Pioneer River

Map of River

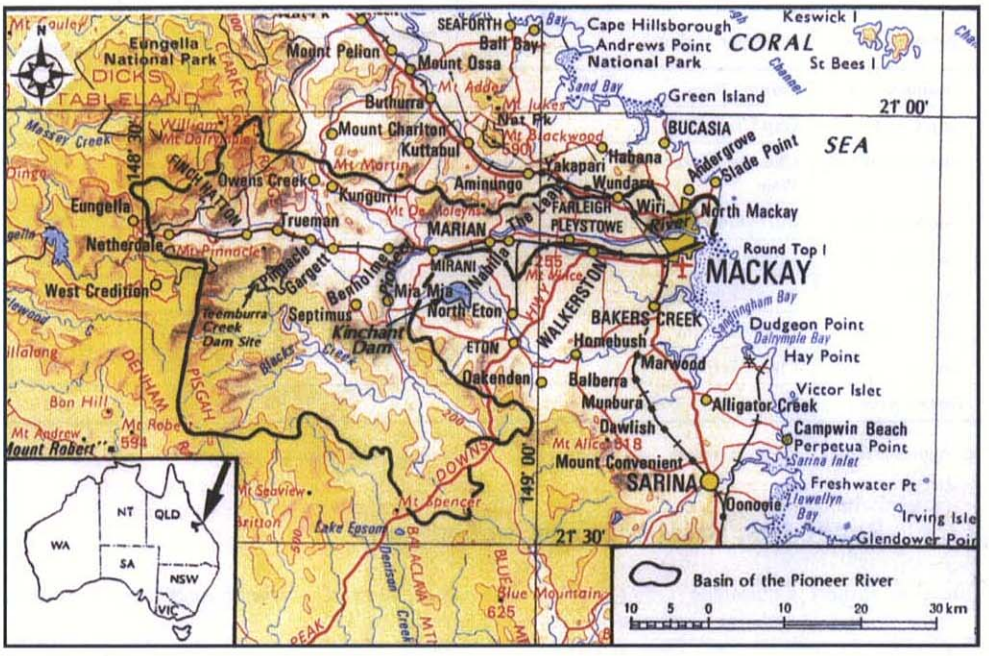


Table of Basic Data

Name: Pioneer River		**Serial No.:** Australia-2
Location: Queensland's Central Coast, Australia	S 21° 00′ ~ 21° 30′	E 148° 30′ ~ 149° 15′
Area: 1 500 km^2	**Length of main stream:** 120 km	
Origin: Clarke (1 000 m), Connors Range (500 m)	**Highest point:** Mt. William (1 259 m)	
Outlet: Coral Sea, South Pacific Ocean	**Lowest point:** River mouth (0 m)	
Main geological features: Carboniferous-Cretaceous, Medium to coarse grained granites and granodiorites, alluvium, sandstone, siltstone, claystone and shale.		
Main tributaries: Cattle Creek (360 km^2), Blacks Creek (505 km^2)		
Main lakes: None		
Main reservoirs: Mirani Weir 5.8 x 10^6 m^3, Marion Weir (3.8 x 10^6 m^3), Dumbleton Weir (6.1 x 10^6 m^3), Kinchant Dam (62.8 x 10^6 m^3) (fed by diverted water)		
Mean annual precipitation: Basin average 1 500 mm (1920~1969)		
Mean annual runoff: 28.6 m^3/s (at Pleystowe Mill, 1917~1982)		
Population: 42 000 (Main towns only) (1991)	**Main towns:** Mackay, Finch Hatton, Mirani Marian.	
Land use: Agriculture- sugar cane, vegetables and grazing (beef) (40%) Forest (60%)		

1. General Description

The Pioneer River is located in the Mackay-Whitsunday region of Queensland and flows in an easterly direction from the Connors and Clarke Ranges to discharge into the Coral Sea at Mackay. Rainfall patterns are highly seasonal with the five month period from December to April being extremely wet. Rainfall is also highly variable from year to year. Overall, the climate of the Pioneer River catchment based is warm, wet and humid, although conditions may become very dry in the winter and spring. The catchment is 1 500 km^2 in area, and has a mean annual discharge of about 900 x 10^6 m^3.

Mackay is the major service centre for the region and is located at the mouth of the river. The urban centres of the catchment have experienced high population growth, but relatively little growth in the rural areas. This trend is indicative of a shift from a traditional rural-based economy, to one predominantly based on tourism and service industries. The sugarcane industry remains as the major industry of the region.

