

Pukhtunkhwa's Case Against Kalabagh Dam

کالا باغ ڈیم کے متعلق پختونخوا کا مقدمہ

The scientific and technical details presented in this paper were provided by a team of experts led by Eng. Fatehullah Khan Gandapur (late). This is Awami National Party's Position Paper on Kalabagh Dam, made public, during Gen. Musharaff's era when the dictator declared his intentions to build the controversial Kalabagh Dam.

PUKHTUNKHWA'S CASE AGAINST THE PROPOSED KALABAGH DAM PROJECT

Introduction:

The controversial Kalabagh Dam project is proposed on River Indus about 210 km downstream of Tarbela Dam and 92 miles downstream of Attock, the confluence point of the Kabul and Indus rivers. The claimed storage capacity is 7.6 MAF (million acre feet), Dam height is 260 feet and Reservoir elevation is 925 feet. The government tailored feasibility reports, volume N Appendix N, and other manipulated studies were completed in 1985 and these reports were given to the Provincial governments in 1990 after being kept hidden as a high state secret for five long years. Estimated cost in 1985 was about \$ 5 billion (Present cost \$10 billion plus). The official study says that Kalabagh Dam will replace the lost storage due to silting at Tarbela and Mangla Dams (refer main volume page 1.1, para 1.2b).

General Pervez Musharraf has launched a renewed campaign to lobby for the proposed controversial Dam. This paper is limited to the reservations of the Pukhtunkhwa province (NWFP) with reference to Kalabagh Dam Project. The Sindh Province has its own reservations, which are totally different in nature. The people of Sindh fear drought and intrusion of the sea and the disappearance of Thatta and Badin from the map. On the other hand we fear submergence, inundation and water logging of the entire Peshawar valley, if this dam is constructed. A technically infeasible and flawed project cannot be made feasible by lobbying and even bullying the future victims in the name of a evolving consensus. The funny claim of WAPDA that Kalabagh Dam is one of the most extensively studied projects in the world is totally refuted by more than 26 excerpts in the dam's own feasibility report prepared by the project consultants.

On the contrary, the dam is the most canvassed and publicized project in the world for which a forced consensus is being sought politically in spite of its technical infeasibility. Moreover, WAPDA falsely claims that its design is well documented and should be accepted by its critics. In fact, the Kalabagh Dam Consultants have suggested a structure at Kalabagh like a barrage (low-level sluicing) and not a dam as the Kalabagh Dam will not evacuate silt and make the dam at Kalabagh hydraulically infeasible due to rapid silting and short life span (refer to the KBD Feasibility Report June 1988, page 3.8 para 3.27).

But WAPDA specifically directed the consultants in the terms of reference (TOR) to come up with a design at the exact location of Kalabagh and with the exact storage capacity of 7.6 maf (million acre feet). No room was given to the consultants for coming up with a better storage site along the Indus. Their hands were tied by WAPDA, so they came up with the present design of restricted mid-level sluicing but they registered their reservations at almost 26 instances in the feasibility report.

Role of CI ratio (Capacity-Inflow Ratio) in planning dams:

In planning dams and reservoirs at the preliminary stage of desk studies or at the pre-feasibility stage, the most important of all is to work out and know the capacity-inflow ratio (CI ratio). The CI ratio is a simple ratio between the capacity of a reservoir at a site and the average annual river flow at that site. This ratio is vital to estimate and know the life span and service value of the project to establish its economic viability. However, it is very painful to know that WAPDA has shown utter ignorance in understanding the CI ratio and its great importance. For example in the first instance, WAPDA states "CI ratio of a reservoir depends upon the topography of the site". Secondly, it states "CI ratio is not the only criteria for planning a technically feasible and economically viable multipurpose project". Yet thirdly, another shocking part of the statement is that CI ratio of KBD is shown in percentage as 0.069 %.

