Paper No. 235

INDUS RIVER SYSTEM AUTHORITY WATER RESOURCES MANAGEMENT DROUGHT MITIGATION STRATEGY

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EXISTING SITUATION

Pakistan has finite water resources estimated 141 million MAF per annum. Its population is rapidly increasing. Water availability per capita will be decrease in the future years. The situation is not happy even at present. The present water availability is 1233 M3 per capita, which is half of China, 1/4th of Asian average and 1/8th of world average availability.

1. Water availability is going to reduce to 1175 Meter cube per capita in 2010 and 190 Meter cube per capita in 2025. It means down the road, Pakistan will soon be leading the water short countries of the world.

Table I, gives the water scarcity indicators &
Table II, the implications of water shortages.

It indicates that we will once again be exposed to food shortages and bitter internal disputes.

Thus the dire need to better manage the water resources of Pakistan.

Pakistan is standing still for the last 27 years and development of the water resources has become a victim of politics and provincial dispute. This is a technical issue and need be viewed in the same perspective for survival in this world as an independent nation.

The only silver lining in this dismal situation is that on the average 36.47 MAF is going below Kotri (Post Tarbela period). If we can manage this water, we can improve the water availability in the country.

There has been a wake up call from nature in the form of two years continuous drought in 2000-02. The country is still reeling from effect of the drought.

WATER RESOURCES MANAGEMENT STRATEGY

There are studies going on and two of these have been completed:-

1. 'Pakistan Water Resources Strategy Study' done by Halcrow group Consultants etc. under Asian Development Bank with Ministry of Water & Power, Islamabad.

Draft final report has been issued.

The cost of works proposed under water strategy is worth US Dollar 33622.00 Million in water sector.

The study concentrates on water resource development, urban and rural water supply and sanitation, industrial water supply, Irrigation & Drainage, Hydropower, environment and flood protection. Its cost summary is at table-III.

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* Former Chairman IRSA Punjab

The study is comprehensive. It diligently profiles the water resources and connected by-laws in the country. It sets ranking criteria under the water sector for implementation and proposes some legal non-structural measures for implementation of strategy study.

It is silent on drought mitigation strategy.

2. Another study is going on under national drainage programme. The consultants are busy to finalize the study but no report has been received so far.

3. Water Resources & Hydropower development vision 2025 has been brought out by Wapda.

It identifies various schemes and studies worth 746.00 Billion (12.42 Million Dollars).

It is silent about drought mitigation in Pakistan.

Any master plan in Water Resources Management must have long term measures for drought mitigation as an assurance against famines and food shortages.

DROUGHTS

Droughts in Pakistan have not been uncommon. This part of the world has experience of severe famines.

In fifties, food grain storages were built to counter food shortages. Famines were taken care of in time. In the latest scenario rivers discharges reduce to all time low, dwindling water supply, increasing population once again pose threat of famine. The droughts are predictable to some extent. Therefore we need to change our strategy from storing food to storing water.

The duration of drought had been identified by the scientists (El-Nina & La Nina phenomena) from 6 to 8 years. Our holy book tells us a drought of 7 years duration in Egypt. It would be all time safe to provide storage for 7 years drought but there would be financial and geographical constraints;

Egypt climate is predominantly desert climate being entirely within Sahara. It is one of the hottest and sunniest countries in the world. Only 3% of the country consists of Nile valley and delta. The Nile valley and delta is intensively cultivated by irrigation and contain about 95% of Egypt's population.

In contrast, Pakistan has a monsoon climate. It receives 70% of rain fall during three months of July, August & September. Its rivers are fed by monsoon rains like Jhelum & Chenab.

Only Indus receives 10% of its supply from monsoon and balance is from ice melt and glaciers. River Kabul is mostly feed by snow melt.

Last 80 years flow data of the rivers reveals that for Indus, 74-75, 82-83, 2000-02 and for Jhelum at Mangla 1946-47, 1960-62, 1970-72, 1999-2000, were drought years.

Therefore, the drought period can be taken safely 3 years for Indus & 5 years for Jhelum. Except for 2000-02 the years of drought are different on the two rivers.

Once we have arrived at drought durations for the two rivers then the required storage capacity to counter drought has been worked out in Table IV.

It would be seen that the storage required at Indus for 3 years drought period is 72 MAF, whereas on Jhelum 5 years drought period, the required capacity is 50 MAF. Thus the total drought mitigation requirement is 122 MAF.

IS THIS CAPACITY AVAILABLE?

