EVALUATION OF TARBELA'S WATER CONTRIBUTION DURING RABI CROP SEASON, 1976 AND 1977

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SUMMARY AND CONCLUSION

1. The Tarbela Dam Multipurpose Project is the final element of the Indus Basin Settlement Plan under-taken pursuant to the 1960 Indus Water Treaty between India and Pakistan. Located on river Indus about 50 miles north-west of the Federal Capital, the project was conceived primarily to augment irrigation water supply during the dry winter season. Electric generation capability is a byproduct. The Project commands 13 million acres of cultivable land and will ultimately have an installed electric generation capacity of 2,100 megawatts (MW).

2. The Indus rises in Tibet and flows for about 1900 miles into the Arabian Sea. On its way to the sea, the river is swelled by contributions from tributaries, mainly the Kabul river which joins the Indus at Attock. A series of barrages downstream divert the river into canals. The irrigation system is dependent essentially on the run-of the river. The discharge rises during the summer (Kharif crop period: April to September) and declines sharply in the winter (Rabi crop season: October to March). Tarbela has not materially altered run-of-river-dependency of the System, although live capacity of 9.3 million acre feet (MAF) of its reservoir does provide a firm security against repetition of drought conditions as experienced in 1965-66. Poor winter inflows, however, are not rare in the Indus System and so it seems doubtful that Tarbela will bring about any dramatic change in the total water availability at the farm-gate.

3. Water from the Tarbela reservoir started flowing to the fields during the Rabi crop season of 1976. During Rabi 1976 and 1977, Tarbela released 1.59 and 7.56 MAF of water, respectively. It is difficult to quantify precisely the change in canal withdrawals attributable exclusively to Tarbela waters. However, simple computations based on a hypothetical view of Indus Basin without Tarbela show that Tarbela storage releases facilitated additional canal withdrawals of about one MAF in 1976 and about 2.3 MAF in 1977. Considering the significant canal and water course losses in the Indus Basin Irrigation System, the actual delivery at the farmgate would be still modest.

4. Tarbela's power contribution is more impressive than its performance on the water side. The present installed capacity of Tarbela power turbines is 700 MW. The Government of Pakistan plans to install another five turbines by 1982, raising the name-plate capacity to 1750 MW. Effective summer and winter capability of Tarbela then, would be about 42 and 27 percent, respectively, of the corresponding total figures for the entire country. More important, while the capacity of Tarbela reservoir will be lost almost completely in about 50 to 60 years because of sedimentation, the power generation capacity will remain practically unimpaired.

I. INDUS BASIN IRRIGATION SYSTEM

The Indus River together with its six main tributaries -- Ravi, Beas, Sutlej, Chenab, Jhelum and Kabul -- constitute the vast Indus Basin Irrigation System commanding about 33.5 million acres of cultivable land. The System consists of about 38,000 miles of irrigation channels and a series of barrages and headwork that divert river flow into canals. The rivers are interconnected through link canals, eight of which have been constructed pursuant to the September 1960 Indus Water Treaty between India and Pakistan. The Treaty authorized Pakistan (lower riparian) unrestricted use of the average aggregate annual flow of 142 million acre feet (MAF) of the Indus, Jhelum and Chenab. The three Eastern rivers - Ravi, Beas and Sutlej - with a total mean annual flow of 33 MAF were allocated to India (upper riparian). However, since 66 percent of the irrigated area served by the Eastern rivers was located in Pakistan, the Treaty provided for a Settlement Plan aimed at transferring water from the Western rivers to meet the irrigation requirements of the Eastern areas of Pakistan. The Plan envisaged construction of two storage dams(1), eight inter-river link canals(2), five barrages(3), and one Gate Syphon(4). In addition, the plan also provided for the re-modelling of three existing canals(5), two headworks(6) and some existing canal systems(7) dependent on the Eastern rivers. All the Settlement work, except Tarbela Dam has been completed. Were

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(1) Mangla on the Jhelum and Tarbela on the Indus.

(2) Trimmu-Sidhnai, Sidhnai-Mailsi, Mailsi-Bahawal, Rasul-Qadirabad, Qadirabad-Balloki, Balloki-Suleimanki, Chashma-Jhelum, Taunsa-Panjnad.

(3) Sidhnai on Ravi, Qadirabad on Chenab, Rasul on Jhelum, Marala on Chenab, Chashma on Indus.

(4) Mailsi on Sutlej.

