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## THE ASSOCIATED PROGRAMME ON FLOOD MANAGEMENT

# INTEGRATED FLOOD MANAGEMENT

# CASE STUDY

# PAKISTAN: *LAI NULLAH BASIN FLOOD PROBLEM*

# *ISLAMABAD – RAWALPINDI CITIES*

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## LIST OF ACRONYMS

| | |
|---|---|
| ADB | Asian Development Bank |
| ADPC | Asian Disaster Preparedness Centre |
| ADRC | Asian Disaster Reduction Centre |
| CDA | Capital Development Authority |
| Cfs | Cubic Feet Per Second |
| DCOs | District Coordination Officers |
| DTM | Digital Terrain Model |
| ECNEC | Executive Committee of National Economic Council |
| ERC | Emergency Relief Cell |
| FFC | Federal Flood Commission |
| FFD | Flood Forecasting Division |
| FFS | Flood Forecasting System |
| GPS | Global Positioning System |
| ICID | International Commission on Irrigation & Drainage |
| ICIMOD | International Centre for Integrated Mountain Development |
| ICOLD | International Commission on Large Dams |
| IDB | Islamic Development Bank |
| IFM | Integrated Flood Management |
| IWRM | Integrated Water Resources Management |
| JBIC | Japan Bank for International Cooperation |
| JICA | Japan International Cooperation Agency |
| LLA | Land Acquisition Act |
| MAF | Million Acre Feet |
| NFPP | National Flood Protection Plan |
| NWF | North-west Frontier |
| NWFP | North-west Frontier Province |
| O&M | Operation & Maintenance |
| PCIW | Pakistan Commissioner for Indus Waters |
| PIDs | Provincial Irrigation Departments |
| PMD | Pakistan Meteorological Department |
| PST | Pakistan Standard Time |
| QPM | Quantitative Precipitation Measurement |
| RCB | Rawalpindi Cantonment Board |
| SDO | Small Dams Organization |
| TMA | Tehsil Municipal Administration |
| UNDP | United Nations Development Program |
| WAPDA | Water & Power Development Authority |
| WASA | Water & Sanitation Authority |

# PAKISTAN: *LAI NULLAH BASIN FLOOD PROBLEM ISLAMABAD – RAWALPINDI CITIES*[1]

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**Abstract**

Integrated flood management is presently being taken as a paradigm shift in the concept of flood management with a view to effectively manage and mitigate flood and related problems locally, on a national basis, regional basis and on a river basin wise. In this context, a Case Study on Flood Problem in Islamabad-Rawalpindi cities of Pakistan has been prepared. Unprecedented flood event of 2001 has been taken as an event which marked the start of paradigm shift and for development of a comprehensive Lai Nullah Flood Control Program. The paper discusses catchment and administrative jurisdiction of Lai, its topography and the present hydrological and land use patterns with specific reference to floods.

The paper discusses the country-wide river system, various structural and non-structural measures in place and those in the Case Study area. Relative importance and applicability of these measures have been glanced through and an account has been presented of the changed mechanism and strategies of flood management with reference to particular flood event. In this context, for Case Study area, Lai Nullah 2001 flood event has been projected and an analysis of measures being adopted/proposed for future has been made vis-à-vis for the entire river system. Paper also contains legal aspects of flood management with regard to land use, flood warning system, preparedness and response. Emerging concept of stakeholder participation has been adequately covered.

An effort has been made to concisely project the role and responsibilities of various departments engaged in IFM at country level besides role and responsibilities of federal, provincial and local authorities in the management of flood problem in the Lai Nullah Case Study area. Objectives of national water resources management policy and flood management flood policy have been discussed in the context of IFM. The paper concludes with emphasis on adopting integrated flood management approach by proposing certain recommendations both for the country as well as for the Lai Basin area for real time flood management.

[1] This case study provides complementary information to the one contained in the Chenab River of Pakistan, submitted separately

[2] Federal Flood Commission, Government of Pakistan

# Chapter –1

## LAI NULLAH BASIN
## Location, Physical Features, Land and Water use Patterns

### 1. Location

### 1.1 Catchment Area:
Lai Nullah Basin (Nullah in Pakistan's National Language URDU means Tributary River/Stream) has a catchment area of 239.8 Km² (161.2 Km² in Islamabad and 73.6 Km² in Rawalpindi) and a length of about 30 Km, stretching from the Margalla hills in Federal Capital City Islamabad at the Northwestern edge until Soan River at the Southy-eastern edge in District Rawalpindi of Province of the Punjab. The Basin is located between 33º 33´ and 33º 46´ North and 72º 55´ and 73º 07´ East.

### 1.2 Administrative Division:
The catchment area of Lai Nullah Basin is administratively divided into District Islamabad (Federal Capital) in the upper reaches of 144.4 Km² and Rawalpindi City of Punjab Province in the lower reaches of 90.5 Km².

### 1.3 Ground Elevation:
The ground elevation of the Lai Nullah Basin ranges from EL. 420 m at the downstream and of the Basin (i.e., the confluence with soan River in Rawalpindi City) to EL. 1,240 m at the upstream end (i.e., a mountain top in the Margalla Hill range in Islamabad City).

### 1.4 Physical Features:
#### 1.4.1 Climate
The climate of the Lai Nullah Basin area is classified as "Subtropical Triple Season Moderate Climate Zone", which is characterized by single rainfall season from July to September and its moderating influence on temperature. The case Study area has hot summers and cold winters. In June the daily maximum temperature reaches to 40 ºC, while the daily minimum temperature falls near to 0 ºC in December and January. Between July and September, the temperature is slightly moderate due to humidity.

The case Study area receives rains in all seasons but monsoon rain is pronounced and constitutes a definite rain season but monsoon between July and September. The total rainfall during the rain season is about 600 mm, accounting to 60% of the annual rainfall of about 1,000 mm.

#### 1.4.2 Topography:
The Basin could be broadly divided into the following four areas in view of topography:

i) Margalla Hill Range: It stands behind Islamabad City area as a wall, which forms the North boundary of the Lai Nullah Basin. The foot of the Margalla range stands at elevations of about 620 m, while top of the mountain, which is only 3 Km from the foot is at about 1,200 m. Among several, four major tributaries originate from here. They are Saidpur Kas, Tenawali Kas, Bedarawali Kas and Johd Kas and are as steep as nearly 10%.
ii) The Higher Plain: The Higher Plain expands over the built-up area of Islamabad city with a gradual slope from North to South.
iii) The Lower Plain: The Lower Plain is the upper part of Rawalpindi area upstream of Chaklala Bridge. The area forms a bowl-shaped topography.
iv) The Valley area in the North to South direction. After Chaklala Bridge, the topography changes very much a definite valley. The river/Nullah turns steeper with many cascades,

fully down to Soan River, which is a tributary river of mighty river Indus- the largest river among major rivers in Pakistan.

### 1.4.3 Hydrology

In the jurisdiction are of Islamabad the river system is composed of three major tributaries, namely (i) Saidpur Kas, (ii) Tenawali Kas and (iii) Bedarawali Kas. They originate from the Margalla Hills and flow into the mainstream of Lai N ullah just upstream from Kattarian Bridge, at I.J. Principal Road forming the administrative boundary between Islamabad and Rawalpindi.

Below Kattarian Bridge, in the jurisdiction are of Rawalpindi, the mainstream meets other three major tributaries; namely (i) Nikki Lai, (ii) Pir Wadhai Kas and (iii) Dhok Ratta Nullah one after another, then flows down through the center of Rawalpindi City and finally pours into Soan River. In addition to these major tributaries, there are other six (6) tributaries or drainage channels/sewage channels, which joint the mainstream between the confluences of Dhok Ratta Nullah and Soan River.

### 1.4.4 Geology:

In the upper raches, Lai Nullah cuts through the surficial deposits, which generally consists of Potwar loessic silt. In deposits forming a thick mantle over. In lower reaches of Lai Nullah, the surficial deposits are found to be present directly over loder formation, where the Lai Conglomerate has been removed by degradation.

### 1.4.5 Land and Water Use Patterns:

The land use is defined as the way how the limited land can be used in the most effective manner for different purposes such as residential area, industrial one or public one etc. Hence the land use is usually named and divided with different categories by urban planners. According to Master Plan, a large area of Islamabad was divided into five zone-1 (Urban), Zone-2 (Urban), Zone-3 (forest, residential), Zone-4 & Zone-5 (sparsely populated, rural areas). Urban areas have been developed into various sectors as C, D, E, F, G, H, I etc.

