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FLOOD MANAGEMENT IN INDIA

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Abstract: In this paper, flood problems in India, regional variability of the problem, present status of the ongoing management measures, their effectiveness and future needs in flood management are covered. Flood problems in India are presented by four zones of flooding, viz. (a) Brahmaputra River Basin, (b) Ganga River Basin, (c) North-West Rivers Basin, and (d) Central India and Deccan Rivers Basin. Some special problems, related to floods like dam break flow, and water logging in Tal areas, are also mentioned. Progress of various flood management measures, both structural and non-structural, are discussed. In addition, future needs to achieve efficient and successful flood management measures in India are also pointed out.

INTRODUCTION

In June and July 2017, many States across India were affected due to floods. The major affected States include Gujarat, Rajasthan, West Bengal, Odisha and Assam among others. As per an estimate, there were at least 650 deaths since 1 June due to rain-related causes. Besides the toll on humans, the recent floods caused considerable damage to animal life, infrastructure and the environment. It is against this backdrop, it is pertinent to understand the causes of recurrent floods, their impact on social and economic life and the necessary steps to mitigate the impact as well as to avoid their recurrence.

India is highly vulnerable to floods. Out of the total geographical area of 329 million hectares (mha), more than 40 mha is flood prone. Floods are a recurrent phenomenon, which cause huge loss of lives and damage to livelihood systems, property, infrastructure and public utilities. It is a cause for concern that flood related damages show an increasing trend. The average annual flood damage in the last 10 years period from 1996 to 2005 was Rs. 4745 crore as compared to Rs. 1805 crore, the corresponding average for the previous 53 years. This can be attributed to many reasons including a steep increase in population, rapid urbanization growing developmental and economic activities in flood

Plains coupled with global warming.

An average every year, 75 lakh hectares of land is affected, 1600 lives are lost and the damage caused to crops, houses and public utilities is Rs.1805 crores due to floods. The maximum number of lives (11,316) was lost in the year 1977. The frequency of major floods is more than once in five years.

Floods have also occurred in areas, which were earlier not considered flood prone. An effort has been made in these Guidelines to cover the entire gamut of Flood Management. Eighty per cent of the precipitation takes place in the monsoon months from June to September. The rivers bring heavy sediment load from catchments. These, coupled with inadequate carrying capacity of rivers are responsible for causing floods, drainage congestion and erosion of river-banks. Cyclones, cyclonic circulations and cloud bursts cause flash floods and lead to huge losses. It is a fact that some of the rivers causing damage in India originate in neighbouring countries; adding another complex dimension to the problem. Continuing and large-scale loss of lives and damage to public and private property due to floods indicate that we are still to develop an effective response to floods. NDMA's Executive Summary Guidelines have been prepared to enable the various implementing and stakeholder agencies to effectively address the critical areas for minimising flood damage.

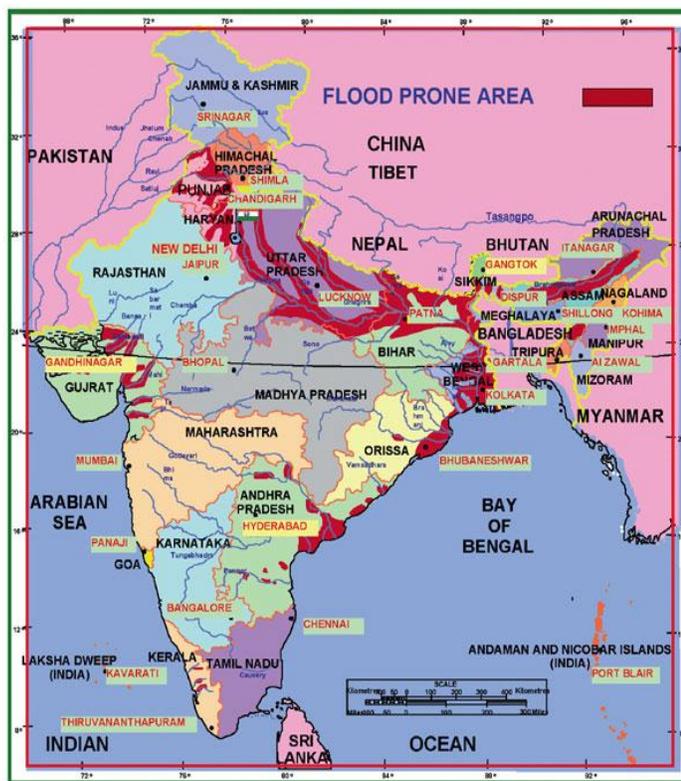


Figure1: Flood prone area in India (Source: Google Images)

