAWANTA
BLESING
COWAN
MURLONG
RUDALL
YADNARIE
MANN
SHERINGA 'A' LENS
Sheringa
SHERINGA 'B' LENS
TOOLIGIE
Tooligie
HINCKS
WAY
PEARCE
HAIG
PEACHNA
NICHOLLS
34°00'
Lake Hamilton
Brimpton Lake
Mt. Hill
Mt. Hope
Yeelanna
KIANA
MITCHELL
SHANNON
BROOKER
MOODY
BUTLER
Lake Malata
1000
3000
7000
14000
LEGEND
7000 .... Salinity contour (mg/L).
.... Groundwater flow line.
Area of salinity < 1,000 mg/L .... From Painter, 1972.
SCALE
10 0 10 20 30
KILOMETRES
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA
EYRE WATER RESOURCES STUDY
POLDA BASIN
SALINITY CONTOURS
COMPILED P.C.Smith
C.D.O. 7-6-84 DATE
DRAWN M.R.
SCALE 1 : 500,000
DATE Feb. '84
PLAN NUMBER 84-40
CHECKED
3199

Figure 11


WITERA
ADDISON
135°00'
TRAVERS
KYANCUTTA
136°00'
PINKAWILLINIE
CORTLINYE
KIMBA
Port Kenny
PORDIA
PALABIE
WANNAMANA
MAMBLIN
KOONGAWA
PANITYA
Cootra
Venus Bay
WRIGHT
Talia
DOWNER
WALLIS
COCATA
KAPPAKOOLA
WARRAMBOO
COOTRA
CARALUE
SOLOMON
KELLY
COUNTY MUSGRAVE
Lake Newland
Mt. Wedge
POLDA
Colton
McINTOSH
ULYERRA
HAMBIDGE
Darke Peak
JAMIESON
HEGGATON
Polda Trench
DARKE
PASCOE
LOCK COALFIELD (Approx.)
LOCK
Mangalo
COLTON
TALIA
TINLINE
SQUIRE
CAMPOONA
MANGALO
Cape Finniss
Bramfield
BASIN
BOONERDO
SMEATON
ELLISTON
BARWELL
McLACHLAN
PALKAGEE
Tuckey
Kappawanta
Rudall
CLEVE
Approximate limit of basin
WARD
HUDD
KAPPAWANTA
BLESING
COWAN
MURLONG
RUDALL
YADNARIE
MANN
Tooligie Hills
Sheringa
TOOLIGIE
HINCKS
Tooligie
WAY
PEARCE
HAIG
PEACHNA
NICHOLLS
34°00'
Lake Hamilton
Mt. Hill
Brimpton Lake
Mt. Hope
Yeelanna
KIANA
MITCHELL
SHANNON
BROOKER
MOODY
BUTLER
Lake Malata
SCALE
10 0 10 20 30
KILOMETRES
LEGEND
20 Water table contour in metres. Contour interval 5 m.
Monthly water level observation well (excluding those adjacent Polda Trench - see Fig. 14).
Rainfall station.
Area of salinity < 1000 mg/L.
DATUM: A.H.D.
Figure 12
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA
EYRE WATER RESOURCES STUDY POLDA BASIN
WATER TABLE CONTOURS
COMPILED P.C.Smith
C.D.O. 7-6-84 DATE
DRAWN M.R.
SCALE 1 : 500,000
DATE Apr. '83
PLAN NUMBER 84-41
CHECKED
3169



WITERA
ADDISON
135°00'
TRAVERS
Port Kenny
PORDIA
PALABIE
KYANCUTTA
WANNAMANA
MAMBLIN
KOONGAWA
136°00'
PINKAWILLINIE
CORTLINYE
KIMBA
PANITYA
Cootra
Venus Bay
WRIGHT
Talia
DOWNER
WALLIS
COCATA
KAPPAKOOLA
WARRAMBOO
COOTRA
CARALUE
SOLOMON
KELLY
COUNTY MUSGRAVE
TALIA
INSET-See Fig. 14
Lake Newland
POLDA
Colton
McINTOSH
ULYERRA
HAMBIDGE
Darke Peak
JAMIESON
HEGGATON
POLDA
POLDA TRENCH
DARKE
PASCOE
LOCK COALFIELD
Mangalo
COLTON
TALIA
TINLINE
SQUIRE
LOCK
Cape Finniss
Bramfield
BASIN
CAMPOONA
MANGALO
BOONERDO
SMEATON
ELLISTON
BARWELL
McLACHLAN
PALKAGEE
Tuckey
KAPPAWANTA-BRAMFIELD
Rudall
CLEVE
APPROXIMATE LIMIT OF BASIN
WARD
HUDD
KAPPAWANTA
BLESING
COWAN
MURLONG
RUDALL
YADNARIE
MANN
SHERINGA 'A'
Sheringa
SHERINGA 'B'
TOOLIGIE
Tooligie
HINCKS
WAY
PEARCE
HAIG
PEACHNA
NICHOLLS
34°00'
Lake Hamilton
Mt. Hill
Brimpton Lake
Mt. Hope
Yeelanna
KIANA
MITCHELL
SHANNON
BROOKER
MOODY
BUTLER
Lake Malata
SCALE
10 0 10 20 30
KILOMETRES
LEGEND
o 14 Monthly water level observation well (prefix with Hundred abbreviation).
• 14 Aquifer test well (prefix with PT) - from Painter, 1972
Area of salinity < 1000 mg/L From Painter 1972.
HUNDRED ABBREVIATIONS:
BLESING BLS
HUDD HUD
KAPPAWANTA KPW
PEARCE PER
SQUIRE SQR
TALIA TAA
TINLINE TIN
WARD WAD
WAY WAY
Figure 13
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA
EYRE WATER RESOURCES STUDY
POLDA BASIN
OBSERVATION AND AQUIFER TEST WELL LOCATIONS
COMPILED P.C.Smith
C.D.O. 7-6-84 DATE
DRAWN M.R.
SCALE 1 : 500,000
DATE Feb. '84
CHECKED
PLAN NUMBER 84-42

