

National Disaster Management Guidelines

Management of Floods

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National Disaster Management Authority
Government of India

Mission

To minimise vulnerability to floods and consequent loss of lives, livelihood systems, property and damage to infrastructure and public utilities.

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FOREWORD

India is highly vulnerable to floods and out of the total geographical area of 329 mha, more than 40 mha is flood prone. Floods are recurrent phenomenon, which cause huge loss of lives and damage to livelihood system, property, infrastructure and public utilities. It is a cause for concern that the flood related damages are showing an increasing trend. The average annual flood damage during the last 10 years (1996-2005) was Rs. 4745 crore as compared to Rs. 1805 crore, the corresponding average for the last 53 years. This can be attributed to many reasons including rapid increase in population and urbanisation coupled with growing developmental and economic activities in the flood plains and global warming.

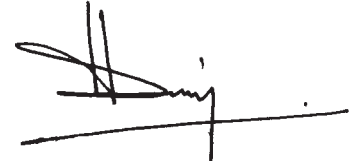
From the past experience, it is observed that though the various Expert Committees/ Working Groups headed by eminent dignitaries have made several useful recommendations/ suggestions, these have mostly remained unimplemented, which is a cause of concern. These guidelines have highlighted those recommendations and actions required to be taken on them.

While formulating these guidelines, we have involved 161 experts from various concerned central ministries and departments, state governments, scientific and technical institutions, academics, professionals and eminent personalities from the society and non-governmental organisations and tried to make the document as comprehensive as possible, so that it provides the desired direction in the work to be done in flood management in the country. The central ministries and state governments can accordingly make their Disaster Management plans based on these guidelines, which will minimise the vulnerability to floods and ensure better preparedness over a defined period of time.

I express my deep appreciation of the commitment of various stakeholders for their wholehearted support and cooperation in the preparation of these guidelines. I would also like to commend the significant contribution made by the Ministry of Water Resources and Central Water Commission and the members of the Core and the Extended Groups, for their long hours of work in drafting and finalising the guidelines.

I also wish to express my sincere appreciation of the efforts of Dr. Mohan Kanda, Member, NDMA, and his team for formulation and finalisation of these guidelines.

New Delhi
17 January, 2008

A handwritten signature in black ink, consisting of several loops and a long horizontal stroke at the end.

General NC Vij
PVSM, UYSM, AVSM (Retd)



Member
National Disaster Management Authority
Government of India

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I am thankful to the Core Group members for their unrelenting cooperation in the extensive effort that went into the formulation of the National Guidelines for Flood Management by the National Disaster Management Authority (NDMA). I would like to place on record the significant contributions made by the Ministries of Water Resources, Earth Sciences, the Central Water Commission, the India Meteorological Department, governments of the States and the administration of the Union Territories from time to time.

I express my sincere thanks to the representatives of the other central ministries and departments concerned, representatives of the scientific and technical institutions, eminent professionals, the National Institute of Disaster Management, non-governmental organisations and the representatives of the Corporate Sector for their valuable inputs which helped us improve the content and the presentation of this document.


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It is hoped that this humble effort will prove useful to the Central Ministries and Departments, the States and the Union territories in formulating effective Flood Management Plans that will improve the management of this phenomenon in the future.

New Delhi
17 January, 2008



Dr. Mohan Kanda, IAS (Retd.)

Abbreviations

AICTE	All India Council of Technical Education
AIR	All India Radio
ALTM	Air-born Laser Terrain Mapping
ARMVs	Accident Relief Medical Vans
ARG	Automatic Rain Gauge
ATI	Administrative Training Institute
BCM	Billion Cubic Meter
BIS	Bureau of Indian Standards
BMTPC	Building Materials and Technology Promotion Council,
BRO	Border Roads Organisation
CAT	Catchment Area Treatment
CBO	Community Based Organisation
CBRI	Central Building Research Institute, Roorkee
CBSE	Central Board of Secondary Education
CD	Civil Defence
CFCB	Central Flood Control Board
CFI	Construction Federation of India
COA	Council of Architecture
CPWD	Central Public Works Department
CRF	Calamity Relief Fund
CSR	Corporate Social Responsibility
cumec	cubic meter per second
cusec	cubic feet per second
CWC	Central Water Commission
CWPRS	Central Water and Power Research Station
D	Quarter ending December
DAE	Department of Atomic Energy,
DART	Disaster Assistance Response Team
DD	Doordarshan