All the above statements by WAPDA are gross misconceptions and amount to a record-breaking distortion of facts apart from showing very poor technical understanding in this field. This is the main reason for terrible mishandling of storage projects by WAPDA. It indicates that WAPDA has not understood what CI ratio means and what role it plays in the planning and selection of a dam site at the pre-feasibility stage as is evident from its explanation. As a matter of fact it is the CI ratio that indicates the life span, the service value and the economic viability of storage at the pre-feasibility stage. In case of KBD portion of the reservoir at Attock on the Indus, the capacity of the reservoir is 3.5 maf and the average annual inflow is 90 maf. The CI ratio therefore comes to 3.5:90 or 1:26. This is a ratio and it is never expressed in percentage. Therefore, WAPDA is wrong to show the CI ratio as 0.069 per cent. The poor CI ratio shows rapid silting and short life span with poor service value of the project.

WAPDA is also terribly mistaken to relate CI ratio to the topography. It never depends on the topography of the site as wrongly conceived by WAPDA. There are only two factors involved in finding CI ratio, namely the capacity of the reservoir and the inflow of the river. **In case of the KBD, the CI ratio (1:26) is the poorest in the world.** This is because the KBD reservoir is located at the tail end of the Indus River valley drawing a huge inflow of 90 maf of water from a vast catchment area of 110,000 sq. miles passing through a meager reservoir of 3.5 maf. Therefore, 90 maf of silty water from a vast catchment area will pass through it thereby depositing the entire silt in it. It will serve as a silting pond for the huge 90 maf of the Indus flow. This will cause rapid silting, giving very short life span with poorest service value. This renders the KBD economically and hydraulically infeasible, as the important role of CI ratio is that it indicates the suitability of storage dam at a specific site. This ratio is the poorest in case of KBD. And this is exactly why the consultants have indicated to build structure like a barrage (low-level sluicing) instead of a dam, as the site is not suitable for a storage dam.

However, WAPDA has either failed to understand the language of the consultants or it is forced to dance to the tune of a specific ruling lobby. **WAPDA is misleading the public that the KBD will control one of the world's greatest catchment area of 110,000 square miles with 90 maf of the annual flow. How is that possible to control 90 maf of flow in a 3.5 maf of the KBD reservoir at Attock?**

Silting up of the Reservoir and its effects

It is said, "the death of a reservoir begins the day it is built". KBD main report on page 4.11 in para 4.55 also reveals that heavy silting will take place in the 3.5 maf Attock portion of the KBD reservoir against the heavy inflow of about 90 maf of water. As KBD reservoir has the poorest Capacity inflow ratio in the world, therefore it will rapidly silt up as Tarbela is fast losing its silt trap efficiency after performing 30 years of service. The muddy Kabul River is also contributing about 110 million tons of silt equal to 0.1 maf (million acre feet) annually in addition to 0.2 maf of silt flow from Tarbela Reservoir. Besides all the above, the lurking danger of the liquefaction (liquidation) of a 200 feet high and about 60 Km long silt island in Tarbela Reservoir would be a potential catastrophe for a downstream storage dam. The selection and fixation of reservoir site by WAPDA with the poorest CI ratio is a great mistake, as it will rapidly silt up. This is why the Kalabagh consultants have shown great concern of rapid silting in the main project report on page 3.5 para 3.17, page 4.12 para 4.57. and page 3.9 para 3.31. Few of the relevant excerpts are quoted below: –

- **“Upstream of Attock the flood level are sensitive to the amount of sediment so that flood risk will increase with time”.**

- **“The future distribution of sediment can be predicted in general terms only and local behavior will depend on actual sediment inflows, reservoir operation and local flow pattern”.**
- **“No immediate solution for sediment management seems to be practically viable”.**
- **“The high sediment load carried by the Indus at Kalabagh has an important bearing on the design of Kalabagh Dam and on the operation rules of the reservoir.”**
- **“In the long run the generation of power will be on run-of-river”.**

