# KALABAGH DAM

## A GOLD MINE FOR PAKISTAN

Engr. Barkat Ali Luna
Former Consultant
to the World Bank

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اللَّهُ الَّذِي خَلَقَ السَّمَوَٰتِ وَالْأَرْضَ وَأَنزَلَ مِنَ
السَّمَاءِ مَاءً فَأَخْرَجَ بِهِ مِنَ الثَّمَرَاتِ رِزْقًا لَّكُمْ ۖ

وَءَاتَىٰكُم مِّن كُلِّ مَا سَأَلْتُمُوهُ ۚ وَإِن تَعُدُّوا نِعْمَتَ
اللَّهِ لَا تُحْصُوهَا ۗ إِنَّ الْإِنسَانَ لَظَلُومٌ كَفَّارٌ

(القران سوره ابراهيم)

**[Remember that] it is God who has created the heavens and the earth, and who sends down water from the sky and thereby brings forth [all types] of fruits for your sustenance.**

**And [always] does He give you the thing what you may ask of Him; and should you try to count God's blessings, you could never compute them. [yet] behold, man is indeed most persistent in wrongdoing, stubbornly ingrate!**

# ACKNOWLEDGEMENT

God Almighty has blessed Pakistan with numerous bounties. It is for the Pakistani people to explore such treasures and utilize their worth in building a glorious Pakistan. It is our misfortune that we have failed to acknowledge His blessings. We could not stand together, think together and work together and denied to reap the benefits of His generous gifts. Kalabagh Dam is one such mine of gold. We have been rejecting to accept it through multifarious excuses, non-truths and petty issues raised by its opponents who, as a matter of fact, can derive colossal benefits from its existence.

This Book exposes the shallowness and short sightedness of its opponents and brings to lime light the grace of this Nature's gift, removes all the dust surrounding it and presents this Dam as a pillar of glory for Pakistan. All non-truths have been exposed and the realistic facts and figures have been clarified.

In compilation of this Book, colossal help has been provided by eminent engineers and friends of the author. First of all, I express my heartiest gratitude to our well-known Engr. Shams-ul-Mulk who has glanced through the contents of this Book and appreciated it in writing its Foreword. He was Chairman Water and Power Development Authority (WAPDA) when Kalabagh Dam was designed under his supervision during eighties of the 20th Century and till today he has been narrating the attributes of this dam which is the best of all future dams that can be built on the Indus River. Highly valuable support was provided by Engr.

Muhammad Jabbar (ex) General Manager and presently Advisor (National Water Resources Planning & Development Programe) WAPDA who joined hands with the Author in correcting mis-statements from all quarters and providing correct data from WAPDA who conducted all studies by local and foreign consultants under its supervision. All Chapters of the Book were reviewed and updated by Engr. Muhammad Jabbar collecting information from WAPDA studies & files taking special interest in presentation of facts & figures related to the Dam. I am extremely grateful to him for the time and interest devoted by him in making this Book free of all doubts and dust surrounding the Dam project. Valuable suggestions and data were also provided by Engr. M.H. Siddiqui, Consultant to the Punjab Irrigation & Power Department and Engr. Khurshid Anwer (ex) Manager Attock Oil Company who have been in touch with all developments relating to the Dam Project. Many thanks are also due to my engineer friends like Ch. Mazhar Ali, Muhammad Afzal Cheema, Iftikhar Ahmed Malik & others who made valuable suggestions during review & improvements in various Chapters of the Book.

My special thanks are due to Mr. Rizwan Athar who worked as my Secretary during preparation & publication of this Book. I highly appreciate his untiring efforts in typing & retyping all the Chapters with the assistance of Mr. Muhammad Hayat Magray incorporating changes resulting from different suggestions and reviews and arranging the Book in its

proper order. Without his collaborating efforts, the publication of this Book would have not been possible. Being an intelligent young man, he shared discussions with me in incorporating useful suggestions in the text of the Book at various places.

May this Book open the closed doors of the opponents' minds and enable our future generations to derive the benefits that Nature has stored in the Kalabagh Dam Project.

**Engr. Barkat Ali Luna**
Chairman,
National Development Consultants (Pvt) Ltd/
Former Consultant to the World Bank

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# A GOLD MINE FOR
# PAKISTAN

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# FOREWORD
# KALABAGH DAM
# AN IRREPLACEABLE ASSET FOR PAKISTAN

After the successful political struggle led by Quaid-i-Azam, Pakistan came into being on 14th August, 1947. This was a political victory that had no precedence in the World. But another struggle was to follow soon, and it was a misfortune that a leader of Quaid-i-Azam's calibre was not alive to lead that struggle also. This strife was related to Pakistan's rights for the use of waters of the Indus River System. Water is not a commodity that like oil, gas or other natural resources could be either manufactured or imported. Water is life and that gives it its importance.

The Indus Waters Treaty was by no means a complete end to the water related issues for Pakistan. The first one that came into being was about Pakistan's need for a dam in addition to Mangla Dam which was the single dam provided in the Treaty for Pakistan. It was followed by identification of another dam. It would go to the lasting credit of WAPDA that in all such issues it was WAPDA that prevailed with the result that work on Tarbela dam was initiated. Pakistan was then in a stage of development that it was touted to be an emerging Asian Tiger. To maintain such a rate of economic growth the World Bank recommended the construction of Kalabagh Dam in early 1990s. All pre-construction work was completed by 1988, but the project did not move to active construction phase. This was the most grievous betrayal of the people of Pakistan.

The rulers of Pakistan did not suffer, but the betrayal weighed heavily on the people. A country on its way to be an Asian Tiger had become stuck far short of its potential destination. What has happened due to this blunder and its consequences of load-shedding, closure of factories & employment sources, water shortage for agriculture,

unusual high costs of energy, is horrendous and Pakistan faced the unfortunate knock on the doors of IMF as the only way to survive.

After giving a talk in National Defence University Islamabad on new challenges to Pakistan's water security, I was asked by one course participant if Kalabagh Dam was still an issue in Pakistan's water politics. I replied that it was not only an issue but a bigger challenge, because the dam at Kalabagh has been missed so far not for valid technical, financial or economic reasons. It has in fact become a monument of the triumph of falsehood over truth and reason (hopefully so far only) and any nation or a country which in bags of its history contains such monuments, would find it difficult to even survive, what to speak of making progress in a highly disciplined era of the 21st century. One does hope that the people of Pakistan would wake up to the realities. This book would go a long-way in creating that awareness.

The author of this book Mr. Barkat Ali Luna is a very well-known engineer with 63 years' experience in water related issues. When I started my career as an engineer he was already well-known as a very competent engineer. He was one of those who over-awed me with his knowledge. He has done great justice to the subject. Like all patriotic acknowledgeable engineers, he has presented a very convincing case for the construction of Kalabagh Dam. I am one of those who sincerely hope that his voice would be heard.

**Engr. Shams-ul-Mulk**
(Ex) Chairman
Water & Power Development Authority (WAPDA) of Pakistan
(Ex) Chief Minister of Khyber Pakhtunkhwa (KPK) Province of Pakistan

# PREFACE

## THE BEGINNING OF KALABAGH DAM

In 1960 Pakistan and India signed the Indus Waters Treaty (IWT) and work started on Mangla and Tarbela dams and related projects. But Pakistan was not satisfied as Tarbela dam was not going to be sufficient to meet the increase in demand due to the increase in population.

In a visit to Washington in 1963, President Muhammad Ayub Khan impressed upon the World Bank (WB) the need for a Development Plan beyond Tarbela Dam. WB set-up 'Indus Special Study' under international experts of repute. After three years they produced a report titled 'Development of Water and Power Resources of West Pakistan – A Sectoral Analysis'. WB claimed this study to be a long ranging model to be followed by experts in economics and engineering.

i) The report stressed that the benefits of water, power and flood control of Mangla and Tarbela dams would be fully committed by the year 1990 because of the increase in population and in the economic and social demands.

ii) If Pakistan wants to maintain its pace of progress then it must have a third large dam by 1992. And the preliminary engineering work on the dam must begin in 1977.

iii) This large dam should be Kalabagh dam (KBD) followed by Bhasha dam. This will give time to Pakistan to start the initial investigative and engineering work on the Indus and its tributaries.

This report was received by the government of Pakistan in 1967 and it was sent to WAPDA for implementation.

WAPDA started investigations in 1977 and feasibility reports on Kalabagh dam were prepared twice. Work was completed in 1988. World Bank Mission came to Lahore and expressed their satisfaction. However, by then the atmosphere had been vitiated by the propaganda of non-issues by the opponents of the dam.

It should be made clear that WAPDA was not advocating KBD under pressure from Punjab. If that had been so KBD would have been built before Tarbela Dam. In 1961-62, WB wanted to build KBD but WAPDA did not agree. Now that a large dam was required and WB again wanted KBD to be built, WAPDA agreed.

Pakistan has got the largest irrigation network in the World. The Indus River and its tributaries bring 137.8 MAF of water. On an average 83% of the water i.e. 114.7 MAF is available in the summer and only 17% i.e. 23.1 MAF is available in the winter periods. However, during the Kharif period demand for water is 79.1 MAF while the supply is 114.7 MAF, i.e an excess of 35.6 MAF most of which goes waste to the sea. The situation in the Rabi period is the opposite, only 23.1 MAF is available while the demand is 38.2 MAF i.e. a deficit of 15.1 MAF.

While excess of water brings floods which cause damage up to 20 billion Dollars as in the year 2010, shortage of water cuts down production of food crops. It has been learnt over the centuries that the only way is to store when there is surplus, for use when there is shortage. That is why 42 thousand large dams have been built the World over in the 20$^{th}$ century.

By not building KBD Pakistan is suffering a loss of 180 billion rupees per year. It should be noted that KBD would have produced 12 billion units of power annually at Rs. 1.5 per unit of electricity. Instead of paying Rs. 1.5 we have

been paying Rs. 16.5 i.e. Rs. 15 more per unit. 15 multiplied by 12 billion is 180 billion which is a huge amount being paid per year in electricity bills.

By not utilizing the full potential of hydel energy and limiting it to only 6,400 megawatts, more reliance has been put on oil and gas. In the year 2009, 48% of our power needs were met by burning gas. Gas reserves have started dwindling and gas is not available for textile, fertilizer and other industries and for other uses. Despite this, load shedding is going on, factories are shutting down, opportunities for employment are getting less, export earnings are going down and poverty is increasing.

The 21st century which is called the Asian Century and in which almost all Asian countries are prospering, Pakistan is the only Asian country which is facing serious economic problems. It is imperative that correct steps are taken for the betterment of the people. It is obvious that Pakistan has to prepare itself for its water security on an urgent basis. The situation of water availability will gradually become even more critical with approaching global warming, when the glacier melting will gradually reduce the inflow in the rivers particularly Indus. The construction of big reservoir to store water which is presently going into the sea is the most important step. It is obvious that a big reservoir which is the most feasible in all respects is through Kalabagh Dam, whose construction should be started immediately, followed as soon as possible by Basha Dam. **No wrongly placed political arguments should hamper the water security of the Country.** These Projects will also produce large hydropower and make these projects highly economical as well. The Book in your hands provides all details related to Kalabagh Dam which is no doubt a special gift of the God for the people in our beloved Country.

# Chapter 1

# KALABAGH DAM PROJECT

# A GOLD MINE FOR PAKISTAN

Kalabagh Dam Project site is 210 Km downstream of Tarbela Dam and 26 Km upstream of Jinnah Barrage on the River Indus. The Dam is located at the lower most end of the narrow and deep Attock Gorge on the Indus River. For effective river regulation and hydro-electric input to the national power system, it is the best location of a dam on the Indus, having a catchment area of almost 70% greater than that of Tarbela dam. The site of Kalabagh Dam is shown in Fig-1.1. A special feature of the project is that it is designed for mid level sediment sluicing every year to ensure that its live storage would be available for many generations. It is estimated that 3.2 MAF live storage will be available even after 100 years of operation. This site is the downstream most good storage site on the Indus which also regulates the Kabul & the Swan river flows and makes use of about 30 MAF of average monsoon flows. In wet years, the flow regulation/hydel generation would be substantially improved. Detailed designs & tender documents for this project were prepared but further action for construction has been withheld due to political considerations.

## 1.0 PRINCIPAL PROJECT DATA

The project envisages construction of 260 ft. high earth fill dam. With its maximum retention level at 915 ft. SPD, it will create a reservoir with usable storage of 6.1 MAF. The project has two spillways on the right bank for disposal of flood water. In the event of the highest probable flood, these spillways

will have a discharge capacity of over 2 million cusecs. On the left bank is the power house which will be connected to twelve conduits each 36 ft. in diameter, and have an ultimate generation capacity of 3600 MW. The Location of the Project near Kalabagh Town and its Layout is shown in Figs-1.2 & 1.3. The salient features of the Project are listed below:-

| | |
|---|---|
| INDUS RIVER AT SITE | |
| Catchment Area | 110,500 sq. miles |
| Maximum Observed Flood | 1,200,000 cfs |
| RESERVOIR | |
| Gross Storage | 7.9 MAF |
| Live Storage | 6.1 MAF |
| Dead Storage | 1.8 MAF |
| Maximum Retention Level | 915 ft. SPD |
| Minimum Reservoir Level | 825 ft. SPD |
| Area at Maximum Retention Level | 164 sq. miles |
| MAIN DAM | |
| Crest Elevation | 940 ft. SPD |
| Crest Width | 50 ft. |
| Maximum Height (above river bed) | 260 ft. |
| Length | 4,375 ft. |
| OVERFLOW SPILLWAY | |
| Sill level | 860 ft. SPD |
| PMF Discharge | 1,040,000 cfs |
| ORIFICE SPILLWAY | |
| Sill level | 785 ft. SPD |
| PMF Discharge | 950,000 cfs |
| INSTALLED CAPACITY | 3600 MW |

## PROJECT COST

The total project cost at September 2005 price level, including contingencies, price escalation and interest during construction, was estimated as US$ 6.124 billion. Implementation of the project was estimated to take about 6 years and the first power unit was to come into operation at short time. The time estimates are modified by the financial resources provided and the priorities of budget allocations.

## 2.0 KALABAGH DAM FUNCTIONS

The study of the Kalabagh Dam Project, was financed by the United Nations Development Programme (UNDP) and the Government of Pakistan (GOP). The World Bank was the executing agency while UNDP and WAPDA were the cooperative agencies.

World Bank has indicated the important functions of Kalabagh Dam Project as follows;-

a) To generate a large amount of low cost hydro-electric power close to major load centres and supply the existing power grid for meeting the growing power demand of domestic, agricultural and industrial consumers. The contribution would vary in different periods of the year.

b) To complement the reduction in the storage capacities of Mangla and Tarbela reservoirs which would get gradually depleted due to sedimentation.

c) To provide additional storage on the Indus, the biggest source of surface water supplies in Pakistan and thus provide better system control and management for supplying adequate and timely water for agricultural, industrial and domestic uses.

d) To regulate and control the extreme flood peaks of the Indus, the Kabul and the Swan rivers and alleviate flood damages downstream.

e) To provide irrigation facilities to new areas and substantially improve river supply to non-perennial as well as perennial areas in the Indus river system of canals.

f) This large reservoir on the river Indus would substantially increase Pakistan's capacity to regulate its water distribution for irrigation canals. The maximum retention level was reduced from 925 to 915 primarily to meet political requirements and to reduce the submerged area. This in turn has reduced the storage and hydel generation capacity and improvement in power generation systems through conjunctive use of Tarbela and Kalabagh Reservoirs and conjunctive water distribution and controls.

g) Reducing dependence on imported fuels and substantially reducing average power generation costs.

## 3.0 COLOSSAL BENEFITS

Kalabagh dam project after extensive national and international research and studies, is ready for implementation since 1988. However, it is painful to see that a vital project of national importance and of such a magnitude as Kalabagh Dam has been used by some of our leaders and political forces as an instrument of mud throwing and exploitation. Through insidious slogans, it has been driven into the sphere of fruitless and counterproductive debates instead of a sane and rational project plan aimed at formation of a development policy for the future. Political leaders and rivals in power production (IPPs - Independent Power Producers) with distorted knowledge about details of the project and its vision have been adding to the problem by jumping into this sad controversy for their narrow financial and political gains. If the Dam is not built, the Country will face colossal damages, some of which have been listed below under the heading "If Kalabagh Dam is not Built." Without doubt, we have already damaged and would further damage our own interests and of our future generations, if we do not build this dam soonest possible. Kalabagh is the best option that we have at the present moment for hydropower generation and to march ahead.

It may be noted that Kalabagh Dam has already proved its worth. It was scheduled to be completed in 1992 but we failed to complete it even by this date and are in the grip of very serious power crisis, crippling water shortages, monstrous floods,

collapse of industries and overwhelming majority of jobless population. Had we started and completed this dam by this time, we would have not faced the wrath of Nature for our lack of vision and the will to take timely decisions.

## 4.0 IF KALA BAGH DAM IS NOT BUILT – CONSEQUENCES

The following consequences shall have to be faced by the Nation:-

i) Population explosion will subject the economy to additional burden of importing food grains of 1.5 million tons, sugarcane 12.25 million tons, oil seeds 1.72 million tons and forages 60.22 million tons by the year 2025 with cost of Rs. 200 billion per annum.

ii) By the year 2020 loss of storage capacity of on-line reservoirs (Mangla excluded) due to sedimentation (=5.69 MAF) would result in increasing shortage of committed irrigation supplies causing serious drop in existing agricultural production.

iii) For implementation of Water Apportionment Accord 1991, new storages are essential. In its absence it would give rise to bitter interprovincial disputes, particularly in dry water years.

iv) The annual energy generated at Kalabagh would be equivalent to 20 million barrels of oil otherwise needed to produce thermal power. This annual import of fuel would cause an

additional burden of Rs. 100 billion per annum to the economy.

v) Thermal generation in the absence of low cost hydel generation would further upset the thermal-hydel mix in the system causing prohibitive rise in the power tariffs.

vi) Had the country built Kalabagh dam by this time, at least 20 billion units could have come from it at a very low rate of Rs. 1.5 per unit. The country could thus have an additional Rs. 220 billion from this source per annum.

vii) Growth of domestic industrial and agricultural sectors would be impeded due to high power cost. Industrialists have been shifting their industries to other countries due to severe impact of load shedding in Pakistan.

viii) Due to non-availability of enough fresh water, secondary salinisation of lands will become difficult to control and would seriously affect our crop yields.

ix) There is a fertile virgin tract of land about 850,000 acres in Bannu & Dera Ismail Khan districts which is 50 to 150 ft higher than the water level in the Indus River. This land can be brought under the plough by building the K.B Dam after achieving consensus among the provinces of Pakistan. The province of Khyber Pakhtunkhwa will lose a major development opportunity of agriculture & attendant facilities in this area in the absence of KB Dam.

x) Sindh will be the maximum beneficiary from the Kalabagh Dam. It would get additional supplies of 2.257 MAF from the stored supplies. Out of this 1.55 MAF may be provided for Kharif sowing & Kharif maturing, while the balance 0.707 MAF would be available for additional Rabi crops. With scanty rainfall & saline ground water over vast areas, Sindh will be worst hit, if the dam is not built.

xi) The province of Balochistan can use its 12% share of stored supplies equal to 0.732 MAF in Kachhi Canal and Patfeeder Extension which are being built at huge costs to develop new lands.

xii) Punjab has its share equal to Sindh i.e 2.257 MAF. This will recoup the supplies to the Sutlej Valley Canals which are diminishing due to sedimentation in Terbela & Chashma reservoirs.

xiii) If we calculate the cost of failing to build the dam for the last 15 years the total cost of failure works out to a horrendous amount of $40 billion, while the actual building of the dam will cost only $6 billion. Can someone justify this kind of folly?

## 5.0 KALABAGH DAM - A GOLD MINE FOR PAKISTAN

The list of benefits is unending. If assessed in monetary terms, Kalabagh Dam is a gold mine. In fact the ore material at a gold mine would finish over time, but the natural flow of the mighty Indus will never stop, and the multifarious benefits of

water & power from the Kalabagh Dam will be perpetual.

Remember; the availability of a proper dam site, a suitable reservoir, adequate river flows to fill the reservoir and fertile cultivable lands with potential human resources are generous gifts of the Almighty God and are not available to every country. Pakistan is fortunate in this regard. Let us thank God and make use of these gifts for the benefit of human beings who are struck by poverty. We have to exploit every available good dam site.

In case we continue to ignore such gifts, the Creator of this Universe warns us of fatal consequences. The Holy Quran states these consequences as below:-

وَلَا تَكُونُوا كَالَّذِينَ نَسُوا اللَّهَ فَأَنسَاهُمْ أَنفُسَهُمْ ۚ
أُولَٰئِكَ هُمُ الْفَاسِقُونَ (سورہ حشر آیت 19)

(Don't become such people who forget the God Almighty, because God then makes them forget their ownselves and they become the rejected people).

Who are the people who forget their own selves: those who do not understand their own benefits, their own interests, their own welfare and the needs of their kith and kin and of the future generations. Certainly we are destroying our own interests and increasing the poverty of a vast majority of population in Pakistan.

A couplet of a Sindhi Poet (Shah Abdul Latif Bhitai) narrated by a Sindhi Engineer during a discussion on Kalabagh Dam very aptly describes the situation we are facing by the denial of Kalabagh Dam.

رب رُسّے تے مت گھسّے ھنیں نہ ھتھیار

اھڑی کرائیسی کارُ جھن میں جوکھو جی جو

(When God is annoyed, He distorts the minds of people. He does not pick up any weapons to kill the people, but pushes them to a track of their own misery & disrepute).

Beware, this is a serious warning from the Almighty and we cannot escape it. We are already caught in His trap and are sinking deeper & deeper. Let us consider and adopt the ways to seek His forgiveness or else we will perish in dishonor.

