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Water Resources and Conservation Strategy of Pakistan

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1. INTRODUCTION

Water is one of the basic necessities of life. God has gifted Pakistan with abundant water resources, with rivers flowing down the Himalayas and Karakoram heights from the world's largest glaciers and free and unique bounty for this land. Pakistan is basically an agrarian economy. Out of its total geographical area of 79.61 million hectares, cultivated area is 22.05 million hectares. The total area under irrigation is 19.02 million hectares [Agricultural Statistics of Pakistan (2005-06)]. Irrigated land supplies more than 90 percent of agricultural production and most of the country's food. Agriculture sector is regarded as the backbone of Pakistan's economy. It contributes 25 percent of the GDP. About more than 50 percent labour force is employed in this sector. Agriculture sector is also the major user of water and its consumption will continue to dominate water requirement. Similarly, for industrial development main source of energy is hydropower which is generated by dint of water stored in big dams and reservoirs. Therefore the importance of the water for the survival of our economy cannot be denied.

The objective of this paper is to analyse in-depth the water resources and conservation strategies for Pakistan. Some scholars have recognised the integrative effects of partition on water resource governance in Pakistan. In Pakistan, Water and Power Development Authority (WAPDA) was established to build and operate major dams and canal constructed by Indus Basin Development Programme. To coordinate large-scale infrastructure investment, the World Bank Commission on Water and Power Resources of West Pakistan carried out a study in Sector Planning [Lieftinck, *et al*. (1968)]. This study provided general guidance for coordinating inter-sub sectoral investments in groundwater development, drainage, hydroelectric power, agricultural inputs and economic sector planning. 1970s witnessed tension related to economic, environmental and institutional performance in water sector, which led to new paradigms for water management. Concern began to grow when national water sector expenditures were not yielding expected agricultural and economic benefits; and they failed to support local water institutions. In the International Drinking Water Supply and Sanitation Decade (1981-90), improvement in domestic water supply and sanitation has been made slowly and largely independently from other sub sectors. Programmes have encouraged appropriate technology; participatory approaches; and local financing, operation and maintenance [Pasha and McGarry (1989); Altaf, *et al.* (1993)]. Vision for Water for the

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21st Century [Pakistan Water Partnership (1999)] lays out a bold plan for progressive transformation of water resources governance, economics and environmental quality. According to National Water Vision, by 2025, Pakistan would have adequate water available through conservation, development and good governance. Water supplies would be of good quality, equitably distributed and meet the needs of all users through an efficient and integrated management. Institutional and legal system that would ensure sustainable utilisation of water resources and support economic and social development with due consideration to the environment, quality of life, economic value of resources, ability to pay and participation of all stakeholders [Pakistan's Water Vision (2003)].

The remaining portion of the study is organised as follows. The Section 2 highlights the water resources in Pakistan, while the Section 3 discuses the water demand and availability in Pakistan. The conservation of water resources is explained in Section 4. The final section presents the conclusion of the study.

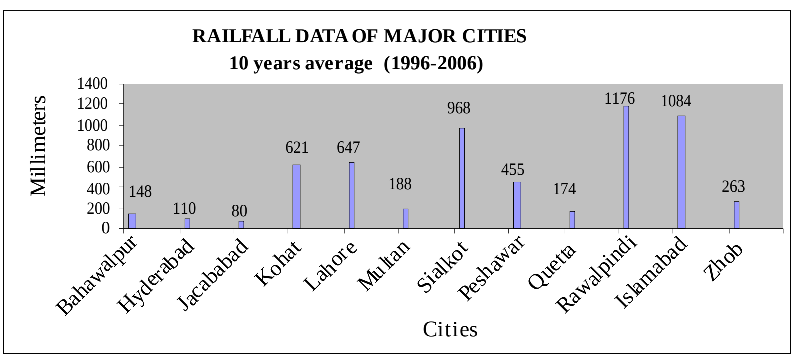
2. WATER RESOURCES OF PAKISTAN

There are two types of major water resources in Pakistan, natural and artificial. Natural resources include rainfall, rivers, glaciers, ponds, lakes, streams, *karez* and wells etc. whereas artificial resources consist of the surface water from rainfall and rivers, which is in excess of the requirements for irrigation and other uses, is stored in dams and reservoirs. The water from these dams and reservoirs is not only used for irrigation and supplying water for daily consumption, but also used for hydroelectric power generation.

