Todd River

Map of River

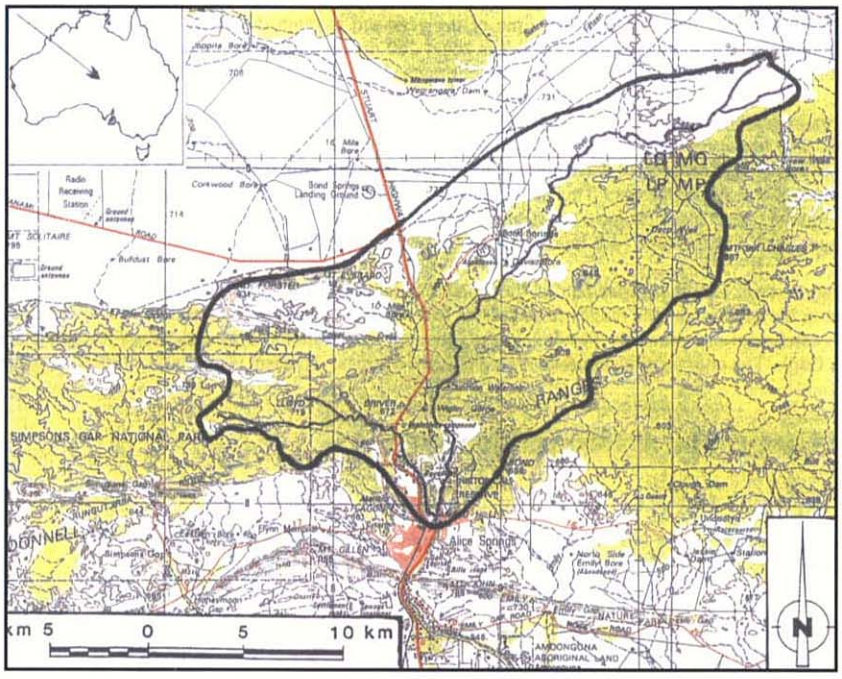


Table of Basic Data

Name: Todd River at Alice Springs (a sub-catchment of the Todd River, which is a branch of the Hale River)		**Serial No.:** Australia-3
Location: Northern Territory, Central Australia	S 23° 20' ~ 23° 50'	E 133° 30' ~ 134° 10'
Area: 445 km^2	**Length of main stream:** 50 km	
Origin: MacDonnell Ranges (800m)	**Highest point:** Mt. Everard (949m)	
Outlet: The Todd River is a branch of the Hale River which flows into Lake Eyre	**Lowest point:** Alice Springs (575m) is the lowest point in this sub-catchment of the Todd River.	
Main geological features: Arunta Complex hills, rocky hills, steep-sided gorges, broken, angular, granite-gneiss rock, exposed rock outcrops, occasional sandy flats.		
Main tributaries: Charles River (39 km^2)		
Main lakes: None		
Main reservoirs: None		
Mean annual precipitation: 260 mm (1901~1994) (Catchment Rainfall - 4 stations)		
Mean annual runoff: 0.423 m^3/sec (1962~1995) Todd River at Alice Springs		
Population: 27,000 (1994)	**Main cities:** Alice Springs	
Land use: Pastoral Lease (grazing), National Park Reserves		

