



GOVERNMENT OF PAKISTAN
MINISTRY OF WATER AND POWER

ANNUAL FLOOD REPORT 2013



Sialkot (Punjab)



Karachi (Sindh)



Chitral (Khyber Pakhtunkhwa)



Jhal Magsi (Balochistan)

Pictures of 2013-Floods

**OFFICE OF THE CHIEF ENGINEERING ADVISOR/
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ISLAMABAD**

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FOREWARD

Pakistan is facing the threat of floods due to climate change/global warming. Pakistan is frequently experiencing disastrous floods from the past several years. The 2010 flood was most devastating in nature and cost huge sum of property, agricultural crops and a large number of human lives. Flood damages are caused mainly due to riverine flooding in major rivers and flash floods in secondary and tertiary rivers including hill torrents, besides, coastal & urban flooding. Pakistan had faced floods of various magnitudes since 1950 to 2013 resulting into affliction of vast areas in the four provinces including Gilgit-Baltistan, FATA & Azad Jammu & Kashmir.

The country suffered the worst ever riverine floods in its 66-year history in 2010, when floods caused over 1985 deaths, affected about 20 million population, 1,608,184 houses were damaged/destroyed, 17,553 villages and land area of around 160,000 Sq.km was affected. Subsequently, 2011-Rains/Floods affected an area of 26,305 Sq.km, population of about 9.20 million, claiming more than 500 lives, damaging 1.357 million houses and devastated standing crops on about 1.90 million acres. The torrential rains during monsoon season-2012 affected population of about 4.85 million (about 14,159 villages) about 571 people lost their lives, besides, cropped area of about 1.172 million acres were affected. The recent floods of 2013, affected cropped area of about 1.107 million acres affecting 8,297 villages, claiming about 333 lives, fully damaging 33,763 houses and 46,180 houses partially and a population of about 1.489 million has been affected.

In Pakistan, floods are generally caused by the heavy concentrated rainfall in the catchment areas of main rivers during the monsoon season, which are often augmented by snowmelt. Pakistan has suffered a cumulative financial loss of more than US\$ 37.554 billion during the past 66 years. During the period 1950 to 2013, around 11,572 people lost their lives, some 188,531 villages damaged/ destroyed and a total area of 603,942 Sq.km was affected due to 21 major flood events.

There is a dire need to adopt modern techniques for better flood management that improves the functioning of the river basin as a whole, recognizing that floods have beneficial impacts and can never be fully controlled. Such an approach seeks to maximize the net benefits from the use of floodplains and to minimize loss of life, subordinating flood loss reduction to the overall goal of maximizing the efficient use of the floodplain.

Keeping in view of recent challenges including climate change, Federal Flood Commission initiated working on formulation of National Flood Protection Plan-IV on fast track basis. The consultants were engaged in May 2013 through Water Sector Capacity Building Project for preparation of NFPP-IV. The plan is likely to be finalized by the end of current calendar year. Actual implementation has been planned to be carried out during the next ten years i.e. from (2014-15) to (2024-25), subject to the approval of plan by the Government of Pakistan and provision of adequate funds for construction of various interventions to be proposed in the NFPP-IV during the next ten years.

EXECUTIVE SUMMARY

Pakistan has experienced floods for fourth consecutive year. In 2010, 2011, 2012 and 2013, the riverine/ flash floods and urban flooding were caused by torrential rains during the monsoon season and destroyed hundred thousands of houses and flooded millions acres of agricultural land, killing thousands of people, besides damage to other public & private infrastructure. In Pakistan, floods are generally caused by the heavy concentrated rainfall, which are sometimes augmented by snowmelt and generate exceptionally high flood flows in rivers. Occasionally destructive floods are also caused due to Monsoon currents originating in the Bay of Bengal and resultant depressions which often result in heavy downpour in the Himalayan foothills, which is sometime augmented by the weather systems i.e. *Seasonal Low* from Arabian Sea & *Westerly Wave* from Mediterranean Sea.

Prior to 1976, the Provincial Governments were responsible for the planning and execution of flood protection works. Heavy losses sustained to the economy during disastrous floods of 1973 and 1976 were discussed in the Inter-Provincial Conference in 1977 and subsequently in January 1977, it was decided by the Federal Government to establish Federal Flood Commission (FFC) at the Federal Government level for Integrated Flood Management on country wide basis. Since its establishment, FFC has so far prepared and executed three National Flood Protection Plans covering periods from 1978-1988 (NFPP-I), 1988-1998 (NFPP-II) and 1998-2008 (NFPP-III). A total investment of around Rs 27.00 billion (this includes 1988-Flood Damages Restoration Project and 1992-94 Flood Damages Restoration Project costing Rs 1.80 billion and 6.50 billion respectively) has been made for construction of flood protection infrastructure and improvement in Flood Forecasting & Warning System in the past 36 years.

Keeping in view the level of investments made under the three 10-Years National Flood Protection Plans (NFPP I,II&III), and the needs of the provinces, Gilgit-Baltistan & Federally Administered Areas (FATA) & AJK, the National Flood Protection Plan –IV was prepared and submitted to Ministry of Water and Power in November 2006, for approval of the Competent Authority. However, the same could not be approved in time due to low priority given to Flood Sector as result of drought like conditions over the country during that period. Keeping in view the large scale damages occurred during past three consecutive floods in country, the need for investment in flood sector has gained importance. Federal Flood Commission accordingly started working on formulation of National Flood Protection Plan-IV. The consultants were engaged in May 2013 through Water Sector Capacity Building Project for preparation of NFPP-IV. The plan is likely to be finalized by the end of current year. Actual implementation has been planned to be carried out during the next ten years i.e. (2014-15 – 2024-25) subject to the approval of plan by the Government of Pakistan and provision of adequate funds for construction of various interventions to be proposed in the Plan.

Pakistan has suffered a cumulative financial loss of more than [US\\$ 37.554](#) billion during the past 66 years. Around 11,572 people lost their lives, some 188,531 villages damaged/ destroyed and a total area of 603,942 Sq.km was affected due to the 21 major flood events. The 2010-Floods were worst flooding in the past about 80 years in the region. Rains/Floods of 2011-monsoon season were of small scale, which mainly affected the Sindh Province, especially southeastern parts of the province, northeastern Balochistan, and southern Punjab, whereas the torrential rains during monsoon season 2012 affected Northeastern Balochistan, southeastern & upper Sindh, southern Punjab & parts of Khyber Pakhtunkhwa.

Federal Flood Commission is responsible for integrated planning for flood management at the national level and arranges financial resources for the implementation of new flood protection projects on country wide basis. Presently, funds are allocated under PSDP for execution of urgent nature flood projects through Normal/Emergent Flood Programme. The four Provinces, Gilgit-Baltistan, FATA and AJ&K submit their flood protection schemes, which are technically scrutinized by the Federal Flood Commission and submitted to Ministry of Water & Power for approval of DDWP/ CDWP. Flood Communication Cell of Federal Flood Commission remains operational on round-the-clock basis for the entire flood season (1st July to 15th October) each year. The rainfall and rivers flow data including major reservoirs water levels data is obtained from Flood Forecasting Division, Lahore, WAPDA and other concerned organizations and transmitted to all concerned agencies through Daily Flood Situation Report.

2013-Floods

2013-rains/floods affected cropped area of about 1.107 million acres affecting 8,297 villages, claiming about 333 lives, fully damaging 33,763 houses and 46,180 houses partially and a population of about 1.489 million was affected.

Way Forward

Past four consecutive years of flooding in Pakistan is the impact of global climate change owing to remarkable increase in frequency of occurrence of floods and variation in monsoon behaviour in the country. It is therefore very essential to chalk out Plan on country wide basis for long-term measures for better flood management in future, besides, short-term measures for safe passage of Flood Season 2014. The short-term measures include completion of all urgent nature approved/ongoing flood projects by the executing agencies (Provincial Irrigation Departments and Federal Line Agencies) including essential O&M works of existing flood protection infrastructure well before the start of monsoon season 2014. The encroachments in flood plains and waterways/drains need to be removed by the Provincial Irrigation Departments and Federal Line Agencies with the help of Districts Administration so that flood flows are passed safely during Flood Season 2014 and loss/ damage to populations/human lives, valuable agricultural lands and other public & private property located in the high risk areas are minimized to maximum possible extent. The organizations responsible for O&M of storm water drainage system of major and other cities may take necessary measures well in time for improving the discharge capacity of storm drains, besides, arrangement of dewatering pumps for use in emergency situation during monsoon season 2014.

The coordination among flood management related organizations, especially during monsoon season needs to be further improved. Work on long-term planning {formulation of NFFP-IV (2014-2024)} has already been initiated by FFC in consultation with stakeholders. The Plan may be approved on Top Priority basis and adequate funds may be arranged in the coming years for timely implementation of interventions proposed in NFFP-IV.

ACKNOWLEDGEMENT

The preparation and distribution of Annual Flood Report of Federal Flood Commission commenced from 1998 with a view to compile essential information on yearly basis for documentation of the yearly flood events, flood flow data, lessons learnt from those yearly events, and for exploring the needs for future protective measures.

The 2013 Annual Flood Report contains inter-alia, information about historical floods in Pakistan, flood management works, functions of FFC & other related Provincial and Federal Government organizations, flood warning dissemination system and flood preparedness activities carried out during flood season. The report also focuses on rains/floods of 2013, which caused considerable damages to private as well as public infrastructure due to riverine and flash floods, besides, urban flooding due to torrential rains in northern & southern parts of Punjab and some parts of Sindh, Khyber Pakhtunkhwa & Balochistan Provinces including Federally Administered Areas (Gilgit-Baltistan, FATA & AJK).

Services of following officers are greatly acknowledged who contributed in a dedicated manner for the preparation of 2013-Annual Flood Report of Federal Flood Commission:

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1.	Mr. Asjad Imtiaz Ali	Chief Engineering Advisor/Chairman Federal Flood Commission	Supervisory
2.	Mr. Alamgir Khan	Chief Engineer (Floods)	Contributory
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4.	Mr. Zafar Iqbal	Senior Engineer (Floods)	Contributory

**FLOODS
IN
GENERAL PERSPECTIVE**

1. FLOODS IN GENERAL PERSPECTIVE

1.1 Flood Problem in Perspective

Pakistan is a country with diverse type of land and fluctuating pattern of climate. Climate is usually considered hot and dry in Pakistan but it has shown significant obvious variations in last few years. Many districts and urban centers lying nearby to rivers are ever on a great risk to confront with different flood types i.e. riverine flood, flash flood and urban floods particularly in Punjab & Sindh provinces. Floods constitute one of the world's most serious environmental hazards. Four thousand years of recorded history tells of man's repeated failure to evade the destructiveness of floods. In spite of many years of experience and highly developed scientific techniques, floods even now continue to play havoc almost in every part of this planet.

Losses from floods annually destroy about million acres of crops land and affect hundred thousands of people with a monetary loss in billion of rupees. Major direct flood damages in Pakistan are to agricultural crops, urban and rural abadies, besides, other private & public utilities. It is generally recognized that complete prevention from floods is humanly impossible, but protection from flood is feasible and is a vital necessity. By proper planning, means can be devised to harness the fury of floods to safeguard human life and property. Devoid their destructive power, floods can be used in the service and the welfare of a community.

1.2 Floods in Pakistan

The floods in rivers are generally caused by heavy concentrated rainfall in the catchments, during the monsoon season, which is sometimes augmented by snow melt flows. Monsoon currents originating in the Bay of Bengal and resultant depressions often result in heavy downpour in the Himalayan foothills, which occasionally generate destructive floods in the main rivers and their major tributaries. Sometimes exceptionally high flood flows in major rivers are generated due to formation of temporary natural dams by landslide or glacier movement and their subsequent collapse.

Flooding of the Indus River and its tributaries represents the greatest hazard in Pakistan. Floods occur normally in summer season (July - October). Therefore, damages to agriculture are mainly to the standing Kharif crops. However, in some cases the inundated lands do not dry up in time and ultimately affecting sowing Rabi crops.

The major rivers (Indus, Jhelum, Chenab, Ravi, Sutlej) and secondary rivers (Kabul, Swat etc.) cause flood losses by inundating low lying areas round the rivers bed by damaging irrigation and communication network, besides, land erosion along the rivers banks. In the upper part of the Indus Basin (Punjab & Khyber Pakhtunkhwa), floodwater spilling over the high banks of the rivers generally returns to the river. However, in the lower parts of the country (Sindh province), the River Indus is flowing at ridge i.e. higher elevation than adjoining lands, hence, spill flood water do not return to the main river channel. This largely extends the extent and period of inundation resulting in more damages to abadies, standing crops and other private as well as public infrastructure. For

that purpose flood embankments have been constructed on either side almost in the entire length of River Indus in the Sindh Province and many vulnerable locations in the upper parts of the country. However, breaches are occurred sometimes in the flood embankments/River Training Works or overtopped, when the rivers attain the Exceptionally High Flood Level *{LMB Taunsa Barrage in Punjab & Tori Bund Complex in Sindh Province events during 2010-Monsoon Season}*. Such breaches often cause greater damages than would have occurred without the bunds because of their unexpected nature and intensification of land use following the provision of flood protection.

