GOVERNMENT OF BRITISH COLUMBIA

MEMORANDUM

TO Dr. J. C. Foweraker
Head
Groundwater Section

FROM A. P. Kohut
Senior Geological Engineer
Groundwater Section

March 7, 1977

SUBJECT Saanich Peninsula Water Supply

OUR FILE 0239013

YOUR FILE

At the request of Mr. N. Howard, Chief Engineer with the Capital Regional District, all available observation well hydrograph data for the Saanich Peninsula was updated to the end of February 1977. The Groundwater Section currently monitors 15 observation wells on the peninsula. Six of these wells are equipped with automatic water recorders while the remainder are read manually. A summary of the active wells is given in the attached Table 1. Updated hydrographs and corresponding precipitation data for the period of records are shown in Figures 2 through 12. This memorandum briefly discusses the recent groundwater trends shown by the hydrographs in comparison to previous records. Implications of the present groundwater trends and their likely effects on groundwater supplies in the Saanich Peninsula this coming season are also commented upon.

Seasonal Fluctuations in Water Levels Due to Precipitation

Water levels in observation wells on the Saanich Peninsula fluctuate seasonally following an annual cycle in response to precipitation. Generally precipitation is normally highest during the period September through to April peaking generally from November to February. Apart from the annual response of wells to precipitation, other factors may affect water levels in wells including, for example, local geologic conditions, interference from nearby pumping wells, water level fluctuations in nearby reservoirs, rivers and lakes and also ocean tides. The observation well hydrographs, however, are generally representative of natural non-pumping water levels in the areas where the wells are completed, whereas domestic and production wells may not respond in the same manner as the background water levels for the reasons outlined above. It is evident upon examination of individual observation well hydrographs that there is generally a marked difference in the seasonal response of bedrock and surficial wells.

Surficial Wells

Surficial wells completed in sand and gravel aquifers generally reach lowest water levels in October to January, peaking in April or May and lagging behind the major rainfall period by three to four months. This is best shown in the hydrographs from wells 2-66, 12-66 and 15-66. Well 102-71 which shows a seasonally erratic hydrograph is influenced by a nearby pumping well. Long-term hydrographs are not available from wells 122-76, 123-76 and 124-76 which are located in the Cordova Bay Aquifer east of Elk Lake. Although these wells

TABLE 1: SUMMARY OF ACTIVE OBSERVATION WELLS, SAANICH PENINSULA, FEBRUARY 1977

SITE DESIGNATION	DATE ESTABLISHED	TOTAL WELL DEPTH (feet)	TYPE	RECORD	REMARKS
WR-2-66	1966	48	Surficial	Manual	Well Screened 44-47 feet
WR-12-66	1966	35	Surficial	Manual	Well Screened 32-35 feet
WR-15-66	1966	54	Surficial	Manual	Well Screened 41.5-44.5 feet
WR-102-71	1971	90	Surficial	Manual	Well Screened 55-65 feet
WR-117-75	1975	157	Bedrock	Manual	----
WR-118-75	1975	155	Bedrock	Manual	----
WR-119-75	1975	255	Bedrock	Recorder	----
WR-120-75	1975	547	Bedrock	Manual	----
WR-122-76	1976	55	Surficial	Recorder	Slotted Casing 15-44.5 feet
WR-123-76	1976	54	Surficial	Manual	Slotted Casing 12-41 feet
WR-124-76	1976	107	Surficial	Manual	Slotted Casing 65-81.5 feet
WR-125-77	1977	135	Bedrock	Recorder	----
72-1	1975	500	Bedrock	Recorder	----
72-2	1975	530	Bedrock	Recorder	----
72-3	1975	530	Bedrock	Recorder	----

respond to local rainfall events they have not shown any annual fluctuations to date due to precipitation. These water levels on the other hand may be more directly influenced by the level of Elk Lake.

Bedrock Wells

Wells intersecting fractured zones within the bedrock tend to respond rather quickly to precipitation in most instances. Bedrock wells generally attain their lowest water levels in the period August to November following the relatively "dry" summer months of little rainfall. The wells then recover rapidly during winter precipitation, reaching their highest levels in the period January to April. This annual trend is best shown, for example, in hydrographs from wells 118-75, 119-75 and 72-3.

Recent Hydrograph Trends

The most significant trend shown as of the end of January 1977 has been the continuous decline of water levels in surficial wells since May 1976. Wells 12-66 and 15-66 have begun to respond to recharge as of the end of February 1977. Normally the surficial wells would begin to recharge in the period October to January. Lack of response to recharge this season can be attributed to the relatively low rainfall recorded during these months and the normal time lag for response of these wells. With any future rainfall this spring the water levels, for example, may not be expected to peak therefore until May or June of 1977. Although seasonally low, water levels in the surficial observation wells are not historically low. From the limited available records, present and past low water levels are compared in the following Table 2.

Table 2 Comparison of Present (February 1977) and Past Water Levels in Surficial Observation Wells

Well	Years of Records	Present Water Level Feet Below Ground	Water Level in February Prior to Historic Low	Historic Low Water Level Feet Below Ground
WR-2-66	10.2	36.4	34.4	38.5 (Dec. 1973)
WR-12-66	10.2	25.6	24.4	27.7 (Nov. 1975)
WR-15-66	10	32.3	32.0	34.4 (Dec. 1967)
WR-102-71	7	27.5	28.6	30.9 (Dec. 1973) (influenced by nearby pumping)

Dr. [redacted]. Foweraker March 7, 1977

In contrast to the surficial wells, bedrock observation wells have responded to the fall 1976 rains and have been undergoing recharge since October and November 1976, and in some cases (Wells 117-75, 118-75) since August 1976. Start of recharge in 1976, however, began later than that observed in 1975 (August) as precipitation after July 1975 was particularly heavy throughout the period August to December 1975 (32.4 inches). Water levels in the bedrock observation wells are therefore seasonally on the upswing. With any additional rainfall they should attain a seasonal high in April or May 1977. In contrast to the past seasonal low levels, present water levels in the bedrock observation wells are compared in the following Table 3.

Table 3 Comparison of Present (February 1977) and Past Recorded Water Levels in Bedrock Observation Wells

Well	Years of Records	Present Water Level Feet Below Ground	Water Level in February Prior to Historic Low	Historic Low Water Level Feet Below Ground
WR-117-75	1.5	5.3	no data	14.4 (Aug. 1975)
WR-118-75	1.5	~~4.8~~ 5.5 apr 14/4/77	no data	14 (Aug. 1975)
WR-119-75	1.5	1.6	no data	17.5 (Oct. 1975)
WR-120-75	1.5	20.9	18.9	21.9 (Nov. 1976)
72-1	2.2	0.1	above ground	21 (July 1975) (influenced by nearby pumping)
72-2	2.2	~~2.3~~ 3.2 apr 14/4/77	no data	10 (Nov. 1974)
72-3	2.2	0.5	no data	8 (Nov. 1974)

Of particular interest is the hydrograph of well 72-2 where the water level remained relatively high over the interval July to November 1976 in contrast to the previous year. This apparent recharge during the summer months of 1976 may have been due to decreased evaporation, lower water demand in the region and "carry-over" of storage contributed from the previous year's very high rainfall. One could also speculate that the higher water levels may have been due in part to artificial recharge which was carried out by Sidney Waterworks on a nearby well on Ardmore Avenue in 1976.

