DEPARTMENT *of*
PRIMARY INDUSTRIES,
WATER *and* ENVIRONMENT

Tasmania

Hydrological Analysis of Rivers in the Brid Catchment

A Report Forming Part of the Requirements for State of Rivers Reporting

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1. Historical Background

Catchments and Drainage System

The study catchment was that containing the Brid River system. The Brid River itself is situated in the north-east of the state. It is a class 4 unregulated stream but it has tributary streams that are heavily impacted by on-stream storages. The upper catchment has been cleared for a mixture of cropping and pasture. The middle catchment is heavily forested and the lower catchment is largely cleared for pasture. Stream substrate grades from boulder and sand to cobble, gravel and predominantly sand in the lower reaches. Geologically the river originates in granodiorite and passes through a turbidite and alluvial sequence. The river originates from Mount Scott at an altitude of 660 m and is approximately 60 km in length. The Brid River catchment has a total area of 148.2 km^2

The catchment is long narrow, bounded to the south by the St Patricks catchment, the west by the Sidling Range and Little Forester catchment, and to the east by the Great Forester catchment. There is only one significant tributary of the Brid this being the Little Brid River (which enters downstream of Lietinna).

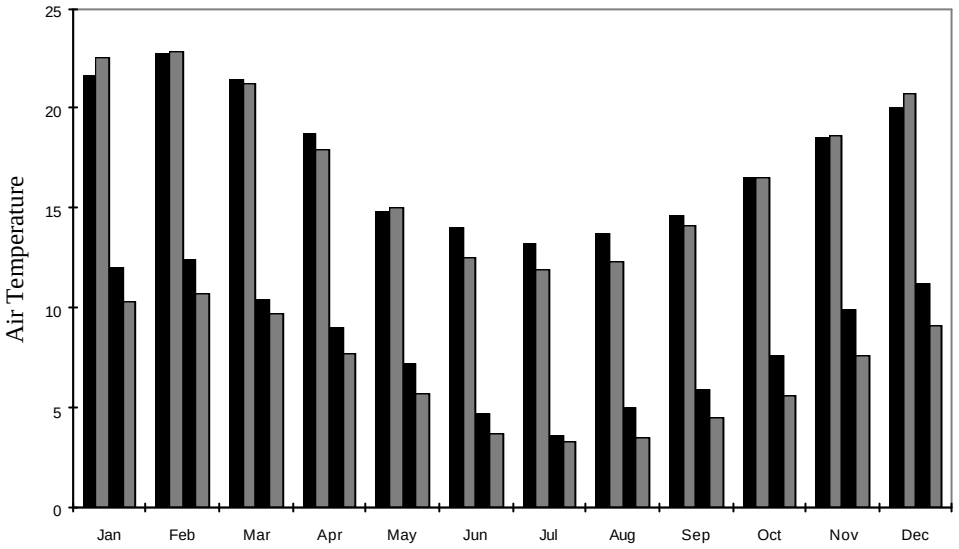
The annual median flow is 0.918 cumecs and summer median flow is 0.475 cumecs. The average annual rainfall range for the catchment is 700 - 900 mm. There is an average (last 10 years) summer (December to March) extraction of water for irrigation purposes of approximately 500 megalitres.

Climate and Rainfall

Although the climatic conditions of the northeast region are generally influenced by its proximity to the sea, the distribution of rainfall is mainly controlled by topographic changes, with highest rainfall occurring around the Ben Nevis and associated ranges. Nearer the coast, annual average rainfall is approximately 750 - 800 mm (cf Bridport) increasing to around 1200 mm near the top of the catchment at South Springfield (cf Diddleum). Rainfall statistics for five significant sites in the northeast are presented in Appendix 1, and show that highest monthly totals occur in July and August and lowest in February and March.

Thunderstorms can occur throughout the catchment at any time of year, however they are most prevalent during summer and autumn when there is a greater frequency of north to north-westerly winds creating uplift of warmer air from the coast.

