
DEVELOPMENT OF WATER RESOURCES KHYBER PAKHTUNKHWA

Introduction

Khyber Pakhtunkhwa is relatively a backward province of Pakistan. Due to merger of erstwhile FATA with the Province, its existing poverty has further enhanced. Land holding of agricultural land in the province is low and resultantly the province is suffering from shortage of all staple food grains. The province has a vast potential of bringing its huge quantum of arable land under irrigation through its available water resources.

To attract attention of political governments and other policy makers, the Institute of Regional Studies (**IRS**) in collaboration with Pakistan Engineers Forum (**PEF**) Peshawar convened a Symposium on 13th September, 2023. Various experts of irrigation sector presented their papers regarding water and land resources of the province. They also highlighted proposals for optimal utilization of land and water resources in the province. The prevailing obstacles in achieving the proposed action plans and the way out were also discussed.

The Symposium was presided over by Engr, Muhammad Naeem Khan former Chief Engineer Irrigation Department, former Secretary Irrigation department and CEO PEDO Khyber Pakhtunkhwa. The expert speakers in the symposium were Engr. Shafiqur Rehman former Chief Engineer Irrigation Department, Khyber Pakhtunkhwa, Professor Rashid Rehan of the University of Engineering and Technology Peshawar (UET), Engr. Sheikh Muhammad Jalil DG Small Dams Irrigation Department. Eng Shafiqur Rehman has prepared this report.

Brief report and conclusions from the Symposium are summarized and reproduced here.

- **Dr. Muhammad Iqbal Khalil** Chairman IRS Khyber Pakhtunkhwa Peshawar.

- **Engr. Azizul Haq** President Pakistan Engineers Forum (PEF) Khyber Pakhtunkhwa.

1. Pakistan

The Islamic Republic of Pakistan is located in South Asia. Geographical Area is 796,095 km², and Population is 241.49 million (2023) on a growth rate of 2.55%. (Approved on 5th August 2023 by the CCI). The country shares 6,774 kilo Meters of land border with Afghanistan (to the west), China (to the north-east), India (to the east) and Iran (to the south-west). It has also got a 1,046-kilo meter coastline along the Arabian Sea. It has narrowly been separated from Tajikistan by a strip of Afghanistan's Wakhan Corridor in the northwest (Chitral), and also shares a maritime border with Oman. Culturable agricultural land of Pakistan is 39.58 million hectares out of which 30 million hectares is cultivated. Out of cultivated area, 20 million hectares is under proper artificial irrigation water supplies and 16 million hectares is under dry-land farming. The total irrigated area is 60% of the cultivated area and the rest comprises on Culturable waste, buildings, roads, streams, forests rangelands etc. There are 3 major reservoirs (Chashma with 0.42 MAF capacity against its designed 0.72 MAF), Mangla with the revised present capacity of 7.356 MAF after recent raising against the original design of 5.34 MAF) and Tarbela having 6.5 MAF capacity against its original design of 9.680 MAF). The decreasing trend in storage capacity is due to continuous siltation which indicates a total anticipated loss of about 37% till 2025. The Irrigation system mainly comprises on 18 barrages (Ferozepur, Sulemanki, Islam, Balloki, Marala, Trimmu, Panjnad, Sukkur, Kotri, Taunsa, Guddu, Chashma, Mailsi, Sidhnai, Rasul, Qadirabad, and Marala); 12 link canals, 45 irrigation canals, over 107,000 water courses, millions of farm channels and field ditches. The length of main canal system is about 5, 85,000 Kilometers, whereas the length of watercourses & field channels exceeds 1.62 million kilo