Dr. C. Foweraker, March 7, 1977

Summary

1. Shallow surficial observation wells on the Saanich Peninsula are seasonally low and have been declining steadily since May 1976. The wells have just begun to respond to seasonal fall and early winter rainfall which to date has been abnormally low. Water levels in these wells would not be expected to peak until three to four months after the major rainfall period provided rainfall in the next few months is near normal. Without additional rainfall, water levels could continue to decline. In comparison to previous years, the water levels are low for this time of year but they are still relatively high, about one to three feet above previously recorded lows.

2. Water levels in bedrock observation wells are on their seasonal upswing and bedrock aquifers have been generally recharging since October 1976. With any additional rainfall, water levels should continue to rise attaining their annual high in April or May 1977.

Recommendations

Of immediate concern is the declining water levels in shallow surficial wells. Should below average rainfall continue during the months of February through to May, continued decline of the water table might be expected. It is difficult to predict the future behaviour of the water table in shallow wells at this time because of the known time lag for response of these wells to precipitation. Water levels, for example, may yet rise in response to the limited rainfall which occurred during the past fall and early winter.

At present it is too early to assess the possible effects of the present trend of the water levels in shallow surficial wells. However, if below average precipitation continues, precautions should be taken to conserve water from shallow surficial aquifers. A month-end review of rainfall data and hydrograph records of the surficial wells should be carried out until early summer to keep up-to-date on the situation.

With regards to bedrock wells, there is no immediate concern with regards to low water levels. Wells producing from bedrock aquifers, therefore, are not expected to behave much differently than in past years. Hydrograph records from bedrock observation wells should, however, be updated on a monthly basis until early summer.

Due to the importance of Elk Lake to the water supply of the Saanich Peninsula, an automatic water level recording gauge should be installed in the lake to monitor water level fluctuations. In view of the possible hydraulic connection

.../6

Dr. [illegible]C. Foweraker March 7, 1977

between the lake and the Cordova Bay aquifer, this information could be invaluable in understanding water level response in the aquifer and possible seepage losses from the lake. Similarly a recording gauge should be installed in the Brentwood quarry to monitor water level fluctuations. Metering of consumption from all municipal production wells and springs should be carried out and provision should be made on all well installations for obtaining monthly water level readings.

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APK/bmg


DEEP COVE
PATRICIA BAY
COLES BAY
INDIAN RESERVE
TSEHUM HARBOUR
ROBERTS BAY
SIDNEY
VICTORIA INTERNATIONAL AIRPORT
BAZAN BAY
SAANICHTON BAY
EAST SAANICH INDIAN RESERVE
SOUTH SAANICH INDIAN RESERVE
BRENTWOOD BAY
SAANICH INLET
HIGHLAND DISTRICT
LAKE DISTRICT
ELK LAKE
PROSPECT LAKE
CORDOVA BAY