Temperatures throughout the catchment are influenced by distance from the coast rather than topographic variation, with inland areas experiencing greater extremes than those nearer the coast. The difference between the coastal temperature and inland areas is clearly shown in Figure 1.1, which compares average maximum and minimum temperatures at Bridport (elevation 0m) with Scottsdale (elevation 200m). Although maximum air temperatures are very similar during much of the year, the average monthly minimum temperature is always lower at Scottsdale.



Solid bars represent maximum and minimum monthly temperature for Bridport
Hatched bars represent maximum and minimum monthly temperature for Scottsdale

Figure 1.1 Average Maximum and Minimum Temperatures at Bridport and Scottsdale

2. Monitoring in the Catchment

Bureau of Meteorology

As part of the Statewide rainfall monitoring network, the federal Bureau of Meteorology currently operate one monitoring station in the Brid catchment. There are also 3 stations located relatively close to the catchment, and these are shown in Table 2.1. These stations are primarily maintained for flood warning and climate monitoring purposes. The data from these, and all other sites in Tasmania can now be accessed on the world-wide web at www.bom.gov.au.

Station Number	**Name**
091086	Ringarooma (Fry Street)
091257	Trenah (Wattle Banks)
091219	Scottsdale (West Minestone Rd)
091284	Bridport (Emma St)

Table 2.1 Bureau of Meteorology rainfall stations

Rivers and Water Supply Commission / DPIWE

The site on the Brid River 2.6km upstream of the tidal limit; is currently operated by the Department of Primary Industries, Water and Environment (DPIWE). Records of river flow have been collected at this site since 1965. Water quality monitoring including, turbidity, conductivity and temperature has been undertaken at this site from 1994. This data is discussed in a separate section of the "State of Rivers" report.

3. Monthly Flows

The variability of monthly flows in the Brid catchment is shown in Figure 3.1, which provides a box and whisker style plot for data from the monitoring site at Brid 2.6 km upstream of the Tidal Limit (19200). The plots display the median (or the middle of the data) as a line across the inside of the box. The bottom and top edges of the box mark the first and third quartiles respectively, indicating the middle 50% of the data. The ends of the whiskers show the spread of the data and together enclose 95% of the data. The dots beyond the whiskers indicate the high and low extrema.

The box and whisker plot shows a strong seasonal pattern, with flows peaking in the period July through to September. Lowest flows are experienced between January and April. This period also corresponds to the peak irrigation demand from the river

The monthly flows may appear to be variable especially in the winter months, but when compared to other areas such as the South Esk, the monthly flows can be viewed as relatively consistent or regular. Compared to the Great Forester, the Brids' pattern of monthly flows is very similar, but the volume is approximately 2/3 of that experienced in the Great Forester River.

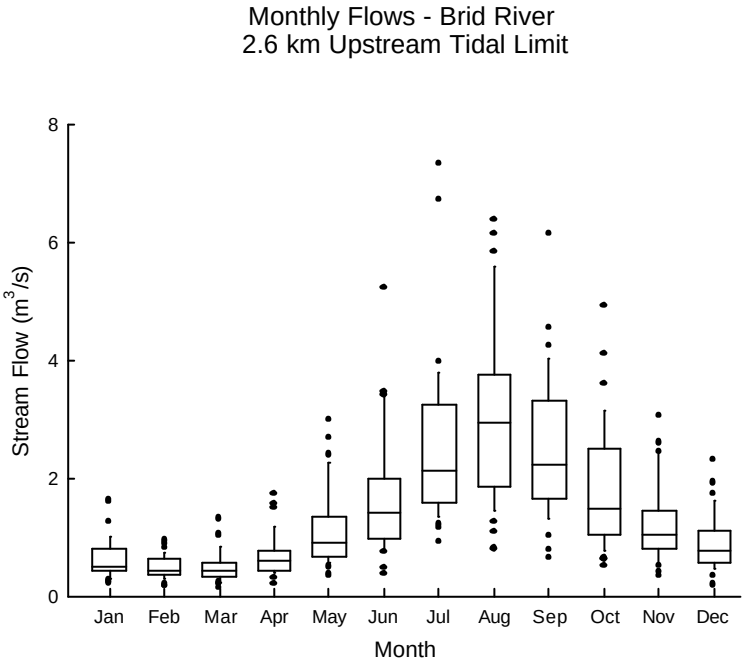


Figure 3.1 Monthly Flow Analysis from Brid River 2.6 km upstream of the Tidal Limit (Site #19200)

Site Statistics

The following displays the historical statistics for the record from the site, Brid River 2.6 km upstream of the Tidal Limit.

