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

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Abstract. Information is provided about the general approach and experience regarding flood management and mitigation in Pakistan, and in the Lai Nullah Basin in particular. An extraordinary flood event in the year 2001 marked the start of a shift towards the concept of integrated flood management with a view to effectively manage and mitigate flood and related problems, both on a national basis and on a river basin level. The paper discusses the countrywide approach, the various structural and non-structural measures in place and also those in the case study area. The relative importance and applicability of these measures are outlined and, for the case study area, an analysis of those being adopted or proposed for the future is made. Legal aspects of flood management regarding land use, flood warning, preparedness and response are briefly described. Mention is also made of emerging concepts of stakeholder participation. The study concludes with a detailed listing of "*lessons learnt*", which could be used for possible application in countries that intend to adopt an IFM approach

1. Location

The Lai Nullah Basin is located in the northern part of Pakistan, with a catchment area of 239.8 Km². It has a length of about 30 Km, stretching from the upper reaches which comprise the Federal Capital City Islamabad, at its north-western edge, to the lower reaches which hold the Rawalpindi District, Punjab Province, in its south-eastern edge. The Nai Nullah river has six mayor tributaries, three originating in the foothills of Islamabad in the higher plain area; it then flows down through the lower lying city of Rawalpindi, where another three tributaries join the river. The current land use in the Lai Nullah basin is 38.6 % of residential and 14.2 % of agricultural areas, 14.8 % of forest and the rest are grass and bare land surfaces.

2. Nature of floods

Floods in the Lai Nullah Basin occur during the monsoon season (July to September) when Pakistan receives rainfall from three types of weather systems, namely: (i) monsoon depressions from the Bay of Bengal, India (the most important system); (ii) westerly waves from the Mediterranean Sea; and (iii) seasonal lows from the Arabian Sea. This is superimposed by snowmelt for the Indus River.

In the Lai Nullah area a total of 19 floods occurred during the 59-year period from 1944 to 2002; thus, on average there were flood damages almost once every three years in the twin cities of Islamabad and Rawalpindi. In the latter, the low-lying areas along the Lai Nullah and its tributaries are affected by even small floods.

Extreme flood years were 1981, 1988, 1997 and 2001, the latter having been the largest among the recorded events (considered as a national disaster). The intensity and amount of rainfall caused the water level of Lai Nullah and its tributaries to rise remarkably and flooding Rawalpindi (where the damages were several times larger than in Islamabad). A total of 74 human lives were lost, about 400,000 people were affected, 742 cattle head perished, 1,087 houses were completely and 2,448 partially damaged. Estimates indicate a damage/loss of more than USD 0.25 billion to infrastructure, Government and private property.

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

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3. Flood management and mitigation measures

Pakistan has one of the world's largest irrigation and canal networks, and the Indus River basin is among the world's largest systems. In view of this, the country-wide flood management planning is geared to essentially achieve: i) reduction of flood losses in an economically sound manner; ii) prioritizing areas of greater economic hazards; iii) protecting the cities and vital infrastructures; 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 riverine areas.

In order to implement the above, structural as well as non-structural flood management measures are in place. The first include embankments, dykes, spurs, bunds and water diversion structures constructed on main and tributary rivers. These are mainly geared to provide: (i) safety to major irrigation infrastructures, as well as to local community living close to the riverine areas; (ii) more land reclamation for enhanced agricultural practices; (iii) effective utilization of available water resources; and (iv) to keep the river system within the main river meandering belt. After the extreme floods of 1992, efforts have been made to follow an integrated flood management approach by undertaking implementation of over 250 flood-protection schemes on five major rivers in Pakistan after a detailed feasibility study.

The non-structural measures include a comprehensive flood forecasting and warning system with three weather radars, a high-frequency radio communication system at 19 barrages and major reservoirs for effective river inflow/outflow data reception and dissemination, besides inter-provincial and inter-agency coordination at the federal and provincial level.