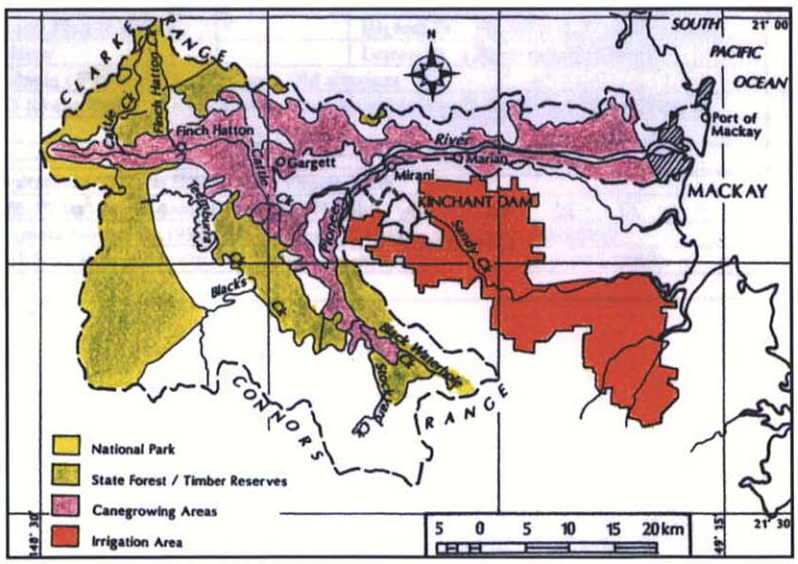
Water scarcity is a major issue. The region often experiences droughts that have severe effects on agriculture and thus on the region's economy. Some of the area used for sugarcane production has suffered serious erosion problems due to fifty years of cultivation.

Although much of the land has been cleared for agricultural use, large tracts of rainforest and open Eucalypt forest are still present. Plant species typical to both tropical and more temperate zones can also be found in the region . About 250 species of bird and 48 species of mammal can be found throughout the catchment area. The upper Pioneer River and tributaries are home to 23 different species of fish, with an even greater diversity found in the lower reaches and estuaries.

A 'Waterwatch' group has been established in the region to monitor water quality and raise community awareness of water supply issues

2. Geographical Information

2.2 Land Use Map

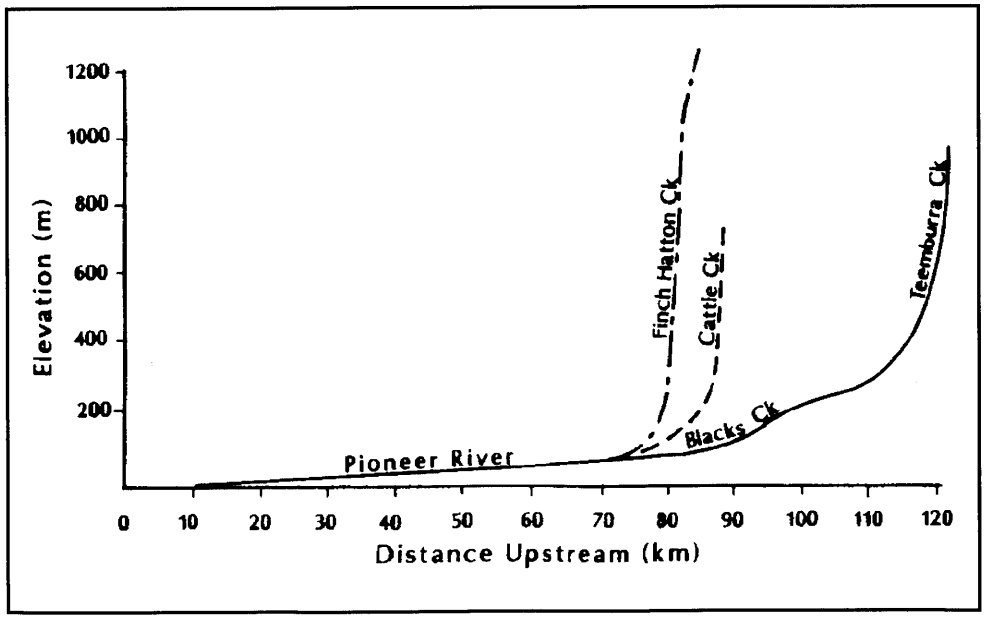


2.3 Characteristics of River and Main Tributaries

Name of river	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities Population (1991)	Land use[%]
Pioneer	120 1 500	Mt. William, 1 259 Sea level, 0	Mackay 40 250 Marian 587 Mirani 465	F(60), A&G (40)
Blacks Creek	70 505	750 100		F(90), A&G(10)
Cattle Creek	40 360	1 259 50	Finch Hatton 283	F(40),A(60)
Teemburra Creek (Tributary of Blacks Creek)	40 66	450 150		F(85), G(10), A(5)

