12

STANDING COMMITTEE ON WATER RESOURCES

(2020-21)

SEVENTEENTH LOK SABHA

MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION

Flood Management in the Country including International Water Treaties in the field of Water Resource Management with particular reference to Treaty/Agreement entered into with China, Pakistan And Bhutan

TWELFTH REPORT

LOK SABHA SECRETARIAT

NEW DELHI

August, 2021 /Sravana,1943 (Saka)

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Presented to Lok Sabha on 05.08.2021

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^ Vacancy caused on account of demise of ShriNand Kumar Singh Chauhanw.e.f. 02.03.2021

^^ ShriKausal Kishore &Shri A. NarayanaSwamyceased to be the Member of this Committee w.e.f. 08.07.2021 after induction as Minister.

^^^ Nominated to the Committee w.e.f 05.04.2021 vice ShriDipsinhRathod

* Vacancy caused due to retirement of Mir Mohammad Fayazw.e.f. 10.02.2021.

** Vacancy caused on account of demise of Shri A. Mohammedjanw.e.f. 23.03.2021.

INTRODUCTION

I, the Chairperson, Standing Committee on Water Resources (2020-21) having been authorised by the Committee to submit the Report on their behalf, present the Twelfth Report on "Flood Management In the Country including International Water Treaties in the field of Water Resource Management with particular reference to Treaty/Agreement entered Into with China, Pakistan And Bhutan".

2. The Committee (2019 -20) had taken up the subject "Flood Management in the Country and evolving a Decision Support System for release of Water from the Dams" for examination. As the Report could not be finalized during the tenure of the Committee, therefore, this subject was again selected by the Committee (2020 -21) under a different nomenclature, i.e. "Flood Management In the Country including International Water Treaties in the field of Water Resource Management with particular reference to Treaty/Agreement entered Into withChina, Pakistan And Bhutan" for a detailed examination and Report. The Committee took evidence of the representatives of the Ministry of Jal Shakti – Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of External Affairs and representatives of the Governments of Assam and Kerala on 06 August 2020, 17 August 2020 and 17 November 2020 respectively.

3. The Report was considered and adopted by the Committee at their sitting held on 03.08.2021.

4. The Committee wish to express their thanks to the representatives of the Ministry of Jal Shakti – Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of External Affairs, Representatives of the Governments of Assam and Kerala for providing the requisite written information as also for depositions made in connection with the detailed examination of the subject.

5. The Committee would also like to place on record their sense of deep appreciation for the assistance rendered to them by the officials of the Lok Sabha Secretariat attached to the Committee.

NEW DELHI;
03 August , 2021
12 Sravana*, 1943 (Saka)*

Dr. Sanjay Jaiswal
Chairperson,
Standing Committee on Water Resources

REPORT

PART I

BACKGROUND ANALYSIS

1.1 According to the World Meteorological Organization "flood" is definedas:

(i) Rise, usually brief, in the water level in a stream to a peak from which the water level recedes at a slower rate.
(ii) Relatively high flow as measured by stage height or discharge.
(iii) Rising tide.

"Flooding" signifying the impact of flood is defined as the overflowing by water of the normal confines of a stream or other body of water, or accumulation of water by drainage over areas that are not normally submerged. Since various rivers/streams have different carrying capacities, no specific parameter/ criterion based on quantum of excess water flows has been laid down for defining flood.

1.2 Floods are natural calamity that India faces almost every year, in varying degrees of magnitude. The frequent occurrence of floods can be attributed to various factors, including wide variations in rainfall both in time and space with frequent departures from the normal pattern, inadequate carrying capacities of rivers, river bank erosion and silting of river beds, landslides, poor natural drainage in flood prone areas, glacial lake outbursts, etc. India suffers huge economic loss annually besides the precious human lives due to floods. From the time immemorial man has adapted to the furies of nature. As a matter of fact, the floods can't be controlled completely but man has made continued efforts to devise means to control the floods and mitigate their impacts. The devastation caused due to floods in the past has drawn attention of the planners of the country towards comprehensive flood management plans, policies and implementation thereof. The detail of annual damages due to floods is available from year 1953 onwards. The maximum area affected due to flood in any one of the years under consideration is taken as the area liable to flood in that State. Considering all such figures for all the States for the period from 1953 to 1978, RashtriyaBarhAyog (National Commission on Floods) has assessed the total area liable to flood in the country as 40 Mha. About 80% of this, i.e., 32 Mha area could be provided with reasonable degree of protection. The severity of the problem can be seen from the above figures that this area constitutes about $1/8^{th}$ of total geographical area of the country.

1.3 For monitoring the floods in the country through its flood forecasting network, the Central Water Commission has categorized various flood situations into three different

categories, namely Above Normal, Severe and Extreme depending upon the river water level with reference to warning level, danger level, and highest flood level.

- ***Above Normal Flood*:** If the water level of the river at flood forecasting site touches or crosses its Warning level, but remains below the Danger Level of the site then the flood situation is called the "Above Normal" situation.
- ***Severe Flood*:** If the water level of the river at the forecasting site touches or crosses Danger Level but below the Highest Flood Level of the forecasting site then the flood situation is called "Severe Flood" situation.
- ***Extreme Flood*:**The flood situation is said to be "Extreme" when the water level of the river touches or crosses the "Highest Flood Level" recorded at any forecasting site so far.

1.4 On being asked about when and under what circumstances, flood in an area is declared as a 'National Calamity, the Department of Water Resources, River Development & Ganga Rejuvenation (DoWR, RD & GR) in its written reply stated as follows:

> *"Under the existing Scheme of State Disaster Response Fund/National Response Fund of Ministry of Home Affairs, there is no such provision to declare any disaster including flood as a "National Calamity". However, in the event of disaster of a 'severe nature', financial assistance towards the notified natural disasters including flood is met from the State Disaster Response Fund (SDRF) which is further supplemented from the cess-based fund of National Disaster Response Fund (NDRF) in accordance with the established procedure, which includes an assessment based on the visit of an Inter-Ministerial Central Team".*

1.5 When asked whether the Department is contemplating to formulate a National Policy on Flood Control and Management, in the light of frequent and recurrent floods in the country, the Department in its written reply stated as follows:

> *"Central Government had formulated the National Water Policy in 1987, which was subsequently reviewed and revised in the year 2002 and 2012. The main objective of the National Water Policy is to take cognizance of the existing situation in water sector, to propose a framework for creation of a system of laws and institutions and a plan of action with a unified national perspective in planning, management and use of water resources. Effective management of flood & drought has always been a part of National Water Policy. The National Water Policy has been sent to all States/Union Territories(UTs) for appropriate action. As per available information, 16 States/UT have formulated and adopted their State Water Policies.*
>
> *With a goal to address the present challenges in water sector, revision of National Water Policy 2012 has been envisaged by the Department of Water Resources, River*

Development and Ganga Rejuvenation (DoWR,RD and GR), Ministry of Jal Shakti. A drafting committee has been constituted on 5th November, 2019 to revise the National Water Policy. The process of revision of National Water Policy involves consultations with various stakeholders including States/UTs".

1.6 According to the DoWR,RD and GR, damages due to heavy rain and floods are compiled by Central Water Commission(CWC) after receipt of confirmation from respective States. The State-wise details of losses due to floods are compiled by Central Water Commission (CWC) based on the data provided by the States. The State-wise data for the year 2018 and all India averaged data over the period 1953 to 2018 is at given**Annexure I& II.**Data in respect of 2019 is stated to be reconciled with the concerned State Governments and is likely to be published thereafter.

Causes of Floods

1.7 The DoWR,RD and GR have informed the Committee that India faces floods almost every year, in varying degrees of magnitude. The frequent occurrence of floods can be attributed to various factors, including wide variations in rainfall both in time and space with frequent departures from the normal pattern. The main causes of floods are as under:

i) High intensity rainfall in short duration
ii) Poor or inadequate drainage/channel capacity
iii) High Silt Load in rivers
iv) Encroachment of Riverine Areas.
v) Deforestation/Watershed Degradation
vi) Loss/destruction of wetlands
vii) Unplanned reservoir regulation
viii) Snowmelt and glacial lake out bursts

1.8 Elaborating on the challenges faced by the different regions of the country due to floods, the Secretary, DoWR, RD & GR during the oral evidence held on 17.8.2020 stated as follows:

"Today, the Southern States or the Central States have different kinds of problems. Assam, Bihar and UP have different kinds of problems. Assam, UP and Bihar are three States where there are not many dams. The water which comes either from Nepal or from our own territories, is uncontrolled whereas the Krishna Basin or any such basin are highly dammed basins; and water is basically unregulated".

1.9 When asked as to what extent the role the encroachment of river beds- closed river mouths, low carrying capacity of Flood Spill Channels (FSC), and failure of flood control structures contribute to causing floods, the Department replied as under:

"The role played by various factors as indicated above in causing flood is described below.

Encroachment of river-beds: *The flood plain of a river is essentially its domain and any intrusion into or developmental activity therein obstructs the river's 'right of way' leading to flooding. Generally flood embankments are constructed to check the spills of flood waters to nearby areas and there is provision for natural meandering of rivers by locating flood embankments to an appropriate distance from the river banks. However, generally areas between the embankments and river banks are encroached by the local people and these people are most vulnerable to floods.*

Closed river mouths*: The rivers on their courses are joined by various streams and tributaries so that catchment areas are drained out suitably. When due to rapid urbanization, deposition of silt and other factors, mouths of such streams and tributaries get clogged, drainage congestion problem in that area leads to flooding .*

Low carrying capacity of Flood Spill Channels (FSC): *Diversion of flood waters through flood spill channels involves transfer of a part of the flood discharge to another basin or to the same basin downstream of the problem area or to a depression where it could be stored for subsequent release. This measure can be used to manage unusual floods around cities as in the case of flood spill channel near Srinagar and also in the lower reaches of a river near the sea as in the case of Krishna Godavari drainage scheme. But in due course of time, discharging capacities of such flood spill channel may get reduced due to issues like encroachment, siltation etc, which causes floods in nearby areas.*

Failure of flood control structures*: As stated above flood embankments are constructed to check the spills of flood waters to nearby areas. However, due to various reason viz., meandering of rivers, shifting of main flow channel and consequent erosion, offset between river banks and embankments get reduced and embankment itself becomes vulnerable to floods. Further due to neglect of repair and maintenance issues embankment also sometimes becomes weaker. Due to these factors embankments gets breached or overtopped resulting in floods in nearby areas".*

Effect of Climate change on Floods

1.10 When asked as to whether any study has been undertaken to assess the impact of climate change on floods, the Department in their written reply stated as follows:

"Climate change is a global environmental challenge and there are studies projecting varied impacts on different sectors including agriculture and water resources. According to India's Second Biennial Update Report (BUR) submitted to the United Nations Framework Convention on Climate Change (UNFCCC), the overall impact of climate change on water resources is anticipated in terms of rise in extreme events, thereby increasing the flood and drought frequency, intensity of rainfall and spatial variability.

The Government is implementing National Action Plan on Climate Change (NAPCC) which comprises of missions in specific areas of solar energy, energy efficiency, water, agriculture, Himalayan eco-system, sustainable habitat, green India and strategic knowledge on climate change. The NAPCC provides the overarching framework for all climate actions. The Government is also implementing the scheme, "National Adaptation Fund for Climate Change" to support adaptation measures of States/UTs in areas that are particularly vulnerable to the adverse impacts of climate Change.

National Water Mission (NWM) under DoWR, RD & GR is one of the eight Missions established under NAPCC. The main objective of National NWM is "Conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management". NWM is facilitating preparation of State Specific Action Plan (SSAP) for water sector for managing the impact of climate change".

Eight numbers of research studies on impact of climate change on water resources are going on sponsored through Indian National Committee on Climate Change(INCCC) under National Water Mission. The details are as under:-

S, No.	Name of the Scheme	State/Institute
1	Impact Assessment of Climate Change on Hydro- meteorological processes and Water Resources of Mahanadi River Basin	IISC Bangalore (Lead Instt.) IIT Bhubhaneshwar
2	Climate change impact studies for Rajasthan Area of inland drainage and Mahi basin	MNIT Jaipur (Lead Instt.) CU Ajmer Rajasthan IIT Delhi
3	Impact of Climate Change on Water Resources of Tapi Basin	SVNIT Surat (Lead Instt.) MNIT Jaipur MANIT Bhopal
4	Effects of Climate Change and land use/land cover changes on spatial and temporal water availability in Subarnarekha Basin	IIT Kharagpur
5	Impact of Climate Change on Water Resources of Sabarmati Basin	IIT Gandhinagar (Lead Instt.) SVNIT Surat
6	Impact of Climate Change on Water Resources in River Basins from Tadri to Kanyakumari	IIT Mumbai (Lead Instt.) NIT Surathkal CWRDM Kozhikode

7	*Statistical Downscaling for Hydro-climatic Projections with CMIP5 Simulations to Assess Impact of Climate Change*	*IIT Mumbai (Lead Instt.)*
		IIT Guwahati
		IISc Bangalore
		IIT Gandhinagar
		IIT Kanpur
8	*Dynamic Downscaling to study Climate Change I on Water Resources in India*	*IIT Delhi (Lead Instt.)*
		IIT Madras
		Anna University
		BHU Varanasi

IIT – Indian Institue of Technology, MNIT–Malviya National Institute of Technology, MANIT – Maulana Azad National Institute of Technology, SVNIT – Sardar Vallabhbhai National Institute of Technology, NIT - National Institute of Technology, CWRDM - Centre for Water Resources Development and Management, IISC – Indian Institute of Science, BHU – Banaras Hindu University

It has been often stated that due to climate change on account of global warming the rainfall pattern has been altered over the years with lesser number of rainy days but heavier rainfall".