Site	Site Number	Start of Record	End of Record
Brid River 2.6 km upstream of the Tidal Limit	19200	26/6/1965	Present

Catchment Area	Approx AAR	Easting	Northing	Control
139 km^2	750 mm	531300	5458800	Weir

	Median	Average	Maximum	Minimum
Flow Record (m^3s^{-1})	0.918	1.45	58.27	0.09

4. Comparison of Monthly Flows; Historical vs Study Period

The following bar chart demonstrates the type of season that was experienced in the study period compared to the historical record (Figure 4.1). During the study, all months apart from October experienced less flow than the historical record. This was especially marked during the six months from March to August. This indicates that in general terms the study was conducted in drier than average conditions.

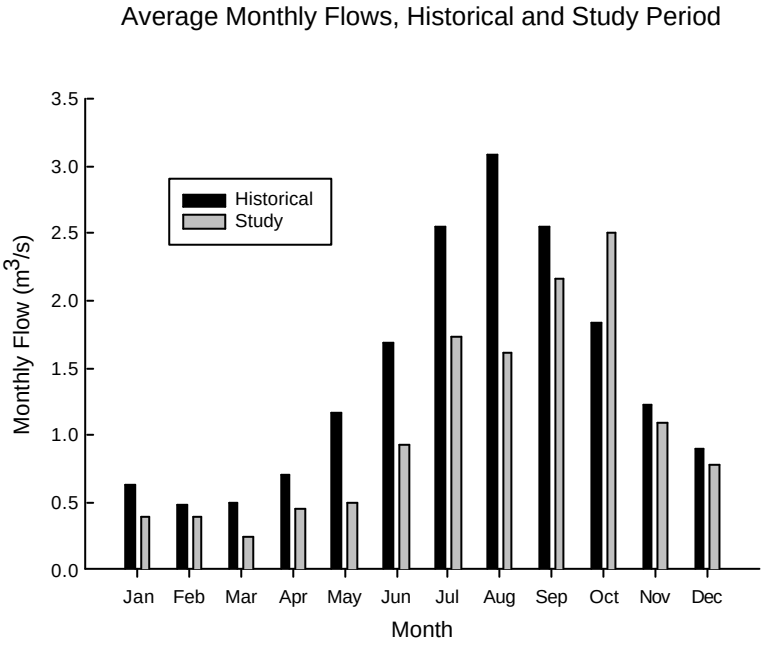


Figure 4.1 Comparison of monthly flows for the Brid River 2.6 km upstream of the Tidal Limit, (Historical Record vs Study Period).

5. Floods

Flood frequency analysis was conducted on flows in Brid River 2.6 km upstream of the Tidal Limit. An annual series of peak flood events was extracted for use in the flood frequency analysis. The analysis was corrected for the under estimation of flood peaks that results when using an annual series. The sample coefficient of skew was insignificant at the 95% level, as a result a 2 parameter log normal distribution was fitted. The results of this analysis are shown in Figure 5.1. As the plot is shown in logarithmic form, the vertical and horizontal grid lines are of unequal spacing. Some examples of how to read this graph are; (a) there is a 1 in 10 year chance that a flood of approximately 36.5 cumecs or more will occur (river height of approximately 1.54m). (b) there is a 1 in 2 year chance that a flood of approximately 16.5 cumecs or more will occur (river height of approximately 0.89m).