FIGURE 1

HYDROGRAPHS SHOWING WATER LEVEL FLUCTUATIONS

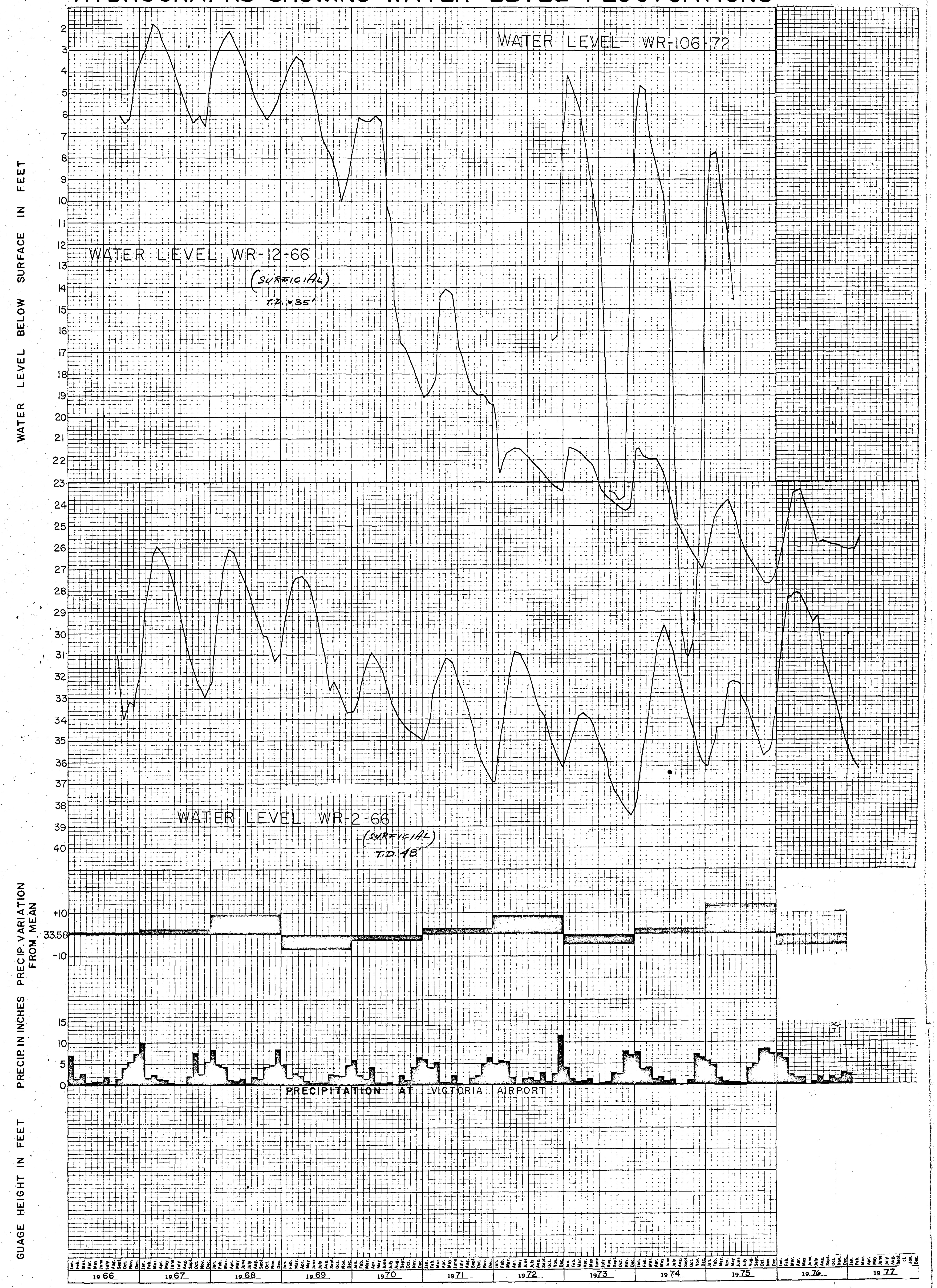


FIGURE 2

HYDROGRAPHS SHOWING WATER LEVEL FLUCTUATIONS

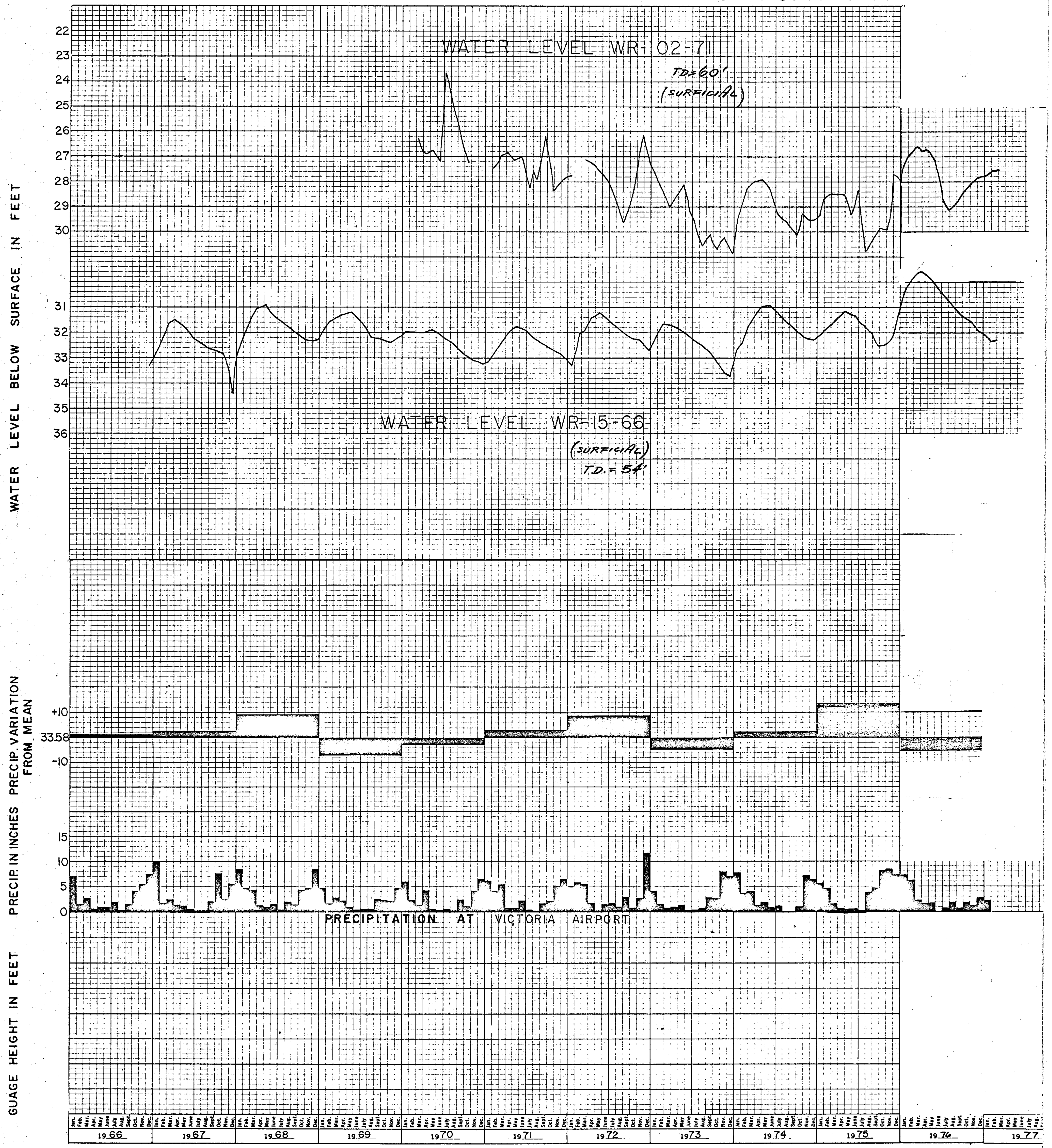


FIGURE 3

HYDROGRAPHS SHOWING WATER LEVEL FLUCTUATIONS