The above excerpts show that the dam is a very short-lived project due to rapid silting. The most amusing design aspect of Kalabagh is that its **“restricted mid-level sluicing”** design concept dictated by WAPDA, in terms of reference (TOR), for a dam at a specific site. They have recommended to adopt **“unrestricted low level sluicing design.”**

Sluicing is the process of extracting or pushing out silt from the reservoir using the flow of the river. Exit points are provided in the dam which when opened lets the water out along with the silt it's carrying. The lower these exit points are the more silt is carried out and the higher they get they more silt is left behind on the riverbed. Therefore low level sluicing design like that of a barrage has these exit points nearer to the bed of the river, so all the silt is passed on with the water and with a restricted mid level sluicing design (as in Kalabagh Dam) the silt gets deposited below these exit points hence reducing the reservoir capacity. In case of Kalabagh Dam the exit points are at mid level i.e. 825 ft against the total reservoir height of 925 ft that is why it is called mid level sluicing. To sluice the reservoir it will have to be emptied to the level of the exit points for the river to flow out and carry the silt with it. This emptying of the reservoir to the height of the exit points is called the Draw Down level or to draw down the reservoir. In case of Kalabagh this level will be maintained for 50 flood days, out of the total of a 100 flood days, between the 1st of June and the 20th of July. Therefore it is called restricted sluicing because it restricts the period from 100 to 50 days. During this period power will not be generated.

Therefore the consultants have given their honest opinion by disagreeing with its client (WAPDA) stating that there is no specific method to sluice silt except **“the lower the draw down level, the longer this level is maintained and the higher the flows then the more effective the sluicing will be”, like a barrage.** For proof, reference may be made to the dam KBD) main project report June 1988, page 3.8 para 3.27.

Attention is again invited to another very important excerpt from the KBD Project Report 1988 page 3.5, para 3.17. It states;

“The high sediment load carried by the Indus at Kalabagh has an important bearing on the design of Kalabagh and on the operation rules for the Reservoir. If a high proportion of sediment is trapped the storage volume will rapidly reduce with the loss of irrigation benefits derived from storage. Such sedimentation could eventually also cause unacceptable back-water effects.”

Backwater effect is caused by the silting up of the reservoir, which slows down the flow of the river that is draining into the reservoir so when the river slows down it starts depositing silt on its bed. Like the reservoir the riverbed too starts to rise with time and the water rises above it. As in this case river Kabul would do so, especially with its heavy silt load. This is a clear recipe of disaster for Peshawar valley.

This excerpt clearly means that heavy silt load carried by the Indus at Kalabagh plays vital role in selecting the type of hydraulic design for the KBD so as to avoid rapid silting, loss of storage and backwater flooding beside loss of irrigation benefits. The above excerpt therefore confirms to adopt low-level unrestricted sluicing design to cater for the evacuation of heavy and rapid silting

in the Kalabagh Reservoir as the hydraulic design has an important bearing on the project and on its life span and service value. There is yet another excerpt from the main project report of 1988 on page 3.8 in para 3.27. It states;

“However, although draw down is required for irrigation benefits, the lower the draw down level and the longer the sluicing period, the greater is the loss of power and energy generation.”

For further proof of its infeasibility, refer to the KBD’s project report June 1988, page 3.9 para 3.31, which states;

“Chas T. Main etc considered special low-level sluices to achieve very low draw down. In that case power generation must be discontinued. Thus economic Penalty is large”.

The above excerpts show that the Kalabagh Dam is a very short-lived project due to rapid silting like the original Sanmenxia Dam in China that was built with mid-level sluicing design and failed within two years of its construction due to rapid silting and backwater flooding. The Chinese then rebuilt it with low-level sluicing design and now its working is perfect as a barrage. For proof refer to Water Supply and Management, November 5 No: 4/5 pp 351 to 361 of 1981 by Long Yuqian and Zhang Qishun.