None of the Barrages/Headworks except Taunsa has been remodeled during past 63 years. These are aged structures and do not have enough capacity to withstand floods of 2010 magnitude. During exceptionally high floods stage these results in afflux on the upstream side, which sometimes results in breaches in the flood embankments. At times, the flood embankments have to be breached at predetermined locations to save the main structures *(RMB Jinnah Barrage was operated during Monsoon Season 2010)*.

1.3 Flood Control Objective & Need

Flood management planning in Pakistan is being carried out to essentially cover the following three specific objectives:

- i. To reduce or eliminate damages to existing properties;*
- ii. To prevent future increase in damages; and*
- iii. To mitigate the residual hazards.*

In Pakistan, flood control planning is a complex problem and calls for great ingenuity and experience on the part of the planners. The nature of flood problems varies in each of the four provinces and federally administered areas due to varying physiographic, climatic, demographic, and socio-economic conditions. Even the characteristics of catchment areas of various rivers differ from each other. Flood problems relating to various provinces are given as under:

PUNJAB

In Punjab, the flood protection marginal bunds have been generally constructed either to protect Headworks and other irrigation structures, or to safeguard certain towns, villages & adjoining agricultural lands. Due to general topography of the area sloping towards the south-west, pre-determined breaching sections have been provided in the right marginal bunds for operation for safety of Headworks/ barrages in case of exceptional high flood flows i.e. likely to exceed the designed level. In order to protect areas from erosion, spurs have been constructed in critical reaches. These spurs have protected vast areas and in some cases even large tracks of eroded lands have been reclaimed.

SINDH

The Indus River flows on a ridge in Sindh Province and generally, surrounding areas (outside the flood embankments) are lower than the river bed; hence, water once leaving the Indus River does not return back to the main channel. Escaped water thus causes greater damage to widespread areas, and it persists for a longer period even after flood peaks are over (*Refer Tori Bund, Mulchand Shah (M.S) Bund breaches during 2010-Monsoon Season*). Moreover, Sindh is situated on a receiving end of drainage of all the rivers and if flood protection measures adopted in the upper reaches are not properly planned, severe damages are likely to occur in the Province. In most of the reaches, a double line of flood embankments has been constructed on both sides of the river from Guddu to few kilometers short of Arabian Sea. These flood embankments have been further compartmentalized to contain widespread inundation.

KHYBER PAKHTUNKHWA

In Khyber Pakhtunkhwa, the floods are mainly due to flash flood flows in secondary rivers (Kabul, Swat, Panjkora, Kurram etc.) and major hill torrents/flood flow generating nullahs having steep bed slopes, which greatly increase flood velocity and severely erode the banks. In Khyber Pakhtunkhwa, mostly short spurs have been constructed to save the areas from erosion. A battery of about 40 spurs having considerable shank length and a Marginal Bund have been constructed along the right bank of Indus River “Chashma Barrage – Ramak Reach” for protection of D.I. Khan City and adjoining area from devastating flood flows of Indus River. A large number of spurs and flood embankments in critical locations have also been constructed along Kabul, Swat, Panjkora, Kurram rivers and other flood flows generating nullahs/hill torrents.

BALUCHISTAN

Due to peculiar physiographic and climatic characterizes in Balochistan, mostly the flood protection walls/embankments & short spurs have been constructed for protection of orchards, agricultural lands and abadies. Some bunds have also been constructed to serve as a flood diversion/ abatement measures.

GILGIT-BALTISTAN, FATA & AJK

PCC & Gabion Flood Protection Walls, short Spurs/Studs etc. have been undertaken in Gilgit-Baltistan, FATA and AJK for protection of abadies, adjoining agricultural lands and other private as well public infrastructure from the erosive and spill action of flood flows in rivers/flood flows generating nullahs.

1.4 WATER RESOURCES IN PAKISTAN

Five main rivers, namely, the Indus, Jhelum, Chenab, Ravi and Sutlej and their tributaries flow through the country's plains. The Indus, Jhelum and Chenab are known as the **Western Rivers** and Ravi, Beas, and Sutlej known as the **Eastern Rivers**. These rivers

supply water to the entire Indus Basin Irrigation System. The rivers have their origin in the higher altitudes and derive their flows mainly from snowmelt and monsoon rains. The catchment area of Indus is most unique in the sense that it contains seven (7) of the world's highest-ranking peaks, after Mount Everest. These include **K-2 (28,253 feet)**, **Nanga Parbat (26,660 feet)**, **Rakaposhi (25,552 feet)** etc. Likewise, barring the polar areas, seven (7) glaciers situated in the Indus catchment, **namely Siachin, Hispar, Biafo, Batura, Baltoro, Barpu and Hopper** are amongst the largest in the world.

1.5 IRRIGATION NETWORK OF PAKISTAN

The Irrigation System of Pakistan is the largest integrated irrigation network in the world, serving around 45 million acres of contiguous cultivated land. The system is fed by the waters of the Indus River and its tributaries. The irrigation network of Pakistan mainly comprises of 3 major reservoirs (Tarbela, Mangla & Chashma), 19 Barrages, 12 inter-river link canals, 45 independent irrigation canal commands and 143 medium dams (having height 15 meters and above).

The major storage reservoirs include Tarbela (*existing Live Storage Capacity = 6.557 MAF against original storage capacity of 9.70 MAF*), Chashma (*existing Live Storage Capacity = 0.263 MAF against original storage capacity of 0.70 MAF*) on River Indus and Mangla with existing Live Storage Capacity = 7.392 MAF (*this includes the additional storage capacity of 2.88 MAF after Mangla Dam Raising allowing Maximum Conservation Level of 1242 feet*) against original storage capacity of 5.34 MAF on River Jhelum. The schematic diagram of Indus Basin Irrigation System is given at **Figure-1**.

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 a watercourse is made through a time-schedule called "Warabandi".

According to IRSA record, the average annual surface water availability from Western and Eastern Rivers is 144.63 MAF (*Western Rivers: 138.04 MAF & Eastern Rivers: 6.59 MAF*), whereas the maximum inflows recorded was 183.45 MAF and minimum inflows were 99.05 MAF during the post Tarbela period (*1976-77 to 2012-13*). *The Provincial utilization was 96.88 MAF, System losses were 17.55 MAF and Escapages downstream Kotri Barrage were 30.20 MAF.*

1.6 FLOOD PROTECTION FACILITIES IN PAKISTAN

The existing flood management strategy includes flood flows regulation by three major reservoirs (Tarbela, Chashma on Indus & Mangla on Jhelum), protection of important private & public infrastructure, urban/rural abadies and adjoining agricultural lands located along the rivers banks by flood embankments and spurs & other interventions, besides, Flood Forecasting & Early Warning System, Rescue & Relief measures in case of flooding situation. The Provincial Irrigation Departments (PIDs) maintain about 6,807

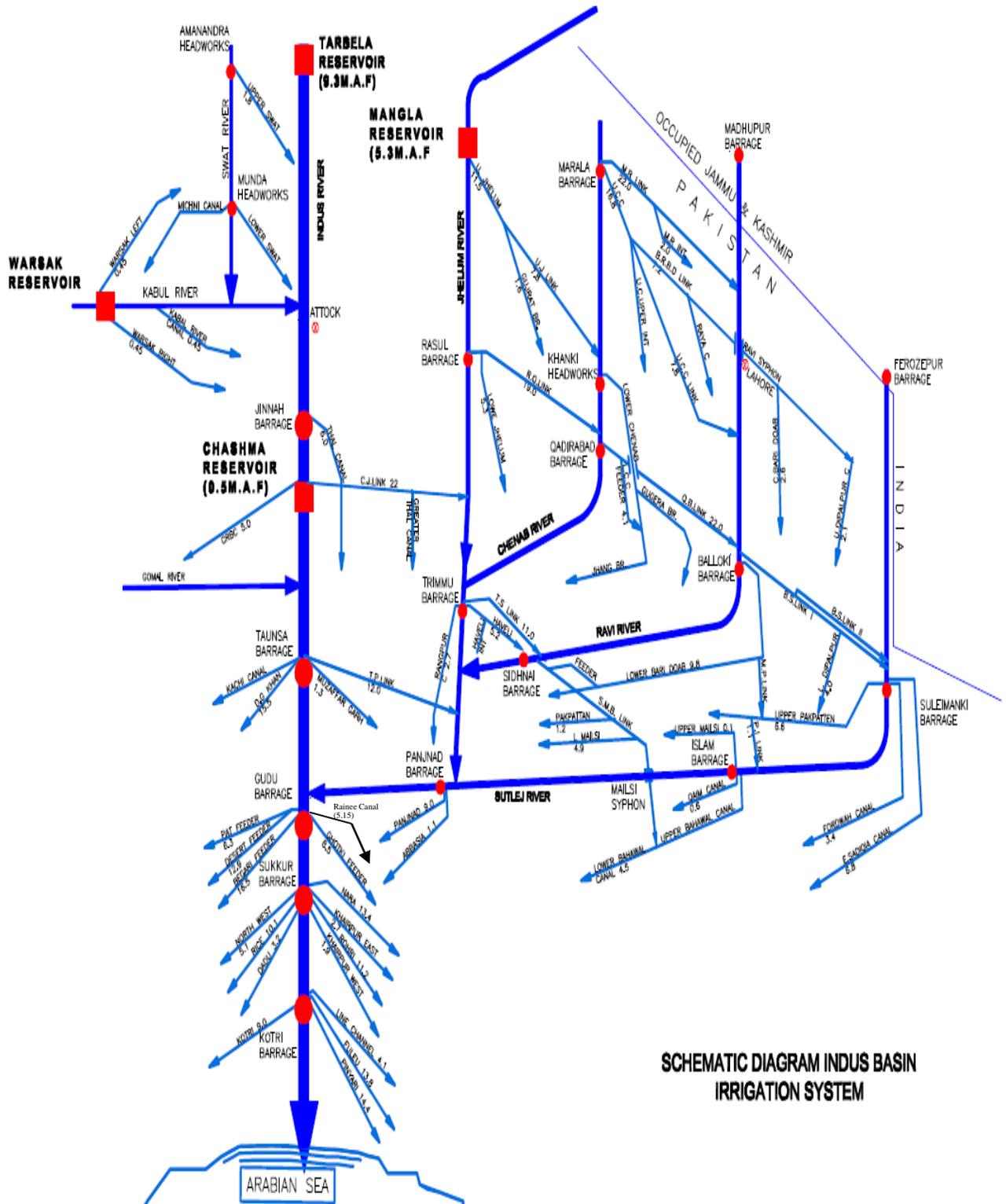
km of flood protection embankments and around 1410 spurs along main and other rivers. Province-wise break up of existing flood protection facilities is given in **Table-1**.

TABLE-1

EXISTING FLOOD PROTECTION INFRASTRUCTURE*

Name of Province	Embankments (K.M)	Spurs (No.)
Punjab	3,334	496
Sindh	2,424	46
Khyber Pakhtunkhwa	352	186
Balochistan	697	682
Total	6,807	1,410

** The inventory is being updated*



SCHEMATIC DIAGRAM INDUS BASIN IRRIGATION SYSTEM

Figure 1: Schematic Diagram of Indus Basin Irrigation System

1.7 IMPACT OF GLOBAL WARMING & CLIMATE CHANGE ON FLOOD MANAGEMENT

Global warming causes climate change, which is a serious issue for the world. It is a serious threat to the third world as its impacts will not be felt equally across our planet. Developing countries including Pakistan are much more vulnerable to the impacts of

climate change. The melting rate of glaciers in South Asia has increased, which may cause floods in Pakistan and surrounding countries in the coming years. Pakistan economy has faced significant losses due to environment damages and degradations. Besides many other challenges, climate change is emerging as perhaps the greatest environmental challenge for Pakistan causing floods, droughts and increasing hunger, poverty, displacement, soil degradation, desertification and deforestation.

Pakistan is a resource constraint country with a fast growing population, low natural resource development based and unfavorable local socio-cultural conditions, and climate change is an additional stress for the country. There is strong need to educate people about these natural disasters that why these disasters are becoming more frequent in the region including Pakistan. Educating masses about natural disasters and building up their preparedness at educational institutions can be of great help to minimize the damages of disasters. Media can play its due role in this regard as without its support, awareness cannot be boosted. Areas vulnerable to climate change-induced natural disasters must have a adequate flood protection facilities, besides, reliable Medium Range Weather/Flood Forecasting & Warning System in place.