ABBREVIATIONS

DDMA	District Disaster Management Authority
DEM	Digital Elevation Model
DI	Drainage Improvement
DM	Disaster Management
DMA	Disaster Management Authority
DMS	Disaster Management Support
DMP	Disaster Management Plan
DST	Department of Science and Technology
DPR	Detailed Project Report
DRM	Disaster Risk Management
DSS	Decision Support System
DVC	Damodar Valley Corporation
DWR	Doppler Weather Radar
EEP	Emergency Evacuation Plan
EOC	Emergency Operations Centre
EREC	Earthquake Risk Evaluation Centre
FF	Flood Forecasting
FF and W	Flood Forecasting and Warning
FM	Flood Management
FMO	Flood Meteorological Office
FMP	Flood Management Plan
FP	Flood Protection
FRL	Full Reservoir Level
J	Quarter ending June
GFCC	Ganga Flood Control Commission
GIS	Geographical Information System
GLOFs	Glacial Lake Outburst Floods
GOI	Government of India
GSI	Geological Survey of India
ha	Hectare
HFL	Highest Flood Level
HPC	High Power Committee on Disaster Management
HSC	Hazard Safety Cell

HUDCO	Housing and Urban Development Corporation
ICS	Incident Command System
ISRO	Indian Space Research Organisation
IDNDR	United Nations International Decade for Natural Disaster Reduction
IDRN	Indian Disaster Resource Network
IE(I)	Institution of Engineers (India)
IIT	Indian Institute of Technology
IMD	India Meteorological Department
IIA	Indian Institute of Architects
IWRM	Integrated Water Resources Management
M	Quarter ending March
mha	major accident hazard
MEA	Ministry of External Affairs
MES	Military Engineering Services
MFR	Medical First Responder
MHA	Ministry of Home Affairs
mha	million hectares
MHRD	Ministry of Human Resource Development
MOA	Ministry of Agriculture
MOD	Ministry of Defence
MOES	Ministry of Earth Sciences
MOHFW	Ministry of Health and Family Welfare
MOR	Ministry of Railways
MOWR	Ministry of Water Resources
MOSRTH	Ministry of Shipping, Road Transport and Highways
MWL	Maximum Water Level
NCC	National Cadet Corps
NCDM	National Committee on Disaster Management
NCMP	National Common Minimum Programme
NCMRWF	National Centre of Medium Range Weather Forecasting
NDMA	National Disaster Management Authority
NR	National Reserve
NDRF	National Disaster Response Force

ABBREVIATIONS

NEC	National Executive Committee
NFMI	National Flood Management Institute
NGO	Non-governmental Organisation
NHAI	National Highways Authority of India
NIC	National Informatics Centre
NIDM	National Institute of Disaster Management
NIT	National Institute of Technology
NRSA	National Remote Sensing Agency
NSS	National Service Scheme
NWA	National Water Academy
NWP	National Water Policy
NYKS	Nehru Yuvak Kendra Sangathan
PRI	Panchayati Raj Institution
PVO	Private Voluntary Organisation
QRMT	Quick Reaction Medical Team
RBA	Rashtriya Barh Ayog
RF	Rainfall
RM	River Management
RMC	Regional Meteorological Centre
RR	Rehabilitation and Resettlement
RRC	Regional Resource Centre
S	Quarter ending September
SDMA	State Disaster Management Authority
SOI	Survey of India
SOP	Standard Operating Procedure
SW	South-west
TAC	Technical Advisory Committee
TF	Task Force
UGC	University Grants Commission
ULB	Urban Local Body
UNDP	United Nations Development Programme
WL	Water Level
WAPCOS	Water and Power Consulting Services India Ltd

