

A decorative graphic on a blue background. It features a large, stylized number '6' inside a white circle with a light blue border. To the left of the circle, there are overlapping lines in light blue and dark blue/black that form a jagged, downward-pointing shape. To the right of the circle, there are two horizontal lines, one light blue and one dark blue/black, extending across the width of the page.

**6**

**CHAPTER**



## 6

## Chapter

# Implementation of the recommendations of Review and Oversight Committees for Flood Control measures

## 6.1 Introduction

The subject of flood control is not included in any of the three legislative lists under the Constitution of India. However, Drainage and Embankments are two of the measures specifically mentioned in the State List. Therefore, the related schemes are formulated and implemented by concerned State Governments. The role of Union Government is advisory in nature.

Government of India (GoI) has set up various committees for management of flood, such as Rashtriya Barh Ayog, Task Force 2004, Working Group on Water Resources for XI and XII Plan, etc. GoI has also framed National Water Policy (2012) to govern the planning and development of water resources and their optimum utilization. The reports of the above committees/policies contain certain recommendations for management of flood in time bound manner.

Rashtriya Barh Aayogh (RBA) was constituted (1976) to identify flood prone areas to reduce annual damage occurring due to floods. RBA submitted its report in March 1980. The recommendations were forwarded (September 1981) to all States/UTs/Ministries in the form of guidelines and instructions for implementation.

As per Report of Working Group on Flood Management for XII Plan (October 2011), an integrated basin management approach is needed that encourages the use of the resources of a river basin as a whole instead of traditional, fragmented and localized approach. It also emphasized that for making use of new technologies, it is desirable that a scientific assessment of the flood prone areas detailing at micro level and considering frequency of flooding, duration and depth of inundation, etc. should be done.

In this chapter, the status of compliance of some of important recommendations made by these Committees and important clauses specified in the National Water Policy 2012 have been discussed.

## 6.2 Assessment of areas liable to floods

Identification of flood affected areas was an important input for taking up flood management schemes for flood alleviation. As per recommendation No. 1 of RBA, the following activities were to be undertaken:

- i. State Governments were asked to verify the RBA assessed figures of area liable to floods and furnish data along with connected maps to Central Water Commission (CWC)/ Ganga Flood Control Commission (GFCC) before March 1982.
- ii. Flooded area at any time during the period for which records have been maintained should be transferred by the States on a detailed map of the river basin.
- iii. CWC/GFCC should carry out test checks in the field of the areas marked in the Map. The area may be updated every five years.
- iv. CWC should undertake a study and lay down criteria for defining “flooded area”.

As per GFCC guidelines, review of flood affected area in a State was to be undertaken in every Five Year Plan. The Working Group on Flood Management and Region Specific Issues, (October 2010) suggested for review of the flood affected areas of the respective States.

State/UT-wise status of assessment of areas liable to flood in respect of the sampled States (as of July 2016) is given in Table 6.1.

**Table 6.1: State/UT-wise status of assessment of areas liable to flood**

State/UT	Geographical Area (in lakh ha)	Flood prone area as identified by RBA (in lakh ha)	Flood prone area as identified by the State/UT (in lakh ha)	Whether verification of flood prone area done
1. Arunachal Pradesh	93.00	-	1.19	Not verified
2. Assam	78.40	31.50	38.20	Verified
3. Bihar	93.81	42.60 (jointly for Bihar & Jharkhand)	68.80	Not verified
4. Haryana	44.20	23.50	23.50	Not verified
5. Himachal Pradesh	55.70	2.31	4.76	Not verified
6. Jammu & Kashmir	222.20	0.80	5.14	Not verified
7. Jharkhand	83.10	-	Figures not available	Not verified
8. Kerala	38.90	8.70	14.70	Not verified
9. Manipur	22.30	0.80	0.80	Not verified
10. Odisha	155.70	14.00	33.40	Not verified
11. Puducherry	0.50	0.10	0.50	Not verified

State/UT	Geographical Area (in lakh ha)	Flood prone area as identified by RBA (in lakh ha)	Flood prone area as identified by the State/UT (in lakh ha)	Whether verification of flood prone area done
12. Punjab	50.40	37.00	40.50	Not verified
13. Sikkim	7.10	0.00	0.20	Not verified
14. Tamil Nadu	130.10	4.50	4.50	Not verified
15. Uttar Pradesh	240.93	73.36	73.40	Verified
16. Uttarakhand	53.47		Figures not available	Not verified
17. West Bengal	88.80	26.50	37.66	Not verified

Source: Report of the Experts Committee (March 2003) to Review the Implementation of Recommendations of RBA (National Flood Commission)

Of the selected 17 States/UT, only Assam and Uttar Pradesh had verified the RBA assessed figures of area liable to floods. As such, only these two States had furnished the data along with connected maps to CWC/ GFCC. CWC did not have any information on the activities at (ii), (iii) and (iv) of Recommendation No. 1 of RBA.