1.8 HISTORICAL FLOOD EVENTS IN PAKISTAN

Since its creation, Pakistan has faced 21 severe flood event i.e. 1950, 1955, 1956, 1957, 1959, 1973, 1975, 1976, 1977, 1978, 19981, 1983, 1984, 1988, 1992, 1994, 1995, 2010, 2011, 2012 & 2013, the 2010 floods were worst ever in the country. The floods of various magnitudes since 1950 to 2013 affected vast areas in the four provinces including Gilgit-Baltistan, FATA & Azad Jammu & Kashmir.

Flood damages are caused mainly due to riverine flooding in main rivers and flash floods in Secondary & Tertiary Rivers/Hill Torrents, Coastal flooding due to Cyclone & urban flooding due to torrential rains and inadequate storm drainage facilities, besides, GLOFs. The unprecedented floods of 2010 were the worst floods in history of the country in which about 1985 people lost their lives, 1,608,184 houses were damaged/ destroyed, 17,553 villages were affected and total area of 160,000 Km² was affected.

Owing to adverse impacts of climate change, in the recent years, vulnerabilities of communities to coastal & urban flooding have also increased. The Sindh province, particularly southeastern parts of the province was severely affected due to unprecedented rains and inadequate drainage facilities during Monsoon Season-2011. The torrential rains during 2012 rains/floods affected Southern Punjab, Sindh & Balochistan provinces; about 571 people lost their lives, 636,438 houses were damaged/ destroyed, 14,159 villages were affected and a total area of 4,746 Sq.km was affected.

2013-FLOODS

The 2013-rains/floods damaged cropped area of about 1.107 million acres affected 8,297 villages, claiming about 333 lives, fully damaging 33,763 houses and 46,180 houses

partially, besides, population of about 1.489 million was affected. The historical flood events experienced in the past and their damages are given in the **Table-2**.

TABLE-2
HISTORICAL FLOOD EVENTS EXPERIENCED IN PAKISTAN

Sr. No.	Year	Direct losses (US\$ million) @ 1US\$= PKR 86	Lost lives (No)	Affected villages (No)	Flooded area (Sq-km)
1	1950	488	2,190	10,000	17,920
2	1955	378	679	6,945	20,480
3	1956	318	160	11,609	74,406
4	1957	301	83	4,498	16,003
5	1959	234	88	3,902	10,424
6	1973	5134	474	9,719	41,472
7	1975	684	126	8,628	34,931
8	1976	3485	425	18,390	81,920
9	1977	338	848	2,185	4,657
10	1978	2227	393	9,199	30,597
11	1981	299	82	2,071	4,191
12	1983	135	39	643	1,882
13	1984	75	42	251	1,093
14	1988	858	508	100	6,144
15	1992	3010	1,008	13,208	38,758
16	1994	843	431	1,622	5,568
17	1995	376	591	6,852	16,686
18	2010	10,000 @ 1US\$= PKR 86	1,985	17,553	160,000
19	2011	3730* @ 1US\$= PKR 94	516	38,700	27,581
20	2012	2640** @ 1US\$= PKR 95	571	14,159	4,746
21	2013	2,000^ @ 1US\$= PKR 98	333	8,297	4,483
Total		37,554	11,572	188,531	603,942

* Economic Survey of Pakistan 2011-12

** NDMA (article at <http://www.claimsjournal.com/news/international/2012/10/05/214891.htm>)

^ Thomson Reuters Foundation (article at <http://www.trust.org/item/20130909134725-rm708/>)(Agriculture sector)

1.9 INTEGRATED APPROACH IN FLOOD MANAGEMENT

Integrated Flood Management (IFM) integrates land and water resources development in a River Basin, within the context of Integrated Water Resources Management, with a view to maximizing the efficient use of floodplains and to minimizing loss of life and property. Integrated Flood Management, like Integrated Water Resources Management, should encourage the participation of users, planners and policymakers at all levels. The approach should be open, transparent, inclusive and communicative; should require the decentralization of decision making; and should include public consultation and the involvement of stakeholders in planning and implementation.

The management of floods as problems in isolation almost necessarily results in a piecemeal, localized approach. Integrated Flood Management calls for a paradigm shift from the traditional fragmented approach, and encourages the efficient use of the

resources of the river basin as a whole, employing strategies to maintain or augment the productivity of flood plains, while at the same time providing protective measures against the losses due to flooding. Sustainable development through Integrated Water Resources Management aims at the sustained improvement in the living conditions of all citizens in an environment characterized by equity, security and freedom of choice. Integrated Water Resources Management necessitates the integration both of natural and human systems, besides, land and water management.

Both population growth and economic growth exert considerable pressure on the natural resources of a system. Increased population pressure and enhanced economic activities in flood plains, such as the construction of buildings and infrastructure, further increase the risk of flooding. Flood plains provide excellent and technically easy livelihood opportunities in many cases. In developing countries with primarily agricultural economies, food security is synonymous with livelihood security.

The ecosystem approach is a strategy for the integrated management of land, water and living resources, a strategy that promotes conservation and sustainable use in an equitable manner. Both Integrated Water Resources Management (IWRM) and Integrated Flood Management (IFM) encompass the main principles of the ecosystem approach by considering the entire basin ecosystem as a unit and by accounting for the effects of economic interventions in the basin as whole. Environmental sustainability of the flood management options is one of the prerequisites in IFM.

Sustainable and effective management of water resources demands a holistic approach, linking social and economic development with the protection of natural ecosystems and providing appropriate management links between land and water uses. Therefore, water related disasters i.e. floods & droughts, as they play an important role in determining sustainable development, need to be integrated into water resources management.

A holistic approach to emergency planning and management is preferable to a hazard-specific approach and IFM should be part of a wider risk management system. This approach fosters structured information exchange and the formation of effective organizations relationships. In integrated flood management planning, achieving the common goal of sustainable development requires that the decision making processes of any number of separate development authorities be coordinated. Every decision that influences the hydrological response of the basin must take into account every other similar decision.

Adaptive management offers a robust but flexible approach to dealing with scientific uncertainties, wherein decisions are made as part of an ongoing science-based process. It involves planning, acting, monitoring and evaluating applied strategies and modifying management policies, strategies and practices as new knowledge becomes available. Adaptive management explicitly defines the expected outcomes; specifies the methods to measure performance; collects and analyses information so as to compare expectations with actual outcomes; learns from the comparisons and changes actions and plans accordingly. Water will be the primary medium through which the expected effects of climate change will materialize. Climate change and increased climate variability will affect flood processes in several ways simultaneously. Sea level rise will place coastal communities at higher flood risk and changing precipitation patterns will lead to an increased occurrence of flash floods and, in some regions, riverine floods. Integrated Flood Management takes account of those expected effects, and is therefore an autonomous adaptation strategy to climate variability and change.

The recurrence of the extreme precipitation anomalies that result in floods or droughts is a normal component of natural climate variability. The adverse effects of floods and droughts often entail far-reaching socio-economic and environmental implications, and may include loss of life and property; mass migration of people and animals; environmental degradation; and shortages of food, energy, water and other basic needs. The degree of vulnerability to such natural hazards is high in developing countries where necessity tends to force the poor to occupy the most vulnerable areas. The vulnerability of developed countries increases with economic growth and the accumulation of property in flood-prone areas and in highly urbanized settings.

Flood Management is an integral part of IWRM and describes the interplay between floods and the development process. It takes a look at traditional flood management practices; identifies the major challenges for flood managers and decision-makers dealing with sustainable development; and describes the basic tenets and requirements of IFM.

Integrated Flood Management is not universally applicable, but rather requires adaptation to specific situations, varying according to the nature of the floods, the flooding problem, the socio-economic conditions and the level of risk a society is prepared to take (or is forced to take) in order to achieve its development objectives. Similarly, the application of IFM at different administrative levels or geographic scales (national or transnational basins, for example) implies differentiated approaches to the process and to policy design.

1.10 FLOODS AND THE DEVELOPMENT PROCESS

Societies, communities and households seek to make the best use of the natural resources and assets available to them in order to improve their standard of life. They are all subject, however, to a variety of natural and man-made disturbances such as floods, droughts and other natural hazards, economic recessions and civil strife. These disturbances adversely affect personal assets and the multipliers of community well-being, such as job availability, the natural resource base and social networks, all of which contribute to the capacity to increase personal incomes. Unequal opportunities with respect to access to resources and information, and unequal power to participate in the planning and implementation of development policies mean that these disturbances have varying effects on different societies and on different groups within societies.

Natural disasters cause much misery, especially in developing countries where they cause great stress among low-income economies. Approximately 70 percent of all global disasters are linked to hydro meteorological events. Flooding poses one of the greatest natural risks to sustainable development. Flood losses reduce the asset base of households, communities and societies through the destruction of standing crops, dwellings, infrastructure, machinery and buildings, quite apart from the tragic loss of life. In some cases, the effect of extreme flooding is dramatic, not only at the individual household level, but in the country as a whole.

Although living on a floodplain exposes its occupants to flooding, it also offers enormous advantages. The deep fertile alluvial soil of floodplains – the result of eon of flooding is ideal for higher crop yields and the location provides good market access. Floodplains typically support high population densities, such as riverine area along both sides of Indus River and its major tributaries. This high productivity contributes considerably to regional food security.

The balancing of development needs and risks is essential. The evidence worldwide is that people will not, and in certain circumstances, cannot abandon flood-prone areas.

There is a need, therefore, to find ways of making life sustainable in the floodplains. The best approach is to manage floods in an integrated manner.

1.11 TRADITIONAL FLOOD MANAGEMENT OPTIONS

The traditional management response to severe floods was typically an adhoc reaction – quick implementation of a project that considered both the problem and its solution to be self-evident, and that gave no thought to the consequences of flood risks for upstream and downstream areas. Thus, flood management practices have largely focused on mitigating floods intensity and reducing their localized damages to private and public property. Traditional flood management has employed both structural and non-structural interventions, besides, physical and institutional interventions. These interventions were employed during and after flooding, and have often overlapped. The traditional flood management interventions are listed below;

- *Source control to reduce runoff:*
Permeable pavements, a forestation artificial recharge;
- *Storage of runoff:*
Wetlands, detention basins, reservoirs;
- *Capacity enhancement of rivers:*
Bypass/Escapes channels, cunnette, widening of channels etc.;
- *Separation of rivers and populations:*
Land-use control, flood protection infrastructure i.e. dikes, flood plan mapping zoning, house raising;
- *Emergency management during floods (flood forecasting & warnings, flood fighting works to raise or strengthen dikes, evacuation; and*
- *Flood recovery:*
Counseling, compensation or insurance.

Surface water storage, dams, embankments and retention basins, is a traditional approach to attenuating flood peaks. Water storage attenuate floods by slowing the rate of rising waters, by enhancing the time it takes for the waters to attain high level and evade the synchronization of flood peaks, hence, lowering the peak level in the downstream areas. Such storages reservoirs serve multiple purposes including flood management. Storage Reservoirs have to be used in an appropriate combination with other structural and non-structural measures.

Seemingly self-evident, but regularly overlooked in practice, is the need to make flood management a part not only of the planning and design, but also of the operation of reservoirs. Releases of surplus water from reservoirs at the time, when rivers in the downstream areas experiencing high flood flows can create risks, therefore, careful operation of reservoirs can minimize the loss of human life and damages to property due to properly managed releases. In this context transboundary cooperation is indispensable.

Dikes/flood embankments are most likely to be appropriate for floodplains that are already intensely used, in the process of urbanization, or where the residual risks of intense floodplain use may be easier to handle than the risks in other areas i.e. (from landslides or other disturbances).

Land-use control is generally adopted where intensive development on a particular floodplain is undesirable. Providing incentives for development to be undertaken elsewhere may be more effective than simply trying to stop development on the floodplain. Where land is under development pressure, however, especially from informal development, land-use control is less likely to be effective. Flood protection or raising houses levels are most appropriate where development intensities are low and properties are scattered, or where the warnings times are short. In areas prone to frequent flooding, protection of the infrastructure and the communication links from floods can reduce the debilitating impacts of flood on the economy.