Rainfall

There are two major sources of rainfall in Pakistan i.e. the *Monsoons* and the *Western Disturbances*. There is about 70 percent of the annual *Monsoon* rainfall from July to September. Pakistan has both arid and semi-arid zones. The entire Indus plain receives an average seasonal rainfall of 212mm and 53mm in the *Kharif and Rabi* seasons respectively. The rainfall varies as we move from the north and northeast to the south of the country. It is only the canal command areas in the NWFP and the northern-most canal commands of the Punjab Province that receive some appreciable amount of rainfall during summer as wall as in winter season.

Based on 10-Year average (1996-2006), data of annual rainfall in some of the major cities is depicted in the following graph.



Source: Agricultural Statistics of Pakistan (Various Issues).

Glaciers

There are more glaciers in Pakistan than any other land, except North and South Poles. The glacier area of Pakistan is about 13,680 sq km and on the average is 3 percent of mountainous region of upper Indus Basin and accounts for most of the river turnoff in summer. Pakistan has greatest mass and collection of glaciers on the earth. In Karakoram Range, the total length of glaciers is 160 km. About 37 percent of the Karakoram area is under its glacier, Himalayas has17 percent and European Alps has 22 percent.

It was estimated the total area of glacier of the upper Indus catchments is about 2,250 sq km, which is mainly from most of the river runoff in the summer season. The snow fed Kabul river starts from Unal Pass in southern Hindukash is at an elevation of 3,000 meters above the sea level. After flowing in eastern Afghanistan, it enters Pakistan from north of Khyber Pass. The Jhelum River originates from Kashmir at lower elevation than that of Indus River (Pakistan Water Strategy Report).

Rivers and Dams

Pakistan has been blessed with a number of rivers which are tributaries to the Indus. The five main rivers which join Indus from eastern side are Jhelum, Chenab, Ravi, Beas and Sutlej, beside three minor rivers are the Haro, Soan and Siran. There are number of small rivers which join the River Indus from the west side, in which biggest river is Kabul and others are Kunar, Punj, Kora. The Gomal Kurram, Tai, Kohat Tank and several other small streams join the Indus River from the right side.

The Table 1 transpires that maximum flow in Indus River during the *Kharif* season (April to September) was 55 .087 MAF (million acre feet) and at minimum was 42.208 MAF and on the average was 51.3 MAF during the period 2002–07.

The overall maximum flows during *kharif* season of six rivers including Indus, Jhelum, Chenab, Ravi, Sutlaj and Kabul was 118.9 MAF in 2005-06 and minimum flow was 80.226 in 2004-05 and on the average, it was 101.9 MAF during the period 2002-07.Similarly, for the *Rabi* season (October to Mach) the maximum flow in case of Indus River was 10.0 MAF in 2006-07 and minimum flow was 8.5 MAF in 2003-04. On average it was 9.1 MAF during 2002-07. Whereas, overall maximum flow for the *Rabi* season for all the major rivers was 29.2 MAF and minimum was 21.6 MAF in 2002-03 and on the average, was 25.1 MAF during 2002-07.