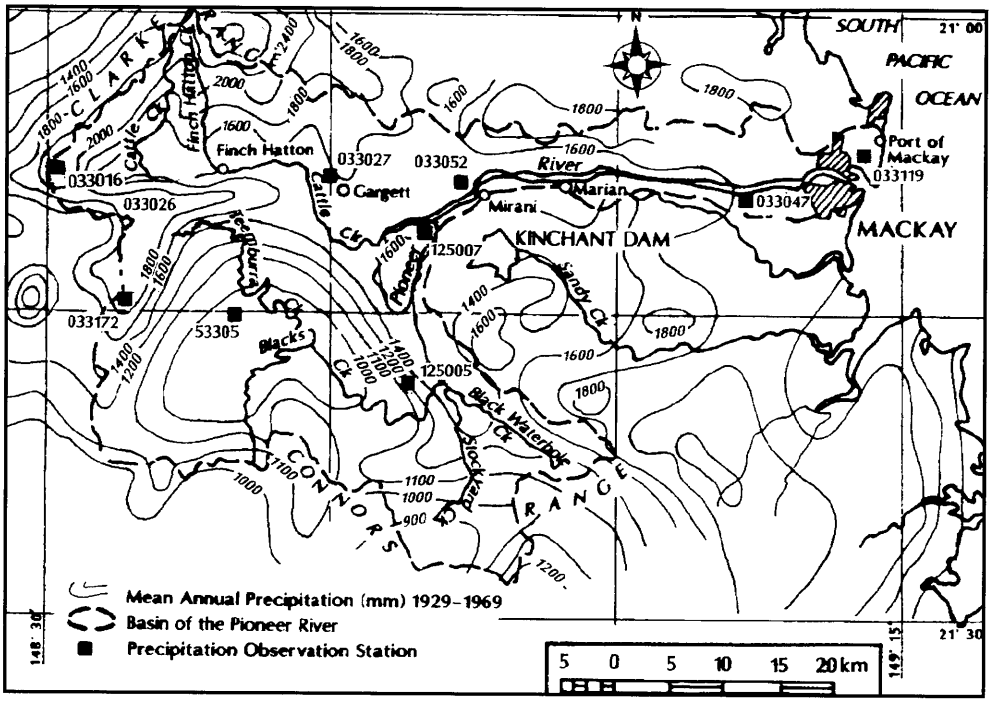
A: Agriculture (sugar cane), F: Forest, G: Grazing, (cattle), U: Urban

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Precipitation Observation Stations



Based on the data of Department of Primary Industries, Water Resources, Queensland. Isohyetal map was made by interpolating 11 long term stations in the catchment between 1920~1969 taking into account topography and synoptic variations.

3.2 List of Meteorological Observation Stations

The table of meteorological stations below is a selection of the main stations in the catchment.

No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [mm]	Mean annual evaporation [mm]	Observation items [1)]
033016	**Dalrymple Heights**	680	S 21° 08′ E 148° 29′	1938~1994	2 253	-	P
033026	**Finch Hatton**	92	S 21° 09′ E 148° 38′	1914~1994	1 666	-	P
033027	**Gargett**	74	S 21° 09′ E 148° 45′	1914~1994	1 463	-	P
033047	**Tekowai**	14	S 21° 10′ E 149° 07′	1899~1994	1 699	2 053	T,P,E,DS
033052	**Mirani**	50	S 21° 09′ E 148° 52′	1949~1994	1 495	-	P
033119	**Mackay** (Met. Office)	30	S 21° 07′ E 149° 13′	1959~1994	1 722	2 045	T,P,E,DS
033172	**Ridgelands**	143	S 21° 14′ E 148° 33′	1953~1994	2 154	-	P(TB)
125005*	**Whitefords**	85	S 21° 19′ E 148° 49′	1988~1994	N/C	-	P(TB)
125007*	**Mirani Weir**	58	S 21° 11′ E 148° 50′	1989~1994	N/C	-	P(TB)
533005*	**Teemburra Creek**	220	S 21° 15′ E 148° 40′	1985~1994	N/C	-	P(TB)

All rainfall stations shown are operated by the Australian Bureau of Meteorology with the exception of those marked * which are operated by the Water Resources Division of the Queensland Department of Primary Industries.