Chapter II
Flood Management in the Country

Flood Management in the Country

2.1 Explaining the steps taken for flood management in the country, the DoWR,RD and GR in a written note have stated that different measures have been adopted to reduce the flood losses and protect the flood plains. Depending upon the nature of work, Flood protection and flood management measures are broadly classified as under:

(a) Structural Measures
(b) Non-Structural Measures

Structural Measures

2.2 The structural measures for flood control which bring relief to the flood prone areas by reducing flood flows and thereby the flood levels are:

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

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

(a) embankments which artificially raise the effective river bank and thereby prevent spilling and
(b) 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.

Non-structural Measures

2.4 The administrative methods endeavour to mitigate the flood damages by:

(a) Facilitating timely evacuation of the people and shifting of their movable property to safer grounds by having advance warning of incoming flood through setting up a flood forecasting system.
(b) Discouraging creation of valuable assets/settlement of the people in the areas subject to frequent flooding i.e. enforcing flood plain zoning regulation.

2.5 The details of various flood management measures taken up till XII Plan by the Government is as under:

S. No.	Flood Management Measures	Extent
1	Embankment	37072.659 km
2	Drainage channel/channel improvement	39726.700 km
3	Village raised/protected	7713 nos
4	Town/Village protection works	2906 nos
5	Raised Platforms	65 nos

It has been stated that the above measures have resulted in protecting area of about 20.54 mha till XII Plan.

2.6 When asked about the reasons for recurrence of floods every year despite having structural and non-structural measures in place, the DoWR,RD and GR in a written reply stated as under:

> *"Providing absolute protection to all flood prone areas against all magnitude of floods is neither practically possible nor economically viable. 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.*
> *Further, Integrated flood management calls for a paradigm shift from the traditional, fragmented and localized approach, and encourages the use of the resources of a river basin as a whole. Therefore, there is a need for an approach backed by latest technologies and implemented in a most effective manner. In order to have integrated basin development including flood management in a holistic manner, setting up of River Basin Organisations (RBOs) needs to be expedited. The River Basin Organizations shall have the mandate to implement flood control measures encompassing immediate, short-term and long-term solutions in an effective manner apart from overall water resources development of the basin".*

2.7 On being asked about the monitoring mechanism in the Department for ensuring that the flood control structures of the States are properly maintained and inspected by the concerned authorities at regular intervals, the Department in their written reply stated as under:

> "*Extensive and regular monitoring of the projects being executed under* Flood Management Programme *(FMP) Scheme is carried out by the Central Water Commission (CWC), Ganga Flood Control Commission (GFCC) and Brahmaputra Board (BB) in their respective jurisdiction. The main objective of monitoring is to ensure the achievement of physical and financial targets for timely completion of projects, identification of the inputs required, analysis of the reasons for any shortfalls/bottlenecks and suggest remedial measures etc., with a view to complete*

them in a time bound manner. The above central organizations also play an active role at formulation stage of the Detailed Project Reports(DPRs) for flood management works by the State Governments in their respective jurisdiction and provide necessary guidance in preparation/ submission of the funding proposals in time for appraisal and release of central assistance".

2.8 To a query regarding whether any Inter-Ministerial Study group has been formed to study the problem of floods as also to control/mitigate the floods, the Department replied as follows:

"In order to formulate the strategy for flood management works in the entire country and river management activities and works in the border areas for period 2020-2023, a Committee has been constituted by National Institution for Transforming India (NITI)Aayog under the chairmanship of Vice Chairman, NITI Aayog. Officials from various Departments/ Ministries of Government of India, Experts from the field and Principal Secretaries from States of Jammu & Kashmir, Uttar Pradesh, Bihar, West Bengal, Punjab, Assam, Arunachal Pradesh, Tripura, Madhya Pradesh and Kerala have been included as the members of this Committee".

2.9 The DoWR,RD and GR have further informed the Standing Committee that the aforesaid Committee was constituted in October, 2019. It has met twice since its constitution in February, 2020 and May, 2020.Further, in pursuance to decision taken in the second meeting of Committee of NITI Aayog held on 27.05.2020, a Sub-Committee was constituted under the chairmanship of Secretary, DoWR, RD & GR, Ministry of Jal Shakti to assist the Committee in formulation of the proposal /strategy of flood management in respect of three broad areas, viz., structural measures, non structural measure and the scheme for financial assistance to states for taking up flood management works and river management activities/ works in border areas. Report of Sub-Committee has been submitted to the aforesaid Committee of NITI Ayog in July-2020

Constitutional provisions on flood management:

2.10 As per constitutional provisions, the subject of flood management including erosion control falls within the purview of the States. The flood management and anti-erosion schemes are planned, investigated and implemented by the State Governments with own resources as per priority within the State. The Union Government only renders assistance to States which is technical, advisory, catalytic and promotional in nature.The subject of flood control has not been specifically mentioned in any of the three legislative lists included in the Constitution of India. However, drainage and embankments are mentioned in Entry 17 of List II (State List) and is mentioned as under:

"Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provision of entry 56 of List I (Union List)."

Entry 56 of List I (Union List) reads as follows:

"Regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest."

2.11 On being asked whether non-inclusion of the subject 'Flood control' in the Union or Concurrent list limits the role of the Union government in proper control/supervision of the floods and their management, the Department in its written reply stated:

"In order to achieve long-term solution to the floods, the flood management has to be considered as part of integrated river basin management plan. Therefore, including the subject "Flood Control" in the Union or Concurrent list may not serve the desired purpose as management of floods is only one of the component of entire river basin plan.

Ministry of Jal Shakti has been propagating the concept of River Basin Organizations(RBO) for overseeing the planning and development of water resources of a river basin as a whole. It is expected that once the RBOs are formed, the effective management of floods can be appropriately undertaken".

2.12 To a specific query as to whether inclusion of 'Flood control' in the Concurrent list would have leveraged the Union Government to deal the problem of floods and its management in a holistic manner, the Department in its written submission stated as follows:

"As stated above, 'Flood Control' has to be seen as part of overall development of water resources of river basin as the water available in the flood season is generally conserved for meeting the demands for rest of the year. Therefore, unless the subject, "Development of Water Resources" is brought under the Concurrent/Union List, the Union Government would not get the desired leverage to deal with problems of floods and its management."

2.13 When asked whether any proposal has been mooted by the Department for bringing the subject of 'Flood control', under concurrent list of the constitution, the Department replied as under:

"As indicated above, in order to have an effective role by the Union Government in flood management, the subject "Water Resources Development" may have to be brought under the Concurrent list. However, as the subject has wider implications, the Department has not mooted any proposal for bringing the subject under concurrent list of the constitution".

2.14 The Ministry have further informed the Committee that in order to achieve the goal of integrated river basin management, suitable legislative measures within the existing provisions of constitution have to be evoked. In this direction Ministry of Jal Shakti has initiated the formulation of River Management Bill under the provision of entry 56 of List I (Union List). Another legislation in the form of Dam Safety Bill, 2019 which will enable Union Government to play effective role in taking measures for prevention of flood related disaster has been taken up by Ministry of Jal Shakti and has already been passed in Lok Sabha in year 2019. The existing Disaster Management Act, 2005 also empowers Union Government to issue necessary directions to the State Government/Authorities to take appropriate measures for prevention of any impending disaster.

Flood Plain Zoning

2.15 According to the DoWR,RD and GR,Flood-Plain Zoning is a concept central to flood plain management. This concept recognises the basic fact that the flood plain of a river is essentially its domain and any intrusion into or developmental activity therein must recognise the river's 'right of way'. 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 specify the types of permissible developments in these zones, so that whenever floods actually occur, the damage can be minimised, if not avoided. Although, this approach is generally endorsed by all in principle, scant attention is given to it in actual practice, leading to increased flood damages.

2.16 When asked about the work undertaken in all flood prone States relating to flood plain zoning, the Department in its written reply stated as follows:

> *"Ministry of Jal Shakti has continuously impressed upon the states the need to adopt flood plain zoning approach. A model draft bill for flood plain zoning legislation was also circulated by the Union Government to all the States. This bill envisages zoning of flood plain of a river according to flood frequencies and defines the type of use of flood plain. The states of Manipur, Rajasthan and Uttarakhand, erstwhile State of Jammu & Kashmir had enacted legislation however, delineation and demarcation of flood plains is yet to be undertaken.*
>
> *Major flood prone States viz Uttar Pradesh, Bihar, West Bengal, Assam, Odisha etc have not taken initiative to enact flood plain zoning bill. The States expressed their inability to enact the Act mainly on account of reasons like high population density, practical difficulties in relocation and rehabilitation, scarcity of land resources in urban areas, etc".*

2.17 On being asked whether the rules for River Regulation Zones have been notified and implemented, the Department in its written submission stated as follows:

"For regulating activities in flood plains of river Ganga and its tributaries, a Special Committee was constituted by Department of Water Resources, River Development & Ganga Rejuvenation under the chairmanship of Chairman, Central Water Commission in August, 2017 to identify and demarcate the flood plains of river Ganga in segment B of Phase- I (Haridwar to Unnaoj) on one in twenty-five years' cycle or appropriately and to identify various zones of activities therein.

The Committee in its Report (September, 2019) identified the flood plains in aforesaid stretch of river Ganga and categorized the flood plains in two zones viz. No Development Zone and Restricted/ Regulatory Zone. Prohibited and regulatory activities for both these zones have also been specified in the report.Government of Uttar Pradesh has initiated the work of identification of flood plain zones as per recommendations of the Committee.

Government of Uttarakhand has also demarcated the flood plains in Uttarkashi and Haridwar District and specified the activities prohibited and permitted in the demarcated area. State of Jharkhand has informed that demarcation of flood plain zones will be carried out during 2024-2025, after obtaining requisite data".

Scientific Assessment of Flood Prone Area

2.18 On being asked whether new technologies are being used to carry out scientific assessment of the flood prone areas using latest satellite imagery data and considering frequency of flooding, duration and depth of inundation etc, the Department in its written submission stated as follows:

"An Expert Committee for scientific assessment of Flood Prone Area (FPA) in the country has been constituted under the chairmanship of Chairman, (Central Water Commission) CWC with members drawn from India Meteorological Department *(IMD), Survey of India, Ganga Flood Control Commission (GFCC), Brahmaputra Board, National Disaster Management Authority (NDMA), National Remote Sensing Centre (NRSC), Planning Commission (NITI Ayog), Department of Space, Ministry of Agriculture, IIT Guwahati, IIT Roorkee, DoWR, etc.*

The Expert Committee in its 2nd meeting held in June 2013 had decided to define the flood prone area as the area affected by flood having a return period of 10 years. It further classified flood prone areas into three categories: Severe - inundation area computed corresponding to Highest Flood Level(HFL) with respect to 1 in 3 year flood frequency/ return period; Moderate - inundation area corresponding to 1 in 7 year flood and Normal - inundation area corresponding to 1 in 10 year flood.

Using the latest technology available today, the inundated area of India as a whole has been delineated by analyzing the Satellite Imageries available viz. Landsat (1984-2019), Microwave & Multispectral of Sentinel-1&2 (2014-2019) on Google Earth Engine Application Program Interface. Delineation of flood prone area corresponding to 10, 7 & 3 year return period floods has also been carried out and presented in the 5th meeting of Expert Committee held on March, 2020. Refinement of the study carried out by CWC is underway in consultation with NRSC".

Chapter III

Floods in Assam

Floods caused by Brahmaputra River

3.1 When asked about the main reasons for devastating floods every year by Brahmaputra river, the Department in its written submission stated as follows:

> *"The topographical and the geographical location of North East Region is unique with the hydro-meteorological situation making it one of the highest rainfall zones in the World. The State of Assam, the Gateway of North East India, is criss-crossed by number of major rivers originating from lower Himalayan ranges and debouching into the plains causing flash floods in the flood plains of Assam and neighbouring states. The main factors, which combine to create serious flood and erosion problems in Assam and its neighbouring states, are Heavy Rainfall, Physiographic Condition, High Silt Load, Encroachment of Riverine Areas, Steep Slope, Inadequate Drainage, Deforestation/Watershed Degradation, Obstruction at tributaries' confluence with River Brahmaputra and Loss/destruction of wetlands".*

3.2 On being asked about the remedial measures Department propose to take to prevent flood fury in Brahmaputra river basins including Assam, the Department replied as under:

> *"To address the problem of flood in north-eastern states and the issue of flood storage needs in Brahmaputra basin, a committee consisting of representatives from CWC, Central Electricity Authority (CEA), NHPC, National Water Development Agency(NWDA), Brahmaputra Board and Govt of Arunachal Pradesh, was constituted by MoWR (Now Ministry of Jal Shakti) in 2013. In its report, the committee concluded that the flood or high discharge in Brahmaputra basin is basically due to very high rainfall in the Indian catchment of the basin, and suggested that in order to mitigate the flood peaks in Brahmaputra, flood storage are required in the basin. However, due to natural topography of the basin, these flood storages can be provided in Siang, Subansiri, Lohit and Dibang sub basins only. Based on its study, the Committee estimated that a flood storage of about 9.2Billion Cubic Meters(BCM) in Siang, 1.91 BCM in Subansiri, 1.61 BCM in Lohit and 0.56 BCM in Dibang sub basin will be required, which may reduce the water level in Brahmaputra at Guwahati during floods by 1.2m to 1.5 m, depending upon the rainfall condition in intermediate catchment.*
>
> *Long term solution to the flood problem lies in creation of storage reservoirs on rivers and their tributaries with dedicated/specific flood cushion by reducing the flood peaks and levels, integrated reservoir operation, interlinking of rivers etc. Short term solutions in form of embankments, anti erosion measures, etc to manage floods and erosion problem are necessary to safeguard the flood prone areas, properties and population".*

3.3 To a query about the status of manpower (both technical and non-technical) in Brahmaputra Board and the adverse effect on its functioning due to shortage of manpower, the Department stated as follows:

"Due to retirement of officers and employees of Brahmaputra Board in bulk with effect from 2016, without corresponding fresh recruitment, the current manpower in Brahmaputra Board (both technical &non technical) is inadequate. Currently in Brahmaputra Board, out of 161 technical sanctioned posts, 61 are vacant whereas, out of 254 non technical Posts 168 are vacant.