During the present study there was a moderate flood which occurred on September 23rd, which had a peak flow of approximately 19.17 cumecs (corresponding river height of approximately 1m. 2.6 km upstream of the Tidal Limit). Examining Figure 5.1, it can be concluded that a flood of this magnitude corresponds to an approximate annual exceedence probability (A.E.P.) of 1:2 to 1:3

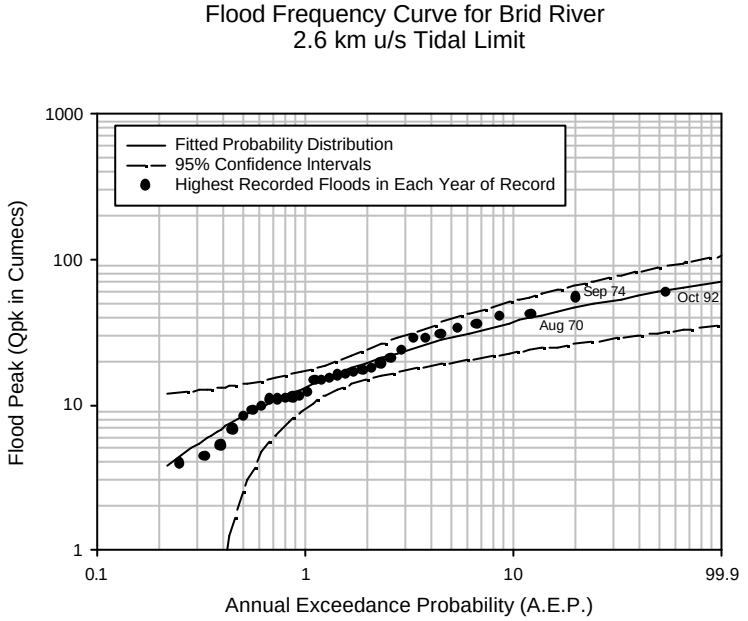


Figure 5.1 Flood frequency Curve for Brid River 2.6 km upstream of the Tidal Limit.

6. Droughts and Low Flows

Several hydrographs were analysed to describe the recession flows for the Brid River 2.6 km upstream of the Tidal Limit. The recession segment of a hydrograph is that part which displays how the water storage in the river decreases over time following high river flows. Using several recession segments for the analysis, a 'recession curve' can be generated which represents the basic pattern of decrease of flow in the river. The recession curve essentially reflects groundwater discharge to the river and how groundwater storage influences and sustains flows in rivers.

The recession curve for the Brid River 2.6 km upstream of the Tidal Limit is described by the following equation, and is presented graphically in Figure 6.1

$$\text{Flow} = 0.13095 + 1.7513 * 0.999959^{\text{Time (Minutes)}}$$

The upper part of the recession curve contains mainly surface flow (runoff) while the lower section is more representative of groundwater discharge to the river. The curve demonstrate that once the flow recedes to approximately 2 m^3/s on the recession limb it takes close to 50 days to return to a base flow of approximately 0.25 m^3/s. If the time period is extended beyond 50 days, the base flow would recede further to approximately 0.13 m^3/s. This lower bound for base flow reflects the summer period of flows in the Brid River. Base flow experienced in winter months is higher and is estimated to be 0.5 to 1 cumecs.

Low flow frequency curves have been derived for a range of durations from 1 day through 90 days (Figures 6a to 6f). The curves give the probability that any given minimum flow will occur over various time periods. For example, over a five day period, the probability that an average daily flow of 0.25 cumecs will occur is approximately 50%, while over a longer period such as ninety days this probability decreases to approximately 10%.

This information has implications for the establishment of environmental flow allocations for the Brid River and for the assessment of risk in supply of water from the river for purposes such irrigation and domestic use. Such risks will also need to be taken into account during the Water Management Planning process to be carried out as part of the currently proposed water reforms.