Flood Forecasting & issuance of timely warnings are complementary to all forms of intervention. A combination of timely, clear & accurate warning messages with a high level of community awareness gives the best level of preparedness for self-reliant action during floods. Public education programme/awareness campaign is crucial to the success of warnings intended to preclude a hazard from turning into a disaster. Evacuation is an essential constituent of emergency planning, and evacuation routes may be upward into a flood refuge at a higher elevation or outward, depending upon the local circumstances. Outward evacuations are generally necessary where the depths of water are significant, where flood velocities are high and where the buildings are vulnerable. Successful evacuations require planning and awareness among the population of what to do in a flood emergency. Active community participation in the planning stage and regular exercises to assess the viability of the system help ensure that evacuations are effective. The provision of basic amenities such as water supply, sanitation and security in areas where affectees gather is particularly important in establishing a viable evacuation system.

1.12 THE CHALLENGES OF FLOOD MANAGEMENT

Both population & economic growths exert considerable pressure on the natural resources of a system. Increased population pressure and enhanced economic activities in floodplains, such as the construction of buildings and infrastructure, further increase the risk of flooding. Floodplains provide excellent, technically easy livelihood opportunities in many cases. In developing countries with primarily agricultural economies, food security is synonymous with livelihood security. Floodplains contribute substantially to the food production that provides nutrition for the people of these countries. While it can be argued that virtual water trade and by inference reduced dependence on flood prone and water scarce areas could address the issue of food security, it would not address the issue of livelihood security. The competition for access to limited land resources can jeopardize the weaker areas of the population who largely occupy the floodplains, policy measures must be assessed for their overall effect on the livelihood opportunities of populations at risk.

1.13 RAPID URBANIZATION

When there are increases in population in rural areas, it is often difficult for the standard of living to improve beyond basic sustenance. Farm living is dependent on environmental conditions that are often difficult to predict, and in times of drought, flood or crop failure, survival becomes extremely problematic. Under these conditions, people move from rural environments into cities to seek economic opportunities and better access to basic services. Climate change is likely to accelerate the migration patterns into urban areas by altering the livelihood basis from both fishing and farming, and by increasing the occurrence and intensifying the effects of natural hazards.

The urban proportion of the global population rose from 13% in 1900 to more than 50% at present. This figure is likely to rise to around 57% by 2025 and nearly 70% in 2050. Most of this urbanization will take place in developing countries where the growth is level in planned urbanization causes changes in the hydrological response of watersheds and affects and forms, water quality and habitat. Population growth and migration towards unplanned urban settlements in the floodplains of developing countries increase the vulnerability of the poorest sectors of society to flooding. These sectors of society also suffer from a lack of health and sanitation facilities and are thus most vulnerable to disasters and post disaster consequences. Flood Management policies must consider the needs of these societies.

1.14 CLIMATE VARIABILITY AND CHANGE

A variety of climate and non-climate parameters influence flood processes. Apart from the antecedent basin conditions, flood magnitudes depend on precipitation intensity, depth, timing, and spatial distribution. Temperature and wind affect snowmelt, which in turn affects flood magnitudes. The projected effects of global warming include changes in atmospheric and oceanic circulation, and many subsystems of the global water cycle are likely to intensify, leading to altered patterns of precipitation and runoff. Various climate model simulations show complex patterns of precipitation change, with some regions receiving less and others receiving more precipitation than they do now.

The likely increase in the intensity of tropical cyclones implies a corresponding increase in the intensity of precipitation events. Similar patterns are also likely in high latitude areas that are expected to experience an increase in mean precipitation. Most tropical and middle and high latitude areas are expected to experience a greater increase in extreme precipitation than in mean precipitation. These heavy precipitation events are likely to increase in magnitude and frequency, resulting in an increase in the frequency of major floods. Climate change poses a major conceptual challenge as it shakes the foundation of the normal assumption that the long term historical hydrological conditions will continue into the future. At the same time the future development path and the consequent impacts on climate change can at best be projected in terms of different development scenarios. Tackling climate change requires leadership, vision, capacity, and resources beyond our experiences to date.

FEDERAL FLOOD COMMISSION

2. FEDERAL FLOOD COMMISSION

2.1 Historic Background

Prior to 1976, the Provincial Governments were responsible for the planning and execution of flood protection works. Disastrous floods of 1973 & 1976 caused heavy loss of life and property and it was felt that the existing flood protection facilities and planning were inadequate to provide effective protective measures for the country. Heavy losses to the economy due to floods were discussed in the Inter-Provincial Conference held in January 1977 wherein it was decided to establish Federal Flood Commission (FFC) for integrated flood management on country wide-basis.

2.2 Functions of Federal Flood Commission

The functions under the charter of duties of FFC, as given in para-2 of Resolution, dated 4th January, 1977, are as under:

- i. Preparation of National Flood Protection Plans (NFPPs);
- ii. Approval of flood control schemes prepared by Provincial Governments and concerned Federal Agencies;
- iii. Review of flood damages to flood protection infrastructure and review of plans for restoration and reconstruction works;
- iv. Measures for improvements in Flood Forecasting and Warning System;
- v. Standardization of designs and specifications for Flood Protection Works;
- vi. Evaluation and monitoring relating to progress of implementation of the National Flood Protection Plans (NFPPs);
- vii. Preparation of a research programme for Flood Control and Protection; and
- viii. Recommendations regarding principles of regulation of reservoirs for flood control.

The Provincial governments and Federal Line Agencies undertake the flood protection schemes proposed under the National Flood Protection Plans (NFPPs). The Federal Government, however, provides the resources for meeting the capital costs of projects under NFPPs.

2.3 Achievements of FFC

Since its establishment in 1977, FFC has so far executed three 10-Years National Flood Protection Plans covering periods from 1978-1988 (NFPP-I), 1988-1998 (NFPP-II) and 1998-2008 (NFPP-III). Brief details of projects executed under the three 10-Years Plans are given as under:

National Flood Protection Plan-I (1978-88):

Details of flood protection schemes executed under **National Flood Protection Plan-I (NFPP-I)** through various programme/projects are given as under;

Normal/ Emergent Flood Programme:

- Expenditure incurred: Rs 1,729.75 million
- No. of flood protection schemes completed in the four Provinces, AJ&K, FATA & NA (now G-B): 311
- Source of Funding: 100% by GOP

Under NFPP-I, emphasis was mainly given on the implementation of structural measures (construction of flood protection structures). Pakistan Meteorological Department (PMD) and WAPDA carried out only maintenance works related to Flood Forecasting & Warning System equipments.

National Flood Protection Plan-II (NFPP-II) (1988-98):

Details of flood protection schemes/activities carried out through various programme/projects are given as under;

Normal/ Emergent Flood Programme:

- Expenditure incurred Rs 805.33 million
- No. of Schemes executed 170
- Source of funding 100% by GOP

Flood Protection Sector Project-I (FPSP-I):

- Expenditure incurred Rs 4,735.29 million
- No. of flood protection schemes executed 256
- Co-financed by GOP & ADB ADB= 80%
GOP = 20%

Under NFPP-II, the following activities were undertaken for improvement of Country's existing Flood Forecasting & Warning System through Flood Sector Protection Project (FPSP-I), which was jointly funded by ADB and GOP.

- Procurement & installation of Meteor-burst Telecommunication System (Phase-I) including one Master Station and 24 remote sensing stations.
- Installation of 10-CM Quantitative Precipitation Measurement (QPM) Weather Radar at Flood Forecasting Division (FFD) Lahore.
- Pre-feasibilities studies for four Barrages i.e. Sulemanki, Baloki, Trimmu & Panjnad for increasing their design discharge capacity to carry increased flood flows in view of 1992 floods.
- Preparation of Flood Plain Maps of Indus River (5-Reaches i.e. Chashma-Taunsa, Taunsa-Guddu, Guddu-Sukkur, Sukkur-Kotri & Kotri-Seas Reach).

Prime Minister's River Management Programme 1994-1996

- Expenditure incurred Rs. 613.386 million
- No. of schemes executed 10
- Source of Funding 100% by GOP

1988-Flood Damage Restoration Project

- Expenditure incurred Rs. 1,874 million
- No. of structures restored 2,028
- Source of Funding 90% by IDA & ADB,
10% by GOP

1992-Flood Damage Restoration Project

- Expenditure incurred Rs. 6,888.36 million
- No. of structures restored 1,980
- Source of Funding 80% by IDA, ADB & KfW
20% by GOP

National Flood Protection Plan-III (NFPP-III) (1998-2008):

Details of flood protection schemes/activities carried out through various programme/projects are given as under;

Normal/Emergent Flood Programme:

- Expenditure incurred Rs 4,192.35 million
- No. of flood protection schemes executed in four Provinces, AJ&K, FATA, ICT and Northern Areas (Now Gilgit-Baltistan) 362
- Source of Funding 100% by GOP

Special Grant through President/Chief Executive Directive (2000-2002)

- Expenditure incurred Rs. 92.035 million
- No. of schemes executed 21
- Source of Funding 100% by GOP

Flood Protection Sector Project-II (FPSP-II):

- Expenditure incurred Rs 4,165 million
- No. of Flood Protection Schemes executed 101
- Source of Funding 80% by ADB,
20% by GOP
- Flood Forecasting & Warning System Rs 432.123 million

The major activities undertaken for improvement of country's existing Flood Forecasting & Warning System include;

- Procurement & installation of 24 No. HF-Radio Sets.
- Procurement & installation of 20 additional remote sensing stations under existing Meteor-burst Telecommunication System (Phase-II);
- Upgradation of 10 CM Quantitative Precipitation Measurement Weather Radar procured under FPSP-I in the premises of FFD, Lahore;
- Upgradation of 5.36 CM Sialkot Weather Radar into 10 CM Quantitative Precipitation Measurement Weather Radar;
- Procurement & installation of a 10 CM Quantitative Precipitation Measurement Weather Radar at Mangla;
- Development of initial/1st version of Computer Based Flood Early Warning System (FEWS) through NESPAK, PMD & Delft Hydraulics;
- Expansion of Flood Plain Mapping activity covering major tributaries of River Indus i.e. Rivers Jhelum, Chenab, Ravi & Sutlej.
- Bathymetric Survey & flow measurements of Indus River and its major tributaries (*Sutlej, Ravi, Chenab & Jhelum*) for improvements in discharge rating curves & to collect data for FEWS Model & Flood Plain Mapping activities.

Establishment of Flood Forecasting & Warning System for Lai Nullah Basin (Islamabad & Rawalpindi):

- Expenditure incurred: Rs 348 million
- Source of Funding;
 - *Japanese Grand –in-Aid* Rs 337 million
 - *GOP share* Rs 11.00 million
- Facilities provided include:
 - Two No. Telemetry rainfall gauging stations at Golra, Islamabad and Bokra, Islamabad;
 - Two No. water level gauging stations at Kattarian Bridge, Rawalpindi and Gawalmandi Bridge, Rawalpindi;
 - Master control station in PMD, Islamabad;
 - Two monitoring stations at FFC and TMA/Rescue-1122-Rawalpindi respectively;
 - Executive Warning Control room in Rawalpindi Fire Brigade , and
 - Nine (9) No. warning posts at various locations.

2.4 National Flood Protection Plan -IV

After experiencing 2010 floods in country, the need for investment in flood sector has gained importance. Federal Flood Commission has initiated working on formulation of National Flood Protection Plan-IV on fast track basis. The consultants were engaged in May 2013 through World Bank funded Water Sector Capacity Building Project (WCAP) for preparation of NFPP-IV. The plan is likely to be finalized by the end of current calendar year (2013-14). Actual implementation has been planned to be carried out during the next ten years i.e. from (2014-15 – 2024-25), subject to approval of NFPP-IV by the Government of Pakistan well in time and provision of adequate funds in coming years for construction of various interventions to be proposed in the said Plan.

Presently, the urgent nature flood protection works are being undertaken through GOP funded Normal/Emergent Flood Programme under PSDP on yearly basis, which are planned and executed by the Provinces and Federal Administered Areas.

2.5 Normal/Emergent Flood Programme

Federal Flood Commission is presently coordinating implementation of Normal/Emergent Flood Programme, which was started in (1978-79). It is a need-based yearly program in which Provincial Irrigation Departments and Federal Line Agencies submit their schemes (based on their share) each year, which are processed by FFC for approval of Scrutinizing Committee of FFC and DDWP/CDWP. The award of contract, execution and disbursement is the responsibility of Provincial Irrigation Departments and Federal Line Agencies.

The primary objectives of the programme are to construct flood protection works in order to minimize losses caused by floods to public and private infrastructure and to create public awareness for prevention and flood adaptability amongst the masses and enhance beneficiary participation. This includes poverty alleviation, self-sufficiency in food through protection of standing crops, socio-economic development, reduction of water borne viral diseases, reclamation of eroded land for efficient use, flood protection and disaster risk reduction. Normal/ Emergent Flood Programme has played effective role in management of floods and prevention/reduction of damages to life, property and infrastructure.

The flood protection schemes taken up under PSDP are processed for approval and implementation before 30th June of each financial year subject to in-time approval and release of funds by Finance Division to the Line Agencies.