Table 1

Annual Flow (MAF)

Sr. No.	Name of River	2002-03		2003-04		2004-05		2005-06		2006-07	
		Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
1.	Indus	48.28	7.944	55.087	8.540	42.063	9.511	56.00	9.535	55.066	9.975
2.	Jhelum	12.307	5.097	17.659	5.008	11.739	6.717	17.725	5.468	16.437	6.777
3.	Chenab	17.984	5.465	21.504	4.360	14.903	6.415	21.112	4.019	21.382	6.328
4.	Ravi	0.413	0.452	0.854	0.093	0.391	0.405	0.702	0.142	1.164	0.352
5.	Sutlej	0	0.027	0.022	0.094	0	0.043	0.311	0.044	0.070	0.08
6.	Kabul	12.015	2.565	15.668	3.235	11.130	5.939	23.006	4.972	14.357	5.696
	Total	90.999	21.55	110.794	21.33	80.226	29.03	118.856	24.18	108.476	29.208

Source: IRSA, Islamabad.

The historical background of dams in Pakistan is relatively short. At the time of independence, there were only three dams in Pakistan. The Khushdil Khan Dam–1890 and Spin Karazi.1945 was located in water scare area of Balochistan. In Punjab there was only Nomal Dam, 1913 which was located in the Mianwali district.

In Pakistan, the construction of dams was started in 1955 when the country was facing acute shortage of power and Warsak Dam was constructed on the Kabul River near Peshawar.

Later on India stopped water supply for Pakistan which affected the network of cannel system. It became very important to build the large storage of dams to restore water for affected canal system. Two large dams were constructed; one is Mangla with the gross storage capacity of 5.88 MAF and other is Terbala with storage capacity of 11.62 MAF, as part of its Indus Basin Replacement Works. There are number of water supply dams and relatively smaller schemes of irrigation were also undertaken.

Table 2

Storage Loss of Reservoirs

Reservoir	Original Gross Storage Capacity (MAF)	Storage Loss by the Year 2003 (MAF)	Storage Loss by Year 2010 (Projected)(MAF)
Terbela	11.62 (1974)	3.14 (27%)	3.95 (34%)
Chashma	0.87 (1971)	0.37 (43%)	0.48(55%)
Mangla	5.88 (1967)	1.18 (20%)	1.60 (27%)
Total	18.37	4.69 (26%)	6.03 (33%)

Source: MTDF (2005-10).

The above Table 2 shows the original gross storage capacity of the major reservoirs estimated at 18.37 MAF. Whereas by 2003, storage loss was estimated at 4.69 MAF, that is 26 percent of the original gross storage capacity due to sedimentation. According to MTDF by 2010, the storage loss would be 6.03 MAF which would be 33 percent of the gross storage capacity.

Surface Water

The resource of surface water is the Indus System based on the river inflow measured at the rim station. In the context of Indus Basin System a rim station is defined as a control structure (barrages, reservoirs etc.) on river just when the river system enters into the Pakistan territory or upstream of the canal irrigated Indus plain of Sindh and Punjab provinces.

The rim stations for the Indus System Rivers are the Kalabagh Barrage for the main Indus River, Marala Berage for the Chenab River, Marala Reservoir for the Jehlum River, and Sulemanki and Ballkoi barrages for the Sutlej and Ravi rivers.

The Indus System and its tributaries bring on an average 154 MAF of water annually. Three Western rivers contain 144.91 MAF of water and Eastern rivers contain 9.14 MAF of water. From total of this water, 104.73 MAF is utilised for irrigation, 39.4 MAF flows to sea and about 9.9 MAF is consumed by the system losses which include seepage, evaporation and spill during floods. The flow of the Indus Rivers varies from year to year and within the year.

The water of Indus Basin Rivers is diverted to main canals through reservoirs/barrages. These canals distribute the irrigation water through a network of branch canals into the command area.

The Indus Basin Irrigation System is the world one of the best net work consisting of 16 barrages, 3 major reservoirs, 2 head-works, 2 siphons across major rivers, 44 canal systems, (23 in Punjab, 14 in Sindh, 5 in NWFP and 2 in Balochistan)12 inter river link canals and more than 107,000 water courses. The total length of canals is about 56,073 km. With the addition to canal supply, the system utilises 41.6 MAF of groundwater pumped through more than 500,000 tube wells (Pakistan Water Strategy Report).