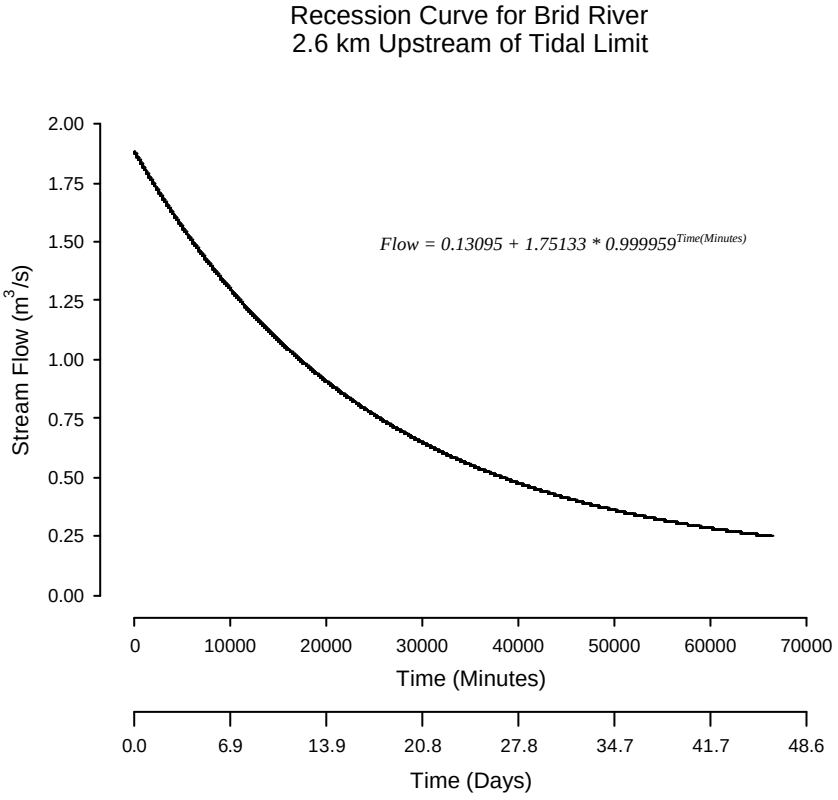
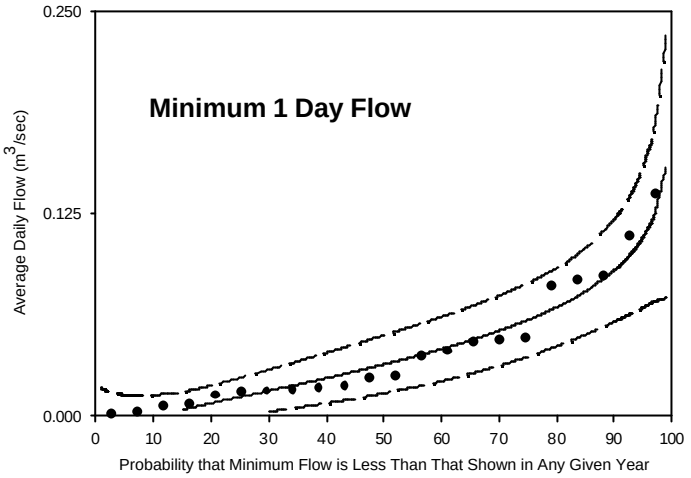
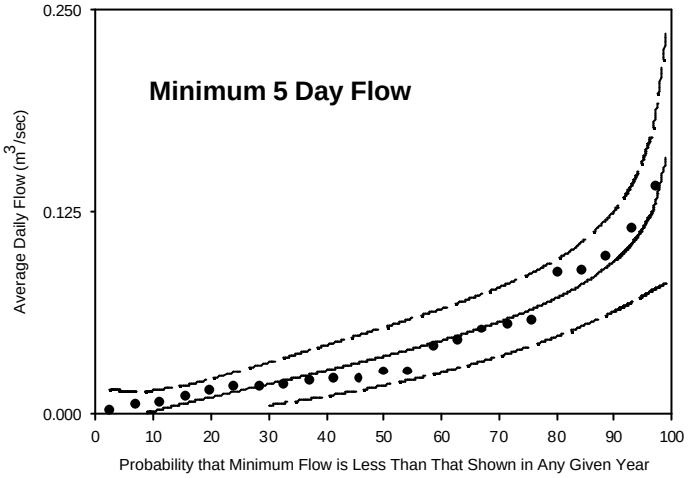
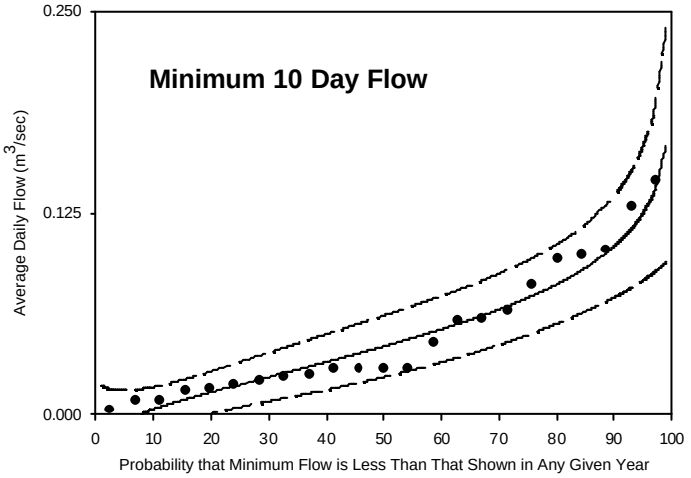