2.6 Summary of GOP Investment on Flood Protection Works

The summary of federal investment on flood protection works since 1978 to June 2013 is given in **Table 3**.

TABLE 3

SUMMARY OF FEDERAL INVESTMENT ON FLOOD PROTECTION WORKS

Sr. No.	Flood Plans/ Programs	Location	No. of schemes	Expenditure (Rs Million)
1.	NFPP-I (1978-88)	Countrywide	311	1,729.75
	Normal Annual Development Programme			
2.	NFPP-II (1988-98)			
i.	Normal/Emergent Flood Programme	Countrywide	170	805.33
ii.	First Flood Protection Sector Project (FPSP-I)	Four Provinces	256	4,735.29
iii.	Prime Minister's River Management Programme (1994-96)	Punjab, Khyber Pakhtunkhwa & Balochistan	10	613.386
3.	NFPP-III (1998-2008)			
i.	Normal/Emergent Flood Programme	Countrywide	362	4,192.35
ii.	Second Flood Protection Sector Project FPSP-II (1998-2007)	Four Provinces	101	4,165.00
iii.	Special Grant through President/ Chief Executive Directive (2000-2002)	Gilgit-Baltistan	21	92.035
iv.	Lai Nullah Flood Forecasting & Warning System <i>through Japanese Grant</i>	District Rawalpindi & ICT	1	348.00
v.	Normal/Emergent Flood Programme (2008-13)	All over the country	139	2,156.805
	Sub Total-I (NFPP-I,II &III)		1,371	18,837.95
4.	Flood Damage Restoration Projects			
i.	1988-Flood Damage Restoration Project	Four Provinces	2,028	1,874.00
ii.	1992-Flood Damage Restoration Project	Countrywide	1,980	6,888.36
	Sub Total-II		4,008	8,762.36
	Grand Total		5,379	27,600.31

FLOOD MANAGEMENT MECHANISM

3. FLOOD MANAGEMENT MECHANISM

3.1 Organizations involved and responsibilities

Flood management is a multifunctional process involving a number of organizations. The Government Organizations, which play major role in the flood management are the Provincial Irrigation Departments (PIDs), WAPDA, Provincial Relief Organizations, Pak Army, PCIW, Emergency Relief Cell (ERC) of the Cabinet Division, Federal Flood Commission (FFC), NHA, Pakistan Railways, Flood Forecasting Division (FFD)/PMD, National Disaster Management Authority (NDM), GB-DMA, SDMA, Provincial Disaster Management Authorities (PDMAs) and DDMA/District Administration. Functions of these organizations are briefly described hereinafter;

3.1.1 Provincial Irrigation Departments:

The Provincial Irrigation Departments (PIDs) play a front line role in flood management, fighting and mitigation. Major flood related functions include:

- i. Operation and maintenance of Barrages and measurement of discharges at specific sites (Barrages/Headworks) on rivers, Irrigation & Drains Networks, besides, flood management facilities;
- ii. Planning, design, construction and maintenance of Irrigation, Drainage & Flood Protection & River Training Works;
- iii. Collection and transmission of Rivers flows data to FFD, Lahore, FFC and other concerned organizations for flood management activities;
- iv. Establishment & Operation of Flood Warning Centre during the monsoon season each year for sharing flood flows data and other information, besides, timely dissemination of the flood forecasts/warnings to concerned quarters;
- v. Preparation & implementation of the Flood Fighting Plans during monsoon season every year.

3.1.2 WAPDA

WAPDA is actively involved in the flood forecasting process as it provides water levels of major reservoirs (Tarbela, Chashma & Mangla), river flows and rainfall data collected through Flood Telemetric System/Gauged sites in the catchment areas of major rivers. The system is supplemented by Meteor-burst communication system. WAPDA supports another hydrometric data measurement and transmission system through its Surface Water Hydrology Project.

WAPDA's Flood Telemetric Network is directly linked with FFD, Lahore. WAPDA provides hydrometric flood data and water levels, inflows/ outflows of Tarbela, Chashma and Mangla reservoirs to FFD, Lahore, FFC and other concerned organizations. Coordination between FFD Lahore and WAPDA has considerably improved after the 1992-flood disaster. Regular meetings in the office of General Manager (Planning & Design) are held during flood season and necessary instructions are issued to Tarbela and Mangla Dam Flood Management Committees.

3.1.3 Provincial Relief Organizations/ Provincial Disaster Management Authorities:

Ultimate aim of flood warnings is to reduce the loss of life and damages to property of the community living in the flood prone/high risk areas. Provincial Relief Organizations (*now Provincial Disaster Management Authorities*) are responsible for disaster preparedness, preparation of emergency response plan, rescue and relief measures and rehabilitation plan and its approval from Provincial Government before implementation; examine the vulnerability of various parts of the province to different disasters and specify prevention or mitigation measures; lay down guidelines for preparation of disaster management plans by the Provincial Department and District Authorities; evaluate preparedness at governmental levels to respond to disaster and enhance preparedness; coordinate response in the event of disaster; give directions to DDMA's regarding actions to be taken in response to disaster; and promote general education, awareness and community training etc. pertaining to all disasters including floods. Relief functions at the District and Tehsil/Union Council level are now performed through the District Disaster Management Authorities, who coordinate with the concerned departments to carry out the disaster management functions at the District level.

3.1.4 Pak Army:

Pak Army's Corps of Engineers under the command and control of Engineer-in-Chief (*E-N-C*) provide necessary help to the civil authorities to carry out the rescue and relief operations during and after the floods. Provincial Governments provide necessary logistic support/equipment (*boats, life jackets, vehicles, tents etc.*) to Pak Army for such operations.

Pakistan Army's flood related functions encompass all the three phases of flood operations from the pre-flood to post flood phases including the important flood phase. Pre-flood phase is the flood preparatory phase during which the adequacy and serviceability of the flood fighting equipment is ensured. Pre-flood meeting are also held at the Corps Head Quarters and Engineer Directorate, GHQ in order to review the arrangements of PIDs, PDMA's & Federal Line Agencies for handling flood situation.

Pre-flood inspections of the flood protection structures are carried out by the respective Commander Corps of Engineers alongwith concerned officers of Provincial Irrigation Departments for their respective areas to ensure that the flood protection structures (Bunds, Barrages, Spurs etc.) are in satisfactory state of maintenance. Deficiencies, if any, are brought to the notice of PIDs. Availability of sufficient stock of explosives is ensured at pre-determined breaching sections to activate the pre-determined breaching sections, whenever required.

An officer of the 4 Corps Engineers is placed on duty in the Flood Warning Centre, Lahore, to keep a close watch on the flood situation. All flood forecasts and warnings are communicated to the CC Engineers 4 Corps in time, which are transmitted to the D.G. Engineers and all other CC of the Engineers. In the event of floods, units of the Pak Army move out to their respective areas of responsibility and carry out the relief and rescue operations in coordination with the respective civil administration. A post flood meeting is held under the Chairmanship of Engineer-in-Chief/ D.G. Engineers to discuss the performance of all the flood management related agencies with the view to bring about the necessary improvement in future.

3.1.5 Pakistan Commissioner for Indus Waters (PCIW)

Pakistan has a unique flood-forecasting problem in the sense that major part of the flood generating in upper catchments of Rivers Sutlej, Ravi, Jhelum and Chenab lie across the border in India/ held Kashmir. A number of water storage reservoirs have been constructed over Eastern Rivers (Ravi & Sutlej) across the border. As a result, the free flood flow conditions are disrupted making the operation of the rainfall/runoff model extremely difficult. The situation underlines the need for the acquisition of rivers flow data from across the border in respect of important sites over the rivers in India/held Kashmir. Consequently, an agreement had been signed between the two countries in 1989 through their respective Commissioners for Indus Waters, which includes provision/sharing rivers flows data with India such rivers flow and rain data as is considered important for flood forecasting in Pakistan. A number of river flow stations are specified for this purpose.

The Pakistan Commissioner for Indus Waters receives the Chenab River and Eastern Rivers (Ravi & Sutlej) data normally once in a day. The data is then passed on to the FFD, Lahore for preparation and issuance of Flood forecast to concerned organizations. Frequency of data reception is increased to six hourly and even to hourly in case of severe flood situation. Pakistan Commissioner for Indus Waters is thus responsible to provide to FFD, Lahore, the much-needed data obtained from India for use in the flood forecasting models to ensure accurate forecasts for Rivers Sutlej, Ravi, Jhelum & Chenab. Pakistan Commissioner for Indus Waters is the only forum through which any clarification or further information can be obtained from India with regard to flood flows data of Chenab & Eastern River (Ravi & Sutlej).

3.1.6 Emergency Relief Cell (ERC), Cabinet Division

Emergency Relief Cell (ERC) exists under the Cabinet Division and is controlled by the Cabinet Division. The Cell is headed by the Director General. The main functions of the Emergency Relief Cell include:

- Planning and assessment of relief requirements for major disasters;
- Stock piling of basic need items during emergency such as dry ration, tents, blankets etc;
- Establishing emergency fund upon declaration of any part of the country as calamity affected; and
- Maintaining contact with NDMA, UNO and its related organizations, besides other international aid giving agencies.

3.1.7 FFC and its Role in Flood Management/Mitigation

Since its establishment in 1977, FFC has prepared three National Flood Protection Plans i.e. NFPP-I, II&III and implemented through PIDs & Federal Line Agencies. The Plans envisaged both structural as well as the non-structural measures. Structural measures include construction of flood embankments, spurs and river training works, whereas non-structural measures mainly pertain to establishment of a modernized Flood Forecasting & Warning System to provide timely and reliable weather/flood information to the organizations dealing with flood management and general public as well. The major step towards this end is installation of 10 CM QPM Doppler Weather Radar one each at FFD, Lahore and Mangla, besides, up-gradation of Weather Radar at Sialkot, besides, other

important step is the development of improved Flood Forecasting Models i.e. Flood Early Warning System Model (FEWS Model) for FFD, Lahore. Improvement in measurement and transmission of the hydrometric data based upon the meteor-burst a physically based model accounting for the hydro dynamical changes in the flood wave. The model calls for the survey of the channel geometry to determine the channel parameters at suitable intervals of the channel length. It has, therefore, built-in discharge/elevation relationship, which should readily yield the flood levels at any point along the channels. This is of great advantage in the area of flood warning since it allows the estimation of the areas of inundation along the channel. In turn Flood inundation Maps (Flood Plain Mapping) have been prepared to facilitate the identification of the villages and other public & private property and installation, which may likely to inundate at certain flood flow stage, so as to make them safe against that magnitude of floods. All that can be determined on the basis of Hydrodynamic model. The existing Flood Telemetry and Meteorburst Communication Systems of WAPDA have also been considerably improved and expanded by installation of one Master Station and 24 remote sensing stations under the Asian Development Bank assisted First Flood Protection Sector Project (FPSP-I) and 20 additional remote sensing stations alongwith 24 No. HF-Radio Sets under the Second Flood Protection Sector Project (FPSP-II).

A large number of flood protection works, i.e. 6803 km of Embankments and more than 1400 Spurs have so far been executed by the Provincial Irrigation Departments and Federal Line Agencies through various GOP Projects/Programme and foreign donor agencies.

Establishment of Flood Communication Cell during Flood Season

During flood season, each year, Flood Communication Cell of Federal Flood Commission remains in operation on round-the-clock basis for the entire flood season (1st July to 15th October). The Daily Flood Situation Report (*containing rainfall, river flows, reservoirs water levels and weather situation for the country*) is issued to all concerned organizations.

The main job of the Flood Communication Cell is to obtain weather and rivers flow data/information from the Flood Forecasting Division (FFD), Lahore, WAPDA, Provincial Irrigation Departments (PID's) and other Flood Warning Centers set up in the Provincial Headquarters, besides, flood flows data of Eastern Rivers through PCIW. The duty staff alongwith one officer remains available round the clock during all working days as well as Sundays and National Holidays for collection of rainfall and rivers flow data & weather reports for compilation and dissemination to all concerned organizations.

FFC also sends reports to the President Secretariat and Prime Minister Office as and when the situation demands. The Daily Flood Situation Report on Weather & River Discharges as received from FFD, Lahore, WAPDA & PIDs is prepared and issued to the concerned Government officials during the Monsoon Season every year containing the following data/information;

- i. Actual rivers flood flows position of major rivers at RIM Stations and other important control points in a tabular form;
- ii. Prevailing weather situation & future outlook;
- iii. Concise forecast relating to the movement of various weather systems and river flow condition for the next 24 hours including likely inundation /flooding of nullahs etc. as received from PMD/FFD, Lahore;

- iv. Damage details in the event of flood emergency in the flood affected areas. In case of exceptionally High Flood Stage/emergency situation, special advisory on Weather & Rivers flood flows position is issued on six hourly basis.