The shortage of manpower does affect the functioning of Brahmaputra Board. However, the same is overcome to certain extent by entrusting additional charge to officials of some other organisations of the Department stationed in North East region".

3.4 When asked about the problems/hindrances being faced by the Department in containing the recurring floods in Assam and NE region, the Department in its written submission stated as under:

"The flood management schemes are planned, formulated and implemented by the concerned State Government from their own resources as per their priority. The Union Government supplements the efforts of the States by providing technical guidance and promotional financial assistance for management of floods in critical areas. Most of the embankments were constructed on main stem of river Brahmaputra and its tributaries way back in 1960s, 70s. These embankments need raising & strengthening as well as bank protection measures in form of revetment or Reinforced cement concrete (RCC) porcupines requiring huge capital investment.

Lack of cooperation among States in respect of inter-state projects, lack of budgetary support by State Governments for maintenance of flood management measures, difficulty in implementation of flood plain zoning and regulations are some of the problem faced in checking the recurring floods in Assam and North East(NE) region.

3.5 The State Government of Assam in their presentation before the Committee has inter alia stated the following facts:

(i) RashtriyaBarhAyog identified 31.05 Lakh Ha i.e. 39.58% of total land area of the State as flood prone. It comprises 10.2 % of the total flood prone area of the country. Average of 0.8 million ha in Assam flooded annually since 1953. During major floods, area affected can be almost 50% of Assam's total area of 7.8 million ha. A minimum of 2000 villages are exposed to extensive flood inundation every year. Since 1954, Total area eroded is 4,27,000 Ha. (about 7%) and rate of erosion has been 8,000Ha./Year. The Brahmaputra river area has almost doubled in the last century.

(ii) Most of the flood and bank protection structures were constructed as short term measures are very old and have become weak. The Highest Flood Level (HFL) of the rivers in the flood plain are increasing due to continuous deposition of silt. River witnesses Chronic flooding and river bank erosion. Substantial displacement of population has occurred due to river bank erosion. Flood and Erosion is particularly destructive today on account of the fact that the Brahmaputra Valley is densely populated. Measures taken so far did not yield desired result on account of the extremely shallow river bed of the river & heavy sediment carried by the river in the monsoon. Water storage reservoirs on the North Bank tributaries of the Brahmaputra are urgently needed. High population density in the flood plain indicates need for sufficient and adequate flood management works.

3.6 Elaborating on the challenges faced by Assam due to constuction of Hydro Projects in Arunachal Pradesh, the representative of State Government of Assam during the course of oral evidence stated as follows:

"Sir, I would like to highlight just one point and that is about storage reservoirs. It is a complex problem; it requires interaction between the Government of India, Government of Assam and Government of Arunachal Pradesh. There are certain things which the Government of Assam wants, there are certain things which the Government of Arunachal Pradesh wants and where the Government of India can play an honest broker. That is one and, of course, it requires significant amount of resources.

Basically, it is too important a subject to be left to the Ministry of Power of the Government of India alone. This is something which has to be looked at as a multipurpose project as various entities are looking at what is to be done and if only return on investment is to be looked at in terms of what will be the cost of generation of power and how cheaply I can do it, then naturally you will never consider building a storage dam. But if that was the consideration to do it, then, perhaps, Bhakra or Damodhar Dams would never have been built. So, my request is that to the Northeast and to Assam, something similar is required and that is something which will be a game changer for the people of Assam and the Northeast".

3.7 When asked about the impact of run-of-the-river Hydro Electric Projects located in Arunachal Pradesh on the floods in Assam, the Department of Water Resources, River Development and Ganga Rejuvenationin a written reply stated as follows:

"Some of the dams constructed for hydroelectric generation like Ranganadi, Pare, Doyang, Kopili, Umiam, Serlui, Tuirial, etc. located upstream of Assam in Arunachal Pradesh and other states release water on account of heavy inflows in rivers due to high precipitation in upper catchment of their rivers which resulted in some damages in downstream areas in Assam. As most of these projects are run-off-the river projects, there is no scope of absorbing the flood peaks. However, with

proper operation, coordination and regulation of reservoirs there is some possibility of achieving flood moderation up to a certain extent.

Recently, exercising the powers delegated section 10 of the Disaster Management Act, 2005, Secretary, Department of Water Resources, RD & GR, Ministry of Jal Shakti has issued necessary directions to all authorities to inform downstream authorities whenever a decision is taken by them to release water from the reservoirs/ dams within its limits. The said decision should be communicated sufficiently in advance by the concerned State/ UT Government/ Authorities/ Dam Authorities in order to allow mitigating measures to be set up by the downstream authorities against any impending flood situation, which could be caused due to the release of water from the dams/reservoirs".

3.8 Furter elaborating on the impact of hydro projects in Arunachal Pradesh on the floods in Assam, the representative of the Department of Water Resources, River Development and Ganga Rejuvenation during evidence stated as under:

"Sir, many a times it also arises that China will divert water from its territory and we will have water security problem in Brahmaputra river. As you know, the area of Galling in Arunachal Pradesh, which is on the border, the area below it, there is a lot of rain. Now it is a matter that even if there is not much water from it, we still get a lot of rain. But, as I mentioned earlier, we do not have any storage structure of our own. We hear about China that they have built a diversion structure, so they have not built dams on it as far as we get information. You might know that some of his projects were first thought of. You are right that all the power projects built so far are almost run-of-the-river power projects. They are not storage projects. Large storage projects are nonexistent. The first was that there would be three Siang projects in Upper Phase - Upper Siang, Middle Siang and Lower Siang. Later, a large storage dam was thought to be built on Upper Siang. That would be beneficial during floods in Assam. There have been many meetings regarding that. Whenever multipurpose projects or dams are built anywhere, there are some submergence there. Submergenceare not very large there. There is a city Yingkiong, which is the headquarters of Upper Siang district. Yingkiong has a population of only about eight to ten thousand people. There is an issue of rehabilitating those 8-10 thousand people. Their number is less, but there is a little more sensitivity. As you understand, Arunachal Pradesh is basically a tribal state. Most recently, about ten days ago, the Honorable Minister went there and I too. Along with other things, it also happened to the honorable Chief Minister of Arunachal Pradesh and the honorable ministers of that region, that we should give them a better package and if we make them a better city than the present one. It will be good if you do it. There is a big issue of rehabilitation of the people there. If that is resolved and if the project of Upper Siang is made then it will be very good. The projects that we have, will be better than this because it will also reduce the generation cost of power and the biggest benefit will be that the flood situation in Assam will be overcome every year".

3.9 The Government of Assam in their power point presentation to the Committee have submitted the following issues/suggestions for consideration of the Committee:

(i) Fresh Funding under Flood Management and Border Area Programme (FMBAP) needs to be provided by Government of India (GoI).
(ii) State Govt. has given suggestions on guidelines of the new Flood Management and Border Areas Programme (FMBAP) schemes which GoI is considering to restart. This needs to be accorded priority.
(iii) Central Share of Funding of FMP should be on 90-10 pattern.
(iv) Assam should be given priority in FMP Projects.
(v) River erosion in Assam had a crippling affect on the economy of the State. Erosion should be included in admissible list of calamities for assistance under National Disaster Response Force (NDRF)/ State Disaster Response Fund (SDRF).
(vi) Embankments of Brahmaputra and Barak are old & weak. Used extensively as roads in the remote areas of the State. Need to be strengthened & converted as "Road Cum Embankment".
(vii) To protect Majuli island and for communication, peripheral embankment system of Majuli Island should be improved.
(viii) At the request of State Govt to Hon'ble PM, GoI is considering setting up a basin level organization for integrated management of flood & erosion in the North East.
(ix) Assam, has given its suggestion on the draft North East Water Management Authority (NEWMA) Bill. The same may be placed in Parliament after incorporating suggestion given by Assam.

North East Water Management Authority (NEWMA)

3.10 The DoWR,RD and GD has informed the Committee that for integrated management of Water Resources for whole of NE region, Sikkim and Brahmaputra basin of West Bengal, setting up of a multi disciplinary body viz. Noth East Water Management Authorty is under active consideration. The salient features of the proposed North East Water Management Authority (NEWMA) which is to be set up by legislation (Bill) are-

(a) Brahmaputra and Barak river basin shall be managed as a single system and in an ecologically sustainable manner as a common pool community resource held, by the basin States, under public trust doctrine to achieve food security, livelihood support, and ensure equitable and sustainable development.
(b) Basin States shall in their respective territories develop, manage and regulate the waters of an inter-state river basin in an equitable and sustainable manner, provided

that the determination of optimum utilisation of waters and adequate river flows shall be as per the river basin Master Plan.

(c) Demand management of water shall be given priority, which economises on water use, maximises value from water and bringing in maximum efficiency in use of water resources.

(d) NEWMA will have two tier arrangements comprising of Governing Council (GC) under the chairmanship of Hon'ble Minister Jal Shakti and Co-chairmanship of Vice Chairman, NITI Aayog and an Executive Board under the chairmanship of Chief Executive Officer (CEO) of the authority.

The draft Bill has been prepared in consultative mode with all stake holders at the highest level and was circulated to all concerned States and related central Ministries, NITI Aayog, etc. A conference of Hon'ble Chief Ministers and Ministers of North East Region (NER) States was also held under the chairmanship of Hon'ble Minister Jal Shakti in March 2020. Draft Bill along with draft Cabinet note is currently being examined by Ministry of Law and Justice. Efforts are being made to introduce the Bill in the Parliament at the earliest.

Chapter IV
Floods in Kerala

Floods in Kerala

4.1 When asked about the problems being faced by the Department in flood control and forecasting in the State of Kerala, the DoWR, RD and GR replied as under:

> *"Kerala is situated along the Western Ghats with most of the towns and cities located on the foothills. The state has several small intra-state rivers with very small catchment areas, almost all of them flowing west toward Arabian Sea. Also, the steep slopes of rivers involved, leave a very small response time to issue a forecast for any station with respect to any base station upstream. The rivers are flashy in nature and swell up pretty quickly, and hence, effective level based conventional forecast is very difficult to make. Presently CWC is issuing the flood forecasts by adopting rainfall-runoff mathematical modelling in respect of 5 stations (3 level and 2 inflow) in State of Kerala".*

4.2 On being asked whether any efforts were made to prevent the floods in Kerala in 2018 and what steps have been taken to combat the menace of floods in the Kerala State post 2018, the Department in a written reply stated as under:

> *"During the year 2018, CWC was not having any flood forecasting station in Kerala as there was no request from Government of Kerala to start flood forecasting activity in their State. Thereafter, 5 stations were identified by Government of Kerala and flood forecasting activity in Kerala started from 2019 onwards. Subsequent to 2018 floods, CWC also studied the reservoir releases and made some recommendations to the Government of Kerala to follow in case of excess rainfall. This report was shared with all stake holders in Kerala. To prevent faulty reservoir operations, State Government has been advised to formulate rule curves for major reservoirs based on probability of various inflows over a long time series. CWC has rendered technical assistance to Government of Kerala in preparation of rule curves for 3 major reservoirs (Kakki, Idukki, and Idamalayar)".*

4.3 Apprising the Committee about the challenges faced by Kerala in flood control, the representative of State Government of Kerala during the oral evidence stated as follows:

> *"In Kerala, we hardly store 7 per cent of the water. Our reservoirs are very limited. We can store only 7 per cent of water. An hon. Member asked a question as to what is the problem with new dams. Around 95 per cent of our dams were constructed between 1960 to 1980. After the Forest Conservation Act and the Wildlife Protection Act came into force, we have a lot of hurdles to get clearance for the dams. There is also a strong environmental lobby in Kerala which is also against creating more dams. We do not have much space like other States. Ours is a very narrow State. Most of*

the potential reservoir sites are inside the forest area which comprise around 28 per cent of the State's area. So, a large reservoir, which will actually store the water, is coming in the forest area. So, it needs forest clearance. Even during the Cauvery water dispute, we got the allocation for Attappady Irrigation Project but we have not yet got clearance from the Ministry of Environment, Forest and Climate Change. After around 20 years fight, we got the allocation. The Supreme Court has also sanctioned that project but the project has not yet got clearance from the Ministry. That is one problem we are facing".

4.4 The witness further added:

"In other reservoirs, the catchment area is very big, so you will get a lead time, you will know that within five days or seven days how much flood will come. As far as reservoirs in Kerala are concerned, our lead time is limited to three to five hours. No flood forecasting will work for Kerala. The problem that we face in our State is that still we do not have 14 days qualitative prediction. When we look into IMD's prediction for the next five days, we can take it with 75 per cent confidence. But our problem is, if IMD is saying that heavy rain is going to come and five days before if I am releasing big quantity of water into the river, I do not have time. At that time, the quantity will be more and the river may be flooded without rain.