Groundwater in Pakistan

Other important source of water is groundwater which consists 99 percent of freshwater and easily accessible for the world. In Pakistan the volume of ground water is immeasurable. In last four year its availability has been increased from 3 percent to the 40 percent of total water available at the farm gate. The Government of Punjab has underlain unconfined aquifer covering about 79 percent of area, whereas the Government of Sindh has underlain about 28 percent of area of fresh ground water.

The water is used for irrigation purposes and pumped through tube wells. Whenever groundwater is saline is put into drains. Water which cannot be cleaned is utilised for the irrigation proposes, after diluting with the fresh canal water. In the last 25 to 30 years, especially in the Upper Indus plain the ground water is utilised for the canal supplies where the quality of groundwater is good. The irrigation of land has been started though tube wells in early sixties. For the Indus Basin Irrigation System (IBIS) 500,000 tube wells has been installed. It has been estimated that the pumpage in all command area is 50 Billion Cubic Meter (BCM). The total potential of groundwater in Pakistan is 55 MAF (Pakistan Water Strategy Report).

3. WATER DEMAND AND AVAILABILITY

The level of agricultural production is directly related to the availability and effective use of water as a major input. The demand for water is increasing rapidly, while the opportunities for further development of water resources are diminishing.

Several reasons for growing water strategies could be attributed to expansion in irrigation activities for boosting food and non-food production to meet the increasing demand of growing population and growth in civic population needing large supply of water. Salinity is another severe problem to be tackled. Salinity mainly occurs in some irrigated land rocking water in the soil which absorbs mineral salts from the earth. Due to evaporation of water, such salts dry out on the soil surface and deplete its fertility. It is estimated that salinity has damaged about 25 percent of cultivated land. Reclamation of salined land is too much expensive. In Pakistan half of the run water (it is water, falls on the country, is collected in river, lakes and dams) is drawn about as much gain from the under ground spin aquifer. By 2025 water demand would be 92 percent of entire runoff. It is estimated that 25 percent about has been destroyed due to salinity. For irrigation purpose, only one third of water is used. Efficient use of water is enrolment friendly. Both over watering a poor drainage system are compounding the salinity problem [Kaleem (2007)].

"Managing the Indus River Basin the Light of Climate Changes", water supply is falling behind agricultural and urban demand particularly in Karachi where population growth exceeds the physical institutional capacity of the public water system [Omar (2004)].

Allocation of water among the provinces used to be made on *ad hoc* grounds up to March 1991, when there was mutual consensus in the form of inter-provincial water accord. Unfortunately, due to drought of the late 1990s continued to the 21st century resultantly the accord remained unworkable. This has made imperative to work out an efficient and equitable management strategy about Indus Basin. There has been growing realisation to economise water through using best cultivation techniques for proper water management.

Table 3

Overall Water Availability

(Million Acre Feet)