N/C Record too short for calculation of mean
1): Temperature E: Evaporation P: Precipitation (TB: Tipping bucket with digital data logger) DS: Duration of shine

3.3 Monthly Climate Data

The tables below show climatic data for selected stations in the Pioneer catchment.

Station: Mackay (033119)

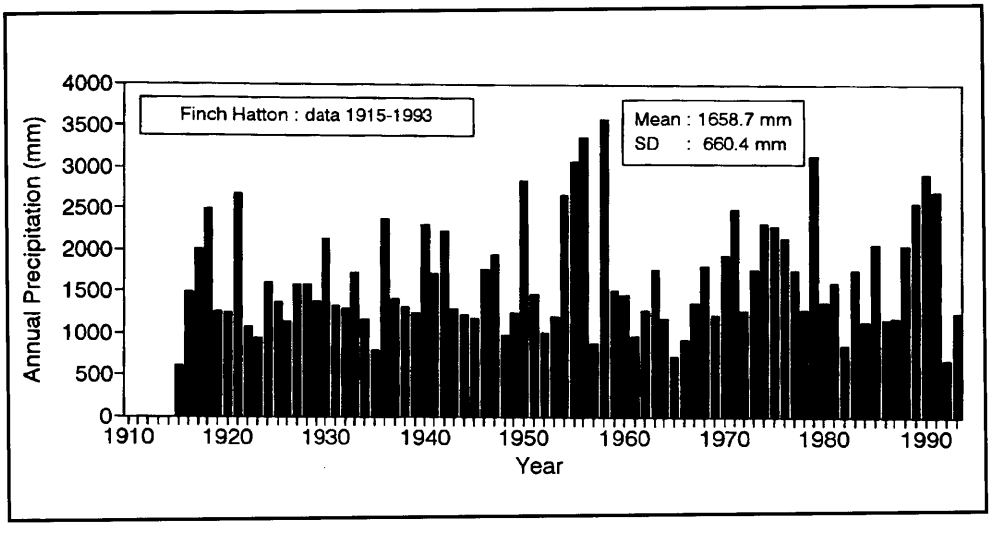
Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	26.4	26.3	25.3	23.3	20.6	17.7	16.9	18.2	20.7	23.5	25.4	26.4	22.5	1960~1993
Precipitation [mm]	295	399	293	152	115	61	45	28	15	35	87	197	1 722	1959~1993
Evaporation [mm]*	200	170	170	160	120	105	110	140	175	225	235	235	2 045	1970~1993
Duration of sunshine [hr]	267	216	239	210	208	228	236	279	285	304	282	285	3 039	1984~1993

Station: Tekowai (033047)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	26.4	26.1	25.2	23.0	20.2	17.6	16.7	17.8	20.1	22.7	24.8	26.1	22.2	1908~1993
Precipitation [mm]	356	350	293	143	93	61	38	27	29	45	79	185	1 699	1989~1993
Evaporation [mm]*	214	171	177	144	115	102	109	139	180	226	237	239	2 053	1970~1993
Duration of sunshine [hr]	220	190	220	240	226	216	239	273	273	288	276	257	2 918	1965~1983

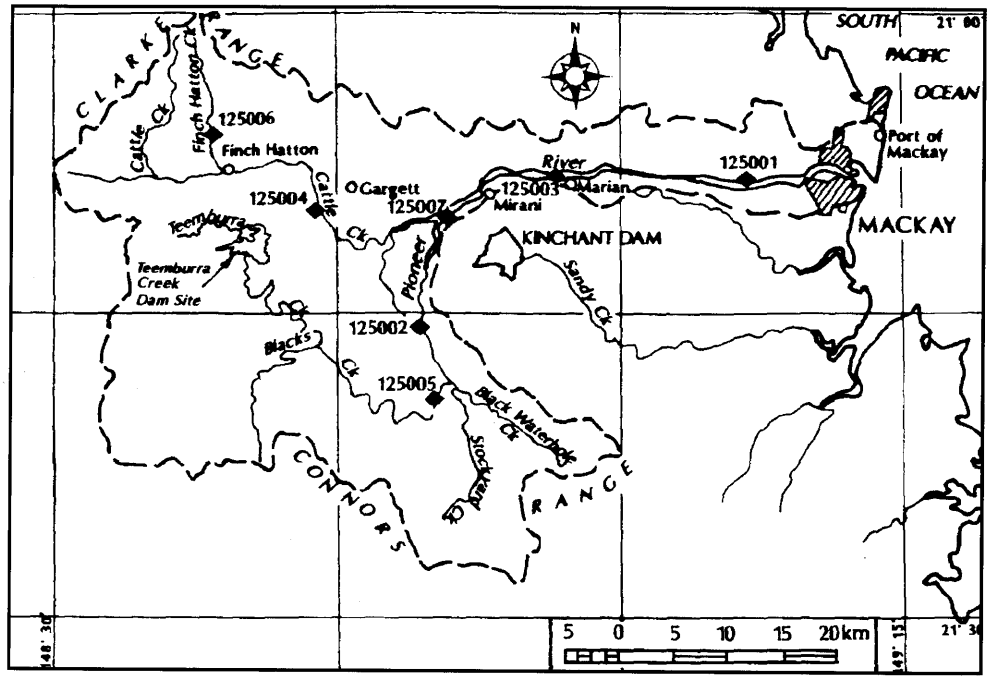
* Evaporation pan used: - US Class A (48 inch dia)

