PAPER NO.611

RIGHTS AND RESPONSIBILITIES OF LOWER RIPARIANS OF KALABAGH DAM ON INDUS RIVER

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1. Introduction:

The river systems anywhere in the world are Unitary, and cannot be divided. They are above geographical, cultural or political boundaries. Unlike the land-mass, a river cannot be divided into a Sudanese Nile and Egyptian Nile or a Nevada Colorado and a Mexican Colorado, and for that matter, Indus can not be divided as a Kashmir Indus, Pathan Indus, Punjab Indus and Sindh Indus. Therefore, the message of the river to the people living on its bank is very clear that if "you want to exploit my resources you have to unite and become one". River cannot be divided into pieces for the exploitation of its benefits. Yet in the recent past there have been disputes amongst the various communities living along its banks; particularly the upper Riparians and the lower Riparians. The nature of disputes in the latter case arises out of two reasons:

i. Lack of confidence and mutual trust: and

ii. Since upper riparians (UR) have the controls, the lower riparians (LR) have a feeling that they are at the mercy of the upper riparians. These attitudes are very natural and are found even along a watercourse where the users at the tail end quarrel with those at the head/upstream. It is so natural that even two brothers located at up and downstream ends may get involve into arguments.

People with matured mind show greater sense of wisdom and settle down on a give and take basis or more appropriately find an equitable solution amicability acceptable to all concerned. Even a give and take solution would be preferable to a no solution situation, in which case all suffer and remain deprived of the precious water. It is in this sprit the Kalabagh Dam (KBD) should be considered for implementation. This papers looks into the rights of the LR for which necessary assurance needs to be given before implementing the project and ofcourse, their responsibilities towards the people living on the banks of Indus.

2. Two Case Studies:

Hoover dam on river Colorado in U.S.A and Mexico and Aswan High dam on Nile in Sudan and Egypt, offer interesting case studies.

The Colorado dries up after the last dam i.e. Hoover except for an irrigation channel, which carry water to South California. Before the construction of Hoover dam it used to

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* *Research Paper does not reflect the views of P.D.C.*

fall in the Gulf of California in Mexico, now there exist nothing since highest flood peaks get absorbed in Hoover reservoir and a series of high dams built on Colorado upstream. (In all seven dams have been built on Colorado River). The dam was completed in 1935 and one of its objectives was to save South California from devastation of floods, the same scenario as being created by Indus in Sindh during flood season. The dam itself has been built in Nevada, hundreds of miles upstream of California, since this offered the best site from geological and engineering viewpoint. A meeting was held in 1922 between the six states through which the river flows (upper and lower riparians) and a representative of the federal government which resulted in "Colorado River Compact" (CRC) duly signed by the representatives (1). This paved the way for the construction of the dam. The CRC divides the Colorado Basin into an upper and lower half, and awarded half of the river's estimated flow to each basin. Further division of each basin's apportionment was left to the states in that basin which was done taking the dam's feasibility another step forward. This is parallel to Indus Water Accord(IWA) 1991 between the four provinces in Pakistan. Final step was taken when the Congress in 1928 finally passed the "Boulder Canyon Project Act" authorizing the construction of Hoover dam.

It started in 1931 and was completed in 1935 two years ahead of schedule. This concrete arch dam 726 ft high created worlds one of the largest reservoir with 28.5 maf, its lake extending 110 miles and producing 2080 megawatts of cheapest and environmental friendly power. In 1994 ASCE named it as one of the seven civil engineering wonders (1). It provides irrigation water to one million acres in California and 0.5 million acres in Mexico. The dam is half in Nevada and half in Arizona (gets 4% of water) yet it is the lower riparian i.e. South California which in addition to water gets 56% of hydropower while Arizona & Nevada gets 19% and 25% respectively. The vanishing of yearly floods is another major benefit received by California.

Similarly there is an interesting case study of Aswan High Dam built on Nile in Egypt and its fruits shared between Egypt and Sudan through a "1959 Water Agreement". As per the agreement the share of Sudan from the reservoir was fixed at 14.5 billion cu meters (b.cu.m) and that for Egypt 7.5 b.cu.m (2). The total share of Nile waters for Egypt and Sudan in the post dam conditions rose to a total of 55.5 b.cu.m and 18.5 b.cu.m respectively. In addition Egypt paid 20.0 million pounds to Sudan for relocating of structures. Once the agreement was signed in 1959, the dam was completed in 1964 creating worlds largest reservoir of 127.2 maf (compare this with 7 mafs of Kalabagh Dam) extending 220 miles in Egyptian territory and another 100 miles into Sudan. The power generated (1970 figure) amounts to a colossal 10,000 million kWh raising the per capita electricity consumption in Egypt from 170 to 550 kWh which is quite close to the level in Western Europe.