Thus, the recommendations of RBA with regard to identification of area affected by flood in country remained non-implemented. No records in regard to flooded area were transferred on a detailed map of the river basin by the States. As such, CWC/GFCC could not carry out test check in the field area marked in the map in the absence of such identification of area.

The Ministry stated (August 2016) that an expert committee for the scientific assessment of the flood prone area in India had been constituted in CWC (July 2012) and three meeting have been held so far. Ministry further stated (December 2016) that necessary follow-up actions on the recommendations of Rashtriya Barh Aayog had been taken up.

However, the recommendations of RBA have not been implemented as pointed out above.

### 6.3 Assessment of area that can be given protection against flood damage/protectable area

As per recommendation No. 3 of RBA, the following activities were to be undertaken:

- i. The State Government should carry out field surveys and indicate the area that can be given protection against flood damage.
- ii. The assessment of protectable area should be reviewed every five years to account for change in the circumstances and needs for flood protection.

CWC had requested States (after September 1981) to undertake field survey and assess the area that can be given protection against flood damage/protectable

area taking into account the changed circumstances and review them every five years.

In the 17 States/UT covered in audit, we found that five States viz. Bihar, Himachal Pradesh, Odisha, Tamil Nadu and Uttar Pradesh had furnished details of the area which was provided with reasonable protection. Apart from these, Punjab and Uttar Pradesh had furnished the details of area which was proposed for protection. The remaining States did not carry out the field surveys and indicate the area that could be given protection against flood damage. Also, none of the selected States carried out review of assessment of protectable area every five years to account for change in the circumstances and need for flood protection.

#### **6.4 Figures of flood damages**

As per recommendation No. 2, 28 and 29 of RBA, detailed figures of flood damages should, as far as feasible be collected under the following heads by State Government, CWC, GFCC and Department of Agriculture.

- (a) Floods
  - i. Unprotected areas flooded
  - ii. Protected areas flooded due to failure of protection works
  - iii. Areas between the embankment and 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 area and unprotected area.

However, as per data available with CWC (2003) flood damages statistics were compiled State wise i.e. administrative units-tehsil, sub-division and district and not category wise/basin-wise/sub basin-wise as recommended by RBA. The CWC has not compiled data related to flood damages after 2003 in the manner as recommended by RBA.

#### **6.5 Scientific Assessment of Flood Prone Areas in India**

In its report (1980), RBA assessed 40 m ha of area as flood prone in India. As there was no standard scientific definition of Flood Prone Area (FPA) in India, RBA recommended that FPA should be worked out in a better way by making use of topographic maps and detailed hydrological data.

MoWR, RD&GR constituted (July 2012) an Expert Committee for scientific assessment of FPA in India. As of August 2016, three meetings of the Expert Committee had taken place (August 2012, June 2013 and September 2015). In its second meeting, the Committee recommended that Regional Committees be constituted for each State. These committees would identify, demarcate and

classify the FPAs based on the prescribed methodology, classification and criteria. The 10 activities mentioned in Table 6.2 below had to be carried out by the Regional Committees.

**Table 6.2: Activities identified for Regional Committees**

Activities	Timeframe
1. Identification of rivers/tributaries, basins sub-basins and sites/locations in the State/UT, preferably on a Geographical Information System (GIS) platform for which FPA assessment is needed.	By 31 October 2015
2. Collection of hydro-meteorological data.	
3. Flood frequency analysis to determine Highest Flood Level corresponding to three year, seven year and 10 year return period flood.	
4. Delineation and Assessment of area under inundation on the available topo-sheets <sup>46</sup> corresponding to the HFLs determined as per flood prone area definitions, or by any methodology like based on historical satellite data, by using SRTM <sup>47</sup> /ASTER <sup>48</sup> /CARTODEM <sup>49</sup> , etc. (Refinement of assessment using digital topo-sheets on finer scale (1:15,000) with finer contour intervals (5 m or less and 0.5-1.0 m in case of plain and deltaic region) can be done on the availability of same.	By 31 December 2015
5. Compilation of flood damage data and related parameters.	By 31 December 2015
6. Validation of FPA by historical data, ground verifications, by using remote sensing technique with help from NRSC, NIH <sup>50</sup> , any consultant, etc.	By 31 January 2016
7. Submission of preliminary/interim report (1 <sup>st</sup> Version) by Regional Committee.	By 28 February 2016
8. Submission of preliminary/interim report (1 <sup>st</sup> Version) by Expert Committee.	By 31 March 2016
9. Submission of Final report by Regional Committees after refinement of assessment/data and its validation.	By 31 May 2016
10. Submission of Final report by Expert Committee after refinement of assessment/data and its validation using GIS platform.	By 31 July 2016