Major causes of floods in India include inadequate capacity within riverbanks to contain high flows, riverbank erosion and silting of riverbeds. In addition, other factors are; landslides leading to obstruction of flow and change in the river course, retardation of flow due to tidal and backwater effects, poor natural drainage in the flood prone area, cyclone and associated heavy rainstorm/cloud bursts, snowmelt and glacial outbursts, and dam break flow.

OBJECTIVES OF STUDY:

Main objectives of this paper are to present:

- (1) Flood problems in India,
- (2) Progress of on-going flood management measures, and,
- (3) Future needs in flood management.

RESEARCH METHODOLOGY:

The present study focused on the environmental and health status analysis due to climate change. As environmental analysis is the study of air, land and water, the impact of climate change on these are important. As regards the methodology, the tools and technique employed has been determined in consonance with the set objectives. During the course of the study both the descriptive and analytical

technique have been used. To achieve of the study on the other hand, the significant part of the study is based on the secondary data obtained from the official websites and other websites. The data is also attained from research papers, articles and newspapers.

Flood Problems in India:

The CAG’s latest performance audit of flood control schemes and flood forecasting shows how little is done to manage flood-induced disasters of India’s total geographical area of 329 million hectares, about 45.64 million hectares are stated to be flood-prone, according to estimates in 1980. The Working Group for the Flood Management Programme for the 11th Five Year Plan (December 2006) estimated that, on average, 7.55 million hectares get affected, 1,560 lives are lost and damage worth Rs 1805 crore caused due to floods every year. Yet, if we look at the latest performance audit of flood control schemes and flood forecasting by the Comptroller and Auditor General of India, it seems precious little is done about managing flood-induced disasters. The report was tabled in parliament on July 22, even as some states started to report devastating floods.

Scientific assessment: Non-existent

In October 2010, the Working Group on Flood Management and Region Specific Issues had sought a review of the flood-affected areas of respective states. In July 2012, the Ministry of Water Resources (MoWR) constituted an expert committee for scientific assessment of flood-prone areas in India. As of August 2016, three meetings of this expert committee had taken place (August 2012, June 2013 and September 2015). In the second meeting, a recommendation was made to constitute regional committees for each state. It was expected that these regional committees would “identify, demarcate and classify Flood Prone Areas based on the prescribed methodology, classification and criteria.” While such regional committees have been constituted in all states and Union Territories, very few states have taken up assessment earnestly. The CAG noticed during the performance audit of schemes for flood control and flood forecasting (Report No. 10 of 2017) that “till July 2016, of the 17 states covered in the audit, only six states – namely Bihar, Haryana, Kerala, Odisha, Punjab and West Bengal – had taken up scientific assessment of Flood Prone Areas.” In the remaining 11 states that were covered in the audit, regional committees had not taken up the assessment. These states are Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Manipur, Puducherry, Sikkim, Tamil Nadu, Uttar Pradesh and Uttarakhand. Audit scrutiny also revealed that in Arunachal Pradesh, Madhya Pradesh and Uttar Pradesh, not a single meeting of the regional committees had taken place as of February 2016! As per the timeline decided in the third

meeting of the central committee, by February 28, 2016, regional committees were supposed to submit preliminary/interim reports on their assessment.

Flood damage statistics: Non-existent

The CAG's performance audit of flood control and flood forecasting (Report No 10 of 2017) has criticised the Central Water Commission (CWC) for its failure to comply with recommendations of the National Flood Commission (1980). Audit scrutiny revealed that "the CWC had not compiled data related to flood damages after 2003 in the manner as recommended by National Flood Commission." The latter had desired that detailed figures of flood damages should be collected under the following heads:

A: Floods (i) unprotected areas flooded (ii) protected areas flooded due to failure of protection works and (iii) areas between the embankment and the river which are left unprotected.