So, we have devised a strategy that we analysed the data of 40 years because we constructed Idukki and Idamala reservoirs were constructed 40 years ago. We sat with experts and analysed on which month we are getting more water and more rain. We are always creating a space there so that we can have moderate releases from the dams. That helps us because we are not allowing water to cross that particular ruler. My permitted level in my dam is this much, I can store up to this level. But when I reach this level, I will increase my power generation or I will open my spillway and see that the water level does not cross that particular level so that there is enough space. For example, if you are hit by a car running at 5 km. per hour speed, there will not be any problem. But if a car running at 200 km. per hour speed, that will cause you problem. We are adopting the same principle here and we are releasing water in moderate quantities".

4.5 As regards, the coordination between the Government of Kerala and Tamil Nadu, the represenative of Government of Kerala apprised the Committee as follows:

"The hon. Member raised a question regarding Tamil Nadu. The authorities of Tamil Nadu are extending a lot of support. But this time, as far as Mullaperiyar project is concerned, we requested Tamil Nadu that they have to take more water in Mullaperiyar river and they have taken. They have cooperated with us. But this rule is important to see that we are adopting the same principle in Kerala. As far as the Parambikulam-Aliyar Project is concerned, we created a WhatsApp Group. All Tamil Nadu Engineers from Parambikulam-Aliyar Project Group came and because of the coordination with them, we avoided a flood situation Chalakudy also. They fully cooperated with us; whatever suggestions we have given in a professional manner,

they respected them and they also have given us suggestions to us. We actually deliberated on them".

4.6 The State Government of Kerala in its written submission informed the Committee *of* the following facts:

(i) The very important matter of concern for Kerala is that, there is sharp elevation difference between the hills and the sea in the geographical structure of the State with a high mountainous Western Ghat at Anamudi, which is at an elevation of 2695m from Mean Sea Level(MSL). Most of the areas in the elevation range from 1600m to 2500m. This elevation falls very rapidly in a narrow width between the Ghats and the sea. This sharp elevation difference along with the high intensity rainfall during the monsoon months is the main reason for the acute flood problem faced by the State.

(ii) Except in rare cases, the river channels are sufficiently deep in hilly tracts and the midlands, and they reach usually the river banks containing the flood without breaching. But in the low lands, the banks are very low and the river section can not contain the high floods, which resulted in overflowing the spate to the adjacent lands and get them inundated. The large scale changes in land-use pattern due to rapid development and high population density, reclamation of low lands which used to provide cushioning effect to the flood waters and the obstructions caused to the natural drainages etc have negatively influenced to worsen the flood impacts. State has only two major reservoirs viz. Idukki and Idamalayar, which are having more than 1000 Million Cubic Metre (MCM) live storage capacity, where we can provide some moderate flood cushion balancing the necessity for our lean months demands of drinking water, irrigation, electricity generation, saline water ingression mitigation and industrial uses.

(iii) There is spatial variability of rainfall across the State with certain places receiving more than average rainfall of 3000 mm and others less than 1000 mm. The temporal and spatial water availability of the State is widely varying too as Kerala is now facing floods in monsoon and acute water shortages during lean months. For lean season demands, Kerala depends on the combined live storage of 5072 MCM under 35 reservoirs under various agencies, which hardly store 6.5% of the annual run-off.

(i) The studies conducted by the Central Water Commission and the IIT Madras emphatically concluded that the opening of dams has little role in the extreme floods in 2018 that occurred in the State of Kerala, but it was due to the unprecedented, extraordinary and extremely heavy rainfall which occurred within 3 days that had caused the deluge.

(ii) During the monsoon the sea coast of Kerala is affected with severe sea attack due to high tides. Due to this severe sea attack the areas near the coastline experiences flooding. But in order to carry out reformation/rehabilitation of coastal protection works, there is significant limitations of funds under State Plan. Though a Centrally Sponsored Scheme namely "Flood Management and Border Areas Programme (FMBAP)" exists, the State is unable to access the same owing to mandatory clearances required from the State Coastal Zone Management Authority. Though the State had approached its authority, it was informed that the clearance could not be issued unless EIA

(Environmental Impact Assessment) for one whole year is carried out. It was requested to the authority for exempting the State from insisting the norms at least for the works related to reformation of already existing sea-walls, if carried out, so as to settle some of the issues in vulnerable reaches. The authority informed that the same would not be possible.

(iii) Regarding the Inter-State dams, situated in Kerala and operated by Tamil Nadu, viz. the Mullaperiyar Dam (MPD) and three dams in the Parambikulam-Aliyar Project (PAP) system, there is still lack of coordination between the two State Governments resulting in delay in finalization of rule curves of two major reservoirs which is essential for ensuring the safe operation of these two reservoirs.

Chapter V
Flood Forecasting

Flood Forecasting

5.1 The Department of WR, RD & GR has informed the Committee that the work of flood forecasting and warning in India is entrusted with the Central Water Commission (CWC). Flood Forecasting and flood warning in India was commenced in a small way in the year 1958 with the establishment of a unit in the Central Water Commission (CWC), New Delhi, for flood forecasting for the river Yamuna at Delhi. Presently, there are around 1600 Hydro-meteorological sites being operated by CWC across the country covering 20 river basins for gauge, discharge, sediment & water quality observations. Many of these stations are used as flood monitoring stations for formulating flood forecasts.

State-wise Existing Flood Forecasting Stations

Sl. No.	Name of State/ UT	Number of flood forecasting Stations		
		Level	Inflow	Total
1	Andhra Pradesh	10	9	19
2	Arunachal Pradesh	3	0	3
3	Assam	30	0	30
4	Bihar	40	3	43
5	Chhattisgarh	1	2	3
6	Gujarat	6	7	13
7	Haryana	1	1	2
8	Himachal Pradesh	1	0	1
9	Jammu & Kashmir	3	0	3
10	Jharkhand	2	15	17
11	Karnataka	1	14	15
12	Kerala	3	2	5
13	Madhya Pradesh	2	10	12
14	Maharashtra	8	13	21
15	Odisha	12	7	19
16	Rajasthan	2	11	13
17	Sikkim	3	5	8
18	Tamil Nadu	4	11	15
19	Telangana	5	7	12
20	Tripura	2	0	2
21	Uttar Pradesh	39	5	44
22	Uttarakhand	4	2	6
23	West Bengal	12	4	16
24	Daman & Diu	1	0	1
25	NCT of Delhi	2	0	2
	Total	**197***	**128**	**325***

* As per information submitted by the Department, now CWC operates 198 Level Forecast Stations thereby increasing the total tally to 326.

5.2 The activity of flood forecasting comprises of Level Forecasting and Inflow Forecasting. The level forecasts help the user agencies in deciding mitigating measures like evacuation of people and shifting people and their movable property to safer locations. The Inflow Forecasting is used by various dam authorities in optimum operation of reservoirs for safe passage of flood downstream as well as to ensure adequate storage in the reservoirs for meeting demand during non-monsoon period. Presently, Flood forecasts are issued by CWC at 326 stations (128 Inflow Forecast Stations + 198 Level Forecast Stations) as per Standard Operating Procedure. Annually, about 7000 flood forecasts are issued by CWC during floods.

5.3 When asked about the sufficiency of Flood forecasting Stations to cover the whole country for the purpose of issuing flood forecasting warning, the Department replied as under:

"Presently, CWC has operationalised 326 Flood Forecast Stations. Out of which 198 stations are Level Forecast Stations in various villages and towns along the banks of various rivers and 128 are inflow forecast stations for various Dams/reservoirs/ Barrages etc. These stations are spread over 25 States/UT and 20 major river basins.While level forecast has almost reached the saturation levels with scope of covering some more stations in those states which are uncovered; there is scope of increasing the inflow forecast as CWC network is covering only 128 reservoirs in the country".

5.4 On being asked about the technology being used for gauging water flows, the Department stated as under:

"The manual Hydro-meteorological Stations are being modernised with automated Data Acquisition System and Data transmission through Satellite (telemetry) from 1999 onwards. As on date 941 stations have been installed. Another 153 stations are in advanced stage of installation. Manual observations are continued in all these stations also as a redundancy in case of any failure of equipment at times of flood".

5.5 When asked about the reasons for not setting up Inflow Forecasting Stations by the CWC in the States of Arunachal Pradesh, Assam, Himachal Pradesh and Jammu Kashmir, the Department in a written reply stated as under:

"Inflow Forecasting is done for Dams/ Reservoirs/ Barrages for providing advance information about the flow into these structures. Flood Forecasting is done based on the request from various State Government/Project Authorities. No request has been received from the States of Arunachal Pradesh, Assam, Himachal Pradesh and Jammu & Kashmir. Further, there is no major storage structure across the important rivers in these States except for some Barrages and small storage structures".

5.6 On being asked whether there was lack of coordination between the local administration and CWC in providing timely information thereby causing enormous

hardship to the masses during the deluge, the Department in a written reply submitted as follows:

> *"CWC is providing all flood related information to concerned States including Daily Flood Bulletins, Flood Forecast, Daily Situation Reports cum Advisories. Before commencement of flood season, regional level stake holder consultations are done and contact details of concerned nodal officers are updated and exchanged. Separate social media groups are created for passing flood information from respective Divisional Flood Control Room (DFCR) of CWC to the concerned Stakeholders including State Government Departments, Project Authorities as well as local SDRF and NDRF battalions. Hence, it is ensured that all flood related information reaches the concerned Stakeholders immediately as soon as forecasts are formulated".*

Chapter VI

Flood Management Programme

6.1 During the XI Plan, Government of India had launched "Flood Management Programme for providing central assistance to the State Government for undertaking works relating to river management, flood control, anti-erosion, drainage development, flood proofing, restoration of damged flood management works and anti-sea erosion works.

6.2 When asked about the number of works approved and their cost under Flood Management Programme since the launch of its programme, the Department in its written submission stated as follows:

> *"A total of 522 projects with an estimated cost of Rs 13238.37 Cr have been approved for central assistance since XI Plan (XI Plan - 420 projects with an estimated cost of Rs 7857.08 Cr and XII Plan - 102 projects with an estimated cost of Rs. 5381.29 Cr). As per available information, so far 414 schemes have been completed; 64 schemes foreclosed (1 no. shifted to RMBA) and 44 schemes are ongoing. The details are at* ***Annexure-III"****.*

6.3 When asked about the total area that has been protected against floods under the projects/schemes, the Department in a written reply stated as under:

> *"The completed 414 projects have provided flood protection to an area of about 4.987 mha. This protected area also includes restoration of earlier protected area by means of works like Raising & strengthening (R&S) of embankments etc. A population of about 51.97 million has also been benefited with these 414 completed schemes".*

6.4 On being further asked about the problems/obstacles being faced by the Government in implementation of these Programmes, the DoWR, RD & GR replied as under:

> *"It has been experienced that flood management projects undertaken by the State Governments get unduly delayed. The main reasons attributed to delays as highlighted by the States pertains to acquisition of land, encroachment of land, inadequate budgetary provision at Central and State level, difficult access to remote sites, contractual issues, limited working season, etc".*

Flood Management and Border Areas Programme (FMBAP)

6.5 The Department of WR, RD & GR has stated that a comprehensive scheme titled "Flood Management and Border Areas Programme (FMBAP)" with an outlay of Rs 3342.00 Cr (FMP-Rs 2642 Cr & RMBA-Rs 700 Cr) for period 2017-2020 with merged components from the existing Flood Management Programme (FMP) and River Management Activities

& Works related to Border Areas (RMBA) schemes during XII Five Year Plan was approved by the Union Cabinet and it aims at completion of the on-going projects already approved under FMP. The details of these components are as under:

(i) **Flood Management Program (FMP):** The Ministry had approved Flood Management Program (FMP) with an outlay of Rs 8,000 Cr in XI Plan which was continued with outlay of Rs 10,000 Cr during XII Plan also. A Central Assistance of Rs 4873.07 Cr was released during XI &XII Plan(XI-Rs 3566.00 Cr and XII-Rs 1307.07 Cr).

(ii) **River Management Activities & Works related to Border Areas (RMBA) Component:**This was started as a Central Sector Scheme with an outlay of Rs 820 Cr in XI plan for taking up non-structural measures such as Hydrological Observation and Flood Forecasting works on common border rivers, payment to neighboring countries (China) for supplying Hydro-observation(HO) data on common rivers, investigation of WR projects in neighbouring countries and activities of GFCC was funded through this scheme. In addition to above activities, 100% Central Assistance was also provided for taking up structural measures such as Anti Erosion/Flood Management schemes on rivers on international borders and Union Territories. The scheme with an outlay of Rs 740 Cr was also continued during XII Plan. A Central Assistance (as grant in aid) of Rs563.61 Cr was released during XI &XII Plan(XI plan-Rs. 340.41 Cr and XII Plan-Rs223.2 Cr).

6.6 The Department apprised the Committee that the Flood Management Programme (FMP) was implemented during XI Plan with an outlay of Rs. 8000 crore. Under the Programme, central assistance was provided to State Governments for taking up works related to river management, flood control, anti-erosion, drainage development, flood proofing, restoration of damaged flood management works and anti-sea erosion. The pattern of funding was 90 % (Centre):10 % (State) for Special Category States and 75 % (Centre): 25 % (State) for General/ Non-Special Category States. During XI Plan, 420 projects with a total estimated cost of Rs.7857.08 crore were approved under FMP. Central assistance to the States/UTs to the tune of Rs. 3566.00 crore was released during this plan period. During XII Plan, the Government of India approved continuation of "Flood Management Programme" with an outlay of Rs.10000 crore. The funding pattern under the Scheme for the special category States covering the North Eastern States, Himachal Pradesh, Jammu & Kashmir and Uttarakhand was revised to 70% (Centre) :30% (State) and for General States – 50% (Centre) : 50% (State). During XII Plan, 102 works with a total estimated cost of Rs.5381.28 crore were approved under FMP. Central assistance to the States/UTs to the tune of Rs. 1307.07 crore was released during this plan period.Thus total release during XI & XII Plan was Rs 4873.07 Cr under FMP.