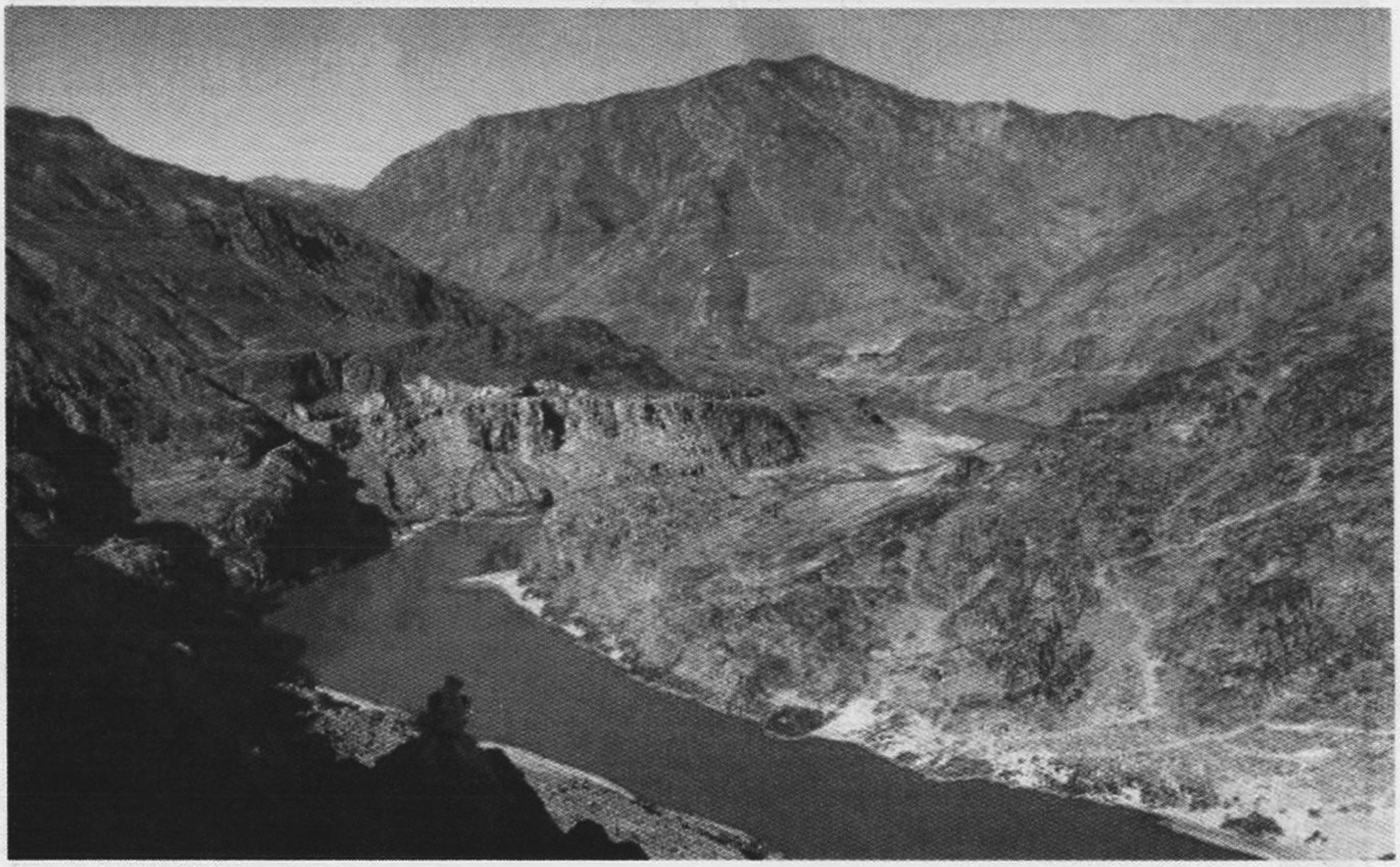


**FIG-1.1: KALABAGH DAM - PROJECT SITE**

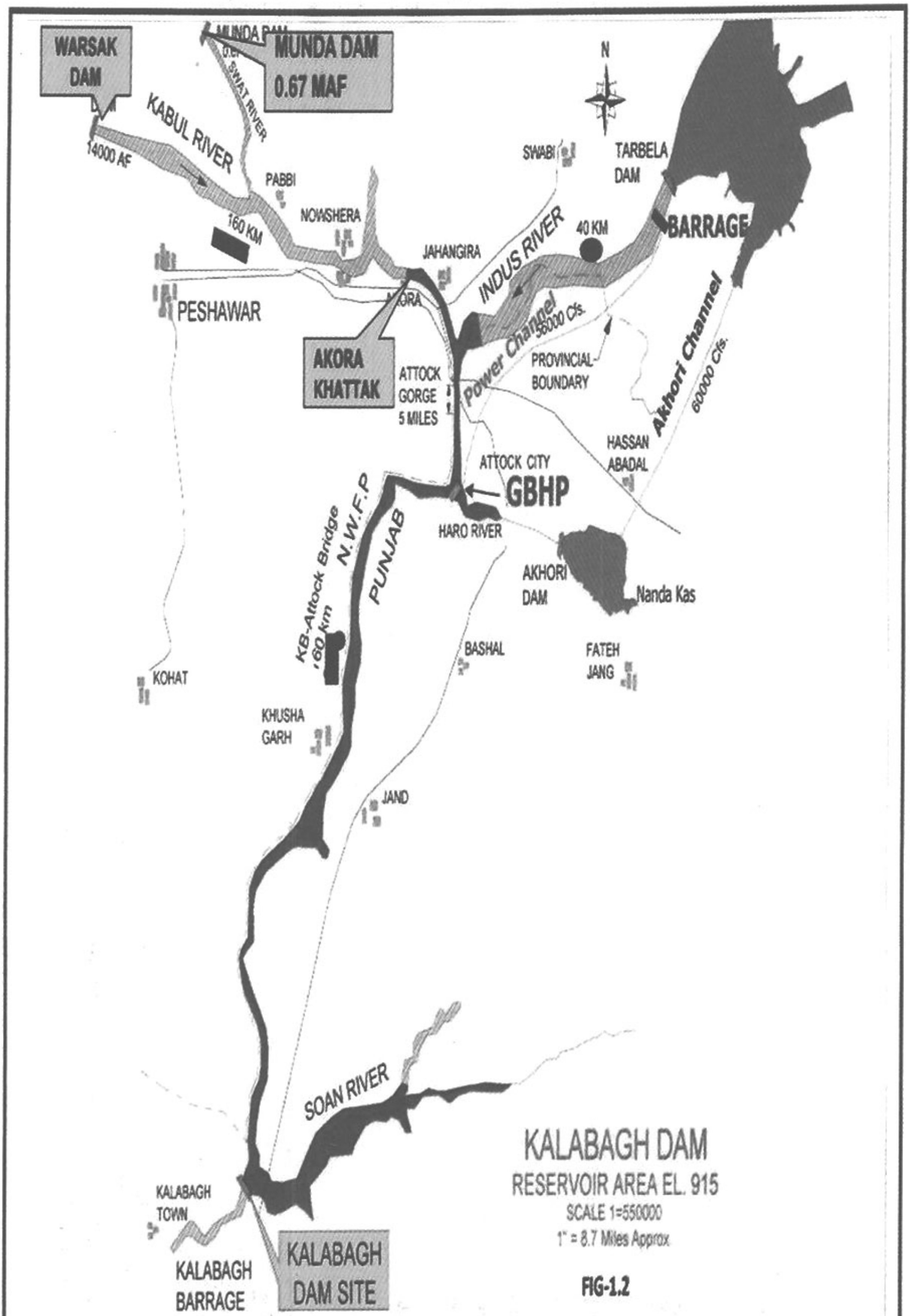
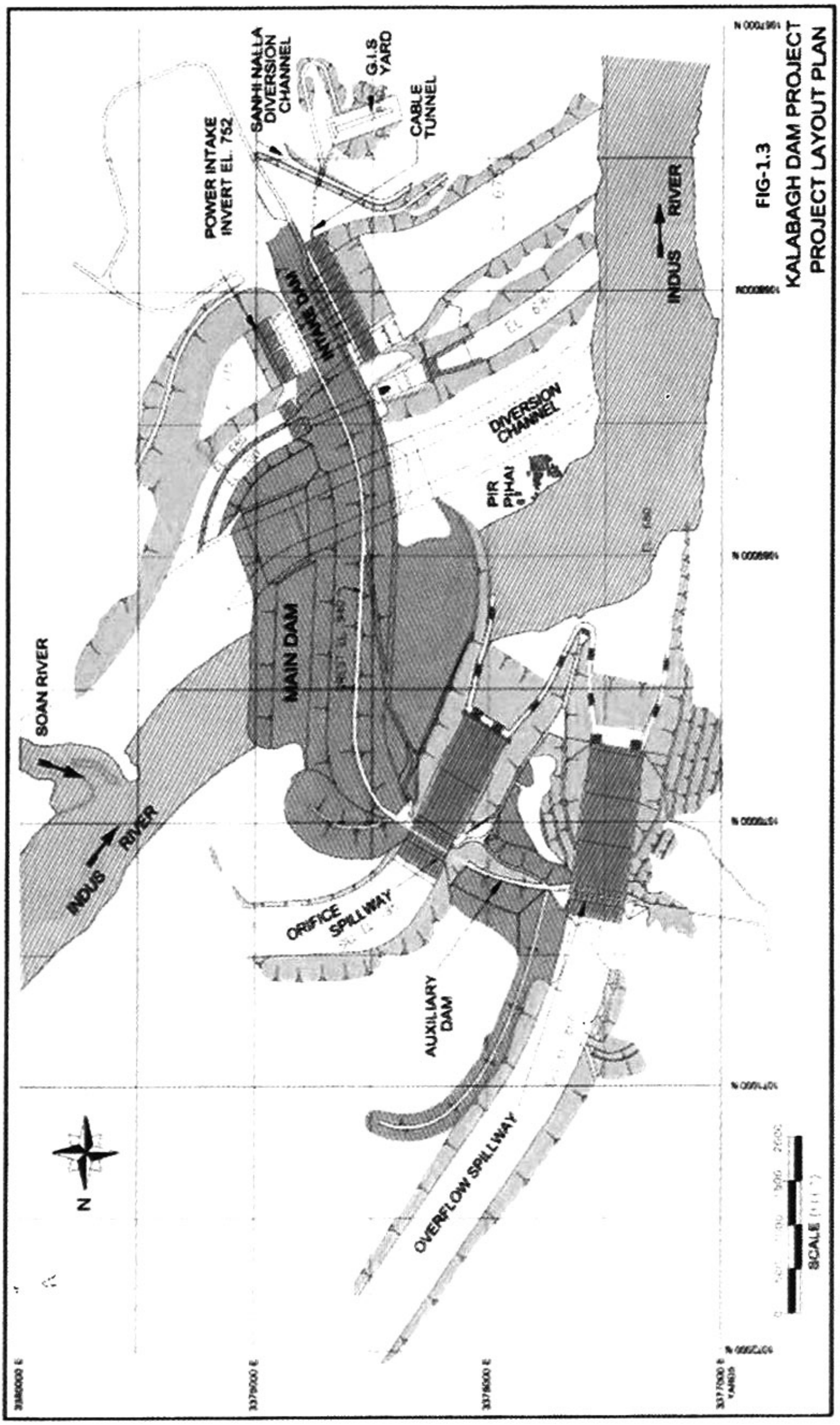

WARSAK DAM
MUNDA DAM
0.67 MAF
SWAT RIVER
KABUL RIVER
14000 AF
160 KM
PABBI
NOWSHERA
JAHANGIRA
PESHAWAR
AKORA KHATTAK
ATTOCK GORGE 5 MILES
N
SWABI
TARBELA DAM
BARRAGE
INDUS RIVER
40 KM
Power Channel 360000 Cfs.
PROVINCIAL BOUNDARY
Akhori Channel 600000 Cfs.
HASSAN ABADAL
ATTOCK CITY
GBHP
HARO RIVER
KB-Attock Bridge ,60 km
N.W.F.P
PUNJAB
AKHORI DAM
Nanda Kas
BASHAL
FATEH JANG
KOHAT
KHUSHA GARH
JAND
SOAN RIVER
KALABAGH TOWN
KALABAGH BARRAGE
KALABAGH DAM SITE
KALABAGH DAM
RESERVOIR AREA EL. 915
SCALE 1=550000
1" = 8.7 Miles Approx

FIG-1.2


KALABAGH DAM PROJECT LAYOUT
FIG-1.3
KALABAGH DAM PROJECT
PROJECT LAYOUT PLAN
POWER INTAKE
INVERT EL. 752
SANHI NALLA
DIVERSION
CHANNEL
G.I.S
YARD
CABLE
TUNNEL
MAIN DAM
DIVERSION
CHANNEL
PIR
PIHAI
INDUS
RIVER
SOAN RIVER
INDUS
RIVER
MAIN DAM
ORIFICE
SPILLWAY
AUXILIARY
DAM
OVERFLOW SPILLWAY
N
SCALE

# Chapter 2

# PAKISTAN BEING PARALYZED BY WATER AND POWER DEFICIENCY

## 1.0 PAKISTAN – A WATER DEFICIENT COUNTRY

Due to complete stoppage of any sizeable surface water resources development after full commissioning of Tarbela Dam during 1976 even sustainability of existing irrigated agriculture is in serious jeopardy. The Country is facing serious water shortages for agriculture to meet the food and energy requirements of the burgeoning population. The population of 32.4 million in 1948 increased to 154.6 million in 2005 and is estimated to increase to 221 million by 2025. Even a conservative estimate would indicate that it may have increased to 190 million by this time.

Pakistan is mostly an arid region. Precipitation is scanty and crops cannot grow without irrigation. Surface water is used for irrigation through an extensive irrigation system in the Indus plain where rivers are the primary source of water. The river flows however, in Pakistan are in two distinct seasons i.e., Kharif (summer) and Rabi (winter). The river flow data shows that in Kharif season about 84% of the flows occur while in the Rabi season only 16% of the annual flows occur. The crop water requirements are about 60% in the Kharif Season and 40% in the Rabi season. Thus there is a large disparity between the water availability and the irrigation requirement in the Rabi season. In view of the indicated shortages of water in the Rabi season, it is not possible to have the required quantity of water available for irrigation at the required time. For getting optimum production from the crops it is essential that the water for irrigation is available when it is needed.

Pakistan is highly deficient, as far as existing water storages are concerned. Out of total flows of the Indus and tributaries of 140 MAF, the present live storage capacity in Pakistan is hardly 11.77 MAF which is only 8 % of the total annual flows. The storage capacity in Aswan Dam (Egypt) is 132 MAF which is 350% of the annual flow of the Nile River. In Pakistan about 1040 MAF of water has gone to the Sea unutilized during the last 34 years. **Our failure to construct more storage dams after completion of Tarbela reservoir in 1976 is imposing heavy penalties and constraining the economic growth significantly.**

These plain facts demonstrate how short-sighted Pakistan has been in the utilization of even its limited water resources. If the present inaction of development of national surface water resources continues, Pakistan would be faced with innumerable socio-economic problems in the coming years. To avoid food shortages and economic disaster during the coming years, remedial measures are required to be taken up immediately. The Country does not have much time available now and the Government must convince itself and the federating units as to what is essential, in the coming years, for the economic safety and survival of Pakistan.

The recent ECNEC approval of the multi-billion dollar Diamer Basha Dam (DB Dam) straddling the Indus on the borders of the Northern Areas and the NWFP has raised the hope for starting work on the first mega storage project after 34 years since the Tarbela dam. After the completion of Diamer Basha, it is expected to produce about 4500 MW of electricity. So robust a generation capacity will certainly go a long way in relieving the country's growing energy crunch. At the same time this Dam would also help to tackle

some of the irrigation requirements of the four Provinces. However the building of this Dam presents a number of likely engineering, environmental and cultural challenges. The project will flood 59 miles of the Karakoram Highway (KKH) and would submerge prehistoric rock carvings in the Northern Areas in addition to disturbing the ecological balance of the northern Area. For transportation of construction material, heavy machinery and equipment to the Dam site, 203 miles of KKH (Havellian to Dam site) will need to be rehabilitated/up-graded prior to start of the Project construction. Construction & maintenance of high voltage transmission lines from the Dam site to the load centres will involve high costs and the associated high risks have to be suitably investigated and remedied.

Due to continuous capacity loss of our on-line storages there are now cries against water shortage all over the canal commands. Furthermore public is feeling crushed by very high energy tariff of IPPs thermal plants. Expensive electricity is a serious constraint to agriculture and industrial expansion and low cost hydropower would provide a relief.

**Consequent to increasing irrigation water demand and decreasing supply, serious disputes would arise between the provinces on the sharing of a scare resource particularly in the critical sowing periods of Kharif and Rabi.** This is already happening between Sindh and Punjab with increasing frequency. There are likely to be water conflicts within the provinces as well as disputes may arise among the upper and lower shareholders on the same canal. Water scarcity could thus be damaging not only to agriculture of the provinces but also to inter provincial harmony. This could lead to wide spread socio-political

unrest in the Country. **In order to mitigate adverse impact of emerging water shortage and resulting food and energy crisis, there is an urgent need for construction of at least one more large dam immediately.**

The large Kalabagh Dam multipurpose storage project which is lying ready for implementation since 1988 can be constructed in a short period of 6 years. Kalabagh Dam (KB Dam) had been planned to come on line by early 1992 after extensive investigations and planning since 1954. The project planning studies, detailed designs and tender documents were prepared by a joint venture of five high level engineering firms, with funds provided by the UNDP. The World Bank supervised the studies in the capacity of Executing Agency. **KB Dam has been found to be the best option, the quickest vehicle for harnessing water and hydel resources and a project whose construction could be undertaken immediately, as all its basic documents have since been finalized.** Only international tendering is now needed to be done and once that process is started, construction could be taken in hand soon after. The total cost of the Project was worked out as 6.12 billion US $ in the year 2005 and construction process can be taken in hand without any further delay.

In the face of growing water shortages and energy crises which are at alarming stages all over Pakistan, viable alternative for increasing supplies is the construction of Kalabagh Multipurpose Project. Any delay in the construction of ready-to-build KB Dam, could have far reaching adverse ramifications not only economically but socio politically as well. Water scarcity and lack of cheap hydro energy would constrain agriculture as well as industrial production. There would be need of much larger

wheat imports. Foreign exchange earning potential of exportable crops such as cotton and rice and industrial products would be substantially reduced. With meagre foreign exchange resources and loss of potential of increase in exports, heavy food grain imports would considerably add to our already spiraling external debt and economic problems.

## 2.0 PAKISTAN – A POWER DEFICIENT COUNTRY

DB Dam and KB Dam are not mutually exclusive. Infact, both are indispensable for meeting the growing water & power requirements of the Country. It must be emphasized that there is no alternative to Kalabagh for providing the hydropower (3600 MW) and irrigation water (6.1 MAF) in the coming years as no hydropower project has reached the construction and implementation stage while Kalabagh has reached since more than 25 years ago. Kalabagh Dam would generate sizeable cheap hydropower and thus check the excessive tariff increases due to large scale induction of costly thermal power.

It is high time the government should start undertaking the long awaited steps to accomplish the vital tasks in respect of KB Dam. Topping the list of these vital tasks is the delicate and political challenges of forging national consensus. Regrettably, no active steps appear to have been taken so far. Even if accomplished, consensus would need to be followed up by efforts to raise funds for a project investment of around 6 billion dollars. The fund raising task would need the blessings and support of the international donors, in particular, the World Bank and the Asian Development Bank. Success in these tasks would, in a large measure, depend upon the findings and recommendations of the studies, which would need to be conducted by

independent international experts and address the concerns regarding the social and environmental impacts of the project.

For the Kalabagh project to be fully completed with all of its planned power units of 3600 MW commissioned by 2025, the construction would need to commence by the year 2019. To meet this deadline, the Government needs to initiate immediately the activities for undertaking of the above mentioned vital tasks. This programme would demand that the required social and environmental impact studies may be completed by end of 2017. Necessary administrative and financial arrangements for studies by independent international experts would need to be made soonest possible to meet the deadline.

In the din of politicking that has, unfortunately, surrounded the Kalabagh project, its important potential, (hydropower generation) has been overlooked. The present day shortage of power in Pakistan is of the order of 4000-5000 MW which can be relieved substantially by 3600 MW generation at the KB Dam. Once on line, its power station would go a long way in meeting the needs of expanding industries and agriculture and bringing down the Country's overall cost of power production. **That would make it possible for the government to effect a sizeable reduction in the power tariff. At present, the consumer, whether domestic, agricultural or industrial, is paying through the nose.** With the high cost of electricity our agricultural produce is at a great disadvantage in the international market, our industries would find it hard to compete once the WTO regime comes into force. The cost needs to come down substantially to pave the way for economic development.

There is a common slogan that KB Dam should be built after developing consensus of all Provinces, but nothing seems to be happening to develop this consensus. On the contrary, the present governmental approach is in a way to shelve the project. The delay, in addressing and resolving the objections against KB Dam at the political forum, like resolutions of Assemblies is harmful. **The need of additional water and power is so vital to our survival that all out efforts should be made to iron out the differences among the four Provinces.** As a nation we need to be educated by experts on the vital need of additional storages. Instead of making unbalanced political statements, we should have frank and open debates on TV and public seminars where the pros and cons may be discussed thread bare so that a national consensus may be developed. For this purpose, we need to create a special cell in WAPDA or the Ministry of Water & Power for arranging such activities on a regular basis for creating an atmosphere for consensus leading to the start of construction work on the vital KB Dam.

# Chapter 3

## PAKISTAN LOSING WATER WAR

Pakistan and India have always been in a competition in all fields but storing water is an area where, apparently, Pakistan is being outrun by India. The neighboring country has set up many dams as a result of which the surplus flood water is stored and used as and when needed. But, in Pakistan dams have not been given due importance and resultantly, it has to blow up embankments to save cities during flood seasons and reconstruct them afterwards. The cycle is being repeated almost every year and most of the national exchequer is eaten up in this exercise.

### 1.0 Indian Position on Dam Construction & Hydel Generation

1.1 After the Indus Waters Treaty, signed in 1960 between the two countries with World Bank as the arbitrator, India got about 33 Million Acre Feet (MAF) water: River Sutlej 14 MAF, Bias 13 MAF and Ravi 6 MAF. Three major dams and hydropower stations with the water storage capacity of 14 MAF were established on the eastern rivers and besides generating thousands of mega watts of energy India irrigated about 137 million acres of lands.

1.2 Data collected in this connection show that India not only controlled the floods but also utilised the flashing floods for constructive purposes, whereas, Pakistan failed to do so and had been facing famine and floods. The Indian dams benefitted four provinces, including Eastern Punjab 4.22 MAF, Rajasthan 8.60 MAF, Haryana 3.50 MAF and Occupied Jammu and Kashmir 0.65 MAF.

1.3 The Bhakra Dam on the Sutlej has a storage capacity of 5.60 MAF and could generate 1325 MW, besides irrigating 17 million acres. Pong dam on Beas River has a capacity of 5.91 MAF and can generate 360 MW; Thein Dam on Ravi River has a storage of 2.65 MAF and generation of 600 MW. Many other dams with storage and power generation capacity are under construction on these rivers.

1.4 In India, many hydel power generation projects worth 25,556 MW have been completed and some are under construction such as Tehri Dam 2400 MW, Karcham Wangtoo Hydroelectric Plant 1000 MW, Nathpa Jhakri 1500 MW, Chamera Dam 1071 MW.

1.5 Besides developing a centralized irrigation system, India established hydro flood control system. It constructed 640 km-long Indra Gandhi Canal, irrigating deserts in northwestern and western Rajasthan, which carries water from the Beas and Sutlej rivers in the Punjab.

1.6 India used every drop of water and enhanced its hydel as well as agri-production and stands high enough to export crops to its western neighbours.

## 2.0 Pakistan's Position on Dam Construction and Hydel Generation

2.1 The causes for floods on both sides of the boundary line may be the same but the way both the countries dealt with the disaster is different altogether. Water experts, studies and data reflect responsibility on the Indian side, but on the contrary criminal negligence on the Pakistan side.

2.2 Pakistan got about 142 MAF water after signing the Indus Waters Treaty in 1960 and built only two major reservoirs till 1976: Tarbela and Mangla with total capacity

of 14.262 MAF. Let alone the paper work, feasibility report preparations and lip service, Pakistan could not add a single big reservoir to meet escalating irrigation and power needs. Water experts are on the same page on the issue that the criminal negligence on the part of our rulers led to floods, load shedding and famine in the country. The barren lands in Pakistan are averaging around 22.5 million acres, owing to scarcity of river waters.

2.3 Though Pakistan needs many hydel power dams, it badly failed to construct any big water reservoir. In 1977, Federal Flood Commission was established to ensure effective management of flood hazards countrywide, to help in overall water management at national level and to encourage hydropower development. But it appears to have failed in achieving any progressive step.

2.4 According to official data, an average of 30 Million Acre Feet (MAF) of water is going down the sea every year from Kotri Barrage. Calculations by Financial Experts indicate that one MAF of water, if utilized properly, can easily add 1 to 1.5 billion dollars to the national economy, though average gain rate from one MAF water is around 2 billion dollars. The total annual loss comes to around 50 to 60 billion dollars, given the fact that we are wasting 30 MAF of water annually.

2.5 Three provincial assemblies stand united together to pass resolutions against the construction of Kalabagh dam, but no one questions why poor are always the victim of every flood. No one questions implementation of the Flood Commission report that clearly mentions the negligence of the elites. This report, besides initiating action against the responsible, had recommended that the entire concept of flood-fighting relating to embankments needs to

be revised. The existing plan, from yesteryears, would not serve the purpose, it said.

2.6 Had the responsibility been fixed, the disasters in the repeated floods would have been minimized. It needs a serious thought that the opponents of Kalabagh dam and other reservoirs are responsible for the repeated damage to lives, crops and houses in Pakistan.

## 3.0 General Public Kept in Darkness

3.1 We should stop deluding ourselves that it is Indian agents who are opposing Kalabagh dam. Did not a political leader say that Sindh would become a desert if Kalabagh dam was built? It is our own politicians who have misled our people. We have to convince the people with facts and figures that no such thing will happen; on the contrary nothing can save Sindh from becoming a desert if Kalabagh dam is not built. The media must carry out investigative reporting to get the facts and figures from the experts. If we keep skirting around this issue Kalabagh dam will never be built and we will keep losing the water war no matter how many small dams we build.

3.2 It is for the editors, the columnists, the letter writers, et al to tell the people that dams are built all over the world to overcome water shortage, not create it. We have managed to survive without any increase in supplies for the last 38 years while the population has increased from 4 to 19 crores — how many more years are we going to survive on the same 105 million acres feet of available water while 22 million acres of arable land is still undeveloped. Approximately 80 per cent of this land is in Sindh. We are depriving ourselves of water and agricultural

improvement. No one sane will do what we are doing to our own country.