meters. During 2022 the surface water availability during Kharif season remained 67.87 MAF and Rabi as 52.68 MAF which gives a total 98.57 MAF at canal head and 80.20 MAF at farm gate, Ground Water availability remained about 2 MAF from public tube wells, about 42.2 MAF from private tube wells, and 5.6 MAF from the Scarp Tube wells which gives a total ground water availability as 49.8 MAF. Historical water availability below the rim stations was calculated as 148.8 MAF out of which 117.5 MAF has been distributed amongst the provinces in 1991 Water Apportionment Accord. The remaining as flood water was 31.3 MAF at Kotri Barrage. Leaving 5 MAF as environmental flow downstream Kotri Barrage, the remaining 26.3 MAF goes waste to the Arabian Sea. It means that water of about 4 Tarbela dam storage is annually flowing Waste toward the Sea during flood season. Besides, making the country as food insecure, the economic loss of such wastage of flood water is about 26 billion US Dollars. At present, work on Basha-Diamir dam on Indus River, Kurram Tangi Dam at Kurram River, Mohmand Dam at Swat River and many other small dams on various hill torrents is in progress and at the deferent stages of completion.

2. Khyber Pakhtunkhwa

I. GEOGRAPHICAL AREA.

Geographical area of Khyber Pakhtunkhwa Province is 74521Sq:KM and newly Merged Areas is 27220 Sq.: Km giving a total area of the province as 101,741 Sq:K

II: POPULATION

Population of Khyber Pakhtunkhwa as per 2017 PopulationCensus was 30.52 million with 2.89 % Growth Rate and Merged Areas = 5.001676 million with annual growth rate of 2.41%. Urban population was 141898 and

Rural was 4859778, Households of MA was 558379 and thus the total population of the province as a whole was 35.52 million (8.60 persons perHouse in MA and 7.22 in KP). In 2023, the population increased to 40.856 million at the 2.38% growth rate with an average house hold of 6.94 person. Rural population is 34 million and urban is 6.856. The present data indicates that 83% of the population reside in rural area depending on agricultural activities and thus pressure on water and agriculture sector is very high.

III. DETAIL OF CULTIVATED AND CROPPED AREA

Description	2018-19	2019-20	2020-21	2021-22
Reported Area	8,355,157	8,355,157	8,366,937	8,366,937
Total Un-Cultivated Area	6,482,462	6,479,620	6,513,790	6,542,346
Forest Area	1,239,014	1,239,080	1,226,396	1,167,515
Not Available for Cultivation	3,924,986	3,925,107	3,972,746	3,980,638
Culturable Waste	1,318,462	1,315,433	1,314,648	1,394,193
Total Cultivated Area	1,872,695	1,875,537	1,853,147	1,824,591
Current Fallow	608,270	594,602	633,051	640,816
Net Area Sown	1,264,425	1,280,935	1,220,096	1,183,775
Area Sown More than Once	598,107	550,049	578,762	600,953
Total Cropped Area	1,862,532	1,830,984	1,798,858	1,784,728

IV. DETAIL OF EXISTING IRRIGATED AREA (HECTARES)

Year	Total Irrigated Area	Canals		Tanks	Tube Wells	Wells	Lift pumps	Others
		Govt.	Private					
2018-19	934,578	449,076	258,820	23,740	86,432	49,636	33,384	33,490
2019-20	934,578	441,279	256,060	23,493	95,694	49,329	33,244 3	33,553
2019-20	1,002,497	456,414	278,418	4,716	94,355	80,858	54,113	33,623
2021-22	967968	455159	276631	4417	97344	40550	49152	44715

V. UN-IRRIGATED AREA OF KHYBER PAKHTUNKHWA

According to the Development statistics Khyber Pakhtunkhwa 2023, Cultivable area of Khyber Pakhtunkhwa is 1824591 hectares, cropped area is 1784728 hectares. Irrigated area is 967968 hectares and thus the un-irrigated area of the province is 1784728–967968 ha=816760 hectares or 2017397 acres. The cropping intensity is 97.80 and land use intensity is 56.68%, Agriculture sector provides 30.57% employment to the local populace. The Nos. of employed persons is 2,875,972 Nos. out of which 1,812,112 are Males and 1,063,860 are Females.

Vi. CULTURABLE WASTE AREA KHYBER PAKHTUNKHWA.

According to the Development Statistics Khyber Pakhtunkhwa 2023, there is about 1.39 million hectares or 3.43 million Acres uncultivated land, which is fit for cultivation but cropped due to undulated nature and deficient in crops nutrients. By leveling and agriculture extension services the said Culturable waste land can be converted to cropped area.