B: Drainage Congestion (i) in unprotected areas (ii) behind embankments

C: The extent of area affected by drainage congestion should be compiled separately for protected and unprotected areas.

Flood forecasting: Inadequate

Uptil 2006-07, the CWC had established 175 flood forecasting stations and the number remained stagnant until 2014-15. At present, the CWC's network of 184 stations caters to 19 states and two UTs. It has failed to establish a single station in Goa, Himachal Pradesh, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Rajasthan and Sikkim as well as in the Andaman & Nicobar Islands, Chandigarh, Daman and Diu, Lakshadweep and Puducherry.

While the Plan envisaged installation of 219 telemetry stations, 310 base stations and 100 flood forecasting stations, only 56 telemetry stations had been installed as of August 2016. Out of 375 telemetry stations in the country, audit scrutiny found that 222 were non-functional after installation. Most of the telemetry stations installed during the 11th Plan were non-functional due to which real-time data was unavailable. The CAG auditors also pointed out that there was an insufficient number of flood forecasting stations and rain gauge stations to meet realistic flood forecasting requirements in Jammu and Kashmir and the Lower Brahmaputra division in West Bengal.

While J&K has four rivers prone to floods every year, the state accounts for only one flood forecasting station (at Rammunshi Bagh on the Jhelum) which was established in 2015 following the devastating floods in September 2014. The Working Group

on Flood Management (2014-15) had strongly recommended undertaking a comprehensive study of floods in J&K within six months and directed the CWC to initiate urgent steps to set up a central flood forecasting mechanism with 19 additional modernised stations. However, two years on, only seven sites (level forecasting stations) were established, and no automatic telemetry equipment was installed.

Rehabilitation of natural drainage system: Not done

The parliamentary standing committee on water resources stated in its 21st report (February 2014) that the Ministry / CWC should in consultation with all the basin states chalk out a time-bound implementable programme of action to identify drainage systems needing immediate rehabilitation and adopt all measures necessary for repair and restoration. The CAG auditors observed that the CWC had not taken any action to identify drainage systems needing immediate rehabilitation. Out of 17 states selected for audit, they found that only Tamil Nadu and Odisha had prepared measures for rehabilitation of natural drainage systems.

Only 7% of big dams have Emergency Action Plans

The CAG auditors found that as of March 2016, out of 4,862 large dams, Emergency Action Plans were prepared for only 349 (i.e. a mere 7%). What is even more shocking is the revelation that a whopping 95% of our large dams are maintained without operating procedures / manuals! While it is important for dam authorities to carry out pre- and post-monsoon inspection of all these large dams, the CAG auditors noticed that out of the 17 selected states, only two carried out such inspections; three had carried out inspections partially and the remaining 12 had not even bothered to give inspections a thought.

Flood Prone States in India:

River floodplains and coastal areas are the most susceptible to flooding, however, it is possible for flooding to occur in areas with unusually long periods of heavy rainfall. The major flood prone regions in India are Punjab, Haryana, most of the Gangetic plains including Uttar Pradesh, North Bihar and West Bengal, the Brahmaputra valley, coastal Andhra Pradesh and Orissa, and southern Gujarat.

Which is the most flood prone state in India?

Though the north Indian plains are more vulnerable to floods than the southern ones, the flood-prone areas in the country can be broadly classified into three divisions – the Ganga Basin, the Brahmaputra and Barak Basins and the Central Indian and Deccan Rivers Basins. A brief description of these follows:

Ganga Basin: The Ganga Basin gets flooded mostly in the northern part by the northern tributaries of the Ganga River. The badly affected states of the Ganga basin are West Bengal, Bihar and Uttar Pradesh. Besides the Ganga, rivers like Sarada, Rapti, Gandak and Ghagra causes flood in eastern part of Uttar Pradesh. The Yamuna is famous for flooding Haryana and Delhi. Bihar experiences massive dangerous flood every year. River Burhi, Bagmati, Gandak, Kamla along with many small rivers contribute to floods in Bihar. In West Bengal, rivers like Mahananda, Bhagirathi, Damodar, Ajay etc. cause floods because of tidal effects and constricted river channels.