(5) Balloki-Suleimanki, Marala-Ravi, BRB.

(6) Balloki and Trimmu.

(7) Dipalpur, Fordwah, Pakpattan, Mailsi, Bahawal etc.

it not for the damage caused to the tunnels during the initial filling in 1974, the Dam would have been complete by now. A summary view of the Indus Basin Irrigation System is shown in the attached schematic diagram.

Tarbela Dam

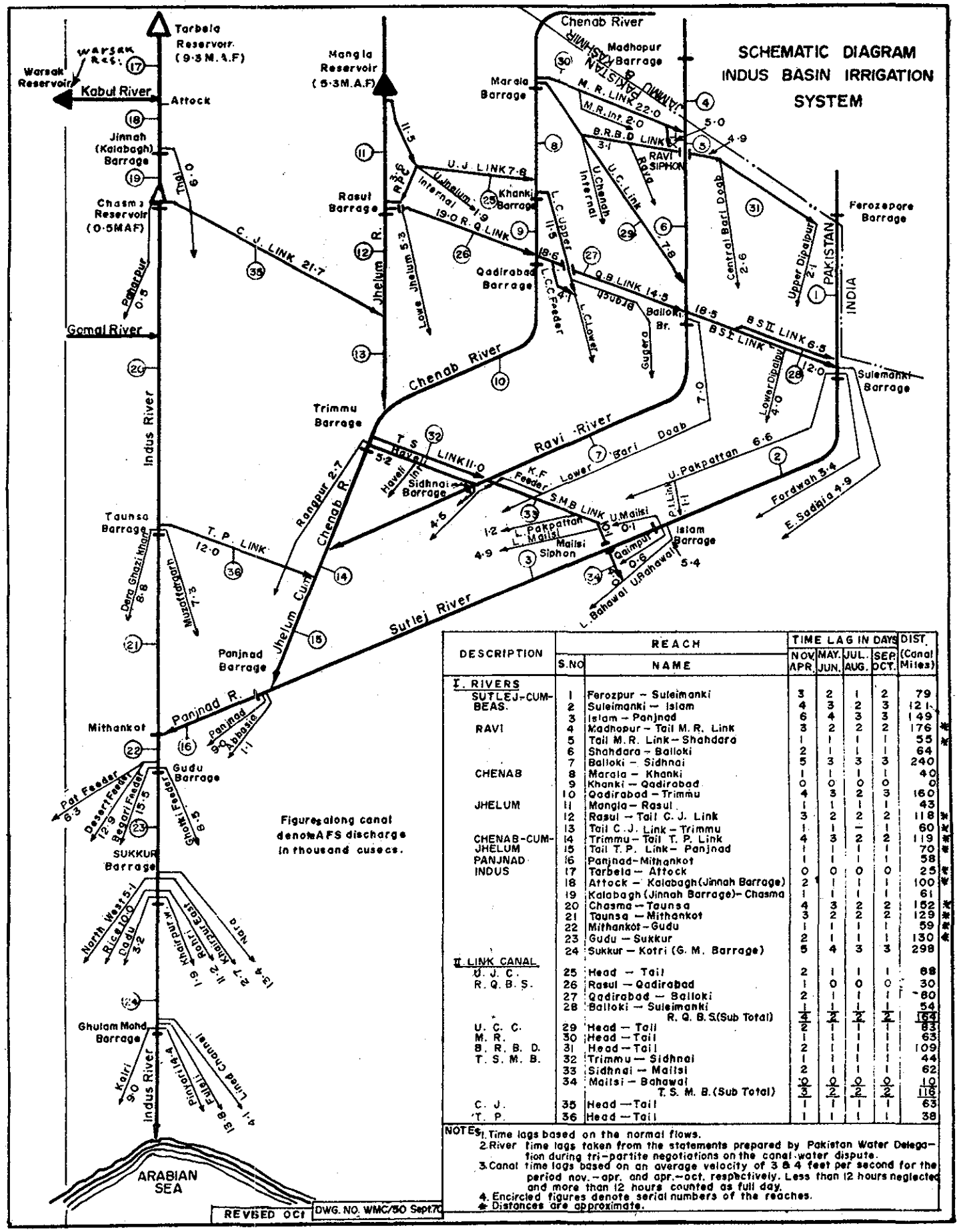
Tarbela Dam is a multipurpose project located about 50 miles north-west of the Federal capital on the river Indus. The Project includes a main embankment dam, two auxilliary dams, four irrigation and power tunnels on the right and a fifth on the left bank. The gross storage capacity of Tarbela reservoir is 11.1 MAF, including a dead storage of 1.8 MAF. A total of 23 canals covering a cultivable area of about 13 million acre, are under Tarbela's direct or indirect command. The project will ultimately have an installed electric generation capacity of 2,100 MW.