Source: Third meeting of Expert Committee for scientific assessment of FPA in India

Regional Committees for all 36 States/UTs had been constituted. However, we noticed that till July 2016, of the 17 States/UT covered in audit, scientific assessment of FPAs by the Regional Committees was taken up only in Bihar, Haryana, Kerala, Odisha, Punjab and West Bengal. In the remaining 11 States, the scientific assessment of FPA was yet to be started. Further, in Arunachal Pradesh,

<sup>46</sup> A toposheet is a shortened name for 'Topographic sheet'. It contains information about an area like roads, railways, settlements, canals.

<sup>47</sup> Shuttle Radar Topography Mission.

<sup>48</sup> Advanced Spaceborne Thermal Emission and Reflection Radiometer.

<sup>49</sup> Cartosat-1 derived Digital Elevations Models.

<sup>50</sup> National Institute of Hydrology, Roorkee, a unit under MoWR, RD&GR.

Madhya Pradesh and Uttar Pradesh no meetings of the Regional Committee were held as of February 2016.

### **6.6 Preparation of Digital Elevation Models and Frequency Based Flood Inundation Maps for flood affected areas**

Clause 10.6 of National Water Policy (2012) stipulated that Frequency Based Flood Inundation Maps should be prepared to evolve strategies for coping with floods and droughts, as protecting all areas prone to floods was not practicable. Further, as per recommendation 28 of 21<sup>st</sup> Parliamentary Standing Committee on Water Resources for 2013-14, Digital Elevation Models<sup>51</sup>(DEMs) were to be prepared to demarcate flood affected areas in the States that were facing perennial flood ravages, especially the Ganga basin States.

From the 17 States/UT covered in audit, we found that only Bihar and Odisha prepared Frequency Based Flood Inundation Maps. CWC was involved in development of mathematical models for flood forecasting which were to be further utilised in preparation of the maps. But as of March 2016, the models were not developed by CWC due to which Frequency Based Flood Inundation Maps were not prepared by CWC.

Preparation of DEMs including Bathymetric survey<sup>52</sup> of two lakh square meter (sq m) of the most flood affected areas in Bihar, Uttar Pradesh and West Bengal at a cost of ₹ 400 crore was initially included in the Expenditure Finance Committee (EFC) proposal for the plan scheme “Flood Forecasting” in XII FYP. Later on this component was withdrawn and included in proposal of National Mission for Clean Ganga for preparation of DEMs in 2.5 lakh sq. m. area in Ganga Basin through a separate EFC. The Ministry did not furnish the latest position in this regard.

We found that none of the States sampled in audit had prepared DEMs. In the case of West Bengal, Irrigation and Waterways Department stated (August 2016) that preparation of DEMs for FPA was costly and time consuming.

During the exit meeting (December 2016), the Ministry stated that on the directions of the Expert Committee constituted for the purpose by it, Regional Committees were constituted in States/UTs, with Principal Secretaries of the State as Chairman and senior CWC field officer as Member-Secretary, for scientific assessment of Flood Prone Area. The huge money charged by National Remote Sensing Centre (NRSC) for high resolution DEMs is a deterrent in preparation of the inundation maps. State Governments too do not have required funds for this. The work on scientific assessment of flood prone area is under way in CWC.

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<sup>51</sup> The Digital Elevation Model (DEM) prepared by using satellite data, is one of the key inputs for hydrological/hydraulic model development, and flood hazard mapping.

<sup>52</sup> Bathymetry is the study of underwater depth of lake or ocean floors.



However, the fact remains that non-preparation of DEMs resulted in non-demarcation of various flood zones in the Country digitally and absence of scientific images of the food affected areas. The non-preparation of Frequency Based Flood Inundation Maps also defeated the purpose of development of strategies for coping with floods.

### 6.7 Morphological Studies

Paragraph 10.3 of National Water Policy 2012 envisaged that Morphological studies should be undertaken, based on which planning, execution and maintenance of revetments, spurs, embankments, etc. could be carried out, so as to prevent loss of land eroded by rivers. This will become increasingly more important, since climate changes were likely to increase the rainfall intensity, and hence, soil erosion. Twenty first Parliamentary Standing Committee on Water Resources, 2014 recommended that the Ministry/CWC/GFCC should immediately conduct detailed morphological studies of all the rivers in 11 Ganga Basin States<sup>53</sup> and complete this exercise within a definite time frame with a view to achieve better results in building, renovating and maintaining revetments, spurs and embankments in the area to control and mitigate the disaster caused by the flood.