3.1.8 Flood Forecasting Division (FFD), Lahore

FFD, Lahore, the specialized unit of Pakistan Meteorological Department, which plays a pivotal role in the Flood Forecasting & Warning process obtains the hydro-meteorological data from the various National and International sources, which is then analyzed to produce weather & flood forecasts, warnings and disseminated to various Federal/Provincial organizations and electronic/print media through various means and also uploaded on PMD Website.

3.1.9 National Disaster Management Authority (NDMA)

Government of Pakistan had embarked upon establishing appropriate policy to minimize risks and vulnerabilities and passed NDMA ordinance 2006. National Disaster Management Authority (NDMA) has been established to serve as the focal point and coordinating body to facilitate implementation of disaster risk management strategies. This necessitates NDMA to directly interact/communicate with all stakeholders, including Ministries, Divisions, and Departments in relaxation to normal communication channel.

NDMA is an expedient to provide an effective national disaster management system and for matters connected therewith and incidental thereto. As per National Disaster Management Authority Act-2010, the main functions of NDMA are as under:

- i. Act as implementing, coordinating and monitoring body for disaster management;
- ii. Prepare the National Plan to be approved by the National Disaster Management Commission;
- iii. Implement, coordinate and monitor the implementation of the national policy;
- iv. Lay down guidelines for preparing Disaster Management Plans by different ministries or departments and the provincial authorities;
- v. Provide necessary technical assistance to provincial government and provincial authorities for preparing their Disaster Management Plans in accordance with the guidelines laid down by the National Disaster Management Commission;
- vi. Coordinate response in the event of any threatening disaster situation or disaster;
- vii. Lay down guidelines for or give directions to the concerned ministries or provincial governments and provincial authorities regarding measures to be taken by them to response to any threatening disaster situation or disaster;
- viii. For any specific purpose or for general assistance requisition the services of any person and such person shall be co-opted as member and exercise such power as conferred upon him by the authority in writing;
- ix. Promote general education and awareness in relation to disaster management;
- x. Perform such other functions as the National Disaster Management Commission may require performing.

3.2 Flood Warning Dissemination System:

Monsoon Season normally starts in 1st week of July (*sometimes, it starts little early*) and ends in last week of September (*sometimes prolongs upto mid October*). However, the Flood Warning Centers of all flood management related agencies start functioning from 15th June every year for collecting weather & flood flows data and keep continue upto 15th October. During this period effective interaction and communication between various floods related provincial as well as federal agencies is maintained on round-the-clock basis in order to counter any eventuality due to monsoon rains/floods.

3.3 Pre-Flood Preparedness Meetings:

A number of pre-flood meetings are organized annually by the concerned flood management organizations, i.e. Pak Army, NDMA, and Ministry of Water & Power/FFC to review the status of preparedness and Flood Fighting Plans/arrangements of concerned organizations. The following pre-flood meetings were held during 2013;

- i. Pak Army Pre-Flood Coordination Conference was held on **June 18, 2013** at Engineers Directorate, GHQ Rawalpindi, which was attended by the Commanders of Pak. Army formations, FFC, NDMA, PMD, WAPDA etc. The Flood Preparedness Plans were reviewed;
- ii. NDMA organized the National Conference on Monsoon Preparedness on **June 26-27, 2013** and reviewed Contingency Plans of flood management related organizations for Monsoon Season 2013.
- iii. The 48th Annual Meeting of Federal Flood Commission was organized on **July 03, 2013**, under the Chairmanship of Honourable Federal Minister for Water & Power, to review the status of preparedness of concerned Federal & Provincial Government organizations and arrangements made for safe passage of Flood Season-2013.
- iv. A meeting for review the arrangements of flood management related organizations and also to evaluate progress on decisions taken in 48th Annual Meeting of FFC was arranged on **August 05, 2013** under the Chairmanship of Secretary Ministry of Water & Power, in Ministry of Water & Power, Islamabad.

**PREPAREDNESS/
CONTINGENCY PLANNING
FOR
MONSOON SEASON 2013**

4. PREPAREDNESS & CONTINGENCY PLANNING FOR MONSOON SEASON 2013

The Federal Flood Commission (FFC) mainly plays coordination role among the Provincial as well as Federal Government Organizations dealing with flood management in the country minimizing the damages to crops by managing the flood water, at the sole responsibility of provincial Irrigation Department, and Federal Line Agencies. However, as per practice, FFC holds meeting prior to start of Monsoon Season (1st July to 15th October) every year, to review the status of preparedness/ flood fighting arrangements made by Federal/Provincial Organizations in case of flood situation during Monsoon season.

4.1 Pre-emptive measures suggested by Federal Flood Commission for Monsoon Season-2013 for better flood management and minimizing flood losses

The Provincial Irrigation Departments of the four provinces and Federal Line Agencies were asked in March 2013 to undertake the following pre-emptive measures well before the start of monsoon season-2013 for better flood management and minimizing flood losses.

- i. Provision of adequate O&M funds for Flood Protection Infrastructures through Provincial Budget and execution of all urgent nature O&M works/ activities of Irrigation, Drainage and Flood Protection Infrastructures well before the start of monsoon season-2013.
- ii. Pre-flood inspection of all Flood Protection Infrastructures (flood bunds, spurs, Barrages/Head Works and allied works etc) be carried out jointly with concerned Corps of Engineers of Pak Army and a report in this respect may be submitted to all concerned including this office. Strengthening all weak sections of bunds/spurs etc, arrangements for provision of explosive and others material at sites of pre-determined breaching sections and stone reserve stock/ flood fighting material at all critical reaches of flood embankments.
- iii. Preparation of District/ Division-wise Flood Fighting Plan by the PID's and Federal Line Agencies, keeping in mind lessons learnt during the past three consecutive flood events (2010, 2011 & 2012) and their circulation among concerned organizations.
- iv. Removal of encroachments in the riverine area for clearance of waterway of main and other rivers including hill torrents, besides, drains prior to start of Monsoon Season-2013.
- v. Completion of all Flood Damages Restoration works related to Irrigation, Drainage & Flood Protection Infrastructure damaged during monsoon season 2010, 2011 & 2012.
- vi. Outlines SOPs for implementation of Flood Fighting Plan in their respective areas, keeping in view the experience of 2010 floods.
- vii. Review the existing SOPs of major reservoirs (Tarbela & Mangla) so as to maximize their flood mitigation role in future floods.

- viii. To review and update SOPs for barrages, keeping in view flood experienced during 2010-Monsoon season and ensure their implementation for safe passage of flood peak in future.
- ix. Provincial Irrigation Departments/ Federal Line Agencies to ensure strict vigilance and round the clock patrolling of flood embankments along major & other rivers, especially vulnerable locations as identified during pre-monsoon season inspections in order to ensure safe passage of flood flows of Monsoon Season 2013.

4.2 Preparatory Meeting of Federal Flood Commission

In order to review the status of implementation of above listed pre-emptive measures, a preparatory meeting of Federal Flood Commission was held on May 16, 2013 in office of Chief Engineering Advisor/ Chairman Federal Flood Commission, Islamabad. The representatives of PIDs/ Federal Line Agencies ensured necessary O&M budget allocation for repair to flood protection infrastructures & machinery/equipment before start of monsoon season-2013. The following directions were issued to PIDs/ Federal Line Agencies, WAPDA & PMD etc.:

- i. Federal Flood Commission will write DO letters to Chief Secretaries of the four provinces and Federally Administered Area (Gilgit-Baltistan, FATA & AJK) for allocating/release of adequate O&M funds well in time for repair and rehabilitation/strengthening of Irrigation Drainage & Flood Protection Infrastructure.
- ii. Federal Flood Commission will write letter to District Coordination Officer (DCO), Rawalpindi to take up the matter with Finance Department, Government of the Punjab for release of Rs. 53.00 million as requested by WASA Rawalpindi on priority basis for early completion of remaining desilting works of Lai Nullah in Rawalpindi (Long-term measures).
- iii. Ministry of Water & Power and P&D Division will make all possible efforts for release of balance funds of RBOD-I & III to WAPDA allocated under PSDP (2012-13) for clearance of outstanding liabilities, besides, Normal/Emergent Flood Programme (2012-13) for completion of emergent nature flood protection schemes before 30th June 2013.
- iv. Irrigation Department of the four provinces & Federal Line Agencies will make utmost efforts to speed up physical progress on emergent nature repair/rehabilitation works related to Irrigation Drainage & flood Protection Infrastructure, so as to complete the same by/before 15th June 2013. The compliance report would be submitted to Federal Flood Commission soon after completion of the task.
- v. Provinces & Federal Line Agencies will ensure to carry out pre-flood monitoring of flood protection infrastructure (flood bunds, spurs, barrages/head works and allied works etc) and ensure strengthening all weak sections of bunds/spurs etc. well before the start of monsoon season 2013 (by/before 30th June 2013).
- vi. Arrangements of explosive and others material will be made at sites of pre-

determined breaching sections and stone reserve stock/flood fighting material would also be arranged at all critical reaches of flood embankments as identified during pre-flood inspection before start of monsoon season 2013 (before 30th June 2013).

- vii. Provincial Irrigation Department & Federal Line Agencies will finalize District/Division-wise Flood Fighting Plan, keeping in mind lessons learnt during the past three consecutive flood events (2010, 2011 & 2012) and ensure their circulation among concerned organizations by/before 15th June 2013.
- viii. Provincial Irrigation Department & concerned Federal Line Agencies will ensure removal of encroachments from flood protection infrastructure and flood plains before start of Monsoon Season 2013 (15th June 2013). The compliance report would be submitted of FFC.
- ix. Provincial Irrigation Department & Federal Line Agencies will ensure completion of all 2010, 2011 & 2012-Flood Damages Restoration Works related to Irrigation, Drainage & Flood Protection Infrastructure by/before 15th June 2013 and the compliance report would be submitted to Federal Flood Commission.
- x. PMD, FFD, Lahore & WAPDA will carry out all essential repair/maintenance works of Flood Forecasting and Warning System equipment and ensure that the System/Network is fully functional by/before 15th June 2013.

4.3 Establishment of Flood Communication Cell

The Flood Communication Cell of Federal Flood Commission started functioning from 15th June 2013 on round-the-clock basis and communicated river flow data to all provinces and concerned agencies on daily basis in normal/low flood stage and 6-hourly basis in case of danger flood levels in main rivers. Based on PMD's Weather Forecasts and Advisories, FFC also issued Daily Flood/Weather Situation Reports to all concerned agencies through its Flood Communication Cell during the entire flood season-2013.

4.4 Specific Activities/ Initiatives undertaken by Federal Flood Commission to mitigate damages/losses due to 2013-Rains/Floods

The other major activities/ initiatives undertaken by Federal Flood Commission to mitigate damages/losses due to 2013-rains/floods included the followings:

- i. A High Level Flood Management Committee having representation from Federal Flood Commission (FFC), National Disaster Management Authority (NDMA), WAPDA, Pakistan Meteorological Department (PMD), PCIW, IRSA and Engineer Directorate, GHQ, Rawalpindi was notified by the Ministry of Water and Power for the Monsoon Season 2013, as was done in the previous Monsoon Season (2012). The primary objective of the Committee on flood management would be to oversee and ensure proper operation of Tarbela, Chashma and Mangla Reservoirs during Monsoon Season 2013, besides, coordination for Flood Forecasting & Management activities. The Committee met /interacted as frequently as was needed during monsoon season-2013 and advised necessary precautionary measures so as to save human lives and damages to property.
- ii. The 48th Annual Meeting of Federal Flood Commission was organized on July

- 03, 2013, under the Chairmanship of Honourable Federal Minister for Water & Power, to review the status of preparedness of concerned Federal/ Provincial Government organizations and arrangements made for safe passage of Flood Season-2013.
- iii. A progress review meeting on decisions taken in 48th Annual Meeting of FFC was also held on 5th August, 2013 under the Chairmanship of Secretary Ministry of Water & Power, in committee room of Ministry of Water & Power, A-Block Pak. Secretariat, Islamabad.
 - iv. Country-wide monitoring of flood works has been conducted by Federal Flood Commission (FFC), during Financial Year (2012-13), despite limited manpower and logistic support.
 - v. The de-silting work in critical reaches (in Rawalpindi City) was carried out by WASA, Rawalpindi prior to start of Monsoon Season 2013.
 - vi. PCIW has been advised for making all necessary arrangements for obtaining river flow data of “Eastern Rivers i.e. Ravi, Sutlej & Bias” from Indian counterpart and its dissemination well in time to all concerned organizations for taking further action at their end during Monsoon Season-2013.
 - vii. Federal Flood Commission (FFC) initiated working on formulation of “National Flood Protection Plan-IV” through World Bank funded Water Sector Capacity Building & Advisory Services Project (WCAP). The Consultants were engaged for preparation of Comprehensive Flood Management Plan (NFPP-IV) for next ten years (based on integrated & innovative approach). The study is likely to be completed by February 2014.
 - viii. Pakistan Meteorological Department (PMD) with its specialized Unit i.e. Flood Forecasting Division (FFD) established at Lahore and WAPDA worked well during the entire Monsoon Season-2013 in close coordination with Federal Flood Commission.