1. General Description

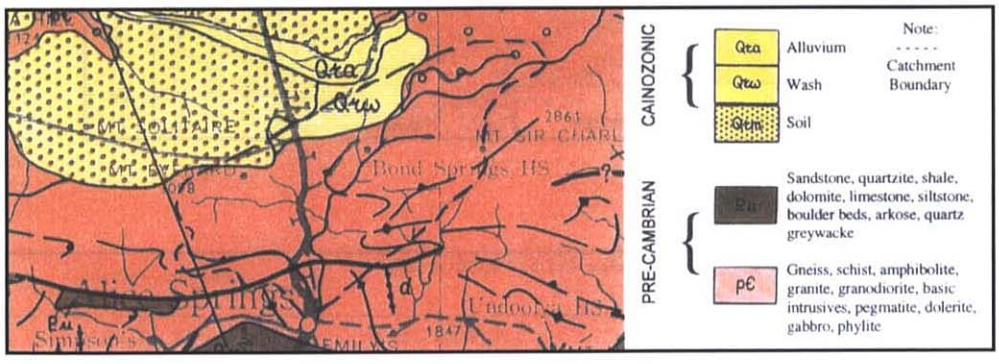
The Todd River catchment above Alice Springs covers an area of 445 km^2 and is located in the geographical centre of Australia. Flowing in basically a southerly direction, the mainstream length of the Todd River is approximately 50 km. The climate of the catchment is typically arid continental with large daily temperature variations. Rain, which falls infrequently may occur at any time of the year and is often due to thunderstorm activity caused by convective processes. The mean annual rainfall is about 260 mm and the average monthly rainfalls range from 40 mm in February to 9 mm in September. The summer months have the higher average rainfalls.

The maximum catchment elevation exceeds 900 m and the streams are generally very wide and shallow with a sandy bed. The upper northern part of the catchment is composed of fairly flat red soil plains and the catchment boundary in this area is difficult to determine. The Arunta Complex hills form the north-eastern and central part of the catchment above Alice Springs. This area is made up of rolling, occasionally steep, rocky hills into which the river and other drainage channels have cut steep-sided rocky gorges. The ground surface is mostly broken, angular, granite-gneiss rock with exposed rock outcrops and occasional sandy flats.

The vegetation cover is highly dependant on the amount of rainfall seasonally and annually, but is generally sparse. Vegetation in the catchment area ranges from grasses and scrubs (Acacia) to low shrublands and woodlands. Land use in the catchment are primarily Pastoral Lease (grazing) and National Park Reserves (Telegraph Station and Simpson's Gap). The only significant urban region is Alice Springs. Tourism is a significant local industry.

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map

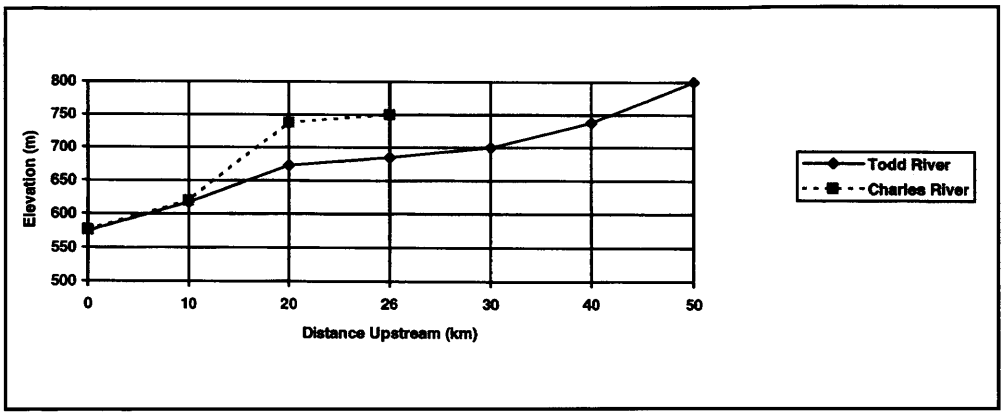
The land use within this catchment is either pastoral lease (grazing), National Park (protected areas) or urban (Alice Springs). The Map of the River (on the previous page) shows the boundaries of the National Parks (Telegraph Station and Simpson's Gap) and the location of Alice Springs.