		Surface Water		Ground Water			Total
Year	Season	At Canal Head	At Farm Gate	Public T.Wells	Private T.Wells	SCRAP T.Wells	Water Availability
1997-98	Kharif	67.50	51.30	0 .96	19.11	0.00	71.37
	Rabi	35.64	0.65	0.97	19.16	0.00	50.78
	Total	103.14	81.95	1.93	38.27	0.00	122.15
1998-99	Kharif	72.79	51.73	0.96	19.25	5.25	77.19
	Rabi	37.91	30.98	0.97	19.38	5.25	55.59
	Total	110.70	82.71	1.93	38.63	10.51	133.78
1999-00	Kharif	74.71	51.97	0.96	19.11	4.86	76.90
	Rabi	31.99	31.40	0.97	19.16	4.85	56.38
	Total	106.70	83.37	1.93	38.27	9.71	133.28
2000-01	Kharif	62.85	52.57	0.96	19.53	4.63	77.69
	Rabi	23.32	31.65	0.97	19.62	4.64	57.08
	Total	86.17	84.22	1.93	39.35	9.27	134.77
2001-02	Kharif	58.11	52.62	0.96	19.67	4.32	77.57
	Rabi	21.50	31.72	0.97	20.04	4.33	57.06
	Total	79.61	84.34	1.93	39.71	8.65	134.63
2002-03	Kharif	68.19	52.68	0.96	19.81	4.00	77.45
	Rabi	28.22	31.78	0.97	20.27	4.01	57.03
	Total	96.41	84.46	1.93	40.08	8.01	134.48
2003-04	Kharif	69.59	52.86	0.96	19.81	4.0	77.60
	Rabi	33.56	31.90	0.97	20.27	4.01	57.15
	Total	103.15	84.76	1.93	40.08	8.01	134.78
2004-05	Kharif	61.39	59.96	0.96	19.81	4.0	84.73
	Rabi	24.53	25.70	0.97	20.27	4.01	50.95
	Total	85.92	85.66	1.93	40.08	8.01	135.68
2005-06	Kharif	73.02	60.94	0.96	19.70	4.00	85.60
	Rabi	31.51	26.12	0.97	20.28	4.01	51.38
	Total	104.53	87.06	1.93	39.98	8.01	136.98
2006-07	Kharif	70.78	57.60	0.96	19.70	4.00	82.26
	Rabi	31.18	29.88	0.97	20.68	4.01	55.54
	Total	101.96	87.48	1.93	40.38	8.01	137.80

Source: Water Resources Section, Ministry of Planning and Development.

The above Table 3 depicts the total water availability for the last 10 years from 1997-98 to 2006-07. It is in a matrix form, showing the water position during *Kharif* and *Rabi* seasons of each year with a bifurcation of surface water and ground water. The surface water is both at canal head and farm gate level. Whereas the ground water is in form of public, private and scrap tube wells. The total surface water at farm gate level is showing a rising trend right from 1997-98 to 2006-07 and similarly, is the position of surface water at farm gate during the *Kharif* season. This is due to increasing demand for water in irrigation with the passage of time. However, in case of *Rabi* season surface water at farm gate level shows somewhat a mixed trend. The water availability at canal head has always been more than that of farm gate level.

So far as ground water is concerned, the water availability both during *Kharif* and *Rabi* seasons remained stagnant throughout the period 1997-98 to 2006-07. However, water availability through private tube wells both during *Kharif* and *Rabi* seasons more or less has been increasing throughout the last 10 year period.

Per capita water availability has been declining at an alarming rate, from 5300 cubic meters in 1951 to about 1200 cubic meters in 2000. The per capita water availability during the various years is given in Table 4.

Table 4

Per Capita Water Availability

Year	Population (Million)	Per Capita Availability (m^3)
1951	34	5300
1961	46	3950
1971	65	2700
1981	84	2100
1991	115	1600
2000	148	1200
2013	207	850
2025	221	659

Source: Draft State of Environment Report 2005.

According to State of Environment Report 2005, the shortage of water has been estimated at 25 percent for the year 2010 and 33 percent for 2025. The uncontrolled harvesting of groundwater for irrigation purposes has led to severe environmental hazards. Today, groundwater contributes about 48 percent of available water. The water demand both for irrigation and non-irrigation purposes by the year 2009 -10 is estimated at 168.99 MAF. The water supply at farm gate in the year 2004 is 135.68 MAF, which is expected to increase to 150.30 MAF by the year 2009-10.

According to the National Water Policy (2004), for irrigation purpose about 93 percent of the water currently is utilised in Pakistan. The rest is supplied to urban and rural populations and industry. As mentioned earlier, Pakistan’s population is estimated to increase 221 million by the year 2025, the percentage of water requirement would be increased dramatically. The details of water availability and requirement are given in Table 5.

