

FLOOD MANAGEMENT

K. RAMAMOHAN REDDY

Centre for Water Resources, J.N. Technological University, Hyderabad, Andhra Pradesh

P. JAYARAMI REDDY

G. Pulla Reddy Engineering College, Kurnool, Andhra Pradesh

P. SREENIVASULU

ADIS-ABABA State University, Ethiopia

Abstract *Flood management is relatively new subject of interest in developing countries though it has become old in developed countries. It is possible to mitigate the flood through sound management practice leading to minimization of human and material loss and maximization of storage of water both under ground and over ground. New fundamentals and innovative measures of effective flood management are presented. Recommendations of federal interagency floodplain management review committee of USA to manage the nation's floodplains are summarised. Flood management strategies to be adopted in developing countries are also suggested.*

INTRODUCTION

For decades our nation has labored to reduce the impact of floods, yet the toll in lives lost, home damaged and property destroyed is enormous. Why has this happened? What causes the floods? Has human intervention over time exacerbated the situation? What should the nation be doing to prevent a repetition?

Controlling all floods is impossible, but working with them is not. The difference between these two concepts is vital and may be the key to the development of flood policy in future everywhere in the world. The goal of flood control is to eliminate floods by building structures such as levees and dams. The underlying assumption is that once the structure has been built the problem has been handled; maintenance and monitoring become low priority concerns. In contrast the goal of flood management is to reduce the hazard to lives and property by the most cost effective measure, recognizing that not all floods can be eliminated. The underlying assumption is to commit to long term management of all factors that affect flood risk. This requires a management system that includes objectives, accountability, monitoring and the ability to change policy in light of new information.

When a region relies exclusively on flood control structures instead of using them as one of many possible components of a flood management strategy, there is a tendency to believe that the flood danger has been eliminated and to disregard other risk management methods such as elevating structures. This can result in increased damage when flooding occurs, because the property at risk is now more valuable and the increased damages can outweigh by the benefit of less frequent flooding afforded by the project. For example, the monarch-chesterfield levee was Federal Emergency Management Agency (FEMA) approved structure that was up-graded in the early 1980s to provide protection against the estimated 100 years flood. Believing that the area was now floodproof, the town of

Chesterfield had encouraged high-value development in what inevitably was still a flood-prone area. When flooding occurred, the damages were significantly higher than they would have been if the levee had never been built. Further, natural flooding tends to be gradual and predictable, whereas when a levee fails or flood control reservoir spills uncontrollably, the effect is catastrophic. A 1987 FEMA study estimated that about one-third of U.S. flood disasters are caused by levee overtopping or failure.

The goal of flood management is to alleviate existing and future hazards to lives and property in the most cost-effective ways. This can be accomplished through structures or other means such as zoning, floodproofing, floodwarning and financial incentives.

Over the past 60 years, acceptance of these ideas has grown, leading to new national policy initiatives. In 1973, for example the U.S. began a flood insurance programme that shifted the burden of disaster relief from the federal tax payer to those who occupy floodprone lands and it encouraged local governments to adopt non-structural flood management strategies. The inherent conflict between flood control and flood management has not yet been resolved. The language of flood management has been adopted by most government agencies. But flood control is still the dominant paradigm for many politicians, engineers and the public.

FOCUS ON NEW FUNDAMENTALS

The concrete flood control channel of Corte Modera Creek in Marin country, California designed for the 200 years flood, overtopped its banks in 1982 and 1986, while conveying less than the 15 years flow. A subsequent corps review determined that the transport of bed-load sediment had a significant adverse effect on flood hydraulics. Throughout the U.S. and around the world, concrete flood control channels have been constructed using clear water flow assumptions. Channels that will carry large amounts of bed load during their design flood will now require reevaluation. The 1980 flood in the Los Angeles river showed that designed flows had been underestimated by at least 30%, due to urbanization of the watershed portions. The largest concrete flood-control channels are now estimated to have only 25 year flood capacity. Half a million people live in the 100 years flood plain and a \$340 million reconstruction project is being considered by corps.