2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities population (1994)	Land use [%] (1991)
1	**Todd** (Main river)	50 445	Mt. Everard 949 Alice Springs 575	Alice Springs 24,843	G(60%), N(40%)
2	**Charles** (Tributary)	16 39	MacDonnell Ranges 780 Todd River 580		G(94%), N(4%), U(2%)

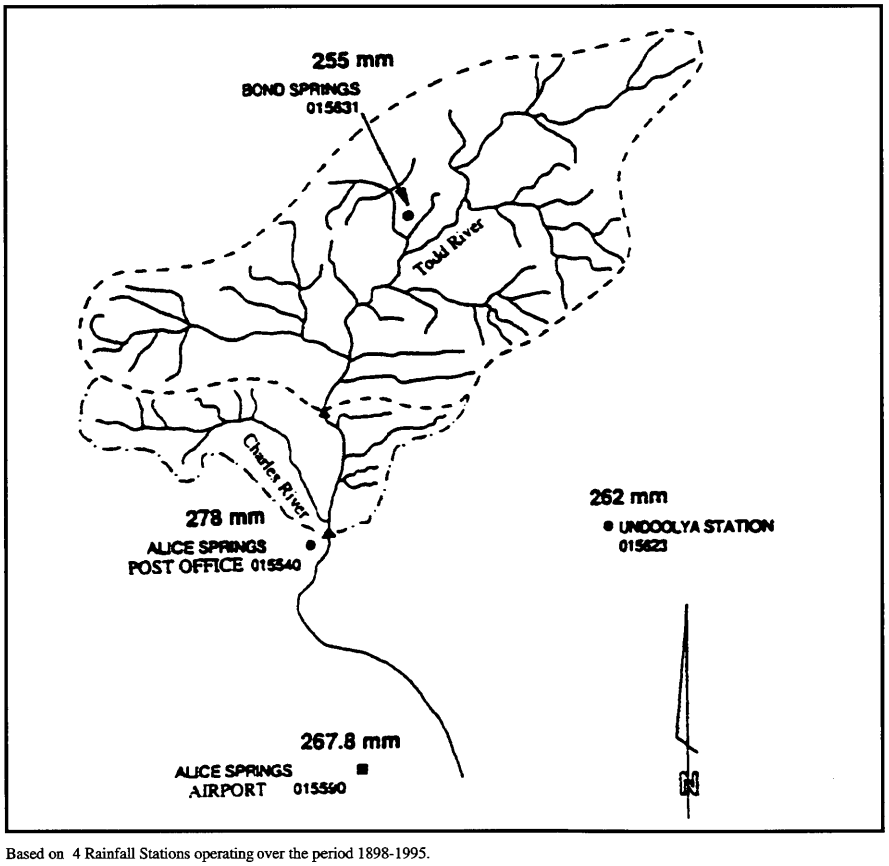
G: Grazing (cattle) N: National Park/Reserve U: Urban

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Mean Annual Precipitation Map and Observation Stations



Based on 4 Rainfall Stations operating over the period 1898-1995.

3.2 List of Meteorological Observation Stations

Station No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [mm]	Mean annual evaporation [mm]	Observation items [1]
015590	Alice Springs Airport	545	S 23° 48' 42" E 133° 53' 56"	1941 ~ 1995	267.8	3,030	T, DP, DS, P, E
015540	Alice Springs Post Office	560	S 23° 42' 36" E 133° 52' 06"	1873 ~ 1987	278	3,000	P
015623	Undoolya Station	590	S 23° 41' 43" E 134° 02' 03"	1898 ~ 1995	262	3,050	P
015631	Bond Springs	700	S 23° 32' 45" E 133° 54' 01"	1901 ~ 1995	255	3,050	P, TSP
R0060009	Stokes Street		S 23° 41' 44" E 133° 51' 44"	1976 ~ 1996	233		TB
R0060018	Station Creek		S 23° 30' 01" E 133° 55' 23"	1980 ~ 1996	258		TB
R0060045	Bond Springs Turnoff		S 23° 35' 13" E 133° 52' 32"	1986 ~ 1996	266		TB