In Rawalpindi City a mixed land use in pre-dominant in the control areas,. There is no clear segregation of compatible land uses, which have not been related to overall transportation system, thereby creating congestion, chaotic traffic conditions, and hazardous environmental problems. Fig-1 indicates land-use pattern of 2002 in case Study area. The trend of land use in the Lai Nullah Case Study area is as given in table 1.1 below.

**Table 1.1**

**Lai Nullah Land use Trend**

| Land Use | Present (2002) | | 2012 | | 2030 | |
|---|---|---|---|---|---|---|
| | ($Km^2$) | (%) | ($Km^2$) | (%) | ($Km^2$) | (%) |
| Agricultural Area | 33.4 | 14.2 | 29.1 | 12.40 | 11.4 | 4.9 |
| Residential Area/Densely populated | 31.2 | 13.3 | 35.2 | 15.00 | 38.8 | 16.5 |
| Residential Area/Moderately populated | 53.2 | 22.7 | 68.6 | 29.2 | 95.2 | 40.5 |
| Residential Area in the Suburbs | 6.1 | 2.6 | 5.6 | 2.4 | 2.3 | 1.0 |
| Forest | 34.9 | 14.8 | 32.3 | 13.8 | 32.0 | 13.6 |
| Green and Bare Land | 74.9 | 31.6 | 62.4 | 26.6 | 53.5 | 22.8 |
| Water Body | 1.6 | 0.7 | 1.6 | 0.7 | 1.60 | 0.7 |
| **Total:** | **234.8** | **100.00** | **234.8** | **100** | **234.8** | **100** |

The present water supply capacity in the Lai Nullah Basin area is about 785 Million Liters per day in total. Out of the total water supply, the service area of Capital Development Authority in federal Capital, Islamabad shares 507.33 Million Liters per day, while the service area of Water & Sanitation Agency (WASA) OF Rawalpindi city and can its Cantonment share 122.74 Million

Liter per day and 155.48 Million Liter per day respectively. The sources of above water supply capacity is divided into surface water and ground-water. Groundwater is abstracted in the Case Study area by 450 tube-wells (182 in CDA Area, 194 in WASA area and 74 in Cantonment area).

The surface water supply capacity of the study area is 528.70 Million Liters per day, which actually is the capacity of seven treatment plants. They abstract raw water from dam reservoirs, or directly from the natural flow discharge of small distributaries. Principal surface water sources in Lai Nullah basin come from Simly Dam on Soan River, Khanpur Dam on Haro River and Rawal Dam on Kurang River. Presently the flood water, as it originates from the upper four major tributaries, is not being utilized for any of the urban or irrigation purposes. Rather whatever flood water is generated it goes as waste water to Soan River besides inundating low lying areas.

### 1.5 Gender activities, Tasks etc:

In Islamabad, high paying professionals predominate including professionals (man & women) in fields of science, education, banking, etc. There are poor people in Islamabad too with subsistence level of income. They live in low-lying flood prone areas of Lai Nullah, generally referred to as “Katchi Abadi”. Their men usually engage in work of daily wages like white washing, gardening etc. with women being engaged in private home cleaning and the like.

In Rawalpindi urban area mostly people are engaged in business relating to small and medium scale enterprises. Domestic works are the major form of employment for poor female in the area. Middle class women is mostly engaged in teaching and cloth stitching jobs besides assisting their man in their home run business.

## Chapter –2

## LAI NULLAH FLOOD PROBLEM

### 2.1 Lai Nullah Flood

Lai Nullah flood flows actually contribute to River Soan which is the tributary river of River Indus – the largest river among major rivers in Pakistan.

Available past record indicates that floods in Lai Nullah Basin occur in the Monsoon Season (July-September every year) when the overall country receives down pour from three weather systems: namely I) Monsoon depressions from the Bay of Bengal India (the most dominate system), ii) Westerly waves from the Mediterranean Sea, and iii) Seasonal Low from the Arabian Sea. This is superimposed by snow melt for the Indus River.

### 2.2 Extreme Flood Events:

Scraps of descriptions about post floods, as collected from several study reports indicate that, in the Lai Nullah Basin area, flood has occurred with the frequency of 19 years, at least in 59 years from 1944 to 2002 as may be noted from table 2.1 below. In other words, flood damage broke out almost once in every three years in the two cities of Islamabad-Rawalpindi of Pakistan

**Table 2.1**

**Lai Nullah – Extreme Flood Years**

| Year | Date | Year | Date |
|---|---|---|---|
| 1944 | August 13 | 1985 | No data |
| 1957 | No date | 1988 | No data |
| 1966 | July 31 | 1990 | No data |
| 1970 | No data | 1994 | July 3 |
| 1972 | No data | 1995 | July 24 |
| 1976 | No data | 1996 | July 29 |
| 1977 | No data | 1997 | August 27 |
| 1978 | No data | 2001 | July 23 |
| 1981 | No data | 2002 | August 13 |
| 1982 | August 10 | | |

Among the above extreme flood years, 1981, 1988, 1997 and 2001 had been the worst with 2001 being of highly unprecedented nature.

### 2.3 Frequent Flood Inundated Area:

In Rawalpindi City, being on the lower elevation, low-lying areas along Lai Nullah and tributaries suffer from even small floods. Serious flood events to occur along in particular: the main stream between Gunj Mandi Bridge and Railway bridge, and the tributaries of Arya Nullha, Dhok Rata Nullah Dhok Charaghdin. Flood inundation starts in these areas once the water level of Lai Nullah reaches 18 feet (491.5 m) at Gawal Mandi Bridge.

### 2.4 2001 Flood Disaster:

The flood in 2001 has been the largest and heaviest among the recorded floods, and thus can be taken as a national disaster. On July 23, 2001, a total of 620 mm rainfall was recorded in a spar of only 10 hours (0600 hours to 16 hours PST) AT Islamabad Met station. The water level of Lai Nullah and its tributaries remarkably rose and all houses and some road bridges along the way were swept away. According to Pakistan Meteorological department (PMD), instead of monsoon depression, this rainfall was caused by a freak combination of disastrous weather events including: (a) intense heating on the surface, (b) presence of mid latitude westerly trough and (c) moisture feeding through monsoon flow along Himalayas. According to PMD reports, the

intensity as well as amount of rainfall was more in Islamabad than in Rawalpindi. The swollen flow invaded Rawalpindi causing several times damages than Islamabad. A total of 74 human lives were lost, about 400,000 people were affected, 742 cattle head were totally perished, 1,087 houses were completely damaged in Rawalpindi besides some 2,448 partially damaged. Estimates indicate a damage/loss of more than 15 billion rupees (US $ 0.25 billion) to infrastructure, Government property and to Small and Medium scale Business Enterprises.

### 2.4.1 Flood Event Categorization:

At the country wide level the flood related disasters are categorized in terms of Flood Classification for the main river system (five rivers namely: Indus, Chenab, Ravi, Jhleum and Sutley). In this context there are two flood categories: i) Mild and ii) Danger.

**Mild Flood Category:**

This flood category is further sub-classified into three types based on flood intensity in main river(s) as under:

| | |
|---|---|
| a) Low Flood: | River flowing within deep (winter) channel(s) but about to spill threatening only river islands/belas(small dry land within rivers) |
| b) Medium Flood: | River partly inundating river islands/belas |
| c) High Flood: | River almost fully submerging islands/belas and flowing upto high banks/bunds but without encroachment on the freeboard (margin over and above the High Flood Design Level of bank/bund/embankment to cater for any above high flood level situation) |

**Danger Flood Category:**

This flood category is further sub-classified into two types based on flood intensity in main river(s) as under:

| | |
|---|---|
| a) Very High Flood: | River flowing between high banks/bunds with encroachment on free board. |
| b) Exceptionally High Flood: | Imminent danger of overtopping/breaching or the high bank areas have become inundated |

### 2.5 Differential Impact of 2001 Flood Disaster on Women and Men:

An interview survey was conducted to assess differential impact of 2001 flood disaster on women and men some of the common replies obtained are:

- 2001 flood had badly damaged our houses, assets and it would take 15-20 years to fully recover;
- Flood affecters were unable to buy books for their school going kids and resultantly had discontinued their kids from going to schools
- Most of the buildings were badly damaged and residents feel that if they are again hit by floods of even lesser magnitude, their buildings are going to collapse.
- The male members of the families, who were doing private jobs, spent 1-2 months at home to clean and rehabilitate their homes and assets, became jobless. This economic disaster further increased their vulnerability.
- Due to floods, large number of dowries of young girls were perished, resulting in economic as well as social damage to individually affected families.
- Continuous fear of flooding again when ever there is rain.
- Female members of families, living at the edge of Nullah feel insecure that government will demolish their houses, most of which come under the definition of encroachment.
- If flood comes again we will be shelter less/home less.