The undersigned has carried out an analysis with moving means of storable surplus and it has been found that for Indus the 4 years moving means storage surplus would be 127 MAF refer Table-V whereas on Jhelum 6 years moving means storable surplus is 21.4 MAF refer Table VI. Deficiency of available storage on Jhelum would burden Indus which will have to store about 100 MAF to compensate for the deficiency of available storage on Jhelum. Then 28 MAF would be transported to Jhelum in time of need.

The present transfer capacity of Indus Link canals i.e. C-J link & T.P Link from Indus to Jhelum Chenab Zone is 33000 cs. Which can transfer 19.8 MAF from Indus to Jhelum Chenab Zone. At present these links are required to transfer 10.3 MAF (average) to J-c Zone. We have about 9.5 MAF capacity per annum available which could be utilized to transfer 28 MAF from Indus to J-C Zone in 5 years.

ARE SITES AVAILABLE?

The length of river Indus from Kalabagh to source (Skardu) is 800 miles which could accommodate 16 dams with a total storage of 100 MAF. The upper most sites that are Katzarah dam site alone can accommodate 25 MAF.

The distance between Mangla to Muzaffarabad is 120 miles and suitable storage site with 21 MAF on this river could be found.

CONSENSUS ON STORAGES

At present a site is identified and consensus started. This ends up in inter-provincial discussion. It is especially true to Kalabagh site. It is better to settle parameters for future storages through national debate which could be as under:-

a) It should be carry over storage (except for Kalabagh which should have outlet only on right.

b) Question of royalty should be settled and rationalized once for all.

After having settled these parameters we should go on building storages instead of having site specific comments from Provinces.

These storages would primarily be carry over Dams due to geographical constraints and consensus but would be used for hydel-electricity production. These will repay their cost in 5 years and private investors for such projects is not hard to find now-a-days.

Table I
WATER SCARCITY INDICATORES
(Faulkenmark Indicator)

>1700 M^3 / Capita	Water Scarcity Rare
< 1700 M^3 / Capita	Country faces seasonal or regular water-stressed conditions
< 1000M^3 / Capita	Water shortages hamper the health and well being of the human beings-Economic activities are affected
< 500M^3 / Capita	Shortages are severe constraints to human life

Table II
IMPLICATION OF WATER SHORTAGE

1. Stagnation of Agricultural growth and threat to Economic Viability
2. Dependence on other Nations for Food
3. Adverse impact on industrial Development
4. Drinking Water Constraints to Human Life
5. Provincial Disputes

Table III
WATER RESOURCE STRATEGY STUDY
(Cost Summary)

Sub-Sector	Cost ($US million)
Water Resources Development	10,000
Urban Water Supply and sanitation	5,066
Rural Water supply and sanitation	2,173
Industrial Water Supply and Pollution Control	253
Irrigation and Drainage	11,099
Hydropower	4,500
Environment	113
Flood Protection	418
Total	**33,622**

Table IV

Unit maf (Kharif only)	INDUS @ KALABAGH	Unit maf JHELUM @ MANGLA
Average inflow (1922 – 2002)	76.14	18.06
Min. inflow	52.32	8.20
Shortage	23.82	9.86
Storage for 3 years drought	71.46 = 72	
Storage for 6 years drought		22.04

Total Drought mitigation requirement = 72 + 50 = 122 maf..
6 years available supply for Mangla = 22.04 maf.
4 years storable surplus available on Indus = 127 maf.
Balance required for 5 years continuous drought at Mangla (Jhelum) = 50 – 22 = 28
Balance + Total required on Indus = 72 + 28 = 100 maf
Net required on Indus 100 maf against 127 maf availability
Net required on Mangla = 22 maf

Table V

Kharif (Indus Zone)