There are around 301 rivers falling under 11 Ganga basin States. CWC awarded works relating to morphological studies of only 15 rivers<sup>54</sup> during 2015-16, to be completed in two years. Out of these 15 rivers, morphological studies of only eight rivers (three *per cent*) was taken up.

In the absence of morphological studies, proper planning, building, renovating and maintaining revetments, spurs and embankments to prevent loss of land due to erosion, could not be ensured.

The Ministry stated (December 2016) that the policies laid out in National Water Policy were being followed.

The reply cannot be accepted as Morphological studies as envisaged in the policy were not completed in any of the States.

### 6.8 Comprehensive Master Plan and formation of Implementation Committee

The 21<sup>st</sup> Parliamentary Standing Committee on Water Resources noted (February 2014) that the main function of GFCC is to prepare Comprehensive Master Plan

<sup>53</sup> Bihar, Chhattisgarh, Delhi, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Rajasthan, Uttar Pradesh, Uttarakhand and West Bengal.

<sup>54</sup> Ganga, Rapti, Sharda, Kosi, Bagmati, Yamuna, Brahmaputra, Subansiri, Pagladia, Krishna, Tungbhadra, Mahananda, Mahanadi, Hoogly and Tapi.

(CMP) for flood protection and flood management in the Ganga basin States. Similarly, Brahmaputra Board was to carry out survey and investigations in Brahmaputra Valley and prepare a Master Plan for the control of floods, bank erosion and improvement of drainage in the Brahmaputra Valley and activities connected therewith. Guidelines of the GoI on the FMP envisage that Central assistance to the States would be provided for taking up flood management works in an integrated manner covering entire river/ tributary or a major segment.

The GFCC prepared CMPs for all the 23 rivers which are tributaries of the Ganga. GFCC being an Advisory Commission, execution of all works suggested under the CMPs has to be carried out by the respective State Governments. However, information regarding preparation of Action Plans for implementation of recommendations contained in CMPs was not forthcoming from State Governments. Our observations relating to preparation of CMP are as follows:

- a. Out of 17 sampled States/UT, 10 States (Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Manipur, Odisha, Punjab, Tamil Nadu and Uttarakhand) did not prepare CMP for flood management. Instead, these States prepared flood management projects on selective basis.
- b. In Uttar Pradesh, CMP was prepared by the GFCC, however its recommendations were not implemented despite being one of the severely flood-affected States.
- c. While formulating the FMP schemes in West Bengal, major recommendations of GFCC were either not incorporated in the Detailed Project Report (DPR) or were not implemented. Seven FMP schemes falling in the Ganga Basin revealed that important recommendations such as creation of natural detention basins, partial diversion of the flood water to the spill channels, water shed management, morphological studies, etc, were not taken up.
- d. In Arunachal Pradesh, though Brahmaputra Board (BB) had prepared the basin wise CMP, no action plan on the basis of the CMP was prepared by the State (June 2016).
- e. Assam implemented only the short term schemes recommended in the CMP, but did not implement the long term measures recommended in the master plan.

Further, the Ministry requested (February 2014) six severely flood-affected Ganga basin States, namely Bihar, Himachal Pradesh, Jharkhand, Uttarakhand, Uttar Pradesh and West Bengal to constitute Implementation Committees to ensure time-bound implementation of the recommendations of the CMPs.

We found that only Uttar Pradesh formed Implementation Committee, but no records relating to its meetings and progress achieved towards implementation of

comprehensive plans were made available to audit. Thus, due to non-formation of Implementation Committees, time bound implementation of the recommendations of the CMPs for management of floods could not be ensured.

In Tamil Nadu, it was observed that Master Plan for Chennai and its suburbs, for its three rivers viz., Kosasthalayar, Cooum and Adyar, was not prepared (August 2016) to manage floods and for augmentation of water resources. The Engineer in Chief, Water Resource Department, stated (August 2016) that comprehensive master plan for Chennai and its suburbs could be evolved only in co-ordination with District Administration and local bodies. The absence of co-ordination between the WRD, Revenue Department and local bodies contributed to non-preparation of basin wise CMP, denying the planned execution of macro and micro drainage networks.