V. UN-IRRIGATED AREA OF KHYBER PAKHTUNKHWA

The climate of Khyber Pakhtunkhwa varies from area to area. Stretching south-wards from the Broghol Pass in the Hindu Kush mountainous region in the north, down to Dera Ismail Khan, the temperature, rainfall and other meteorological characteristics of the area varies widely. Dera Ismael Khan is one of the hottest places in South Asia while in the northern mountainous areas, the weather remains temperate in the summer and intensely cold in the winter. The natural precipitation is scanty, uneven, and mostly occurring in northern mountains where agricultural cultivation is limited. Further the rainfall and snow melt water is wasted during surface evaporation and transmission in rivers-streams as well as from the ground surface. The surface water generated by rain and snow fall has, therefore, minimally been utilized in agriculture and other sectors. Concluding is that under such circumstances, crops can only be successfully raised by supplying artificial irrigation water through small scale irrigation channels, govt.maintained canal system, storage reservoirs, tube wells, dug wells and water ponds. At present the province is not able to optimally utilize its water resources. The climate change phenomenon has further aggravated the situation. Pakistan contributes less than 1 percent of global greenhouse gas emissions and is ranked among the top ten climate-affected countries. The province is neither secure in essential food commodities nor in a position to adequately honour its obligation of the agreed UN SDGs specially the Zero Hunger, Poverty reduction, environment for decent work, desirable economic growth, and improvement in health. Upkeep of the existing Irrigation system in good state of O&M, Implementation of new Irrigation schemes for bringing more area under irrigation and storage of water to be utilized in needy periods are, therefore, essentially required.

VIII. MAJOR IRRIGATION INFRASTRUCTURE OF KHYBER PAKHTUNKHWA PROVINCE.

1	Flow Irrigation Schemes	84 Nos
2	Total Length of Govt. Canals	3700 Km
3	Lift Irrigation Scheme	45 Nos
4	Storage Dams	19 Nos
5	Tube Wells	962 Nos
6	Surface Drains	2818 km
7	Sub surface Drains	2045km
8	Canal Patrol Road	3414km
9	Flood Protection Bunds/Embankment & Spurs	360 Km

IX. LAND USE AND CROPPING INTENSITY OF KHYBER PAKHTUNKHWA

S #	Year	Land use Intensity (%)	Cropping Intensity(%)	Remarks
1	2019-20	58.78	97.62	Land use intensity of Pakistan = 73.59% & Punjab = 89.60% Cropping intensity of Pakistan = 106.22% & Punjab = 139.90
2	2020-21	58.50	97.07	
3	2021-22	56.68	97.80	
Source. Development statistics Khyber Pakhtunkhwa 2023				

3. WATER RESOURCES OF KHYBER

PAKHTUNKHWA PROVINCE

I. GENERAL

Main water resources of the Khyber Pakhtunkhwa Province are mountainous snow reserves of Malakand and Hazara civil administrative divisions and that of the newly merged districts of erstwhile FATA, Indus River passing through Kohistan, Battagram, Mansehra, Abbottabad, Haripur, Sawabi, Nowshera, Kohat, Lakki Marwat and DI Khan