3.3 For purely ulterior motives the country was put on the thermal path to the total exclusion of the hydel potential. The energy mix was put on its head. From 70:30 hydel to thermal, it became 70:30 thermal to hydel. Oil at $10 per barrel one day had to go upto $100 per barrel someday. Today we have inadequate power at very high rates which is tantamount to not having any power. Not only our factories and our homes are in darkness, but there is darkness in our thoughts also which is finding expression on the streets. On top of that no water has been added to the kitty for the last 38 years, yet we call ourselves an agricultural country. In-fact we have been forced to import food from our neighbouring Punjab, which on the other hand is feeding all other Indian provinces, something which our Punjab also used to do before water was taken away from it.

3.4 Regarding the Water for Irrigation, the farmers do not have adequate water to irrigate their fields because whatever water is available is being usurped by the influential lot and the lower level people have to migrate. Unfortunately, this is the story of people all over Pakistan, who are facing scarcity of water. The amount available per person has reduced drastically over the years because of increase in population and because we are not storing any water.

Let us say for example, that a man has a fixed income which is sufficient for him at present, he might not be in the same position when the size of his family increases. The size of the Pakistan family was 8 crore, when our second dam was built and our rivers with the two dams started giving us 105

million acre feet of irrigation water (one MAF is one foot of water standing over one million acres). Now after 38 years, the size of our family has increased to 19 crore, but we still have the same fixed income in terms of water. Should it then be a surprise that there are severe shortages all around, of drinking water, of water for irrigation, of water for industry, of water for power generation? Only a third mega dam can increase the 105 MAF that we have been managing with for the last 38 years. Small dams will not fill the huge gap between supply and demand, Dasu dam will not give us any water, Basha dam has many physical hurdles to cross and will take many years to deliver. The only dam without any physical hurdle is Kalabagh dam.

3.5 Tarbela dam was commissioned in 1976 when nobody could have thought about Kalabagh dam. It was under Gen. Zia during 1980 that consultancy work started on the Kalabagh dam by local, foreign and World Bank consultants and continued till 1986. Work also proceeded alongside on buildings and roads infrastructure. According to the Punjab irrigation department, international tenders were about to be floated when the project had to be put on the back burner because of a controversy arising on the political front.

The historical 'Water Apportionment Accord' signed by all the provinces, gave many concessions to Sindh, including an increased share in all future dams by reducing Punjab's share, equal share for both despite Punjab having a much larger area under cultivation.

3.6 Kalabagh site is an ideal location for a mega dam which will benefit the whole country. It may be mentioned that only a dam at this site can utilize the copious flows of the tributaries of the Indus, namely Kabul, Chitral, Swat,

Kurram, Siren, Haro and Soan, as well as trap its own flood water. South Punjab, Sindh and Balochistan will keep suffering from floods from these river-sized tributaries until Kalabagh dam is built.

# Chapter 4

# PERCEIVED ILL EFFECTS ON THE ECO SYSTEM DOWNSTREAM OF KOTRI BARRAGE

## 1.0 CONCERNS OF SINDH – STAGE–I

As a part of the controversy on KALABAGH DAM, a number of apprehensions were expressed by Sindh at the early stage. Most of these objections were based on lack of information. In addition, there were reservations in the minds of some quarters without any strong reasons. The project was thoroughly reviewed and revised/modified to address these apprehensions which in the past may have been a factor in blocking the start and implementation of Kalabagh Dam Project. These reservations on the proposed Kalabagh Dam launched a National dialogue on the possible effects of upstream storages on the present ECO-System downstream of Kotri Barrage. Different views were presented by different people and the issue got greatly politicized. It is imperative to place the facts and non-facts about the issue before the profession and the public which are abstracted in this chapter. It may be specifically mentioned that the storage at Basha and other upper storages on the Indus System have invited no such objections although their impact is no different than that of the Kalabagh Dam and in some cases even more harsh.

The ecological disciplines which can possibly be affected in Sindh area downstream of Kotri Barrage by construction of upstream storages on the Indus River are the following:-

- Sea Water Intrusion
- Mangrove Forests

- Fisheries
- Riverine Forests
- Riverine Irrigation
- Domestic Water Supply
- Sailaba Cultivation in the Riverine Area.

The impact of Kalabagh Dam on the above disciplines was analysed in a detailed study conducted by a consortium of local & foreign Consultants. This study revealed that the apprehensions expressed by the people in Sindh and others who oppose the construction of Kalabagh Dam on the Indus River are mostly the result of lack of knowledge and unrealistic assumptions. It highlighted the urgent need for informing the people in general about the facts and non-facts as well as real issues and non issues about Kalabagh Dam. These issues and aspects are briefly explained below. The Technical Committee on Water Resources which comprised eight top experts, two from each province submitted their findings and recommendations (year 2003-2005). It was stressed that construction of dams on the Indus is a viable option for Pakistan to enable transfer of Indus river waters from summer high flow season to winter and from wet years to dry years. Kalabagh Dam is the first upper dam project which can store the monsoon flows of the upper reaches of the Indus.

The findings of the detailed study by the Consultants are given below:-

## 2.0 SEA WATER INTRUSION

### 2.1 Possible Effect on Groundwater

The Sea tides rise and fall into the Indus estuary twice daily.

Their height varies with the changes in moon rise and fall. This phenomenon can possibly affect the Tidal Delta Area in two ways; (i) the Sea water seeping from the estuary may render the ground water saline and make it unfit for irrigation and drinking purposes and (ii) it may cause salinity in the soil above the ground water and render it unfit for growing any crops.

As far as no. (i) is concerned, the ground water in the entire reach from Kotri to Sea (174 miles) is heavily saline and hazardous for irrigated agriculture and drinking purposes. Proof of this fact is available in the records of the PC-I Proforma of Kotri Barrage Project and Field Investigations Report prepared by Master Planning Division of WAPDA (1979) in the command area of Kotri Barrage. This ground water was saline even when for centuries in the pre-canal era, the entire flow of the Indus River and its five tributaries (182 MAF per annum) flowed through this reach. It has remained saline even to a higher degree after the flow of three eastern rivers (33 MAF) was taken away by India and also after the Indus Basin Canal system withdrew 105 MAF of water from the rivers. It will not be affected if another 6.1 MAF is stored by the Kalabagh Dam Project. A saline groundwater which could not improve with the annual river flow of 182 MAF running over centuries, would not materially change if about only 6 MAF are stored at Kalabagh Dam and to this extent reduced flow in the river channel flows in future. This area would also get periodically flushed by high floods.

## 2.2 Possible Effect on Soil above the Groundwater

Regarding any effect on the soil above the groundwater there is no flow downstream Kotri during the winter season and early Kharif period of about 8 months every year.

During this period the tidal waves rise and fall unchecked in the Indus Tidal Delta and the soil above the ground water attains maximum possible salinity and is therefore unfit for sowing any Rabi crop. The storage in the Kalabagh reservoir can be useful for mitigating this salinity, because some stored water can be continuously released from the Dam for flushing the river channel and this has been studied and recommended as reported in the last paragraph (No. 8) of this chapter.

During summer however, no crops are grown in the riverine area due to the possibility of flood inundation at any time. It is, in fact, primarily due to this reason that at present no irrigation is practiced in the Indus Active Delta. It may be realized that under such circumstances Sea water intrusion would not be a cause of concern.

It may also be mentioned that apart from the Indus Active Delta there are numerous creeks/estuaries along the shore line from Karachi to the Indian Border. Sea tides also rise and fall twice daily in these estuaries, but no problem due to Sea water intrusion ever existed in these areas. Therefore sea water intrusion is not an active factor to be considered as a cause of concern.

## 3.0 MANGROVE FORESTS

Mangroves are bushes and sub-trees which grow along tidal estuaries in salty marshes and on muddy coasts and characteristically have exposed supporting roots in large numbers. Due to their thick root system at the bottom, they dampen the velocity of tides and provide a spawning ground for the fish as shown in Fig-4.1. They can survive long periods in high salinity but occasional dilution of sea water with fresh water is needed for them to flourish.

Periodic high floods provide the required flushing.

The total area under mangrove forests is about 321,510 acres which is spread over the shore line from Karachi to the Indian Border. The photograph in Fig-4.2 taken from the satellite imageries shows (in pink colour) the distribution of mangrove forests as well as the Indus Active Delta in the center. It would be noticed that there are thick mangrove forests from Karachi to the Active Delta and from Active Delta to the Indian Border. In the Active Delta area mangrove forests are hardly 7,400 acres or only 2.3% of the whole mangrove forest area. This is not a significant figure to influence any decision.

## 3.1 Development of High Salt Tolerant Species of Mangroves

During the 19th century, Indus River had more than 12 branches in its delta area (Fig-4.3) covering the shore line from Karachi to the Indian Border. As a result, flood discharge used to spread over the whole area from Karachi to the Indian Border. With the development of human settlements, the Government of Sindh (GOS) constructed flood bunds along both sides of the Indus River which stopped inundation on both sides (see Fig.4.4). Supply of fresh water was thereby totally cut-off on both sides of Indus Delta towards Karachi and the Indian Border but inspite of that mangrove forests are thriving on both sides of the delta.

In the Indus delta, 8 species of mangroves have been recorded in the past. Of these, only 2 or 3 are flourishing now, of which one *(Avicennia marina,* local name *timer)* now comprises more than 95% of surviving bushing and trees. Reduction in or stoppage of river flow, and

consequent increase in salinity, is the principal cause of extinction of other mangrove species in the Indus Delta which were less tolerant of high salt concentrations. Currently most abundant species, *Avicennia marina,* is the most salt-tolerant. It can tolerate high salinity even up to 85,000 ppm while the Sea water Salinity is upto 35,000 ppm. The impact of storages is therefore, not considered significant.

## 3.2 Effect of Forest Management Measures

The larger blocks of mangroves located towards the Karachi side and on the Indian Border side are under the control of the Sindh Forest Department which exercises management control over growing and exploitation of the mangroves. These large areas are considered as protected forests where the Sindh Forest Department grows young plants, takes their care and protects them from cutting and grazing. Consequently the mangroves are thriving in these areas.

However, the area surrounding the mouth of the Indus (Active Delta) has the lowest density of mangroves (7400 acres only). This area is in theory controlled by the Central Board of Revenue because it used to be cultivated with red rice, when the Indus flowed at higher levels. It is obvious that a combination of no control and land clearance for red rice cultivation have contributed to decimation of the mangrove stands in this area. This situation has resulted in virtually no forest control management, no planting of new trees & no care. Increased cutting and grazing have continued in the area. If the high salt tolerant variety *Avicennia marina* is grown in this area and forest management measures are adopted, mangroves in the Active Delta area can thrive the same way as they do on the Karachi side and on the side of the Indian Border. Reduction

in the river flows is not the significant factor.

## 3.3 Occasional Dilution of Sea Water with Fresh Water

It can be argued that on the Karachi side and on the Indian Border side, some fresh water (or less saline water) is brought to the shore line by lower Indus drains. These drains do bring less saline water (than the Sea water), because the underground water is saline; but the Indus River, its two main branches, the Mutni and the Ochito rivers and their creeks also bring seepage water to the Indus Delta area during the winter, besides large supplies of flood water during the summer. The obvious reason for extinction of mangrove forests in the delta area is heavy cutting of trees and lack of forest management. This area should be placed under the control of the Sindh Forest Department and treated as a protected forest area. If these measures are adopted and the high salt tolerant variety *(Avicennia Marina)* is planted, thick mangrove forests are likely to grow and flourish in the Active Delta area.

The assumption of adverse effect on mangrove forests as a result of the construction of Kalabagh Dam would have a minor influence and is a non-fact. It is a non-issue and cannot be a significant factor or a basis against the construction of Kalabagh Dam Project. The impact of Kalabagh Dam alone would be of no consequence.

# 4.0 FISHERIES

## 4.1 Palla Fish

The "Palla" which is one of the choice table fish in the area, is a migratory sea-water fish which spawns only in the sweet waters of the Indus and later drops back to the sea. At the time of fresh water flows to sea during June, it

migrates as adults upstream into the river to spawn. The trigger for the migration is believed to be the increase in fresh water flow during this month, which the fish may detect with the smell of lower salinity water. This quest leads them to their spawning areas.

It produces enormous number of tiny free-floating eggs, which drift back downstream, hatching and developing into larvae. Three days after they hatch, the young larvae leave for the estuary where the survivors develop into small fish, then move out to sea to grow to adult size and come back again later to recommence the spawning cycle.

Before the barrage was built at Sukkur in 1932, Palla fish were reported to migrate as far up north as Multan, but after its construction, the run of fish beyond Sukkur stopped. Later in 1955 the Kotri Barrage constructed near Hyderabad resulted in further reduction in the Palla run. The fish ladders provided at this barrage proved a failure. The fish cannot climb the fish ladder due to its faulty design. The fish now migrate only up to Kotri barrage where they congregate and are generally caught in large numbers by netting.

## 4.2 Shrimp Fisheries

The present day tidal deltaic plain is characterized by numerous crisscrossing creeks/channels and swampy mudflats. This area of about 1.526 million acres, stretches from Karachi in the west to the Rann of Katch along the Indian border. It is the most important area for the fishing industry and is closely linked with the coastal mangroves. The Indus delta mangroves are important as nursery ground for fish especially for the commercial and artisanal Shrimp fishery. Mangroves provide shelter and protection to many

fish species during their early stages of life. The juveniles of shrimp grow in estuaries of the Indus delta and migrate to the sea after achieving a certain size. Maximum migration takes place during recruitment. At this time of massive migration, the fleet of trawlers line up in front of the mouth of the deltaic creaks and catch as many shrimps as possible without any consideration of the stage of development in which these shrimps are. There are virtually no controls over the fishing industry and has proved to be the most harmful factor.

The shrimp fishery in Sindh forms the most important sector in fisheries because of its foreign exchange earning potential and the creation of jobs in the industry. During the past the production of shrimp fish in Sindh has shown a mixed trend. There was an overall increase from 26,460 metric tons in 1983 to 33,900 metric tons in 1993 with a decline in the production in 1989 to 22,955 metric tons. The year 1993 shows a production of 33,900 metric tons and a sharp increase over the preceding years.

(Source:- Agriculture Statistics of Pakistan, Ministry of F&A, G.O.P. , Islamabad).

According to the statistics with the Govt. of Pakistan there is no evidence to establish that due to any reduction in the river flows d/s Kotri fish population in Sindh has declined. On the other hand, statistics confirm that there has been a gradual increase in the fish production after Partition. Table given below shows increased fish production of about 92% from 1983 to 1994. Various factors have contributed to this increase.

# FISHING CRAFTS AND FISH PRODUCTION

## INLAND AND ESTUARINE FISHERIES (SINDH)

| Year | Inland Fishing Crafts (Nos) | | | Production (1000 metric tons) |
|---|---|---|---|---|
| | Sail Boats | Row Boats | Total | |
| 1983 | 2,302 | 2,397 | 4,699 | 37.4 |
| 1984 | 2,489 | 2,729 | 5,218 | 44.6 |
| 1985 | 2,710 | 3,100 | 5,810 | 46.6 |
| 1986 | 2,950 | 3,520 | 6,470 | 50.8 |
| 1987 | 3,183 | 3,738 | 6,921 | 53.6 |
| 1988 | 3,200 | 3,800 | 7,000 | 54.0 |
| 1989 | 3,215 | 3,860 | 7,075 | 57.5 |
| 1990 | 3,280 | 3,900 | 7,180 | 60.3 |
| 1991 | 6,941 | 3,144 | 10,085 | 58.0 |
| 1992 | 3,484 | 2,731 | 6,215 | 60.0 |
| 1993 | 3,457 | 2,777 | 6,234 | 60.3 |
| 1994 | 4,278 | 6,208 | 10,486 | 71.8 |

Source: Agriculture Statistics of Pakistan, Ministry of Food and Agriculture, G.O.P. Islamabad/ Marine Fisheries, Karachi.

## 5.0 RIVERINE FORESTS

According to the Sindh Forest Department record, the riverine forests below Kotri are spread over an area of 104,405 acres. They are formed by an assortment of tree species. The most important of these species is Acacia Nilotica. Riverine forests at present rely on annual flooding by the Indus. The Indus below Kotri starts rising in June and continues until it reaches its annual peak in July or August. During the flood season, the river discharges its overflowing waters into the surrounding forests and depending on the peak discharge, largely irrigates some or all of them. In dry years and with increasing withdrawals from the Indus for irrigation water the picture goes on changing.

## 5.1 Flood Irrigation is Erratic

Due to difference in topography, not all the areas under forests get flooded equally. The area between the bunds can be divided into i) high level areas which are seldom flooded, ii) intermediate areas which are subject to flooding every five or six years, and iii) low-lying areas subject to annual flooding or almost once in two years.

Indus River flows vary from 200,000 cusecs to 1,000,000 cusecs from year to year, but only at peak flows do the highest lands receive any water. Riverine forests do not benefit much from the normal 200,000 cusecs flowing in the river constantly over months. With rising higher canal withdrawals, the delta forests get less and less benefit of Indus flow and floods.

## 5.2 Forest Eco-System Already Under Stress

It has been studied in detail that with discharge of 500,000 cusecs only 45.7% of the forest area receives water in 5 out of 11 years. Almost 16% of the high level forests receive

flood water only once in 12 years when the peak discharge is over 675,000 cusecs. It is clear that the flood events that are occurring at present are insufficient to maintain and promote the forests. The productivity of the reverine forests is already on the decline because of the reduced extent and duration of annual flooding. Acacia Nilotica, an important source of timber, is said to require 20 to 25 days of flooding each year for optimal growth. This required duration of flooding is not available even at present and the eco-system of forests is already under stress. Major damage is caused by un-controlled forest cutting of the shrubs for fuel and other needs.

## 5.3 Need for Pumped Irrigation

There is urgent need that some alternative measures are adopted to sustain the riverine forests. Fortunately a possibility exists to irrigate these forests by pumping supplies from the canals running parallel to both the embankments along left and right banks of the Indus River.

Under the above situation, it is not true to say that the eco-system of forests will be adversely affected by the construction of Kalabagh dam on the Indus River. It would be a minor factor. These forests need pumped irrigation supplies even at present and this supply would improve with construction of Kalabagh Dam and remodeling of the existing canals running along the left and right banks of the Indus River. The annual water supply requirements of the present forested area is not large and has been estimated to be 0.643 MAF which can be well managed by pumped irrigation. Wind power can be a cheap and additional source of power for pumping.

# 6.0 RIVERINE IRRIGATION

## 6.1 Low Yields of Crops

Agriculture is the main stay of earning of the riverine inhabitants. Agriculture depends primarily on residual soil moisture. Soil moisture stress, before the time of maturing, results in low yields. The various major crops being grown in the riverine area are Fruits (14%), Rice (12%); Sugar Cane (7%); Wheat (12%); Pulses (7%) and Fodder (8%). Flood irrigation carries a high element of risk. Crops are grown on a single irrigation and therefore their yields are erratic and lower than their potential. In dry years the situation further deteriorates.

High lands situated away from the river and near the flood embankments have less frequent flooding and as such these areas are being provided supplementary irrigation through lift pumps installed on the canals running alongside the bunds.

## 6.2 Kharif & Rabi Cultivation

Out of total gross area of 336,542* acres nearly 95,038 acres is under cultivation. The present cropped area in the reach below Kotri is about 107,168* acres. Out of this, 48,632* acres are cultivated in Kharif and 58,536* acres in Rabi. Annual cropping intensity is about 112 percent with 51 percent in Kharif and 61 percent in Rabi.

Irrigation is not practiced in the Active Delta. This is partly because of high salinity of the soil which has been reclaimed from the sea, and partly due to the frequent inundation of this low lying land by sea water.

(Source:- Report; Riverine Development in Sindh; WAPDA & UNDP (1994)

## 6.3 Lift Irrigation

At present 31,479* acres out of the total area of 95,038* acres are under lift pump irrigation. About 250 pumps provide irrigation to 24,951* acres using water from canals outside the riverine area. About 6,528 acres get water from Indus through 83 pumps. The irrigation during Rabi relies on leakage through the gates at Kotri barrage, escapes of canals, or seepage of groundwater into the river downstream of the barrage.

Spills of river Indus during summer provide irrigation to an area of 63,559 acres. Any reduction in flood flow during the Kharif season will reduce the average area inundated each year, which will in turn reduce the acreage of crops that may be grown in this area on the flood waters. With varying levels and discharge in the Indus, the only way to attain an assured water supply for crops is to install more lift pumps on the existing canals running outside along the two bunds. Water requirements for the present C.C.A have been estimated to be 1,67,344 A.F in Kharif and 1,41,950 A.F in Rabi (total = 0.31 MAF).

(Source:- Report; Riverine Development in Sindh; WAPDA & UNDP (1994)

# 7.0 DOMESTIC WATER SUPPLY

## 7.1 Population in the Riverine Area

The population in the riverine area below Kotri is estimated to be about 120,000 out of which that of the active delta area is over 10,000. Water for drinking purposes including live stock is obtained mainly from surface supplies. Hand pumps and open wells are not very common as a source of drinking water. The main constraint to ground water use and development is the deteriorated ground water quality

with brackish or saline water occurring at very shallow depth.

There are about 200 villages in the riverine area, out of which about 135 villages get their water supply directly from the canals of Kotri Barrage running parallel to the bunds. Thirty four (34) villages collect water from the Indus.

## 7.2 Quality of Domestic Water Supply

Surface water of the Indus river downstream of Kotri barrage becomes saline after about one month of no releases from Kotri barrage. This increased salinity is caused by the seepage of saline ground water into the river bed. A small release from Kotri will provide sufficient dilution to control the salinity of the river water to acceptable level upto Aghimani. The INDUSALT computer model based on the conditions surveyed in March 1997, suggested that a freshwater flow of 175 cfs would be sufficient for the purpose. The storage of Kalabagh Dam can provide possibility of much larger releases downstream of Kotri barrage to solve this problem and would in fact improve the situation. (Refer para 7.3 "Special Study for Releases Downstream Kotri" for this purpose)

Alternatively the canals as proposed for irrigation of riverine forests and riverine irrigation can meet all the domestic water requirements of the villages located in the riverine area. This arrangement is needed even at present and shall also meet the requirements for the future. The population in this area remains under stress and needs relief to improve their quality of life.

## 7.3 Requirements for the Active Delta Area

The only source of drinking water for about 67 villages, in the Active Delta, located from Karo Chan to Sea, is the Indus creek channels. When during floods the water level rises in the creeks, they store water in ponds for drinking purposes. The population of the Active Delta (about 10,000 fishermen) rely on this stored fresh water as their source of drinking water during the Rabi season. With the construction of Kalabagh dam increased releases downstream of Kotri barrage will resolve the problem even during the Rabi Season and would provide significant relief.

## 8.0 SPECIAL STUDY FOR RELEASES DOWNSTREAM KOTRI

**THE MINISTRY OF WATER & POWER, GOVT. OF PAKISTAN, CONDUCTED DURING 2005 TWO SPECIAL STUDIES THROUGH INTERNATIONAL CONSULTANTS.**

**BASED ON THE RESULTS OF THESE IMPORTANT STUDIES, THE INTERNATIONAL PANEL OF EXPERTS (IPOE) IDENTIFIED THE NEEDS FOR WATER ESCAPAGE BELOW KOTRI BARRAGE FOR THE FOLLOWING PURPOSES;**

- Checking salinity encroachment in the river aquifer and coastal zone
- Providing coastal stability
- Ensuring sustainable environment
- Maintenance of fisheries
- Prevention of salinity accumulation
- Providing water for riverine forests, riverine agriculture, Pollution control and drinking water supply

To meet these requirements, the IPOE recommended the following releases d/s of Kotri Barrage.