Politics is always there in high dams particularly when planned in developing countries. Here the dam was being built with Russian aid and after U.S had withdrawn their offer, therefore a battery of professional engineers was commissioned bringing all types of

environmental, cultural, hydrological, agricultural objections to the construction of the dam. However all these objections even if correct when weighed against only three direct benefits i.e. cheap and abundant power, enhanced water supply and flood control, were summarily rejected by the authorities. An objection was raised by Dr. Ahmed (2) an Egyptian hydrologist in 1960, that with the creation of huge Aswan reservoir, the colossal evaporation losses would leave less water than without a dam. Egyptian authorities engaged two of the best known British hydrologists Dr.Hurst & Mr. Black to investigate the issue in cooperation with the Russian designers. They rejected Dr. Ahmed's hypothesis and the government without wasting any time gave the green signal. Thirty-six years of the post dam era testifies the correct stand taken by the government.

The dam has paid back the investments many times over, and came to the rescue and saved Egypt and Sudan from drought by maintaining the irrigation supplies when the rain failed for seven years 1980-87.

There can always be legitimate concerns in the minds of people living downstream and right course would be to remove their doubts and include mitigation measures in planning and design of the project so that lower and upper riparians can enjoy and share the benefits happily (3,4). Just as it is their right that they would get their share and their doubts are removed, there are responsibilities, minimum of which is not to block the exploitation of the river resources on grounds which have vague scientific and technical basis.

There is opposition from another quarter to build large dams, in the name of environment. The most vocal critics are the NGOs located in the west with branches all over the world who criticize the construction of large dams in developing countries in the name of environmental and social impact and destruction of ecosystem. However with necessary mitigation measures which ensure environmental protection the large dams seem to be the only solution to uplifts the economy of poor under developed countries. U.S.A alone has two thousand large dams built providing the cheapest power, water for irrigation and flood control.

The following paragraphs discuss the likely fears, concerns, complaints the engineers in Sindh have about the construction of Kalabagh Dam (KBD) and the mitigation measures which will restore their confidence in the fruitfulness of the project not only for Sindh but for whole of Pakistan.

3. Concerns of Lower Riparians:

3.1 Physical and environmental impacts due to construction of the KBD:

i) The salt-water intrusion from the Arabian Sea would increase. The seawater flowing upstream through dry river channels in high tides would leave behind salt layer, thus causing surface salinity on the land. Secondly fresh groundwater in the delta region of Indus River would be polluted due

to drying up of fresh surface water of Indus and advancing saline water from the sea.

ii) Sailaba cultivation will be affected.

iii) Mangrove forests will be destroyed.

iv) Production of shrimps will come to an end.

v) Water supply for urban areas like Karachi will be affected.

3.2 Hydrological Reservations:

There is not enough water to allow storage, and therefore KBD is not feasible, or if it is built it will be at the cost of Sindh.

3.3 Lack of Trust on Upper Riparians.

i) Proposal to build Greater Thal canal upstream of KBD direct from the reservoir, with 11.0 maf / year discharge (5).
ii) Operating Chasma-Jhelum link as a canal when water is needed by Sindh.
iii) Past incidents in water distribution which caused dents in mutual trust and confidence.

4. Explanations & Mitigation Measures:

4.1 Physical and Environmental Impacts:

i. Salt Water Intrusion:

Surface Effects:

With reference to figure 1 the high tides in Arabian Sea (20-22 ft) reach upto Aghimani 87 miles upstream and 10 ft above MSL. Aghimani is situated on Thatta Sajawal Bridge. This water while receding leaves a salt layer on the surface. 10 maf has been reserved under (IWA) 1991 between the four provinces, which will wash away this salt layer (6). KBD will not alter this situation, because as it is there is no flow in Indus since 1954 after the Kotri barrage was built from Oct. to May. This situation would continue and has little impact because u/s from branching point (A) the channel is well defined and salts and seawater confine to the channel section and do not affect the surrounding lands.