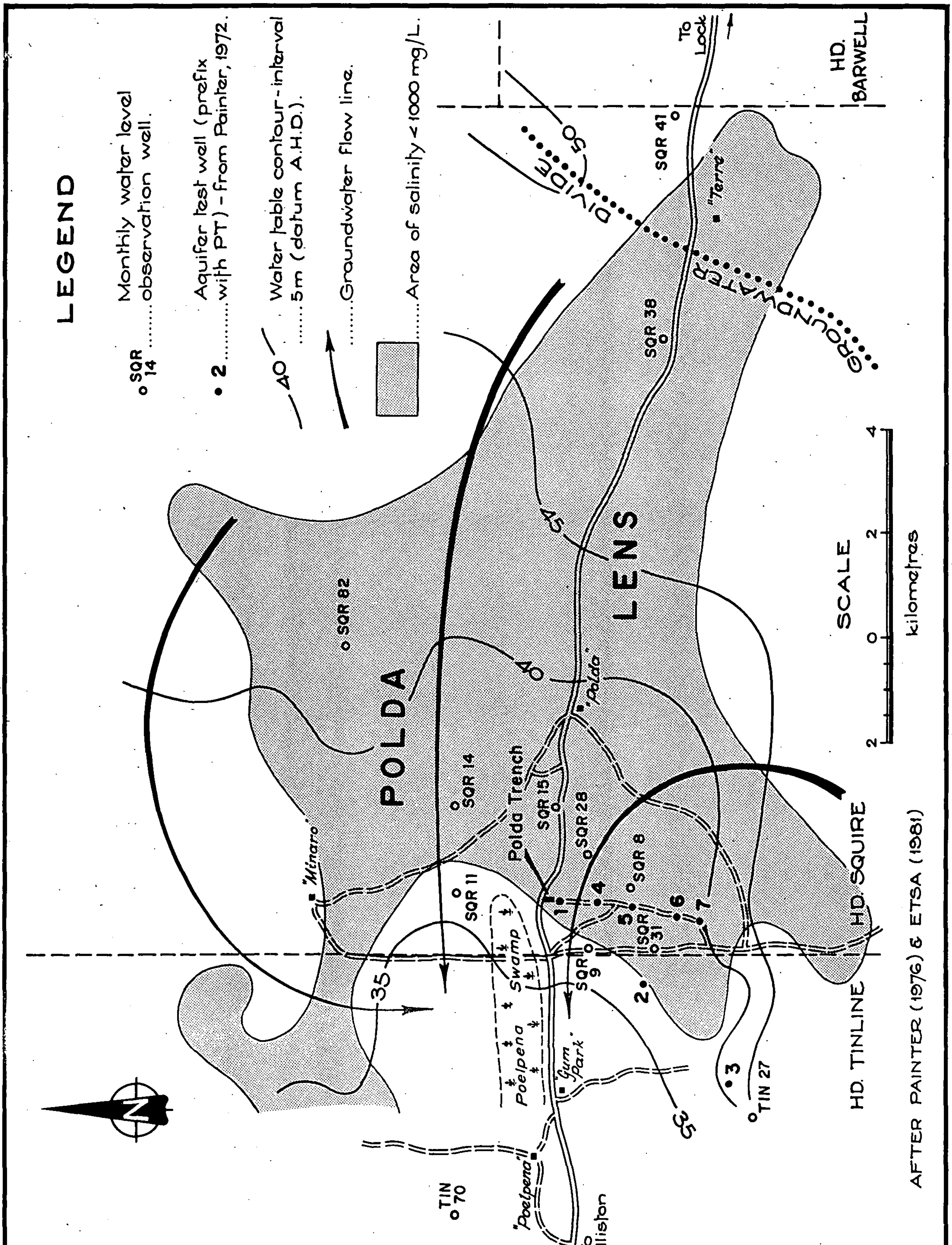


Figure......14

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED P.C.Smith	C.D.O.	7-6-84 DATE
EYRE WATER RESOURCES STUDY POLDA BASIN	DRAWN M.R.	SCALE 1:100 000	
OBSERVATION AND AQUIFER TEST WELL LOCATIONS - POLDA LENS	DATE Feb. '84 CHECKED	PLAN NUMBER S 17206	