- **AN ESCAPAGE OF 5000 CS THROUGHOUT THE YEAR TO CHECK SEA WATER INTRUSION, ACCOMMODATE THE NEEDS FOR FISHERIES AND ENVIRONMENTAL SUSTAINABILITY AND MAINTAIN THE RIVER CHANNEL.**
- **A TOTAL VOLUME OF FLOOD FLOW OF 25 MAF IN ANY FIVE YEAR PERIOD (AN ANNUAL EQUIVALENT OF 5 MAF) IN KHARIF PERIOD TO TAKE CARE OF THE FOLLOWING:-**
  - **DEPOSITION OF SEDIMENT ON COAST AND DELTA AREA TO STOP THE COASTAL EROSION**
  - **KEEPING THE RIVER MORPHOLOGY IN GOOD CONDITION**
  - **SUSTAIN MANGROVE GROWTH**

This escapage should be managed and ensured in wet years. The need is required to be planned with the rising irrigation water withdrawals from the Indus.

The Sindh Province has listed all the ill effects of storing 6.1 MAF at the K.B. Dam in their Book on "K.B. Dam & Sindh – a View Point" and have concluded their view point at page 61 in the following words:-

"Because of reduced flows to the extent of 6.1 maf, the effects mentioned above will be there, although the extent & gravity of effects may vary. However these effects can be mitigated/reduced if environmental flows are allowed as given

in Section-7 of the Water Apportionment Accord (WAA). Two studies are being conducted by the Ministry of Water & Power, Govt. of Pakistan, to find out minimum escapage needs for different requirements below Kotri. If 10 maf water as demanded earlier by Sindh or quantity as determined by the two studies is made available every year, the above mentioned ill effects can be taken care of".

According to this statement the issue of ill-effects due to storing of 6.1 MAF at the K.B. Dam would get resolved by following the recommendations given by the International Panel of Experts given in para 8 above. As clarified in this Chapter, these marginal ill effects can be remedied. However, the non-construction of K.B. Dam involves major economic and social damages to the Nation in the form of water shortage and load-shedding all over the Country. It may be added that the objections raised against Kalabagh Dam would apply to any /all storage dams planned in the future for the progress and prosperity of nation and to afford a cheap hydropower source. Pakistan needs proactive use of every drop of its river waters to meet needs of the growing population and needs of commerce and industry. More & more storage dams would be needed and would be constructed in the foreseeable future. The comprehensive study in year 2005 by the Technical Committee on Water Resources has brought out this factor very forcefully. Viable solutions/remedies need to be considered and planned to make it possible to use every drop of river water in high flow/wet years and in floods. Pakistan does not have many good dam sites and every viable site on the Indus would have to be developed fully

and in a planned manner for the benefit of the nation. Prosperity for all and no damage to anyone is the viable option. River waters flow as stored, would be used in the near future for the best interests of Pakistan, and for progress & prosperity of Pakistan.

FIG-4.1: Avicennia Marina near Korangi Creek, to show pneumatophores growing vertically from the underground roots of the trees in the background.

DISTRIBUTION OF MANGROVES IN THE INDUS DELTA, DERIVED FROM 1990 LANDSAT

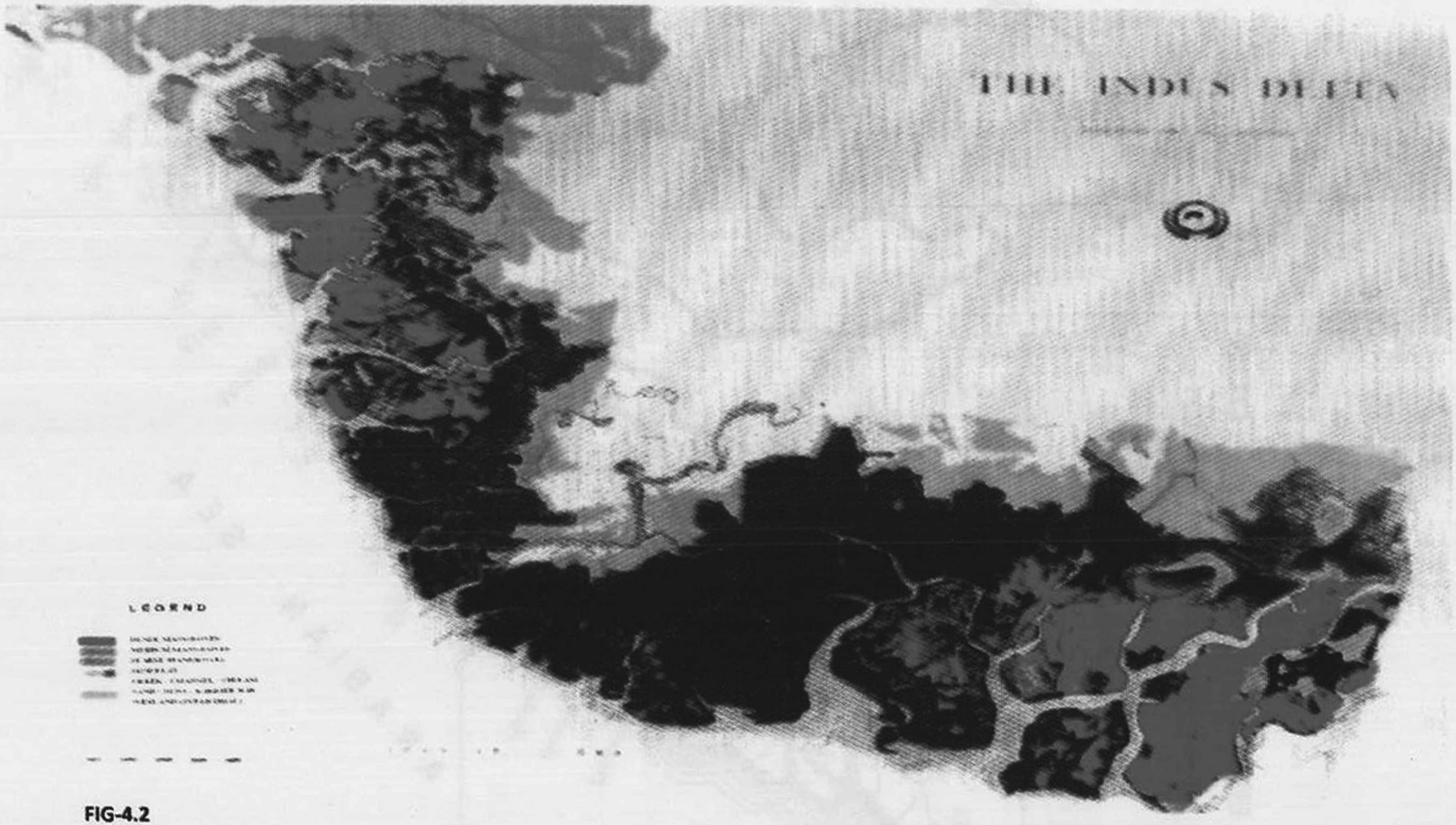
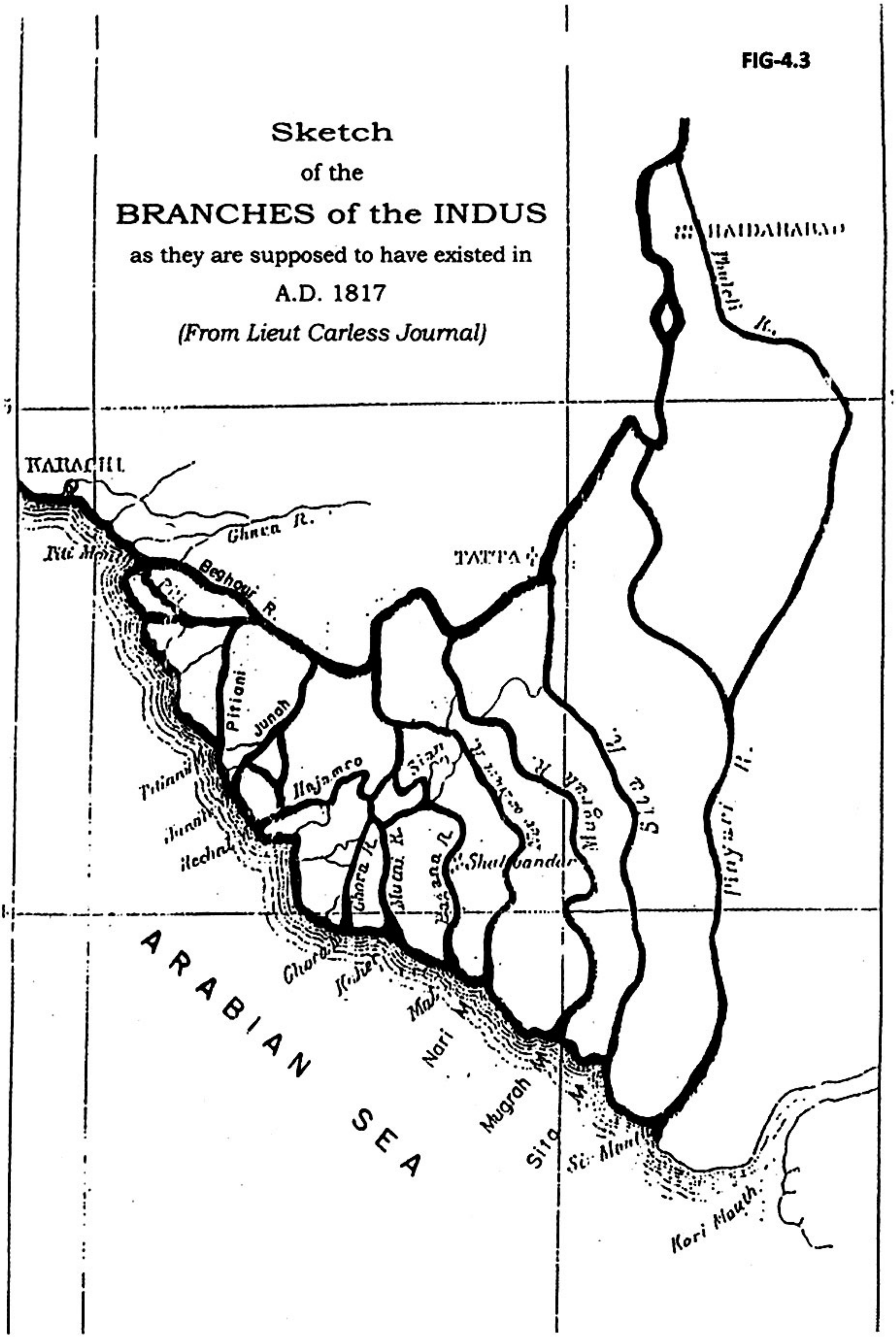



FIG-4.2

**THE INDUS DELTA**

STUDY FOR DEVELOPMENT OF IRRIGATION USES IN PUNJAB

FIG-4.3


Sketch
of the
BRANCHES of the INDUS
as they are supposed to have existed in
A.D. 1817
(From Lieut Carless Journal)
HAIDARABAD
Jhurkli R.
KARACHI
Ghara R.
Re Mouth
Beghaur R.
Pitiani
Junah
Pitiani
Junah
Hajamro
Sian
Shahbander
Mugrah R.
Sita R.
Pinyari R.
TATTA
Mugrah
Nari
Si Mouth
Kori Mouth
ARABIAN SEA

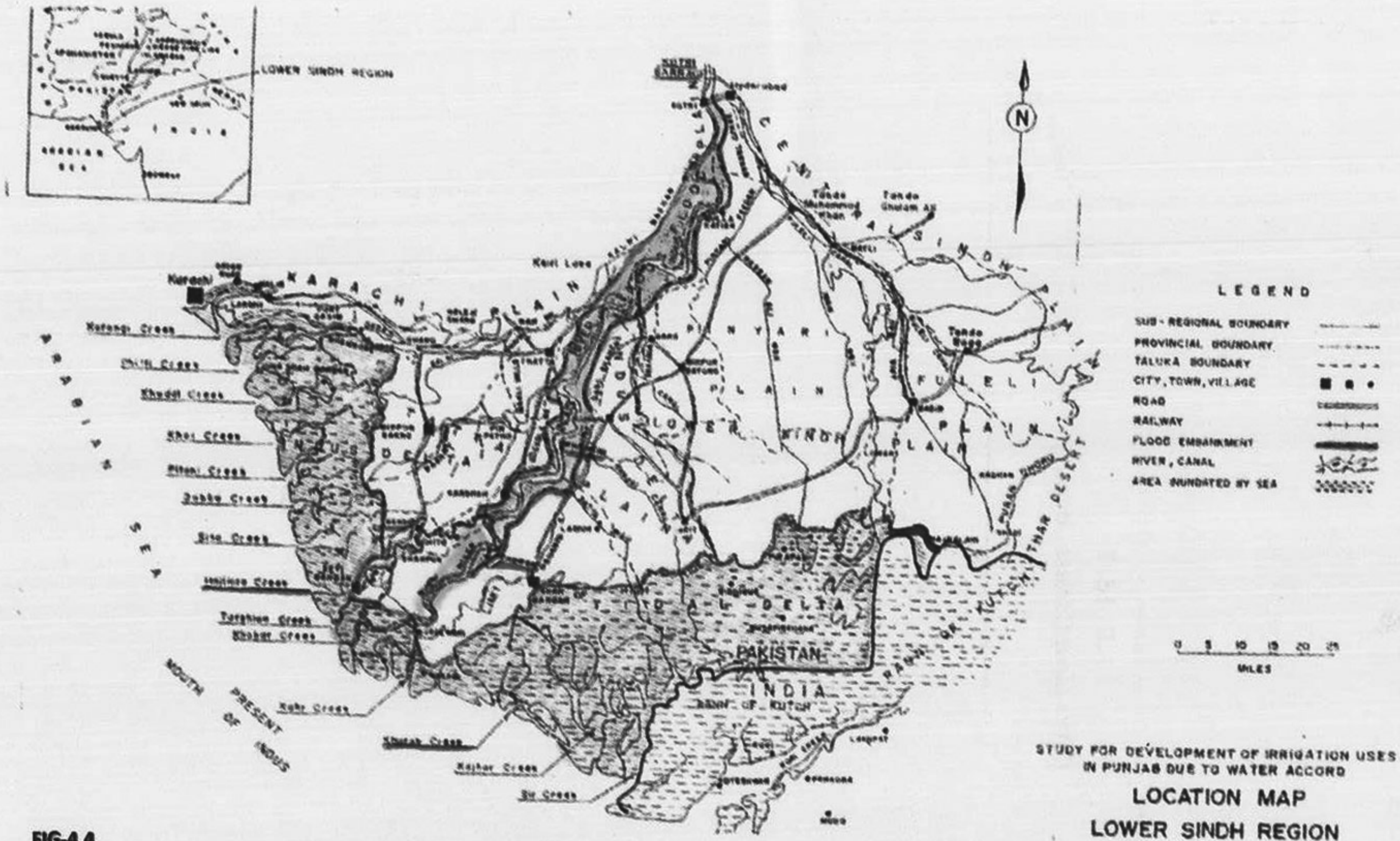



FIG-4.4

**LOCATION MAP LOWER SINDH REGION**

STUDY FOR DEVELOPMENT OF IRRIGATION USES IN PUNJAB DUE TO WATER ACCORD

# Chapter 5

# CANALS OFF-TAKING FROM K.B DAM

## 1.0 CONCERNS of Sindh – STAGE – 2

**(Ref: "Kala Bagh Dam & Sindh – A View Point" Book published by the Sindh Graduates Association Pages 55-58)**

i) Sindh holds the view that Canals are proposed to off-take from K.B Dam, which will draw excessive water and as a result supplies to Sindh will be reduced. Details of this objection are given below:-

WAPDA has identified the following areas for irrigation on the right bank of K.B Dam.

| | **Districts** | **Area (Acres)** |
|---|---|---|
| a) | D.I. Khan | 521,040 |
| b) | D.G. Khan | 98,010 |
| c) | Mianwali | 43,140 |
| d) | Bannu | 4,560 |
| e) | Lift areas in Bannu & D.I. Khan | 183,960 |
| | Total: | 850,710 |

The areas proposed on the left bank are:-

| | **Districts** | **(Acres)** |
|---|---|---|
| a) | Area up to Khushab | 128,000 |
| b) | Jalalpur Canal Area | 159,310 |
| | Total: | 287,310 |

ii) The left bank canal will pick up supplies partly for irrigation enroute, but mostly transfer water to Jhelum river. Major beneficiary areas would be those located in the command of Lower Jhelum Canal and Rasul Qadirabad Link where water shortages would be made up by K.B Dam through Rasul Qadirabad Link Canal.

iii) It is also stated (at pg 57) that "against total live storage capacity of 6.1 MAF of K.B Dam, if 8.00 MAF are drawn into canals, will it have no effect on Sindh? It definitely will."

iv) Concluding their objection it is stated at page 58 that "there appears to be no justification for any new canals from K.B Dam."

## 2.0 THE FACTUAL POSITION BASED ON DETAILED STUDIES & WATER APPORTIONMENT ACCORD (1991)

Studies carried out by Kalabagh Consultants, a joint venture of Binnie & Partners (U.K), Harza Engineering Co. (USA), Preece Cardew & Rider (UK), during 1983 have confirmed that construction of Left and Right High Level Outlets at Kalabagh are economically not attractive. In fact, the proposed K.B. Dam project (which is ready for construction) does not include any canals from the left or right flanks. Notwithstanding this, if any province wants to build, then its share of water would be strictly governed by W.A.A (1991). Construction of any canal does not increase the share of a province in the river water. All such objections are baseless assumptions.

The truth of Sindh's objection can be judged in the light of the following facts:-

i) Sindh objects to the construction of right and left bank canals from the reservoir of K.B Dam on the plea that these canals will be used for stealing water from the stored supplies by the Punjab & KPK Provinces, thus reducing Sindh's share of stored supplies. Sindh has the right to ensure that their share is honestly passed onto them. However, there seems to be a lack of trust between the shareholders. The real issue therefore relates to stealing of water and the lack of trust for the distribution of stored supplies. For this purpose, they should insist to ensure fair distribution through the Indus River System Authority (IRSA) which has been specially constituted for this purpose. Regarding construction and running of the right bank & left bank canals, all the provinces, under para 8 of WAA (1991) which is reproduced below have the right to use their water shares in any of their canals within their agreed allocations. Building a new canal does not increase the share of the province.

> Para 8 "There would be no restrictions on the Provinces to undertake new projects within their agreed shares"

There should be no objection to running of the right bank or/and left bank canals by a province within its allocations fixed under the WAA agreement. Even the existing canals are restricted in their operations within the provincial shares.

ii) In the case of Diamer Basha Dam (D.B Dam) Sindh has no such objection. They have agreed to the construction of D.B Dam on the ground that due to high mountainous

ranges surrounding the Dam, no right or left bank canals can be constructed from this Dam. However stealing of water from this Dam is quite possible. Sindh's share of supplies has to be released below the Dam into the River Indus for conveyance to Sindh. This has to pass all the way through the Indus River which traverses a long route through the KPK and the Punjab. Upon this route are located a number of barrages (Jinnah, Chashma & Taunsa) wherefrom the following large canals off-take for irrigation in the Punjab & the KPK Provinces.

| **Name of Barrage** | **Name of Canal** | **Capacity (Cusec)** | **Province** |
|---|---|---|---|
| Jinnah | Thal | 9,000 | Punjab |
| Chashma | C – J Link | 21,700 | Punjab |
| | CRBC | 8,500 | Punjab+KPK |
| | G. Thal | 8,500 (Final) | Punjab |
| Taunsa | T – P Link | 12,000 | Punjab |
| | D-G. Khan | 9,000 | Punjab |
| | Kachhi | 6,000 | Balochistan |
| **Total** | | **74,700** | |

The above canals run with reduced capacities within the shares of the provinces during the winter season even when Rabi supplies are badly needed. Stealing of supplies into these canals can be lot easier than the so-called canals off-taking from the K.B Dam.

iii) As far as stealing is concerned, remedies can he devised. There should be a will to move forward for the benefit & progress of Pakistan. Two mechanisms are already in place in the form of Water Apportionment Accord (WAA) and the Indus River System Authority (I.R.S.A.) for control of any problems in proper distribution of provincial shares. Sindh is well represented on IRSA. There are two members on this Authority from Sindh, while the remaining 3 provinces are represented by one member each. The distribution of stored water has already been decided & agreed among the Provinces. The issue of releases d/s of Kotri Barrage for maintenance of ECO System in the riverine areas has also been decided by an International Panel of Experts (I.P.O.E.). Only minor issues may need resolution which should not deprive the Nation from the colossal benefits of K.B Dam to all the provinces.

iv) Regarding the misuse of left bank canal off-taking from the K.B Dam for meeting shortages in the command of the Lower Jhelum Canal, Chashma Jhelum (C.J.) Link already exists which obviates the need for another Link Canal from the K.B Dam for meeting with the shortages in the command of the Lower Jhelum Canal. The statement of Sindh that 8.0 M.A.F. will be drawn into the right and left bank canals, is beyond any imagination. The share of Punjab is 37% and that of KPK is 14%, total 51% of the live storage capacity equal to 6.1 x 0.51 i.e 3.0 M.A.F. How is it possible to draw 8.0 M.A.F. against the share of 3.0 M.A.F and the total live storage of 6.1 M.A.F in the reservoir? Obviously the statement is in the air and does not carry any weight. It may be recognized that even in the periods of acute drought, no province can draw more than its agreed share. There are numerous checks to ensure that water distribution discipline is maintained within the provinces

even when river supplies may be short and may vary over periods. Short supplies in the rivers in certain periods are strictly regulated by the provincial shares under the control of the Indus River System Authority (IRSA).

## 3.0 SITE CONDITIONS FOR CONSTRUCTION OF RIGHT & LEFT BANK OUTLETS FOR OFF-TAKING CANALS

### i) High Level Outlet Works (HLOW)

**THE DESK STUDY (CARRIED OUT BY PROJECT CONSULTANTS) HAS CONFIRMED THAT;-**

The High Level Outlet Works (HLOW) water releases would have to be conveyed through tunnels over long distances, because of the hilly terrain around the Kalabagh Reservoir. Serious geotechnical problems are to be encountered on some reaches of the tunnel routes.

The right HLOW involves large diameter tunneling through 15.5 miles of hill ranges –10 miles through Tattak and 5.5 miles through Khisor. The first 7 miles of tunneling would be in the Nagri formation consisting of interbedded sand stone and clay stone, with dips steepening from 4° to 40°. Highly disturbed geologic conditions would be encountered in the area of the Kalabagh fault system. The tunnel alignment would cross at least two major regional faults in this reach, the Dhinegot fault at mile 2.75 and the Ainwan fault at mile 4.5. The gouge zone in the former is about 150 to 300 ft. wide. The Ainwan fault is about 100 to 150 ft. wide with steep dips. Further away, the Kalabagh fault zone would be encountered at mile 7.5. This is a highly controlled zone, extending more than 700 ft. Tunnelling through such formations will be both difficult and very costly. The last 1.5 miles route would pass through lime stone, calcareous sandstone, rock salt and marl of the saline series.

The left HLOW tunnel route passes through comparatively better terrain. The first 6 miles or so are in the Nagri formation of Siwaliks consisting of interbedded sand stone and clay stone. Dips generally increase from 4° to 15° in the downstream direction along the tunnel alignment. The remaining route is in Chinjil, Kamlials and Murree formations. The Chinjil formation consists of about 70% clay stones. The Kamlial and Murree formations mostly comprise sand stone interbedded with red shale and pseudoconglomerates.

The conveyance works will not only be excessively costly but also present serious problems of tunneling in disturbed zones. Beyond the hill ranges the right HLOW canal would run into numerous cross-drainage works including a mile and a half long aqueduct over Kurram River. The left HLOW would require a major crossing over or under Sanhi Nala near the dam, besides another one at Goran Nala. The order of magnitude of only tunneling cost would be more than 100,000 million rupees (1987).