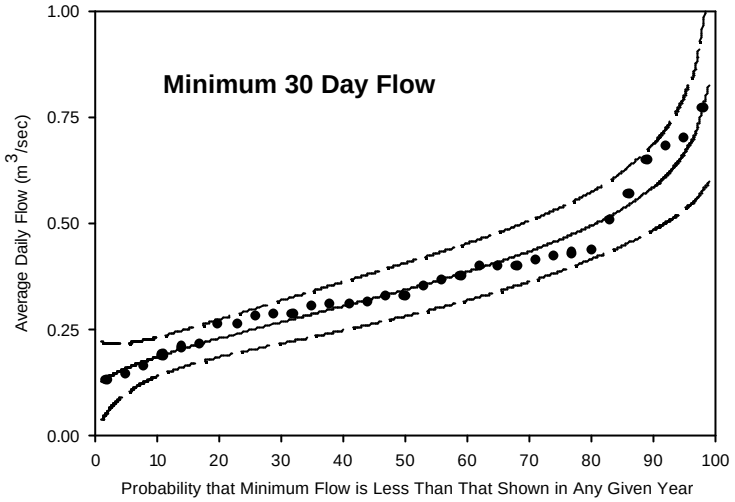
Figure 6.1 Recession Curve for Brid River 2.6 km upstream of the Tidal Limit.