Back Water Effect (Flooding of River Kabul)

In case of the KBD, all the hydraulic factors to evacuate silt are most unfavorable. This is because the Indus River bed slope is flattened after the construction of a mid-level sluicing dam that reduces stream power to evacuate silt. The duration of flow to evacuate silt too has been reduced from 100 flood days to 50 flood days. Moreover, the quantity of the Indus flow is also reduced by the diversion of silt free water of 56,500 cusecs into the Ghazi Barotha after depositing silt in the Ghazi-barrage pond for subsequent deposition at Attock. This shows all vital factors that help evacuate silt are very adverse. Therefore, rapid silting will take place in the 3.5 maf mid-level sluicing reservoir of KBD at Attock. Due to flattening of the Indus bed slope the velocity of flow or the stream power that carries silt will slowdown and would not be able to carry silt for evacuation. As a result, silt will be deposited up stream of the Attock gorge, which is a 2000ft wide, in a 3.5 maf KBD reservoir. All this shows that the hydraulic condition and the hydraulic design of the dam play a very vital part to regulate sediment. These unfavorable factors affect the feasibility of the dam due to very short life span and poorest service value so as to make it economically infeasible.

A wrong hydraulic design of mid-level sluicing will cause rapid silting, backwater flow and flooding of the whole of the fertile valleys of Peshawar. It will block the drainage route of the entire valley. **The most serious and dangerous is the blockage of the sub-surface drainage flow from the two valleys towards the only outlet through Attock gorge as the area up stream of the Attock gorge is subjected to heavy silting. This will receive 0.1maf silt annually from Kabul River alone.** Even a layman can understand that when there is an obstruction the velocity of water slows down. When that happens the water stream will deposit more and more sediment on the riverbed. This will consequently result in raising the riverbed level with passage of time. Eventually the bed levels will be raised to a point where it would be more or less equal to the level of the reservoir. In the case of Kabul river the outflows from Hissara Drain (Charsadda) and Kalpani river (Mardan) which constitute the main outlets will be choked. Similarly, due rise in the Kabul river bed there will be backflows into the Mardan and Swabi SCARP Systems causing immense damage. Millions of dollars have been spent on these projects and huge tracts of saline/water logged lands reclaimed. The good effects of these projects will be negated. Even in

1984/85 WAPDA admitted that a detailed sedimentation study, especially of the Kabul River had not been conducted. Now more than twenty years later the situation in Kabul River has become much worse. Due to heavy cutting of forests in Afghanistan and Pakistan there is much greater erosion taking place which has resulted in much heavier sediment transportation. This will lead to much faster silting of the Kalabagh Dam reservoir as against earlier estimates and will reduce its life drastically. This is a matter of serious concern and will radically change the already doubtful feasibility of the project. Unless a reliable sedimentation study by a renowned independent consultant is carried out we should not give any credence to the current figures quoted in the Kala Bagh Dam Report.

The above-mentioned fact underlines the danger of unacceptable backwater effect due to flooding of Kabul River. But the problem is not confined just to Kabul River. Rivers like Swat, Panjkora, Chitral and many others that drain into River Kabul will also be affected. Equally serious is the flooding in the riverbeds in a number of districts during monsoons and other rainfall seasons. Heavy floods that brought death and destruction on a large scale during the spring of 2005 even without a dam in Kalabagh, amply proved the gravity of the problem. Most of the existing drainage systems in the Peshawar valley will fail which will in turn result in water logging the fertile lands of the whole valley. Even if all the area does not submerge it will definitely be **inundated and get waterlogged**.