**The above description of ground realities leads to the following conclusion.**

- **The High level outlet tunnels would have to pass through zones where the geological conditions are very unfavourable. It was concluded that it would be difficult to construct the tunnels, which would be vulnerable to future tectonic disturbance, and that the development is not feasible by normally accepted standards. Other possible ways of irrigating these high level areas may be preferable.**

- **Use of the outlets would incur a substantial energy penalty and over 1140 GWh/year would be lost on the average.**

- **KALABAGH DAM PROJECT AS PER ITS DESIGN (1988) DOES NOT INCLUDE ANY RIGHT BANK OR LEFT BANK OFF-TAKING CANALS. IN CASE A CONSENSUS IS ACHIEVED IN FUTURE ABOUT THESE CANALS AND THE IN-DEPTH STUDIES PROVED THE FEASIBILITY OF THEIR CONSTRUCTION, THESE CANALS WILL BE CONSTRUCTED. TILL THEN PAKISTAN WILL ENJOY THE BENEFITS OF POWER AND THE FLOOD MITIGATION THROUGH THE STORAGE CAPACITY OF KALABAGH DAM.**

# Chapter 6

# MAXIMUM BENEFIT TO SINDH

## 1.0 ADDITIONAL SUPPLIES TO SINDH FROM KALABAGH DAM

Like Mangla and Tarbela Dams, the proposed Kalabagh Dam would provide substantial additional supplies to the non-perennial as well as barren areas in Sindh. The Water Apportionment Accord (WAA-1991) specified a total volume of 117.35 MAF for distribution among the four provinces. Against this figure, present actual canal withdrawals are about 105 MAF. There is a shortfall of about 12.00 MAF which is not being utilized by the provinces due to lack of storage of flood waters and non-availability of stored supplies. This shortfall consists of 8.4 MAF available as river flow during the summer and 3.6 MAF which is not available during the winter season. The available storage potential of 8.4 MAF during summer is not being utilized, because there is no water available during early Kharif and late Kharif periods for sowing and maturing of Kharif crops. With the construction of Kalabagh dam this short fall of about 12.00 MAF will become utilizable and Sindh will be able to utilize an additional discharge of about 5.087 MAF over and above its present level of canal withdrawals. Out of this 5.087 MAF, 1.895 MAF will be provided from the stored supplies, while the remaining 3.192 MAF will be utilized from the available unutilized summer discharge in the Indus River. A detailed picture of the present and future distribution of supplies under WAA among the four provinces is given in Table 6-2.

## 2.0 MAXIMUM GAIN TO SINDH AREA

It would be seen from Table 6-1 that with the construction of Kalabagh dam, Sindh will derive the maximum benefit as compared to other provinces. With the availability of 12.00 MAF (additional WAA supplies) the shares of various provinces will be as below:-

**TABLE 6-1**

| PROVINCES | ADDITIONAL ALLOCATIONS UNDER WAA (MAF) | | |
|---|---|---|---|
| | KHARIF | RABI | TOTAL |
| i) Punjab | 2.420 | - 0.875 | 1.545 |
| ii) Sindh | 5.140 | - 0.053 | 5.087 |
| iii) NWFP | 1.856 | 1.575 | 3.431 |
| iv) Balochistan | 1.645 | 0.250 | 1.895 |
| **Total** = | 11.061 | 0.897 | 11.958<br>**Say** 12.00 MAF |

Present and future distribution of supplies among the four provinces as per Water Apportionment Accord 1991 is given in the tables 6-2 & 6-3 at Part-A & Part-B given on the next sheet:-

# WATER APPORTIONMENT ACCORD (1991)
# PRESENT AND FUTURE DISTRIBUTION OF SUPPLIES AMONG THE FOUR PROVINCES
# TABLE 6-2

## PART-A

| WATER APPROPRIATION SPECIFIED IN INDUS WATER ACCORD (1991) | | | | PRESENT CANAL WITHDRAWALS (ACTUAL) (MAF) | | | ADDITIONAL SUPPLIES ALLOCATED UNDER WAA | | |
|---|---|---|---|---|---|---|---|---|---|
| PROVINCE | Kharif (MAF) | RABI (MAF) | TOTAL (MAF) | K | R | TOTAL | K | R | TOTAL |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| PUNJAB | 37.07 | 18.87 | 55.94 | 34.650 | 19.745 | 54.395 | 2.420 | -0.875 | 1.545 |
| SINDH | 33.94 | 14.82 | 48.76 | 28.800 | 14.873 | 43.673 | 5.140 | -0.053 | 5.087 |
| KPK | 5.28 | 3.50 | 8.78 | 3.424 | 1.925 | 5.349 | 1.856 | 1.575 | 3.431 |
| BALOCHISTAN | 2.85 | 1.02 | 3.87 | 1.205 | 0.770 | 1.975 | 1.645 | 0.250 | 1.895 |
| TOTAL | 79.14 | 38.21 | 117.35 | 68.079 | 37.322 | 105.392 | 11.061 | 0.897 | 11.958 |

## TABLE 6-3

**PART-B**

| CROP PERIOD | ADDITIONAL SUPPLIES FOR FOUR PROVINCES (MAF) | ADDITIONAL SUPPLY FOR SINDH (MAF) | REMARKS |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| i) Early Kharif (April 1 – May 31) | 2.290 | 0.947 | To be available from the new storage |
| ii) Main Kharif Period (June 1 – Aug. 31) | 6.571 | 3.192 | Already available during summer. |
| ii) Late Kharif (Sept. 1 – Sept. 30) | 2.200 | 1.001 | To be available from the new storage. |
| **TOTAL** | **11.061** | **5.140** | |

* Source: Water Apportionment Accord 1991.

The Province of Sindh will be able to utilize 5.14 MAF during the various Kharif periods as per col. 3 of Table 6-3 above. With this additional supply, an area of 4.8 million acres can be cultivated in Kharif at a water allowance of 3 cusecs per 1,000 acres.

It may be mentioned that in the absence of these additional supplies Sindh would be the worst sufferer because Punjab and NWFP have more rains and also fresh groundwater that can provide some relief during the emergencies. Sindh

does not have these two natural advantages. By 2020, the siltation in Mangla, Tarbela and Chashma reservoirs will reach 7.33 MAF (refer Chapter Water Availability for Storage at Kalabagh). This would further worsen the situation. It may be emphasized that due notice should be taken of these hard facts (i) that with the construction of Kalabagh Dam Sindh will be the maximum gainer and (ii) that in the absence of this storage dam Sindh would be very badly hit. There is an urgent need that the affected people should be made aware of this situation soonest possible.

## 3.0 BENEFIT TO KHYBER PAKHTUNKHWA

The Province of Khyber Pakhtunkhwa (KPK) (Ex. NWFP) would also derive substantial benefits from the stored supplies at the KB Dam. It may be seen from Table 6-2 that KPK's share in the additional supplies will be 3.431 MAF over & above its present withdrawals of 5.349 MAF which would bring a substantial increase of 3.43 above the present 5.349 or 64% in its present situation. There is a fertile tract of virgin soil, about 850,000 acres in the Bannu & Dera Ismail Khan Districts of KPK which can be brought under the plough, if the political differences among the provinces are resolved. This will usher in a new era of development opportunities in the KPK which would greatly contribute to the prosperity of Pakistan.

This land in Bannu & D.I. Khan Districts is 50 to 150 ft. higher than the water level in the Indus River, but would be commanded by gravity from the proposed pond level of the KB Dam. When Tarbela Dam was constructed a stub tunnel was constructed on the upstream side of the Dam which has later been connected with the Pehur Canal to irrigate high level area on the right bank of the Indus River.

In a similar manner, the right bank high lands of Bannu & Dera Ismail Khan Districts can be provided irrigation facilities through a canal from the KB Dam.

A consensus about the construction of this canal must not be delayed and should be achieved. The other benefits of the Dam from stored supplies and power generation are very high and the construction work at the dam site should not be delayed.

## 4.0 BENEFIT TO BALOCHISTAN

Balochistan at present is the least developed of the provinces. There is, therefore, urgent need to accelerate and enhance the development effort in this part of the Country. For this purpose two large canals (i) Kachhi Canal and (ii) Extension of Patfeeder Canal are already being constructed. This Province will have its share of additional supplies equal to 1.895 MAF over and above its present allocation of 1.975 MAF (Table 6-2) and this would virtually double the quantum of supplies to Balochistan. This is a Nature's gift to Balochistan warranting no delay in the construction of KB Dam. Balochistan is already facing the impact of poor attention in the past.

## 5.0 BENEFIT TO PUNJAB

The existing reservoirs at Tarbela, Mangla and Chashma are losing their designed storage capacities year after year. Table 6-4 below gives the picture of loss by sedimentation that we may be facing in the near future.

**TABLE 6-4**

| Reservoirs | Live Storage Capacity (MAF) | Rate of loss per year (MAF) | Total Loss by Sedimentation (MAF) | | Balance Live Storage Available (MAF) | |
|---|---|---|---|---|---|---|
| | | | By the year 2011 | By the year 2025 | By the year 2011 | By the year 2025 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tarbela | 9.679 | 0.11 | 3.18 | 4.39 (45% of original) | 6.499 | 5.289 |
| Mangla | 5.34 | 0.031 | 1.4 | 1.8 (34% of original) | 3.94 | 3.54 |
| Chashma | 0.72 | 0.014 | 0.515 | 0.705 (almost total lost) | 0.205 | 0.015 |
| **Total** | **15.739** | **0.155** | **5.095** | **6.895 (43.8% of original)** | **10.644** | **8.844 (56.2% of original)** |

Source: WAPDA studies for sedimentation in Tarbela, Mangla & Chashma storage reservoirs.

The projected warning is that by the year 2025, storage capacity of 6.895 MAF (more than the live storage of KB Dam) will be lost by sedimentation and only 8.844 MAF (56.2% of original) will be available to Pakistan for utilization. This would have a crippling effect on the agriculture and power production and each province would have its share of grave sufferings.

In the Punjab, the share of Sutlej Valley (SV) Canals will be reduced to almost half. These storages were built mainly to recoup supplies to the SV Canals as a result of the Indus Waters Treaty which transferred the entire flow of three Eastern rivers (Sutlej, Beas & Ravi) to India. Consequently the Indus Basin Project was constructed which consisted of 8 inter-river link canals, 6 barrages & 3 reservoirs at Tarbela, Mangla & Chashma. The impact of sedimentation in the reservoirs will be crucial which essentially needs immediate action for construction of another large reservoir. KB Dam will provide only 6.1 MAF live storage against the lost capacity of 6.895 MAF by the year 2025, while we need at least 2 large storages (Kalabagh & Diamer Basha) to meet the food & fibre requirements of our burgeoning population.

This situation would also have a major impact on other Provinces and lead to strong political protests. This warrants serious planning, quick resolution of provincial prejudices and immediate action on the construction of both Kalabagh and Diamer Basha Dams. We do not have much flexibility or margins for an honorable existence.

# Chapter 7

## WATER AVAILABILITY FOR STORAGE AT KALABAGH

### Review of Calculations Made in the Book "Kala Bagh Dam & Sindh" Published by the Sindh Graduates Association

The major objection raised against KB Dam is that water is not available for storage at the KB Dam. In one exercise, it is concluded that surplus storable water of 6.1 MAF live storage capacity is available only for 6 years out of 28 years (1976-77 to 2003-04). Different approaches are used to prove this contention which are briefly narrated below (Ref. Book "quoted above, pages 47 to 55).

**1) Upstream Approach:** In this approach water received at the rim stations and that utilized above these points is taken as the starting point. The rim stations of western rivers are Tarbela for Indus, Nowshera for Kabul, Mangla for Jhelum and Marala for Chenab. From the total receipts at the starting points (i.e. at the rim stations) plus utilization above them, the following volumes have been deducted in the Table given at page 48 & 49 of the Book mentioned above. The figures given have to be corrected as per comments given in Table-1 below:-

**Table-1: New Canals under Construction & other Commitments**

| Canals/Drains /Dams | Figs given by the Sindh Graduates Association | Comments for Correction |
|---|---|---|
| ▪ Kachhi Canal | 1.0 MAF | 1.0 MAF Agreed (approved by IRSA) |
| ▪ Raini Canal | 1.1 MAF | 1.1 MAF Agreed (approved by IRSA) |

| | | |
|---|---|---|
| ▪ Greater Thal | 0.63 MAF | 0.63 MAF Agreed (2.5-1.87 = 0.63) (approved by IRSA)<br>1.87 MAF already included in Water Accord allocation of 79.14 MAF in Kharif |
| ▪ Pat Feeder Extension | 0.1 MAF | 0.1 MAF Agreed (approved by IRSA) |
| ▪ Gomal Zam Dam | 1.0 MAF | Nil<br>Gomal Zam Dam water requirements are to be dealt under para 10 of WAA (1991) which is reproduced below:-<br>• "No. restrictions are placed on developing irrigation uses in the Kurram, Gomal and Kohat basins, so long as these do not adversely affect the existing uses on these rivers".<br>• As per this para there will be no contribution of Gomal River to the flows of Indus because water of Gomal River is to be used within the individual Gomal Zam basin through flood irrigation. Gomal Dam would only regulate the water. Due to this very reason un-restricted developments were |

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| | | allowed under para 10 of WAA. |
| ▪ LBOD | 2.2 MAF | Nil<br>Para 12 of WAA (1991) is reproduced below:-<br>"The requirement of LBOD will be met out of the flood supplies in accordance with the agreed sharing formula."<br>WAA (1991) does not allocate any water requirement for LBOD. This is a completed project and already operating without any additional allocation approved by IRSA. |
| ▪ Mangla Raising | 2.9 MAF | Nil<br>This storage is to be ignored as an additional usage because this water is to be consumed for providing (i) shortfall in the approved allocations and (ii) the loss of storage due to siltation in the Mangla Reservoir. |
| **Total** | **8.93 MAF** | 2.83 MAF |

The calculation of 8.93 MAF reduction in the flow going downstream of Kotri Barrage is incorrect. As shown above, the reduction will be only 2.83 MAF in the flow going downstream of Kotri Barrage. It should be noted that major mistakes have presumeably been committed in the Table at page 48 & 49 of the Book "Kalabagh Dam & Sindh" to mislead the readers.

Similarly major incorrect modifications have been made in calculating the surplus water availability in Table-2 at page 49 which are explained against the relevant items given below. These incorrect modifications have apparently been made to strengthen the assumed arguments:-

## Table-2: Surplus Availability Under the Upstream Approach (Kharif)

### A. Availability

| Description | Figs. Given by the Sindh Graduates Association | Comments for Correction |
|---|---|---|
| ▪ Average Western river (Kharif) inflow (at the rim stations) | 115.55 MAF | 115.55 MAF – Agreed |
| ▪ Uses above rim stations | 3.54 MAF | 3.54 MAF – Agreed |
| ▪ Inflows to Western rivers below | Ignored | Inflow generated in Pakistan is 2.2 MAF<br><br>There is a major mistake here. Below the rim stations, numerous tributaries, nullahs & drains join the Indus river |

| | | |
|---|---|---|
| the rim stations. | | such as Swan and Harrow rivers as well as numerous nullahs descending from the Suleman range. Similarly Chenab is joined by Aik & Bhimber nullahs & so is Jhelum by many nullahs below Mangla (such as Bong, Jatli, Rehmanpur & Jaggu). They add substantial discharge to the western rivers which has to be added to the rim stations' figure. |
| ▪ Inflow from Eastern rivers. | Ignored | It is 4.01 MAF which is the total flow reaching Pakistan from below Madhopur on the Ravi river & below Ferozepur on the Sutlej river during the Kharif Season.<br><br>No doubt India is entitled under the Indus Waters Treaty to unrestricted use of Eastern Rivers, but it is naturally limited to runoff generated within the Indian territory, the lowest control points for which are Madhopur on the Ravi and Ferozepur on the Sutlej. Below these points there is no possibility of India diverting the water joining these rivers towards the Indian territories.<br><br>Regarding above Madhopur and Ferozepur, India has |

| | | |
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| | | already made developments through a number of irrigation works including dams. The last dam of the series was constructed at Thein on Ravi river in 1990. Uncontrolled flood flows of 4.01 MAF & 0.59 MAF during Kharif & Rabi respectively are still continuing to flow into Pakistan. This water would remain available to Pakistan without restrictions.<br><br>With the passage of time gradual siltation of Indian dams (Bhakra, Nangal on Sutlej, Pong & Pandoh on Beas and Thein on Ravi) and barrages would increase the flows available to Pakistan.<br><br>The uncontrolled flood water in India is available for utilization by the Indus Basin Irrigation System (IBIS) in Pakistan.<br><br>These are the total flows reaching Pakistan from below Madhupur on Ravi & Below Ferozepur on Sutlej. |
| | **Total: 119.09 MAF** | 125.32 MAF |

There is a need for environmental flow downstream of Kotri for riverine areas and Indus delta maintenance. In the Water Accord of 1991, a figure of ± 10 MAF has been mentioned but not agreed and studies for all needs through International Consultants were required, which have now been done. According to these studies, the downstream Kotri requirements are as below:-

- An escapage to sea of 5,000 cfs throughout the year which is equivalent to 3.6 MAF for the whole year.
- A total volume of 25 MAF in any 5 year period to be released in high floods for delta maintenance. This is equivalent to 5 MAF on yearly basis. A major part out of this relates to unregulated flood supplies.
- Total (max.) requirement below Kotri works out as 3.6+5.0 = 8.6 MAF on yearly basis. A major part out of this relates to unregulated flood supplies.
- The above flows are specially meant for maintenance of ecological conditions for the river reach from downstream of Kotri Barrage to the Sea. No province has the right to utilize these flows except for the requirements as mentioned in the Study Report of the International Consultants.

## B. Commitments

| Description | Figs. given by the Sindh Graduates Association | Comments for Corrections |
|---|---|---|
| ▪ System losses. | 15.10 MAF | 15.10 MAF - Agreed |
| ▪ Indian uses on Western river. | 2.00 MAF | 2.0 MAF - Agreed |
| ▪ Anticipated Afghanistan uses on Kabul River. | 0.50 MAF | 0.5 MAF - Agreed |
| ▪ Water Accord Allocations | 79.14 MAF | 79.14 MAF - Agreed as Water Accord Allocation.<br>However the four provinces cannot utilize 79.14 MAF without a new storage. Water is needed for sowing crops in April & May and for maturing these crops during Sept. & Oct. This water can only be available after construction of new storages. |
| ▪ New Canals/ | 8.93 MAF | 2.83 MAF.<br>As explained in Table-1 |

| | | |
|---|---|---|
| other commitments | | |
| ▪ Kotri downstream requirement | 10.00 MAF | 8.6 MAF.<br>Downstream annual requirements Kotri have been worked out by International Experts to be equal to 8.6 MAF as described above. This modifies the figure of 10 MAF assumed earlier on adhoc basis. |
| ▪ Filling of existing dams | 12.00 MAF | 6.31 MAF.<br>This is a major mistake. KB Dam cannot come before the year 2020. By then the siltation in the existing reservoirs will reduce the live storages by the volumes given below:-<br>Tarbela = 5.06 MAF<br>Chashma = <u>0.63 MAF</u><br>**Total = 5.69 MAF**<br>Loss of storage at Mangla has not been included, because Mangla Dam has been raised with an additional capacity of 2.9 MAF which will recoup the loss of storage for some time in the future.<br>The need for filling of existing dams would thus be reduced to 12.00 – 5.69 = 6.31 MAF. |

| | | |
|---|---|---|
| **Total Requirement** | **129.67 MAF** | 114.48 MAF |
| ▪ Surplus | 119.09 – 129.67 = (-) 10.58 MAF | 125.32 – 114.48 + 10.84 MAF |

The figures adopted by Sindh lead to a negative figure (-10.58 MAF) which is unbelievable. The calculations include major mistakes which distort the results. It is confirmed as worked out above that 10.84 MAF will be available as surplus as annual average. Kalabagh Dam is required to store only 6.1 MAF which will be certainly available. In wet years much larger volumes of river floods would become available.

**2) Downstream Approach:** In this approach average water going down to the sea is taken as 32.5 MAF. From this discharge the following existing usage and future allocations are deducted to arrive at the end result.

## Table-3: Surplus Water Availability under the Downstream Approach

### A. Availability

| Description | Figs. taken by the Sindh Graduates Association | Comments for Corrections |
|---|---|---|
| ▪ Out flow to Sea. | 32.50 MAF | 32.50 MAF – Agreed (In-fact it generally varies – average 30 to 40 MAF per year) |
| Total | 32.50 MAF | 32.50 + 5.69 = 38.19 MAF<br><br>For addition of 5.69 MAF see Table – 2.<br><br>Kalabagh Dam will not be constructed by 2020. By that time 5.69 MAF more water will flow D/S Kotri due to siltation in Tarbela & Chashma reservoirs and loss in storage capacity of these reservoirs. |

## B. Deductions

The following figures are required to be deducted from the total to work out the surplus available.

| Description | Figs. taken by the Sindh Graduates Association | Comments for Corrections |
|---|---|---|
| ▪ Indian uses on Western rivers (as per Indus Waters Treaty 1960) | 2.00 MAF | 2.00 MAF – Agreed |
| ▪ Afghanistan uses on Kabul river. | 0.50 MAF | 0.50 MAF – Agreed |
| ▪ News canals/ commitments | 8.93 MAF | 2.83 MAF - Reference Table No.1 corrected figs. |
| ▪ Eastern river inflow | 6.23 MAF | Nil<br><br>No reduction, because India cannot take away the inflow in Eastern rivers within the Pakistan territory.<br><br>See Table No.2 above. |
| ▪ Shortfall in Water | 11.24 MAF | 11.24 MAF – Acceptable although not certain, because all possible |

| | | |
|---|---|---|
| Accord utilization | | requirements have been taken to the maximum. This is only an assumed estimate. |
| ▪ Kotri Downstream | 10.00 MAF | 8.6 MAF – As worked out by the International Panel of Experts as explained under Table 2 |
| **Total Reductions** | 38.90 MAF | 24.93 MAF |
| ▪ Surplus availability | (-) 6.40 MAF | We will have 38.19 - 24.93 = 13.26 MAF of water available above the present uses for further developments. Further the wet years high supplies indicate the need of additional storage capacity for optimum uses of our river system i.e, wet year high surpluses to be transferred to meet dry year shortages. |

The surplus availability in this approach as worked out by Sindh is (-6.40 MAF) indicating a baffling result that surplus water is not available for storage at the Kalabagh Dam. This is the result of numerous (assumed) major mistakes planted in the calculations which have been explained above. As confirmed above 13.26 MAF surplus water will be available and Kalabagh Dam can be constructed after meeting with all the requirements in full. Negative

availability high lights the mistaken approach only to incorrectly strengthen the assumptions made in the Book "Kala Bagh Dam & Sindh" published by the Sindh Graduates Association.

It may be noted that under the upstream approach, a surplus flow of 10.84 MAF is available while under the downstream approach, a surplus volume of 13.26 MAF will be available after meeting with all requirements to the full extent. This is an average annual availability. In wet years, far larger volumes would be available and every drop should be productively used in our irrigation system. We have large barren areas needing development which emphasise the need for more storages to meet the needs of 'burgeoning' population in Pakistan.

As a matter of fact, dams for storage of water are built for storing the wet year flows for use in the dry years. It is an established fact that surplus flows, about 30 MAF worth billions of dollars are being escaped into the Sea every year. Pakistan cannot afford this tremendous loss which can be avoided by building dams like Kala Bagh & many other feasible sites on the Indus River.

# Chapter 8

# RECOMMENDATIONS OF THE TECHNICAL COMMITTEE ON WATER RESOURCES

## 1.0 Constitution of the High Level Committee

In pursuance of the directive of the President of Pakistan, Federal Government in the Ministry of Water & Power constituted on November 15, 2003, a Technical Committee on Water Resources specifically to develop consensus on building of new river storages as water situation for irrigated agriculture was worsening and getting poorer day by day. This Committee had a chairman and eight members, two from each province, having long professional experience in the field of water resources development and operation. This Committee held a number of meetings with the top level public functionaries and organizations and examined the latest in-depth studies since accepted by the government on water resources and large storage dams.

## 2.0 Examination of Data and Reports

The Committee considered various reports including those on the projects of Kalabagh Dam and the Basha Dam on the Indus River. The hydrological data of rivers and canals compiled by WAPDA was considered comprehensive and reliable. Indian uses of Western Rivers before they enter Pakistan, and the operation of inter-river link canals including Chashma-Jhelum (C.J.) and Taunsa-Panjnad Link Canals (T.P.) were also examined. Mangla dam filling, Kotri outflow to sea over the past years, Water Accord 1991, the upper regulation zone (C-J Zone), the lower regulation zone (Indus zone), inter-flow between the two zones and outflow of Indus river to the sea were reviewed in depth. These

operations were considered to be sound and also had been improved with operational experience.