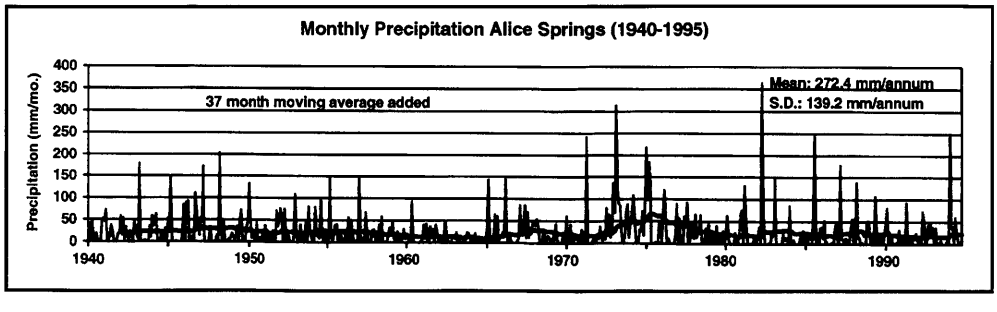
1) DP: Dew Point, DS: Duration of Sunshine, E : Pan Evaporation, P: Precipitation, T: Temperature, TB: Tipping bucket pluviograph, TSP: Tilting syphon pluviograph,.

3.3 Monthly Climate Data

Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C] Max.	Alice Springs	36.1	34.9	32.5	27.9	22.8	19.7	19.5	22.3	26.7	30.8	33.5	35.4	28.5	1941~1995
Temperature [°C] Min.	Alice Springs	21.3	20.7	17.4	12.6	8.4	5.2	4.0	6.1	10.0	14.7	17.8	20.1	13.2	1941~1995
Precipitation [mm]	Alice Springs	36.2	39.8	34.8	13.3	20.8	14.9	14.5	10.8	9.1	20.6	25.4	36.7	267.8	1941~1995
Raindays [No.]	Alice Springs	5	5	3	2	3	3	3	2	2	5	5	6	43	1941~1995
Evaporation [mm] (Pan) [1]	Alice Springs	390	322	307	213	146	108	121	170	225	310	341	377	3,030	1974~1995
Duration of sunshine [hr]*	Alice Springs	10.2	9.8	9.8	9.4	8.3	8.3	9.1	9.8	10.0	10.1	10.2	10.3	9.6	1954~1995

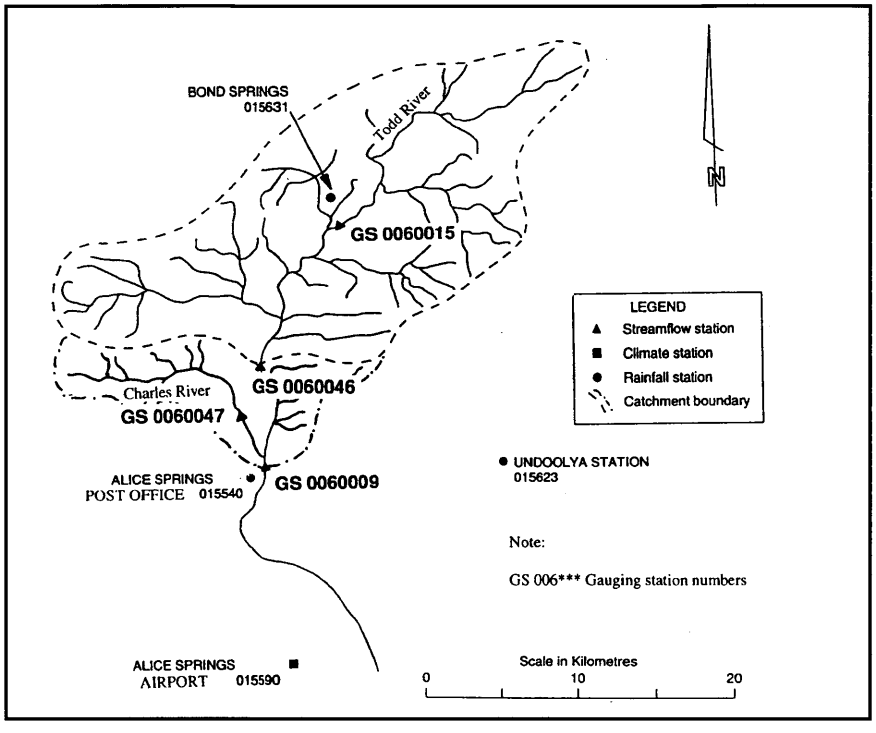
1) Class "A" Evaporation Pan with Bird Guard
* Daily Values