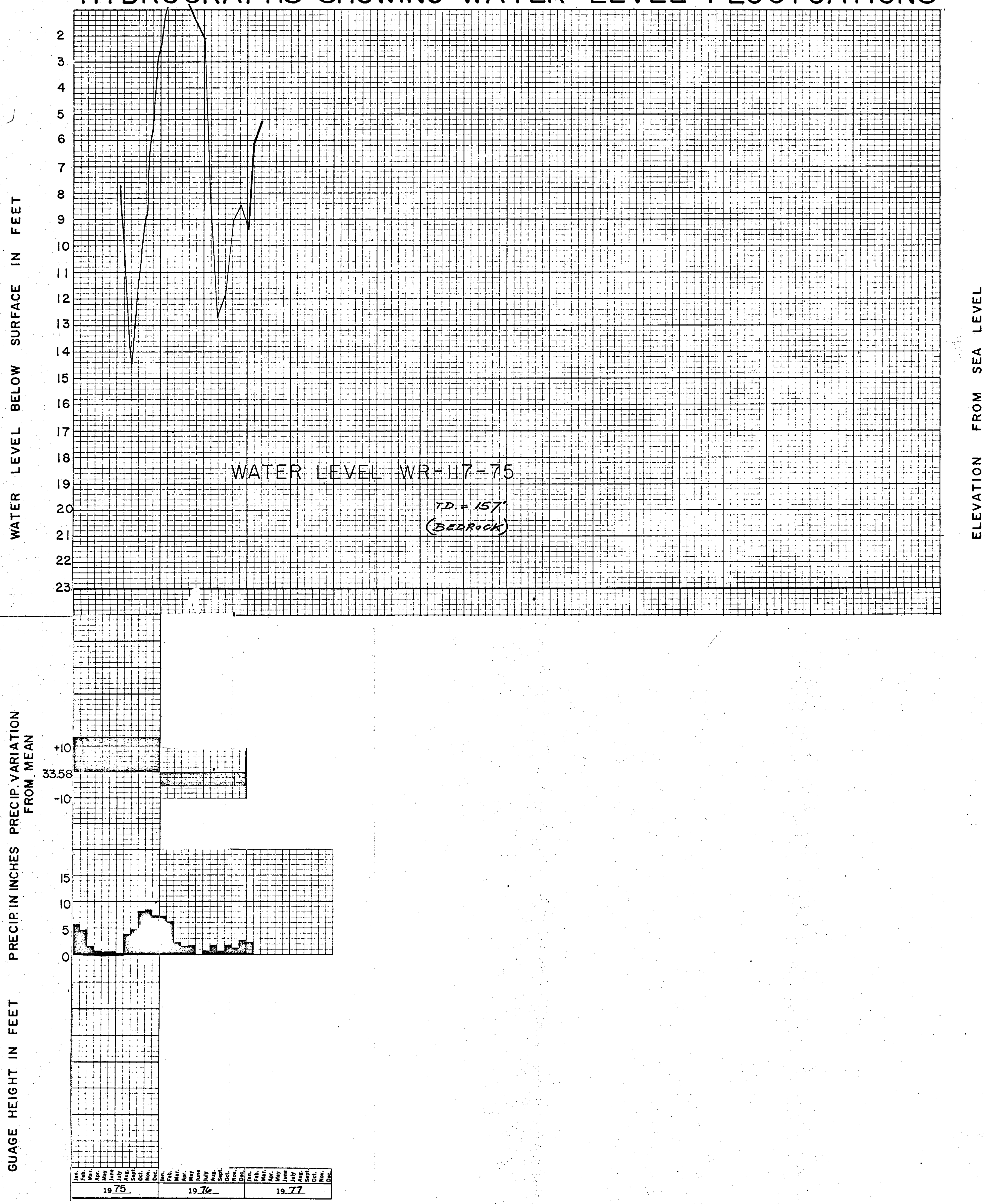


FIGURE 4

HYDROGRAPHS SHOWING WATER LEVEL FLUCTUATIONS

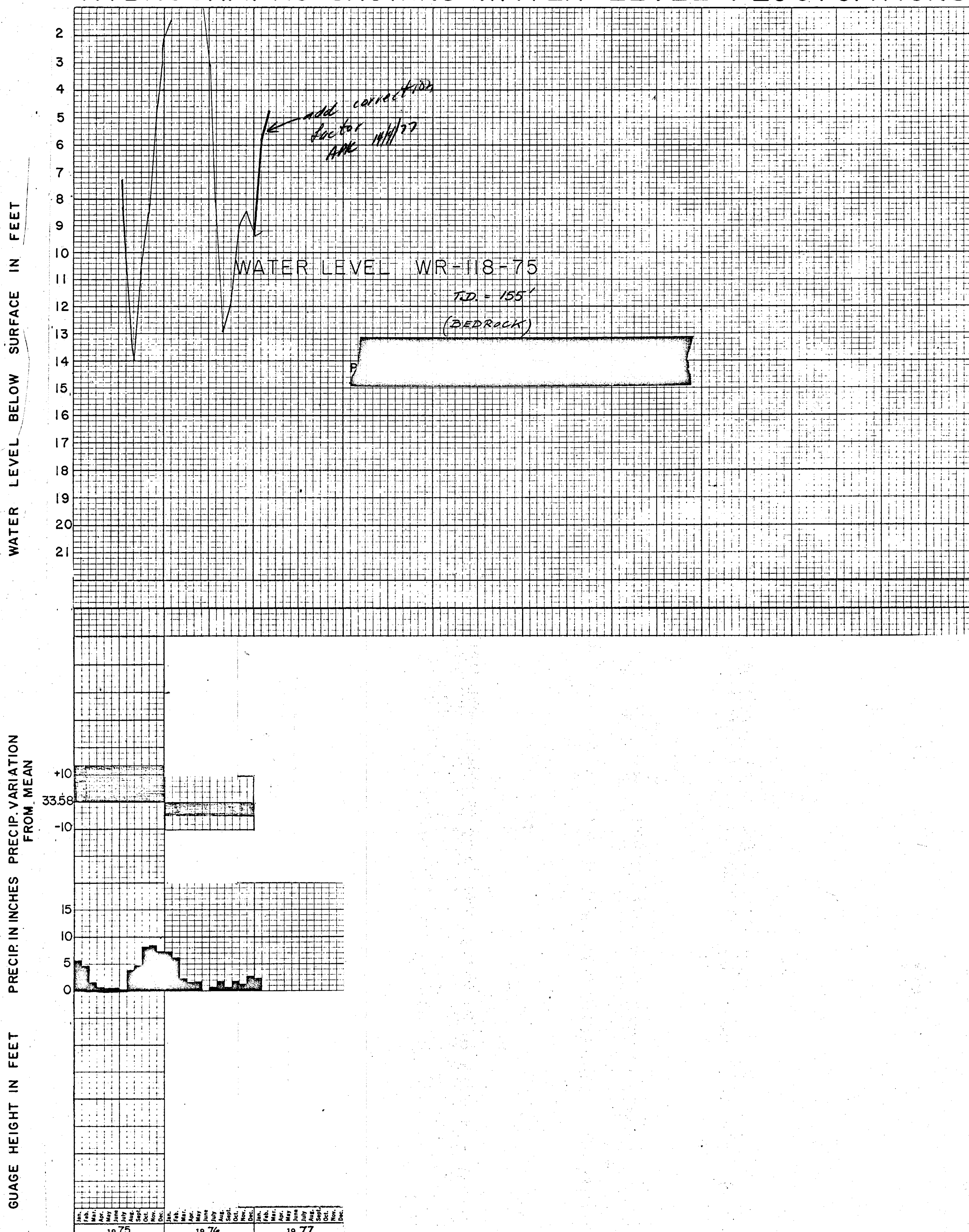


FIGURE 5

92 - B - 11

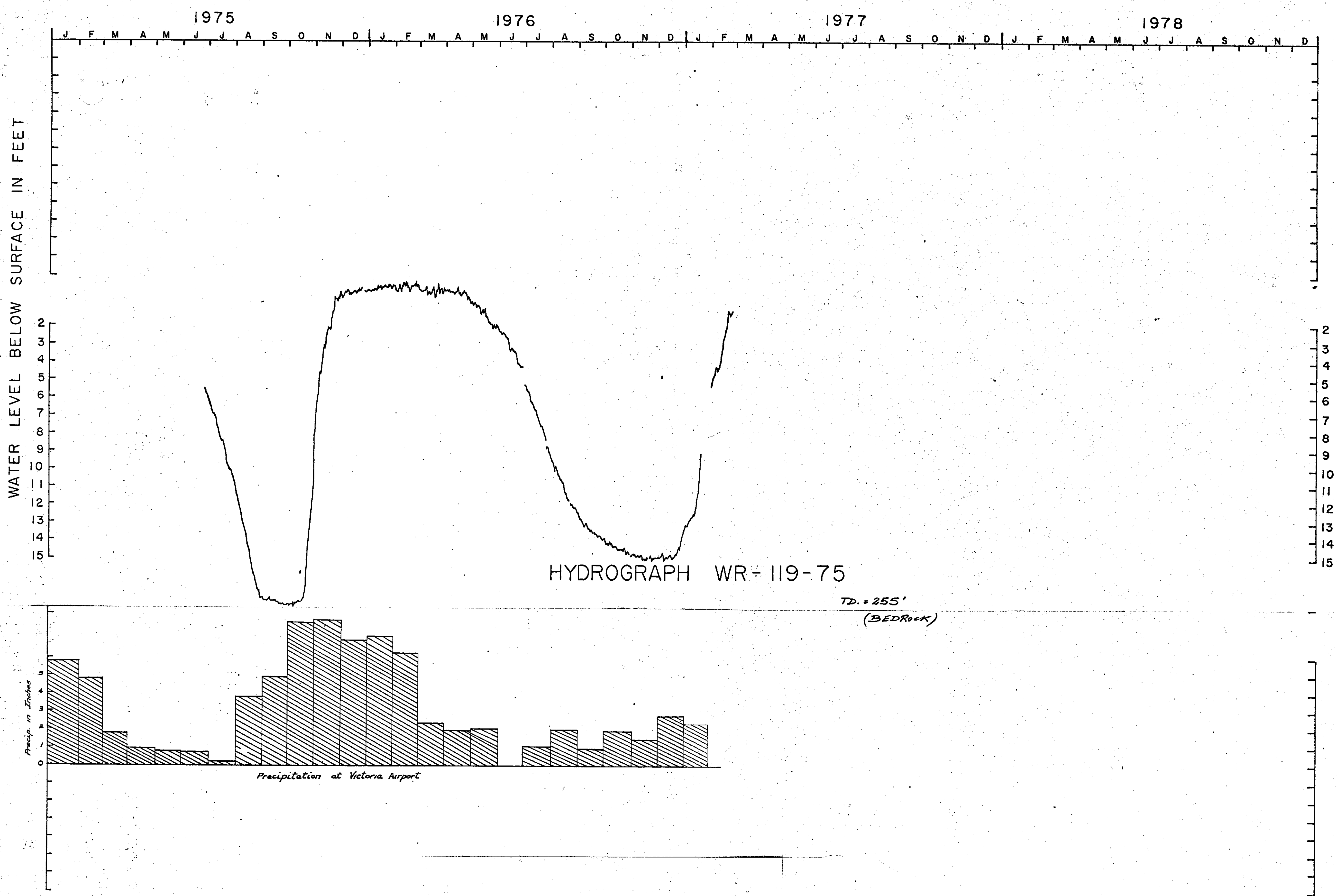

1975
1976
1977
1978
J F M A M J J A S O N D
WATER LEVEL BELOW SURFACE IN FEET