### **6.9 Flood Plain Zoning**

Flood Plain Zoning measures aim at demarcating zones or areas likely to be affected by floods of different magnitudes or frequencies and probability levels and specifying the types of permissible developments in these zones, so that whenever flood actually occurs, the damage can be mitigated.

CWC circulated a Model Bill on Flood Plain Zoning to all the States in 1975 for guidance of States for enactment of legislation in this regard. The Model Bill provided model clauses about flood zoning authorities, surveys and delineation of flood plain area, notification of limits of flood plains, prohibition or restriction of the use of the flood plains, compensation, and power to remove obstruction after prohibition.

The 21<sup>st</sup> Parliamentary Standing Committee on Water Resources recommended (2013-14) that MoWR, RD&GR take vigorous steps for persuading the States to enact the necessary legislation in this regard without delay.

We observed that only three States Manipur, Rajasthan and Uttarakhand had enacted Flood Plain Zoning Acts. As such, due to non-enactment of legislation for Flood Plain Zoning, enforcement of the measures to minimize/avoid damages due to floods could not be ensured.

The Ministry accepted (December 2016) that only States of Manipur, Rajasthan and Uttarakhand had enacted legislations for the Bill and stated that initial actions had been taken up. The Ministry further stated that it was up to the States to enact the Flood Plain Zoning Bill.

In Uttarakhand, Disaster Mitigation & Management Centre (DMMC) in 2012 had emphasised the need to banning construction especially in proximity of rivers and streams in line with the provisions of the Uttarakhand Flood Plain Zoning Act

2012. The Geological Investigation Report (2014) of DMMC and study report of (2014) of Wadia Institute of Himalayan Geology attributed that most of damages during the floods of June 2013 were due to construction and encroachment along the riverbeds and flood plain areas. If the recommendations of DMMC (2012) had been adopted by the Government, the impact of the floods of June 2013 would have been lesser.

In Tamil Nadu, the proposal (June 2014) to form a Committee to give recommendations for enacting the legislation for enactment of Flood Plain Zoning Bill, was under consideration of the State Government (August 2016). Lack of legislation for Flood Plain Zoning, resulted in developments abutting waterways, leading to inundation in Chennai and its suburbs during 2015 floods.

The fact remained that Bill on Flood Plain Zoning could not be enacted in most States even after more than 40 years since it was first envisaged.

#### **6.10 Conduct of glacial lake outburst flood and landslide dam break floods studies**

Clause 10.7 of National Water Policy 2012 envisages that in order to increase preparedness for sudden and unexpected flood related disasters in hilly reaches, glacial lake outburst flood and landslide dam break floods studies with periodic monitoring along with instrumentation, etc., should be carried out.

The work of monitoring of Glacial Lake and Water Bodies (GL/WB) in the Himalayan Region was taken up by CWC in 2009. The inventory of GL/WB was prepared in 2011 based on satellite imageries taken in 2009. As per inventory, there were 2,027 GL/WB with more than 10 hectares of water spread areas. Since 2011, monitoring of only 477 GL/WB having water spread area of more than 50 hectares was done every year during monsoon season (June-October).

Thus, periodic monitoring in hilly reaches was not being done for all the inventorised Glacial Lake and Water Bodies.

#### **6.11 Conclusion**

Recommendations of Rashtriya Barh Aayogh with regard to identification of area affected by flood in the country remained unfulfilled. In most of the States the scientific assessment of flood prone areas was not carried out. Non-preparation of Digital Elevation Models led to non-demarcation of various flood zones in the Country digitally and absence of scientific images of the food affected areas. Morphological studies with a view to achieve better results in building, renovating and maintaining revetments, spurs and embankments to control and mitigate disasters caused by floods were not completed by any of the 17 States/UT. None of the States/UT sampled in audit had prepared Comprehensive Master Plans (CMP) for flood management. Six severely flood affected Ganga basin States did

not constitute Implementation Committees for time bound implementation of the recommendations of the CMP for management of floods. None of the sampled States except Jammu & Kashmir, Manipur and Uttarakhand had enacted Flood Plain Zoning Acts. As such, enforcement of the measures to minimize/avoid damages due to floods could not be ensured.

#### **6.12 Recommendations**

We recommend that

- i) MoWR, RD&GR may persuade the State Governments to prepare a time bound action plan to comply with the recommendations made by Rashtriya Barh Ayog, Task Force 2004, Parliamentary Standing Committee on Water Resources and National Water Policy 2002 and 2012, and factor these recommendations in the release of funds in the various schemes of Central Government.
- ii) MoWR, RD&GR may take up with the States to enact the Flood Plain Zoning Bill and implement it in a time bound manner.