Colombo plan report (1953-54) confirms that "salts appear on the surface of the soil in tidal belt extending upto Sujawal (Aghimani) and these lands have no significant agricultural potential" (6). The recently built Tidal Link has invited sea much deeper upto 123 RD since there is reverse flow in the link when tides are high, (The bed level of the Tidal link is below sea level). However this has not done any damage from economic viewpoint since the land upto 123 RD has no agricultural potential.

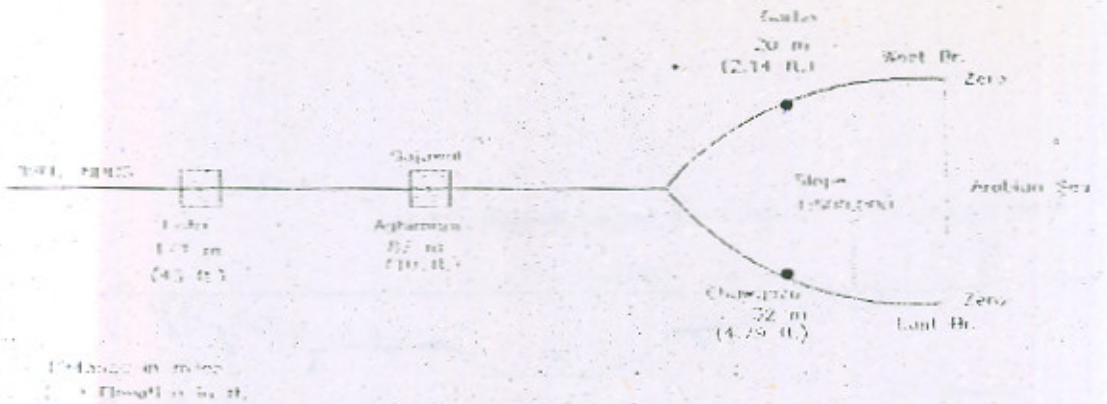


Figure-1

Sub Surface Effects:

Seawater Intrusion in coastal Aquifers with the drying up of the fresh water source the seawater penetrates inland into fresh aquifers and wells produce saline water. In case of Indus delta following points may be noted.

a. There exist no fresh water coastal aquifer, which is likely to be contaminated.

b. Out of 900 km of coastal line of Pakistan the width of Indus delta is only 20 km. Therefore salt water intrusion due to drying up of the river would atmost affect 20 km wide and few km deep coastal belt in which there are no wells.

c. A strip on both sides of the river will be affected from Sujawal to the branching point A. in case when there is no flow in the river and high tied in the sea.

It is proposed that some flow should be maintained in this reach to wash away the salts. The IWA has reserved 10 maf to pass into ocean. This discharge will help wash away the salts, help mangrove forests and sustain hatching of shrimps. Presently there is no control on this discharge, however with the KBD; it will be possible to have the desired discharge for a longer period. Hundred thousand cusecs can be regulated from KBD for 50 days or fifty thousand for 100 days to make 10 maf.

ii) Floods and Sailaba Cultivation

The Indus flood plain called "Katcha" is as wide as 10 to 12 km. (figure 2). After the flood season this area is partly cultivated while the rest of the area supports riverine forests. The reservations expressed by lower riparians are that due to construction of KBD and reduction in flood peak the areas will go out of cultivation. Following information will be helpful to reach on optimum peak, which ensure enough moisture in the flood plains to support agricultural activities.

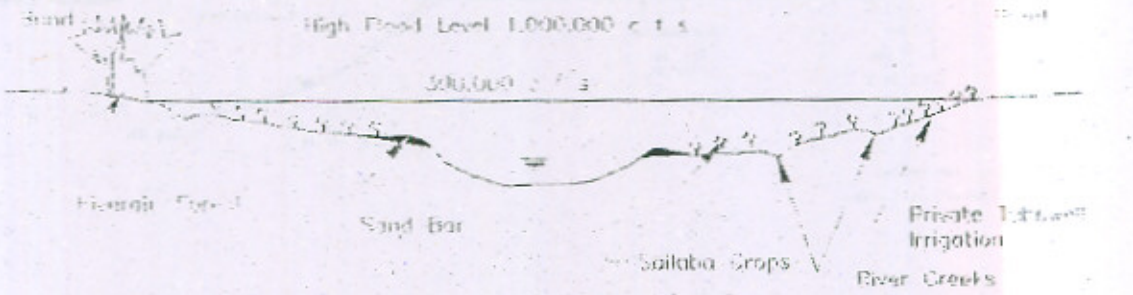


Figure-2

Since the dam is located 1240 km (770 miles) upstream from the sea, it will regulate only that part of the flood which joins the river at 1240 km and upstream. There are three components of flood with reference to KBD.