6.7 When asked about the funding pattern between the Centre and States regarding the Flood Management Programme, the Secretary during the course of oral evidence held on 6.8.2020 replied as follows:

"But more than funding pattern, for your kind information, the total money, which we get, in India, do not pay more than ten percent of the amount spent for flood control. You are from Bihar, you will know how much you get. Our year-round budget has been 500 - 600 crores in the last three years. One is the funding pattern and the other is total quantum of funds. Now, only 500-600 crores will be available to the states. This is a much bigger problem. States do not have objections at 60: 40 or 90: 10. They say give us more money, take new projects which we are unable to take. Currently there is restriction that new projects will not be taken this year. This year was to be taken, but only after the full report of the Finance Commission can be taken.

6.8 During the sitting held on 17.8.2020, the Secretary further stated as follows:

"My next point is this. There was a lot of discussion that took place about funding, revenue generation and funding pattern. Again, pardon me for saying so, as Sir has said, outlay is one. In my opinion, I would be a little frank that outlay does not mean so much unless it is backed by the budget provision. So, we may have an outlay Rs. 8,000 crore; we may have an outlay of Rs. 10,000 crore in the next five year plan, but what is the budget, which is made available to me. As I told you, budget for flood control has been about Rs. 500 crore to Rs. 600 crore for the last three-four years every year. So, basically, what we provide is the technical support to the States for formulating the project, appraising the project. As far funds are concerned, most of the States – as Assam also said – they have also gone to external funding and external borrowing etc. It is because our budget provision for flood control is very, very limited. Sir, you would remember, when you discussed about the budget provisions, our total budget provision this year also is less than Rs. 9,000 crore for all the schemes put together, which includes about Rs. 1,000 crore salaries and establishment expenses. So, Rs. 8,000 crore would be the total budget provision whether it is for irrigation, miner irrigation, surface, lift, flood control, Ganga and other rivers – everything put together. But anyway, some of the problems, which were there as far as the funding pattern was concerned and non-inclusion of some of the rivers apart from Kosi and Gandak in Bihar and other things, are being taken care of in the new guidelines, which are almost finalised. The Sub-Committee, which was formed, has given its report, and Vice Chairman, NITI Aayog is looking at it. May be, shortly, the new guidelines would be there, which would take care of those problems relating to funding pattern etc.

Sir, as far as funding of projects is concerned, either we have budget provision or we have extra budgetary resources. Now, as far as flood management is concerned, there is no extra budgetary resources as far as our Ministry is concerned. State Governments may be borrowing. But yes, you are right, Sir. It was discussed

earlier also. For example, Pradhan Mantri Krishi Sinchai Yojana (PMKSY), major/medium irrigation projects. We have borrowed from National Bank for Agriculture and Rural Development (NABARD); and this year, I would be required to pay. Out of Rs. 8,000 crore which is left with me, I would have to pay about Rs. 2,800 crore towards the interest and the principal payment for the amount, which has been borrowed in the past. So, that means, the actual money, which is to be available in the budget, would be Rs. 8000 crore minus Rs. 2,800 crore. But yes, we can get budgetary resources from outside, which would be in addition to what the budget provision is there".

6.9 On drawing the attention of the Department to the demands of the States to increase the Centre's share under FMP scheme to 90 % which was reduced to 50% under XIIth Plan the Department in a written reply stated as follows:

"The funding pattern of the Centrally Sponsored Schemes (CSS) is decided by Ministry of Finance, GoI as a policy matter and central assistance to States is given following the directions of Ministry of Finance. The State of Assam being a North East State and therefore funding pattern during XII Plan for FMP Schemes in State of Assam was 70% (Central) : 30% (State). Further, Ministry of Jal shakti has proposed to NITI Aayog Committee for adopting funding pattern in general category States to be 60 % (Centre): 40 % (State) and for projects of 8 North Eastern States, J&K, Himachal Pradesh and Uttarakhand, to be 90 % (Centre): 10 % (State)".

6.10 The Department have further apprised the Committee that currently the Ministry of Jal Shakti has no proposal under consideration to set up a dedicated fund for Flood Management Programme (FMP) on the lines of Clean Ganga Fund.

Chapter VII
Interlinking of Rivers (ILR)

7.1 To a query whether there is any proposal under consideration in the Ministry on inter-basin transfer of water, the Department in a written reply apprised the Committee as follows:

> *"Government of India has taken up the Interlinking of Rivers project in a consultative manner and has accorded top priority. The National Perspective Plan (NPP) was prepared by the then Ministry of Irrigation (now Ministry of Jal Shakti) in August 1980 for water resources development through inter basin transfer of water, for transferring water from water surplus basins to water-deficit basins. Under the NPP, the National Water Development Agency (NWDA) has identified 30 links (16 under Peninsular Component and 14 under Himalayan Component) for preparation of Feasibility Reports (FRs). The Pre-feasibility reports of all the 30 links have been completed and circulated to concerned States.*
>
> *Under the NPP, four priority links have also been identified for preparation of Detailed Project Reports (DPR) under the Peninsular Rivers Development Component viz; Ken-Betwa link project (KBLP), Damanganga-Pinjal link project, Par-Tapi-Narmada link project and Godavari-Cauvery link project. Based on the concurrence of the concerned States, DPRs of KBLP, Damanganga-Pinjal link project and Par-Tapi-Narmada link project have been completed and sent to concerned States.*
>
> *The implementation of interlinking of riversas per National Perspective Plan would give benefits of 25 million ha of irrigation from surface waters, 10 million ha by increased use of ground waters, raising the ultimate irrigation potential from 140 million ha to 175 million ha and generation of 34 million Kilo Watt (KW) of power, apart from the incidental benefits of flood control, drought mitigation, navigation, water supply, fisheries, salinity and pollution control etc".*

7.2 On being further asked about the execution of any project for Inter Linking of River as well as the major problems being faced by the Department in implementation of the ILR Projects, the Department in its written submission stated as follows:

> *"Four priority links for preparation of Detailed Project Report (DPR) under Peninsular Rivers Component have been identified viz; Ken-Betwa Link, Damanganga-Pinjal Link, Par-Tapi-Narmada link and Godavari-Cauvery link. Based on the concurrence of the concerned States, Detailed Project Reports of Ken-Betwa link project (Phase-I,II& Comprehensive report), Damanganga-Pinjal link and Par-Tapi-Narmada link have been completed. The techno-economic clearance and various statutory clearances of the Ken-Betwa link project phase-I have been accorded except Stage-II forest clearance and Central Environment Committee (CEC) clearance of Hon'ble Supreme Court. The techno-economic clearance to the Damanganga-Pinjal link project has also been accorded subject to statutory clearances. The DPR of Par-Tapi-Narmada link is under technical appraisal in Central Water Commission. The draft MoA/MoU for*

implementation of Ken-Betwa, Damanganga-Pinjal and Par-Tapi-Narmada link projects have been sent to party States which are under discussion presently.

Major problems being faced in implementation of ILR projects

- *Achieving a consensus among the States concerned for water sharing and implementation.*
- *Some concerns have been expressed about the requirement of power to lift waters as proposed in link proposals.*
- *States have an apprehension that the link proposals may have adverse effects on the existing irrigation and power requirements.*
- *Submergence of land and Relief and Rehabilitation (R&R) issues".*

7.3 When asked whether any steps have been taken for bringing comprehensive legislation for optimum development of inter-State rivers and river valleys as envisaged under the National Water Policy – 2012, the Department stated as under:

"The Ministry after holding detailed deliberations has come out with draft River Basin Management Bill, 2018. The draft River Basin Management Bill proposes optimum development of inter-State rivers by facilitating inter-State coordination ensuring scientific planning of land and water resources taking basin/sub-basin as unit with unified perspectives of water in all its forms (including soil moisture, ground and surface water) and ensuring comprehensive and balanced development of both catchment and command areas. The draft Bill proposes to establish 13 River Basin Authorities for various river basins of the country. It is expected that enactment of the proposed legislation would result in optimum integrated development and management of inter-State River waters with basin approach and will result in change of environment from the one of conflicts to that of cooperation. This draft Bill has been circulated to the State Governments and other stake holders for their comments and suggestions and has also been placed in public domain for eliciting comments/ suggestions from the general public at large. The draft Bill is currently under consultation stage".

Chapter VIII
Integrated Reservoir Operation for Flood Management

Release of water from Dams

8.1 The Committee note that in last few years, dam releases has become an issue as far as flooding in downstream reaches is concerned. The Department of Water Resources, River Development & Ganga Rejuvenation have cited the following instances of flooding occurred in the recent past due to sudden release of water from dams in one State has wreaked havoc in other States:

2019

i) *Releases from Koyna Dam and other small dams in Maharashtra as well as Almatti Dam in Karnataka creating flood like situation in Telangana and Andhra Pradesh*
ii) *Releases from Chambal basin dams in Madhya Pradesh and Rajasthan and Betwa Basin dams in Madhya Pradesh and UP creating flood like situation in UP, Bihar and West Bengal in Ganga*
iii) *Releases from Bhakra Beas Management Board (BBMB) Projects in HP and Punjab creating flood like situation in Punjab.*

2018

i) *Releases from Dams creating flood like situation in Kerala.*

2016

i) *Releases from Bansagar Dam in Madhya Pradesh and Rihand dam in Uttar Pradesh creating flood like situation in Patna in Bihar and its downstream areas".*

8.2 When asked how strictly the rules regarding release of water from dams are followed and who is the final authority to decide release of water from dams, the Department in its reply stated as under:

"To prevent faulty reservoir operations, State Governments have been advised to formulate rule curves for major reservoirs based on probability of various inflows over a long time series. CWC has rendered technical assistance to Government of Kerala in preparation of rule curves for 3 major reservoirs (Kakki, Idukki, and Idamalayar). Damodar Valley Reservoir Regulation Committee has prepared rules levels for various reservoirs of Damodar valley system under guidance of CWC. Preparation of the Rule Curves for Ukai reservoir (Gujarat) has also been carried out by CWC. Agencies like State Govts/Project Authorities are responsible for managing the reservoir operations and are final authority to decide release of Water from the Dams. In some cases, the regulation of reservoir(s) is done through Committees such Damodar Valley Reservoir Regulation Committee, Bansagar Reservoir Regulation Committee, etc. Similarly, Bhakra Beas Management Board operates Bhakra and Pong reservoirs through a Committee comprising of BBMB officials and member from co-basin States".

8.3 Elaborating on the matter, the DoWR,RD and GR has stated that in past some instances have been reported whereby dams constructed for hydroelectric power generation and other purposes such as irrigation located in upstream States released water on account of heavy inflows in rivers due to high precipitation in upper catchment of their rivers. This resulted in damages in downstream areas located in other State. However, with proper operation, coordination and regulation of reservoirs some flood moderation could have been achieved and damages to downstream areas could have been controlled to a certain extent.

8.4 Recently, exercising the powers delegated section 10 of the Disaster Management Act, 2005, Secretary, Department of Water Resources, RD & GR, Ministry of Jal Shakti has issued necessary directions to all authorities to inform downstream authorities whenever a decision is taken by them to release water from the reservoirs/ dams within its limits. The said decision should be communicated sufficiently in advance by the concerned State/ UT Government/ Authorities/ Dam Authorities in order to allow mitigating measures to be set up by the downstream authorities against any impending flood situation, which could be caused due to the release of water from the dams/reservoirs.

Reservoir Operation

8.5 According to the Department of WR, RD & GR, the flow in the river changes seasonally and from year to year, due to temporal and spatial variation in precipitation. Thus, the water available abundantly during monsoon season becomes scarce during the non-monsoon season, when it is most needed. The traditional method followed commonly for meeting the needs of water during the scarce period is construction of storage reservoir on the river course. The excess water during the monsoon season is stored in such reservoirs for eventual use in lean period. Construction of storages will also help in control of flood, as well as generation of electricity power. To meet the objective set forth in planning a reservoir or a group of reservoirs and to achieve maximum benefits out of the storage created, it is imperative to evolve guidelines for operation of reservoirs. Without proper regulation schedules, the reservoir may not meet the full objective for which it was planned and may also pose danger to the structure itself and to the people.Control of flood is better achieved if the reservoir level is kept low in the early stages of the monsoon season. However, at a later stage, if the anticipated inflows do not realize, the reservoir may not get filled up to Full Reservoir Level (FRL) even upto end of monsoon. On the contrary, if the reservoir is kept at high levels initially to avoid the risk of reservoir remaining unfilled at later stage, there may be problem of accommodating high floods occurring at later stage.

8.6 It has also been stated by the Department that flood moderation is one of the important functions of a reservoir. Operation of a flood moderation reservoir aims to

moderate the flood flows, by temporarily retaining the flood water and making controlled releases within the safe carrying capacity of the downstream channels, in order to minimise flood damages. Flood moderation storage in a reservoir is seldom provided for complete protection against extremely large floods, such as the Standard Project Flood. However, storage capacity is usually sufficient to reduce flood levels resulting from such an event to moderate levels and to prevent any major flood disasters. Flood storage is usually sufficient for storing the entire runoff from minor and moderate flood events. Reservoirs are usually not constructed solely for flood moderation purpose alone. Often flood moderation is combined with conservational purposes. In such case, either a fixed amount of storage space on the top of the reservoir is reserved for flood moderation purpose and storage below is used for conservational purposes or storage capacity available is shared for both conservational and flood control purposes. In the situation when it is at the top of conservation level, the flood cushion can be created by making additional releases from the reservoir in anticipation of flood, before the flood actually strikes. Such a release is called pre-release or reservoir evacuation. Pre-release makes storage space available in the reservoir to absorb part or whole volume of incoming flood. Pre-release can be effective even if the reservoir is at levels lower than the full conservation level, when the flood impinges the reservoir. In such a situation the storage space created due to pre-release is in addition to the storage space available between Maximum Water Level (water level upto which reservoir level may be allowed to rise safely in the event of occurrence of flood) and the current reservoir level.