Districts, Chitral River of Upper & Lower Chitral, Panjkora River of Upper and Lower Dir, Swat River of Swat, Malakand and Charsadda, Khan-Besham River of Shangla, Barando River of Bunir, Siran River of Mansehra, Dawar River of Abbottabad and Haripur, Haro River of Abbot Abad and Haripur, Kabal River of Khyber, Peshawar and Nowshera, Bara River of Khyber and Peshawar, Mastoor River of Orakzai District, Khanki River of Orakzai District, Kohat Toi of Hangu and Kohat Districts, Kurram River of Kurram District, Tochi River of North Waziristan Districts, Gomul River of Lower and Upper South Waziristan Districts, Tank and DI Khan, Zhob River of South Waziristan District and few other perennial tributaries of the mentioned Rivers. There are also water lakes like Aanso Lake Kaghan Valley, Saif ul Muluk lake Kaghan Valley near the town of Naran, Mahodand Lake in the upper Usho Valley of Swat, Dudipatsar Lake also known as Dudipat Lake in Kaghan Valley, Lulusar Lake in Kunhar Valley, Bashigram Lake in Madyan, Daral Danda lake in Daral Swat. The mentioned water resources provide irrigation water for cultivable lands, used as sources for drinking water supplies, generate cheap renewable hydro power energy and are used for tourism purposes. Another important water resource of the province is ground water which is extracted through tube wells, open dug wells or come out as natural springs. According to the Development Statistics 2023 there are 15437 diesel 742 electricity and 6982 solar energy operating wells in the province. The quantity and depth of ground water resource across the province has not yet been adequately investigated both quantity and quality wise. It has been noticed that in some areas of the province, more water than permissible is extracted from the ground aquifers whereas in other areas it has even not been exploited.

II. WATER RESOURCES OF KHYBER PAKHTUNKHWA PROVINCE....1 1991 WAA DISTRIBUTION.

S#	Province	Kharif (MAF)	Rabi (MAF)	Total (MAF)
1	Punjab	37.07	18.78	55.94 (47.7%)
2	Sindh	37.94	4.82	48.76 (41.5%)
3	KP	5.28	3.5	8.78 (7.5%)
4	Baluchistan	2.85	1.02	3.78 (3.3%)
5	Total distributed			
6	Future storage and flood water			
	Punjab	Sindh	KP	Baluchistan
	37%	37%	14%	12%

III. WATER RESOURCES KHYBER PAKHTUNKHWA.....2

(A)	Surface resources			
(a)	Indus basin			
(i)	Below Rim Station	=	148.8	MAF
(ii)	Above Rim Station	=	5.2	MAF
	Subtotal Indus Basin	=	154	MAF
(b)	Outside Indus Basin			
(i)	Kharan Coast	=	0.8	MAF
(ii)	Makran Coast	=	3	MAF
	Sub Total outside Indus Basin	=	3.8	MAF
	Total Surface Water (1) & (2)	=	157.8	MAF
(C)	Ground water	=		MAF
(D)	Hill torrents.	=		MAF
	Total			

IV. WATER RESOURCES KHYBER PAKHTUNKHWA.....3

(i)	Surface water downstream	=	148.8	MAF
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	Rim Stations			
(ii)	Distributed in WAA 1991	=	117.5	MAF
(iii)	Balance	=	31.3	MAF
	Deduct provision for environmental flow downstream Kotri Barrage	=	5	MAF
(v)	Balance available	=	26.5	MAF
(A)	14% share of KP in future storages and flood water.	=	3.71	MAF
(B)	Ground water	=		MAF
(C)	Hill torrents	=	1.68	MAF
(i)	Surface water downstream Rim Stations	=	148.8	MAF
(ii)	Distributed in WAA 1991	=	117.5	MAF
(iii)	Balance	=	31.3	MAF
(iv)	Deduct provision for environmental flow downstream Kotri Barrage	=	5	MAF
(v)	Balance available	=	26.5	MAF
(A)	14% share of KP in future storages and flood water.	=	3.70	MAF
(B)	Ground water	=	Not yet Worked out	MAF
(C)	Hill torrents	=	1.68	MAF
(D)	Unutilized Share	=		MAF
(i)	Yet to be utilized out of PHLC allocation of 0.53 MAF	=	0.29	MAF
(ii)	Yet to be utilized out of Indus canals		0.22	MAF
(E)	Allowed in 1991 WAA 1991 for 5000 acres land			

	above 1200 feet AMSL			
(F)	Allowed in Kohat, Kurram and Gomal Basins in WAA 1991 if water rights therein are not adversely affected.			