Table 5

Pakistan's Water Scenario

Year	2004	2025
Availability	104 MAF	104 MAF
Requirement (including Drinking Water)	115 MAF	135 MAF
Overall Shortfall	11 MAF	31 MAF

Source: Ten Year Perspective Development Plan 2001-11, Planning Commission.

The Irrigation System of Pakistan

The irrigation system of Pakistan is the largest integrated irrigation network in the world, serving 42 million acres of cultivated land. This system is fed by the water of the Indus River and its tributaries. The salient features of the irrigation system are given in the following Table 6.

Table 6

Salient Features of Irrigation System of Pakistan

Structure	No.
Major Storage Reservoirs	3
Small Dams (Appox. 3.00 MAF)	80
Barrages	19
Inter-River Link Canals	12
Independent Irrigation Canal Commands	45

Source: Pakistan's Vision of Water Resource Management.

The major storage reservoirs include Tarbela, Chashma on Indus River and Mangla on Jhelum River. The total length of main canals and distributaries are 64,000 km. whereas watercourses comprise another 1,621,000 km. The diversion of river waters into off taking canals is made through barrages, which are gated diversion weirs. The main canals in turn deliver water to branch canals, distributaries and minors. The watercourses get their share of water through outlets in the irrigation channels. Distribution of water from watercourses is effected through a time schedule called "*Warabandi*".

4. CONSERVATION OF WATER RESOURCES IN PAKISTAN

Scarcity of water and drought has compelled the countries to adopt the conservation measures. In the scare water situation, Islam do not permits unnecessary utilisation of water. Scrolling the pages of Islamic history, we witness the struggle of Hazrat Hajira for water under blazing sun in the burning desert and sprouting of water spring from the rocky soil as a gift from Allah. The efforts for search of water was so much liked by the Almighty Allah that it has become a fundamental part of Hajj till the Day of Judgment. Moreover, cessation of water with stones to avoid its wastage and stocking it for long time besides saying "Zam Zam "means "stop" was the first step towards water storage, which led to concept for construction of dams.

The construction of dams in Pakistan is imperative, as only two major dams have been constructed after 1947, whereas, India and Turkey have constructed 24 and 65 dams respectively during the same period. The sedimentation in reservoirs is increasing drastically not just scuttled resources for irrigation but also lower energy production which also effects on industrial sector's expansion and efficiency of agriculture. The government is working on prospect projects for raising the storage in order to meet the future water and energy consumption of our country. The details of the prospective storage projects are given in Table 7.

Table 7

Prospective Storage Projects

Name of Project	Storage Capacity (MAF)		Installed Capacity	Status
	Live	Gross	(MW)	
Basha Dam	6.4	7.30	4500	Engineering Design (Under Preparation)
Kalabagh Dam	6.10	7.90	3600	Ready for Implementation
Skardu Dam	–	–	4000	Under Feasibility Study
Akhori Dam	3.60	7.00	600	-do-
Munda Dam	0.56	1.00	660	Engineering Design (Under Preparation)

Source: Monthly Progress Report, WAPDA House, Lahore.

The critical issue in water sector is to resolve the scarcity of water through augmentation and conservation. The augmentation of water supplies by implementing high priority projects like raising of Mangla Dam, construction of Gomal Zam Dam, Greater Thal Canal, Rainee Canal, Kachhi Canal, Mirani Dam, Sat Para Dam, Sabakzai Dam, Kurram Tangi Dam, Diamer Basha Dam, Munda Dam and other medium and small reservoirs. Priority will be given to the completion of ongoing schemes at advance stages. It is estimated that on completion of these projects an area of 3,239,882 acres will be irrigated. The complete details of water projects under implementation are given in Table 8.