Also refer to KBD project report volume IX, appendix U, pages U8 to U10 and page 15 besides the KBD Executive Summary December 1994, page 23 and the report on backwater studies page 6. These reports show that to prevent Nowshera and several other towns against flooding a 30 feet high embankment around these towns will be required for their protection against backwater flow and flooding. The Consultants had also identified the high flood levels that had occurred as a consequence of the 1929 flood and during which the water level rose by almost 25 ft. According to WAPDA's calculations Nowshera is between 940 to 950 ft as against the reservoir retention level of 925 ft, but even with this 15 to 25 ft difference Nowshera still required these embankments. Here it should also be noted that the height of the reservoir in the present design remains the same i.e. 925 ft and has not been reduced to 915 ft as WAPDA would like us to believe. Actually what WAPDA says is that it will not be filled beyond 915 ft. With a long trail of past betrayals and deceptions who is going to believe the cock and bull stories churned out by the official propagandists.

Moreover, as per 1980 estimate of the KBD report, about 250,000 people will be displaced and 180,000 acres of land will be affected. The new official propaganda line understates the fallout to make the controversial project acceptable.

Poor power generation:

WAPDA has falsely shown that power generation from the dam is initially 2400 MW. Actually it is 350 MW as reported by Dr Pieter Lieftnick in Volume-I of his report. The basic reasons for low power generation are the mid-level sluicing design and the unsuitable site for the dam with the poorest CI ratio in the world. The adoption of wrong sluicing design requires emptying and refilling of the reservoir every year that takes about four months in a vague attempt to de-silt the reservoir.

This reduces power generation even at an advanced stage by one-third, bringing it down to 1600 MW. By reducing the water level in the reservoir by 10 ft, in a so-called attempt to avoid backwater flow and flooding in the Kabul River will further reduce the generation to 1350 MW. But as the luck will have it this figure also turns out to be a deception. WAPDA has adopted a cheating method by providing for installation of a 2000 MW of Thermal power plant attached to the dam

to support the low hydropower generation from the dam. The actual power generation from the dam therefore comes to 350 MW as worked out by Dr Pieter Liefnick. For proof refer to the following:

- The KBD Executive Summary, December 1984 page 28 and Exhibit-II. **The construction cost of thermal station is shown.**
- The KBD Project Report June 1988, pages 4.4, 4.5 and 4.8. This excerpt reveals **“The station will operate as a source of base load with Thermal power plant providing additional peak time power as required. Thermal plant will then be used to supplement the hydro-based energy to satisfy the load demand pattern.”**
- The KBD main report page 4.8, paras 4.39, 4.4 and 4.1 which states that **“Four 500 MW low cost Thermal plant unit have been programmed as shown on diagram No: 10 of the KBD main report.”**
- The KBD project report Executive Summary October 1988, pages 41 to 45 **“Backwater studies”** by Binnie and Partners, Harza, PCR, NES PAK and ACE.
- The KBD main report pages 42, 43 and 44 besides the report of Dr Pieter Liefnick.

No Provision for a right bank Canal

According to a feasibility study regarding the right bank canal during Gen. Fazli Haq's governorship it was determined by government experts that because of lengthy tunnels of about 17.5 miles involved in the proposed 95 miles long canal and due to hard/difficult terrain the right bank canal is not technically and economically feasible / viable. WAPDA also conducted a feasibility study and it was concluded that the canal project was not feasible therefore a right bank canal that could provide water to the southern districts of the province was given up. It is not a part of the project anymore. The false and deceiving propaganda regarding a right bank canal is currently being conducted by WAPDA in an effort to divide the people of Pukhtunkhwa (NWFP).