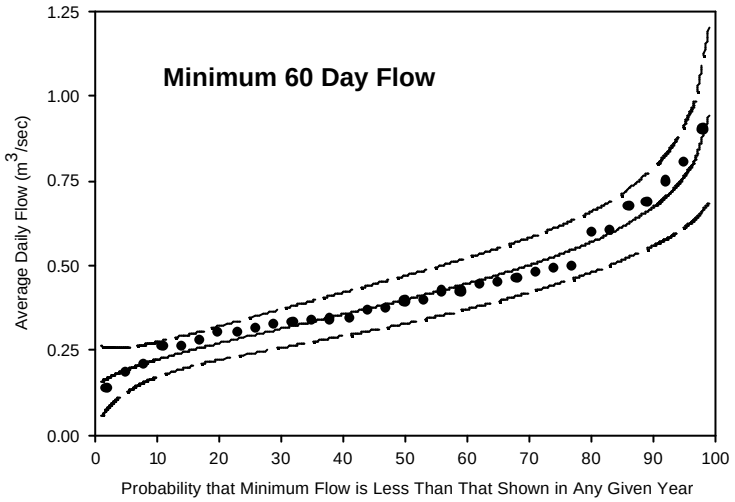


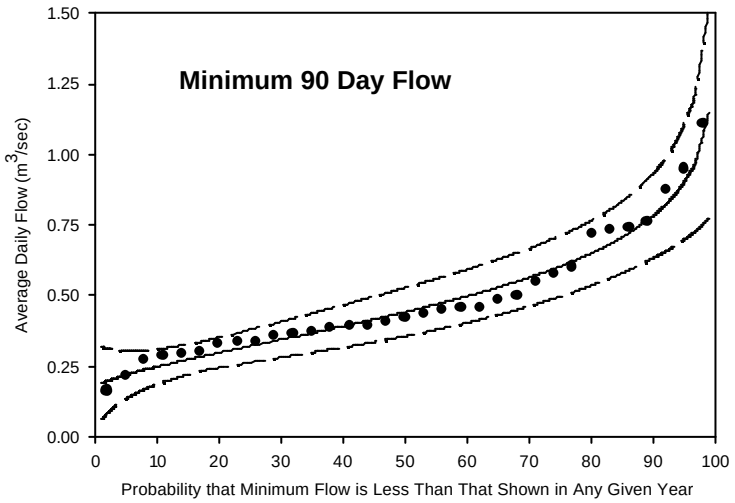




Figures 6.2 (a-c) Low flow frequency curves for the Brid River 2.6 km upstream of the Tidal Limit. Each graph shows the probability that any given minimum flow will occur at each time period







Figures 6.2 (d-f) Low flow frequency curves for the Brid River 2.6 km upstream of the Tidal Limit. Each graph shows the probability that any given minimum flow will occur at each time period

7. References

Bureau of Meteorology, Monthly Weather Review Tasmania 1998 (January through December)

Jordan, W.M. (1973) Tasmanian Water Resources Survey - Report No. 14 on the Brid and Tomahawk Rivers. Rivers and Water Supply Commission, October 1973.

Appendix 1

Rainfall statistics for five significant sites in the northeast

Bridport - Post Office

Site No. 091007 - Opened in January, 1912.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	44.0	42.6	41.8	66.2	81.2	81.7	87.9	86.3	66.0	68.0	53.3	54.0	780
Median	40.5	37.5	38.4	53.3	67.4	72.3	81.6	80.3	68.2	63.1	51.7	49.8	773
Highest	137.7	192.0	135.8	249.6	224.1	192.8	218.2	248.0	171.0	174.2	115.0	149.4	1128
Lowest	5.4	0.0	1.4	1.6	1.8	12.4	6.0	17.7	3.0	4.1	11.4	1.0	387
Years	84	83	84	84	84	84	82	84	82	81	83	81	78

Scottsdale - West Minestone Rd

Site No. 091219 - Opened in March, 1971.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	61.4	41.9	54.9	88.6	108.4	103.9	128.0	121.3	100.8	85.8	74.2	73.3	1040
Median	61.8	38.8	50.2	84.6	108.6	90.4	116.6	112.1	105.1	81.4	67.2	67.0	1057
Highest	134.4	109.2	146.2	203.8	181.4	224.4	287.6	269.4	227.8	153.2	161.8	218.0	1426
Lowest	9.4	1.8	5.0	19.0	7.6	54.2	32.8	40.2	13.8	32.0	25.2	11.6	678
Years	27	27	28	28	27	27	27	28	27	27	27	27	25

South Springfield

Site No. 091093 - Historical data (31 years record)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	59	57	60	97	146	140	153	165	127	122	89	84	1299

Maximum Annual Total for record = 1875 mm

Minimum Annual Total for record = 809 mm

Jetsonville

Site No. 091045 - Historical data (49 years record)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	48	56	45	72	92	106	116	114	90	88	63	59	949

Maximum Annual Total for record = 1465 mm

Minimum Annual Total for record = 568 mm

Diddleum - Sowters Rd

Site No. 091270 - Opened in May, 1992.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	124.6	111.0	52.0	94.3	176.6	161.3	195.8	191.8	157.7	124.2	114.4	92.1	1536
Median	108.9	121.6	41.9	87.0	168.0	143.0	201.2	210.0	148.1	111.3	96.3	81.4	1555
Highest	228.0	164.0	143.4	53.0	355.6	232.4	261.6	347.0	257.7	231.6	199.4	164.6	1961
Lowest	70.0	52.2	7.8	53.2	52.8	93.8	103.1	105.8	51.2	64.6	89.2	13.6	1137
Years	6	6	6	6	6	7	7	7	6	6	6	6	5

 # Refer: Bureau of Met. 1998