## 3.0 Urgent Need for Storage of Water

The availability of river water for future storage was established including the inter-valley storages. KEY POSITIONS OF STORAGE DAMS ON THE INDUS WERE FOUND TO BE VITAL FOR PROPER RIVER WATER UTILIZATION and productive use of available river flows. River flows varied widely during various years and also during the various periods of the same year. With increasing population, Pakistan was fast heading towards a water shortage situation. The three storages at Tarbela on the Indus river, Mangla on the Jhelum River and Chashma on the Indus River were primarily for replacement under the Indus Basin Replacement Plan and more storages were required for further development. These storages had already lost about 6 MAF of their live capacity by siltation. Due to lack of adequate storage capacity, large volume of river water escapaged to the sea, benefitting no one. Substantial additional storage capacity was required for inter-season (Kharif-Rabi) transfers and inter-year transfers from wet years to dry years. All feasible on-line storages on the rivers and tributaries as well as off-channel storages were essential. All the identified new on-line storages (about eight in number) were on the Indus and were hydropower multipurpose projects. The current additional storage needs at field level were about 15 to 20 MAF and allowing for conveying losses in the rivers/canals, corresponding additional storage capacity at the source came to 20 to 25 MAF or 3 to 5 mega dams.

## 4.0 Kalabagh Dam and Basha Dam

It may be added that river storages do not consume water but vary and regulate the nature of river flows over the time period. The established uses are not reduced but are improved to enhance agricultural production and hydropower availability. The existing storage capacity in Pakistan was hardly 12 MAF and needed to be substantially increased to improve the use of river waters for agriculture, industry and domestic purposes. The optimum level was 30 to 40 per cent of annual river flow for good regulation, and Pakistan was yet far away from this optimal target. Series of storage dams on rivers at all feasible sites were a compelling requirement and FROM ALL CONSIDERATIONS, KALABAGH DAM HAD THE HIGHEST PRIORITY. The political controversy over the Kalabagh site had been initiated by vested interests and needed to be suitably modified and corrected. Presently well investigated options for good storages are Basha and Kalabagh sites on the river Indus. The two dams are multipurpose in nature and together provide a capacity of about 12 MAF. They are complementary in nature and provide food security and economic development. Kalabagh dam is the priority option as Basha dam is in active seismic region and would need deeper examination and higher investment due to its height, foundation conditions and approach roads. Kalabagh dam was of low height and is simpler in design. It may be taken up from Pakistan's own resources and would be the first jump for economic and technical advancement. It would provide a sound base for agricultural and industrial growth and confidence building. Basha dam has been launched earlier primarily from political considerations, although KALABAGH DAM CLAIMED PRIORITY FROM ALL CONSIDERATIONS. The projects of Kalabagh and Basha

dams should in fact go hand-in-hand for optimal economic, political and technical advancement of Pakistan and to provide basic low cost hydropower.

## 5.0 Top Priority for Kalabagh Dam

For the Kalabagh site, WAPDA and World Bank have prepared comprehensive planning, investigation and detailed studies. It is a multipurpose dam about 110 miles downstream of Tarbela dam. Services of competent local and foreign consultants had been used over a long period of about 30 years. It would be a dam of 6.1 MAF (live) storage capacity and 3600 MW hydropower generation. This project has been subjected to rigorous scrutiny for its technical and economic viability and has been considered to be excellent from all considerations. It is the lower most multipurpose site on the Indus River. The project could be completed in about 6 years and would store a large volume of Indus flows from snowmelt monsoons. ASSIGNING A LOWER PRIORITY TO THIS SITE IS A HEAVY PRICE THAT PAKISTAN IS ALREADY PAYING. Indus annual flows at Kalabagh are about 90 MAF while they are 60 MAF at Tarbela and 50 MAF at Basha. The site is nearest to the power centers and the national power transmission grid. This is the only site to use monsoons flows. It would further improve Tarbela generation by about 30 percent by enabling installation of three additional generation units. There are no access road problems. It would provide Tarbela an additional facility for higher base load/peaking power requirements. It would also provide additional capability for irrigating large areas by gravity flow in D.I. Khan District after achieving consensus of all provinces. It would also enable integration of Indus-Jhelum-Chenab river basins as one basin for the most optimum water use.

KALABAGH DAM SITE HAS THE TOP PRIORITY FROM ALL CONSIDERATIONS.

## 6.0 Basha to follow Kalabagh Dam Immediately

Pakistan has only a few good river storage sites, and every site would need optimum exploitation in a phased programme. It would be appropriate to have integrated management of the three western rivers as one basin. The urgent need is prioritization of on-line and off-line storages and start construction work to break the shackles of in-action. It may be stressed that the strategy which has unfortunately been used to put Kalabagh on the back-burner as compared to Basha would also in-turn hurt Basha as compared to other sites. Both Kalabagh and Basha should in fact be taken up jointly. By the time Kalabagh is completed, Basha site would reach the sound acceptability standards at international levels. The construction machinery at Kalabagh could be moved to Basha to accelerate the work. Simultaneous start of active work at both Kalabagh and Basha would be a big leap forward for rapid development of water and hydropower resources of Pakistan and would end the many engineered anti-development controversies.

For Pakistan the minimum target for new dam storage capacities would be 30 MAF for the next 20 to 30 years. An integrated development strategy for the three western rivers, the Indus, the Jhelum and the Chenab, as one single basin would be a break-through. The two complimentary and well-studied options of Basha and Kalabagh as multipurpose storage projects are available and should be taken up together. This would end all the counter-productive debates and pave the way for forward march towards progress and prosperity of Pakistan.

## 7.0 Chashma Jhelum Link

Chashma Jhelum (CJ) Link was completed in 1970, but the province of Sindh disputed its operation. The issue was resolved in a meeting held at Lahore on July 03, 1972 chaired by the Federal Minister for Provincial Coordination and an adhoc agreement was signed for operation of C.J Link during July 1972. This adhoc agreement of 1972 was subject to final decision by the President of Pakistan on Apportionment of Waters of the Indus River System.

Subsequently the waters of the Indus River System were apportioned through Water Accord of 1991 which superseded all previous agreements. The Water Accord does not place any restriction on operation of any link canal. Under the provisions of the Water Accord and the Indus River System Authority (IRSA) Act, IRSA prepares the forecast of water availability for each crop season i.e. Kharif & Rabi and determines the provincial shares. The provinces are free to use their allocated shares in any canal system and operate any link channel. The C.J Link is therefore being operated by Punjab for meeting the requirement of its Trimmu Canals remaining strictly within its share allocated by IRSA.

The issue regarding operation of C.J Link was also included in the terms of reference of the Technical Committee on Water Resources constituted by the President of Pakistan in Nov. 2003. The issue was extensively deliberated in the meetings of the Technical Committee and majority of the Members (7 out of 8 excluding the Chairman) agreed that the existing arrangements for operating this Link Channel need no modification.

Some quarters in Sindh also propagate that C.J. Link was forcibly opened in 1985 under the orders of Governor Jilani. This is absolutely incorrect. In May 1985 under instructions from the Federal Ministry of Water & Power, WAPDA closed C.J Link which generated lot of hue and cry both in the public and the press. The then Prime Minister of Pakistan (Mr. Junejo) taking cognizance of this situation convened a meeting at Islamabad on June 08, 1985 which was attended by the Provincial Chief Ministers and Provincial Irrigation Secretaries of Punjab and Sindh apart from the Federal Secretary Ministry of Water & Power. After due deliberations the Prime Minister ordered WAPDA to open C.J. Link with immediate effect.

A view was also expressed by Sindh that C.J. Link and T.P Link Canals were only flood water channels and should operate when there is surplus supply in the Indus River. Furthermore it was expressed that these two Link Canals should not be operated during the period when water is being stored in Mangla Reservoir and also when there are shortages in the Sindh Canals. The Technical Committee examined all details and came to the conclusion that these views are not consistent with the concept of the Indus Waters Treaty and the design and construction of the replacement plan works including the storages at Mangla and Tarbela and the Link Canal Systems (including the 2 Indus Links).

The existing pattern of operating the 2 Indus Link Canals is in accordance with the replacement plan and sharing of storages is being constantly monitored by IRSA. Over the long period after 1991 when the Water Apportionment Accord was signed, no complaint about misappropriation of water distribution has been received. It is the only

appropriate course as a consequence of the Indus Waters Treaty 1960 and the Water Accord 1991. It has worked well and needs no modification.

# Chapter 9

# DIAMER BASHA NOT A SUBSTITUTE FOR KALABAGH DAM

The unprecedented floods of 2010 further increased the importance of Kalabagh dam and the flood-affected people demanded that the construction of the dam be started immediately. It should be noted that Diamer Basha Dam can never be a substitute for Kalabagh dam, because Kalabagh Dam was the only solution to harness the monsoon flows of Swat and Kabul rivers that contributed heavily to the floods of 2010. The monsoon rains occur downstream of Basha dam and do not affect the Basha storage. The country could have been saved from devastation if Kalabagh dam had been built. The people at the helm of affairs should realize the difficulties of the masses before it is too late and the situation aggravates further. The diminishing availability of water for agriculture and the ever rising prices of electricity should ring the alarm bells. The two major pillars of economic growth of the country, agriculture and industry, should not be allowed to suffer indefinitely from the absence of Kalabagh dam. The availability of water to agriculture is reducing day by day and the cost of electricity has increased manifold. Would this not lead to further increase in poverty, unemployment, the law and order situation which would become more and more difficult to handle overtime.

No doubt, Diamer Basha Dam is also a feasible project and is needed for boosting the economy of Pakistan. However, Kalabagh Dam (KB Dam) Project is a far superior Project than Diamer Basha Dam (DB Dam) in many respects. Its superior features have been briefly illustrated in the

following paragraphs. In fact, the two projects are mutually complimentary and not exclusive. The fact remains that we have to store and regulate every unutilized drop of our river flows for maximum benefits, with loss to none.

## 1.0 SUPERIORITY OF KALABAGH OVER DIAMER BASHA DAM

### i) Very Suitable Location

The Dam site is located on the Indus River in Mianwali District and is easily accessible from all sides, close to the load centre as well as distribution network of power transmission. It is 121 miles downstream of Tarbela Dam. On the other hand DB Dam is located 197 miles upstream of Tarbela Dam involving long and difficult access routes, far removed from the load centre and difficult transmission corridors through rugged mountains for conveyance of generated power to the load centres. In choosing priority of construction and acceleration of field work, the K.B. Dam should be taken up first from numerous considerations.

### ii) High River Flows

The mean annual river flow at Kalabagh is 90.00 MAF due to many additional tributaries and nullahs that join the Indus River between DB Dam and KB Dam (i.e Kabul, Swat, and Kuram rivers on the right and Siren, Haro and Soan rivers on the left). On the other hand the mean annual river flow at DB Dam is 50.54 MAF i.e 57% of that at KB Dam. Similarly the basic design flood to be handled at Kalabagh is of the order of 2,000,000 cusecs against only 713,360 cusecs at DB Dam i.e. hardly 32% of that at KB Dam.

### iii) Dam with a Modest Height

At Kalabagh the height of Dam will be only 260 feet above the river bed, while DB Dam will be as high as 893 ft. In addition the KB Dam will be an earth-fill Dam, while DB Dam will be a Roller Compacted Concrete (RCC) Dam. Inspite of its height equal to about 3.4 times that of KB Dam, the live storage potential at DB Dam will be 6.4 MAF against 6.1 MAF at KB Dam, an insignificant advantage from a much higher Dam. This factor should determine the priority of field work and the allocation of financial resources.

### iv) Longer Life Due to Flushing through Low Level Spillway

At KB Dam the orifice spillway has its crest level at 785 ft (above Mean Sea Level) with full reservoir level at 915 ft. This low setting of the spillway crest has the potential of flushing of sediment from the reservoir. At DB Dam the spillway crest is at elevation 3758 ft. with full pond level at 3806 ft. (AMSL) and by virtue of its high setting, no significant advantage will be available for flushing of sediment. The impact of flushing would be only marginal. This advantage would further reduce as the sediment delta builds up.

### v) Easy Access to the Site of Kalabagh Dam

Due to its location, the access to KB Dam is rather easy and would lead to many economic advantages in transportation of construction materials and machinery, construction of access roads and transmission lines, carriage of machinery for the powerhouses as well as subsequent maintenance and repair works of the project. This advantage would be a great facility for the experts who would work for long durations at site.

### vi) Difficult Access for Diamer Basha Dam

For DB Dam, 203 miles of access (KKH) road would have to be upgraded and improved and 59 miles of Karakorum Highway (KKH) will have to be raised and rebuilt through mountainous ranges along the Indus River. This itself will be a huge project which would create difficulties during construction as well as its subsequent maintenance of the project. While both Kalabagh and Diamer Basha sites are required to be built, these factors should determine priority on allocation of scarce financial resources and colonization.

### vii) Very Economical Transmission Lines

The power generated at KB Dam can be connected with the national grid running a short distance away from the Dam site, while the power generated at DB Dam will be transmitted over a long distance of 197 miles upto Tarbela Dam. The transmission lines will be erected through difficult mountainous corridors at heavy costs. The maintenance cost of such transmission lines will also be equally heavy involving personnel problems.

### viii) Shallower Bed Rock at Dam Site

The bed rock in the river bed at Kalabagh is 83 ft. below the river bed, while at DB dam site it is 171 ft. deep. The foundation of the dam has to be taken to the bed rock and deeper bed rock means more cost and large contingencies.

### ix) Lighter Intensity of Earthquake

The earthquake intensity at Kalabagh is comparatively lighter at Kalabagh than at the DB Dam. The following figures show the values adopted in the design of the two dams.

| Dam | Operating Base Earthquake (OBE) | Max. Design Earthquake (MDE) | Max. Credible Earthquake (MCE) |
|---|---|---|---|
| Kalabagh Dam | 0.15 g | 0.32 g | 0.4 g |
| Diamer Basha Dam | 0.22 g | 0.37 g | 0.46 g |

## x) Shorter Construction Period

KB Dam is ready for construction after detailed investigations and research. It can be completed in a period of about six years. The implementation period of DB Dam extends over a period of not less than 10 years and due to the problems of difficult access and RCC technology for dam construction as well as transmission lines, there are likely chances of further delays in the accrual of benefits from this project.

## xi) Increased Power Generation at Tarbela

Since KB Dam is located downstream of Tarbela, the releases for irrigation supplies can be regulated at the KB Dam. Taking advantage of this facility Tarbela Dam can be used to generate more power without any restriction due to the fixed releases for irrigation. It is estimated that the extra power that can be generated at Tarbela Dam will be of the order of 336 GWh & power peaks would be better regulated.

## xii) Low Project Cost

Cost wise KB Dam is substantially cheaper than DB Dam. Estimated costs of both the projects are given below:-

*KB Dam cost estimated in Sept., 2005 = US $ 6.124 billion.*

*DB Dam cost estimated in June, 2009 = US $ 11.178 billion.*

The cost of DB Dam project is substantially higher than that of KB Dam. The cost of DB Dam given above does not include the costs of two double circuit 765 KV transmission lines to load centres and one double circuit 132 KV transmission line to Northern (Gilgit-Baltistan) areas and upgradation of 203 miles long KKH.

It may, however, be realized that while both the sites have to be built and made operational, these factors would determine the priority of financial allocation and employment of experts.

# 2.0 COMPARATIVE STUDY OF DIAMER-BASHA AND KALABAGH DAM PROJECTS

## Designed Technical Parameters and Salient Features

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1. | **LOCATION** | 121 miles downstream of Tarbela | 197 miles Upstream of Tarbela |
| | • Catchment Area | 110,500 sq. miles | 59,150 sq. miles |
| | Mean Annual<br>- River Flow | 90.05 MAF Average (1922-2004) | 50.54 MAF Average (1962-2003) |
| | - Total Estimated Sediment Load | 470 Million Tons (Sluicing will extend the life to perpetuity) | 196 Million tons |
| | • Flood assessment<br>- Basic Design Flood | 2,200,000 cusecs | 713,360 cusecs |
| 2. | **MAIN DAM** | | |
| | • Maximum Height above rock foundation | 343 Ft. (260 Ft. above riverbed) | 893 Ft. |
| | • Type | Embankment type. | Roller Compacted Concrete (RCC) Gravity Dam |

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 3. | **DIVERSION SYSTEM** | | |
| | • Diversion Tunnels | | 2 No. (Right side) |
| | • Diversion Channel | Open Diversion Channel on left side. | 1 No. (Right side) |
| | • Cofferdams | Upstream and downstream | Upstream and Downstream |
| 4. | **SPILLWAY** | | |
| | **I. Orifice** | | |
| | • Crest Level (AMSL) | 785 Ft. | 3,758 Ft. |
| | • No. of Gates | 10 | 14 |
| | • Capacity | 890,000 cusecs | 640,200 cusecs |
| | **II. Overflow** | 860 Ft. | |
| | • Sil Elevation | 700,000 cusecs<br>860 Ft. | |
| | • No. of Gates | 10 | |
| | • Capacity | 700,000 cusecs | |
| 5. | **RESERVOIR** | | |
| | • Full Supply Level (FSL) | 915 Ft. | 3,806 Ft. |
| | • Minimum Operating Level (MOL) | 825 Ft. | 3,478 Ft. |

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | • Live Storage | 6.1 MAF | 6.4 MAF |
| | • Length of Reservoir at FSL | 92 mile | 58.43 mile |
| | • Length of Reservoir at MOL | 75 mile | 42.9 mile |
| | • Reservoir Area at FSL | 164 sq. mile | 44.5 sq. mile |
| 6. | **OUTLETS IN DAM BODY** | | |
| | • Low level | 4 Nos. | 2 Nos. |
| | • Flushing | | 5 Nos. |
| 7. | **FLUSHING TUNNELS** | | |
| | • Right Bank | Flushing will be done through low level orifice spillway | 1 (through conversion of one diversion tunnel) |
| | • Left Bank | | 1 (underneath the power intake) |
| 8. | **POWERHOUSE(S)** | | |
| | • Location and Type | Indoor Left bank, close to the downstream toe of the dam. | Underground, one each on right and left side |

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | • Total Installed Capacity | 3,600 MW (12x300 MW) | 4500 MW (2 x 2250 MW) |
| | • No. of Units | 12 | 12 (6 x 375 MW in each powerhouse) |
| **9.** | **AVERAGE ANNUAL GENERATION** | | |
| | • At Dam Power House | 11,413 Million Kwh | 18,097 Million Kwh |
| | • Additional at Tarbela | 336 Million Kwh | 1,111 Million Kwh |
| **10.** | **TURBINES** | | |
| | • Type | Francis | Francis (Vertical Shafts) |
| | • Number | 12 Nos. | 12 Nos. (6 units in each of the powerhouses) |
| | • Design rated head | 169.95 Ft. | 559.38 Ft. |
| **11.** | **PROJECT COST** | | |
| | • Estimated Cost | US $ 6.124 Billion (September 2005 prices) | US $ 11.178 Billion (June 2009 prices). Does not include the costs of two, double circuit 765 KV transmission lines to load centers and one 132 KV double circuit transmission |

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | | | line to Northern (Gilgit-Baltistan) Areas and up-gradation of 203 Miles KKH. |
| 12. | **AFFECTED LAND** | | |
| | • Agricultural Land | 35,000 Acres | 2,811 Acres |
| | • Barren Land and others | 105,406 Acres | 34,608 Acres |
| | • Total Others | 140,406 Acres | 37,419 Acres |
| 13. | **AFFECTED POPULATION** | | |
| | • (Nos.) | 120,000 | 28,650 |
| 14. | **RESETTLEMENT** | | |
| | • Proposed new settlements around reservoir periphery | 27 Model Villages | 9 Model Villages |
| 15. | **INFRASTRUCTURE** | • A metalled road and a railway line run along the left bank of river about 7 miles from the site. An access road to the site | • For transportation of construction materials, heavy machinery and equipment, to the dam site, 203 miles of KKH (Havellian |

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | | and an air-strip have been constructed. A railway cum road bridge across Indus exists at Kalabagh about 13 miles downstream of the site. | • to dam site) will be rehabilitated/ up-graded prior to start of Project construction. |
| | | • The project has the great advantage of being near the major load centres and main transmission corridors. | • The reservoir will submerge about 59 miles of the existing KKH. During construction 85.52 miles of KKH (Shatial to Raikot Bridge) shall be built at higher level to replace the road submerged in the reservoir. |
| | | | • The power dispersal from Basha will be through two 765 KV double circuit transmission |

| Sr. No. | DESCRIPTION | KALABAGH DAM | DIAMER-BASHA DAM |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | | | lines and one 132 KV double circuit line to Gilgit via Chilas for supply of Power to Northern (Gilgit-Baltistan) Areas. |
| 16. | **PROJECT BENEFITS** | | |
| | • Availability of annual surface water storage for supplementing irrigation supplies during low flow periods. | • 6.1 MAF | • 6.4 MAF. |
| | | • Installed Capacity<br>3600 MW | • Installed capacity<br>4500 MW |
| | | • Reduction of dependence on thermal power, thus saving foreign exchange. | • Reduction of dependence on thermal power, thus saving foreign exchange. |
| | • Harnessing of renewable source of. | • Employment opportunity, particularly to the locals. | • Employment opportunity, particularly to the locals, |

| | | | |
|---|---|---|---|
| | affordable energy | during the construction and operation periods | during the construction and operation periods. |
| | | • Flood control. | • Flood control. |
| | | • Creation of massive infrastructure leading to overall socio economic uplift of the area and standard of living of the people. | • Creation of massive infrastructure leading to overall socio economic uplift of the area and standard of living of the people. |
| | | • Fish breeding in lake. | • Fish breeding in lake. |
| | | • Industrialization . | • Industrialization . |

# Chapter 10

# KALABAGH DAM AND THE POLITICS

## 1.0 Politicization of Kalabagh Dam

Before international tenders could be issued for its construction, the Kalabagh Dam Project had to be put on the back burner because of controversy arising on the political front. During 1986, a famous Political Leader in Sindh launched a virtual rebellion against the government of Gen. Zia-ul-Haq opposing him on everything including Kalabagh dam. In-fact an alarm was raised that Sindh would become a desert if Kalabagh dam was built. The followers of this Leader both the literate and the illiterate, in Sindh and Punjab took this as a gospel truth and have opposed Kalabagh dam ever since. By playing politics with an issue of such national importance, the Kalabagh Dam was effectively politicised. This was only the first of many occasions when a slogan was raised that Kalabagh Dam is a "Zia Dam" which will never be built. Later on this Political Leader rejected a consensus on Kalabagh dam reached between the four provinces through the prolonged efforts of the then Prime Minister of Pakistan in 1991. The Water Apportionment Accord was a landmark agreement between the four provinces who agreed to the construction of more dams on all the rivers including the main Indus.

## 2.0 The Accord Gave Major Concessions to the Lower Riparian Sindh

i) River water distribution was taken away from the controversial WAPDA and entrusted to a new federal body IRSA (Indus River System Agency) having equal representation from the four provinces. Later on a federal representative, also from Sindh, was added. Since

Balochistan gets its water from Gudu barrage, its representative always votes with Sindh. Thus Sindh has three representatives in IRSA against one for Punjab.

The provinces could only raise 10 day indents of their requirements to IRSA which developed a Distribution Plan depending on availability of water and instructed WAPDA to release water from the dams and barrages accordingly.

ii) Punjab agreed to a reduction in its share from the historical 40% to 37%, in order to increase Sindh's share from 34% to 37% in all future dams. Equal share for both is a magnanimous gesture despite Punjab having 70% of the total cropland in the country against 20% in Sindh, and Punjab bearing 80% of the total agriculture burden of the country.

iii) Sindh's interest is further protected with a monitoring contingent of engineers from the Sindh Irrigation Department who are posted on major head works of Punjab. They are in daily contact with their Head Office and have not reported any misappropriation of river waters to date. Theft of water does take place but on the canals within each province. No province can take the water of another province. The left and right bank canals if ever constructed at the Kalabagh dam will also come under their jurisdiction.

iv) It will be seen that the Water Accord was a win-win position for Sindh, but playing politics by the Sindh Leaders has deprived the country of a golden opportunity to resolve the dispute between Punjab and Sindh.

- The terms upper and lower riparians apply only when the upper riparian has control over the distribution of

river waters, not when it is IRSA which is controlling the distribution of river waters for all the provinces.