2 3 4 5 6 7 8 9 10 11 12 13 14 15
HYDROGRAPH WR-119-75
TD. = 255'
(BEDROCK)
Precip. in Inches
0 1 2 3 4 5
Precipitation at Victoria Airport

FIGURE 6

HYDROGRAPHS SHOWING WATER LEVEL FLUCTUATIONS

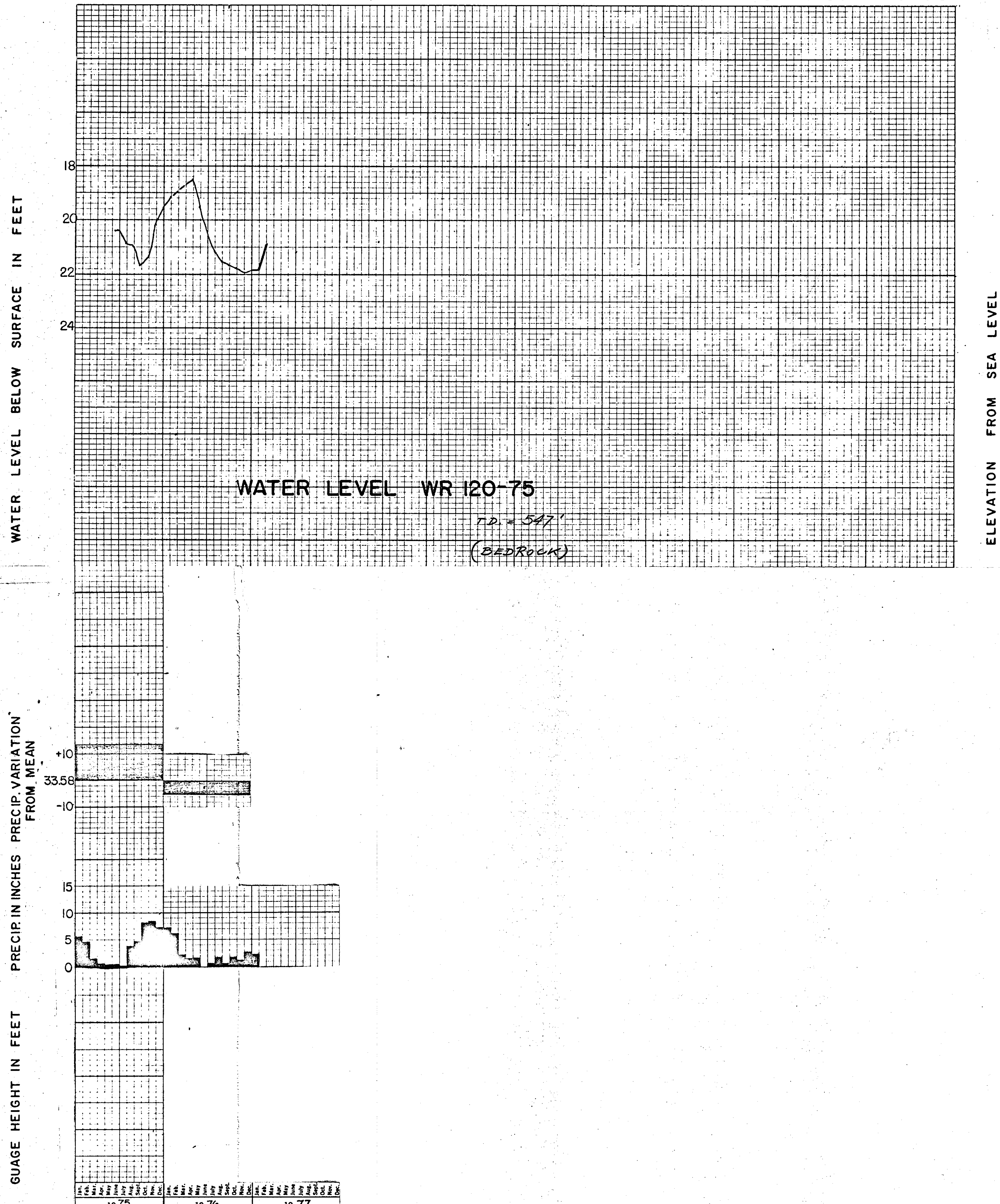
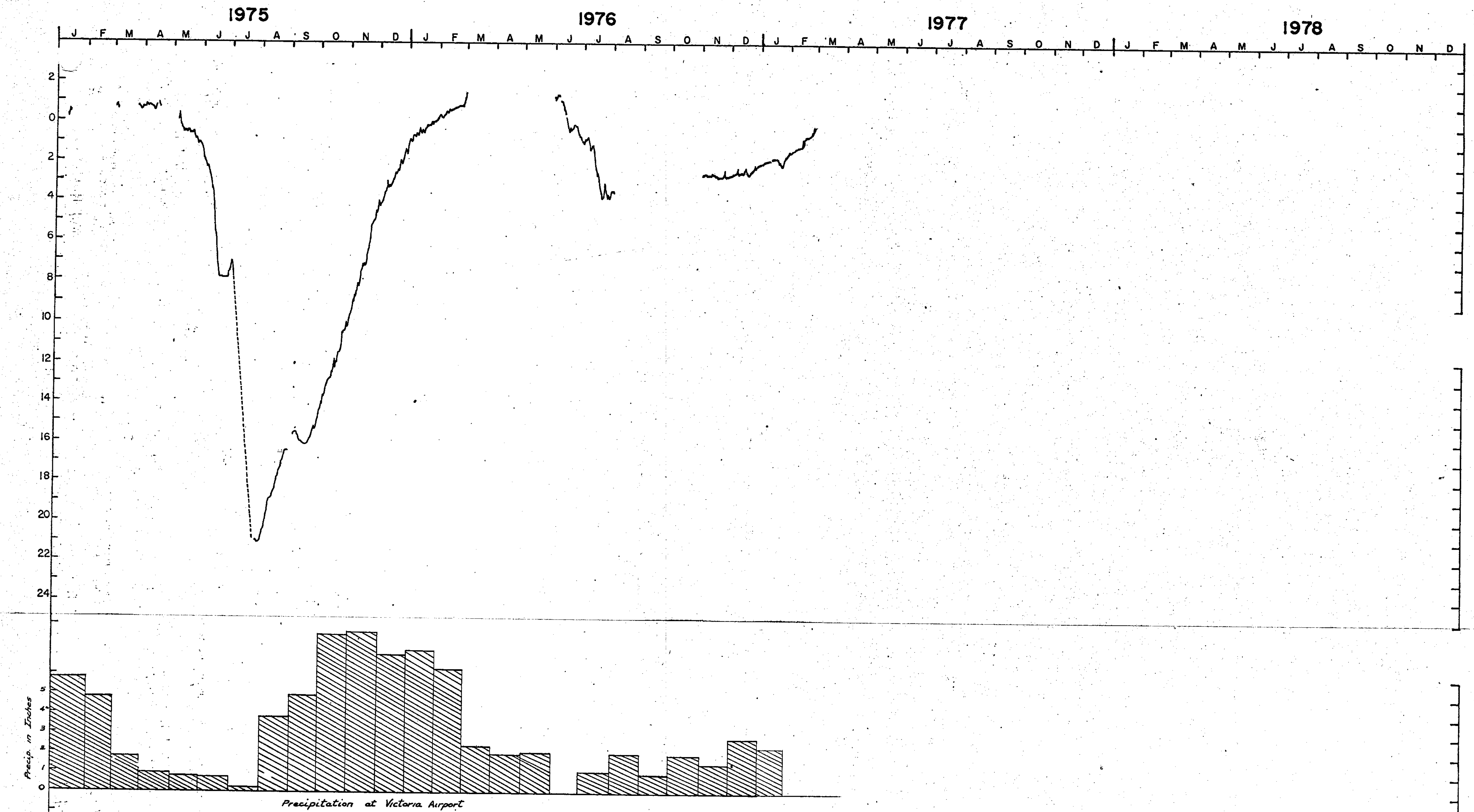