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



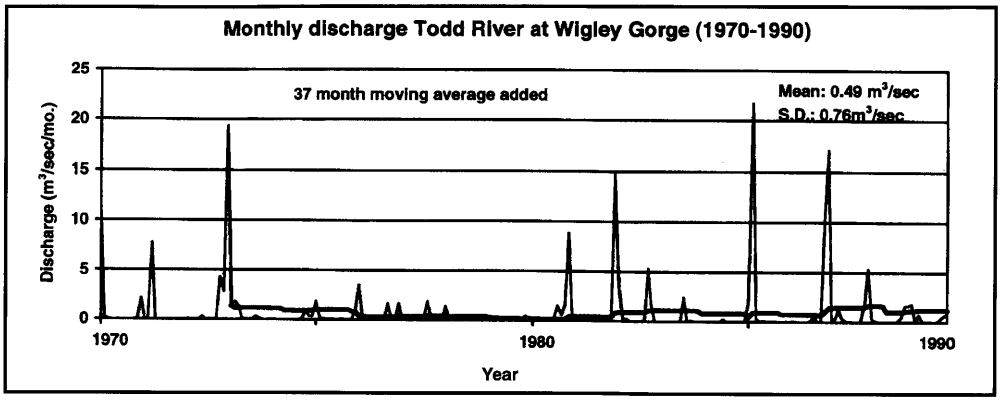
4.2 List of Hydrological Observation Stations

Station No.	Station	Location	Catchment area (A) [km^2]	Observation period	Observation items (frequency)
0060009	**Todd River - Wills Terrace**	S 23° 42' E 133° 53'	445	1952 ~ 1996	Continuous discharge 1972~1996
0060015	**Station Creek - Bond Springs**	S 23° 32' E 133° 55'	35.5	1978 ~ 1996	Continuous height record
0060046	**Todd River - Wigley Gorge**	S 23° 38' E 133° 53'	357	1958 ~ 1996	Continuous discharge 1962~1996
0060047	**Charles River -Big Dipper**	S 23° 40' E 133° 52'	38	1958 ~ 1987	Continuous height record

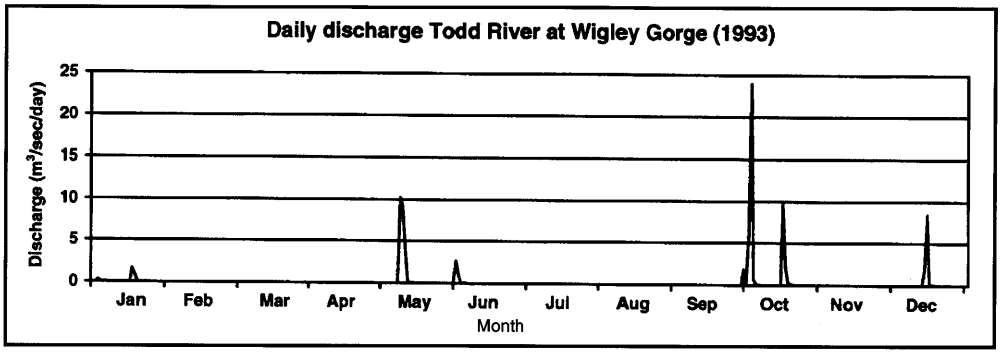
Station No.	$\overline{Q}$ [1] [m^3/s]	Q max [2] [m^3/s]	$\overline{Q}$ max [3] [m^3/s]	Q min [4] [m^3/s]	$\overline{Q}$ / A [m^3/s/100 km^2]	Q max / A [m^3/s/100 km^2]	Period of statistics
0060009	0.493	1194	268	0.00	0.108	268	1972 ~ 1995 *
0060046	0.339	1055	240	0.00	0.095	295.6	1962 ~ 1995 *