Executive Summary

Introduction

Following the enactment of the Disaster Management Act, 2005, (DM Act, 2005) the Government of India (GOI) constituted the National Disaster Management Authority (NDMA) as the apex body for Disaster Management (DM) in India with the mandate, inter alia, for laying down policies and guidelines on DM. At the national level, there is to be a paradigm shift from the erstwhile relief-centric and post-event syndrome to pro-active prevention-, mitigation- and preparedness-driven DM. These efforts will conserve developmental gains and also minimise loss of lives, livelihood systems and property. These Guidelines have been evolved by the NDMA, through a nine-step process. This approach ensures that all contemporary knowledge, experience and information are taken on board, clear destinations are identified, and road maps drawn with milestones duly marked off through a wide consultative process, involving all the stakeholders. Recognising the gravity of the risk and vulnerability of India to floods, the NDMA, soon after its constitution initiated a series of consultations with the various stakeholders to develop Guidelines for strengthening the existing arrangements for flood preparedness, mitigation, and post-flood emergency response, relief, rehabilitation and reconstruction. Senior representatives from the Central Ministries/ Departments and the state governments, related agencies, academics and professionals attended these meetings. The meetings acknowledged that, while several significant initiatives had been taken by government agencies in the past for addressing the risk and vulnerability of India to floods, it is necessary to undertake measures for the evolution of a holistic and integrated strategy to address the critical factors that accentuate flood risk. On

the basis of these deliberations, the NDMA has prepared these Guidelines for Flood Management (FM), to assist the ministries and departments of the GOI, the state governments and other agencies in preparing Flood Management plans (FMPs).

Vulnerability to Floods

Floods have been a recurrent phenomenon in India and cause huge losses to lives, properties, livelihood systems, infrastructure and public utilities. India's high risk and vulnerability is highlighted by the fact that 40 million hectares out of a geographical area of 3290 lakh hectares is prone to floods. On 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) were 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 the catchments. These, coupled with inadequate carrying capacity of the 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. The fact that some of the rivers causing damage in India originate in neighboring countries, adds 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. These

Guidelines have been prepared to enable the various implementers and stakeholder agencies to address effectively the critical areas for minimising flood damages.

Urban Flooding

Flooding in the cities and the towns is a recent phenomenon caused by increasing incidence of heavy rainfall in a short period of time, indiscriminate encroachment of waterways, inadequate capacity of drains and lack of maintenance of the drainage infrastructure. Keeping in view the fact that the problem is becoming more severe and losses are mounting every year, the subject of urban flooding has been recognised by the NDMA as one meriting exclusive attention and separate guidelines for its management are being prepared and will be issued soon.

Action Plans at Various Levels

These Guidelines have been drawn up in the context of a rigorous risk management framework to ensure the effectiveness of action plans that are developed by various agencies. All key agencies, including the central ministries, and departments, state governments, local bodies including Panchayati Raj Institutions (PRIs), and Urban Local Bodies (ULBs) like metropolitan development authorities, municipal corporations, municipal councils and district authorities will develop detailed FMPs based on these Guidelines. State governments and local authorities will play an important role in the formulation and effective implementation of such action plans. The communities and other stakeholders will play an important part in ensuring compliance to the regulations and their effective enforcement. The State Disaster Management Authorities (SDMAs) will be responsible for reviewing and monitoring the implementation of the action plans at the state-level.

The Objectives of the Guidelines

These Guidelines rest on the following objectives aimed at increasing the efficacy of the FMPs, which will be prepared at various levels:

1. Shifting the focus to preparedness by implementing, in a time-bound manner, an optimal combination of techno-economically viable, socially acceptable and eco-friendly structural and non-structural measures of FM.
2. Ensuring regular monitoring of the effectiveness and sustainability of various structures and taking appropriate measures for their restoration and strengthening.
3. Continuous modernisation of flood forecasting, early warning and decision support systems.
4. Ensuring the incorporation of flood resistant features in the design and construction of new structures in the flood prone areas.
5. Drawing up time-bound plans for the flood proofing of strategic and public utility structures in flood prone areas.
6. Improving the awareness and preparedness of all stakeholders in the flood prone areas.
7. Introducing appropriate capacity development interventions for effective FM (including education, training, capacity building, research and development, and documentation.)
8. Improving the compliance regime through appropriate mechanisms.
9. Strengthening the emergency response capabilities.