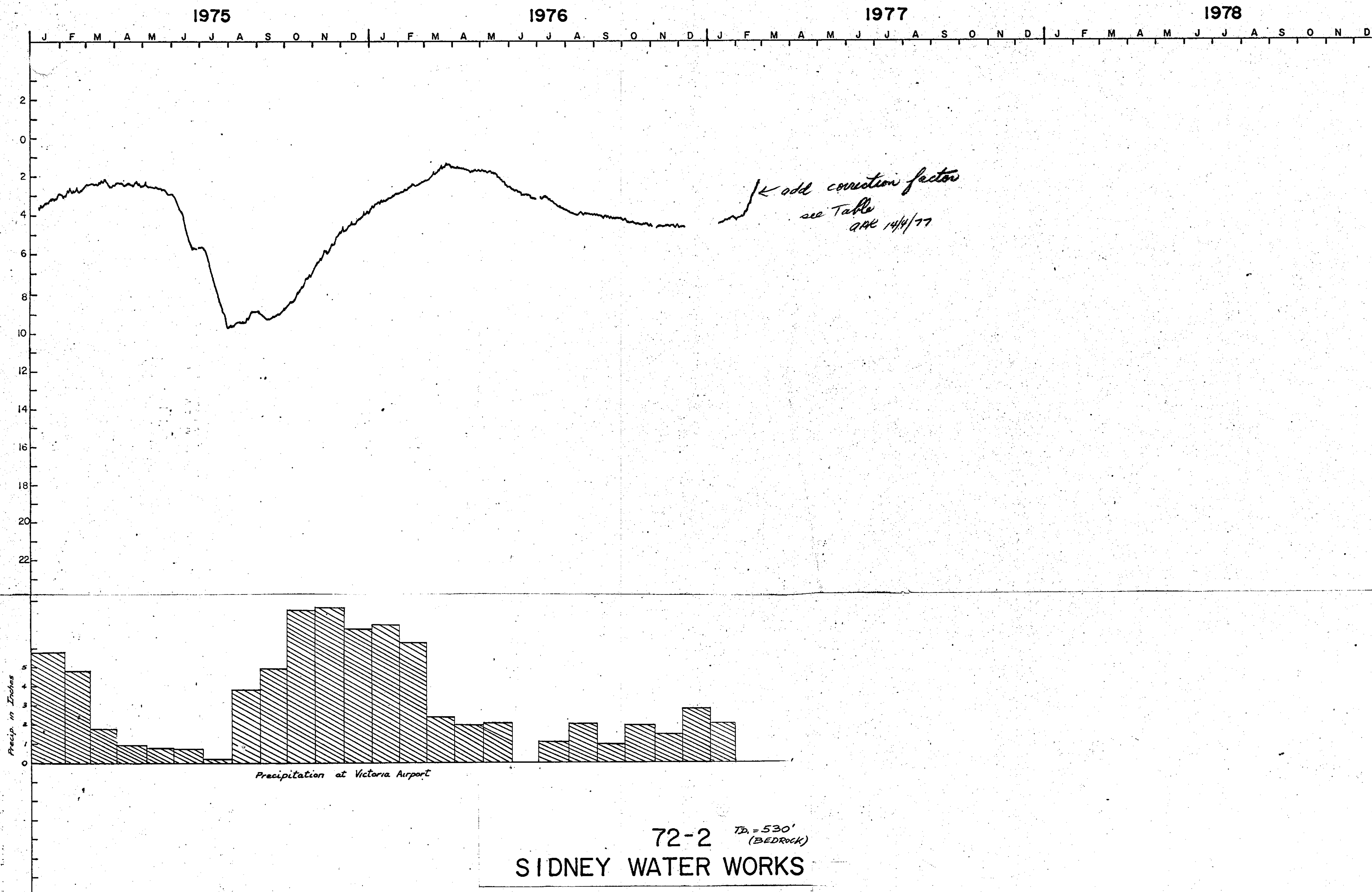
FIGURE 7



72-1 T.D. = 500' (BEDROCK)