Water Conservation Strategy

To work out a sound and cogent water conservation strategy is the need of the time, as demand for water continues to rise because of increasing use of water in agriculture and industry for the purpose of economic development and due to rapid growth of population, whereas there is limited supply of water. Water management is the biggest challenge of 21st century confronted by the country, as irrigated agriculture is 24 percent of GDP, the livelihood for the majority of country and input of agro-based industry/exports. It has been made known that a considerable amount of water is lost during its conveyance for the seepage in the lengthy canals. Proper lining of the canal system could reduce these losses. According to a WAPDA Report more than 5 MAF of irrigation could be saved by lining of minor canals and addition 3.6 MAF could be saved by improvement of water courses. It is heartening to note that Government of the Punjab has introduced modern telemetery system to check and control water theft by the farmers. In order to overcome the menacing of water shortage and its losses, it has become imperative to work on the lines of “Blue Revolution” which is threshold of the strategy meant for making use of more effective techniques and obtaining optimum results for

Table 8

reduction in water losses. The definition of "Blue Revolution" has been coined as a system of drip irrigation that delivers water directly to the roots of crops by cutting use of water by 30 to 70 percent and raising crop yield on the average by 20 to 90 percent.

The Medium Term Development Framework (MTDF) 2005-10 proposes a water conservation strategy with the aim to improve the performance and utilisation of water supply and sanitation system and reducing financial dependence on the Federal and Provincial Governments pertains to (i) adoption of integrated approach, rational resource use, and the introduction of water efficient techniques; (ii) containment of environment degradation; (iii) institutional strengthening, capacity building and human resource development (HRD); (iv) improving performance and utilisation of local systems through better planning, management and community participation; (v) improving quality of life and easy access to water supply, especially for women, (vi) improving sanitation through sewerage and drainage schemes; (vii) promoting increased take up of household sanitation; and (viii) improving the understanding of the linkages between hygiene and health through community education campaigns, especially among the women and children.

Apart from MTDF strategy following recommendations are proposed in the contest of water conservation and management;

- Crash programme for cleaning of water channels including canals/water courses and distributaries.
- Participatory water management at secondary tertiary level in collaboration with provincial irrigation departments.
- Regulating ground water pumpage by issuance of licenses to check overdraft of aquifer.
- Better water management for increasing cropping intensity with riverine area.
- Technical land levelling, surge irrigation, high irrigation efficiency technology including drip and sprinkler.
- Strengthening of institutional capacity building by improving financial sustainability.
- Better and more efficient use of funds.
- To harness the uncultivated lands for irrigation purpose, storage of flood water during *Monsoon* season by construction of a series of small dams/reservoirs on the barren lands and *Barani* areas of Northern Punjab, NWFP and Balochistan.
- Attracting more foreign investment by making an environment lucrative to it.
- Launching of incentive based upon public campaign emphasising conservation of water at all levels.

5. CONCLUSION

The paper analyses the various aspects of water resources of Pakistan and presents a water conservation strategy. The importance of water cannot be laid aside while talking for economic growth and development of Pakistan as it serves as a life blood of the economy. With the rapid growth of population and increased use of water, its supply is not meeting its demand over the time. Besides the menaces of water shortages and energy crisis, global warming is another serious challenge daunting the policy-makers of the country. Water use practices in the country are not in accordance with water conservation and quality requirements. Most of the water is polluted and unhygienic for drinking purpose both for human and animals. There is a need to analyse the existing water resources and recommending comprehensive conservation and management strategy in view of catering the planning requirements for the future. In order to overcome the burning issue confronted with water requirements for agriculture and energy there is a pressing need to construct some new mega dams which could serve the larger interest of the people of Pakistan and their coming generations for accruing the mutual benefits on the basis of equity and justice.

Every year due to floods a lot of water flows down towards sea and its inundation causes huge and irreparable losses to human lives, property and assets of public and private sectors. For overcoming such menaces, small and flood dams at different sites should be constructed.

Last, but not least, there is a need to switch the irrigation from traditional system to the directions of "Blue Revolution" which could meet the challenge of water shortages and water losses to a greater extent. The proper lining of the canal system could also reduce water losses and in this way water could be economised and used for alternative purposes.

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