8.7 The Department has further stated that forecast of inflows into the reservoir plays a vital role in these operational decisions and for increasing the flood moderation efficiency without reducing conservational benefits. It is however, very important to determine the correct amount of pre-release to be made at any instant of time. Incorrect release decisions may lead to inefficient flood moderation and chances of reservoir remaining unfilled upto the conservation level by the end of monsoon. The pre-release decision will depend upon the forecast values of inflow, amount of storage space available in the reservoir, safety considerations of dam, spillway capacity, downstream flooding conditions, and downstream carrying capacity of river channel. Since most of these parameters change with time, the process of estimation of pre-release is a dynamic one. In such situations, computer based real time operation models serve the purpose of an efficient tool for taking operation decisions.For reservoirs in series with intermediate inflows and storage serving solely for flood control downstream, it is optimal to regulate floods by filling the upper reservoirs first and emptying the lower reservoirs first. The operation of reservoirs in parallel requires simulation with optimization approach.

Integrated Reservoir Operation for Flood Management

8.8 Elaborating on the system for regulation of water reservoirs in the country and formulation of necessary regulations/guidelines for the operation and maintenance, the Department in a written reply stated as under:

> *"The responsibility of Operation & Maintenance (O&M)/ regulation of water in reservoirs and safety of the dams primarily rests with dam owners who are invariably States Govt./UTs./PSUs etc. The practice of dam safety including O&M can vary from State to State and from organisation to organisation, the Central Water Commission has been working towards evolving standard practices of dam safety and has recommended its implementation by all States and dam owning organisations.*
>
> *CWC has published Guidelines for Preparing Operation and Maintenance Manual for Dams which contain various aspects of project operation including normal operation and emergency operation. These serve as guidance for dam owners on various protocols and responsibilities for managing water releases during a year including flood seasons. Details for preparation of operational rule curve (both for reservoir filling and release) are also part of the guidelines. However, the role of Central Water Commission is restricted to advisory capacity only, with little scope for proactive intervention in reservoir operation and regulation.The Dam owners are impressed upon to implement these guidelines in National Committee on Dam Safety (NCDS) meetings and through other communications. In order to promote the concept of safe and efficient Dam operations including flood moderation suitable provisions have been kept in the Dam Safety Bill, 2019. The Bill provides for surveillance, inspection, operation and maintenance of the specified dam. The Bill also has exclusive provision regarding coordinated reservoir operations of cascading dams".*

8.9 When enquired about the difficulties being faced in operating the reservoir in an integrated manner with reservoir located in other State, the Department in its written submission stated as follows:

> *"Many a times, in a large river basin, all the reservoirs in the basin or a sub-basin do not fall under the same State. Every State tends to operate the reservoirs under their jurisdiction as per their preferences and the needs. This may, at times, not be a prudent way of operation of reservoirs. Also, sometimes the reservoir is located in one State and the benefits are spread across multiple States. In such cases also, the States which are not in charge of operating the reservoir, may have problems in realizing the envisaged benefits. Dam owners are advised to follow SoP for release of water from their reservoirs and issue advance warnings for the downstream areas through various communications. However, the conflicting objectives and lack of coordination between various States is a challenge in optimal operation of reservoirs.*

Dam Safety Bill, 2019 provides for surveillance, inspection, operation and maintenance of the specified dam for prevention of dam failure related disasters and to provide for institutional mechanism to ensure their safe functioning and for matters connected therewith or incidental thereto. The Bill has exclusive provision regarding coordinated reservoir operations of cascading dams".

8.10 On being asked about the steps taken to overcome these difficulties and how far these have been successful, the Department stated as under:

"In some cases, the integrated operation of reservoirs is carried out through Committees such Damodar Valley Reservoir Regulation Committee, BansagarReservoir Regulation Committee, etc. The dams are operated based upon the decisions of such Committees. Bhakra Beas Management Board operates Bhakra and Pong reservoir through a committee comprising of BBMB officials and member from co-basin States.However, these are very limited examples. The Integrated Operation of Reservoirs, in true sense, can only be achieved with formation of River Basin Authorities for each river basin of the country".

Flood Cushion

8.11 The Committee have been informed that the Working Group on Flood Management and Region Specific Issues set up under XII Plan recommendedthat as a policy, minimum flood cushion of 10% of the live storage capacity should be provided in all new dams and if affordable, with respect to other purposes, providing even a flood cushion upto20% could be considered.

8.12 When asked about the progress made in the implementation of the recommendation of the working Group on the Flood cushion, the Department replied:

"Dams in our country are not dedicated for single purpose of flood moderation whose requirement is conflicting in nature to conservational purposes. Most of the large dams in the country are multipurpose with competing demands. Even in the reservoirs having no dedicated flood cushion, incidental benefits of flood moderation can be derived by providing dynamic flood cushion. To meet the objective set forth in planning a reservoir or a group of reservoirs and to achieve maximum benefits out of the storage created, it is imperative to evolve guidelines for operation of reservoirs. Without proper regulation schedules, the reservoir may not meet the full objective for which it was planned and may also pose danger to the structure itself and to the people.

In order to achieve above objectives, it is necessary that Rule curve/ level for all reservoirs should be prepared & updated accounting change in rainfall trend and changing demand over the years due to rapid increase of population,

urbanisationand industrialisation. Rule curves of major reservoirs, where flood cushion is not in-built, need to be reviewed to have some dynamic flood cushion for major part of the flood season.

Dams are generally owned and operated by State Governments or Public Utilities who have the tendency to fill the reservoir at earliest opportunity which defeats the purpose of utilizing a part of their storage capacity as flood cushion for absorbing any impending flood peak. In order to promote the concept of safe and efficient Dam operations including flood moderation suitable provisions have been kept in the Dam Safety Bill, 2019. The Bill provides for surveillance, inspection, operation and maintenance of the specified dam. The Bill also has exclusive provision regarding coordinated reservoir operations of cascading dams".

8.13 When asked as to whether there is any proposal for making some kind of arrangement in the country to store/conserve excessive water during monsoon season so that it may be used during situations of water crisis, the Department in its written reply stated:

"Central Water Commission monitors live storage of 123 important reservoirs of the country on weekly basis and issues a weekly bulletin. The weekly bulletin contains current storage position vis-à-vis storage status on the corresponding day of the previous year and average of last 10 years on the corresponding day. The total live storage capacity of these 123 reservoirs is 171.090 BCM which is about 66.36% of the live storage capacity of 257.812 BCM in the country.Water storage status of 123 important reservoirs being monitored by CWC is used as an important input for crop planning strategy".

Crisis Management Plan

8.14 The Department of WR, RD & GR has informed the Committee that the Crisis Management Plan of Department of Water Resources, River Development & Ganga Rejuvenation (DoWR, RD&GR) for flood management includes the provision on Integrated Reservoir Operation (IRO) for flood management. The plan for implementation of IRO for flood management included in CMP involves entry of data by reservoir owners in the State in Water Management Information System (WIMS) software provided under the National Hydrology Project. The data from reservoirs alongwith hydro-meteorological data available with CWC as well as those received from IMD including rainfall forecast will be used for running mathematical models for formulating inflow forecast atleast 72 hours in advance at the reservoirs identified in various basins. Based on the inflow forecast provided and the availability of flood cushion in the reservoir, release advisories will be issued by Flood Crisis management Team (FCMT) to be formed in various basins. The FCMT will be headed by the Chief Engineer of the respective basin organisation of CWC with members from all co-basin States and the Superintending Engineer of CWC basin organisation will

be the Member –Secretary. The FCMT will meet frequently during Flood Crisis and advise the Project authorities within the system of reservoirs regarding the quantum of release so that flood inundation in the downstream areas shall be minimized.

8.15 The Department has further stated that however, there is no mandate to the project authorities to follow the release advisory of FCMT as the release of water from project is in the purview of State Governments. In order to operationalise the concept, mandate in the form of an executive order or a parliamentary act may be needed. This can be brought as an executive order under DM Act 2005 or as a part of the proposed Dam Safety Bill which has since been passed by Lok Sabha and is to be passed by the Rajya Sabha.

8.16 The Dam Safety Bill was passed by Lok Sabha on 02.08.2019 and is pending in Rajya Sabha. The Bill inter alia provides for surveillance, inspection, operation and maintenance of the specified dam for prevention of dam failure related disasters and to provide for institutional mechanism to ensure their safe functioning and for matters connected therewith or incidental thereto.The Bill has exclusive provision regarding coordinated reservoir operations of cascading dams.

8.17 The Chapter VIII of the Bill deals with matter related to Emergency Action Plan and Disaster management. It has explicit provisions for establishment of well designed hydro-meteorological network and an inflow forecasting system; emergency flood warning system; install such scientific and technical instruments which are invented or adopted from time to time for the purpose of ensuring the dam safety and the life and property of people downstream; make available the information relating to maximum anticipated inflows and outflows including flood warning and an adverse impact of the same, if any, on persons and property towards the upstream or downstream of the dam, to the concerned district authorities and also make available the information in public domain render necessary assistance to the Authority in establishment and running of the early warning system for the exchange of real time hydrological and meteorological data and information related to the operation of reservoirs.

8.18 The Chapter IV of the Bill deals with Constitution, functions and meetings of State Committee on Dam Safety. The State Committee on Dam safety shall have representation of Chief Engineer or equivalent level officer from upstream State in cases where reservoir area of any of the specified dam of the State extend to another State; and downstream State in cases where flood release of any of the specified dam of the State flows to a neighboring State.

8.19 When asked to explain how the proposed Dam Safety Bill can be helpful in evolving an effective Decision Support System for release of Water from the Dams, the Department in its written reply stated as follows:

"The practice of dam safety including O&M can vary from State to State and from Organisation to Organisation. Dam Safety Bill provides uniform dam safety procedure for surveillance, inspection, operation and maintenance of the specified dam for prevention of dam failure related disasters and to provide institutional mechanism to ensure their safe functioning and for matters connected therewith or incidental thereto.The Bill has provision to constitute the National Committee on Dam Safety, whose functions include evolving policies and recommending regulations regarding dam safety standards which consists the representation of officers from centre as well as state which will act a forum for exchange of views. The Bill has also provision to constitute National Dam Safety Authority, whose functions include implementing policies of the National Committee, providing technical assistance to State Dam Safety Organisations (SDSOs), and resolving matters between SDSOs of states or between a SDSO and any dam owner in that state.

Dam Safety Bill 2019 have suitable provisions related to O&M, Emergency Action Plan (EAP), Dam Safety Evaluation and other important provisions which can be helpful in evolving an effective Decision Support System for release of Water from the Dams".

Chapter IX

Flash Floods, Cloud Burst and Glacial Outburst and Landslides

9.1 The Department of WR, RD & GR has apprised the Committee that apart from riverine floods experienced during monsoon in the country, in recent past several extreme hydro-metrological events have been witnessed which have resulted in abnormal flood like situations. These extreme events could be categorized as (i) Gushing out of water from Artificial blockade of river channel due to moraine deposit triggered by landslides, etc. (ii) Outburst of glacial lakes and/ or water bodies located in higher reaches of Himalayan region, and (iii) Flash Floods due to extreme precipitation occurring in short duration.These incidents have either been triggered due to phenomena which were largely unpredictable or their prediction were not covered under various established protocols. As a result, sudden release of water or accumulation of large volumes of water caused disastrous consequences to cities/ towns/ settlements in the vicinity.

9.2 The Department has informed the Committee that following are some of incidents which occurred during last few years with significantly damaging consequences and/ or potentially damaging consequences are given below:

(i) Blockade of waterway of river Parechu due to landslide in Chinese territory on 28.6.2004 and 8.7.2004 resulting in creation of artificial lake on upstream and accumulation of huge volumes of water
(ii) Flooding phenomenon of Kedarnath, Uttarakhand during 16-18th June 2013
(iii) Blockade of waterway of river BhoteKosi, a tributary of Sun Kosi in Nepal due to landslide on 2.8.2014 resulting in creation of artificial lake on upstream and accumulation of huge volumes of water
(iv) Flooding phenomenon of Jhelum & Chenab basin in J&K during September 3-7, 2014
(v) Landslide on the Phutkal River in Zanskar Valley in Kargil district in Jammu and Kashmir during December 2014
(vi) Landslide Dam (LSD) on Kanka river, a tributary of Teesta in North Sikkim during August 2016
(vii) Landslide Dam (LSD) in Great Bend Area on river YarlungTsangpo in China during 16-19 October, 2018
(viii) Recent Chamoli incident on 7th February 2021

9.3 The Department has stated that various activities for mitigating the effects of such extreme situations can broadly be summarized as :

(i) Analysis of situation using various analytical tools which could generate actionable inputs in form of volume of inundation or accumulated water, rate of

its release due to various scenarios of breaching or translation of sudden down pour

(ii) Pooling of information including remote sensing data about terrain of impacted area including digital elevation/ terrain models,

(iii) Determination of the potential impacted area by using various technology inputs

(iv) Preparation of inundation maps

(v) Notification of emergency

(vi) Disaster Management and Evacuation.