- The Water Accord negotiations laid special emphasis on development of consensus on Kalabagh dam. The Accord could not have allotted 37% share to Punjab without providing means to utilize it for extension of irrigation which is possible only through the left bank canal at Kalabagh dam. For the same purpose the other provinces have to use their allocated shares through new canals now under construction for extension of irrigation in the undeveloped areas.

## 3.0 Kalabagh dam became a victim of politics again when the Political Govt. of Pakistan inducted the IPPs (Independent Power Producers) to overcome the prevailing power shortage.

The IPPs consuming imported oil whose price was not in our control should have been for the short term only and a long term mega hydel project should have been taken in hand at the same time. However the only mega hydel project ready to build at the time was Kalabagh dam in the Punjab and it was shelved again under the cover of IPPs.

The oil at $10 per barrel at the time increased to $100 per barrel, increasing the cost per unit ten-fold, forcing the government to subsidize power and run up a circular debt of billions of rupees. According to a famous statement by Bard:-

> "There is a tide in the affairs of men which, taken at the flood, leads on to fortune. Omitted, all the journey of their life is bound in shallows and miseries".

With missed opportunity, the political leaders have inflicted upon the people shallows and miseries in terms of load shedding and food shedding.

The power crisis has in addition put a huge dent in our export earnings due to closure of industries, plus loss of jobs and hence increase in poverty.

Shortage of water has impacted upon food production leading to severe food inflation, 12 of the 19 crore people have been reduced to one meal per day, the 5 crore people below the poverty line in 2008 have now increased to 8 crores.

**4.0** In 1997, another political leader from the Punjab (then minister for water and power) gave an interview to the 'Jang' newspaper (April 21, 1997) after he had parted ways with the Pakistan People's Party (PPP). In the interview he said that after the initial resistance in Sindh he was able to convince the famous Political Leader in Sindh of the benefits of Kalabagh dam, and in fact the latter had actually sent him a letter of congratulations for his efforts on Kalabagh dam but had asked him not to go public on the issue until the latter had prepared the ground for it in the Party.

In another interview to the same paper he said that when he was canvassing for Kalabagh dam he had gone to the Sindh assembly where he met the political leaders of PPP including the Chief Minister of Sindh and was congratulated for his efforts to build Kalabagh Dam which was considered essential for Pakistan and for Sindh. At another place in the same interview this Politician was told in the governor's house in Lahore that Kalabagh Dam was going to be built.

But on going out of power soon after, the famous politician in Sindh started opposing Kalabagh dam again because a new Prime Minister from the Punjab had taken the issue in his own hands under an agenda of high priority. A slogan was again raised that this was the "Nawaz Dam" which cannot be built. This was the fourth time that Kalabagh Dam scuttled purely on political grounds.

**5.0** The initial opposition to the dam can be justified as not being knowledge based but opposing it after the said famous politician had become convinced that it was essential for Pakistan and for Sindh, reeks of rank opportunism and confirms the image as a Machiavellian politician ever ready to play politics with the interest of the country for political gains. Subsequently under pressure from his Party, the Politician from the Punjab was also heard on television channels saying how wrong it was for him to have supported Kalabagh dam when the people were against it. However, this Politician could not regain his place in the party as he was not accepted by the rank and file of the party. This became apparent when he reverted to his original stand on Kalabagh dam i.e. "I have said it before and I will say it again, Kalabagh dam is more important for Pakistan than the nuclear bomb".

This was not the end of politicization of Kalabagh dam. This time it was at the hands of the PPP sympathizers in senior positions in government offices. The original design of Basha dam was modified to give it superiority over Kalabagh dam.

The original height of Basha was 640 feet and its storage capacity was less than that of Kalabagh dam which had a storage capacity of 6.1 maf even with a much smaller height of 260 feet.

The anti Kalabagh dam lobby redesigned Basha dam to have a height of 900 feet which would give it a capacity of 7 maf. A dam of this size would take ages to build and cost a lot. To match the time and cost with that of Kalabagh dam changes were made in the construction material and in the mode of construction.

By cutting corners the period of construction and cost of construction were brought down to give Basha dam superiority over Kalabagh dam.

It is worthwhile to note some of the excerpts from a letter by Gen. Safdar Butt Chairman-WAPDA to President Pervaiz Musharraf of Pakistan.

i) "You are soon going to decide on the next dam to be built. My loyalty demands that being a senior engineer, I express my views to you.

ii) It is proposed to have 765 KV transmission line to reduce line losses, as against 550 KV for WAPDA, but with a non-existent switchgear. 765 KV switchgear is not available anywhere in the world. Falling back on 550 KV will make the transmission losses very high (not to mention cost per unit)

iii) The up-gradation of (approx) 200 KM of Karakorum Highway (KKH) from Balakot to Basha is a pre-requisite to the start of construction of the dam, since transporting some very heavy machinery will require greater road width, more gradual curves on turns and gentler road gradients. In broadening the road width, as an example, almost vertical hillside slopes and highly weathered, jointed and fractured rock will have to be excavated right up to the mountain tops

involving several thousand feet cuts along hundreds of KMs of length. All this activity has to be carried out while maintaining traffic. Based on my personal experience the time required will be much more. The cost will also be much more. The cost will also be much higher than being shown.

iv) The 100 KM of the existing KKH will get submerged in the Basha Reservoir and will have to be built at a higher and more difficult terrain.

In short everything about Basha is superlative and unprecedented: the roller-compacted-concrete design, the height, the huge underground powerhouses, tunnels and structure sizes; the 765 KV transmission line. Indeed there are a couple of stunted elements as well, namely the estimated cost and the implementation schedule.

**6.0** The end result of a Politician playing politics with Kalabagh dam is that all the followers in Sindh and Punjab take these utterances as gospel truth and think that Sindh will become a desert if Kalabagh dam is built, because the flow in the Indus will reduce and also because Punjab will take too much water from the dam because it is in Punjab. Is AJK getting more water from Mangla dam because it is in AJK, and is KPK getting more power from Tarbela dam because it is in KPK?

There seems to be complete ignorance about the operational system of canals. It is IRSA that will operate the dam and not Punjab, and Sindh has three votes in IRSA, the Sindh representative, the federal representative also from Sindh, and the Balochistan representative who always votes

with Sindh because Balochistan gets its water from Gudu Barrage in Sindh. Punjab has only one vote in IRSA.

Their ignorance is not limited to Kalabagh dam only, they also think that Punjab is stealing Sindh's water through the CJ and TP link canals. They are totally oblivious of the fact that Tarbela dam was built as a part of the replacement works under the Indus Waters Treaty for transferring water from the western rivers to the canals in north and south Punjab previously serviced by the Ravi and Sutlej Rivers respectively. Punjab has a legitimate share in the stored water out of which south Punjab is taking only 20%. North Punjab cannot get its due share without the left bank canal at Kalabagh dam, hence Sindh is taking a lion's share of 70% by default. But the common man is completely unaware of all this and keeps parroting that Punjab is stealing Sindh's water.

**7.0** According to a News Paper article in the Nation, Gen. Zahid Ali Akbar, Ex-Chairman WAPDA disclosed that after he had given a detailed briefing on Kalabagh dam to the then NWFP government in power, Begum Wali Khan said to him in private, 'General, what you say makes a lot of sense, but if we stop opposing Kalabagh dam it will be our political death.

After a similar briefing when Engr. Shams-ul-mulk (Ex) Chairman WAPDA asked Wali Khan to support Kalabagh dam, he said, 'How can I do that after having opposed it for 20 years'. **Opposition to Kalabagh dam is political and due to complete ignorance among the masses about the Kalabagh dam which is undoubtedly a Gold Mine for Pakistan.**

# Chapter 11

## THE WAY FORWARD

There is a common slogan that K.B Dam will be built after developing consensus of all provinces. Not much seems to be happening to get this consensus. The present Governmental approach seems to shelve the project, rather than move forward to discharge its responsibilities for development of the Country and legal proceedings under the Constitution of Pakistan. The legal proceedings by the Lahore High Court under case No. WPNO. 8777/2012 dated 29-11-2012 are quoted below:-

## LEGAL PROCEEDINGS

*"ORDER SHEET*

*THE LAHORE HIGH COURT, LAHORE*

*JUDICIAL DEPARTMENT*

*Case No. WPNO. 8777*

*29.11.2012*

*1. Senior joint secretary (CCI) of the Ministry of Interprovincial Coordination, Government of Pakistan has apprised the court of two decisions by the Council of Common Interests (CCI) regarding the Kalabagh Dam project.*

*The first is dated 16.09.1991 when express approval for construction of Kalabagh Dam multipurpose project was given.*

*Thereafter, on 09.05.1998 the CCI re-visited the project when the Ministry of Water and Power was directed to prepare for detractors a document explaining i) and ii):*

*i) the issues involved in the Construction of Kalabagh Dam*

*ii) and addressing political and technical concerns about it.*

*It was also directed that supplementary projects in support of the Kalabagh Dam be prepared to mitigate its effect.*

*Neither the said decisions nor the projects have thereafter received much attention of the Federal Government.*

*On behalf of the petitioner, it is pointed out that a technical study undertaken in 2004 by representatives of all four provinces has endorsed and approved the feasibility of Kalabagh Dam.*

*2. The Constitution of Pakistan confers a pre-eminent position to the CCI to formulate and regulate policies for the Federation in relation to a number of subjects, including, Water and Power.*

*A decision of the CCI has obligatory effect unless the same is modified by Parliament at the instance of the Federal Government under Article 154(7) of the Constitution.*

*In the present day of shortage of available electric power in the national grid, scarcity and depletion of irrigation water resource for arable land in the country and the frequent occurrence of floods in the Indus basin have adversely affected the quality and security of life of the citizens in the province of Punjab and the country as a whole.*

*The resulting degradation in the quality and conditions of life of the affected citizens violates their fundamental rights guaranteed under Article 9 and 25 of the Constitution.*

*3. In the circumstances and for detailed reasons to follow, the Federal Government is directed that in the performance of its duty under Article 154 of the Constitution, it shall in letter and spirit take steps to implement the decisions of the CCI dated 16.09.1991 and 09.05.1998 regarding Kalabagh Dam.*

*4. Bona fide steps by the Federal Government in the foregoing behalf are necessary so that the fate of the project is not sealed on the basis of presumptions and surmises when in the light of the material on record the project is admittedly feasible both technically and economically.*

*It is therefore directed that whilst implementing the afore-noted CCI decisions the Federal Government shall faithfully strive to explore and devise an administrative framework and safeguards that allay the*

*apprehensions, political or otherwise, nurtured by concerned quarters about the Kalabagh Dam project.*

*5. The foregoing steps shall be taken expeditiously by the Federal Government with a resolve to comply the provisions of Article 154 of the Constitution by effectuating the will of CCI as expressed or by seeking further guidance and direction there from if need arises.*

*Signed: Chief Justice of the Lahore High Court, Lahore"*

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It may be mentioned that Chief Justice had got all the objections by the detractors vetted by WAPDA and had ruled that they were based on lack of relevant information and were therefore not valid. Moving forward under such a situation requires a pragmatic policy which has to be devised consisting of the following actions.

## MOVING FORWARD

### 1.0 PROPAGANDA CAMPAIGN

- The Govt. may develop a strong will to build the Dam
- The project may be debated in the Provincial and federal assemblies to iron out the political differences.

- Frank and open debates on electronic and print media and public seminars to sort out issues & non-issues. (A special cell should be created in WAPDA for this purpose)

## 2.0 DISPUTE RESOLUTION FOR KALABAGH DAM PROJECT

Availability of a suitable dam site together with river flow to fill its reservoir is a gift of Nature to a lucky Nation. We are guilty of not making use of this gift.

KB Dam is a matter of life & death for the future prosperity of Pakistan. It is more so for the Sindh province which is deficient in rainfall and sweet ground water. All national & international experts have confirmed its technical & financial viability. We have already lost more than 27 years in the pursuit of its implementation. It is important that no more time may be lost in keeping the matter dormant. In order to move forward, it is also vitally essential to set up two Commissions for the purposes explained below:-

## 3.0 DISPUTE RESOLUTION COMMISSION

The "Dispute Resolution Commission" should consist of politicians, engineers and public figures of repute who should keep the matter alive. Some foreign experts on dispute resolution may also be engaged. This commission may actively pursue the matter till its final conclusion particularly the following issues:-

a) It should be forcefully explained with facts and figures among the people in Sindh that Sindh will be the

maximum gainer if the KB Dam is built and will be the worst sufferer if it is not.

b) The real causes of opposition to the building of the KB Dam should be sorted out and their remedial measures laid out to start implementation of the Project.

Many complicated issues in the World have been successfully resolved by conflict resolutions like the Camp David Accord etc. There is no reason that KB Dam issue may remain unresolved. As a matter of fact the major issues have already been settled. The shares of Provinces have already been agreed through the Water Accord of 1991. Releases downstream of Kotri Barrage have also been determined through the "Study Report on Water Escapages Downstream Kotri Barrage" by an American Company in association with Pakistani Companies.

## 4.0 JUDICIAL COMMISSION

The Judicial Commission should consist of retired Judges of the Supreme Court of Pakistan & the High Courts of all the Provinces. This Commission may hear all the concerned parties and sort out real issues from the non-issues. Under the present scenario, public at large is confused with the host of non-issues. Once this fog is cleared, the road map for construction of KB Dam will open up and the Nation will be set on the path of progress so vital for the existence of Pakistan.

The report of the Technical Committee on Water Resources (TCWR) appointed by the Govt. of Pakistan examined this

issue in detail during 2003-05 and issued a comprehensive report. This report provides very clear conclusions for the Judicial Commission to discuss, re-examine and sort out real issues from the non-issues and reach a final decision for the Govt. to move forward for strengthening the economy of Pakistan.

## 5.0 INCREASING ABIANA RATE

Simultaneously with the above activities, the following improvements in the use of water must be introduced in order to save the Country from the paralyzing situation.

1. Canal water is being used very ruthlessly by the farmers. In the Punjab a nominal flat rate of Rs. 150/- per acre per annum is being charged against the tube-well cost of Rs. 300/- per acre per annum. Being dirt cheap there is a huge wastage of canal water. The World Bank dislikes providing money for a water project in Pakistan where there is no system for recovering the money spent on water projects.

   In the Punjab where 22 million acres are cultivated under canal irrigation, the total revenue assessed as Abiana is only Rs. 2.5 billion per annum. The actual collection is merely Rs. 1.01 billion (year 2014) which works out to Rs. 50 per acre per annum. This is almost free water which is not being used in an efficient manner and an enormous amount of this precious asset is being wasted.

2. Increase Abiana rate to Rs. 1500/- per acre per annum which is just about half of the cost of Tubewell water.

With farmers using the canal water carefully, wastage will be reduced and better irrigation practices will be adopted leading to the highest crop intensity with the following advantages.

a) Irrigation Department revenue in Punjab for example will increase from 2.0 billion to 20 billion per year.

b) With this extra money the maintenance of the canal system will improve.

c) In addition free extension service can be provided to the small farmers for improving their yield with less water.

d) Dependence on Tube-wells will be reduced, ground water mining will be reduced along with saving of electricity.

e) Efficient use of water will increase public awareness & attitude towards conservation of water for irrigation.

f) Water logging of lands will be avoided with efficient use of water.

## 6.0 ADDITIONAL ADVANTAGES OF DAMS – POLLUTION FREE CHEAP POWER

As per 40 years record, after commissioning of Tarbela dam, more than 30 MAF of water is going to the sea below Kotri Barrage. At an accepted rate of $2.0 billion per MAF, Pakistan is dumping 60.0 billion Dollars into the sea per

annum. In order to save this horrendous loss to the Nation, the following advantages can be availed which must be adopted without any further loss of time:-

Pakistan has about 59000 MW identified hydropower potential (PLATE-II), out of which only 6600 MW of Hydel potential has been harnessed which is only about 10% of the total Hydel potential. Hydel power is an inexpensive, dependable, indigenous and environmentally friendly source of energy. It is essential that its share in overall electricity generation for sustainable economic development of Pakistan must be increased.

There is acute shortage of energy. We urgently need cheap electricity to supply to thousands of villages which are still devoid of this essential modern day need, for poverty alleviation and to sustain our agro based economy.

## 1. Energy is the Engine of Economy

Major advantages accruing from the dam energy are listed below:-

i) Industrial Development
ii) Increased work potential
iii) Job Opportunities
iv) Export earnings
v) Increased transport activities
vi) Improvement of foreign relations
vii) Improvement of human life
viii) Increased economic activities

## 2. Benefits of Flood Mitigation – Saving of Damages

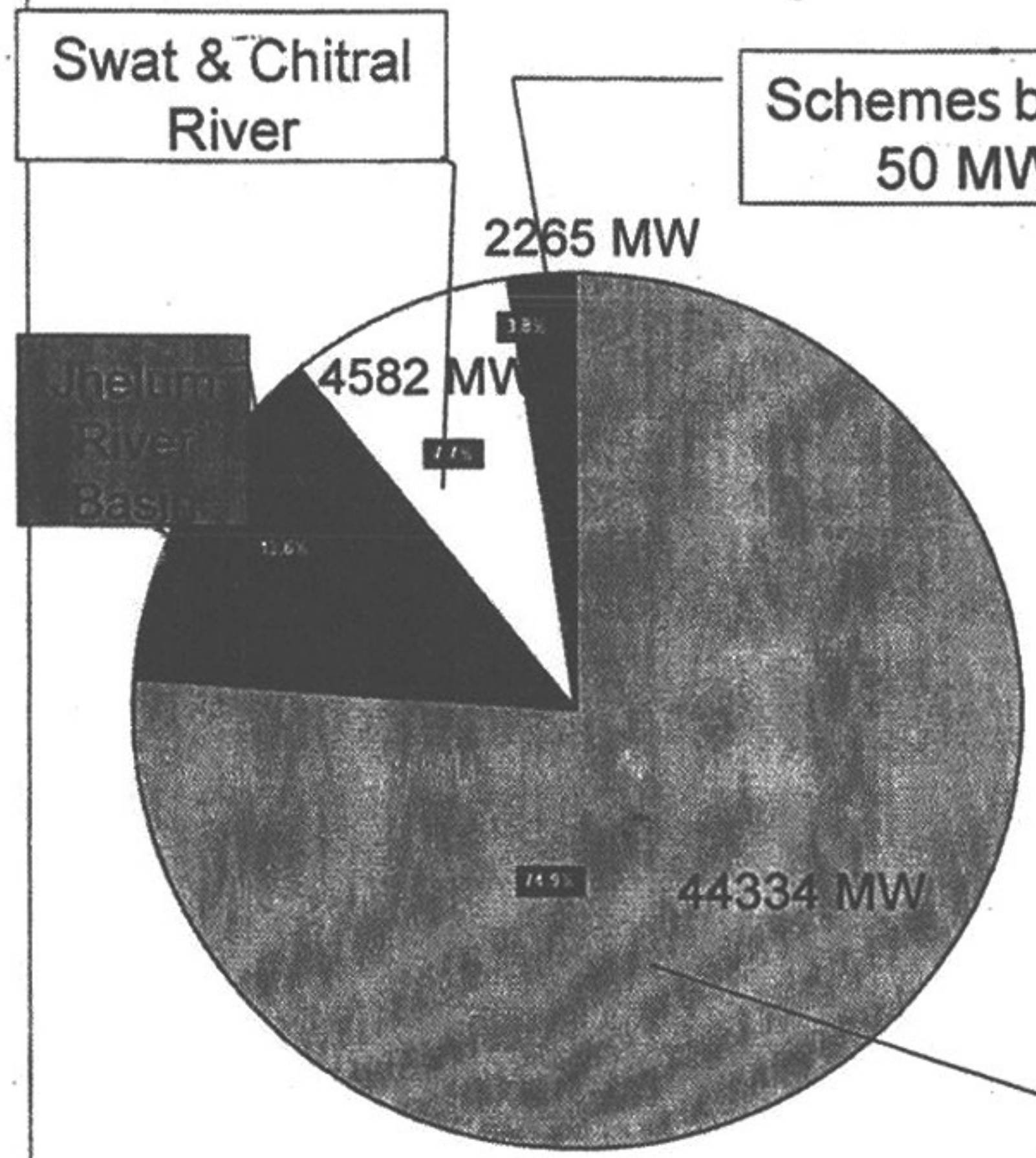
i) Damage to crops
ii) Damage to land
iii) Damage to flood bunds

iv) Damage to Barrage Structures
v) Reduction in displaced persons
vi) Reduction in rehabilitation effort
vii) Reduction in human & animal losses.
viii) Increased geopolitical stability

## 7.0 RECOMMENDATION UNDER THE PRESENT CIRCUMSTANCES

Kalabagh Dam Project (KBD) stands ready for implementation since 1988. Delay in its implementation hit the national economy hard in every sector. For reducing dependence on very costly thermal power, and saving foreign exchange, it is recommended that Kalabagh Dam Project be implemented without any further delay only as a "POWER PROJECT". It would be a "RUN-OF-RIVER", project which would generate 3600 MW of power and would not supply any water for irrigation to any Province. It will maintain the present position of full out flows, below Kotri to Sea. This will give a boost to the economy of Pakistan and substantial relief to its people who have been hit hard by load-shedding of electricity continuing over the last 10 years.

# PAKISTAN'S HYDROPOWER POTENTIAL




| | | |
|---|---|---|
| **Total Potential** | = | **100000 MW** |
| **Identified Potential** | = | **59208 MW** |
| **Tapped** | = | **6516 MW** |
| **In Process** | = | **1422 MW** |
| **Under Study** | = | **35000 MW** |

- Indus River Basin
- Jhelum River Basin
- Swat & Chitral River
- Small Hydel

*Kalabagh DAM*

*A Gold Mine for Pakistan*

PLATE-II

11-11

# APPENDIX

# WATER APPORTIONMENT ACCORD

# APPORTIONMENT OF THE WATERS OF THE INDUS RIVER SYSTEM BETWEEN THE PROVINCES

# KARACHI DATED MARCH 16, 1991

Karachi, dated 16.3.91

APPORTIONMENT OF THE WATERS OF THE INDUS RIVER SYSTEM BETWEEN THE PROVINCES.

As a follow-up to the meeting of the Chief Ministers at Lahore on March 3, 1991, a meeting of the representatives of the four provinces was held at Lahore on March 04, 1991. Another meeting was held at Karachi on March 16, 1991. The list of participants is attached.

The participants agreed on the following points:-

1. There was an agreement that the issue relating to Apportionment of the Waters of the Indus River System should be settled as quickly as possible,
2. In the light of the accepted water distributional principles the following apportionment was agreed to:

(Fig. in MAF)

| Province | | Kharif | Rabi | Total |
|---|---|---|---|---|
| Punjab | | 37.07 | 18.87 | 55.94 |
| Sindh* | | 33.94 | 14.82 | 48.76 |
| N.W.F.P | (a) | 3.48 | 2.30 | 5.78 |
| | (b) Civil Canals** | 1.80 | 1.20 | 3.00 |
| Baluchistan | | 2.85 | 1.02 | 3.87 |
| | | 77.34 | 37.01 | 114.35 |
| | | + | + | + |
| | | 1.80 | 1.20 | 3.00 |

* Including already sanctioned Urban and Industrial uses for Metropolitan Karachi.

** Ungauged Civil Canals above the rim stations.

3. N.W.F.P/Baluchistan Projects which are under execution have been provided their authorized quota of water as existing uses.

4. Balance river supplies (including flood supplies and future storages) shall be distributed as below:

| Punjab | Sindh | Baluchistan | NWFP | Total |
|---|---|---|---|---|
| 37 | 37 | 12 | 14 | 100% |

5. Industrial and Urban Water supplies for Metropolitan city, for which there were sanctioned allocations, will be accorded priority.

6. The need for storages, wherever feasible on the Indus and other rivers was admitted and recognised by the participants for planned future agricultural development.

7. The need for certain minimum escapage to sea, below Kotri, to check sea intrusion was recognized. Sindh held the view, that the optimum level was 10 M.A.F, which was discussed at length while other studies indicated lower/higher figures. It was, therefore, decided that further studies would be undertaken to establish the minimal escapage needs downstream Kotri.

8. There would be no restrictions on the Provinces to undertake new projects within their agreed shares.

9. No restrictions are placed on small schemes not exceeding 5000 acres above elevation of 1200 ft. SPD.

10. No restrictions are placed on developing irrigation uses in the Kurram/Gomal/Kohat basins, so long as these do not adversely affect the existing uses on these rivers.