# Chapter –3

# FLOOD MANAGEMENT MEASURES

## 3.1 Flood Management Measures – Countrywide:

### 3.1.1 Floods, Losses & River System:

Five main rivers, namely, the Indus, Jhelum, Chenab, Ravi and Sutlej flow through the Pakistan's plains. Supplemented by a number of smaller tributary rivers and streams, 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 floods in above major rivers are generally caused by heavy concentrated rainfall in the catchments, during the monsoon season, which is sometimes augmented by snowmelt flows. Monsoon currents originating in the Bay of Bengal and resultant depressions often result in heavy downpour in the Himalayan foothills which occasionally produce destructive floods in one or more of the main rivers of the Indus System. However, in some cases exceptionally high floods have occasionally been caused by the formation of temporary natural dams by landslide or glacier movement and their subsequent collapse.

### 3.1.2 Flood Management Strategies in Place:

Flood management planning in Pakistan is being carried out to essentially achieve: i) Reduction of flood losses in an economically sound manner; ii) Prioritizing of areas of greater economic hazards; iii) Protecting the cities and vital infrastructural installations; iv) Exploring the possible use of existing flood control facilities; v) Promoting appropriate land use in flood hazard areas; vi) Minimizing adverse effects on national ecosystem and environment and vii) Creating flood awareness and adaptability in the Riverian areas

In order to achieve above planning, structural as well as non-structural flood management measures are in place. The structural measures include embankments, dykes, spurs, bunds, water diversion structures and water dispersion structures etc. on the main as well as on the tributary rivers and on various hill torrents while non structural measures include flood forecasting and warning system including three weather radar system, High frequency Radio Communication system at 19 barrages & major reservoirs for effective river inflow/outflow data receipt and dissemination besides inter-provincial and inter-agency coordination at the federal and provincial level. Contrary to the past practices, efforts are now on to achieve integrated flood management through implementation of structural flood protection measures on river reach-wise basis.

## 3.2 Flood Management Measures – Lai Nullah Basin:

As stated earlier Lai Nullah basin lies in the twin cities of Islamabad & Rawalpindi and most of its active part passes through the urban areas of Islamabad & Rawalpindi besides a part of it through rural communities in Islamabad. At present no active and integrated flood management approach is seen in Islamabad in managing the flood waters of Lai Nullah Basin. On the other hand some realization is seen in Rawalpindi to manage Lai floods in the back drop of unprecedented floods of 100 years return period occurred in July 2001.

As a part of strategy to manage flood following measures have been taken: i) Straightening and widening of some of the reaches of Lai Nullah passing through congested Rawalpindi City area; ii) Stone pitching of some of the existing portions of Lai Nullah in Rawalpindi City in order to prevent erosion and danger of collapse of building standing close to the Nullah catchment; iii) Removal of garbage disposal, by the people living in the vicinity, into the flowing water of Lai Nullah, which actually plays a major role in creating artificial floods in some of the reaches, due to heading up of flood waters at the bridge piers; iv) Raising of heights of some of the road bridges built long time age on Lai Nullah; v) Removal of encroachments.

### 3.3 Mechanisms in Place for Effective use of Floodwater and Floodplains and their efficacy:

The Irrigation System of Pakistan is the largest integrated irrigation network in the world, serving 13.96 million hectares (34.5 million acres) of contiguous cultivated land. The system is fed by the waters of the Indus River and its tributaries. The salient features of the system are three major storage reservoirs, namely, Tarbela and Chashma on River Indus, and Mangla on River Jhelum; 19 Barrages; 12 inter-river link canals and 43 independent irrigation canal commands. The total length of main canals alone is 58,500 Km. Water courses comprise another 1,621,000 KMs.

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, distributors and minors. The watercourses get their share of water through outlets in the irrigation channels. Distribution of water from a watercourse is effected through a time-schedule or “warabandi” under which each farm gets water for a specified period once a week. The time-share or “wari” is proportionate to the farm area owned by a farmer under the command of the watercourse.

The system draws an average of 13.08 million hectares meters (106 MAF) of surface water each year for irrigation. Supplemented by an annual groundwater pumpage of some 5.31 million hectares meters (43 MAF), the average depth of water available at the farm gate is 2.31 meters per hectare. Approximately 3 million individual farms with an average size of about 4.856 hectares benefit from this system.

It may be pointed out here that for the **Lai Nullah Case Study Area** presently no mechanism is available for effective use of flood water and floodplain.

### 3.4 Flood Mitigation Measures:

#### 3.4.1 Country-wide Structural Measures in Four Provinces including those for Lai Nullah Basin:

In **Punjab**, the flood protection **bunds/embankments** have been generally constructed either to protect head-works and other irrigation structures, or to safeguard certain towns and villages. Due to general topography of the area sloping towards the south west, the embankments along head-works and irrigation structures have been constructed in such a way that breaching sections are provided on the right marginal bunds to give relief to water heading up against the left marginal bunds during floods and keep the flow through the Barrages within safe limits for the Hydraulic structures. This is done to avoid breaches in the left marginal bunds, which can cause widespread devastation, as most of the development is on the left side of the river. In order to protect areas from erosion, **spurs** have been constructed. These spurs have protected the areas and in some cases even the eroded lands have been recovered.

The Indus River flows on a ridge in **Sindh** Province, and surrounding areas are generally lower than the river bed; hence, water once leaving the Indus River does not return back. Escaped water thus causes greater damage to widespread areas, and it persists for a longer period even after the flood peaks are over. 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 order to minimize such eventualities, **double line of flood embankments** has been constructed on almost both the banks. These embankments have been further **compartmentalized** to contain widespread inundation. These embankments are often threatened by active erosion by the river flows and leakages in the embankments due to poor soils in some reaches.

In **NWFP,** the floods are mainly due to flashy hill torrents having steep bed slopes, which greatly increase flood velocity and severely erode the banks. In NWF Province, mostly **spurs**, **dykes** and **gabion walls** have been constructed to save the areas from erosion. However, due to very steep gradient in some of the river reaches, serious damages to the existing spurs system also sometimes occurs involving fair amount of Operation & Maintenance cost.

Due to peculiar physiographic and climatic characteristics in **Balochistan**, mostly **embankments** and **flood walls** have been constructed to protect orchards or abadies from flood damages. Some bunds have also been constructed to serve as flood diversion/abatement measures. Due to heavy torrential rains damages to these structures take place for which there is a dire need of developing local techniques to use flood waters like: i) Delay action dams, ii) water dispersion structures, iii) Water diversion structures, iv) Provision of small water storages for local usage.

For the **Lai Nullah Case Study Area** some of the structural flood measures have been briefly stated in item 3.2 above.

In order to implement greater integrated water and flood management approach, new structural measures are required to be placed in view of provincial priorities besides ensuring proper Operation & Maintenance of the existing infrastructure. For Lai Nullah issue, to avoid incidence of 2001 like situation there is an urgent need of implementation of some immediate, short, medium and long term priority interventions (which are to be discussed later).

### 3.4.2 Country-wide Non-structural Measures including those for Lai Nullah Basin:

A weakness in flood management had always been the lack of early flood warning system on our rivers. The comprehensive program for strengthening of Pakistan's flood forecasting and warning capability was conceived by the Government after super floods in 1992. The existing measures include: i) 69 High Frequency Radio sets for main federal and provincial agencies involved in the task of flood management including major barrages; ii) 10 cm Quantitative Precipitation Measurement (QPM) Weather Radar at Pakistan Meteorological Department at Lahore (Punjab), 5.36 cm weather radar at Sialkot (Punjab) besides weather surveillance radars at Karachi (Sindh), Rahim Yar Khan (Punjab), D.G Khan (Punjab) and Islamabad (Federal Capital); iii) Mapping of flood prone areas along the Indus River and its major tributaries using the Global Position System (GPS) techniques and the related development of a Digital Terrain Model (DTM); iv) Computer based Indus Basin Flood Forecasting System(FFS), and v) Meteoro-burst Telecommunication System for real time hydromet data receipt and transmission. This system, however, needs to be further extended besides urgent requirement of weather radars to monitor monsoon weather system from Bay of Bengal and to address torrential rain problems in remote areas of Balochistan.