Period	TBD inflow	Kbl dschrg	J-C outflow	losses av. 95-2001	Net inflow 1+2+3+4	Av.wdls 93-2000	Accord wdls.	(3 yrs str. surplus)		(4 yrs str. surplus)		(5 yrs str. surplus)	
	1	2	3	4	5	6	7	8	9	10	11	12	13
1977.78	49.367	13.495	25.200	-10.539	77.523								
1978.79	60.088	19.469	44.240	-10.539	113.258								
1979.80	48.171	19.232	18.030	-10.539	73.894	47.600	55.217	121.875	99.024				
1980.81	47.757	15.852	21.430	-10.539	74.500	47.600	55.217	118.852	96.001	148.775	118.307		
1981.82	50.005	18.256	27.020	-10.539	84.744	47.600	55.217	99.338	67.487	155.996	125.528	185.919	147.934
1982.83	40.958	11.114	19.640	-10.539	61.173	47.600	55.217	77.017	54.766	103.911	73.443	169.569	131.484
1983.84	51.420	19.332	35.510	-10.539	95.723	47.600	55.217	98.840	75.989	125.740	95.272	152.034	113.949
1984.85	54.656	17.282	16.680	-10.539	78.279	47.600	55.217	92.375	69.524	129.519	99.051	156.419	118.334
1985.86	44.785	11.499	13.460	-10.539	59.205	47.600	55.217	90.407	67.556	103.980	73.512	141.124	103.039
1986.87	50.708	16.068	26.950	-10.539	83.187	47.600	55.217	77.87[illegible]	55.02	125.994	95.526	139.567	101.482
1987.88	47.948	16.018	22.480	-10.539	75.907	47.600	55.217	75.439	52.648	106.178	75.710	154.301	116.216
1988.89	63.043	18.105	41.470	-10.539	112.079	47.600	55.217	128.372	105.522	139.978	109.510	170.567	132.572
1989.90	46.018	14.026	18.290	-10.539	67.795	47.600	55.217	112.981	90.13	148.568	118.100	160.173	122.088
1990.91	61.740	17.975	30.880	-10.539	100.056	47.600	55.217	137.130	114.279	165.437	134.969	201.024	162.939
1991.92	58.209	28.166	33.990	-10.539	109.826	47.600	55.217	134.677	112.026	199.356	168.888	227.663	189.578
1992.93	55.126	27.929	41.530	-10.539	114.046	47.600	55.217	181.126	155.277	201.323	170.855	265.802	227.717
1993.94	44.408	17.867	23.850	-10.539	75.586	47.600	55.217	156.638	133.807	209.114	178.645	229.309	191.224
1994.95	65.008	18.876	40.180	-10.539	113.525	47.600	55.217	160.357	137.506	222.538	192.115	275.039	236.954
1995.96	53.084	19.203	46.430	-10.539	108.177	47.600	55.217	154.488	131.637	220.934	190.466	283.160	245.075
1996.97	59.139	16.750	42.360	-10.539	107.710	47.600	55.217	186.612	163.761	214.598	184.130	281.044	242.959
1997.98	46.290	17.749	25.820	-10.539	79.314	47.600	55.217	152.401	129.55	218.326	187.858	246.312	208.227
1998.99	55.167	19.609	29.230	-10.539	93.467	47.600	55.217	137.691	114.84	198.286	167.800	264.193	226.108
1999.00	56.152	12.797	9.230	-10.539	67.640	47.600	55.217	97.621	74.77	157.731	127.263	218.308	180.223
2000.01	45.648	9.411	7.910	-10.539	52.430	47.600	55.217	70.737	47.886	102.451	71.983	162.561	124.476
2001.02	41.411	10.066	8.145	-10.539	49.083	47.600	55.217	26.353	3.502	72.220	41.752	103.934	65.849
Average	**51.852**	**17.006**	**26.806**	**-10.539**	**85.125**	**47.600**	**55.217**	**116.569**	**93.718**	**157.771**	**127.304**	**199.430**	**161.349**

Table VI

JHELUM AT MANGLA (Kharif)

Period	Mangla Inflow	6 Years (Mov.av)	Mangla Outflow	6 Years (Mov.av)	Storable
1	2	3	4	5	6
1977.78	14.52	18.02	9.69		
1978.79	19.70	18.29	16.59		
1979.80	15.49	17.34	13.32		
1980.81	17.70	18.05	13.90		
1981.82	18.33	17.77	16.44		
1982.83	15.62	16.89	12.23	13.69	19.18
1983.84	22.68	18.25	18.49	15.16	18.54
1984.85	15.63	17.57	10.72	14.16	20.36
1985.86	12.05	17.00	7.60	13.23	22.65
1986.87	20.58	17.48	17.15	13.77	22.28
1987.88	21.34	17.98	17.91	14.02	23.81
1988.89	19.71	18.67	15.95	14.64	24.17
1989.90	17.98	17.88	13.98	13.88	23.99
1990.91	19.67	18.55	16.33	14.82	22.41
1991.92	25.08	20.73	23.50	17.47	19.54
1992.93	25.13	21.49	21.91	18.26	19.33
1993.94	18.68	21.04	14.93	17.77	19.66
1994.95	20.74	21.21	16.01	17.78	20.63
1995.96	21.87	21.86	18.22	18.48	20.28
1996.97	24.97	22.75	22.08	19.44	19.82
1997.98	16.96	21.39	12.40	17.59	22.80
1998.99	18.11	20.22	14.46	16.35	23.22
1999.00	11.24	18.98	7.46	15.10	23.25
2000.01	10.27	17.23	6.95	13.59	21.84
2001.02	8.20	14.96	5.68	11.50	20.71
Av(1977.01)	18.09	18.86	14.56	15.54	21.42
Av(1922.01)	18.06	18.38	13.90	14.08	22.04