Earlier Initiatives of the Government of India

Following the unprecedented floods of 1954, the then Union Minister for Planning, Irrigation and Power placed before Parliament on 3 September 1954, the statements on floods which set the objective of reducing the menace of floods. Later on, in a subsequent statement in Parliament on 27 July 1956, the emphasis was laid on doing all that was possible to contain floods in the country. Since then the government has taken various initiatives and set up a number of committees to study the problem and recommend several remedial measures. The most important ones are the High Level Committee on Floods (1957), the Ministers Committee on Flood Control (1964), the Rashtriya Barh Ayog (1980) and Task Force on Flood Management/Erosion Control (2004).

Institutional Framework

As per the constitutional provisions, FM is a state subject and as such the primary responsibility for flood management lies with the states. The central government has taken various initiatives and set up a number of organisations dealing with the floods. The most notable one is the enactment of the National Disaster Management Act, December 2005 and setting up of the NDMA, which has been assigned to deal with all types of disasters including the floods. The National Executive Committee (NEC) with the Secretary of GOI of the ministry or department having administrative control of the subject of the DM as the Chairman and Secretaries of other ministries concerned and the Chief of the Integrated Defence Staff to the Chairman Chiefs of the Staff Committee (CISC) as Members, will assist the NDMA in the discharge of its functions and ensure compliance of the directions issued by the central government apart from preparing the National Disaster Management Plan. The state governments

are to set up State Disaster Management Authorities (SDMAs) and State Executive Committees (SECs) to perform similar functions at the state level. These are in addition to existing organisations dealing with the floods in the states.

There is a need to set up a central organisation to lay down policy and implement FM measures in consultation with the states and other stakeholders as floods are not confined to one state and flooding in one state leads to flooding in adjoining states. Accordingly, it has been proposed to set up River Basin Organisations to deal with the management of water resources at river basin level. It is also proposed to set up a National Flood Management Institute (NFMI) at an appropriate location in one of the flood prone states, to impart training to engineers, administrators, personnel of the police departments, Non-governmental Organisations (NGOs) and Community Based Organisations (CBOs) etc.

Flood Prevention, Preparedness and Mitigation

Floods being the most common natural disaster, people have, out of experience, devised many ways of coping with them. However, encroachments into the flood plains over the years has aggravated the flood problem and a need to take effective and sustained FM measures has been felt. Various measures, structural and non-structural, have been taken by the central and state governments and as a result, considerable protection has been provided to the people. However, more efforts are required in this direction and there is a need to put in place a techno-legal regime to make structures flood-proof and regulate the activities in the flood plains of the rivers. Flood forecasting and warning and Decision Support System (DSS) will be established on a scientific basis taking into account the latest technological developments in the world.

Capacity Development and Flood Response

The central government and the state governments are required to take steps for capacity development for taking effective and sustainable preventive, preparatory and mitigative measures in pre-floods stage and effective and prompt response during- and post-floods stages. Appropriate recommendations have been made in this regard.

Activities for Minimising Flood Risk and Losses

The activities proposed to be undertaken aim at minimising the flood risk and losses and are to be implemented in three phases in addition to recurring activities.

Phase-I

These activities include identification and marking of flood prone areas on maps, preparation of close contour and flood vulnerability maps, formulating plans for expansion and modernisation of flood forecasting and warning systems, identification of priority flood protection and drainage improvement works, identification of reservoirs for review and modification of operation manuals and rule curves and undertaking special studies on problems of river erosion. These will be initiated immediately and efforts will be made to complete them in a phased manner with the last of these activities scheduled for completion by January 2010.

Phase-II

These include implementation of the schemes for expansion and modernisation of the flood forecasting and warning network, execution of flood protection and drainage improvement schemes, modification and adoption of revised reservoir

operation manuals, enactment and enforcement of flood plain zoning regulations and planning and preparation of Detailed Project Reports (DPRs) for storage reservoirs and implementation of the schemes for real-time collection of hydro-meteorological data on rivers in Nepal, Bhutan and China. These activities, which aim at implementation of FMPs, will commence immediately after the completion of the link activities of Phase-I and will be completed by March 2012.