II. RIVER FLOWS

The annual river inflow at Tarbela is about 63 MAF (1968-74). The discharge rises to 55 MAF in summer and recedes to about 8 MAF in winter. This wide fluctuation in the river flow results in considerable wastage of water flowing into the Arabian Sea and occasional floods during the Kharif crop period and serious water shortages during the Rabi. Because scarcity rather than abundance of water is a major problem for Pakistan's agriculture, the effectiveness of Tarbela will depend primarily on the extent to which it can supplement water supplies during the dry season.

Indus at Kalabagh

A simple measure of Tarbela's effectiveness is the probability of Indus flow below a certain minimum average historical limit at the Kalabagh rim-station. Kalabagh has been selected as the standard



DESCRIPTION	S.NO	REACH NAME	TIME LAG IN DAYS NOV. APR.	MAY. JUN.	JUL. AUG.	SEP. OCT.	DIST. (Canal Miles)
I. RIVERS							
SUTLEJ-CUM-BEAS.	1	Ferozpur – Suleimanki	3	2	1	2	79
	2	Suleimanki – Islam	4	3	2	3	121
	3	Islam – Panjnad	6	4	3	3	149
RAVI	4	Madhopur – Tail M. R. Link	3	2	2	2	176 **
	5	Tail M.R. Link – Shahdara	1		1		55 **
	6	Shahdara – Balloki	2	1	1	1	64
	7	Balloki – Sidhnai	5	3	3	3	240
CHENAB	8	Marala – Khanki	1	1	1	1	40
	9	Khanki – Qadirabad	0	0	0	0	0
	10	Qadirabad – Trimmu	4	3	2	3	160
JHELUM	11	Mangla – Rasul	1	1	1	1	43
	12	Rasul – Tail C. J. Link	3	2	2	2	118 **
	13	Tail C.J. Link – Trimmu	1	1	–	1	60 ***
CHENAB-CUM-JHELUM	14	Trimmu – Tail T. P. Link	4	3	2	2	119 ***
	15	Tail T.P. Link – Panjnad	1	1	1	1	70 ***
PANJNAD	16	Panjnad – Mithankot	1	1	1	1	58
INDUS	17	Tarbela – Attock	0	0	0	0	25 ***
	18	Attock – Kalabagh (Jinnah Barrage)	2	1	1	1	100 ***
	19	Kalabagh (Jinnah Barrage) – Chasma	1	1	1	1	61
	20	Chasma – Taunsa	4	3	2	2	152 **
	21	Taunsa – Mithankot	3	2	2	2	129 **
	22	Mithankot – Gudu	1	1	1	1	59 **
	23	Gudu – Sukkur	2	1	1	1	130 **
	24	Sukkur – Kotri (G. M. Barrage)	5	4	3	3	298
II. LINK CANAL							
U. J. C.	25	Head – Tail	2	1	1	1	88
R. Q. B. S.	26	Rasul – Qadirabad	1	0	0	0	30
	27	Qadirabad – Balloki	2	1	1	1	80
	28	Balloki – Suleimanki	1	1	1	1	54
		R. Q. B. S. (Sub Total)	4	2	2	2	164
U. C. C.	29	Head – Tail	2	1	1	1	83
M. R.	30	Head – Tail	1	1	1	1	63
B. R. B. D.	31	Head – Tail	2	1	1	1	109
T. S. M. B.	32	Trimmu – Sidhnai	1	1	1	1	44
	33	Sidhnai – Mailsi	2	1	1	1	62
	34	Mailsi – Bahawal	0	0	0	0	10
		T. S. M. B. (Sub Total)	3	2	2	2	116
C. J.	35	Head – Tail	1	1	1	1	63
T. P.	36	Head – Tail	1	1	1	1	38

NOTES
1. Time lags based on the normal flows.
2. River time lags taken from the statements prepared by Pakistan Water Delegation during tri-partite negotiations on the canal-water dispute.
3. Canal time lags based on an average velocity of 3 & 4 feet per second for the period nov. – apr. and apr. – oct. respectively. Less than 12 hours neglected and more than 12 hours counted as full day.
4. Encircled figures denote serial numbers of the reaches.
* Distances are approximate.