3.4 Long-term Variation of Annual Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

The table of hydrological stations below is a selection of the main stations in the catchment.

No.	Station	Location	Elevation [m]	Catchment area (A) [km^2]	Observation period	Observation items [1)]
125001	Pioneer River at Pleystowe Mill	S 21° 09′ E 149° 03′	6	1 375	1916~1978 1969~1982	H2, Q H1, Q
125002	Pioneer River at Sarichs	S 21° 16′ E 148° 49′	48	740	1958~1965 1965~1994	H2, Q H1, Q
125003	Pioneer River at Marian Weir	S 21° 09′ E 148° 56′	26	1 320	1958~1965 1965~1988	H2,Q H1,Q
125004	Cattle Creek at Gargett	S 21° 11′ E 148° 45′	53	340	1967~1994	H1, Q, WQ
125005	Blacks Creek at Whitefords	S 21° 19′ E 148° 49′	58	505	1973~1994	H1, Q, WQ
125006	Finch Hatton Creek at Damsite	S 21° 06′ E 148° 38′	94	36	1976~1994	H1, Q
125007	Pioneer River at Mirani Pump Station	S 21° 11′ E 148° 50′	34	1 190	1978~1994	H1, Q, WQ*

No.	$\overline{Q}$ [2] [m³/s]	Q max [3] [m³/s]	$\overline{Q}$ max [4] [m³/s]	$\overline{Q}$ min [5] [m³/s]	$\overline{Q}$ / A [m³/s/100km²]	Q max / A [m³/s/100km²]	C_v [6]	Period of statistics
125001	28.6	9 840	2 490	0.354	2.09	718	0.84	1917~1981
125002	11.2	5 070	1 570	0.028	1.51	685	1.01	1961~1992*
125003	21.4	7 750	2 240	0.022	1.62	587	0.92	1959~1987
125004	11.0	2 500	984	0.118	3.23	735	0.67	1968~1992
125005	8.1	2 224	826	0.030	1.60	440	N/C	1973~1994
125006	1.5	363	141	0.024	4.17	1 008	N/C	1976~1994
125007	23.3	6 420	2 440	0.169	1.96	539	1.00	1978~1992+

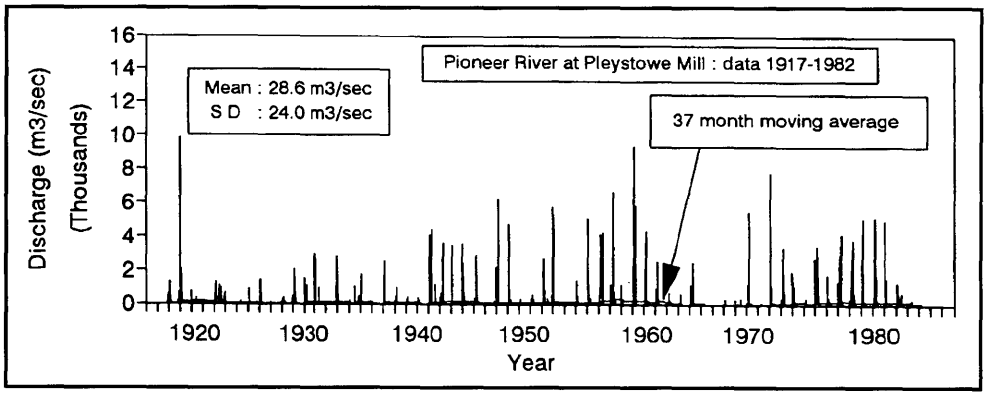
Note: * Missing data during 1965~1966; + Missing data in 1986; N/C not calculated

1) H1: Water level in recording chart or data logger
H2: Water level by manual reading (normally daily)
Q: Discharge
WQ: Water quality monitoring site. (* denotes proposed WQ site)