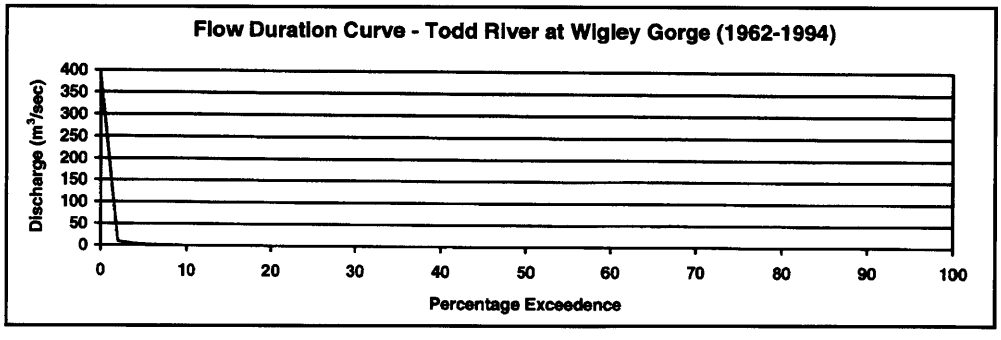
1) Mean annual discharge
2) Maximum discharge
3) Mean annual maximum discharge
4) Mean annual minimum discharge
* Record is not continuous

4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge





4.5 Unique Hydrological Features

In terms of the hydrology of Southeast Asia and the Pacific, the Todd River catchment represents a significantly different hydrological regime. As can be seen from the information provided above, this is an extremely arid region, with zero to very low flow during 95% of the year. Flow events are sporadic in nature and separated by periods of very little or no flow. Flow events are fast rising and flashy in nature. Small flows seep into the groundwater storage through the sandy creek bed. It should be noted however, that the salinity of the groundwater supplies within the Alice Springs town area varies. However, groundwater is used for irrigation of playing fields and the golf course. Groundwater resources are accessed through the drilling of bores (holes drilled into the earth with a revolving drill). Springs occur when the groundwater storage and land surface intersect or the pressure on the groundwater store forces water to the surface through fissures.

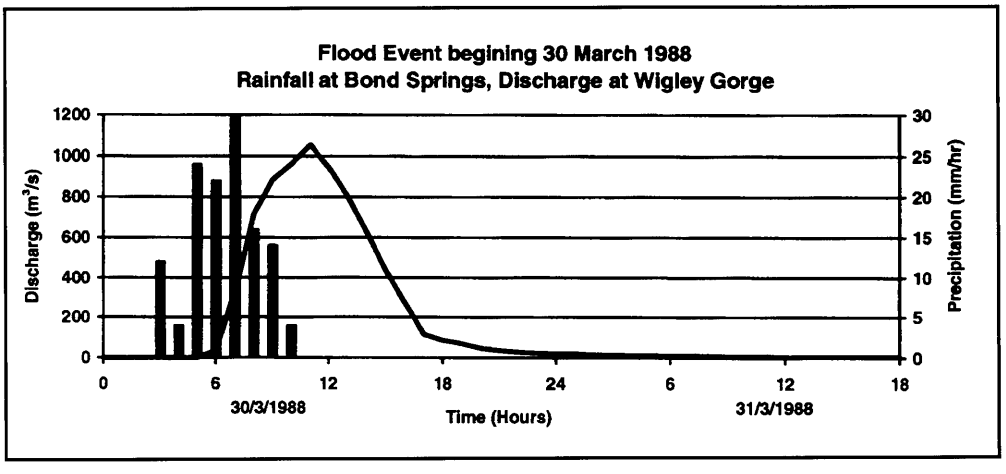
4.6 Annual Maximum and Minimum Discharges