As regards specifically the Lai Nullah basin a number of strategies have been considered for the city of Rawalpindi after the flood of 2001. These comprise: (i) straightening and widening of some of the reaches of Lai Nullah passing through congested city areas; (ii) stone pitching of some of the existing portions of the river in order to prevent erosion and danger of collapse of buildings standing close to the river; (iii) prevention of garbage disposal into the river in order to avoid blocking of water flow at bridge piers; (iv) increasing the heights of some of the road bridges built a long time ago on the river; and (v) removal of encroachments. However, these improvements need to be integrated with measures for Islamabad. In this context, the implementation of two urgent projects has been suggested: (i) the provision of a flood retardation basin in Islamabad as a structural measure, in order to cater for extreme floods and to reduce flood peaks at initial stages, with a view to ensure secure flow in the Lai Nullah downstream in Rawalpindi; (ii) the establishment of an effective flood forecasting and flood warning system for Islamabad-Rawalpindi. Some medium and long term measures are also being proposed which include provision of a long channel to divert flow of Lai Nullah upstream in Islamabad to a downstream tributary river, so that high floods are diverted thus protecting downstream areas on a permanent basis.

With respect to flood forecasting and warning **f**or the Lai Nullah, currently basin storm rainfall is monitored through four existing rainfall stations and one weather surveillance radar in Islamabad. The existing stations are, however, not equipped with automatic data transmission systems for the collection of data on a real time basis. Two manual (off-line) water level gauging stations also existed to monitor flood water level of the Lai Nullah river (currently abandoned due to reconstruction of the bridges on which they were installed after the2001 floods). There is need for an effective forecasting and warning system for the basin.

4. Flood and water management instruments

Disaster management in Pakistan basically evolves around flood disasters, with a primary focus on rescue and relief. The existing institutional structures responsible for disaster management are geared to reactive short-term responses. There exists legislation and a variety of governmental and NGOs that address some critical aspects of preparedness, mitigation, early warning and response to natural and human induced disasters.

As regards land-use, the four provinces of Pakistan are the managers of their respective catchments and flood plains of the Indus river system, and the present land-use policy in operation is that river catchments and flood plains are to be kept as no-go area for the riverine community. There is also legislation that prohibits development of illegal dwellings/encroachments in the floodplain/river catchment areas.

With respect to flood warning and in line with the *National Flood Protection Plan* (NFPP), the *Pakistan Meteorological Department* (PMD) is currently entrusted with the task of flood warning in order to ensure effective flood management. In this context PMDs *Flood Forecasting Department* (FFD) is responsible for the dissemination of the flood forecasts/warnings to a considerable large number of recipients, directly or indirectly concerned with the flood mitigation process.

As regards flood preparedness and response, presently both at the federal as well as at provincial level 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.

Since 1977 up to now an approximate sum of USD 0.65 billion (including foreign loans) have been spent on construction of flood protection works, restoration of rain/flood affected irrigation and flood control schemes, besides reasonable improvements in the flood forecasting capability. In the context of the Lai Nullah integrated flood management, recently an investment of USD 7 million has been made.

In the context of integrated flood management in Pakistan, state owned agencies (concerned federal and provincial departments) had the overall control over resources meant for ensuring IFM. Nevertheless, this trend has now changed and funds are being spent on implementation of disaster/flood control strategies based on an integrated river reach basis. Very recently, women and men have got an access and control over the resources through the induction of social mobilization and a community participation approach in the overall flood management strategy of the country.

Government is allocating lands to farmers in areas other than riverbed to discourage the encroachment trend. In Lai Nullah area strict laws and penalties have been introduced for the land encroachers, and for garbage dumping. More than 2000 encroachments have been removed from the vicinity of the Lai Nullah by paying market prices. At the same time a comprehensive resettlement plan has been prepared to avoid any civic and social problem.