point for two reasons. First, between Tarbela and Kalabagh the Indus is swelled by flow from the reservoirs at Ghariala and Dhok Pathan and the Kabul river. Second, Kalabagh is the point from where canal withdrawals is the Indus zone (defined to exclude two small Indus river canals of Pehur and Lower Siran in NWFP) start. Table I records the Indus flow at Tarbela and Kalabagh from 1968-74, together with mean and standard deviation. Similar statistics are available for additions to the Indus between Tarbela below and Kalabagh above in Table II. The standard deviation has been added to or subtracted from the mean to arrive at "Upper" and "Lower" Average Levels. The tables show that the Rabi inflow at Kalabagh fell below the Lower Average Level in 1972, and was only marginally above in 1971. This was due to poor inflow at Tarbela and below average contributions from Ghariala, Dhok Pathan and the Kabul river. Tarbela's reservoir with a live storage of 9.3 MAF, now ensures inflow of at least the Lower Average Level (10 MAF during Rabi season) at Kalabagh. Even under the worst conditions, with only 6.0 MAF inflow at Tarbela and a minimal addition of ten per cent from tributaries, a release of only 3 MAF from Tarbela's storage would be required for an inflow of 10 MAF at Kalabagh. Thus Tarbela can prevent the severe drought conditions the country has occasionally experienced in the past. Operation of the Tarbela reservoir during 1976- and 1977 lends credence to this view.

III. OPERATION OF TARBELA RESERVOIR

The initial filling of the Tarbela reservoir began on July 1, 1974, but had to be stopped in the following month due to severe damage to the tunnels. Throughout the following Rabi (1975), needs for repairs dictated operation of the reservoir*. Active re-filling started in May 1975. During the Kharif crop season water storage was 10.3 MAF. A portion of this storage was released during the 1976 Rabi (Table III). With an inflow of 8.03 MAF at Tarbela, the flow at Kalabagh stood at 14.01 MAF. Although 4.39 MAF from tributaries was largely responsible for the high flow level at Kalabagh, Tarbela's share of 1.59 MAF was by no means insignificant. During the 1977 Rabi, a rich flow of 18.22 MAF at Kalabagh resulted primarily from the release of 7.56 MAF from Tarbela storage.

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*Since no water was available from Tarbela reservoir, Indus experienced a poor inflow of 8.97 MAF at Kalabagh - 7.10 MAF being the river flow at Tarbela and 1.87 MAF additions from Ghariala, Dhok Pathan and river Kabul.

TABLE I

FLOW OF THE INDUS RIVER (MAF)

PERIOD	TARBELA ABOVE			KALABAGH ABOVE		
	Rabi	Kharif	Total	Rabi	Kharif	Total
Pre-Tarbela						
1968	8.27	53.30	65.57	15.00	78.82	93.82
1969	8.74	60.54	69.28	14.43	74.48	88.91
1970	8.71	53.14	61.85	13.03	61.24	74.27
1971	7.71	51.22	58.93	10.17	62.38	72.55
1972	6.93	51.00	57.93	9.37	67.00	76.37
1973	8.13	73.90	82.03	12.59	95.27	107.86
1974	8.39	36.11	44.50	11.04	52.32	63.36
Post-Tarbela						
1975	7.10	46.69	53.79	8.97	58.88	67.85
1976	8.03	46.97	55.00	14.01	69.24	83.25
1968-74						
Mean	8.13	54.74	62.87	12.23	70.22	82.45
Standard Deviation	0.63	11.43	11.50	2.13	14.10	15.18
Upper Average Level	8.76	66.17	74.37	14.36	84.31	97.63
Lower Average Level	7.49	43.32	51.37	10.11	56.12	67.27

TABLE II

ADDITIONS TO RIVER INDUS FROM GHARIALA AND DHOK PATHAN RESERVOIRS AND RIVER KABUL

(MAF)

Period	Rabi	Kharif	Total
Pre-Tarbela			
1968	6.73	25.52	28.25
1969	5.69	13.94	19.63
1970	4.32	8.10	12.42
1971	2.46	11.16	13.62
1972	2.44	16.00	18.44
1973	4.46	21.37	25.83
1974	2.65	16.21	18.86
Post-Tarbela			
1975	1.87	12.19	14.06
1976	4.39	23.83	28.22
1968-74			
Mean	4.11	16.04	19.58
Standard Deviation	1.69	5.91	5.81
Upper Average Level	5.80	21.95	25.39
Lower Average Level	2.42	10.13	13.76