At Wigley Gorge [357 km^2]

Year	Maximum [1]		Minimum [2] **		Year	Maximum [1]		Minimum [2] **	
	Date	[m^3/s]	Month	[m^3/s]		Date	[m^3/s]	Month	[m^3/s]
1962		203.7	1 to 12	0.000	**1979**	3.04	66.6	1 - 5, 9 - 12	0.000
1963	5.14	347.7	1 to 12	0.000	**1980**	12.01	14.3	1 - 4, 9 - 12	0.000
1964	10.14	172.4	1 to 12	0.000	**1981**	12.12	155.0	1 -5	0.000
1965	12.22	167.0	1 to 12	0.000	**1982**	02.13	102.0	1 -3, 10 -12	0.000
1966	1.22	487.6	1 to 12	0.000	**1983**	3.16	839.8	1 to 12	0.000
1967	2.05	242.6	1 to 12	0.000	**1984**	1.26	666.4	1 to 12	0.000
1968	4.26	149.4	1 to 12	0.000	**1985**	11.02	28.5	1 to 12	0.000
1969	2.10	90.8	1 to 12	0.000	**1986**	6.30	178.7	1 to 12	0.000
1970	12.04	85.0	1 to 12	0.000	**1987**	12.25	75.4	1 to 12	0.000
1971	12.10	332.9	1 to 12	0.000	**1988**	3.31	1,044.7	1 to 12	0.000
1972	3.05	373.9	1 to 12	0.000	**1989**	03.24	143.7	1 to 12	0.000
1973	11.25	454.1	1 to 12	0.000	**1990**	1.10	52.0	1 to 12	0.000
1974	1.27	439.5	1	0.005	**1991**	1.24	480.3	1 to 12	0.000
1975	12.15	104.8	12	0.010	**1992**	11.18	13.7	1 to 12	0.000
1976	2.08	259.8*	12	0.004	**1993**	10.02	143.9	1 to 12	0.000
1977	3.15	484.4	1 - 2	0.000	**1994**	1.01	0.0	1 to 12	0.000
1978	10.29	37.6	1 - 4, 12	0.000	**1995**	3.03	286.6	1 to 12	0.000

1), 2) Instantaneous observation by recording chart
* Missing record, estimated peak at Anzac Oval
** Minimum instantaneous flow recorded for the month(s) shown, Higher flow may have occurred during the month(s)

4.7 Hyetographs and Hydrographs of Major Floods



Flood rains in central Australia in late March and early April 1988 were due to the combined effects of two tropical depressions which had formed 1,500 kilometres apart four days previously. The first depression formed over the Arafura Sea to the north-east of Darwin and initially moved south-westward before recurving over the Joseph Bonaparte Gulf and heading south-southeast across central Australia. The second depression formed over the Indian Ocean south of Java. This system was rather deep and followed a meandering track in an east-southeast direction before weakening inland. The cloud associated with this system combined with the first monsoon depression near the Western Australia and Northern Territory border and subsequently moved southeastward, passing very close to Alice Springs on the 30th March 1988.