Phase-III

Implementation of activities, which include construction of dams and catchment area treatment (CAT) works in India as well as neighboring countries, is likely to take considerable time as they entail major environmental, social, inter-state and international implications. These need careful study and interaction with the stakeholders. It is envisaged that all feasible schemes will be completed by the year 2025.

Recurring Activities

These activities which include inspection of dams, embankments and other structural measures, execution of restoration and strengthening works and expansion and modernisation of flood forecasting and warning systems, are to be taken on a regular basis for ensuring the effectiveness and sustainability of various measures for minimising flood risk.

The relevance and status of various activities will be continuously monitored and reviewed. The activities will be modified, if felt necessary. The preparedness of the central ministries and departments concerned and the state governments will be reviewed in April/May every year and appropriate corrective measures will be taken before the commencement of the monsoon. A post-monsoon review will be held every year in November/December so as to finalise the action

plan for preparatory measures to be implemented before the onset of the next monsoon.

Flood Management Plans

It is expected that based on these guidelines the central ministries and departments concerned and the state governments will prepare their FMPs which will be holistic, participatory, inclusive, eco-friendly and gender-sensitive in nature and the implementation of which will result in a flood-resilient India. The plans will focus on the community and the collective efforts of the government and NGOs.

Important Milestones in the Road-map for the Implementation of the Guidelines

Phase – I (Works to Commence Immediately)

- Mechanism for joint formulation of forecasts by the CWC/IMD/NRSA/states-May 2008.
- Identification of flood prone areas (villages/blocks/tehsils/districts) and marking on national, state and district level maps by the Central Water Commission (CWC)/Ganga Flood Control Commission (GFCC)/Brahmaputra Board and the state governments in collaboration with the National Remote Sensing Agency (NRSA) and Survey of India (SOI) - June 2008.
- Finalisation of plans for expansion and modernisation of flood forecasting and warning systems and development of DSS for management of floods by the CWC, India Meteorological Department (IMD) and the state governments - June 2008.
- Making an assessment of the area suffering from drainage congestion by the state governments- June 2008.
- Making an assessment of the area suffering from erosion by the state governments-June 2008.
- Categorization of flood disaster by NDMA/SDMAs- June 2008.
- Introduction of module on FM in education in schools/technical institutions/defence forces/academies, Administrative Training Institutes (ATIs) etc., by the Ministry of Human Resources Development (MHRD), Ministry of Defence (MOD), Ministry of Home Affairs (MHA), state governments/SDMAs- June 2008.
- Documentation of floods by state governments- June 2008.
- Identification of reservoirs for reviewing and modifying the operation manuals/rule curves by the state governments in consultation with the CWC, GFCC and Brahmaputra Board – June 2008.
- Amendment of building bye-laws to make future buildings in flood prone areas flood-safe by the state governments/SDMAs and ULBs-June 2008.
- Establishing a mechanism for intra-state coordination by the state governments/SDMAs-June 2008.
- Establishing a mechanism for joint operation for reservoirs on inter-state rivers by the state governments/SDMAs – June 2008.
- Establishing a system for monitoring of landslides causing blockages in the rivers, by the CWC/NRSA/ state governments/SDMAs-December 2008.
- Preparation of FM plans by the central ministries and departments- December 2008.