4.5 48th Annual Meeting of Federal Flood Commission

The 48th Annual Meeting of Federal Flood Commission was organized on July 03, 2013, under the Chairmanship of Honorable Federal Minister for Water & Power, to review the status of preparedness of concerned Federal/ Provincial Government organizations and arrangements made for safe passage of Flood Season-2013. The following directions were issued to PIDs/ Federal Line Agencies, WAPDA, WASA & PMD:

- i. Ministry of Water & Power will write D.O letters to Chief Secretaries of the four provinces, Gilgit-Baltistan, FATA & AJK for mobilizing all resources for early completion of 2010, 2011 & 2012-FDR Works, besides, essential repair works related to Irrigation, Drainage & Flood Control Structures and making necessary flood fighting arrangements for better flood management of Monsoon Season 2013.
- ii. Provincial Irrigation Department of the four provinces & Federal Line Agencies will arrange flood fighting material, earth moving machinery & additional labour

- etc. at sites of all critical locations of flood protection structures well before raising water level in main & other rivers.
- iii. PID, Punjab will process the PC-I of project namely “Increasing the discharge capacity of Shahdara Railway Bridge on River Ravi” on fast track basis and submit the same alongwith clearance of PDWP to FFC for technical clearance of Scrutinizing Committee and onward submission to Ministry of Water & Power/Planning Commission for approval of CDWP/ECNEC and funding arrangements. Planning Commission will process the project on top priority basis.
 - iv. Provinces will chalk out a Comprehensive Policy for removal of encroachments in Flood Plains/Waterways & Drains, besides, other Irrigation, Drainage & Flood Control Structures, and resettlements of affectees including restriction on future settlements in Flood Prone Areas.
 - v. Provincial Irrigation Departments & Federal Line Agencies will ensure strict vigilance and round the clock patrolling of flood embankments along major & other rivers, especially vulnerable locations, so as to avoid any unpleasant situation as experienced during 2010-Flood Season.
 - vi. In the wake of NFC Award, the Provincial Governments should share the burden and finance some of the flood protection schemes from their own resources.
 - vii. Since O&M of Irrigation, Drainage & Flood Protection Infrastructure was the responsibility of Provinces, hence, adequate O&M funds would be allocated each year within their respective provincial budgets to ensure timely repair and maintenance of flood protection infrastructure for better flood management.
 - viii. National Highway Authority (NHA) will take short term flood protection measures on war footing basis at site of newly constructed Sultan Bahoo Bridge across River Chenab for safe passage of flood flows during Monsoon Season 2013. Proposal for construction of proper river training works would be prepared in consultation with PID, Punjab and implemented before start of Monsoon Season 2014.
 - ix. PCIW will ensure that all necessary arrangements are made with Indian Counterpart (ICIW) for obtaining Eastern Rivers flow data and its transmission to end users including NDMA and PDMAs during Monsoon Season 2013, in order to ensure timely relief & rescue arrangements in case of flood emergency situation.
 - x. WASA Rawalpindi will dispose of excavated soil (short-term desilting work for Monsoon Season 2013) at proper disposal point, so as to restore the flood flow capacity of Lai Nullah in choked section. TMA & City District Government will take bold steps for stoppage of encroachments, dumping solid wastes/garbage & building material in bed of Lai Nullah. The progress on all such activities would be shared with FFC and other concerned organizations.
 - xi. Chief Engineer, Mangla Dam Project will take up the matter with higher ups and Government of AJ&K on the issue of resettlement of affectees of Mangla Dam Raising Project and maximum filling level of Mangla Dam Project for Monsoon Season 2013. The outcome would be communicated **within a week’s time** to

Ministry of Water & Power, IRSA, FFC, PIDs and other concerned organizations for regulation of flood flows during Monsoon Season 2013.

- xii. PIDs & Federal Line Agencies will strictly follow the timeframe/schedule for execution of flood protection works under Normal/Emergent Flood Programme duly approved by the ECNEC, so as to ensure completion of proposed schemes by/before the target date i.e. 30th June each year.

4.6 Progress Review Meeting on decisions of 48th Annual Meeting of FFC

A progress review meeting on decisions taken in 48th Annual Meeting of FFC was held on 05th August, 2013 under the Chairmanship of Secretary Ministry of Water & Power, in committee room of Ministry of Water & Power, A-Block Pak. Secretariat, Islamabad. The following directions were issued to PIDs/ Federal Line Agencies, WAPDA, PMD & NDMA:

- i. Pakistan Meteorological Department would review the Seasonal Forecast, issued in June 2013 for current monsoon season and update the same for last phase of monsoon season 2013, if any change is felt by PMD with respect to prevailing weather situation.
- ii. Provincial Irrigation Department & Federal Line Agencies will ensure that necessary flood fighting arrangements (Stone reservoir stock, machinery, additional labour etc.) are at place at vulnerable locations of flood bunds.
- iii. The field formations of Provincial Irrigation Departments will ensure strict vigilance and round the clock patrolling of flood embankments along major & other rivers, especially vulnerable locations, so as to avoid any unpleasant situation as experienced during 2010-Flood Season.
- iv. PID, Punjab will process the PC-I of project namely "Increasing the discharge capacity of Shahdara Railway Bridge on River Ravi" on fast track basis and submit the same alongwith clearance of PDWP of FFC for technical clearance of Scrutinizing Committee and onward submission to Ministry of Water & Power/Planning Commission for approval of CDWP/ECNEC and funding arrangements,. Planning Commission will process the project on top priority basis.
- v. National Highway Authority (NHA) will make necessary flood fighting arrangements on war footing basis at site of newly constructed Sultan Bahoo Bridge across River Chenab for safe passage of flood flows during Monsoon Season 2013. The proposal/PC-I for construction of proper river training works would be prepared in consultation with PID, Punjab and implemented before start of next Monsoon Season (2014).
- vi. PCIW will keep watch on inflows, water level and outflows of reservoirs constructed on Eastern Rivers (Chenab, Ravi, Sutlej & Beas) in Indian Territory and ensure collection and transmission of essential data well in time to FFD, Lahore, FFC and other and users including NDMA and PDMAs during Monsoon Season 2013, in order to ensure timely relief & rescue arrangements in case of flood emergence situation.
- vii. WASA Rawalpindi will make its best efforts to remove the debris in constricted sections of Lai Nullah, so as to enhance the flood flow capacity of Lai Nullah in

choked sections. TMA & City District Government will take bold steps for removal/stoppage of encroachments, dumping garbage & building waste material in bed of Lai Nullah. The progress on all such activities would be shared on regular basis with FFC and other concerned organizations.

- viii. PIDs & Federal Line Agencies will strictly follow the timeframe/schedule for execution of flood protection works under Normal/Emergent Flood Programme duly approved by the ECNEC, so as to ensure completion of proposed schemes by/before the target date i.e. 30th June each year.
- ix. PID, Punjab would carry out detailed field survey and prepare a comprehensive proposal (Long-term measures) for Flood Management of D.G. Khan Hill Torrents and process the same for approval and implementation on top priority basis.
- x. PID, Punjab will accelerate the flood fighting activities at Alluwali & Bhakkar Blood Bund sites, so as to save the flood protection structures and abadies from devastating floods of Indus River during the current Flood Season (2013). Thereafter, PC-Is/proposal for permanent remedial measures would be processed on fast track basis, so that proposed measures are implemented well before the start of next Monsoon Season (2014).
- xi. Irrigation Department, Government of Balochistan would make necessary flood fighting arrangements in vulnerable areas for sage passage of monsoon season 2013. A case would be taken up with Provincial Government for arranging adequate funds for early completion of pending/ongoing 2010 & 2012-flood damages restoration works related to Irrigation, Drainage & Flood Control Structures. The progress on restoration works would be submitted on regular basis to FFC till completion of the works.

FLOODS-2013

5. MONSOON SEASON 2013

5.1 Seasonal Rainfall Forecast for Monsoon Season 2013 issued by PMD

Pakistan Meteorological Department issued a Seasonal Forecast vide letter No. Co(Isb)-2(4)/SO/2013 dated 14th June, 2013. The contents of that forecast are reproduced as under;

“In consideration of the meteorological conditions prevailing over Pakistan and various parts of the globe, the seasonal outlook for Pakistan Monsoon Rainfall for the period July to September 2013 is given below;

On all Pakistan basis this year’s monsoon rains are likely to be Normal ($\pm 10\%$ of long period average), which mean that the overall availability of water in the country from Monsoon rains would be satisfactory. However, erratic spread of Monsoon on temporal and spatial scale is likely to be prevalent feature.

Main features of seasonal outlook are as under:

- Onset of monsoon is likely to be in the last week of June, 2013 and the rainfall during July will be below normal.
- Rainfall will increase gradually during August over central parts of the country. However, during last phase of the monsoonal rainfall (September), more than normal rainfall will occur over plain monsoonal areas of Punjab and Sindh.
- Rainfall activity would mainly concentrate over central and southern parts of the country. Therefore, effective water management practices may be adopted to fill the main reservoirs at optimum level.
- Flash flooding over foot hills of Suleiman Ranges cannot be ignored during the month of September, 2013.
- Maximum day temperature will be slightly on higher side during summer season throughout the country.

Note: This is a seasonal forecast with confidence level of 80% and meant for the planning purpose only. Normal rainfall for the period July to September of Pakistan is 137.5 mm.

5.2 Floods/Rains during Monsoon Season 2013

5.2.1 Significant Hydro-Meteorological Events during the month of JUNE, 2013:

Only one Monsoon Low developed over Bay of Bengal during the last week of June 2013, which caused rains in parts of India and finally dissipated on 29th without affecting the country’s weather system. Mostly the rainfall occurred across the country during the month was due to the accentuation of seasonal low over Balochistan and westerly wave in the North of the country. The only wet spell of June 2013 which remained for two days (15th & 16th June) was mainly due to the moist current from the Arabian Sea under the influence of western disturbance. All main rivers were flowing below Low Flood Stage i.e. “Normal”.

5.2.2. Significant Hydro-Meteorological Events during the month of JULY, 2013:

Four significant rainfall events occurred during the month of July, 2013, which are described as under;

The first spell of July 2013 was lasted for 4 days (07-07-2013 to 10-07-2013). It was mainly due to the passage of westerly wave, accentuation of Seasonal Low and incursion of moist current from Arabian Sea.

As a consequence of that rain spell, River Kabul at Nowshera attained Low Flood Stage during the period, while River Indus at Tarbela & Kalabagh and River Jhelum at Mangla attained Low Flood Level during the period.

The 2nd spell also lasted for 4 days(15-07-2013 to 18-07-2013). The rainfall of moderate to heavy intensity was recorded at scattered places in Khyber Pakhtunkhwa. Rainfall of moderate intensity was also occurred over Punjab and Kashmir.

As a result of rains of 2nd spell, River Kabul at Nowshera remained at Low Flood Level during the period while all the other major rivers remained below Low Flood Level i.e. "Normal".

The 3rd spell lasted for 2 days (20-07-2013 to 21-07-2013). The rainfall of moderate to heavy intensity was recorded over northeast parts of Punjab and Kashmir, besides, upper catchments of River Indus.

River Kabul at Nowshera and River Chenab at Marala (*Upstream*) attained Low Flood Level.

The 4th spell remained for 3 days (24-07-2013 to 26-07-2013). The rainfall of moderate intensity was recorded over Punjab & Kashmir including upper catchments of River Indus.

As a consequence of 4th spell during July 2013, River Indus attained Medium Flood Level at Chashma (upstream) & Low Flood Stage at Kalabagh, whereas River Jhelum attained Low Flood Stage at Mangla.

5.2.3 Significant Hydro-Meteorological events during Month of AUGUST 2013:

The monsoon remained comparatively more active during the month of August 2013. Overall five rain spells of heavy to very heavy intensity were experienced during the month of August, which are described as under;

The first rainfall spell of August 2013 (*6th of the Monsoon Season 2013*) occurred during 3rd to 4th August 2013. Moderate to heavy rainfall was observed in this spell over upper catchments of River Indus & Kabul, besides, Northern Sindh, Kashmir and Northeastern Punjab.