3169

APPENDIX A

WELL INVENTORY - PRIVATE WELLS

COUNTY MUSGRAVE

APPENDIX A: WELL INVENTORY - PRIVATE WELLS CO. MUSGRAVE

Hundred	Total No. of Wells	Stock	Stock/Domestic	Domestic	Stock/Irrigation	Irrigation	Unknown
Barwell	2	1	-	-	-	-	1
Blesing	1	1	-	-	-	-	-
Colton	54	43	10	-	1	-	-
Cowan	2	-	-	-	-	-	2
Haig	19	18	1	-	-	-	-
Hudd	12	11	1	-	-	-	-
Kappawanta	11	10	1	-	-	-	-
Kiana	56	45	7	4	-	-	-
McIntosh	Nil	-	-	-	-	-	-
McLachlan	Nil	-	-	-	-	-	-
Mitchell	1	-	-	-	-	-	4
Peachna	6	2	-	-	-	-	1
Pearce	33	31	1	-	-	-	-
Shannon	Nil	-	-	-	-	-	-
Squire	15	11	4	-	-	-	-
Talia	42	38	3	1	-	-	-
Tinline	47	34	3	10	-	-	-
Ulyerra	Nil	-	-	-	-	-	-
Ward	61	30	17	1	-	1	12
Way	75	63	11	1	-	-	-
Totals	437	338	59	17	1	1	21
% of Total		78%	14%	4%	<0.25%	<0.25%	4%

Note: Records from SADME well data system.

APPENDIX B

AQUIFER PARAMETERS

APPENDIX B

Aquifer Parameters
Pleistocene Aquifer

Well No.	Test Type	Analysis Used	Transmissivity m^3/day/m	Storage Coeff Specific Yield	Reference
PT3	Pumping	Thiem[1]	1470	-	Shepherd (1964)
"	"	Theiss[2]	1360	-	"
4a	"	"	2890	2.9×10^{-2}	Bleys (1965)
4b	"	"	2170	5.6×10^{-2}	"
4e	"	"	2010	8.3×10^{-5}	"
4a	"	Jacob[3]	2330	1.83×10^{-2}	"
PT4	"	"	2890	2.28×10^{-2}	"
5c	"	Theiss	1850	2.8×10^{-2}	"
5b	"	"	1370	4.08×10^{-4}	"
PT5	"	Jacob	1280	1.9×10^{-2}	"
5c	"	"	1850	2.7×10^{-2}	"
7c	"	Theiss	1820	2.8×10^{-2}	"
7b	"	"	2010	3.2×10^{-2}	"
7a	"	"	2250	3.6×10^{-2}	"
7c 1st Test	"	Jacob	2440	1.96×10^{-2}	"
7c 2nd Test	"	"	2440	1.22×10^{-2}	Bleys (1965)
PT7 "	"	"	"	-	"
PT9	"	Theiss/Jacob	1290	4.1×10^{-2}	Painter (1970)
PT11	"	"	800	5×10^{-2}	"
PT13	"	"	800	10^{-2}	"
PT14	"	"	3450	6.1×10^{-3}	"
PT15	"	"	2546	2.2×10^{-2}	"
PT17	"	"	1606	5×10^{-2}	"
Polda Trench	"	Logan[4]	2700	-	ETSA (1981)
"	"	Distance Drawdown[5]	2600	3×10^{-5}	"
"	-	Basin[6]	-	2×10^{-2}	"
			Mean 2040 (n=26)	2.1×10^{-2} (n=22)	
			Range 800-3450	3×10^{-5}- 5.6×10^{-2}	

Tertiary Aquifer

Well No.	Test Type	Analysis Used	Transmissivity m^3/day/m	Storage Coeff Specific Yield	Reference
PT8	"	Theiss/Jacob	80	10^{-3}	Painter (1970)
PT10	"	"	80	10^{-3}	"
P45	"	Jacob	2.6	-	ETSA (1981)
P71	"	"	8.2 (drawdown)	7×10^{-3}	"
		"	14.4 (recovery)	-	"
		Theiss	10 (drawdown)	9×10^{-4}	"
P54	"	Jacob	27 (drawdown)	-	"

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