Earthquake Protection

Kalabagh dam is located on a geological Fault Line but yet it has been designed for Operation Basis Earthquake (OBE) which means that it is resistant only to earthquakes measuring between 6.5 to 7 on the Richter scale. Keeping the above condition in mind it should have been designed for a Maximum Credible Earthquake (MCE), which is above 9 to 9.5 on the Richter scale. The Kalabagh Dam consultants Professor Simpton and Mr. Little have already pointed out in volume II and XIII of the KBD feasibility report that a concrete structure higher than 160 feet is infeasible due to the weak nature of bedrock at Kalabagh but still the design is based on 260 feet high dam. We should be very careful particularly after the catastrophic earthquake of 7.6/7.8 on the Richter scale, which hit a part of this province, and also AJK on Oct. 8, 2005. This catastrophic earthquake has necessitated a revolutionary change in the mindset about not only the nature of the designs of the dams but about very idea of big in this particular region. The earthquake threat is a new factor adding to the infeasibility and flawed design of KBD project. It is a serious matter because of the presence of huge nuclear establishments down stream at Chashma. In case of any accident or failure of the proposed Dam the results of just the floodwater would be more than any Hiroshima or Nagasaki.

Conclusion

The above facts indicate that the **KBD is neither beneficial for irrigation nor for power generation. It also shows that Kalabagh is not a suitable site for a storage dam. It cannot provide any additional water for development. It can even hardly be described as a replacement for Tarbela dam.** Yet, it is surprising, that WAPDA had instructed the project

consultants in the TOR (Terms of reference) to provide a mid-level sluicing design specifically pre-selecting Kalabagh site for the dam so as to create a storage of 9.5 maf at 925 ft elevation with free board at 940 ft. **These were the preconditions for the consultants in the TOR. They were not allowed to select a better dam site on the main stem of the Indus River where there is a potential for the storage of about 80 maf of water and 40,000 MW of power generation.** These unusual and formidable conditions imposed on the consultants in the TOR by WAPDA were kept secret from NWFP as it was flooding Peshawar valley and blocking its sub-surface drainage besides blocking the gateway to NWFP by imposing a wrong design. For confirmation refer to the KBD project report volume N, appendix N. An excerpt from the project report is quoted below: – **“Basically design criteria were set during the initial appraisal of the scheme and development outline design. These were based on the requirements of the client through the terms of reference (TOR) or subsequent instructions.”**

Most unfortunately, WAPDA did not agree to accept the design criteria suggested by the KBD project consultants. WAPDA argued that in that case storage as well as hydro power generation will be reduced. WAPDA preferred to ignore the very short life span of the dam due to rapid silting, its adverse consequences of water shortage for irrigated agriculture, the flooding / inundation of Peshawar valley besides wastage of more than \$ 10 billion as the cost of the project. Moreover, there will be a delay of another 25 years for the construction of a new dam on the main stem of the Indus. The Indus River System Authority (IRSA) a very important inter provincial body for distribution of water too rejected the Kalabagh Dam project back in 1996. Surprisingly, WAPDA's second priority is the 3.3 maf Akhori Dam an off-channel reservoir already rejected by the World Bank team due to serious foundation problems. Refer to Dr Pieter Liefnick report Vol:- I pages 269 and 292.

The only charm of the Kalabagh Dam is that it's the only site in the province of Punjab where a restricted and limited design dam can be built. Punjab seems to be having an obsession with Kalabagh but this project would for sure affect the upper and lower riparians. Punjab should respect the views of other federating units and should act like a federating partner and not like a federation commander. WAPDA also argues that Kalabagh Dam's feasibility reports, studies, and designs are ready and work can be started in a year. But it has been shown above that the feasibility of Kalabagh Dam is flawed and is obsolete. But it is also very unfortunate that since 1975 after the completion of Tarbela Dam WAPDA itself has blocked the way for all water and power projects in order to pave way for the construction of just the Kalabagh Dam.

Kalabagh, Bhasha and Akori are merely replacement dams with small storage with very short life span. The three will cost about \$ 38 Billion if built by the year 2020. The three dams will create a storage up to 15 maf and power generation of about 5500MW.