Brahmaputra and Barak Basins: The banks of the Brahmaputra and Barak Rivers get flooded due to the Surplus water in the Brahmaputra basin and the Barak basin. These rivers, along with their tributaries, flood the northeastern states like West Bengal, Assam and Sikkim. The Jaldakha, Teesta and Torsa Rivers often overflow their banks and cause flooding in northern West Bengal, Manipur and Sikkim.

Central India and Deccan Rivers Basin: In Orissa, the deltaic area formed by the Mahanadi, Baitarni and Brahmani Rivers is thickly populated. Quite often these rivers overflow their banks, causing destruction in the area. Southern and central India observes floods caused by the rivers Narmada, Godavari, Tapti, Krishna and Mahanadi due to heavy rainfall. Cyclonic storms in the deltaic regions of Godavari, Mahanadi and Krishna occasionally flood the coastal regions of Andhra Pradesh, Orissa and Tamil Nadu.

From this understanding, it may be concluded that Bihar is India's most flood-prone State, with 76% of the population in the North Bihar living under the recurring threat of flood devastation. According to some historical data, 16.5% of the total flood affected area in India is located in Bihar while 22.1% of the flood affected population in India lives in Bihar. Apart from Bihar, the badly affected states of the Ganga basin are West Bengal and Uttar Pradesh. Besides the Ganga, rivers like Sarada, Rapti, Gandak and Ghagra causes flood in eastern part of Uttar Pradesh. The Yamuna is famous for flooding Haryana and Delhi. Bihar experiences massive dangerous flood every year.

Cyclones invariably bring with them devastating floods. 13 coastal states and Union Territories in the country are affected by tropical cyclones (TCs) and associated floods. Four states – West Bengal, Andhra Pradesh, Odisha, Tamil Nadu – and one UT (Puducherry) on the east coast, and Gujarat on the west coast are more vulnerable to the TCs.



State (million ha)	Area liable to floods
Uttar Pradesh	7.34
Bihar	4.26
Punjab	3.70
Rajasthan	3.26
Assam	3.15
West Bengal	2.65
Haryana	2.35
Orissa	1.40
Andhra Pradesh	1.39
Gujarat	1.39

Existing Flood Management Mechanism in India:

In India, a two tier system of flood management exists as briefly described below:

State Level Mechanism - The State Level Mechanism includes the Water Resources Departments, State Technical Advisory Committee and Flood Control Board. In some States, the Irrigation Departments and Public Works Departments look after flood matters.

Central Government Mechanism – The Union Government has set up following organizations and various expert committees to enable the State Governments in addressing flood problems in a comprehensive manner:

Central Water Commission (CWC) – The Government of India set up Central Water Commission as presently named in 1945 for achieving the goal of furthering and promoting measures of flood control, conservation and utilization of water resources through out the country in the areas of beneficial uses, irrigation and hydropower generation, flood management and river conservation. As a national apex engineering organisation in the field of water resources development, the CWC with its vast experience gained in its strides towards progress in more than six decades, has developed considerable know-how in planning, investigation, management and design of water resources development schemes and made valuable contribution in the country's remarkable progress in this field besides sharing the expertise with developing nations of the world.

Brahmaputra Board – The Government of India set up Brahmaputra Board under Brahmaputra Board Act, 1980 (46 of 1980) under the then Ministry of Irrigation (now Ministry of Water Resources) The jurisdiction of Brahmaputra Board includes all NE States in Brahmaputra and Barak Basin. The main functions of Brahmaputra Board are as under:

- Survey and investigations in Brahmaputra and Barak valley.
- Preparation of master plans to control floods, bank erosion, and improvement of drainage system.
- Preparation of DPRs for dams and other projects
- Standard specifications for construction operation and maintenance of dams.
- Construction of multipurpose dams and maintenance thereof.
- Any other function for implementation of Brahmaputra Board Act-1980.