TABLE III

OPERATION OF TARBELA RESERVOIR

(MAF)

Period	Tarbela Above	Tarbela Below	Storage (-)/ Release(+)
1975			
Rabi	7.10	7.10	-
Kharif	46.69	36.39	(-)10.30
1976			
Rabi	8.03	9.62	(+) 1.59
Kharif	46.97	45.41	(-) 1.56
1977			
Rabi	7.78	15.34	(+) 7.56

IV. CANAL WITHDRAWALS

The Kalabagh inflow level, though a useful index of Tarbela's capability, does not accurately reflect Tarbela's full contribution to the aggregate water availability in the Indus Basin System. A reasonable yardstick for gauging Tarbela's water contribution is the change in the level of canal withdrawals before and after Tarbela operations began. A refined canal withdrawal approach would take into account not only the total river inflows and storage releases, but also the regulatory and diversionary roles of Tarbela and Mangla and various barrages downstream. The state of persently available information hardly permits such an extensive exercise. Therefore only a very rough estimate of additional water availability at canal heads has been made on the basis of canal withdrawal data for 1972-77.

Tarbela Water in the Indus Zone

Annexes A and B summarise canal withdrawals in the Indus and Jhelum-Chenab zones during 1972-77. Information recorded in the Annexes has been re-arranged in the form of simple Balance Sheets, appearing in Tables IV and V. Table IV shows that while water availability from pre-Tarbela sources increased by 2.87 MAF in 1976 and 2.67 MAF in 1977 over the average of 1972-75, canal withdrawals went up by 3.59 MAF and 4.18 MAF, respectively. The flow to Jhelum-Chenab zone and the Arabian Sea also increased, particularly during 1977. It is hypothesised that additional water availability from Tarbela increased not only the canal withdrawals but also the flow to the Jhelum-Chenab zone and the Arabian Sea. If Tarbela did not exist, it seems very likely that given the level of water availability from conventional sources during 1976 and 1977, release to the Chashma-Jhelum Link (C-J Link) at Head and flow to the Arabian Sea would have been marginally higher than the average for 1972-75. Assuming a supply of 0.4 MAF to the C-J Link, and allowing a higher escapage figure of 1 MAF, it appears that Tarbela's storage was responsible for additional canal withdrawals of about one MAF in 1976 and 1.8 MAF in 1977.

Tarbela Water in the Jhelum - Chenab Zone

But the Indus zone canals are not the only canals served by Tarbela. The Trimmu canals - Haveli Project (Rangpur, Haveli Internal and Sidhnai) and Lower Sutlej Valley (LSV) Canals (Lower Mailsi, Lower Bahawal and Pakpattan) - heretofore served by Mangla,

TABLE IV

INDUS ZONE : WATER BALANCE SHEET OF RABI CROP SEASON

(MAF)

AVAILABILITY				DISPOSAL			
Average 1972-75		1976	1977	Average 1972-75		1976	1977
10.50	Indus and Tributaries	12.42	10.66	14.86	Canal Withdrawals	18.45	19.04
0.34	Jhelum-Chenab Zone	1.99	1.66	0.39	Jhelum-Chenab Zone	0.54	2.15
4.52	System Gains	3.79	6.00	0.74	Arabian Sea	1.46	5.03
0.63	Chashma Storage	0.66	0.34				
-	Tarbela Release	1.59	7.56				
15.99	Total	20.45	26.22	15.99	Total	20.45	26.22

TABLE V

JHELUM-CHENAB ZONE : WATER BALANCE SHEET OF RABI CROP SEASON

(MAF)

AVAILABILITY				DISPOSAL			
1972-75 (Average)		1976	1977	1972-75 (Average)		1976	1977
9.33	River Inflows	13.55	10.58	13.20	Canal Withdrawals	16.50	16.31
0.39	Indus Zone	0.54	2.15	0.34	Indus Zone	1.99	1.66
0.38	System Gains	0.34	0.37				
3.44	Mangla Release	4.06	4.87				
13.54	Total	18.49	17.97	13.54	Total	18.49	17.97