SIDNEY WATER WORKS

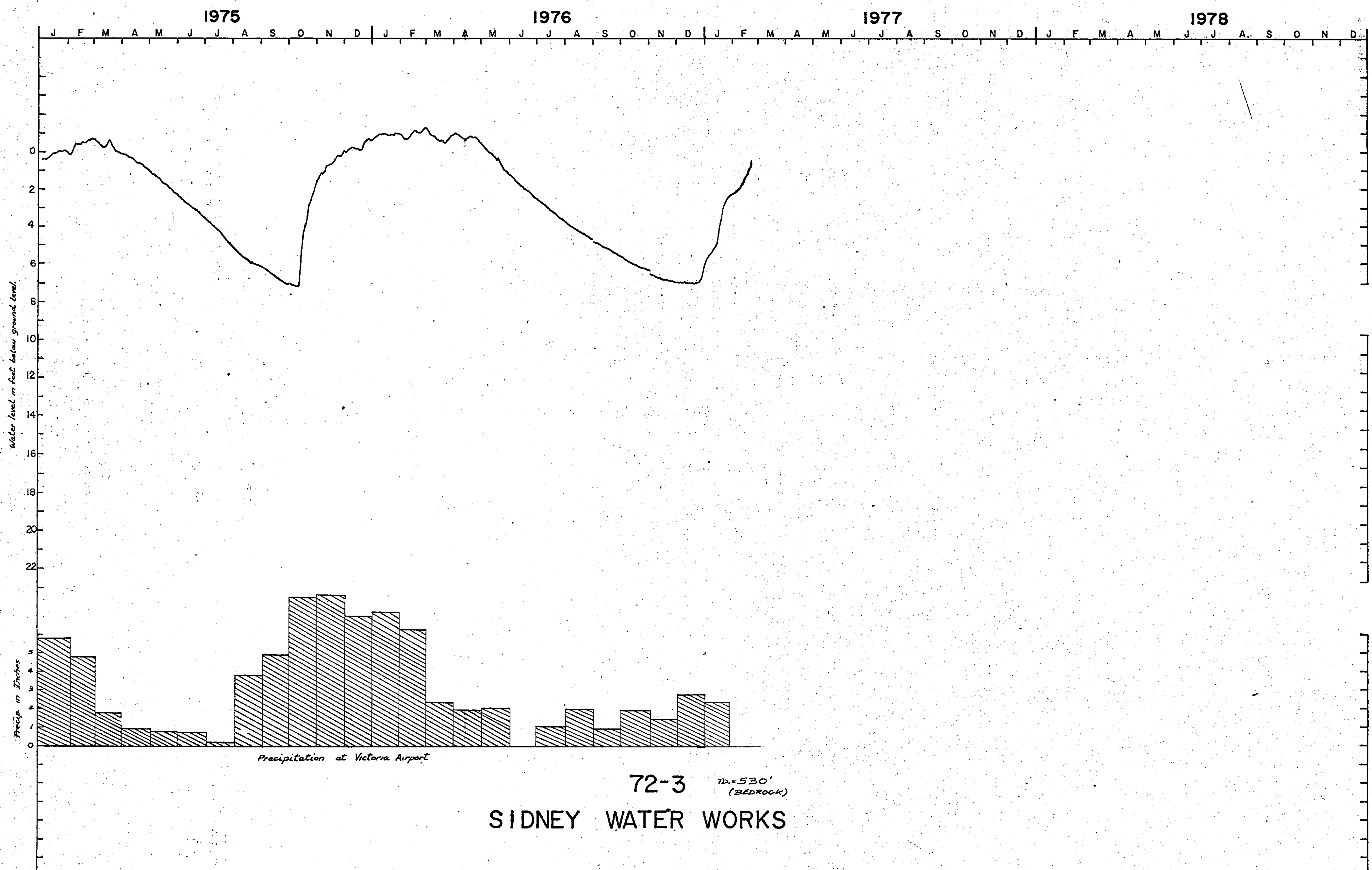
FIGURE 8



72-2 T.D. = 530' (BEDROCK)

SIDNEY WATER WORKS

FIGURE 9



72-3

SIDNEY WATER WORKS

FIGURE 10

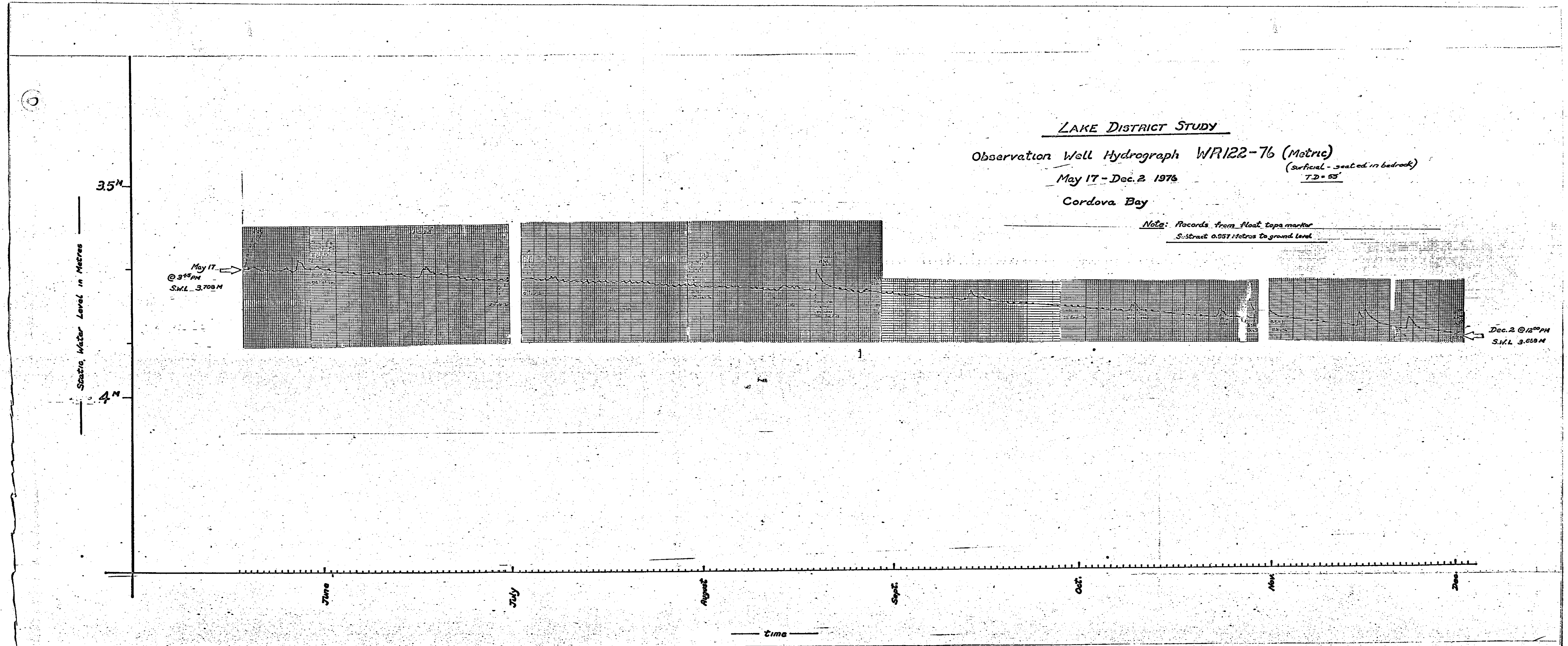
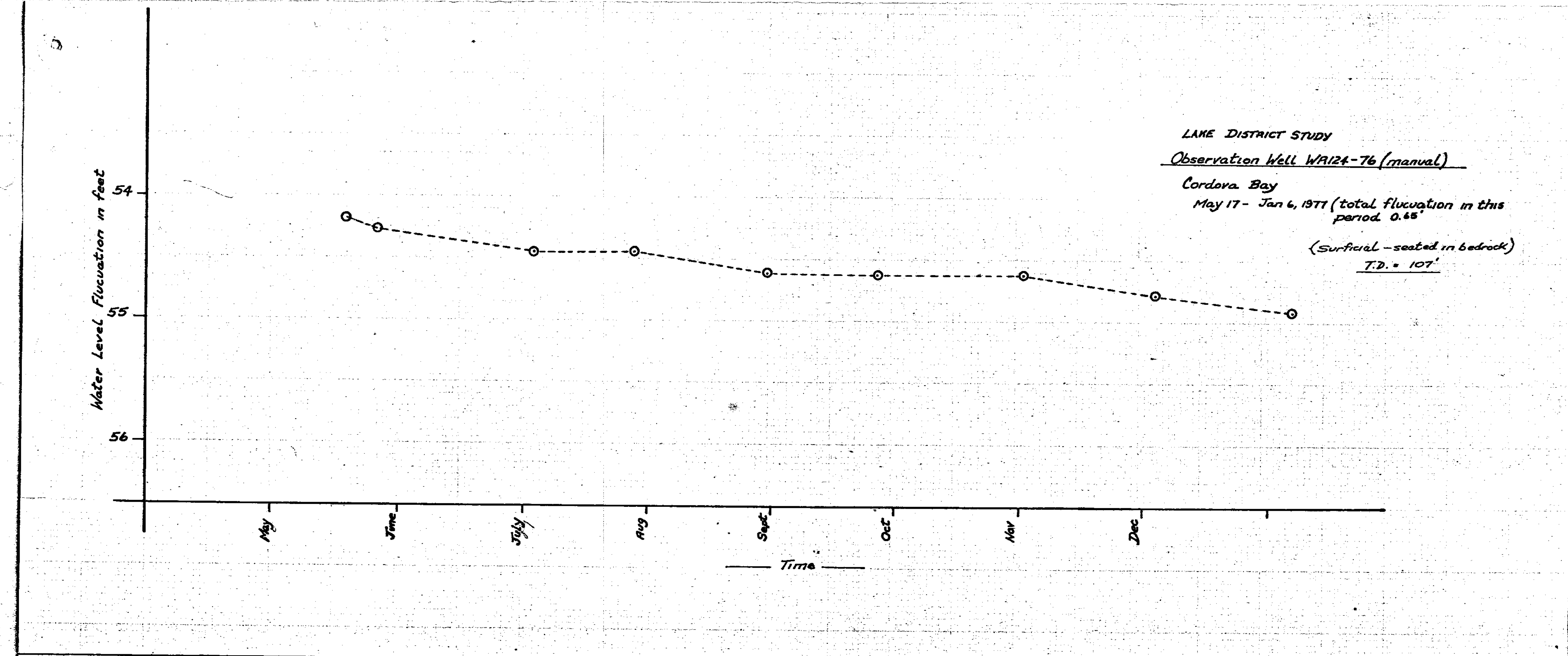