4. ISSUES AND WAYS OUT

I. ISSUES

A. GENERAL

Due to increase in population, increase in nos. of livestock, changes in food patterns, adverse impacts of climate change phenomenon, slow land development and slow increase in per unit yield of essential crops, the province is facing shortages in availability of essential food grains. At the same time the trend of per capita per year water availability is declining with the passage of time. The minimum desired threshold limit of per capita per year water availability is 1000 Cu:M. However, the data reveals that per capita per year water availability which in 1951 was 5,260 cubic meters has reduced to 1,000 cubic meters per capita per year in 2016 which has made the country and thus the province as water stressed. With such declining trend it has been forecasted that during 2025, per capita per year water availability in the country and thus the province would become 860 cubic meters per capita per year. With this the country and the province would become water scarce.

B. STORAGE FACILITY.

Due to non-availability of storage facility in the country each year about 26.5 MAF flood water flows waste to the ocean which is equal to storage of about four Tarbela Dams. The economic cost of 1 MAF is about 1 billion Dollars which means the country is facing a loss of 26.5 billion US\$ each year. The provincial loss is 14% of this

amount. Besides the world's average storage capacity of the surface water is 40% whereas that of Pakistan is only about 10%. which is too low. Similarly Carry over storage capacity of USA is for 900 days, Egypt is for 700 days, and India is for 170 days whereas that of Pakistan is for 100 days only which is too low. The live Storage capacity of Tarbela, Mangla, Warsak and Chashma in 1976 was 16.26 MAF which has been reduced to 13.68 MAF due to siltation of these reservoirs. With further lossof capacity, the country and province would confront further water shortages. Share in future flood water storage as allocated in WAA 1991 is 14%, if worked out on 26.5 MAF at Kotri Barrage it comes out to be 3.71 MAF. Due to socio-practical limitations, the Khyber Pakhtunkhwa.

C. INFRA-STRUCTURE LIMITATIONS

Province would be hardly able to utilize the quantum required for Mohmand Dam left & right bank canals (16737 acres) out of the allocated 14% share in flood water or future storages. From rest of the future storages the Khyber Pakhtunkhwa Province would not be able to withdraw its allocated share as per 1991 WAA.

D.FOOD INSECURITY

The province of Khyber Pakhtunkhwa is confronted with food insecurity. The province is short in almost all staple food grains and depends upon other provinces of the country or imports from abroad. About 20.3 % population is mal-nourished/food insecure. (Joint report of FAO, WFP, UNICEF, WHO and IFAD 2019). The prevalence of malnutrition amongst children aged 6- 59 months is very high. It is estimated that 40% children face stunted growth, 28% are underweight, and 18% are even wasted. 39.0 % population is poor as per Multi-Dimensional Poverty Index in which the food items have more weightage than the other items.

E. INSTITUTIONAL CAPACITY.

At present the capacity of the institutions to implement new water sector projects is low besides either lacking of the water and land regulatory laws or loop holes in it for the management of water resources effectively. The institutions are unable to effectively handle the developmental projects at the stages of planning, designing and implementation and thereafter in keeping them in sustainable operational order.

II. WAY OUT

Following are the proposals to resolve the issues related to water resource management.

I. O&M OF EXISTING WATER SECTOR INFRASTRUCTURE.

Observations in field and data indicate that almost all existing infrastructure of water resources utilization i.e. Irrigation canals, Canal patrol roads, Tube wells, Dams, Head works, Drainage system, and water courses are suffering from lack of adequate O&M. Most of the tube wells are out of order, canal patrol roads are in shabby state, Irrigation canals, drains and dams are in bad state of maintenance. A re-known water expert John Briscoe rightly named Pakistan's irrigation system as 'BNR model': the Build-Neglect-Rebuild model. Resultantly the cropped area and per unit yields of agricultural produce are either not increasing with the planned indicators. In most of the cases the growth is stagnant or even negative. The Govt seems to be on the "construct, ignore and reconstruct mode". Conclusion of the Symposium was that the Govt should pay attention to such state of affairs in terms of financial and human resource revival. To this effect, the Govt: should not hesitate to consider major institutional restructuring, accountability, reward, legislation and allocation of financial resources.