- Preparation of FM plans by the state governments/SDMAs- December 2008.
 - Notification of regulation for prohibiting reclamation of wetlands and natural depressions by the state governments/SDMAs- December 2008.
 - Carrying out special studies on problem of erosion on the rivers Brahmaputra, Mahananda and Gandak by the NDMA in collaboration with the state governments and the CWC/GFCC/Brahmaputra Board – March 2009.
 - Approval and beginning of implementation of National Flood Mitigation Project by the NDMA/state governments – March 2009.
 - Construction of flood shelters by the state governments/SDMAs - March 2009.
 - Identification and preparation of proposals and implementation of priority Flood Protection and Drainage Improvement (FP and DI) works (embankments, anti erosion measures, drainage improvement works and sea walls/coastal protection works) by the state governments in consultation with the CWC/GFCC/Brahmaputra Board – June 2009.
 - Preparation of maps to a scale of 1:10,000 with contours at an interval of 0.5 m/1.0 m and digital elevation model of the flood prone areas by the NRSA and SOI using satellite data and Air-borne Laser Terrain Mapping (ALTM) - June 2010.
 - Preparation of flood vulnerability/flood hazard maps by the CWC, GFCC and the Brahmaputra Board in collaboration with NRSA - January 2010.
- Phase-II (Works to Commence on Completion of Link Activities in Phase-I)**
- Institutionalising the role of CBOs, NGOs, Women's Groups, Youth Organisations, Corporate Houses and other stake holders in flood response by the SDMAs/ Distric Disaster Management Authorities (DDMAs)-June 2008.
 - Reorganisation /reorientation of fire and emergency services, police forces, Civil Defence Organisations (CDOs), home guards for flood response by the SDMAs/DDMAs-June 2008.
 - Raising and operationalising State Disaster Response Forces (SDRFs) by the SDMAs-June 2008.
 - Strengthening/restructuring of the GFCC by the Ministry of Water Resources (MOWR)-September 2008.
 - Strengthening/restructuring of the Brahmaputra Board by the MOWR-September 2008.
 - Enactment and enforcement of the flood plain zoning regulation by the state governments – December 2008.
 - Developing Integrated Water Resources Management (IWRM) models for intra-state rivers by the state governments-March 2009.
 - Establishing a system for forecasting of flash floods by IMD - September 2009.
 - Developing basin wise IWRM models for inter-state rivers by the CWC and state governments-September 2009.

- Notification of modified operation manuals/ rule curves of reservoirs identified under Phase – I and implementation of arrangements for inflow forecasts by the state governments and CWC – December 2009.
- Implementation of the scheme on expansion and modernisation of the flood forecasting network and development of the DSS by the CWC, IMD and the state governments-March 2010.
- Finalising Memoranda of Understandings (MOUs) and implementation of the network for collection and exchange of hydro meteorological data including strengthening and modernisation of existing networks on rivers originating in Nepal, Bhutan and China by the MOWR and Ministry of External Affairs (MEA)-March 2010.
- Setting up of National Flood Management Institute (NFMI) by the MOWR/NDMA – June 2010.
- Examining adequacy and if required, increasing the waterways of bridges/ culverts under roads and railways embankments by the Ministry of Shipping, Road Transport and Highways (MOSRTH), Ministry of Railways (MOR), Ministry of Defence (MOD), National Highways Authority of India (NHAI), Border Road Organisation (BRO) and state governments-June 2010.
- Studies and consultations and finalization of the proposal for flood insurance by the MOWR in collaboration with the Ministry of Finance (MOF), insurance companies and state governments and implementation of a pilot project – December 2008 and on large scale-June 2010.
- Preparation of DM plans for reservoirs by the state governments – December 2010.
- Making public utility buildings/installations flood-safe by the GOI, state governments and ULBs/PRIIs-December 2010.
- Establishing river basin organisations by the MOWR and state governments-June 2010.
- Preparation of DPRs for storage reservoirs in India by the state governments/central organisations – December 2010 and in Bhutan and Nepal-March 2012.
- Preparation of DPRs for long-term FP and DI measures such as embankments, anti-erosion measures, drainage improvement works, and sea walls/coastal protection works by the state governments/central organisations – December 2008 and completion of the works-March 2012.

Phase – III (Commences with Completion of Link Activities in Phase – II)

- Water shed management, Catchment Area Treatment (CAT) and afforestation schemes in critical areas by the state governments/ central organisations-March 2012.
- Construction of storage reservoirs by the state governments/central organisations – December 2017.
- Negotiations with Nepal and Bhutan for construction of reservoirs, watershed management, CAT and afforestation measures in their territories and preparation of DPRs and implementation of the schemes by the GOI and the governments of Nepal and Bhutan- December 2025.