a) Passing d/s of Chasma Barrage (u/s of KBD)
b) Monsoon floods from hill torrents d/s of KBD
c) Floods of Panjnad d/s KBD

The Indus floods at (a) only reaches KBD and amounts to 52 maf per year, of which it has been proposed to store 6.1 maf i.e. 12% (5). The usual flood season lasts for 90 to 100 days starting middle of June. Impounding in KBD will be complete by the end of August (about 40 days of flow). In remaining period peak will pass untouched.

It has been estimated that minimum peak required for sailaba cultivation is 300,000 cusecs, since this would just touch the toe of the bund as shown in (figure 2), and cover the flood plain to deposit required moisture in the subsoil for agricultural needs, and forests (6).

The floods at (b) and (c) will not be affected by the dam and therefore shall pass through undisturbed.

Therefore if a peak of 300,000 cusecs is ensured (in years of lower peaks, water regulation at KBD can help to build the peak) sailaba cultivation will be unaffected.

In very dry years there is a chance that flood peaks may not touch the required level and reach downstream of Kotri barrage may be affected. The total area likely to be lost to

agriculture may be upto 4200 acres (6), for which necessary compensation may be arranged.The mitigation measures may include alternate allotment of agricultural land or irrigation through tubewells to supply required irrigation water in dry years.

iii. Mangrove Forests:

The first report on mangrove forests was prepared in 1953 (7). It's an important eco-system, which needs to be sustained and further developed. In 1953, it was estimated that 40,000 acres (7) were under mangroves, however due to cutting of forests for fuel wood (at the rate of 200,000 cu: ft of fresh wood per year) this has reduced to about 20% and it is no more as thick as it used to be. The provision of 10 maf of Indus water to be ensured through KBD will help the restoration of mangrove forests if unregulated cutting and over exploitation, for fuel and fodder is checked.

iv) Shrimps:

The mangrove forest, which needs fresh water supplies from Indus, is complex eco-systems providing favorable conditions for breeding of shrimps. It is hoped with 10 maf per year or 100,000 cusecs for 50 days or 50,000 cusecs for 100 days will take care of shrimps.

v) Urban Water Supplies:

Urban supplies consume only 3% while 97% goes for irrigation. Karachi the main urban consumer of Indus water needs about 400 mgd (0.448 maf). The water accord has allocated 0.87 maf which is quite adequate and includes increased projected water usage.

4.2 Hydrological Reservations :

Some of the engineers of Sindh have raised the hydrological issues regarding non-adequacy of surplus water available for storage (5, 8, 9, 10). According to the data supplied (8) there are two sets of calculations. One at Kotri and other at Rim stations.

(A) At Kotri :

The total discharge of the Indus system varies between 187 maf to 100 maf. The outflow to the sea is 30.2 maf, following is the break up:

1.	Provinces: (IWA 1991)	12.00 maf.
2.	Eastern rivers post Tarbela Flow Assigned to India	6.30 maf
3.	Authorized (as calculated in reference 8) for India	4.79maf
4.	Allocated for Sindh (IWA 1991)	10.00 maf
		Total Demand 33.30 maf

This leaves 7 maf as against 10 maf earmarked in the water award for Sindh, and nothing is left for KBD storage.

(B) At Rim stations :

In the second set of calculations following data is provided (8)

Total water Available at Rim stations on average year basis (for 4 out of 5 years basis or 80% probability	+ 137.91 maf or + 123.59 maf)
Allocated to provinces (IWA, 1991)	- 114.35 maf
India (as per ref 8)	- 4.79 maf
System Losses	- 16.20 maf
Earmarked for Sindh (IWA 1991)	- 10.00 maf
Total Demand	- 145.33 maf

The second set of calculation indicate a shortage of 7.43 maf on an average year basis and 19.29 maf an on 80% probability i.e. 8 out of 10 years basis. The reference (8) concludes "thus there is simply no water available, on the contrary there is a large shortage even to meet the present commitments".

The above one is a typical set of hydrological calculations to prove that KBD is not feasible. There are other similar hydrological estimates , (5, 9, 10, 11) which show that KBD is not feasible due to non-availability of water for storage or due to sedimentation problem.