For the case of Lai Nullah, presently PMD monitors storm rainfall through existing four rainfall gauging stations and one weather surveillance radar at PMD Office, Islamabad. The existing rainfall gauging stations are, however, not equipped with automatic data transmittal system, which caue difficulties in the collection of accurate gauged data on real time basis. Rawalpindi Municipal Corporation (now Tehsil Municipal Administration-TMA) also operates two manual (off-line) water level gauging stations at Gawal Mandi Bridge and Ratta Amral Bridge to monitor flood water level of Lai Nullah. These stations were, however, abandoned due to reconstruction of the above bridges after 2001 floods.

### 3.4.3 Relative Importance of Structural & Non-structural Measures:

**Structural Measures:**

Pakistan has one of the world's largest irrigation and canal network. Also the Indus River System is among the world's largest systems. The importance of structural measures always exists there for: i) Safety of major irrigation infrastructure, ii) safety of local community living

close to the riverian areas, iii) more land reclamation for enhanced agricultural practices, iv) effective utilization of available water resources & v) to keep the river system within the main river meandering belt. In the context of Lai Nullah Case Study Area existing structural measures as stated in item 3.2 above, and their further strengthening is of paramount importance in order to ensure safety of the surrounding communities in situations similar to that of 2001.

**Non-structural Measures:**
On the other hand non-structural measures have their own merits in: i) the provision of real time weather system, especially, the monsoon system, for careful forecasting for river flows and urban area inundation, ii) effective and real time data receipt and dissemination, iii) management of outflows from country's two major reservoirs, especially, for Mangla Dam in the event of super floods, in such a way that downstream hydraulic structures which are the back bone of Pakistan's irrigation system are protected. In the context of Lai Nullah Case Study Area there is an urgent requirement of effective flood forecasting and warning system at Islamabad-Rawalpindi level which presently is almost non-existent.

### 3.4.4 Women's and Men's Participation in Flood Mitigation Measures:
Flood management at country-wide basis is being managed through Federal as well as Provincial entities and as such the inter relationship between women's and men's participation in above two types of flood mitigation measures in terms of responsibilities and tasks is non-existent. However, there are Non-Governmental Organizations which work at the provincial and federal level at their own and have shared responsibilities and tasks among women and men. In the context of Lai Nullah Case Study Area, 2001 flood incident proved a good example of joint relief work by local as well as international NGOs with equal gender participation.

## 3.5 Modifications to Flood Mitigation Measures Following Extreme Events:
### 3.5.1 Flood Management Activities:
At the country-wide basis, after the super floods of 1992, National Flood Forecasting Bureau (now Flood Forecasting Division-FFD) was established for more effective liaison and interagency coordination during flood season every year. Flood Warning Centres have been made operative at district level to collect and pass on the related information to respective Provincial Flood Warning Centres who in turn pass the same to FFD for nation-wide dissemination of real time information. In the context of Lai Nullah Case Study Area, some changes in the flood management strategies are in the proposal stage, as explained in later section in the Case Study relating to two urgent projects.

### 3.5.2 Changes to Existing Structural and Non-Structural Measures:
At the country-wide level, after the super floods of 1992, serious efforts have been made to follow integrated flood management approach by undertaking implementation of over 250 flood protection schemes on five major rivers on river reach basis after detailed feasibility study. However, important areas of community participation and ensuring reasonable Operation & Maintenance after construction had not been given desired attention which are now being considered for upcoming new flood management projects. In the context of Lai Nullah Case Study Area, after the unprecedented rains and consequent floods in 2001 some reasonable structural improvements have been placed in order to: i) minimize over spillage of flood water and resultant inundation of some of the low lying areas in Rawalpindi City, ii) somewhat improved garbage collection and disposal system, iii) removal of encroachments & iv) local level involvement of NGOs and community based organizations. However, these improvements are only at Rawalpindi level and thus need to be integrated with Islamabad City which is the main source of flood generation in Lai Nullah due to its four major tributaries being originated from the foot hills of Islamabad.

### 3.5.3 Adoption of New Structural and Non-Structural Measures:

Side by side with the existing flood management measures, regular occurrences of rain/flood related disasters in Pakistan, has prompted the Government agencies in devising & adopting new and improved strategies to combat the flood menace. Prominent among these include: i) adopting integrated river and flood management approach through planning and implementation of flood works on river reach to reach basis, assigning due consideration to their effects/impacts downstream, ii) experimenting provision of battery of spurs in an attempt to shift river meander and to control erosion & reclaim more land, iii) further improvement in the shapes of spurs through model testing, iv) adopting river reach wise model testing as a pre-requisite to suggest any on-ground intervention, v) master planning of hill torrents has been done with a view to exploit their water potential for local irrigation of drinking water supply etc. On non-structural side: i) new and advanced weather radar systems get priority, ii) Data collection system which had proved successful in the past is being extended to further remote areas, iii) for flood control projects community participation concept is being introduced in various schemes to ensure placement of any intervention with the participation of beneficiaries in siting, planning & implementation of schemes.

In the context of Lai Nullah Case Study Area, implementation of two urgent projects has been suggested including: i) Provision of flood retardation basin in Islamabad through Capital Development Authority (CDA) with Federal Flood Commission (FFC) as the central coordinating body, as a structural measure, in order to cater for super flood and to shave off flood peaks at initial stages with a view to ensure safe and secure flow in Lai Nullah downstream in urban Rawalpindi, ii) Placement of an effective flood forecasting & flood warning system with Islamabad-Rawalpindi under PMD with Federal Flood Commission as the central coordinating body. Some medium term and long term measures are also being proposed which includes provision of a long diversion channel (in two stages) to divert flow of Lai Nullah upstream in Islamabad and just close to downstream located Rawalpindi City to a tributary river (Kuran River) so that Lai Nullah high flood is diverted through this channel thus protecting downstream areas on permanent basis. This channel will take flood flows of a number of small streams which flow into main Lai Nullah in Islamabad area.

### 3.5.4 Changes in the Relative Importance of Structural & Non-structural Measures:

Over the last decade or so the overall development in the above areas have been considerable and as such change in their relative importance is not so evident or desirable. As a matter of fact there is an increased demand, from the federating units, for more structural interventions on secondary and tertiary rivers in addition to the main rivers on account of water and flood water becoming precious commodity. In the non-structural sector, emphasis is now being given to development of Flood Warning Manual. The idea behind is to depict details of villages, infrastructure, cattle-head, crops etc. parallel to flood of a certain category (e.g. 500,000 Cfs, 600,000 Cfs etc. i.e. 14,160 to 16,1992 cubic meters per second) in order to ensure real time evacuation and migration of communities who are likely to be affected at the occurrence of flood of a certain category. Another shift in the non-structural flood control measure is involvement of beneficiaries in various processes of project implementation so that post implementation O & M problems are handled through sense of ownership by the beneficiaries. This also applies to the Lai Nullah Case Study Area.

### 3.5.5 Information/Data Collection Mechanisms:

As described in the preceding items, data collection and dissemination related to rainfall, river flood etc. is managed through a network of flood warning centres connected with the FFD at the national level. Automatic as well as manual gauge systems are available with the main river system on country-wide level for this purpose. Meteorobusrt Telecommunication System is a recent addition to this data collection and transmission field, besides High Frequency Radio System, which has greatly improved the efficiency of concerned federal and provincial agencies on one hand and has also resulted in improved river flow/routing and forecasting practices due to real time data.

In the context of Lai Nullah Case Study Area, lack of reasonable information collection and data dissemination system is noticeable.

### 3.5.6 Inter-agency Coordination:

An important area that was requiring most urgent attention is improvement in the coordination between different departments of Islamabad & Rawalpindi in order to ensure integrated flood management of Lai Nullah floods. These include Capital Development Authority (CDA), Rawalpindi Development Authority (RDA), Tehsil Municipal Administration (TMA), Rawalpindi, Small dams Organization of Punjab Province in Rawalpindi and Rawalpindi cantonment Board (RCB). A visible improvement has very recently been witnessed in the recent past, as FFC has now been entrusted with the task of ensuring inter-agency coordination for the Lai Nullah Case Study Area. At the national level a more responsible approach is being seen in coordination of flood management and relief measures activities.