Recurring Activities

- Inspections of dams, embankments and other structural measures by the state governments – twice every year, once before monsoon (April-May) and second time after monsoon (November-December).
- Restoration/strengthening works by the state governments—every year.
- Monitoring of structural measures—by the state governments—throughout the year with special attention during monsoon.
- Expansion and modernisation of flood forecasting and warning network and DSS for flood management as and when required.

Important Aspects of the Guidelines

While all the activities under the Guidelines are important for minimising flood risk and loss of lives and properties, the issues which need special attention are the following:

- Indiscriminate encroachment of the flood plains of the rivers and waterways of natural and man-made drainage channels and reclamation of ponds, chauras, lakes and depressions have led to increased flood risk to lives and properties. The regulation of developmental activities in these areas and an appropriate techno-legal regime based on the model bill circulated by the CWC, is an urgent necessity.
- The change in priority in use of storage space of the multi-purpose reservoirs for irrigation, hydropower, drinking and industrial water supply by ignoring flood

moderation has led to large scale flooding. The operation manuals and rule curves of all the reservoirs will be reviewed and modified to give priority to flood moderation.

- Flood forecasting and warning is a non-structural measure, which aims at minimising losses and enabling the agencies concerned to plan rescue and relief measures. The efforts of the CWC, IMD, NRSA and the state governments will be integrated and a mechanism developed wherein during the monsoon, the representatives of all these organisations and the basin states work together in formulation and dissemination of reliable forecasts and warning.

The national vision is to minimise the vulnerability to floods and the consequent loss of lives, livelihood systems, property and damage to infrastructure and public utilities and to build a safer India by developing a holistic, proactive, multi-disaster and technology driven strategy for DM. This is to be achieved through a combination of preventive, mitigative and preparatory measures to generate a prompt and efficient response after the occurrence of floods. The entire process will focus on the community and will be sustained through the collective efforts of the government and NGOs.

The value of these guidelines will lie essentially, in the efficacy of the FMPs that will consequently be made and implemented by the central ministries and departments and the state governments.

The central government and the state governments will provide necessary resources, both financial and managerial for creating adequate structures at all levels to take measures required to minimise risk and vulnerability to floods

Floods and famines have ravaged mankind from time immemorial and a vast store of knowledge

and experience is available on handling these disasters. An attempt has been made in these Guidelines to build on this precious heritage while, simultaneously, factoring in the benefits of modern technology and scientific advantages apart from emphasising the value of concerted action and sustained efforts at mitigation.

Schedule of Completion of Action Points

The timelines proposed for the implementation

of various activities in the guidelines are considered both important and desirable, especially in the case of those non-structural measures for which no clearances are required from central or other agencies. Precise schedules for structural measures will, however, be evolved in the FMPs that will follow at the level of central ministries/states duly taking into account the availability of financial, technical and managerial resources. In case of compelling circumstances warranting a change, consultation with NDMA will be undertaken, well in advance, for any adjustment, on a case to case basis.

Overview of the Guidelines

General

It has been recognised that, while floods cannot be prevented, they can certainly be managed to minimise loss of lives, livelihood systems, property and damage to infrastructure and public utilities. Various measures for management of floods will ultimately lead to reduction in vulnerability to floods. These guidelines on FM have been prepared keeping this reality in mind. Sustained efforts are required to address the problem to reduce the impact of floods in the short term and flood risk in the medium and the long term. So far the response to floods has been reactive in nature and has focused on rescue and relief in the post-flood situation. Preparatory, preventive and mitigative aspects of the FM have not received due attention. With the enactment of the DM Act, 2005 and the constitution of the NDMA, there has been a paradigm shift from the reactive response-centric regime where most of the efforts and resources were used for providing emergency response and relief after floods, to an approach that lays greater emphasis on efforts and resources for strengthening preparedness and mitigation through appropriate intervention apart from consolidating capacity for emergency response. This shift in approach is expected to be achieved with the active participation of the communities and the other stakeholders in all aspects of FM. The guidelines cover all aspects of FM and aim at increasing the efficacy of the FMPs that will be prepared by various key agencies including the central ministries and departments concerned, state governments, districts authorities, local bodies (both rural and urban), including PRIs, metropolitan development authorities, municipal corporations, municipal councils etc. The implementation of the FMPs prepared by them will result in a safer country

capable of managing the floods effectively and thus promote the economic development of the flood prone areas in the country.