9.4 The Department has further stated that it has been observed over the past few decades that the retreat of glaciers has created many precarious moraine dammed glacial lakes at the snout of glaciers in the Himalayan region. Breaching of such glacial lakes may lead to instantaneous discharge of water causing flash flood in downstream areas. Recognizing the hazard potential of such lakes to the population and assets located in their downstream, CWC has been monitoring the Water spread areasof lakes of size more than 50 hectares located on high altitudeusing the satellite data from NRSC. Based on the current inventory, 415 glacial lakes & water bodies with a water spread area more than 50 ha are monitored. Another 62 glacial lakes & water bodies with water spread area in the range 44 to 50 ha have also been taken up for monitoring, thereby making a total of 477 glacial lakes & water bodies under monitoring.

9.5 According to the Department, studies for analyzing the situation arising out of artificial blockade of river flow due to landslide dams pose great challenges, especially on account of non-availability of accurate information on many significant parameters which are either deduced or assumed. For an effective disaster management planning, it is essential to have an estimate of lake volume behind landslide dam, dam break flood due to possible breaching of such dam, attenuation and translation pattern of dam break flood.

Need for Unified Single Nodal Agency for coordination among different Depatments

9.6 On being asked about the steps taken by the Department to ensure the setting up of a single nodal agency/command control to coordinate the activities of different departments to take a unified and cohesive approach during the flood crisis, the Department stated as follows:

"While the primary responsibility of disaster management rests with the States, the Central Government supports the efforts of State Governments by providing logistical and financial support.

On behalf of the Central Government, Disaster Management (DM) Division in the Ministry of Home Affairs co-ordinates with disaster affected State Government(s), concerned line ministries/departments, National Disaster Management Authority (NDMA), National Disaster Response Force (NDRF), National Institute of Disaster Management (NIDM) and the Directorate General of Fire Services, Home Guards and Civil Defence, and Armed Forces for effective disaster risk reduction. The

Division is responsible for legislation, policy, capacity building, prevention, mitigation, response and long-term rehabilitation. In pursuance of Section 8 of the Disaster Management Act, 2005 National Executive Committee has been constituted to act as the coordinating and monitoring body for disaster management. It is chaired by the Union Home Secretary and comprises of Secretary level officers from the Ministries and departments having control of agriculture, atomic energy, defence, drinking water supply, environment and forests, finance (expenditure), health, power, rural development, science and technology, space, telecommunications, urban development and water resources. The Chief of Integrated Defence Staff of the Chiefs of Staff Committee, ex-officio, is also its member. Thus, the mechanism to undertake a unified/cohesive approach during the crisis already exists under Ministry of Home Affairs".

9.7 When asked about the single factor which is considered to be most intractable and challenging in the efforts to mitigate the problem of flood menace till date, the Department stated as follows:

"Floods are attributed to various factors like wide variation in rainfall both in time and space with frequent departure from normal pattern, inadequate carrying capacities of rivers, river bank erosion, silting of river beds, landslides, poor natural drainage, snow melts and glacial lake out bursts. The problem of floods gets further compounded due to interstate/International extent of various rivers. Hence, attributing a single factor as a challenge for mitigating the problem of flood menace is difficult".

Chapter X
Relief and Rehabilitation

Relief and Rehabilitation of people affected by flood

10.1 On being asked about the steps taken by the Department in coordination with the Ministry of Rural Development and Ministry of Home Affairs to ensure timely relief & rehabilitation to the persons affected by flood, the Department replied as under:

> *"In the event of disaster of a 'severe nature', financial assistance towards the notified natural disasters including flood is met from the State Disaster Response Fund (SDRF) already placed at State's disposal in accordance with Government of India's approved items and norms. Additional assistance is extended from National Disaster Response Fund (NDRF) in accordance with the established procedure, which includes an assessment based on the visit of an Inter-Ministerial Central Team".*

10.2 When asked whether the Department compiles data pertaining to losses caused due to flood erosion and sand /debris deposition in agricultural farmlands in the country in terms of acreage, financial and number of farmers affected (State-wise), the Department of WR, RD & GR stated:

> *"The State-wise details of losses due to floods are compiled by Central Water Commission (CWC) based on the data provided by the States.*
> *The State-wise data for the year 2018 and all India averaged data over the period 1953 to 2018 is at* ***Annexure I and Annexure II".***

10.3 On being asked about the formulation of any scheme by the Department to rehabilitate those farmlands which were damaged and became uncultivable due to flood erosion and sand / debris, the Department it its written submission stated as follows:

> *"No such scheme to rehabilitate those farmlands which were damaged and became uncultivable due to flood erosion and sand / debris has been formulated by the Department".*

10.4 In response to a query regarding efforts made for convergence among various Ministries to mitigate the problems being faced by farmers affected by floods including compensation to farmers in various parts of the country, the Department stated as follows:

> *"There is no such dedicated plan/scheme for flood mitigation in NDMA. So far, financial assistance for the compensation to the farmers is given by Ministry of Home Affairs(MHA) from NDRF & SDRF funds".*

10.5 When asked as to whether any insurance policies are available for insurance of human and animal lives and private properties against damage by floods, the Department in its written submission stated as under:

> *"Government of India has launched Pradhan Mantri FasalBimaYojana(PMFBY)/ Restructured Weather Based Crop Insurance Scheme (RWBCIS) to cover losses to the crop due to various risks including floods. Under Pradhan Mantri Suraksha BimaYojana(PMSBY) risk coverage of Rs.2 lakh for accidental death and full disability and Rs. 1 lakh for partial disability is provided. PashuDhanBima Yojana provides insurance cover to the cattle that are owned by farmers, co-operative societies, dairy farms and others in case of death of Cattle due to various specified reasons including Natural Accidents like Flood, Famine, Earthquake, etc".*

Chapter XI

International Water Treaties in the field of Water Resource Management and Flood Control

A. COOPERATION WITH PAKISTAN

11.1 The Department of WR, RD & GR has informed the Committee that the Indus basin extends over an area of 11,65,500 km2 and lies mainly in India and Pakistan with small area in Tibet and Afghanistan. Within India, the Indus basin lies in Jammu and Kashmir(J&K), Himachal Pradesh (HP), Punjab, Haryana and Rajasthan. The Indus system of rivers comprises of main Indus River, its five major left bank tributaries i.e. Jhelum, Chenab, Ravi, Beas and Sutlej (all passing through India) and a right bank tributary namely Kabul river which enters Pakistan through Afghanistan and does not pass through India. The mean annual flow of the Indus system of rivers is about 168 Million Acre-Feet (MAF) including flow from Kabul river. (1 MAF = 1233 MCM = 43.56 TMC) Three rivers namely Ravi, Beas and Sutlej together are known as Eastern Rivers while the rivers Chenab, Jhelum and Indus together are called Western rivers. Out of these six rivers, the Beas River flows within in the territory of India and the remaining rivers cross to Pakistan downstream at different places.

Indus Waters Treaty

11.2 According to the DoWR, RD & GR, the Indus Waters Treaty was a result from a dispute between India and Pakistan on sharing of the waters of Indus basin which was geographically divided at independence. The Treaty was signed on 19th September 1960 in Karachi after eight years of negotiations under the aegis of the World Bank. The Treaty contains a preamble, twelve Articles and eight (A-H) lengthy Annexures. The Salient Provisions of the Treaty are as under

1. All the waters of the Eastern Rivers - Sutlej, Beas, and Ravi with average annual flow of around 33 Million Acre Feet (MAF) is allocated to India for unrestricted use while the waters of Western rivers - Indus, Jhelum, and Chenab with average annual flow of around 135 MAF is allocated largely to Pakistan.

2. However, India is permitted to use the waters of the Western Rivers for Domestic Use, Non-consumptive use, Agricultural use as specified in Annexure C, and generation of hydro-electric power. This right to generate hydroelectricity from Western rivers is unrestricted subject to the conditions for design and operation as specified in Annexure D of the Treaty. India can also create storages upto 3.6 MAF on Western rivers.

3. Any issue, when arises, is first discussed at Permanent Indus Commission for its resolution. If the Commission is unable to resolve the same, the matter of technical nature can be referred to a Neutral Expert by either Party. If the issue is of legal nature, the same can be referred to a Court of Arbitration either jointly by both the Parties or by a Neutral Expert.

4. There is no provision in the Treaty to stop construction of a project till issues are resolved. Only Court of Arbitration can impose such restrictions.

5. The territorial disputes cannot be raised by either Commissioner. Also, there is no option for unilateral exit or modification in the Treaty for either country.

6. This Treaty is bilateral and World Bank only has a limited procedural role limited to appointment of Neutral Expert or Court of Arbitration on request of the Parties.

Permanent Indus Commission

11.3 Under Article VIII of the Treaty, a Permanent Indus Commission (PIC) has been created as an institutional mechanism for implementing the Treaty. PIC comprises of a Commissioner for Indus Waters from each side. Unless otherwise decided by either Government for a particular matter, each Commissioner is the representative of his Government for all matters arising out of the Treaty. The Commission is required to meet regularly at least once a year, alternately in India and Pakistan, and at other times on request. So far, 115 meetings of the Commission have been held since signing of the Treaty in 1960. The last meeting of the Commission was held in August 2018 at Lahore. The next meeting, scheduled in March 2020 has been postponed in view of pandemic. The Commission is also required to undertake periodical inspections of the Rivers for ascertaining the facts connected with the various developments and works on the Rivers. So far 119 tours on either side had been undertaken. The Commission submits its Annual Report to the respective Governments before 30 June every year.

11.4 On the question of utilization of waters of the Indus, Jhelum and Chinab Rivers, the representative of the Department of Water Resources, River Development and Ganga Rejuvenation during the course of oral evidence held on 17.11.2020 stated as follows:

> *"Sir, we have Major Dams on these three rivers. Like Ranjit Sagar Dam is built around Pathankot on Ravi. Vyas has Pong Dam and Sutlej has Bhakra Nangal Dam. We also transfer water from Beas riverto Satluj through tunnel and canal, which is Beas Satluj Link (BSL) Project. Similarly, we are also transferring water from Ravi to Vyas. Through these three projects we are able to use major water. Little by little, the flood season has downstream of these reservoirs, some additional water, which we cannot use, it flows towards Pakistan. Apart from this, some more of our projects are still in the planning stage, as soon as they come, there is a Ujhproject on Ravi's tributary. There is a project called Shahpurkandi Dam Project, which is on Ravi itself and is*

downstream of this Ranjit Sagar Dam. There is a third project, which we have envisaged, the Ravi-Vyas link second, because our one link is already on Madhopur. These three projects, if they come, then the rest of the water is going, we will tap majority. A common claim that our water is going towards Pakistan, it is not so. Right now we are able to use major water of these three rivers".

11.5 He further stated as follows:

"Sir, what you said, I would like to supplement a bit. As people feel that we have taken very little water in that 1960 treaty, much water went to Pakistan. There is topography and other things to use water, currently 40 percent of our country is in the North-East, but in the North East we do not use that water and that water floods Assam and others. The topography there is such, whether it is Jammu and Kashmir, Parts of Himachal Pradesh that it is not possible for us to use more water than this. Technically, it is also not feasible. That is one thing.

Second, the effect that the best water utilization of any river system is seen in India is that of the Indus system. We use more than 95% of these three rivers. In today's day, we are not able to do interlinking of river. There are at least two examples of successful interlinking, which he has mentioned. We also bring Vyas water in Sutlej and Ravi water. On a rainy day, there will be a little more water anywhere; some of that water goes to Pakistan.

Secondly, our problem is that our canals, which are in Punjab and Rajasthan, are built much earlier, they are very old. The way they should be maintained and they should not be able to carry as much water as they should carry. One place is Harike Barrage. Two big canals take off of Harike barrage, one is called Rajasthan feeder and the other is Sirhind feeder. As of the capacity of both of them, in today's day we are not able to utilize even a third of its capacity. Due to this, we have to release that water from the barrage of Harike and finally that water goes towards Pakistan. To lining them both, a project is being funded by the Government of India. If that will be done, then we will be able to use a little more water from the Existing System itself. As he said that one on one, Shahpur Kandi already work is going on. The project was closed for four years, but has been revived in the year 2018. Now we are going to take cabinet approval of Ujh multipurpose project, so due to this, some more water will be used. We are able to make good use of this system of water, which is our share of water. Yes, it is necessary that we have not been able to make more of the three rivers on which we should build more hydro electric projects, because hydroelectric projects will also have to have viability. Today, the way in which resettlement, rehabilitation and the rest of the cost has increased, it is seen everywhere that there is technical feasibility, but there is no commercial viability, if we generate energy for 8-10 rupees. Then what will we do with that? These are some problems, otherwise we are using a lot of water in this system".

11.6 The Department in its written reply has informed the Committee that no storage on Western rivers has been created by India so far.Further, the estimated power potential from Western rivers is about 20000 MW. Twenty Nine run- of-the-river (RoR) hydroelectric

projects of more than 1 MW aggregating to 3482 MW have been constructed on Western rivers in the State and Central sector.

11.7 It has further been stated that Indus Waters Treaty 1960 provides India, the right to develop Irrigated Cropped Area (ICA) of 9,12,477 acres through waters of Western rivers without creating any storage. Further ICA of 4,31,000 acres can be added after creation of conservation storage and release of a specified quantum of water into the river annually from the same, in accordance with the Treaty, thereby taking the potential ICA from Western rivers to 13,43,477 acres. As per the latest data for the crop year 2019-20, the ICA developed by India on Western rivers is 7,59,859 acres.

Regular Hydrological Data Exchange under Indus Treaty

11.8 The Department have further apprised the Committee that Article VI (1) of the Indus Treaty provides for regular exchange of specified data relating to flow of the rivers, extractions / releases from reservoirs and withdrawal from all canals, including link canals. This data is transmitted monthly by each Party not later than three months after the end of the month to which they relate. It also provides for supply of such data at less frequent intervals on request by either Party for operational purposes. It also provides for supply of any hydrological data to the extent that these are available. This data is being exchanged regularly between both the Parties.