## Chapter – 4

## FLOOD AND WATER MANAGEMENT INSTRUMENTS

### 4. Disaster Management Laws:

### 4.1 Present Position:

According to World Disaster Report 2002, two percent of Pakistan's population were killed or adversely affected by disasters during 1999 to 2001 period. Disaster management is Pakistan is basically revolves around flood disasters with a primary focus on rescue and relief. The existing institutional structures responsible for disaster management lend themselves to reactive short-term responses.

A serious weakness exists between the documented responsibilities of stakeholder agencies and their aptitude to and comply with their tasks. At present there is no comprehensive and strategic national disaster management policy that reflects an all risk approach to disaster management. However, there exists legislation and a variety of governmental and non-governmental organizations that are addressing some critical aspects of preparedness, mitigation, early warning and response to natural and human induced disasters.

### 4.2 Legal Aspects of Flood Management:

(a) Land use:

The four provinces are the managers of respective catchments and flood plains of Indus river system and the present land use policy in operation is that river catchments and flood plains are exclusively to be kept as no go area for the riverian community. Also legislations are there that prohibit from developing any ill legal dwellings/encroachments in the river Khadir (i.e., floodplain/river catchment). Contrary to this lot of encroachers are there and in the context of Lai Nullah flood problem, the devastation that had been caused to human life was largely on account these encroachers. Situation has improved after 2001 disaster. RDA/TMA has also enforced certain land use regulations to discourage ill legal developments alongside the Lai Nullah especially to stop ill legal construction of residences, Small & Medium Scale Enterprises, massive dumping of garbage in the mainstream of the Nullah besides measures for construction of single span new bridges in place of multiplier old bridges in an effort to cater for the downstream artificial heading up and ultimate flooding of residential area and small industrial units in the close vicinity.

(b) Flood Warning:

In line with NFPP, PMD is currently entrusted with the task of flood warning in order to ensure effective flood management. In this context PMD FFD is responsible for the dissemination of the flood forecasts/warnings to considerably large number of recipients directly or indirectly concerned with the flood mitigation process. Press briefings are arranged by FFD as a regular feature to ensure correct and authentic flood and weather information to the public. Such briefings are arranged through the representative of the Information Department. Considerable improvement has since been made in the flood warning & their dissemination system since the time that it was initially started. Most of the discrepancies sated above have been removed. A much better coordination new exists with WAPDA.

To forewarn the frontline flood mitigation authorities regarding the possibility of floods due to the arrival of monsoon low/depression in the vicinity of the Pakistan, **Colour Coded Qualitative Forecasts** are issued. To facilitate the understanding of the flood situation for those recipients who are highly placed Government functionaries (mostly at the federal level) and thus need to know the Weather/Flood situation in general (easily understandable) terms and are not concerned with detailed river forecast, **weather/flood forecast** are issued. To give the quantitative information of the magnitude of prevailing and the forecast flood flows at maximum

number of directly or indirectly concerned recipients routine **daily flood forecasts** are given. **Significant flood forecast** is issued at the occurrence of a flood of 'High' or higher level at a specific site/sites over a river and/or nallah within the Indus basin river system. **Areal inundation flood forecast** is issued only when the exceptionally high flood occurs and the areal inundation is forecast on the basis of the hydrodynamic model.

(c) Flood Preparedness & Response:
Presently both at the federal as well as at provincial level very effective planning and practical arrangements are ensured every year and in this context all resources are mobilized to create a sense of response among the affected people towards government efforts. However, affected communities are sometimes vocal about mis-management and lack of effective preparedness by the state owned concerned agencies. The reason being that sometimes required relief measures are not reached to every affected person due to state/provincial constraints and limited real time resource availability.

### 4.3 Allocation VS Use of Resources for IFM:

Since 1977 up-till now an approximate sum of Rs 34 billion (US$ 0.65 billion-including foreign loans) have been spent against a provincial demand of Rs 70 billion (US $ 1.3 billion) on construction of some 750 flood protection works, restoration of some 4,045 rain/flood affected irrigation & flood control schemes besides reasonable improvements in the flood forecasting capability. In this context it is worth mentioning that amount spend on integrated flood management had been less than fifty percent of the actual demand on ground. In the context of Lai Nullah integrated flood management, only recently a serious investment of Rs over 0.40 billion (US $ 7 million) have been made against a constant requirement of funds more that 2.00 billion (US $ 35 million).

### 4.4 Access and Control on Resources of Women & Men:

In the context of integrated flood management in Pakistan, state owned agencies (concerned federal and provincial departments) have an over access and control over resources meant for ensuring IFM. Role of women and men is just confined to sharing of benefits, but, as far as planning, siting, designing and implementation of a certain flood management intervention is concerned, only state owned agencies have their say. In the past there have been instances of allocating and spending meager flood management resources on politically motivated schemes thus completing ignoring IFM approach. Nevertheless, this trend has now changed and funds are being spent on implementation of disaster/flood control strategies based on integrated river reach basis. Very recently, women & men have got an access and control on resources through the induction of social mobilization and community participation approach in overall flood management strategy of the country.

### 4.5 Efficacy of Law Enforcement Mechanisms:

In its true sense although the federal and the provincial governments have certain laws in place and certain policies devised to stop occupation of river bed/river catachment (in the four provines)/space between first line of defence and second line of defence (in Sindh province) by the local community, however, local people are habitual in cultivating crops on small scale to earn their living besides resorting to development of permanent dwellings, in the shape of stone/bush made house, in the river belt. At the advent of flood of a certain magnitude provincial, local and district administration issue regular flood alerts for shifting to safer places, however, such flood alerts and warnings always prove meaningless and people become shelterless and homeless. In the context of Lai Nullah Case Study area, over the last 25 years, people had been following course of ill development of businesses and residential units without being noticed. The prevailing laws are required to be modified as there are flaws which allow the encroacher to get long repeated stays on one pretext or the other once the municipality issues certain instruction for removal etc.

Government is allocating lands to farmers in areas other than river bed to discourage the trend besides local NGOs engaged in awakening the female gender in cheap home based bread earning kills including stitching etc. In Lai Nullah TMA has introduced strict laws and penalties for i) the land encroachers, ii) garbage dumping in line with 2001 flood incident. TMA & RDA has removed more than 2000 encroachments from the vicinity of the Lai Nullah by paying market prices for the encroachments. At the same time RDA has prepared a comprehensive resettlement plan to avoid any civic and social problem.

## Chapter – 5

## INSTITUTIONS RESPONSIBLE FOR FLOOD MANAGEMENT

### 5.1 Agencies Involved In Flood Management & the Extent of their Mutual Cooperation:

### 5.1.2 Country-wide:

Flood management is a multifunctional process involving different organizations. The Government Organizations which play major role in the flood management are Provincial Irrigation & Power Departments (PIDs), Water & Power Development Authority (WAPDA), Provincial Relief Organizations/Departments, Pakistan Army, Pakistan Commissioner for Indus Waters (PCIW), Emergency Relief Cell (ERC), FFC and FFD. Proper understanding of role of these organizations is a necessary pre-requisite for close coordination between them. Role of these organizations are briefly described below:

**i) Provincial Irrigation & Power Departments (PIDs):**

PIDs plays a front line role in the process of flood forecasting as well as flood mitigation. Major flood related functions include: i) Flow measurement at the specific sites at rivers, canals and nallahs; ii) Planning, design, construction and maintenance of flood protection works; iii) Maintenance of data communication network, iv) Supervision of the Flood Warning Centre; v) Close coordination with FFD for the issuance & dissemination of the flood forecasts/warnings; vi) Updating & execution (if required) of the divisional flood fighting plans.

**ii) WAPDA:**

WAPDA is actively involved in the Flood Forecasting process by providing river and rain data from its telemetric gauge sites within the upper catchments of Indus and Jhelum Rivers. Besides WAPDA's involvement in providing the hydrometric flood data, it is also involved in providing the data from such hydraulic structures as Mangla and Tarbela dams and the Chashma barrage. Coordination between FFD and WAPDA sharply improved after the 1992 flood disaster. Its major role is regulating the flows of Mangla and Tarbela reservoirs during flood season every year.

**iii) Provincial Relief Organization/Departments:**

Provincial Relief Organizations are charged with the responsibility pertaining of disaster preparedness, emergency response, and post disaster activities pertaining to all disasters including floods. Relief functions at the district and Tehsil (sub-district) level are performed through the District Coordination Officers (DCOs) who coordinate with the other departments to execute the flood mitigation functions at the district level under the new Devolution Plan of Government which is meant for transferring powers to the communities at the grass root level through Community Based Organizations, Village Councils and Community Citizen Boards.