Brahmaputra Board prepared master plans for the flood management for river Brahmaputra and Barak. Besides this, the Board has undertaken survey and investigations for preparation of master plans for tackling the problems of flood, erosion and drainage congestion including DPRs for multipurpose projects.

Ganga Flood Control Commission - The Ganga Flood Control Commission (GFCC) was set up by Government of India in 1972 for preparation of comprehensive plan of flood control for Ganga Basin and to draw out a phased coordinated programme of implementation of works and monitoring & appraisal of flood management schemes of Ganga basin States. The GFCC has prepared comprehensive plans of flood management of the 23 sub-basins in the Ganga Basin besides drawing out a phased programme of implementation of these

works to proper standards, examination and monitoring of various flood management schemes in the Ganga Basin States.

Farakka Barrage Project Authority – The Farakka Barrage Project Authority carry out anti-erosion and river bank protection works in its jurisdiction in near river vicinity of the Barrage..

National Disaster Management Authority (NDMA) - For prevention and mitigation effects of disasters including flood disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation, the Government of India has set up a National Disaster Management Authority (NDMA) in 2005 under the Chairmanship of Hon'ble Prime Minister of India. The functions of the NDMA are :

- lay down policies on disaster management;
- approve national Plan;
- approve plans prepared by the Ministries or departments of the Government of India in accordance with the National Plan;
- lay down guidelines to be followed by the State Authorities in drawing up the State Plan;
- lay down guidelines to be followed by the different Ministries or departments of the government of India for the purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects
- coordinate the enforcement and implementation of the policy and plan for disaster management;
- recommend provision of funds for the purpose of mitigation;
- provide such support to other countries affected by major disasters as may be determined by the central Government;
- take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;
- lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management.

The NDMA has issued guidelines in January, 2008 for management of floods and the roles of various Central and State agencies have been specified for preparation of flood mitigation plans and taking relief measures during flood disasters.

Government's Initiatives and Policies on Floods:

After the unprecedented floods of 1954, the Government of India took several initiatives and constituted a number of Committees to study the problem of floods in the country.

Recommendations of Expert Committees on Flood Management

A brief account of the recommendations of some of the important expert committees are as follows:

Policy Statement - 1954

Following the unprecedented floods of 1954, the Union Minister for Planning, Irrigation and Power, placed before the Parliament on 3rd September, 1954, two statements namely "Floods in India - Problems and remedies" and "The Floods in the country". The objective unequivocally set, in the policy statements, was to rid the country from the menace of floods by containing and managing floods and thus solving the problem.

In the supplementary statement placed before the Parliament on the 27th July, 1956, the above optimistic note changed a little, stating "We shall, however, be able to curb and confine the floods, more and more and do all that is possible to save ourselves from the harm and the devastation that they bring". Simultaneously, a statement on the flood situation and flood control programme was laid before the Parliament. In this Statement, it was, pointed out that absolute immunity from flood damage was not physically possible even in the distant future.

High Level Committee on Floods – 1957 & Policy Statement of 1958

A High Level Committee on floods submitted its report in December, 1957, and this was considered by the Central Flood Control Board in its seventh meeting held in May, 1958. Some of their important recommendations are

- ❖ Absolute or permanent immunity from flood damage is not physically attainable by known methods of flood control. Flood plain zoning, flood forecasting and warning, and like measures should, therefore, be given due importance, particularly as these do not require large capital investment.
- ❖ Flood control schemes should fit in with other water related plans to the extent feasible.
- ❖ Future multi-purpose project should consider flood control aspects simultaneously.
- ❖ Effects of embankments on river regime be considered, before approving such proposals.
- ❖ In general, embankments are satisfactory means of flood protection when properly designed, executed and

maintained, but a suitable combination of this method with other methods such as storage dams, detention basins, etc. is usually more efficient and should be adopted as resources permit.