LAKE DISTRICT STUDY
Observation Well Hydrograph WR122-76 (Metric)
(surficial - seated in bedrock)
T.D = 55'
May 17 - Dec. 2 1976
Cordova Bay
Note: Records from float tape marker
Subtract 0.957 Metres to ground level
3.5M
4M
Static Water Level in Metres
May 17 @ 3⁴⁵PM S.W.L 3.708 M
Dec. 2 @ 12⁰⁰PM S.W.L 3.858 M
June
July
August
Sept.
Oct.
Nov.
Dec.
time

FIGURE 11


LAKE DISTRICT STUDY
Observation Well WA124-76 (manual)
Cordova Bay
May 17 - Jan 6, 1977 (total flucuation in this period 0.65')
(surficial - seated in bedrock)
T.D. = 107'
Water Level Flucuation in feet
54
55
56
May
June
July
Aug
Sept
Oct
Nov
Dec
Time

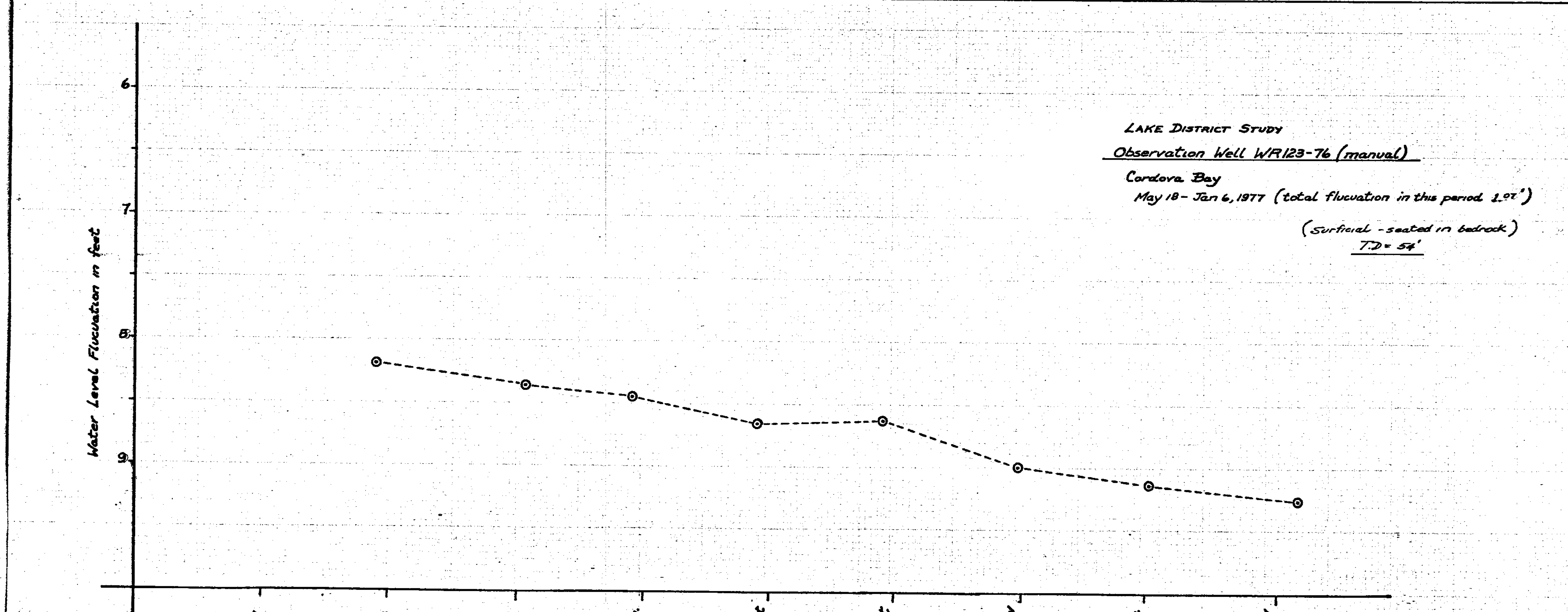

LAKE DISTRICT STUDY
Observation Well WR123-76 (manual)
Cordova Bay
May 18 - Jan 6, 1977 (total flucuation in this period 1.07')
(surficial - seated in bedrock)
T.D = 54'
Water Level Flucuation in feet
6
7
8
9
May
June
July
Aug.
Sept
Oct
Nov
Dec
Jan
Time

FIGURE 12