Flood preparatory actions required to be taken by the Relief Commissioner include: i) Arranging inspection of the flood protection works by the Irrigation Departments and Pakistan Army to ensure that all vital flood protection bunds etc are in a satisfactory state of maintenance; ii) To establish flood warning centre and the flood centres at the district and tehsil levels; iii) To ensure that all flood related agencies/departments involved in the process of flood mitigation are fully geared to perform the functions pertaining to their respective areas; iv) To ensure that flood forecasts/warnings are disseminated without loss of time to all concerned and that they are fully aware of the actions to be taken under each situation.

**iv) Pakistan Army:**

Pakistan Army's flood related functions encompass all the three phases of flood operations from the pre-flood to post flood phases including the all important flood phase. Pre-flood phase is the flood preparatory phase during which the adequacy and the serviceability of the flood fighting equipment is ensured. Since Punjab is the most flood prone province, it is the Relief

Commissioner Punjab, who provides the bulk of the flood fighting equipment to the Army. Pre-flood inspections of the flood protection structures are also carried out by the respective commander corps of engineers for their respective areas to ensure that the structures (bunds, barrages, spurs etc.) are in satisfactory state of maintenance. Availability of sufficient stock of explosives to activate the breaches, if required, is ensured. Pakistan Army's major flood related function starts after the flood occurs. In the event of any flood situation, units of the Army move out to their respective areas of responsibility and carry out the relief and rescue operations in coordination with the civil administration.

**v) Commissioner for Indus Waters (C.I.W):**
Pakistan has a unique flood forecasting problem in the sense that greater part of the flood producing upper catchments of the Sutlej, Ravi, Jhelum and Chenab rivers lie across the border in India/held Kashmir. Furthermore a number of control structures like dams and barrages etc exist over the rivers across the border with the result that the free flow conditions are destroyed making the operation of the rainfall/runoff model extremely difficult. The situation underlines the need for the river flow data from across the border in respect of the important sites over the rivers in India/held Kashmir. Consequently, an agreement has been signed between the two countries through their respective Commissioners for Indus Waters, which includes a provision to receive from India such river 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 data is then passed on to FFD.

**vi) Emergency Relief Cell (ERC):**
Emergency Relief Cell has been established under the Cabinet Division and is controlled by the Cabinet Secretary. The Cell is headed by the Director General Relief. Main role of the Emergency Relief Cell include: i) Planning and assessment of relief requirements of major disasters; ii) Stock piling of basic necessities needed during emergency such as dry ration, blankets etc.; iii) Establishing emergency fund upon declaration of any part of the country as calamity affected; iv) Maintaining contact with UNDP and other international aid giving agencies; v) Making arrangements of disaster relief assistance from other countries; vi) Located at Islamabad, ERC maintains contact with the Federal Flood Commission(FFC).

**vii) Federal Flood Commission (FFC):**
Main responsibilities of FFC include: i) Preparation of National Flood Protection Plan (so far three 10 yaer each National Plans have been implemented and the third is being implemented); ii) Approval of Flood Control Schemes prepared by Provincial Governments and concerned federal agencies; ii) Review of flood Damages to public sector infrastructure and review of plans for restoration and reconstruction works; iii) Measures for improvements in Flood Forecasting and Warning System on country-wide basis; iv) Standardization of designs and specifications for Flood Protection Works; v) Evaluation and monitoring relating to progress of implementation of the National Flood Protection Plan(NFPP); vi) Preparation of a research program for Flood Control and Protection; vii) Recommendations regarding principles of regulation of reservoirs for flood control; viii) Overall coordination for effective flood management on country-wide basis with all concerned federal and provincial departments (for structural, non-structural measures, policy matters relating to floods, water, irrigation, drainage etc.); ix) Liaison with international organizations like ICOLD, ICID, ICIMOD, UNDP, ADRC, ADPC, World Bank, ADB, IDB, JICa, JBIC etc.

In the context of flood warning dissemination, Chairman FFC (being also the Chief Engineering Advisor to the Federal Government) renders suitable reports to the President and the Prime Minister as and when the situation so demands. A Flood Monitoring Situation Report on Weather & River Discharges is prepared and issued to important Government officials on daily basis during the flood season every year. Since its establishment in 1977, FFC has been involved in the implementation of flood works over Rs 10 billion.

**viii) Flood Forecasting Division (FFD):**
FFD of the Pakistan Meteorological Department plays a pivotal role in the entire flood warning and management process. Hydrometeorological data from the various national and international sources is received in this Bureau which is then processed to produce flood forecasts and warnings to be disseminated outwards to various national organizations.

### 5.1.3 Lai Nullah Case Study Area:

The management and/or administration of Lai Nullah is presently undertaken by: i) FFC, ii) CDA, iii) RDA, vi) Small Dams Organization (SDO), v) TMA and RCB. Their role/responsibilities in the context of Lai Nullah are given as under:

**Federal Flood Commission:**
In view of lack of coordination between the administrations of Islamabad & Rawalpindi cities, Laui Nullah problem had been aggravating since 1980. In order to manage Lai Nullah problem in the context of integrated river and flood management approach, Government of Pakistan, in 2001 decided that this important & joint flood management problem in the federal capital and in the important city of Province of Punjab should be tackled by FFC through medium and long term planning and implementation of measures.

FFC is ensuring necessary steps in this regard. Two urgent nature projects (one structural and one non-structural) are being finalized for implementation with the cooperation of CDA, PMD, RDA & TMA.

**Capital Development Authority (CDA):**
Responsible for master planning of Islamabad. After the 2001 super floods, CDA was forced to realize the importance of operational plan to fight against the expected rainwater storm in future.

**Small Dams Organization (SDO):**
It is a sub-ordinate office of Punjab Irrigation Department and is presently responsible for maintenance of Rawal Dam which is one of the main sources for water supply in Islamabad-Rawalpindi. This Office has vast experience in flood management of small rivers and hill torrents and construction of small dams in Potohar Platuo around Islamabad. It has so far constructed 31 small dams and is also looking after their maintenance.

**Rawalpindi Development Authority (RDA):**
The major responsibilities of RDA are, to plan, guide, control and implement major and long term development works in Rawalpindi City. It deals with surface drainage or flood mitigation projects relating to Lai Nullah in the context of water supply, sewerage, land development and management.

**Tehsil Municipal Administration (TMA), Rawalpindi:**
Responsible for: i) Execution & management of development plans, ii) Enforcement of all municipal laws, rules etc., iii) Prevention of encroachments, iv) Collection of approved taxes, user fees, rates, rents, tolls, charges, levies, fines, and penalties after approval of Tehsil Council & v) coordinating & supporting municipal functions amongst unions and villages.

**Rawalpindi Cantonment Board (RCB):**
Responsible for: i) Provision of civic amenities, ii) maintaining of public markets, slaughter houses, public toilets, iii) regulating trade and professions, iv) Enforcing Muslim Family Laws. RCB dose not have any precautionary measures arrangements against the flood water flowing through Lai Nullah in the jurisdiction of RCB.

## 5.2 Central Authority for Flood Management & Coordination:

### 5.2.1 Country-wide:

Up to the end of 1976, the relevant authorities in the Provincial Governments were responsible for the planning and execution of flood protection works. Disastrous floods of 1973 and 1976 resulted in heavy losses indicating that existing flood protection facilities and planning were inadequate to provide effective protective measures for the country. Heavy losses sustained to the economy were discussed at an Inter-Provincial Conference in 1977 and subsequently in January 1977 it was decided to establish Federal Flood Commission with a prime objective to coordinate resources at a focal point for their effective utilization among the federating units and to deal with flood management problem at the national level to introduce integrated approach.

Establishment of Federal Flood Commission greatly helped in integrating the planning measures at the national level and furnishing financial resources for the flood projects. Federal funding through Federal Flood Commission proved a vehicle for quick execution of flood management projects. Though, the Federal funding has provided impetus for flood management planning in Pakistan, the available financial resources have been gradually declining in terms of actual funding as well as in the real terms due to inflation.

### 5.2.3 Lai Nullah Case Study Area:

Until 1984 no concrete flood management & coordination for Lai Nullah Case Study Area in Islamabad-Rawalpindi was in place. In 1984, the Executive Committee of National Economic Council (ECNEC), decided to setup a Technical Committee in M/O water & Power to deal with the Lai Nullah flood problem through coordination among the concerned stakeholders. However, due to varied priorities of CDA in Islamabad and RDA in Rawalpindi, the two departments were not able to arrive at one opinion on managing the Lai flood problem till 1997 when a major flood event hit the twin cities. FFC was assigned the task to act as a coordinating agency between Federal capital and Rawalpindi Administrations. A number of steps were taken in this context as confidence building measures and ultimately FFC has been able to built a consensus among the stake holders on implementing structural and non-structural measures as stated above.