TABLE VI

OPERATION OF CHASHMA-JEHLUM LINK DURING RABI CROP SEASON

(MAF)

	Pre-Tarbela				Post Tarbela	
	1972	1973	1974	1975	1976	1977
INFLOW						
Upstream	8.26	10.92	10.95	9.38	11.67	16.35
Release	0.81	0.64	0.34	0.72	0.66	0.34
OUTFLOW						
Peharpur Canal[a]	0.13	0.10	0.10	0.11	0.15	0.13
C-J Link[b]	0.40	0.44	0.35	0.36	0.54	2.15
Downstream[c]	8.54	11.02	10.84	9.63	11.64	14.41

a) From storage - cum - flow
b) Represents share of Punjab as per ad hoc Agreements regarding distribution of water amongst Provinces.
c) Storage-cum-flow share of Sind.

are now under Tarbela command. The Indus water is conveyed to these canals through the C-J Link, Trimmu-Sidhnai (TS) Link and Sidhnai-Mailsi (SM) Link. This arrangement seems necessary in view of progressive lessening of water availability from the Eastern rivers. The combined average inflow of the three Eastern rivers (Ravi, Chenab and Sutlej) declined from 6.75 MAF during 1962-70 to 5.35 MAF during 1971-77. Jhelum at Mangla also receded by 0.20 MAF during the same periods. The loss was, however, more than compensated for by releases from Mangla reservoir which averaged 3.90 MAF during 1971-77.

Table VI shows the operation of C-J Link Canal. During the pre-Tarbela period the release to the C-J Link at Head averaged 0.39 MAF. It increased to 0.54 MAF in 1976 and shot up to 2.15 MAF in 1977. Keeping in view the rich river inflow the Jhelum-Chenab zone experienced in 1976, and the fact that the supply of 0.54 MAF through the C-J Link was marginally above the usual Chashma releases during preceding years, it is almost certain that Tarbela had little impact on canal withdrawals in the Haveli and LSV during the Rabi crop season of 1976.

The situation for the 1977 Rabi was different. The Jhelum-Chenab zone received 2.15 MAF through the C-J Link. Withdrawals of the Haveli canals and LSV canals increased to 1.54 and 3.96 MAF respectively, compared with the corresponding averages of 1.51 and 1.98 MAF for 1972-75. The extent to which this increase can be attributed to Tarbela is difficult to specify. However, the Indus water above Trimmu formed only 32 percent of the total availability of 6.65 MAF. Even if a normal contribution of 0.5 MAF would have been available from the Indus instead of 2.15 MAF, it seems plausable that by judicious regulation of supplies from Mangla and reducing escapages from 1.66 MAF to the past level of 0.5 MAF, canal withdrawals of about 15.8 MAF would have been possible. The difference between actual canal withdrawals (16.31 MAF) and the hypothetical figure of 15.8 MAF, roughly measures the Tarbela's share in total canal withdrawals in Jhelum-Chenab zone.

ANNEXURE A

OPERATION OF INDUS ZONE CANAL SYSTEM DURING RABI SEASON

(MAF)

	PRE-TARBELA Actuals				Average	POST TARBELA Actuals	
	1972	1973	1974	1975	1972-75	1976	1977
A. INFLOW							
Tarbela Above	6.93	8.13	8.39	7.10	7.64	8.03	7.78
Release from Tarbela Storage	-	-	-	-	-	1.59	7.56
Ghariala & Dhok Pathan Reservoir and River Kabul[a]	2.44	4.46	2.65	1.87	2.86	4.39	2.88
Kalabagh Above	9.37	12.59	11.04	8.97	10.50	14.01	18.22
Release from Chashma Storage	0.81	0.64	0.34	0.72	0.63	0.66	0.34
Trimmu Below	0.07	0.39	0.21	0.09	0.19	0.97	1.23
Sidhnai Below	0.01	0.28	0.21	-	0.13	0.43	0.14
Islam Below	-	0.06	0.01	-	0.02	0.59	0.29
Total Inflow	10.25	13.96	11.81	9.78	11.47	16.66	20.22
B. SUPPLY TO JHEULUM-CHENAB ZONE							
C-J Link at Head	0.40	0.44	0.35	0.36	0.39	0.54	2.15
C. ESCAPAGES							
Kotri Below	-	0.10	2.84	-	0.74	1.46	5.03
D. NET UTILIZATION							
A - (B+C)	9.85	13.42	8.62	9.42	10.34	14.66	13.04
E. CANAL WITHDRAWALS							
Paharpur	0.13	0.10	0.10	0.11	0.11	0.15	0.13
Thal	1.30	1.50	1.48	1.26	1.39	1.70	1.87
Panjnad Canals[b]	0.53	1.02	1.32	0.73	0.90	1.55	2.23
Taunsa Canals[c]	0.42	0.54	1.12	1.07	0.79	1.47	2.77
Guddu Canals[d]	0.60	0.89	1.07	0.56	0.78	1.15	1.65
Sukker Canals[e]	8.99	9.72	10.21	8.31	9.31	10.24	9.94
Kotri Canals[f]	1.35	1.74	2.14	1.07	1.58	2.19	2.68
Total Withdrawals	13.32	15.51	17.44	13.11	14.86	18.45	19.04
F. SYSTEM'S GAIN							
E - D	3.47	2.09	8.82	3.69	4.52	3.79	6.00