As a result of this spell, River Indus attained High Flood Stage (*Upstream*) at Chashma Barrage. River Kabul also attained Medium Flood Level at Nowshera, while River Ravi was in Low Flood situation at Shahdara.

In the 2nd spell, heavy to very heavy rainfall was observed for three days (06-08-2013 to 08-08-2013) over Northern and Northeastern Punjab. River Indus at Taunsa & River Chenab at Marala attained Medium Flood Stage, whereas River Jhelum at Mangla (Upstream) was in Low Flood situation.

The most significant spell of flood season, 2013 caused due to development of Monsoon Low (weather system) over Rajasthan (India) and adjoining Bahawalpur Division and the passage of westerly wave alongwith accentuation of Seasonal Low. During this spell heavy to very heavy rainfall was recorded over Upper catchments of River Chenab, Northern Punjab, Khyber Pakhtunkhwa and Kashmir.

As a consequence of heavy rains in catchment areas, River Chenab attained Very High Stage at Khanki & Qadirabad Barrages and High flood situation at Marala. Flood flows levels in other main rivers also raised i.e. River Indus at Chashma, River Kabul at Nowshera and River Jhelum at Mangla (Upstream) also attained High Flood Stage during that period.

The fourth spell of monsoon rains in August was recorded from 18th to 19th August, 2013. It was due to the interaction of a trough of westerly wave and a low over Indian Punjab. During this spell moderate rainfall was recorded over Kashmir and Northern Punjab, which enhanced the flood flows in Jhelum River, hence, high flood situation was recorded in River Jhelum at Mangla (Upstream).

The fifth and final spell of was occurred from 28th to 30th August, 2013. It was mainly due to affect of westerly wave over country weather system and accentuation of Seasonal Low. However, no significant increase in inflows of major rivers was recorded during that period.

5.2.4 Significant Hydro-Meteorological events during SEPTEMBER, 2013

The first rainy spell of September occurred during the 2nd week (9th to 11th September, 2013). During this spell light to moderate rain were recorded by PMD over the northern Punjab and Kashmir. However, no significant enhancement in rivers flow was observed. The overall rainfall situation during the entire monsoon period is attached as **Appendix-I**, whereas rivers inflows & outflows of major rivers at important control structures (Reservoirs & Barrages) is attached as **Appendix-II** and Escapages below Kotri Barrage during the period (1976-77 to 2013-14) is attached as **Appendix-III**.

5.3 Highest ever recorded flood peaks during major flood events

Highest ever recorded flood peaks during major flood events at various control points of Indus Basin are given in **Table-4**.

Table-4
Major Flood Events & Historic Flood Peaks Recorded in Major Rivers

Dam/ Barrage Site	Designed Capacity	Highest Recorded		1973 Peak Date	1976 Peak Date	1988 Peak Date	1992 Peak Date	2010 Peak [^] Date	2011-Peak [^] Date	2012-Peak [^] Date	2013-Peak [^] Date	2013-Peak [^] Flood Classification
		Year	Flow (Cfs)									
Indus River												
Tarbela Reservoir	1,500,000	1929	8,75,000	420,000 July 1973	304,000 3.8.76	450,000 4.8.88	500,000 10.9.92	833,000 30.7.10	272,200 28.6.11	295,000 4.8.12	392,000 14.8.13	Medium Flood
Jinnah Barrage	950,000	1942	950,000	564,000 20.7.73	862,000 2.8.76	605,000 2.8.88	849,245 10.9.92	937,453 30.7.10	293,900 26.7.11	285,300 18.7.12	479,603 13.8.13	Medium Flood
Chashma Barrage	950,000	1958	950,000	510,000 22.7.73	787,000 3.8.76	580,000 3.8.88	668,000 11.8.92	1,036,673 1.8.10	356,500 28.7.11	298,300 8.7.12	637,482 14.8.13	High Flood
Taunsa Barrage	1,000,000	1958	789,000	568,000 29.7.73	675,000 7.8.76	560,000 28.7.88	655,000 14.9.92	959,991 2.8.10	249,200 31.8.11	243,400 10.9.12	516,017 17.8.13	High Flood
Guddu Barrage	1,100,000	1976	1,199,672	1,084,000 18.8.73	1,199,672 15.8.76	1,163,000 30.7.88	1,087,000 18.9.92	1,148,738* 8.8.10	272,300 3.9.11	236,100 12.9.12	567,418 20.8.13	High Flood
Sukkur Barrage	900,000	1976	1,161,000	1,077,000 21.8.73	1,161,000 16.8.76	1,119,000 31.7.88	1,068,000 20.9.92	1,130,995** 10.8.10	260,800 6.9.11	214,800 14.9.12	510,875 24.8.13	High Flood
Kotri Barrage	875,000	1956	980,000	786,000 Aug 1973	765,000 Aug 1976	648,290 11.8.88	689,300 30.9.92	964,900 27.8.10	261,400 14.9.11	166,000 21.9.12	381,696 30.8.13	Medium Flood
Jhelum River												
Mangla Reservoir	1,230,000	1929	1,100,000	2,20,000 9.8.73	480,060 3.8.76	425,515 16.7.88	1,030,000 10.9.92	344,400 30.7.10	141,300 16.9.11	1150,00 18.9.12	179,000 13.8.13	High Flood
Rasul Barrage	8,50,000	1929	1,000,000	2,70,000 9.8.73	2,69,000 4.8.76	261,664 17.7.88	952,170 10.9.92	263,796 30.7.10	105,800 17.9.11	42500 4.8.12	43,080 19.8.13	Normal
Chenab River												
Marala Barrage	1,100,000	1957	1,100,000	770,000 9.8.73	549,000 1.8.76	751,000 25.9.88	845,000 10.9.92	314,378 6.8.10	150,400 16.9.11	183,200 4.8.12	377,290 15.8.13	High Flood
Khanki Barrage	8,00,000	1957	1,066,000	1,000,000 10.8.73	615,000 2.8.76	864,000 26.9.88	910,500 10.9.92	334,437 7.8.10	171,400 17.9.11	194,800 4.8.12	410,331 15.8.13	Very High Flood
Qadirabad Barrage	9,00,000	1992	9,48,530	854,000 10.8.73	629,000 2.8.76	892,000 26.9.88	948,530 11.9.92	329,483 7.8.10	171,000 17.9.11	194,800 5.8.12	407,803 15.8.13	Very High Flood
Trimmu Barrage	6,50,000	1959	9,43,000	753,000 12.8.73	706,000 10.8.76	584,000 19.7.88	888,000 14.9.92	328,926 11.8.10	132,900 20.9.11	87,800 7.8.12	272,609 20.8.13	Medium Flood
Panjnad Headworks	7,00,000	1992	7,44,152	803,000 17.8.73	710,000 12.8.76	507,000 27.7.88	744,152 18.08.92	310,117 13.8.10	151,300 24.9.11	65,600 17.9.12	317,261 28.8.13	High Flood
Ravi River												
Jassar	-	1988	5,82,000	228,000 10.8.73	170,000 9.8.76	582,000 25.9.88	149,000 11.9.92	195,000 23.8.10	27,700 19.9.11	30,500 26.8.12	67,700 16.8.13	-
Shahdara	-	1988	5,76,000	237,380 11.8.73	170,000 10.8.76	576,000 27.9.88	63,000 12.9.92	41,900 21.8.10	43,000 14.8.11	40,800 22.8.12	74,880 17.8.13	-
Balloki Barrage	2,25,000	1988	3,99,000	2,44,000 13.8.73	234,000 11.8.76	399,000 28.9.88	112,157 13.9.92	69,900 23.8.10	72,100 15.8.11	60,800 23.8.12	117,770 18.8.13	High Flood
Sidhnai Barrage	1,75,000	1988	3,30,000	2,10,000 18.8.73	244,000 15.8.76	330,000 2.10.88	95,500 16.9.92	27,600 28.7.10	30,300 19.8.11	28,600 14.9.12	87,904 23.8.13	High Flood
Sutlej River												
Suleimanki Headworks	3,25,000	1955	5,98,872	177,000 15.8.73	119,000 6.9.76	399,000 30.9.88	197,000 3.9.92	58,300 30.9.10	82,000 29.8.11	21,700 30.8.12	82,370 22.8.13	Medium Flood
Islam Headworks	3,00,000	1955	4,93,000	166,000 17.8.73	111,000 8.9.76	306,000 4.10.88	183,000 7.9.92	31,500 20.9.10	49,600 3.9.11	14,200 13.9.12	70,932 25.8.13	Low Flood

* It does not include flood flows passed through breaches occurred in LMB Guddu Barrage;

** It does not include flood flows passed through breaches occurred in Tori Flood Bund.

^ Based on the Inflows experienced upstream of the Dam/ Barrage site.

5.4 Country-Wide Losses/ Damages due to 2013 Rains/ Floods

The 2013-rains/floods affected cropped area of about 1.107 million acres affecting 8,297 villages, claiming about 333 lives, fully damaging 33,763 houses and 46,180 houses partially and a population of about 1.489 million has been affected. Province wise detail of losses/damages is given in **Table-5**.

Table-5

COUNTRY-WIDE LOSSES/DAMAGES DUE TO RAIN/FLOOD 2013

Province/ Region	Persons Died	Persons Injured	Persons Affected	Houses Damaged		Villages Affected	Cropped Area Affected (Acres)	Cattle Heads Perished
				Partially	Fully			
Punjab	109	39	795,857	7,935	12,656	2,946	745,655	81
Sindh	47	43	524,833	21,400	14,095	3,068	246,590	88
Khyber Pakhtunkhwa	70	27	584	507	287	2	535	80
Balochistan	39	23	167,789	15,419	6,537	2,281	114,463	13,160
Gilgit-Baltistan	NR	NR	NR	NR	NR	NR	NR	NR
FATA	35	26	NR	266	55	NR	17	14
AJ & K	33	15	NR	653	133	NR	NR	81
G. Total	333	173	1,489,260	46,180	33,763	8,297	1,107,260	13,504

NR: Not Reported

Source: NDMA

5.5 2013-Rains/Flood Damages to Flood Protection Infrastructure and need for their Restoration/ Rehabilitation

Irrigation Department, Government of the Punjab reported details of damages to canal and flood protection infrastructure caused by 2013 rains/floods in D.G. Khan Irrigation Zone. The details of such damages alongwith their restoration cost are given below in **Table-6**. The detail of damages to Irrigation, Drainage & flood protection infrastructure including the detail of breaches caused by 2013 rains/floods in Balochistan, as reported by Irrigation Department, Government of Balochistan, is given in **Table-7**.

Table-6
2013-Flood damages to Canals and Flood Protection Infrastructure in D.G Khan
(Rs. Million)

Sr. No.	Detail of Flood Damages/ Losses	Restoration Cost
1	Canal	
A	Canal banks	
i.	Damage left bank of Dajal Br: from RD:55-199 (Tail)	126.00
ii.	Dajal Branch (RD: 55-tail) 79 No. breaches on right flood bund and left bank.	
iii.	Dajal Branch Distributaries System 54 No. breaches	
B	7 No. Structure of Dajal Branch and its system.	
2	River erosion	
i	5 No. Studs along Chandar Bhan Flood Bund RD: 58-61 of River Chenab	100.00
ii (a)	3000 ft. 1 st / 2 nd defence along Khanwah flood bund RD: 55-58	10.00
ii (b)	Raising of Dawal Bund from RD: 49-60 of Khanwah Flood Bund.	10.00
ii (c)	Indus River erosion RD: 36 Khanwah Flood Bund.	10.00
iii	Damage to Structure / spurs of Taunsa Barrage Spur RD: 19, 13 & 34	20.00
iv	Damage to spur of Gajjani escape	15.00
v	Damage to Qalander Shah Groyne of River Indus	50.00
vi	2 No. Solid Stone Stud for Checking Side erosion D/S Ghazi Ghat Bridge.	30.00
vi (a)	Drakhast Drain RD: 18-22	50.00
vi (b)	Tayyab Drain RD: 8-12	
vi (c)	Muhammad Pur Drain RD: 0-6	
Total		421.000

Table-7
2013-Flood damages to canal and Flood Protection Infrastructure in Balochistan Province

Sr. No.	Detail of Flood Damages/ Losses	Restoration Cost
1.	North Irrigation Zone	1117.12
2.	South Irrigation Zone	37.45
3.	Canals	
i.	Pat Feeder Canal Division Dera Murad Jamali	137.94
ii.	Kirther Canal Division Usta Muhammad District Jaffarabad	262.10
iii.	Kirther Canal Division Usta Muhammad District Jhal Magi	200.78
iv.	Drainage Irrigation Division Dera Allah Yar	3.03
Total		1758.40