11. There are no restrictions on Baluchistan, to develop the water resources of the Indus right bank tributaries, flowing through its areas.

12. The requirements of LBOD will be met out of the flood supplies in accordance with the agreed sharing formula.

13. For the implementation of this accord, the need to establish an Indus River System Authority was recognized and accepted. It would have headquarters at Lahore and would have representation from all the four provinces.

14. a) The system-wise allocation will be worked out separately, on ten daily basis and will be attached with this agreement as part and parcel of it.

b) The record of actual average system uses for the period 1977-82, would form the guide line for developing a future regulation pattern. These ten daily uses would be adjusted pro-rata to correspond to the indicated seasonal allocations of the different canal systems and would form the basis for sharing shortages and surpluses on all Pakistan basis.

c) The existing reservoirs would be operated with priority for the irrigation uses of the Provinces.

d) The provinces will have the freedom within their allocations to modify system-wise and period-wise uses.

e) All efforts would be made to avoid wastages. Any surpluses may be used by another province, but this would not establish any rights to such uses.

16/3/91

C.M. Punjab
Ghulam Hyder Wyne

16/3

C.M. Sindh
Jam Sadiq Ali

C.M. NWFP
Mir Afzal Khan

Taj Muhammad Jamali

C.M. Baluchistan
Mir Taj Mohammad Jamali

Shah Mehmood Qureshi
Minister Finance

Muzaffar Hussain
Minister Law

Mohsin Ali Khan
Minister Finance

16/3.91

Mir Zulfiqar Ali Maagsi
Minister Home

Mazhar Ali
Adviser

16.3.

Mohammad Alim Baloch
A.C.S (I&P)/Advisor

Khalid Aziz
A.C.S.(P&D)
16/3/91

Mohammad Amin 16-3-91
Secretary (I&P)

16.3.91
R. K. ANJUM

Annexure-II
(Appendix-D)
(Karachi, Dated 16.3.91)

# APPORTIONMENT OF THE WATERS OF TEE INDUS RIVER
## BETWEEN THE PROVINCES

As a follow-up to the meeting of the

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. . . . . .

March 04, 1991. Another meeting was held at Karachi on March 16, 1991. The list of participants is attached.

1. There was an agreement that the issue relating to apportionment of the Waters of the Indus River System should be settled as quickly as possible.

2. In the light of the accepted water distributional principles the following apportionment was agreed to:

(Fig. in MAF)

| Province | Kharif | Rabi | Total |
|---|---|---|---|
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| (b) Civil Canals** | 1.80 | 1.20 | 3.00 |
| Baluchistan | 2.85 | 1.02 | 3.87 |
| | 77.34 | 37.01 | 114.35 |
| | + | + | + |
| | 1.80 | 1.20 | 3.00 |

* Including already sanctioned Urban and Industrial uses for Metropolitan Karachi.

** Ungauged Civil Canals above the rim stations.

3. N.W.F. P/ Baluchistan Projects which are under execution have been provided their authorized quota of water as existing uses.

4. Balance river supplies (including flood supplies and future storages) shall be distributed as below:

| Punjab | Sindh | Baluchistan | NWFP | Total |
|---|---|---|---|---|
| 37 | 37 | 12 | 14 | 100% |

5. Industrial and Urban Water supplies for Metropolitan city, for which there were sanctioned allocations, will be accorded priority.

6. The need for storages, wherever feasible on the Indus and other rivers was admitted and recognized by the participants for planned future agricultural development.

7. The need for certain minimum escapage to sea, below Kotri, to check sea intrusion was recognized. Sindh held the view, that the optimum level was 10 M.A.F, which was discussed at length, while other studies indicated lower/higher figures. It was, therefore, decided that further studies would be undertaken to establish the minimal escapage need downstream below:

8. There would be no restrictions on the provinces to undertake new projects within their agreed shares.

9. No restrictions are placed on small schemes not exceeding 5,000 acres above elevation of 1200 ft. SPD.

10. No restrictions are placed on developing irrigation uses in the Kurram/Gomal/Kohat basins, so long as these do not adversely affect the existing use on these rivers.

11. There are no restrictions on Balochistan, to develop the water resources of the Indus right bank tributaries, flowing through its areas.

12. The requirements of LBOD will be met out of the flood supplies in accordance with the agreed sharing formula.

13. For the Implementation of this accord, the need to establish an Indus River System Authority was recognized and accepted. It would have headquarters at Lahore and would have representation from all the four provinces.

14. a) The system-wise allocation will be worked out separately, on ten daily basis and will be attached with this agreement as part and parcel of it.

    b) The record of actual average system uses for the period 1977-82, would form the guide line for developing a future regulation pattern. These ten daily uses would be adjusted prorata to correspond to the indicated seasona1 allocations of the different canal systems and would form the basis for sharing shortages and surpluses on all Pakistan basis.

    c) The existing reservoirs would be operated with priority for the irrigation uses of the provinces.

    d) The provinces will have freedom within their allocations to modify system-wise and period-wise uses.

    e) All efforts would be made to avoid to wastages. Any surpluses may be used by another province, but this would not establish any rights to such uses.

# INDUS WATER ACCORD
## 10-DAY SEASONAL SYSTEMWISE ADJESTED ALLOCATIONS
## (EXCLUDING FLOOD FLWS & FUTURE STORAGES)
## PUNJAB KHARIF

| Period | | FLC | X& INT | CBDC | SVC (Upper) | SVC (Lover) | Trieu | Panjnad | Thal Cannal | Taunsa Canals | C&BC | Greate r Thal | Total (1000 CS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr | 1 | 24.2 | 0.1 | 1.8 | 8.3 | 3.9 | 2.9 | 4.3 | 6.0 | 4.9 | 1.8 | 2.6 | 60.8 |
| | 2 | 24.7 | 0.3 | 1.9 | 10.3 | 3.7 | 3.4 | 5.1 | 6.4 | 4.3 | 0.8 | 3.4 | 64.3 |
| | 3 | 28.1 | 1.1 | 2.0 | 13.3 | 5.5 | 5.5 | 7.3 | 6.4 | 7.9 | 0.5 | 4.9 | 82.5 |
| May | 1 | 30.1 | 1.3 | 2.1 | 16.0 | 8.0 | 5.9 | 7.5 | 6.6 | 10.0 | 0.7 | 5.4 | 93.6 |
| | 2 | 30.3 | 2.0 | 2.1 | 17.2 | 8.7 | 6.1 | 9.0 | 6.8 | 11.5 | 1.1 | 5.5 | 100.3 |
| | 3 | 31.6 | 2.0 | 2.2 | 18.1 | 9.2 | 6.3 | 9.5 | 6.8 | 11.9 | 1.3 | 5.5 | 104.4 |
| Jun | 1 | 32.3 | 2.6 | 2.8 | 18.5 | 9.4 | 6.6 | 10.5 | 6.8 | 13.0 | 1.7 | 5.4 | 109.6 |
| | 2 | 33.2 | 8.6 | 2.2 | 18.7 | 9.7 | 6.7 | 10.4 | 6.9 | 13.5 | 1.8 | 5.5 | 117.2 |
| | 3 | 34.0 | 4.0 | 2.0 | 19.2 | 9.6 | 6.7 | 10.7 | 6.7 | 14.0 | 1.8 | 5.7 | 114.4 |
| Jul | 1 | 22.7 | 5.4 | 2.2 | 19.2 | 9.9 | 6.6 | 10.4 | 6.6 | 14.3 | 1.7 | 5.8 | 104.8 |
| | 2 | 29.6 | 5.0 | 2.0 | 17.9 | 8.7 | 5.7 | 9.9 | 6.8 | 12.5 | 1.7 | 5.1 | 104.9 |
| | 3 | 27.8 | 6.1 | 1.8 | 16.8 | 9.7 | 5.1 | 9.6 | 5.9 | 11.8 | 1.8 | 4.7 | 101.1 |
| Aug | 1 | 28.2 | 5.8 | 1.7 | 17.4 | 8.2 | 5.3 | 9.6 | 6.0 | 11.5 | 1.8 | 4.8 | 100.3 |
| | 2 | 21.5 | 6.1 | 1.8 | 19.3 | 9.3 | 6.3 | 10.6 | 6.8 | 11.3 | 1.8 | 5.4 | 100.2 |
| | 3 | 34.6 | 4.9 | 2.0 | 20.6 | 10.1 | 6.8 | 11.1 | 5.6 | 13.9 | 1.8 | 5.9 | 118.3 |
| Sep | 1 | 33.9 | 4.4 | 2.1 | 21.0 | 10.0 | 6.8 | 11.1 | 6.9 | 14.4 | 1.8 | 5.9 | 118.3 |
| | 2 | 33.9 | 8.7 | 2.1 | 20.6 | 9.8 | 6.8 | 10.8 | 6.8 | 14.0 | 1.8 | 5.8 | 121.1 |
| | 3 | 33.1 | 2.3 | 2.3 | 19.6 | 9.8 | 6.9 | 11.0 | 6.2 | 13.0 | 1.8 | 5.5 | 112.1 |
| Total MAF | | 11.10 | 1.24 | 0.74 | 8.31 | 3.07 | 2.15 | 3.40 | 2.37 | 4.13 | 0.55 | [illegible] | 37.07 |

## PUNJAB RABI

| Period | | FLC | X& INT | CBDC | SVC (Upper) | SVC (Lover) | Trieeo | Panjnad | Thal Cannal | Taunsa Canals | C&BC | Greater Thal | Total (1000 CS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1 | 28.2 | 1.0 | 1.4 | 15.2 | 8.9 | 8.5 | 1.8 | 6.9 | 11.9 | 1.8 | - | 85.0 |
| | 2 | 26.7 | 0.6 | 1.9 | 13.4 | 8.4 | 5.7 | 0.9 | 5.9 | 9.8 | 0.9 | - | 74.2 |
| | 3 | 25.4 | 0.7 | 2.0 | 11.3 | 6.3 | 4.6 | 1.0 | 6.2 | 6.2 | 1.0 | - | 64.7 |
| Nov | 1 | 24.3 | 0.8 | 2.1 | 9.6 | 4.3 | 3.6 | 4.3 | 6.1 | 4.5 | 0.9 | - | 60.5 |
| | 2 | 23.5 | 0.1 | 2.0 | 8.6 | 3.3 | 3.1 | 4.0 | 6.0 | 5.0 | 1.0 | - | 56.6 |
| | 3 | 22.4 | 0.0 | 2.0 | 8.7 | 2.9 | 2.9 | 3.7 | 6.0 | 3.1 | 1.0 | - | 52.7 |
| Des | 1 | 22.3 | 0.0 | 1.9 | 9.4 | 4.0 | 3.2 | 3.6 | 5.3 | 2.6 | 0.6 | - | 52.9 |
| | 2 | 21.3 | 0.0 | 1.8 | 8.9 | 3.7 | 3.3 | 3.5 | 5.7 | 2.9 | 0.6 | - | 51.7 |
| | 3 | 17.3 | 0.0 | 1.0 | 5.5 | 3.5 | 2.9 | 1.9 | 5.3 | 1.5 | 0.7 | - | 39.6 |
| Jan | 1 | 9.9 | 0.2 | 0.1 | 1.0 | 6.7 | 4.1 | 1.4 | 1.8 | 0.6 | 0.9 | - | 26.7 |
| | 2 | 8.7 | 0.1 | 0.8 | 3.5 | 4.3 | 2.6 | 2.1 | 0.1 | 1.8 | 0.8 | - | 24.8 |
| | 3 | 10.4 | 0.1 | 1.3 | 7.1 | 0.5 | 0.2 | 2.9 | 2.0 | 3.1 | 0.9 | - | 28.5 |
| Feb | 1 | 19.6 | 0.1 | 1.6 | 9.4 | 0.8 | 1.0 | 3.1 | 4.8 | 3.7 | 1.3 | - | 45.4 |
| | 2 | 19.5 | 0.7 | 1.7 | 9.6 | 2.3 | 2.5 | 3.1 | 5.7 | 3.3 | 1.1 | - | 49.5 |
| | 3 | 17.8 | 0.2 | 1.5 | 7.6 | 3.6 | 2.4 | 2.3 | 4.9 | 3.1 | 0.9 | - | 44.3 |
| Mar | 1 | 18.0 | 0.6 | 1.1 | 10.1 | 4.3 | 2.9 | 3.9 | 4.8 | 3.4 | 1.5 | - | 50.6 |
| | 2 | 20.0 | 0.1 | 1.2 | 11.3 | 5.2 | 4.0 | 4.3 | 5.3 | 3.7 | 1.3 | - | 56.4 |
| | 3 | 21.3 | 0.1 | 1.2 | 10.0 | 5.5 | 3.5 | 4.3 | 5.6 | 4.4 | 1.2 | - | 57.1 |
| Total MAF | | 7.13 | 0.10 | 0.53 | 3.21 | 1.57 | 1.13 | 1.52 | 1.77 | 1.58 | 0.36 | - | 18.87 |
| Grand Total MAF | | 18.23 | 1.34 | 1.27 | 11.52 | 4.64 | 3.28 | 4.92 | 4.14 | 5.63 | 0.91 | 1.87 | 55.94 |

INDUS WATER ACCORD
10-DAY SEASONAL SYSTEMWISE ADJESTED ALLOCATION
(EXCLUDING FLOOD FLWS & FUTURE STORAGES)
SINDH-KHARIF

| Period | | Guddu Canals | Sukkar Canals | Kotri Canals | Total |
|---|---|---|---|---|---|
| Apr | 1 | 0.0 | 34.0 | 6.2 | 40.2 |
| | 2 | 0.2 | 34.3 | 6.8 | 41.3 |
| | 3 | 1.4 | 31.6 | 6.9 | 39.9 |
| May | 1 | 3.7 | 35.1 | 12.3 | 51.1 |
| | 2 | 6.5 | 39.5 | 15.7 | 61.7 |
| | 3 | 12.6 | 43.1 | 21.7 | 77.4 |
| Jun | 1 | 22.7 | 49.1 | 28.9 | 98.7 |
| | 2 | 31.1 | 56.0 | 32.5 | 119.6 |
| | 3 | 35.2 | 60.6 | 33.8 | 129.6 |
| Jul | 1 | 41.1 | 61.2 | 34.2 | 136.5 |
| | 2 | 36.2 | 57.1 | 29.8 | 123.1 |
| | 3 | 30.1 | 54.3 | 31.0 | 115.4 |
| Aug | 1 | 28.5 | 54.0 | 27.6 | 110.1 |
| | 2 | 27.8 | 54.4 | 23.4 | 105.6 |
| | 3 | 29.7 | 54.6 | 23.8 | 108.1 |
| Sep | 1 | 26.5 | 55.1 | 27.6 | 109.2 |
| | 2 | 26.8 | 56.5 | 25.1 | 108.4 |
| | 3 | 25.8 | 55.8 | 23.3 | 104.9 |
| Total MAF | | 7.77 | 17.90 | 8.27 | 33.94 |

SINDH RABI

| Period | | Guddu Canals | Sukkar Canals | Kotri Canals | Total |
|---|---|---|---|---|---|
| Oct | 1 | 17.6 | 43.6 | 18.0 | 79.2 |
| | 2 | 10.2 | 37.8 | 14.5 | 62.5 |
| | 3 | 6.3 | 33.0 | 11.3 | 50.6 |
| Nov | 1 | 4.1 | 31.4 | 9.6 | 45.1 |
| | 2 | 3.5 | 31.4 | 7.5 | 42.4 |
| | 3 | 3.2 | 31.1 | 5.7 | 40.0 |
| Des | 1 | 2.6 | 31.4 | 5.0 | 39.0 |
| | 2 | 2.0 | 31.8 | 4.7 | 38.5 |
| | 3 | 2.0 | 26.3 | 4.5 | 32.8 |
| Jan | 1 | 5.4 | 12.3 | 3.1 | 20.8 |
| | 2 | 10.4 | 5.4 | 8.6 | 24.4 |
| | 3 | 5.5 | 20.3 | 11.7 | 37.5 |
| Feb | 1 | 1.3 | 31.9 | 8.8 | 42.0 |
| | 2 | 1.7 | 31.1 | 4.9 | 37.7 |
| | 3 | 2.3 | 30.0 | 5.2 | 37.5 |
| Mar | 1 | 2.7 | 29.7 | 4.4 | 36.8 |
| | 2 | 2.4 | 29.4 | 4.2 | 37.0 |
| | 3 | 2.0 | 28.5 | 4.7 | 35.2 |
| TOTAL MAF | | 1.73 | 10.34 | 2.75 | 14.82 |

خدا نے آج تک اس قوم کی حالت نہیں بدلی
نہ ہو جس کو خیال آپ اپنی حالت کے بدلنے کا

اقبالؔ

INDUS WATER ACCORD

10-DAY SEASONAL SYSTEMWISE ADJESTED ALLOCATIONS

(EXCLUDING FLOOD FLOWS & FUTURE STORAGES)

NWFP KHARIF

| Period | | Swat Canals | Kabul River Canals | Indus Canals | Other Canals | Civil Ungauged Canals | Total (1000) CS |
|---|---|---|---|---|---|---|---|
| Apr | 1 | 2.91 | 0.69 | 4.53 | 0.16 | 4.91 | 13.20 |
| | 2 | 3.39 | 0.94 | 4.20 | 0.50 | 4.91 | 13.94 |
| | 3 | 3.60 | 1.16 | 3.71 | 0.53 | 4.91 | 13.91 |
| May | 1 | 3.74 | 0.98 | 3.99 | 0.54 | 5.01 | 14.26 |
| | 2 | 3.90 | 1.10 | 4.39 | 0.36 | 5.01 | 14.76 |
| | 3 | 3.90 | 1.18 | 4.62 | 0.48 | 5.01 | 15.19 |
| Jun | 1 | 3.84 | 1.16 | 5.37 | 0.50 | 5.11 | 15.98 |
| | 2 | 3.84 | 1.12 | 5.45 | 0.40 | 5.11 | 15.92 |
| | 3 | 3.90 | 1.20 | 5.55 | 0.34 | 5.11 | 16.00 |
| Jul | 1 | 3.69 | 1.08 | 4.27 | 0.34 | 4.91 | 14.29 |
| | 2 | 3.56 | 0.98 | 4.09 | 0.19 | 4.91 | 13.73 |
| | 3 | 3.24 | 0.84 | 4.03 | 0.16 | 4.91 | 13.18 |
| Aug | 1 | 3.54 | 0.84 | 4.62 | 0.10 | 4.81 | 13.91 |
| | 2 | 3.10 | 1.04 | 4.24 | 0.16 | 4.81 | 13.35 |
| | 3 | 2.93 | 1.08 | 4.62 | 0.26 | 4.81 | 13.70 |
| Sep | 1 | 3.78 | 1.06 | 5.42 | 0.28 | 5.11 | 15.65 |
| | 2 | 3.50 | 1.16 | 5.25 | 0.30 | 5.11 | 15.32 |
| | 3 | 3.10 | 1.18 | 6.01 | 0.54 | 5.11 | 15.94 |
| Total MAF | | 1.28 | 0.8 | 1.7 | 0.12 | 1.8 | 5.26 |

NWFP RABI

| Period | | Swat Canals | Kabul River Canals | Indus Canals | Other Canals | Civil Ungauged Canals | Total (1000) CS |
|---|---|---|---|---|---|---|---|
| Oct | 1 | 3.67 | 1.16 | 4.94 | 0.42 | 3.73 | 13.92 |
| | 2 | 3.75 | 1.20 | 4.97 | 0.49 | 3.73 | 14.14 |
| | 3 | 3.86 | 1.12 | 4.01 | 0.56 | 3.73 | 13.28 |
| Nov | 1 | 3.93 | 1.14 | 3.87 | 0.46 | 3.24 | 12.84 |
| | 2 | 2.72 | 1.04 | 3.24 | 0.35 | 3.24 | 10.59 |
| | 3 | 2.39 | 1.02 | 3.64 | 0.30 | 3.24 | 10.59 |
| Des | 1 | 1.74 | 0.98 | 2.19 | 0.10 | 3.41 | 8.42 |
| | 2 | 1.78 | 1.05 | 1.96 | 0.10 | 3.41 | 8.30 |
| | 3 | 1.74 | 0.94 | 2.00 | 0.22 | 3.41 | 8.31 |
| Jan | 1 | 0.00 | 0.12 | 1.84 | 0.26 | 1.95 | 4.17 |
| | 2 | 0.00 | 0.00 | 1.82 | 0.20 | 1.95 | 3.97 |
| | 3 | 0.00 | 0.40 | 2.07 | 0.12 | 1.95 | 4.54 |
| Feb | 1 | 1.32 | 0.10 | 2.52 | 0.16 | 3.73 | 7.83 |
| | 2 | 1.33 | 0.60 | 2.39 | 0.14 | 3.57 | 8.57 |
| | 3 | 1.43 | 0.58 | 3.81 | 0.06 | 3.57 | 9.45 |
| Mar | 1 | 2.18 | 0.54 | 3.92 | 0.12 | 3.89 | 10.65 |
| | 2 | 2.62 | 0.48 | 3.85 | 0.30 | 3.73 | 10.98 |
| | 3 | 3.27 | 0.58 | 3.66 | 0.30 | 3.73 | 11.54 |
| Total MAF | | 0.81 | 0.06 | 1.12 | 0.11 | 1.20 | 3.50 |
| G.TOTAL MAF | | 2.09 | 0.86 | 2.82 | 0.23 | 3.00 | 8.76 |

INDUS WATER ACCORD

10-DAY SEASONAL SYSTEMWISE ADJESTED ALLOCATIONS

(EXCLUDING FLOOD FLOWS & FUTURE STORAGES)

BALOCHISTAN KHARIF

| Period | | Sukkar Canals | Guddu Canals | Total |
|---|---|---|---|---|
| Apr | 1 | 2.19 | 0.05 | 2.24 |
| | 2 | 0.57 | 0.70 | 1.27 |
| | 3 | 0.00 | 0.40 | 0.40 |
| May | 1 | 0.00 | 0.68 | 0.68 |
| | 2 | 0.60 | 1.24 | 1.84 |
| | 3 | 0.70 | 2.54 | 3.24 |
| Jun | 1 | 2.00 | 5.64 | 7.64 |
| | 2 | 2.20 | 6.44 | 8.64 |
| | 3 | 2.20 | 7.83 | 10.03 |
| Jul | 1 | 2.20 | 9.49 | 11.69 |
| | 2 | 2.20 | 8.80 | 11.00 |
| | 3 | 2.20 | 9.80 | 12.00 |
| Aug | 1 | 2.20 | 9.21 | 11.41 |
| | 2 | 2.20 | 9.21 | 11.43 |
| | 3 | 2.20 | 9.45 | 11.65 |
| Sep | 1 | 2.20 | 9.22 | 11.42 |
| | 2 | 2.20 | 9.78 | 11.98 |
| | 3 | 2.20 | 10.24 | 12.44 |
| TOTAL MAF | | 0.61 | 2.24 | 2.85 |

BALOCHISTAN RABI

| Period | | Sukkar Canals | Guddu Canals | Total (1000 * CS) |
|---|---|---|---|---|
| Oct | 1 | 1.00 | 3.74 | 4.74 |
| | 2 | 0.90 | 3.15 | 4.05 |
| | 3 | 0.90 | 3.15 | 4.05 |
| Nov | 1 | 0.80 | 2.33 | 3.13 |
| | 2 | 0.90 | 2.54 | 3.44 |
| | 3 | 0.60 | 2.17 | 2.77 |
| Des | 1 | 0.70 | 2.21 | 2.91 |
| | 2 | 0.65 | 1.68 | 2.33 |
| | 3 | 0.50 | 1.32 | 1.82 |
| Jan | 1 | 0.60 | 1.83 | 2.43 |
| | 2 | 0.65 | 2.12 | 2.77 |
| | 3 | 0.70 | 2.19 | 2.89 |
| Feb | 1 | 0.60 | 1.91 | 2.51 |
| | 2 | 0.70 | 2.01 | 2.71 |
| | 3 | 0.60 | 2.03 | 2.63 |
| Mar | 1 | 0.60 | 1.43 | 2.03 |
| | 2 | 0.60 | 1.63 | 2.23 |
| | 3 | 0.40 | 1.12 | 1.52 |
| TOTAL MAF | | 0.25 | 0.77 | 1.02 |

X