II. COMPLETION OF ONGOING PROJECTS

It was pointed out in the Symposium that there are many ongoing Mega water resource and land development projects in the province suffering from slow progress and which could not complete within approved cost, stipulated time schedule. Such delay would result in cost overrun and delayed benefits. The indicated projects in Symposium were Kurram Tangi dam project Stage 1, Kurram Tangi Dam STAGE II, Tank Zam Dam, Sheikh Haider Zam Dam, Daraban Zam Dam, Choudwan Zam Dam, Pehur High Level Canal Extension

(PHLCE) Project Sawabi and Nowshera District, Siran Right Bank Canal Project (SRBC) in District Mansehra, 19 ongoing Small Dams in KP, 10 Nos. ongoing Small Dams in erstwhile FATA (New Merged Areas), Rehabilitation of Bara Canal system in District Khyber, Jabba Dam in District Khyber, Bara Dam in District Khyber, Rehabilitation of Warsak left bank Canal District District Mohmand, Rehabilitation of Pehur Main Canal Sawabi, Kalkot canal Upper Dir, Sanam Dam Lower Dir, Mulkoooh Irrigation Scheme in District Chitral, Extension and Improvement of Balambat Canal in District Lower Dir Dam Project.

III. TRANSFORMATION OF CULTURABLE WASTE AGRICULTURAL LAND TO CULTIVABLE LAND

There is about 1.39 million hectares or 3.43 Million Acres uncultivated land, which is fit for cultivation but was not cropped due to undulation and lack of crops nutrients. In Symposium the item was discussed and proposed that Agriculture Department should label and develop the said land as rain-fed or dry land farming.

IV. NEW PROJECTS

After 1991 water apportionment Accord 1991, for utilization of their allocated water share, one mega project was committed with each province by the Federal Govt. for sponsoring. The Schemes of other provinces have been implemented whereas that of Khyber Pakhtunkhwa i.e. CRBC Lift-Cum-Gravity Canal Project in DI Khan and Tank has not been implemented. Being a mega project to bring about 2, 85,877 acres, a considerable quantum of rain-fed land under irrigation, the Provincial Govt. shall initiate all its endeavors to implement the Project through Federal Govt. In Symposium other schemes whose feasibility studies have been carried out by the concerned department were also highlighted for implementation, The Schemes includes; Sheringal Dodba Irrigation Canal in Upper Dir District, Mulkoh Chitral, Lavi Chitral, Singoor Chitral, Extension of Attani Canal Chitral, Zaitur sanik canal Chitral, Doon Awair Canal Chitral, Panjkora Left & Right Bank Canals Lower Dir, Kabalgram Canal Shangla, Jaro

Charbagh Canal Swat, Malkan Dhothar Canal Abbottabad, Water ponds in mountainous areas and solar tube wells in plain areas.

V. GROUND WATER ASSESSMENT

Ground Water is an important resource of the Khyber Pakhtunkhwa Province specifically with reference to fresh water. However, it was indicated in the Symposium that this precious resource stands confronted with many challenges. In some areas of the province, the ground water is being extracted more than recharge potential whereas in other areas of the province it lies unutilized. It was concluded in the Symposium that the Govt. through concerned technical agencies should carry out surveys of the ground water potentials in entire province and utilize it under integrated water resource management framework without further wastage of time.

5. RECOMMENDATIONS

1: Cultivable land of the Khyber Pakhtunkhwa Province is 1824591 hectares, cropped area is 1784728 hectares and Irrigated area is 967968 hectares which is 54% of the cropped area. The remaining 46% un-irrigated land i.e. $1784728 - 967968 \text{ ha} = 816760 \text{ hectares}$ or 2017397 acres needs to be brought under irrigation water supplies for enhanced agriculture produce. The government should initiate mobilization of all possible resources to bring the available un-irrigated area under provision of irrigation water.

2: Culturable waste land in the Khyber Pakhtunkhwa Province is 1.39 million hectares or 3.43 million acres which can be transformed into cultivable through levelling and extension of agricultural services. The government should initiate mobilization of all possible resources to transform the culturable waste agricultural area to cultivable.

2: Since the ground water resource stands grossly miss managed as such the Govt. through concerned technical

agencies should carry out surveys of this precious resource in entire province and utilize it under integrated water resource management framework without further wastage of time.