These experiences have turned attention back to the hydrologic benefits of restoring flood plains, which can be achieved by relocating flood-prone property and removing or setting back levees. However, there are significant institutional and technical barriers to implementing these ideas. Institutional barriers exist because no single federal agency has a mandate for flood management i.e., equivalent to the corp's clear mission to provide flood control. Technical barriers exist because current flood control methods do not recognize the benefits of watershed management or floodplain storage. For example HEC-2, the program used by almost all agencies for computing flood crests, is a steady state model that does not take into account the dynamic storage effect of floodplains on reducing flood peaks. Consequently it offers little incentive to protect or restore floodplains.

INNOVATIVE MEASURES

The same issues confronting the U.S are also being debated in Europe, where there is belated but growing recognition that flood control can conflict with flood management.

German and French flood control agencies are retrofitting massive Rhine river (Europe) embankments with siphons to divert some of the flood peak into gravel pits behind the embankments. This attempt to create artificial floodplain storage is criticised by some river managers who argue that the same benefits could be achieved with substantive environmental improvements by restoring the remaining portions of the rivers natural floodplain.

Over the last 40 years, Chinese river engineers have reduced these flood hazards by developing a sophisticated flood management system of embankments, overflow weirs, diversion areas and floodplain lades. In Bangladesh, rural population build their villages on raised mounds and plants fast growing rice that keeps pace with rising floodwaters. The idea of flood control is comparatively recent here and was originated by a U.S. Agency for International Development (AID) study. Cyclone flooding measures only receive about 2% of the flood action plan's budget, possibly because large-scale structural flood control works are in feasible and implementation of effective measures such as warning systems, refugees and disaster relief systems are of secondary importance of flood control as opposed to flood management strategies. It appears that most of the countries in the world are finally ready to give up the vanity of attempting to control floods and instead concentrate on how we can best live with them and manage our rivers wisely.

NEW DIRECTIONS IN FLOODPLAIN MANAGEMENT

In 1993, Mid Western United states faced a severe flood and caused hazard to lives and property. In January 1994, the Clinton administration chartered an interagency Floodplain Management Review Committee to reduce the hazard due to floods. The review committee, a group of 31 professional assigned to various federal agencies with responsibilities in the water resources arena, worked with the offices of the governors of the nine flood affected states, met with state and local officials and visited over 60 communities. It also made extensive contacts with federal agencies, interest groups and numerous private citizens who expressed and interest in the flood and its impacts. A part of the review committee, the Scientific Assessment and Strategy Team (SAST) chartered in November 1993 by the White House, conducted its activities at the EROS Data centre in Siousx Falls, South Dakota. There it developed a major database of flood and general basin information and analysed the data. In late June 1994, the committee submitted its report to the White House. In October SAST submitted its recommendations for improved scientific activities connected with effective floodplain management.

COMMITTEE RECOMMENDATIONS

The review committee gave following recommendations in consonance with proposed goals.

- To ensure that the floodplain management effort is organized for success, the president should:
 - Propose enactment of floodplain management Act which establishes a national model for floodplain management, clearly delineates federal, state, tribal and local responsibilities, provides fiscal support for state and local floodplain management activities and recognizes states as the nation's principal flood plain managers.

- Issue a revised executive order clearly defining the responsibilities of federal agencies to exercise sound judgement in floodplain activities and activate the Water Resources council to coordinate federal and federal-state-tribal activities in water resources.
- To ensure continuing state, tribal and local interest in floodplain management success, the administration should provide for federal, state, tribal and/or local cost-sharing in pre-disaster, recovery, response and mitigation activities.
- To provide for coordination of the multiple federal programs dealing with watershed management, the administration should establish an interagency Task Force to develop a coordination strategy to guide these actions.
- To seek legislative authority to increase post disaster flexibility in the execution of the land acquisition programs, the administration should fund, through existing authorities, programmatic acquisition of needed lands from willing sellers.
- To enhance the efficiency and effectiveness of the National Flood Insurance Programme, the administration should take vigorous steps to improve the marketing of flood insurance, enforce lender compliance rules and seek state support of insurance, enforce lender compliance rules and seek state support of insurance marketing.
- To reduce the vulnerability to flood damages of those in the floodplain, the administration should give full consideration to all possible alternatives for vulnerability reduction, including permanent evacuation of flood prone areas, flood warning, flood proofing of structures remaining in the floodplain, creation of additional natural and artificial storage and adequately sized and maintained levees and other structures. To adopt flood damage reduction guidelines based on revised principles and guidelines which would give full weight to social, economic and environment values and assure that vulnerability reduction alternatives are given equal consideration.
- To ensure that existing federally constructed water resource projects continue to meet their intended purposes and periodic review of completed projects.
- To provide for efficiency in operations and for consistency of standards, the administration should assign principal responsibility for repair, rehabilitation and construction of levees.
- To provide integrated, hydrologic, hydraulic and ecosystems management of the river basins.
- To provide timely gathering and dissemination of the critical water resources information needed for floodplain management and disaster operations.
- Exploit science and technology to support monitoring analysis, modelling and the development of decision support systems and geographic information systems for floodplain activities.