Why not build the unique Katarah Dam alone by the year 2013. The multipurpose Katarah has a storage capacity up to 35 maf, a 15000 MW power generation capability and more than 1000 years life span. This will cost about \$ 7Billion due to excellent dam site it can be built in about 7 to 8 years if decided right now. Katarah is a unique watershed management dam to stop silt flow in the Indus water. It is a dam needed for water management. It is a development dam as well as a replacement dam. It is a super flood control dam, power dam, poverty alleviation dam and environment improvement dam by irrigating about 10 million acres of barren land in the four provinces through the proposed “All Pakistan Grand Canal”, if sprinkle and drip irrigation methods are used. Katarah is the cheapest reservoir per maf of storage, per MW of power generation, per year of life span and per year of its service value.

Under para 4 of the water accord, it will give a 37% share in floodwater to Punjab that comes to 12.95 maf. This share comes to two times the storage of Kalabagh dam (6.1+6.1) i.e. 12.2 maf. Therefore why does Punjab insist on the hydrologically, geologically and economically infeasible Kalabagh dam rejected by IRSA Act. General Musharraf is probably misguided by WAPDA by giving him wrong information that KBD will irrigate millions of acres of land; generate 3,600 MW of power (against hardly 440 MW). It is only a replacement dam. WAPDA's plea is also wrong that its design is ready. The design has become obsolete for many technical reasons and needs a fresh feasibility to prove its infeasibility. Moreover the raised Mangla that will give 3 maf of live storage would solve the water shortage problem. The country's water needs of more than 20 maf and the technical merits of Katarah requires General Musharraf in National interest to build the unique Katarah dam with out loss of time. Forced canvassing for the infeasible Kalabagh Dam project by the government to appease Punjab is against and not in national interest. It is binding on General Musharraf to get a second opinion out side of WAPDA.

Mr Shams ul Mulk and Mr Sardar Tariq the so-called representatives of Pakhtunkhwa (NWFP) in the technical committee of ANG Abbasi are not the nominees of the provincial government. Actually they are hand picked by the Punjab dominated center government to push through the controversial KBD. Therefore their views are biased and malafide. A serious question is that why Katarah was not investigated when it was pointed out in 1962 by Engr Fateh Ullah Khan and later on confirmed by Dr. Pieter Liefnick head of the World Bank team.

Why 31 years have been wasted by WAPDA, insisting on the building of Kalabagh without investigating other sites on the Indus. We demand that Katarah Dam's feasibility should immediately be given to some foreign firm, as WAPDA is biased and has failed to perform its basic duties. WAPDA should be reorganized and one member (Water) from each province be included in the authority to represent all provinces on the lines of IRSA.

Brief introduction of Katarah Dam

There is a spectacular, multi-purpose and the narrowest dam site on the Indus at the head of the gorge at Katarah located on the downstream of the confluence of three rivers, namely the Indus River, Shiok River and Shigar River. The dam site is about 18 km downstream of Skardu and would create storage in three gorges. Engineer Fateh Ullah discovered the dam site in 1957 by looking at the GTS maps later on he prepared a pre-feasibility report in April 1962. The population of Skardu was then about 4000. On his initiation, the President of Pakistan FM Mohammed Ayub Khan requested the World Bank to send its experts to identify dam sites in Pakistan and other water resources projects. In 1968, Dr Pieter Liefnick of the World Bank and his team identified Katarah dam site near Skardu among others and called it Skardu dam. Confusion is being created by calling Katarah as Skardu, the two different dam sites namely Katarah and Skardu are 22 km apart. Therefore both cannot be called Skardu. The World Bank Team fixes the site for Skardu Dam on the upstream of Skardu town. It is immediately located on the downstream of the confluence of Shigar River with Indus River where a gauge site has since been established for the purpose. At this location the height of Skardu Dam is fixed as 310 feet, length 3700 feet and storage capacity as 8 maf. For confirmation reference may be made to Dr Pieter Liefnick's report — pages 283 and 296. General Musharraf repeatedly urges for big dams and Katarah is really the Biggest Dam. Katarah dam would create a reservoir up to 35 maf, the largest in the world and six times larger than Kalabagh or Basha. It would be able to generate about 15,000 MW of power and would totally

regulate the highly erratic flow of the Indus essentially required for irrigation system in the Indus basin. It would control floods by conserving 35 maf of floodwater that escapes to sea as wastage on the average each year.