- ❖ Priorities for soil conservation work relating to flood control should be as under:-
 - ✓ Catchment areas of multi-purpose dams.
 - ✓ Himalayas with their foothills.
 - ✓ Indo-Gangetic plain and
 - ✓ Deccan plateau.
- ❖ Works relating to watershed management prioritized. Work commenced in a catchment should not be left incomplete to take up work in other catchments.
- ❖ The following order of priority in general is recommended:-
 - a) Emergent schemes,
 - b) Continuing schemes,
 - c) Schemes for the protection of important urban and industrial communities.
 - d) Schemes which would help in augmenting flood protection in the country.
 - e) Schemes which combine other beneficial utilization of waters.

policy statement placed in Parliament in 1958 also emphasises that while substantial diminution of flood related distress is possible, immunity against flood is impracticable.

National Flood Commission (Rashtriya Barh Ayog) – 1980.

The National Flood Commission (R.B.A.) submitted its comprehensive report in March, 1980. This contained a total of 207 recommendations covering the entire gamut of flood problem in the country. Some of the important recommendations are given below:

- ❖ Data collection for providing information on their long term performance and their impact on various socio-economic factors.
- ❖ Legislation and enforcement by States to prevent unauthorized river bed cultivation and encroachments into drains etc.
- ❖ Separate reporting of flood damage for (i) Unprotected areas (ii) Protected areas and (iii) Areas situated between the embankments.
- ❖ Legislation for management of flood plains.
- ❖ A comprehensive dynamic and flexible approach to the problem of floods as a part of a comprehensive approach for the utilization of land and water resources.

- ❖ Priority for measures to modify the susceptibility of life and property to flood damage.
- ❖ Priority for completion of continuing schemes.
- ❖ Adequate funds for maintenance.
- ❖ States to enact legislation amending section 17 (II) of land acquisition act, to make the existing provisions for emergent situations, as applicable for flood control works.
- ❖ Intensifying studies on sedimentation of reservoirs.
- ❖ Forming a national council for mitigating disaster.

Expert Committee to Review the Implementation of the Recommendations of National Flood Commission-2003 (R Rangachari Committee):

An Experts Committee under the Chairmanship of Shri R Rangachari was set up by Ministry of Water Resources, Government of India in October 2001 to review the implementation of recommendation of National Flood Commission.

The Committee suggested emphasis on 25 recommendations out of 207 and summed up its views as follows:

- Flood damage assessment, from year to year, is not done realistically or on scientific basis as per RBA recommendations, due to collateral reasons, which are surmised but not expressed. This needs corrective steps.
- Lack of representative, scientific and credible post-project performance evaluations of past flood management works is a serious handicap.
- Unabated and unplanned intrusion into the flood plains and river beds, sometimes with the approval or acquiescence of Government has now reached alarming dimensions. If this is not managed, flood losses will continue to mount.
- RBA has made a number of recommendations on the future approach and the planning and implementation thereof. Most of these have not been implemented or at the best partially implemented. They will have to be kept in view as part of future approach.
- The international dimensions of flood management as an integral part of Water resource development and management must be pro actively addressed.
- A number of other issues of importance like adequate funds, legislation, research and people’s involvement at all important stages, etc. are very important to effectively manage floods. However, the inter-state issues in multi state river basins is a very important matter waiting to be effectively addressed.

The Government of India while framing policy has laid significant emphasis on the management of floods which gets reflected in the National Water Policy as under :

The National Water Policy (1987) adopted by the National Water Resources council, inter alia, recommended that “adequate flood cushion should be provided in water storage projects wherever feasible to facilitate better flood management”. While it recognized that “physical flood protection works like embankments and dykes will continue to be necessary”, it laid emphasis on adoption of non -structural measures for the minimization of losses, such as flood forecasting and warning and flood plain zoning etc.