MANAGEMENT STRATEGIES IN DEVELOPING COUNTRIES

- Floods are causing havoc in the economy of third world developing countries. This threat of floods should be converted in to an opportunity to improve standards of

living of the people living in these countries. The following few recommendations can be examined.

- National Flood Management Corporations should be created with autonomous status endowed with a few legislative powers and answerable to only national government and parliament. Flood awareness programs should be undertaken.
- Study teams permanently be established individually for each of the rivers. The specific terms of reference to these study teams must be decided by a national technical coordination committee working directly under the chairman of the corporation.

The terms can be status of the river before floods all along its course from the origin to the point where it joins the delta, demarcation of the floodplain areas, finding the ideal location for percolation tanks, identifying the sites for new storage tanks, creating fish culture lake, underground storage reservoirs, undertaking construction of check dams in the catchment areas and contour bunding etc.

- Revising the reservoir operational policies of reservoirs lying in flood prone rivers.
- Initiating steps to introducing flood insurance schemes for the people living in medium risk and low risk areas. While acquiring land where flood risk is very high. This demands legislative powers in the hands of the corporation. The corporation must properly recommend to the parliament, necessary changes to be brought in for acquiring land which is subjected to high risk floods.
- Installing flood warning information systems at cardinal points along the river. National information centers should be hooked up with international information satellite systems for acquiring information on possible floods at least 48 to 72 hours in advance. Proper data base on loss of men and material, levels of flood, areas submerged etc.
- Examining the possibility of increasing the flood storage capacity of the existing reservoirs and creating many number of small and medium reservoirs to store flood waters and use the water resources for irrigation, municipal use, water sports, creating navigation transport systems for reducing the pressure on road and rail systems etc.
- Undertake land erosion control measures and wherever possible sediment load collection, its disposal for profitable purpose and analysing the sediment loads for establishing the possible mineral deposits.
- Establishing pumping stations with pipe network for transporting floodwaters to water deficit areas for improving the soil moisture conditions in those areas.
- Restoration to pre-flood status pipe network for transporting floodwaters to water deficit areas for improving the soil moisture conditions in those areas.
- In every country we find rivers, tanks, depression storages with its green cover and forests but human civilization in 20th century destroyed this balance through industrialisation and urbanisation. If one goes through the enumerated list of tanks and compare it with the existing status we find to our surprise the number of existing tanks is no where when compared to the figures in pre-industrialised period. This has caused recurring of floods with magnitudes higher than previous floods. This has to be studied and measures initiated to re-establish necessary

number of lakes and pondages which would not only reduce the floods but also improve the economy due to higher aeraage coming under irrigation.

- Simultaneously the measures against water logging and environmental hazards should be initiated.
- Flood management using remote sensing technology, which is already practiced in Punjab (India). It provides basic information in space, time and frequency domains which is very useful in providing permanent records by mapping, monitoring and managing flood dynamics.
- Estimation of flood losses, the objective determination of flood losses is of greatest importance for correct selection of the strategy of controlling these natural disasters. An accurate estimation of both actual and possible losses enables selecting the optional variant of measures both on prevention and eliminating damages and losses caused by floods.
- Integrated Flood Management system (IFM) is to be developed incorporating the recent advances in computational hydraulics, computer graphics and data handling. It has five major components: engineering calculations, graphics, database, goodness-of-fit, statistical methods and a cost optimisation component.

CONCLUSIONS

We need to learn to manage the floods rather than arrest the floods. Arresting a flood is very costly when compared to management of floods. The expenditure involved is negligible when compared to losses that accrue to the state exchequer because of the floods. Managing a flood even to the extent of 30-40% will lead to significant monetary achievements and thus help in improving the national economy.

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