## 5.3 Interest Group Involvement in Flood Management Activities:

In dealing with the flood management issues at Federal and Provincial levels, mainly Federal and Provincial departments have main involvement in different activities. Irrigation Departments of Provinces are mainly responsible for preparation of Project Cost Estimates for their respective flood control schemes, but these should be in line with the priorities set in the National Flood Protection Plan which is the jurisdiction of FFC. For that matter FFC has certain bench marks devised for Provincial schemes. Once the schemes are submitted to FFC these are scrutinized with reference to these bench marks. Hence FFC technically clears a certain flood control scheme with assurance of federal financing. Province on the other hand are responsible for execution.

As regards involvement of NGOs, women and men from communities, in decision making process, this culture is at its beginning. In one of on-going flood projects, Federal Government is experimenting involvement of NGO Group in mobilizing the community so that they have a sense of ownership after its completion and thus feels responsibility towards its maintenance.

# Chapter – 6

# POLICY

## 6.1 Policy:

### 6.1.1 Water Resources Management Policy:

Draft of the National Water Policy has been issued in January 2002. The Policy is due to be finalized soon through its approval by the Government for adoption.

**The specific objectives of National Water Policy are to:**

i) Make more effective use of the surface and ground waters that have been developed to realize greater productivity per unit of water; ii) Achieve equitable and assured distribution of water; iii) Bridge deficit between O&M and cost recoveries; iv) Increase the availability of surface and groundwater resources to the optimal level; v) Store and use river water flood surpluses through multipurpose storage projects for increased surface irrigation water availability, flood control and hydropower generation; vi) Conserve the quality of the water resources both surface and groundwater; vii) Reduce the extent of waterlogging land from 14 percent to 9 percent of the canal command area; viii) Minimize drainable surplus by improving management and lining of distributaries, minors and watercourses; ix) Facilitate eventual evacuation of the saline drainable surplus from the Indus Basin to the Arabian Sea where feasible; x) Increase the role of private sector in the development and maintenance of water sector infrastructure and pilot-test the concept of farmers organizations for O&M; xi) Introduce biological drainage with the involvement of farmers; xii) Slowly introduce the concept of water property rights and water pricing for surface and groundwater; xiii) Bring 1.4 million acres of additional land under cultivation; xiv) Strengthen farmers organizations and their capability to manage irrigation systems, drainage and O&M operations; xv) Strengthen and restructure water sector institutions to meet future challenges; xvi) Assist in the studies required for formulation of National Water Policy through the application of Computer Technology in the field of Water Resources Planning and Management; xvii) Bring more agricultural land into production; xviii) Utilize flood flows to augment water availability; xix) Improve flood warning and forecasting systems; xx) Establish a centralized Management Information System (MIS) and computer database of river discharge data, canal diversion, cropped areas, canal maintenance etc. for improving monitoring and management of irrigation systems; xxi) Ensure participation of the public in each phase of planning, design, implementation and management; encourage public awareness of water resources development and improve transparency of decision-making process; xxii) Improve research and development in the water sector and conduct studies in response to national priority setting and xxiii) Optimally develop the water resources in the barani areas.

Water resources management in Pakistan falls under the following legislations: i) Indus water Treaty-1960; ii) Water Apportionment Accord-1991; iii) Canal and Drainage Act-1873; iv) Provincial Irrigation and Drainage Act-1997 and v) Punjab Minors Act-1905.

### 6.1.2 Flood Management Policy:

Flood management planning & policy in Pakistan is being carried out to essentially achieve the policy objectives including: i) Reduction of flood losses in an economically sound manner; ii) Prioritizing of areas of greater economic hazards; iii) Protecting the cities and vital infrastructural installations; iv) Exploring the possible use of existing flood control facilities; v) Promoting appropriate land use in flood hazard areas; vi) Minimizing adverse effects on national ecosystem and environment; and vii) Creating flood awareness and adaptability in the Riverian areas. National Flood Protection Plan contains implementation strategy for these policies.

### 6.1.3 Land Use and Management:

Pakistan is one of the more than 100 countries of the world affected by desertification, which is resulting in environmental degradation, loss of soil fertility, biodiversity and reduction in land productivity. For Pakistan, currently the real issue is not the amount of land demarcated as a protected area but the poor management of the areas already protected. Some acts/ordinance that are concerned with land use and management in terms of environment are: i) Punjab Development of Damaged Areas Act-1952; ii) The Punjab Soil Reclamation Act-1952 and iii) The Islamabad (Preservation of Landscape) Ordinance-1966.

### 6.1.4 Development Planning and Disaster Prevention:

The updated national development strategies in Pakistan are formulated through i) Three Years Rolling Plan (2001-2004) and ii) Ten Year Perspective Plan (2001-2011) prepared by the Planning & Development Division of Planning Commission of Government of Pakistan taking into account recommendations and suggestions from relevant federal and provincial agencies. The two national development plans include various sectors including water (with sub-sectors as flood, irrigation, drainage, ground-water, small dams etc.). Water Vision-2025 of WAPDA is presently being used for the above two plans in the area of water resources management whereas NFPP of FFC is used for development planning in the flood sector which now also accommodates Lai Nullah Study Area future requirements of development. Presently all the development in the flood control, improvement in Garbage disposal system, water supply & sanitation is being done by RDA through ADB funded project. Also the above two plans contain priorities for future water supply and irrigation requirements in Lai Nullah Case Study Area and this is coordinated by FFC as a policy matter for more integrated water resources management in the study area.

## 6.2 National/Provincial Policies Vs Stakeholders Participation:

The Draft National Water Policy clearly states the involvement of all the public as well as private stakeholders in all water sector issues besides decentralizing water service delivery, involving users in planning and management of water projects and encouraging stakeholders to contribute towards policy formulation. In the flood sector under Third National Flood Protection Plan (1998-2012), the concept of community participation for social mobilization, disaster preparedness and participation of related communities in project planning, siting, designing, implementation and post construction O & M is being implemented through the services of a local NGO at federal level and its interaction with provincial local government representatives through the coordinated role of FFC. By virtue of this a sense of ownership towards a particular flood control project will be promoted and the beneficiaries are expected to contribute in terms of labor, manpower & material etc.

## 6.3 Policy Changes in Response to Extreme Flood Events:

Upto the end of 1976, the relevant authorities in the Provincial Governments were responsible for the planning and execution of flood protection works. Disastrous floods of 1973 and 1976 resulted in heavy losses indicating that existing flood protection facilities and planning were inadequate to provide effective protective measures for the country. Heavy losses sustained to the economy resulted in the establishment of Federal Flood Commission which greatly helped in integrating the planning measures and their implementation at the national level and furnishing financial resources for the flood projects. A shift in the policy for federal funding, as a result of extreme flood events of 1973 & 1976, through Federal Flood Commission proved a vehicle for quick execution of flood management projects. Though, the Federal funding has provided impetus for flood management planning in Pakistan, the available financial resources have been gradually declining in terms of actual funding as well as in the real terms due to inflation.

In the Lai Nullah Study Area, flood management planning problem is prevailing for the last atleast 25 years. Unprecedented rains & consequent floods of July 2001 had resulted in colossal damages to property and human life. The main reason behind this catastrophe has been lack of coordination and confidence among various provincial and federal departments

earlier associated with Lai flood problem. After 2001 floods FFC was appointed as coordinating agency. FFC in a very short time has been able to: i) Prepare master plan for flood management of Lai Nullah, ii) identified two urgent projects (structural and non-structural) for immediate execution, iii) requested foreign donors through formal Concept Clearance documents for grants, iv) prepared Project Cost Estimates for the two urgent projects with the consensus of all the stakeholders of Islamabad, v) included Lai Nullah problem area in its National Plan.

### 6.4 IWRM is the Practical Approach:

The discussion under Serial No. 6.3 above very clearly manifests the applicability of Integrated Water Resource Management approach both at the national level as well as provincial and city level. Establishment of FFC had resulted in planning and implementation of NFPP based on IWRM while assigning the role of coordinating agency to FFC in the Lai Nullah area has resulted in pooling of all the resources/strategies for attaining IWRM at sub-national/city level.