5. Institutions responsible for flood management

Flood management is a multifunctional process involving different organizations. The Government Organizations which country wide play a major role in the flood management are *Provincial Irrigation & Power Departments* (PIDs), having a front line role in the process of flood forecasting as well as flood mitigation; the *Water & Power Development Authority* (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 the Indus and Jhelum rivers; the *Provincial Relief Organizations/Departments* are charged with the responsibility pertaining to disaster preparedness,

emergency response, and post disaster activities relating to all disasters including floods; the *Pakistan Army* flood related functions encompass all the three phases of flood operations from the pre-flood, during the flood event and post flood phases; the *Pakistan Commissioner for Indus Waters (PCIW)* is a regulatory body established to get river flow and rain data from India required for flood forecasting in Pakistan; the main role of the *Emergency Relief Cell* (ERC) is related to planning and assessment of relief requirements of major disasters; the *Federal Flood Commission* (FFC) has among its main responsibilities: the preparation of the abovementioned NFPP, the approval of flood control schemes prepared by Provincial Governments and concerned federal agencies, and measures for improvements regarding the flood forecasting and warning system on country-wide basis; and the *Flood Forecasting Division* (FFD) of the already mentioned PMD plays a pivotal role in the flood warning and management process.

The establishment of the FFC greatly helped in integrating the planning measures at the national level and furnishing financial resources for the flood projects. Federal funding through the FFC proved a vehicle for quick execution of flood management projects.

As regards specifically the management and/or administration of the Lai Nullah area, besides involvement of some of the above, there are a number of other agencies that have a role in the this area, namely: the *Capital Development Authority* (CDA), responsible for master planning of Islamabad; the *Small Dams Organization* (SDO) is responsible for maintenance of Rawal Dam, of the main sources for water supply in the twin cities; the *Rawalpindi Development Authority* (RDA) deals with surface drainage or flood mitigation projects; the *Tehsil Municipal Administration* (TMA) is responsible for the execution and management of development plans, the enforcement of all municipal laws and rules, and the prevention of encroachments. Finally, after the 2001 flood it was decided that the joint flood management problem of Islamabad and Rawalpindi should be tackled by the FFC through medium and long term planning and implementation of measures. FFC was assigned the task to act as a coordinating agency between the 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 build a consensus among the stakeholders on implementing the two urgent nature projects mentioned above.

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, the Federal Government is experimenting involvement of NGO groups in mobilizing the community so that they have a sense of ownership after its completion and thus feel responsibility towards its maintenance.

6. Policy

A draft of the National Water Policy has been issued in January 2002 and is due to be finalized soon through its approval by the Government for adoption. Amongst others, it clearly states the involvement of all the public as well as private stakeholders in water sector issues, involving users in planning and management of water projects and encouraging stakeholders to contribute towards policy formulation. In the Third NFPP (1998-2012), the concept of community participation in all aspects of flood control is also clearly spelt out.

The updated national development strategies in Pakistan are formulated through: (i) the Three Years Rolling Plan (2001-2004), and (ii) the Ten Year Perspective Plan (2001-2011), both prepared taking into account recommendations and suggestions from relevant federal and provincial agencies. The two national development plans cover various sectors including water (with sub-sectors as flood, irrigation, drainage, ground-water, small dams etc.). The Water Vision-2025 of WAPDA is presently being used for the above two plans in the area of water resources management, whereas the NFPP of FFC is used for development planning regarding the flood issues.

7. Main lessons learned

- The case study includes a long list of lessons learned, both at country as well as at the Lai Nullah basin level, which are geared to fully adopt the new concept of an IFM approach.

- In summary, the study shows clearly the applicability of an IFM approach both at the national, as well as provincial and city levels. The establishment of the FFC has resulted in planning and implementation of the NFPP based on integrated water resources management. Assigning the role of coordinating agency to FFC in the Lai Nullah area has resulted in pooling of all the resources/strategies for attaining IFM at sub-national/city level.