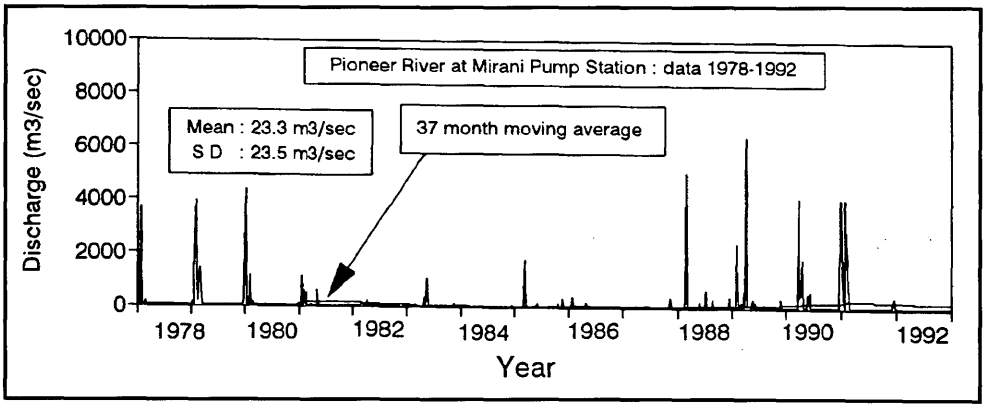
2) Mean annual discharge
3) Maximum discharge
4) Mean annual maximum discharge
5) Mean annual minimum discharge
6) Coefficient of variation of annual total discharge

4.3 Long-term Variation of Monthly Discharge

a) Pleystowe Mill (Station 125001)



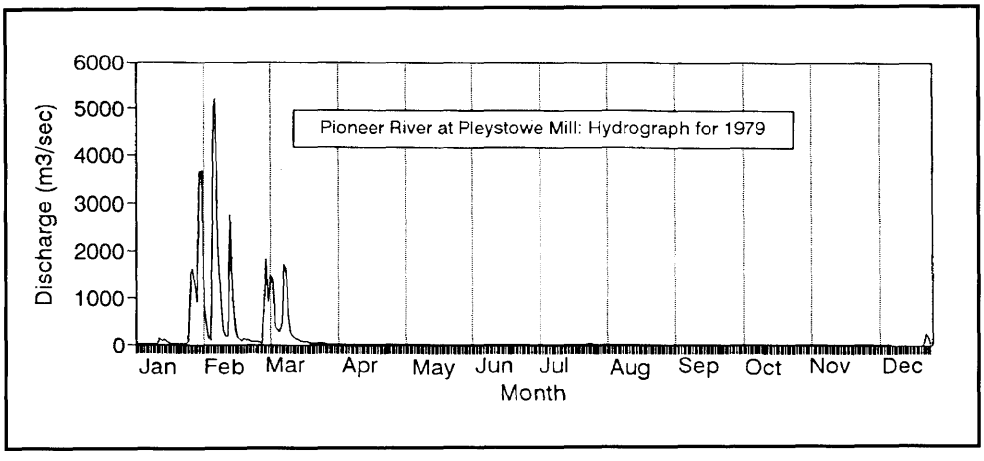
b) Mirani Pump Station (Station 125007)



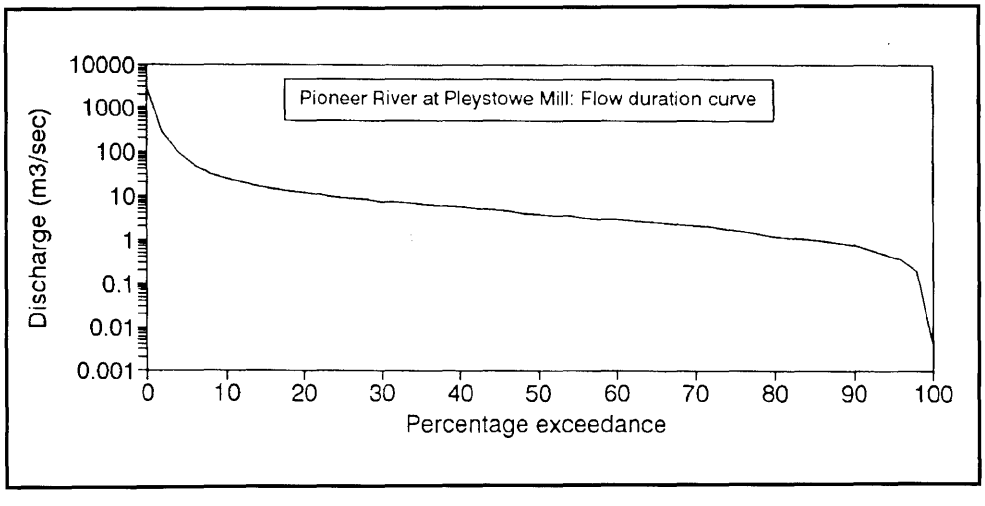
4.4 Annual Pattern of Discharge

Graphs of the discharge series for a selected year and the flow duration curve for the Pioneer River at Pleystowe Mill (Station 125001) are shown below:

a) Discharge series for 1979



b) Flow duration curve



4.5 Annual Maximum and Minimum Discharges

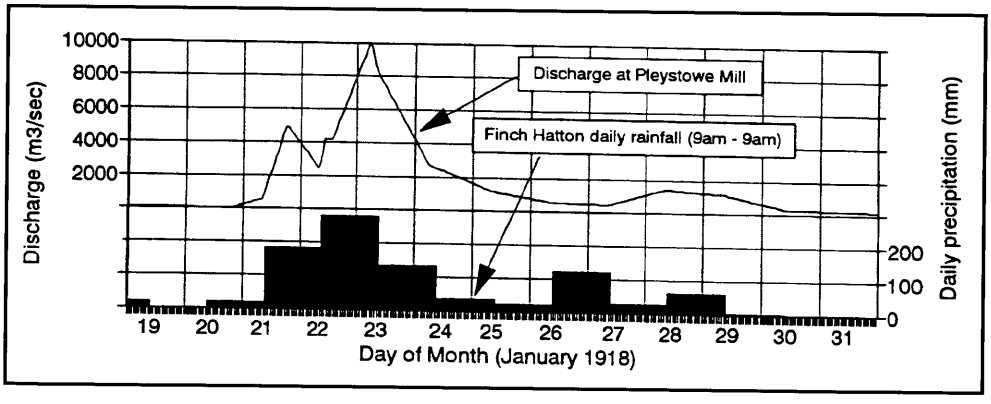
The table below summarises annual maximum and minimum discharges for the Pioneer River at Marian Weir (Station 125003).

Year	Maximum [1]		Minimum [2]		Year	Maximum [1]		Minimum [2]	
	Date	[m³/s]	Month	[m³/s]		Date	[m³/s]	Month	[m³/s]
1959	2.17	5 293	11	0.052	1974	3.02	2 884	12	0.083
1960	1.17	795	11	0	1975	1.16	1 404	11	0.020
1961	2.18	240	10~11	0	1976	3.05	4 370	12	0.020
1962	2.25	503	10~12	0	1977	3.09	3 564	10	0.126
1963	3.25	2 349	12	0.052	1978	2.01	5 319	10	0
1964	3.31	85	1	0.120	1979	2.06	5 168	12	0
1965	5.09	26	11~12	0	1980	1.07	5 421	11~12	0
1966	12.11	284	10~11	0.019	1981	1.20	1 099	10~11	0.058
1967	6.22	284	11	0.052	1982	4.15	258	1~3, 10~12	0
1968	2.16	5 577	11~12	0	1983	5.21	1 282	1~3	0
1969	3.23	215	1	0	1984	1.20	101	10~12	0
1970	1.19	7 751	1	0.019	1985	3.13	2 396	1~2	0
1971	3.07	3 409	10~11	0	1986	2.02	355	12	0
1972	1.09	1 323	10~12	0	1987	11.16	198	1&10~11	0
1973	12.19	2 865	10	0					

1), 2) Instantaneous obervation by recording chart

4.6 Hyetographs and Hydrographs of Major Floods

A graph showing the largest flood on record and the daily rainfall at Finch Hatton (Station 033026) for January 1918 is shown below.



5. Water Resources

5.1 General Description

The Pioneer River catchment is highly undulating, and the river follows a very circuitous course. Australian rivers generally show greater flow variability than rivers in other parts of the world (McMahon, 1982), and the Pioneer river is no exception. It shows very large variations in both annual flow volumes and peak flood discharges. It has been estimated that the Upper Pioneer River provides only 20 percent of the runoff of the whole Pioneer system even though it has 53 percent of the catchment area (Credlin, 1973). The Cattle Creek area generally has higher flood flows due to unusually high rainfall and the very steep and rocky nature of the catchment which produces high and rapid runoff.