The National Water Policy of 2002 adopted by the National Water Resources Council inter alia recommended the following guiding principles:

- I. There should be a master plan for flood control and management for each flood prone basin.
- II. Adequate flood cushion should be provided in water storage projects, wherever feasible, to facilitate better flood management. In highly flood prone areas, flood control should be given overriding consideration in reservoir regulations policy even at the cost of sacrificing some irrigation or power benefits.
- III. While physical flood protection works like embankments and dykes will continue to be necessary, increased emphasis should be laid on non-structural measures such as flood forecasting and warning, flood plain zoning and flood proofing for the minimization of losses and to reduce the recurring expenditure on flood relief.
- IV. There should be strict regulation of settlements and economic activity in the flood plain zones along with flood proofing, to minimize the loss of life and property on account of floods.
- V. The flood forecasting activities should be modernized, value added and extended to other uncovered areas. Inflow forecasting to reservoirs should be instituted for their effective regulation.
- VI. The erosion of land, whether by the sea in coastal areas or by river waters inland, should be minimized by suitable cost-effective measures. The States and Union Territories should also undertake all requisite steps to ensure that indiscriminate occupation and exploitation of coastal strips of land are discouraged and that the location of economic activities in areas adjacent to the sea is regulated.
- VII. Each coastal State should prepare a comprehensive coastal land management plan, keeping in view the

environmental and ecological impacts, and regulate the developmental activities accordingly.

General Flood Management Measures practiced in India:

Different measures have been adopted to reduce the flood losses and protect the flood plains. Depending upon the nature work, Flood protection and flood management measures may be broadly classified as under:

1. Engineering / Structural Measures
2. Administrative / Non-Structural Measures

Engineering /Structural Measures

The engineering measures for flood control which bring relief to the flood prone areas by reducing flood flows and thereby the flood levels are –

- i. an artificially created reservoir behind a dam across a river
- ii. a natural depression suitably improved and regulated, if necessary or
- iii. by diversion of a part of the peak flow to another river or basin, where such diversion would not cause appreciable damage.
- iv. by constructing a parallel channel by passing a particular town/reach of the river prone to flooding.

The engineering methods of flood protection, which do not reduce the flood flow but reduce spilling, are:

- Embankments which artificially raise the effective river bank and thereby prevent spilling and
- channel and drainage improvement works, which artificially reduce the flood water level so as to keep the same, confined within the river banks and thus prevent spilling.

Administrative / Non-structural Measures

The administrative methods endeavour to mitigate the flood damages by;

- Facilitating timely evacuation of the people and shifting of their movable property to safer grounds by having advance warning of incoming flood i.e. flood forecasting, flood warning in case of threatened inundation
- Discouraging creation of valuable assets/settlement of the people in the areas subject to frequent flooding i.e. enforcing flood plain zoning regulation.

Providing absolute protection to all flood prone areas against all magnitude of floods is neither practically possible nor economically viable. Such an attempt would involve

stupendously high cost for construction and for maintenance. Hence a pragmatic approach in flood management is to provide a reasonable degree of protection against flood damages at economic cost through a combination of structural and non-structural measures.

CONCLUSION:

Flood actually is the overflow of water through any water body like ponds, river, lakes, streams etc. it has harmful as well as beneficial effects. harmful effects such as loss of property, deaths of animals, humans. whereas beneficial effects are groundwater recharge, fertile land etc.

Well floods have claimed so many lives in the last few years but we have to live with it because it is part of nature cycle the only thing we can do is stay clear of the flood if it occurs n always be ready for it.

Present-day and future risk from flooding involves a combination of risk-avoidance and risk-reduction activities. The treatment options could be a combination of avoiding risk where possible, controlling risk through structural or regulatory measures, transferring risk through insurance, accepting risk, emergency management planning, warning systems, and communicating risk (including residual risk) to affected parties. The best combination will consider the needs of future generations and not lock communities into a future of increasing risks from flooding.

Floods have been recurrent phenomenon in many parts of India, causing loss of lives and public property and bringing untold misery to the people, especially those in the rural areas. There is also a larger economic impact, as they derail economic activities, thus affecting growth. Indian continent has peculiar climatic conditions since it has floods in some parts whereas drought in other parts. Over the years, several expert Committees have studied the problems caused by floods and suggested various measures for their management to the Government. However, despite the various steps undertaken over the last five decades, the trend of increasing damage and devastation brought by floods has posed a challenge to the Government as well as to the people. The approaches to flood management presently exercised in India also need to give a re-look to have an integrated strategy for policy and management related to floods.

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