## Chapter – 7

## LESSONS LEARNED

### 7. Implementation of Integrated Flood Management:

### 7.1 Main Lessons Derived and Can Be Applied:

This shall be given one by one:

(a) Formulation of National Flood Protection Plan:
As has also been briefly stated in preceding chapters, that prior to 1977, flood management and planning had been the responsibility of four provinces who use to plan structural and non-structural flood control measures based on their own provincial requirements. Floods of 1973 and 1976 had resulted in colossal damage to national economy and to provincial irrigation & flood control infrastructure. As a new strategy at par with other developed countries, Federal Government decided on nation-wide flood control planning & management though FFC. This strategy has proved extremely successful as so far two ten year each NFPPs have been implemented and further improved and integrated third NFPP is being implemented accordingly.

(b) River Reach-wise Planning & Implementation:
Prior to the present arrangements, flood management planning and implementation was being done on an hap-hazard way by the provinces based on their on priorities and without taking into account the impact(s) of certain structural flood management intervention upstream/downstream. A comprehensive improvement has been brought in by i) undertaking river-reach wise study of the entire river system of Pakistan fully catering for integrated relationship of proposed structural measures with upstream and downstream river areas. For example for Indus River feasibility studies for the entire reach has been carried out in phases (i.e., Chashma-Taunsa River Reach, Taunsa-Guddu River Reach, Guddu-Sukkur River Reach and Sukkur-Kotri River Reach). Based on the schemes identified in the feasibility study (of course which are feasible and having sound Economic Internal Rate of Return & Cost-Benefit Ratio) physical implementation is carried out. The present strategy has resulted in increased stability of structures based on sound engineering design and specifications.

(c) Model Testing of each Individual Flood Protection Scheme:
Past practice in implementation of flood works rarely involved prior confirmation of efficacy of a certain structure through model testing which had often resulted in repeated failures even at low flows and increased O&M costs. A mandatory requirement is now to undertake physical model testing of river structure in order to base its effectiveness in conditions of super flows. This approach is proving excellent in all the new flood works and has resulted in reduction of restoration costs.

(d) Battery of Spurs to Control Erosion:
As a measure to achieve IFM, instead of promoting riverside erosion through single spur provision, consideration is being given to the implementation of a series/battery of spurs to shift river meander and to reclaim additional cultural land besides saving valuable irrigation infrastructure and installations etc. This strategy is proving very effective in NWF Province and in Punjab.

(e) Control on Encroachments:
The experience of controlling encroachments in the Case study area and resettlement of encroachers can be adopted for the main river system as well as this will ultimately result in reducing loss of crops, human life as well as property. Concept of flood cess needs to be implemented as outlined in third NFPP.

(f) Inter-agency & Inter-provincial Coordination:
With FFC at the national level coordinating the overall flood control planning, implementation of structural & non-structural strategies, management etc. through various federal and provincial agencies, issue of lack of inter-agency coordination has been resolved to certain extent. However, this requires enhanced and strengthened role of FFC through its institutional and logistical up bringing.

(g) Improved Flood Forecasting & data Dissemination System:
After the super floods in nineties, which proved the inadequacy of flood forecasting and warning capability, some good non-structural interventions had been inducted into the system. These measures like: i) quantitative precipitation measurement weather radar system, ii) real time data collection & dissemination system, iii) river rainfall-runoff modeling for improved downstream forecasting, Zero Flood warning Manual, iv) updating of river discharge rating curves/weir formulae for some of the rivers, v) establishment of FFD, vi) overall coordination role of FFC has greatly resulted in implementing the concept of IFM. This concept is further promoted through extensions of above system, assigning country-wide monitoring role to FFC etc.

In the context of Lai Nullah, devastating flood episodes in the past had further stressed the need of a central coordinating body in order to control rural and urban flooding in the twin cities. Additionally earlier lack of coordination among RDA/TMA and CDA had kept the problem pending till 2001 without any concrete solution. Also PMD's deficient coverage of the area and confined rain recording capability has so far kept concerned apart. Change is now imminent due to assigning of overall coordination role to FFC.

### 7.2 Institutional and Legal Changes Required for IFM:
### Lai Nullah Case Study Area:

(a) Capacity Building: Judging form the technical capacity of the staffs of relevant agencies, the capacity building through i) development of key management capability, ii) financial and legal management capability, iii) planning & design management capability including environmental knowledge, iv) O&M and contract management capability and v) logistic support including public relation and coordination capability etc. is required.

(b) Land Use Control: Through Zoning Ordinance for specifying type and functions of structures that can be built around the study area with a view to minimize flood risk. Sanitary Ordinance to reduce the risk of health problems as a result of sewage disposal, groundwater infiltration into pipes etc. Building Ordinance to specify structural requirements of new building to reduce their vulnerability to flooding, reduce health and safety hazards to occupants and minimize the extent that the building could impede the flow of floodwaters.

(c) Legislation for Encroachment Removal: The existing Land Acquisition Act (LLA) needs to be improved for latest environmental guidelines, regulation of policy guidelines governing "resettlement" and "rehabilitation". Restoration of community and household productive assets, or standard or quality of life, is not covered by LLA besides no legal framework is available to pay compensation to informal settlers, encroachers or ill occupants. LLA needs to be revised to cover all above aspects.

(d) Strengthening of Organizational Set-up: For the river management/administration of Lai Nullah, there is a dire need of reactivation of Management Committee under Federal Water & Power Ministry with FFC, CDA, RDA, TMA, RCB & SDO as members with the following function:

(i) Providing support to manage financial arrangements for implementation of master plan;
(ii) General monitoring of progress of implementation of flood mitigation plan for Lai Nullah;

(iii) Coordination on issues beyond control of FFC's Task Force between Federal and Provincial agencies.

(e) Establishment of a Task Force: In order to cope with the implementation of Lai Nullah Urgent, Short-Term, Medium Term and Long-Term improvement measures, it is recommended to set up a Task Force with the following basic functions:

(i) Review and modifications in the master plan;
(ii) Financial arrangements for implementation of measures proposed in the master plan;
(iii) Land acquisition and house evacuation of the project components to each agency responsible;
(iv) Supervision and coordination for works; and
(v) Overall management and instruction for O&M works

**Country-wide Basis:**

(a) National Disaster Management Agency: In order to handle all the national disasters on country-wide basis, there is a requirement of National Disaster Management Agency which should work under the auspices of Federal Government National Disaster Management Committee having members from all related departments/agencies. This agency should have its provincial branches as Provincial Disaster Management Agencies to work under Provincial Disaster Management Committee with further bifurcation at the district levels as District Disaster Management Committees. This will ideally help in the implementation of disaster management approaches on an integrated basis.

(b) Land Use Control: Through Zoning Ordinance for specifying type and functions of structures that can be built around certain city/village with a view to minimize flood risk.

(c) Legislation for Encroachment Removal: In the context of overall IFM the existing Land Acquisition Act (LLA) needs to be improved for latest environmental guidelines, regulation of policy guidelines governing "resettlement" and "rehabilitation". Internationally prevailing regulations specifying removal of encroachers and their timely settlement must not be ignored as in the past, especially for River Indus in Lower Punjab Province, Sindh Province on certain nullahs in Punjab etc.

(d) River Management Law OR Water Law: There are many laws, acts and ordinances for land administration but less for the river management in Pakistan. As such when river system extends over two different jurisdiction areas, the river is administered by different land administrators, and thus consistent river basin administration is hardly achieved. In order to improve such unfavorable conditions, it is indispensable to enact the "River Management Law OR Water Law".

(e) Role of FFC: In view of active role of FFC being the central coordinating organization at the national level, it is important to enhance its in house capability through induction of staff in specialized fields besides converting it from Commission to Authority. There is a requirement of regular technical as well as financial monitoring to be carried out by FFC to ensure that limited available resources are spent of technically sound and economically viable integrated flood management measures.

(f) Community Participation in Flood Management Works: Flood works implemented in the past had been entirely without any involvement of the beneficiaries. In order to ensure effective O&M of an individual flood protection scheme after its construction, it is important to make it conditional that every flood works is undertaken through active participation of concerned community representative(s) and local government representatives.

(g) In built O & M Mechanism: Flood works implemented in the past were not being maintained in the past as well as presently due to lack of O&M funds by the provinces. In all new flood works, each Project Cost Estimate (PC-I) must include advance provision of O&M funds, at-least for initial three years, in the overall capital cost so that important flood works are maintained well in times of any flood emergency.

Fig-1

**Land Use Pattern - 2002**