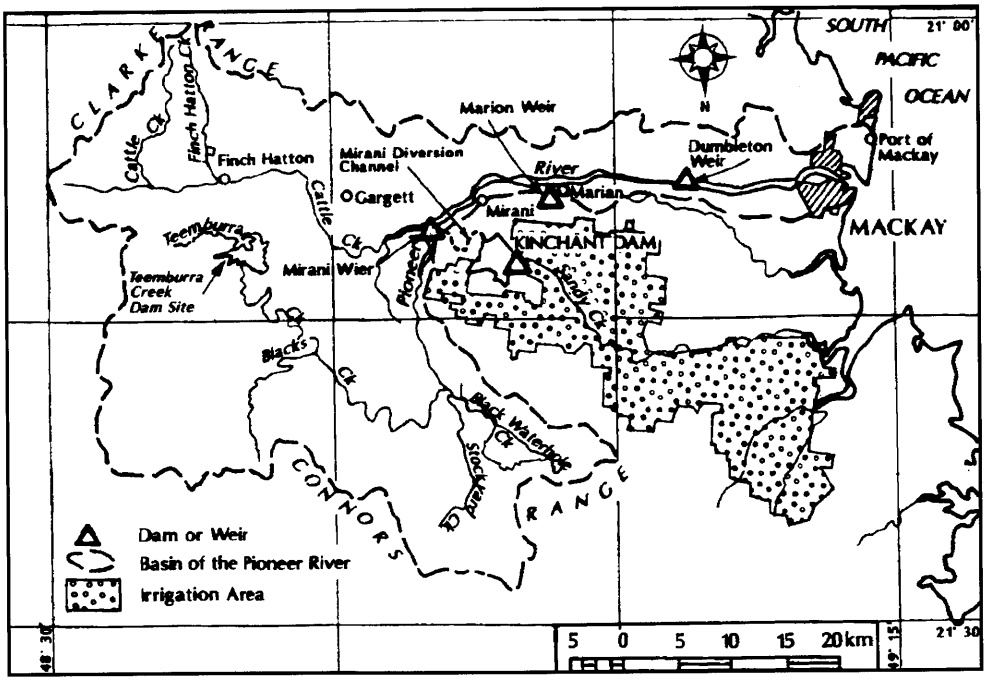
Complete cessation of flow in the Pioneer River was rare in the past but has become increasingly more frequent in recent years. During periods of low flow, springs occur in the river bank at points 16 km and 24 km from the mouth.

A large proportion of the annual discharge occurs as flood flows and over half of the annual discharge is normally in the first three months of the year. This extreme variability in the river flow is a constant problem. Floods occur frequently in the rainy (cyclone) season between December and April. Usually the banks of the Lower Pioneer River are not overtopped except in the tidal reaches where drastic flooding has occurred.

There are three major storages located within the catchment area, and one that is located in an adjacent catchment but is fed by diversion from the Pioneer River. The Mirani, Marian, and Dumbleton Rocks Weirs are all situated on the Pioneer River and are small in comparison to the Kinchant Dam storage which is situated on the northern branch of Sandy Creek in the adjacent catchment. Storage levels are maintained in the Kinchant Dam by pumping water from the Pioneer River at Mirani to a gravity diversion channel which connects to the dam for distribution to irrigation areas. The weirs provide irrigation supplies to the Pioneer River catchment area. There has also been significant development of the groundwater resources of the catchment area.

The Queensland Government has recognised that there will be a future shortfall of water supplies in and adjacent to the Pioneer River catchment. Several options for increasing water supplies are available including the diversion of water from Kinchant Dam and construction of a new dam on one of the tributaries of the Pioneer River.

5.2 Map of Water Resources Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of River	Name of dam	Catchment area [km^2]	Gross capacity [10^6m^3]	Effective capacity [10^6m^3]	Purpose	Year of completion
Teemburra Creek*	Teemburra Dam	66	137	129	A,I,W	1996/97
Sandy Creek	Kinchant Dam	32 [1)]	62.8	61	A	1982
Pioneer River	Mirani Weir	1 100	5.8	4.7	A	1987
Pioneer River	Marian Weir	1 200	3.8	2.8	A,I	1952
Pioneer River	Dumbleton Weir	1 300	6.1	6.1	A,I	1993

A: Agricultural use, I: Industrial use, W: Municipal water supply
*: Under construction
1) This is the catchment area of the Kinchant Dam. The contributing catchment area to Mirani Weir on the Pioneer River can be added to this during periods of water diversion from the Pioneer River.

Major Interbasin Transfer

Name of transfer line	Names of rivers connected		Length [km]	Maximum capacity [m^3/s]	Purpose	Year of completion
	From	To				
Mirani Diversion Channel	Pioneer	Sandy Creek	8.25	10.5	A	1982

A: Agricultural use

7. References, Databooks and Bibliography

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