Structure of the Guidelines

These Guidelines have been divided into 10 chapters.

Floods: Status and Context

The first chapter is general in nature. The nature and extent of the flood problem in the country, various initiatives taken by the GOI in managing them, the actions required for a reasonable and reliable assessment of the problem and collection of the data for the studies leading to systematic and scientific planning and implementation of various interventions to manage floods are briefly described therein.

Institutional Framework and Financial Arrangements

The second chapter titled 'Institutional Framework and Financial Arrangements' outlines the existing and proposed institutions to deal with the problem of floods and manage them effectively. It also deals with the financial system in place and arrangements that are proposed for meeting the requirement of funds for implementation of the various proposed interventions and FM measures, both structural and non-structural.

Prevention, Preparedness and Mitigation

The third chapter on flood prevention, prepared-

ness and mitigation presents an outline of the various types of structural and non-structural measures for managing the floods. Action plans for their implementation have also been prepared.

Flood Forecasting and Warning

Flood forecasting and warning (FF and W) is an important measure for minimising loss of lives and properties and assists the authorities concerned, in prompt and effective response during and after floods. These aspects have been dealt with in the fourth chapter and the action plan for the strengthening and modernisation of existing FF and W network as well as development of a DSS for management of floods has been drawn.

Dams, Reservoirs and Other Water Storages

Dams, reservoirs and other water storages, both natural and man-made, are an effective means for reducing the flood peaks in the rivers. The important role played by them in flood moderation and comprehensive mechanism for operation and regulation of reservoirs, which takes into account the international, inter-state and inter-regional aspects, have been dealt with in the fifth chapter. As large dams and reservoirs have potential for huge damage guidelines for ensuring safety thereof have also been detailed therein.

Regulation and Enforcement

Unplanned and unregulated developmental activities in the flood plains of the rivers and encroachments into the waterways have led to increase in flood losses as well as flood risk. The colossal loss of lives and property due to the flooding of the towns and cities and the areas which get flooded almost every alternate year is a recent

phenomenon and effective steps are required for regulating unplanned growth in the flood plains and preventing encroachment in the waterways. These aspects have been dealt with in the sixth chapter titled 'Regulation and Enforcement'. The measures for making the structures and buildings capable of withstanding the floods and serving as temporary shelters for the flood affected people have also been dealt with in this chapter. The coordination required among the various agencies and state governments for effective FM in inter-state rivers and among various stakeholders for effective response has also been highlighted.

Capacity Development

The seventh chapter on capacity development covers the aspects of education, training, research and development and documentation with respect to FM. The proposals for strengthening the existing systems are also given therein. An action plan for capacity development has also been formulated.

Flood Response

An effective and prompt response to floods is very important for minimising the loss of lives and properties and providing immediate relief to the affected people. The role of communities and NGOs is vital in search, rescue and relief operations. Immediate medical assistance to the affected people and steps for prevention of outbreak of epidemics after the floods are essential components of flood response. As per provisions of the DM Act, 2005, the GOI has constituted National Disaster Response Force (NDRF) for the purpose of specialised response to disasters. Over and above this, a mechanism for coordinated approach and efforts are required for effective response. All these aspects have been covered in the eighth chapter titled 'Flood Response'.

Implementation of Guidelines-Flood Management Plans

The NEC has been entrusted with the responsibility of preparing the National Plan for DM and getting it approved by the NDMA. These guidelines on FM will assist various stakeholders i.e. central ministries/ departments, state governments/ SDMA, PRIs, and ULBs, DDMA, NGOs and the communities at large, in the preparation of FMPs which, in turn, will form the basis for preparing the national flood management and overall DM plan. The factors to be taken into account while preparing

FMPs and aspects for implementation thereof have been dealt with in the ninth chapter.

Summary of Action Points

The last chapter of the Guidelines lists out various action points to be implemented by central ministries and departments concerned and the state governments/SDMA/DDMA. There are, in all, 94 action points which will assist them in the formulation of FMPs and the implementation thereof will result in effective management of floods in India.