(a) Computed as residual

(b) Panjnad
Abbassia

(c) D. G. Khan
Muzaffargarh

(d) Begari Feeder
Desert (Pat) Feeder
Ghotki Feeder

(e) Rohri
Khairpur East & West
Rice
Dadu
North-West
Eastern Nara

(f) Pinyari
Kalri-Baghar Feeder
Lined Channel
Fuleli

ANNEXURE B

OPERATION OF JHELUM-CHENAB ZONE CANAL SYSTEM DURING RABI CROP SEASON

(MAF)

	PRE-TARBELA					POST-TARBELA	
	Actuals				Average	Actuals	
	1972	1973	1974	1975	1972-75	1976	1977
A. INFLOW							
Jhelum at Mangla	3.34	7.16	4.31	3.56	4.59	5.09	4.03
Release from Mangla's Storage	3.08	3.16	5.00	2.53	3.44	4.06	4.87
Chenab Above Marala	3.02	4.72	3.43	3.87	3.76	5.12	3.74
Ravi component at Balloki	1.03	0.79	0.65	0.78	0.81	1.33	1.20
Sutlej component at Suleimanki	0.27	0.14	0.25	0.03	0.17	2.01	1.61
C-J Link at Head	0.40	0.44	0.35	0.36	0.39	0.54	2.15
Total Inflow	11.14	16.41	13.99	11.13	13.16	18.15	17.60
B. ESCAPAGES TO INDUS ZONE							
Trimmu Below	0.07	0.39	0.21	0.09	0.19	0.97	1.23
Sidhnai Below	0.01	0.28	0.21	-	0.13	0.43	0.14
Islam Below	-	0.06	0.01	-	0.02	0.59	0.29
Total Escapages	0.08	0.73	0.43	0.09	0.34	1.99	1.66
C. NET UTILIZATION							
A - B	11.06	15.68	13.56	11.04	12.82	16.16	15.94
D. CANAL WITHDRAWALS							
Five Links[a]	7.84	8.64	7.90	6.09	7.62	8.07	7.97
MR (Internal)	0.12	0.34	0.02	-	0.12	0.05	0.01
Haveli Project[b]	0.52	1.20	1.26	1.87	1.21	1.51	1.54
Central Bari Doab[c]	0.52	0.66	0.65	0.52	0.59	0.68	1.31
Sutlej Valley Canals[d]	2.38	3.54	2.97	1.93	2.71	4.21	2.17
Upper	2.38	3.54	2.97	1.93	2.71	4.21	2.17
Lower	0.47	1.32	1.24	0.77	0.95	1.98	3.96
Total Withdrawals	11.85	15.70	14.04	11.18	13.20	16.50	16.31
E. SYSTEM'S GAIN							
D - C	0.79	0.02	0.48	0.14	0.38	0.34	0.37

(a) Upper Jhelum Canal (Internal)
Lower Jhelum Canal
Upper Chenab Canal (Internal)
Lower Chenab Canal
Lower Bari Doab Canal

(b) Rangpur
Haveli
Sidhnai

(c) Pull Disty
Lahore Branch
Shalamar Disty
Tehra Disty
Guhava Disty
Khera Disty
Rai Minor
Karbot Minor
Bucherkhana Disty
Khalra Branch

(d) Dipalpur, Upper & Lower
Eastern Sadiqia
Fordwah
Mailsi, Upper and Lower
Qaimpur
Bahawal, Upper & Lower