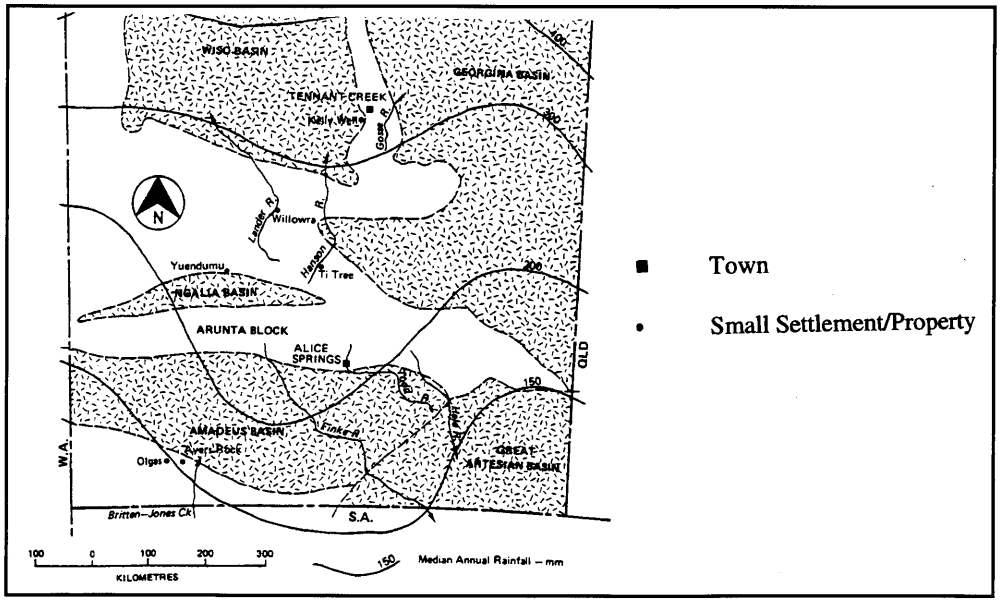
5. Water Resources

5.1 General Description

Because of the relatively low population within the Northern Territory, there has been relatively little development of the water resources. Also, as rainfall is generally less than 300 mm/year and highly variable, only for short periods does enough rain fall to give surface runoff. Groundwater from the large sedimentary basins including the Georgina, Wiso, Eromanga, Ngalia, and Amadeus Basins is the main source of water for the pastoral industry of the arid zones, the tourist industry centred on Alice Springs and the major aboriginal settlements. The Alice Springs water supply is mainly obtained from production bores in the Mereenie Sandstone aquifer of the Amadeus Basin, 15 km south of the town. Additional water resources which are necessary to meet continually increasing demand are currently being obtained from three other aquifers in the Amadeus Basin sequence near the production site. Future sources will be a balance between pumping costs (depth related) and delivery costs (distance related). Recharge is negligible when compared with extraction.

The main hydrological problems of the region include high sediment load in streams when they do flow, flash flooding (because of its rarity) and high levels of total dissolved solids in many bores. High salinity has been encountered either at the time bores were drilled or occasionally as groundwater was extracted, the latter reflecting the generally low recharge rates in the arid zone.

5.2 Map of Water Resources Systems



6. Socio-cultural Characteristics

The general lack of surface water bodies both severely limits the amount of water-based recreation possible and increases the cultural importance of the naturally occurring water resources such as water holes. Alice Springs appears to have overcome the former by installing backyard pools and holidaying at the beach. The annually held Henley-on-Todd regatta is literally 'run' on the dry bed of the Todd River. With respect to the water holes, some of the few permanent water holes and associated landforms are major tourist attractions in central Australia (Standley Chasm, Simpsons Gap, etc.). Water holes were very important to Aboriginals and natural wild life, and there is an extensive mythology which relates water. Some of these sites have been damaged and fallen into disrepair. The

fencing of particular springs and water holes and provision of alternative supplies are necessary measures if the distinctive features of natural surface waters are to be protected and re-established.

There has been considerable debate over the value of recreation and flood mitigation storages in the Todd River catchment. In 1979, a recreational/flood mitigation dam was investigated, but did not proceed largely due to the presence of sacred sites. Following the major 1988 flood, a flood mitigation dam, with limited recreational potential, at Junction waterhole was proposed. The design was later amended to provide for a mitigation only dam. In May 1992, the project was prevented from proceeding by an embargo issued by the then Federal Minister for Aboriginal Affairs under Section 10(4) of the Aboriginal and Torres Straight Islander Heritage Protection Act.

A radio telemetry based flood warning system, comprising seven rainfall stations and three river height stations, has been established in the Todd River catchment above Alice Springs. Data from these stations allows several hours warning of impending flooding to be given. Quantitative peak level forecasts are limited to 1 to 2 hours lead time, due to the relatively small size and fast response of the catchment.

7. References, Databooks and Bibliography

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