Katzarah dam site has an excellent "Capacity-inflow ratio" (CI ratio) in the entire reach of the Indus River valley, therefore its lifespan and service value can be about 1000 years as the highly erodible soil will be submerged and compressed by the 35 maf Katzara reservoir. It will also prevent downstream silt flow from the highly erodible soil of Skardu valley. In planning storage dams and reservoirs, the CI ratio is the most vital factor and the key for the selection of the best possible dam site on a river. On this vital ratio the life and the service value of storage dam depends. Besides this, silt flow at Katzarah dam site is nominal. In spite of all round merits, no one took notice of this unique dam site since 1962.

For information, Hoover dam named after President Hoover of USA at Lake Meade on Colorado River with a storage capacity of 28.5 maf creates is the largest reservoir in the world at present. Whereas, Katzarah dam would create a reservoir of 35 maf larger than created by Hoover dam.

Katzarah dam can irrigate a barren area of about 10 million acres on the Right Bank of the Indus River in the four provinces. If sprinkler method of irrigation is used, it can irrigate more than 20 million acres. A Right Bank Irrigation System would be created in the country. This project would economically result in a revolutionary development of land and water, bring pleasant change in climate and create healthy environment and its own ecosystem. This is because the vast desert-like areas would turn into green fields, orchards and forests. Moreover, the Indus basin irrigation system would get assured water supply free of dispute for all times. Katzarah dam can serve as replacement storage, development storage, inter-seasonal storage and carryover storage.

Fortunately, though by chance, the most wonderful aspect of Katzarah dam would be that the three inundation or flood canals namely Thal, Raine, and Kachi with a combine discharge of about 19500 cusecs or 14 maf now under construction would be made perennial. Presently, these flood canals would only run for 70 flood days and remain dry for the rest of 10 months a year.

Moreover, Katzarah dam would make up the inherent deficiency of $(117.35-105) = 12.35$ maf of water allocated in advance in para 2 of the Water Accord. Storage to make up this deficiency has not been created since 1991. This very factor assumed in advance of creating new storage has resulted in disputes on sharing the imaginary storage of 12.35 maf of floodwater.

In 1962, a proposal was submitted to create a Right Bank Irrigation System to the Federal Govt by Engineer Fateh Ullah Khan to build Katzarah dam, a barrage at Chashma on the Indus with a Right Bank Canal named All Pakistan Grand Canal to irrigate most of the barren right bank areas in the four provinces. Unfortunately, nothing was done to build this unique dam with unlimited benefits though as Chairman IRSA it was repeatedly requested by him to build it to implement the central paras 2,4,6,12 and 14(e) of the Water Accord.

It would take about 7 to 8 years to complete Kalabagh or Basha. By then, Tarbela and Mangla would have lost storage equal to the storage created by the new dam. Therefore, shortage of water and provincial disputes will go on and the new dam at Kalabagh or Basha would not be useful to help solve the water crisis. These dams will only serve as replacement storage and are not meant for the development of new areas.

Against unlimited, multi-purpose and all round advantages of Katzarah dam, the insignificant disadvantages raised by the supporters of Kalabagh dam is that Skardu, its airport and a few Km of road would be submerged. Wherever dams are built, inundation of land is unavoidable. But in densely populated and developed areas in case of Kalabagh Dam, which doesn't even serve its purpose, the matter is far more serious than the unpopulated, barren and remote area like the Skardu

valley that will be affected in case of Katzarah Dam. The planners, engineers and the economists should weigh all the advantages and disadvantages of each dam keeping in view the requirements of water, power, and food and of agricultural development of the future.