The following response suggests the safeguard of the rights of lower riparian and their responsibilities towards collective exploitation of Indus waters.

i) The objective before the engineers representing lower riparians should be the protection of their rights rather than to establish or re-establish the non-feasibility of the dam being considered in the upper reaches of a river system which has already been found feasible by hydrological consultants.

ii) All the authors of the references quoted above are engineers holding a Bachelor's degree without specialization in the science of Hydrology. The hydrological aspects of the KBD have been thoroughly investigated by the national and international hydrologists who have prepared the feasibility reports. Therefore it would be logical to believe and trust the hydrological estimates by experts who are also not a party to the issue.

iii) A good example is the calculation of evaporation losses for KBD at 16.2 maf as against 10.0 maf (8). Egyptian hydrologist Dr. Ahmed opposed the Aswan high Dam on the basis of his calculation of evaporation losses that would take place if the dam were constructed (2). Egyptian authorities invited the Russian teams who were the designers and two internationally known hydrologists from England. The joint British & Russian team rejected the estimates of Dr. Ahmed and showed that Aswan High Dam is feasible inspite of evaporation losses. Thirty-six years of post Aswan High dam has disproved the estimates of Dr. Ahmed.

A similar prediction for Bhakra dam on Sutlej in East Punjab India was rejected and the dam was built. Indians have converted the Rajasthan desert into a granary with the help of Rajasthan Canal off taking from Bhakra reservoir disproving the reservations regarding non-availability of water for storage in Sutlej River.

iv) The reference (8) estimates that Pakistan should give 4.79 maf to Indians if not 7.3 maf. Others estimate the India's share at best is 2 maf. It is well known that in the Indus Basin Treaty 1960 India took the advantage of being upper riparian vis a vis Pakistan and got much greater share of water than it deserved. In addition India had been violating the treaty wherever it got an opportunity. Now there are some experts in Pakistan who are making calculations to give away whatever can be saved for the people of this country (including lower riparians) therefore 4.79 maf or 7.3 maf cannot be accepted and a value of 2.0 maf or less than 2.0 maf may be considered. Therefore the hypothesis of various engineers predicting shortage of water for storage can not be accepted and feasibility studies done by the non-partisan KBD Consultants (12) should be and considered final.

4.3 Mutual Trust Between the Upper & Lower Riparians:

Main objections and reservations expressed are due to lack of trust and confidence between lower and upper riparians regarding distribution of water from KBD reservoir, other two reservations i.e. environmental and hydrological are actually the by-products. Therefore concrete measures are needed to restore the diminishing confidence. In this regard examples are quoted of how the Chasma Jhelum Link has been partly converted into on irrigation channel, without taking into account the needs of people at the tail end, or what is behind planning of Greater Thal Canal with 11 maf per year discharge (5). There are similar objections where the due rights of the people at the downstream have been violated viz a viz their share of Indus waters. The possible solution to restore the confidence and repair the mutual trust is to establish Indus Water Distribution Authority / Commission, which would be final and supreme body to ensure and implement the distribution of the total Indus waters including KBD, and also for reservoirs to be built in future. The Authority / Commission may consist of 6 members, two from Punjab, (one each from upper and lower Punjab), two from Sindh (one each from upper and lower), and one each from NWFP and Balochistan. The Chairmanship will rotate between the members and all decisions would be by consensus. Further details can be worked out providing IWDA a constitutional cover. However it has to be ensured that members are top professional experts in their field with highest caliber and integrity.

5. Conclusion:

The prosperity of Pakistan lies in the construction of not only KBD, but other large and small dams in the Indus system, and it is time people unites to exploit the blessings of the available water resources. The sustainability of water resources projects are dependant on the respect of the rights of people at receiving

end, and their just and responsible attitude towards the people having the key of control i.e. upper reparians.

There seems to be a well-planned opposition from another quarter to build large dams that is from groups located in the developed countries. It is not only Kalabagh in Pakistan, but Sardar Sarover on Narmada, Pangne on Bio Bio, (Chile), Bakun dam (Malaysia), Three Gorges on Yangteze, Epupa on Cunene (Namibia) and Nam Theun on Mekong (Laos) are being opposed in the name of environment by the groups, which are based in Europe and North America. These countries are already enjoying the benefits of large dams (USA alone has 2000 dams built in last hundred years) and cheap electricity and perhaps want to see developing countries remain under developed and dependent on them.

It is time a decision is taken for the welfare of Pakistan and the people living on Indus.

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