Flood Information

11.9 Except for the Beas river which flows entirely in India, all other rivers of Indus system flowing through India, namely Indus main, Jhelum, Chenab and Sutlej cross to Pakistan located downstream. Article IV (8) of the Treaty provides that "The use of the natural channels of the Rivers for the discharge of flood or other excess waters shall be free and not subject to limitation by either Party, and neither Party shall have any claim against the other in respect of any damage caused by such use. Each Party agrees to communicate to the other Party, as far in advance as practicable, any information it may have in regard to such extraordinary discharges of water from reservoirs and flood flows as may affect the other Party." Thus, the Treaty puts an obligation on India to supply the advance information in regard to such extraordinary discharges of water from reservoirs and flood flows as may affect Pakistan. During the flood season. the river flows and discharges from the reservoirs are monitored by this wing in coordination with Central Water Commission, Bhakra Beas Management Board and Government of Punjab. This information on extraordinary discharges of water from reservoirs and flood flows is supplied to Pakistan under Article IV(8) of the Treaty as and when such situation arises.

B. COOPERATION WITH CHINA

Memorandum of Understandingon Brahmaputra and Sutlej Rivers with China

11.10 The Committee have been informed by the Department of WR, RD & GR that recurrent floods in Brahmaputra Basin wreak havoc frequently and a major flood in the year 2000 led to loss of many lives, infrastructure and other properties in India. A need was thus felt for trans-border cooperation for early warning system. Accordingly, a Memorandum of Understanding (MoU) was signed between India and China in January, 2002 for sharing of hydrological information of the Yaluzangbu/Brahmaputra River in flood season by China to India for the three stations on Yaluzangbu/Brahmaputra river viz Nugesha, Yangcun and Nuxia located in Tibet Autonomous Region (TAR). The main purpose of the MoU is flood control and disaster mitigation in downstream areas, mainly in Arunachal Pradesh, Assam and further down. The hydrological data include Water Level, Rainfall and Discharge. The period of data in this MoU was 1st June-15th October every year. The MoU was renewed in June, 2008, May, 2013 and June 2018 for another five years.

11.11 Another umbrella MoU on Brahmaputra was signed between India and China in October 2013, which inter alia increased the originally envisaged duration of data from 1st June- 15th October to 15th May-15th October. This umbrella MoU of 2013 further opens up other areas of co-operation in water sector and has no expiry period. In the year 2005, there was a breach of Parichu Lake in TAR which led to severe flooding of Sutlej river in India. This led to loss of lives and properties in Himachal Pradesh and further down in India. Thus, a need for trans-border cooperation for early warning system was also felt for Sutlej River (called LangqenZangbo in China). Thus, a Memorandum of Understanding (MoU) with People's Republic of China was signed on April, 2005 with provision of hydrological information of the River Sutlej/LangqenZangbo in Flood Season by China to India. Under this MoU, Chinese side provides hydrological information of Tsada station located on River Sutlej/LangqenZangbo. The MoU has a validity of five years. The MoU was renewed in 2010 and November, 2015 for another five years.

Implementation Plans

11.12 The signing of MoU on Brahmaputra and Sutlej rivers with China is followed by the signing of Implementation Plans (IP). The IP gives the modalities regarding technical details of provision of hydrological information, data transmission method, cost settlement etc. The IP also provides details of the stations, frequency, type, duration and format of transmission of data to be supplied.

Expert Level Mechanism (ELM)

11.13 The Department of WR, RD & GR has stated that during the visit of Hon'ble President of the People's Republic of China in November, 2006, it was mutually agreed upon to set up an Expert Level Mechanism (ELM). ELM between India and China was thus established to discuss interaction and co-operation upon provision of hydrological data in flood season, emergency management and other issues regarding trans-border rivers as agreed between them. The ELM meetings are being held annually, alternately in India and China. ELM meetings *inter alia* discuss the following:

i. Discussions on transmission of data and data utilisation Report by Indian side.
ii. Unforeseen flood related events in Tibet Autonomous Region (TAR) and their impacts on Indian side.
iii. Any other mutually agreed item in the agenda which may include presentations by both the sides on flood related matters, hydropower development, opening of new station in TAR, technical exchanges etc
iv. Site visits to water resources projects/works in the respective countries.

11.14 As regards sharing of hydrological data with China, the representative of Department of Water Resources, River Development and Ganga Rejuvenation during the oral evidence held on 17.11.2020 apprised the Committee as follows:

> *"Sir, this is the MoU. China is such a country with which we do not have much cooperation at the moment, but atleast it is of data sharing and that is also on payment basis. Normally like where we are taking data, Nepal is not charging anything from us but China is charging for supplying this data to us. In Brahmaputra, we get data of three stations during flood season, that is, from 15th May to 15th October, we get data on water level, flow, and rainfall.*
>
> *Sir, MoU with China belongs to the Brahmaputra and Sutlej river. Yes, the work of data sharing is happening continuously. Both agreements are for five-five years and are being renewed continuously".*

11.15 When asked whether there is regular sharing of hydrological data by China with regard to rivers of Brahmaputra and Sutlej, the Department replied as under:

> *"Except for the year 2017 (when no data was supplied) data is being supplied by Chinese side for both the rivers viz, Brahamputra and Sutlej as per the MoUs. Hydrological data (Water Level, Rainfall and Discharge) of Brahmaputra River for the three stations in Tibet Autonomous Region (TAR) viz. Nugesha, Yangcun and Nuxia was supplied regularly during the period from 15th May to 15th October during the year 2020, twice a day (0800 hrs and 2000 hrs Chinese Time). Similarly, Hydrological data (Water Level, Rainfall and Discharge) of Sutlej River for the lone station in TAR i.e., Tsada was supplied regularly during the period from 1st June to 15th October for the year 2020, twice a day (0800 hrs and 2000 hrs Chinese Time)"*

11.16 On being asked whether China has any proposal to build dams on Brahmaputra river, the Ministry of External Affairs in their written reply stated as follows:

"The 'Outline of the 12th Five Year Plan for National Economic and Social Development of the People's Republic of China' endorsed in March 2011 indicated that three hydropower projects on the main stream of Brahmaputra River in Tibet Autonomous Region were approved for implementation by the Chinese authorities. A hydropower project at Zangmu was declared fully operational by Chinese authorities in October 2015.Government carefully monitors all developments on the Brahmaputra River. As a lower riparian State with considerable established user rights to the waters of the trans-border rivers, Government has consistently conveyed its views and concerns to the Chinese authorities and has urged them to ensure that the interests of downstream States are not harmed by any activities in upstream areas.

The Chinese side has conveyed to us on several occasions that they are only undertaking run-of-the-river hydropower projects which do not involve diversion of the waters of the Brahmaputra.Various issues relating to trans-border rivers are discussed with China under the ambit of an institutionalized Expert Level Mechanism which was established in 2006, as well as through diplomatic channels. We intend to remain engaged with China on the issue of trans-border rivers to safeguard our interests".

C. COOPERATION WITH BHUTAN

Flood Forecasting Mechanism

11.17 The Ministry of External Affairs, Govt. of India had sponsored a "Comprehensive Scheme of hydro-meteorological and Flood forecasting network on rivers common to India and Bhutan" in the year 1955 for the purpose of flood warning measures in Bhutan. Under the scheme 19 nos. of rain gauge and 8 nos. of wireless stations were set up under the control of MEA. The stations were subsequently handed over to Royal Govt. of Bhutan. The network now consists of 32 hydro-meteorological/ meteorological stations maintained by the Royal Government of Bhutan with funding from India. The data received from these stations are utilised in India by the Central Water Commission for formulating flood forecasts. A Joint Experts Team (JET) comprising of senior officials of India and Bhutan, reviews and monitors the assigned work of this Scheme as well as the release of funds to RGoB.

11.18 A Joint Group of Experts (JGE) on Flood Management has also been constituted for matters related to floods created by the rivers originating from Bhutan and coming to India. The JGE deliberates the probable causes and effects of the recurring floods and erosion in the southern foothills of Bhutan and adjoining plains in India and recommends to both the Governments appropriate and mutually acceptable remedial measures.

Technical Assistance

11.19 The Central Water Commission has established Bhutan Investigation Division (BID) at Phuentsholing, Bhutan for providing technical assistance for various matters including development of hydropower potential in Bhutan. BID has been involved in providing technical assistance for setting up of Gauge and Discharge sites and Wireless stations for Flood forecasting, Survey, Investigation & construction of mini/micro hydel schemes, river training works.

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PART II

OBSERVATIONS/RECOMMENDATIONS

NEED FOR OVERARCHING APEX BODY FOR FLOOD CONTROL AND MANAGEMENT

2.1 The Commitee is of the view that each wing of the Government at national, state and sub-state levels view floods as a situation to be dealt with as and when it happens. Under the existing scheme of things, given the constitutional and administrative compartmentalization, flood management appears to be everyone's business and therefore it reduces to nobody's business. The Committee strongly desires to break this thinking pattern in the administrative structures and recommends that the Ministry of Jal Shakti take up the onus of flood management in the country as an overarching responsibility. The committee recommends that in view of the loss of life and property caused throughout the year in almost every part of the country, the Union Government must take up responsibility for coordinating the national efforts for flood control and mitigation with all stakeholders. The committee therefore, recommends setting up of a permanent institutional structure in the form of National Integrated Flood Management Group (NIFMG) under the chairmanship of Hon'ble Minister of Jal Shakti immediately. Concerned Ministers of the State Governments should be the members of this group and the group should meet at least once a year. This group should take up the overall responsibility of coordination as well as building synergies between all agencies responsible for management of floods and their consequences on life and property. The committee recommend that the first meeting of this group should be held within three months of the presentation of this report to the Parliament.

2.2 While taking an overarching responsibility in flood management, the NIFMG should also take up prevention and mitigation strategies of localized flooding events including the issues of hyper construction and water logging in urban areas as well as issues like localized landslides leading to flooding etc. NIFMG should also get a

strategy prepared for identification of localized areas that are prone to localized flooding which leads to loss of life and property especially in urban areas.

2.3 NIFMG should exercise supervision over all aspects of flood management in the country including those issues, which fall in the domain of State/local governments as well as which are of international linkages. Given the scale of loss of life and property caused by the floods, which show an increasing trend, NIFMG should present an annual report on this issue to Parliament.

The above are the Committee's pivotal and most important recommendations. Rest of the Observations/recommendations of the Committee are given in the succeeding paragraphs.

(Recommendation Sl.No.1)

FLOOD SCENARIO IN THE COUNTRY

2.4 India faces floods almost every year, in varying degrees of magnitude. The frequent occurrence of floods can be attributed to various factors like wide variation in rainfall both in time and space with frequent departure from normal pattern, inadequate carrying capacities of rivers, river bank erosion, silting of river beds, landslides, poor natural drainage, snow melts and glacial lake outbursts. The problem of floods gets further compounded due to interstate/International extent of various rivers. As per RashtriyaBarhAyog (National Commission on Floods) the total area liable to flood in the country is 40 Million ha (Mha). The total damage to crops, houses and public utilities from the year 1953 to 2018 has been estimated to be about Rs. 400097 crore which is a colossal amount. The total human lives lost during this period has been assessed to be around 109374 and around 6109628 cattle have also been perished. The high losses and damages caused by floods every year is indicative of poor planning, failure of the flood control policy / measures, inadequate preparedness and ineffective disaster management. Since floods wreak havoc every year, bringing untold miserly to people apart from causing economic sufferings, the need of the hour is that both the central and the state governments should work out

a lasting solution that goes beyond piecemeal measures such as the building of embankments. An integrated River basin management plan is the need of the hour which requires collective involvement of all major flood prone Indian states and also the neighbouring countries where the trans-border rivers originate so as to find a lasting solution to theproblem.

(Recommendation Sl.No.2)

FLOOD CONTROL PLANNING

2.5 Floods are a recurrent phenomenon in several parts of the country causing loss of lives, damage to public property and infrastructure and bring immense misery to the common people. It also impacts economic activities to a great extent. Owing to climate change on account of global warming, the rainfall pattern has been altered over the years with lesser number of rainy days but heavier rainfall which has also aggravated this challenge. The Committee feel that it is high time that our planners need to rework their flood control strategies. From the very beginning, floods have been an integral part of regeneration cycle of nature that brings silt, vegetation, sediment, and fish into the water systems of a region. With the passage of time, engineering solutions like embankments, barrages etc. to control them have been evolved. However, these solutions have obstructed the free flow of rivers. As a result, the silt, which would spread over huge field to form the flood plains becomes restricted to a much smaller area resulting in the river bed being elevated. Over the period, local population have also encroached the floodplains restricting the drainage system and wrecking water bodies as well. The Committee are of the view that it is a high time to adopt a holistic approach to tackle problem of floods which should involve a multi-pronged strategy such as regenerating and conserving the natural vegetation and soil covers in catchment areas to arrest soil erosion, encouraging those agricultural methods which make best use of floods, invigorate dry springs; recharging of the ground water table and ensure better percolation of rainwater.

(Recommendation Sl.No.3)

CONSTITUTIONAL PROVISIONS WITH REGARD TO THE SUBJECT 'FLOOD MANAGEMENT'

2.6 The Committee observe that the subject of Flood control as such is not mentioned in any of the three legislative lists under Schedule VII of the Constitution. However, since "drainage and embankments" is shown at entry 17 of List II (State List),it is presumed that flood control falls under the jurisdiction of the respective State Governments, barring "regulation and development of inter-state rivers and river valleys," which is mentioned in entry 56 of List I (Union List). The Department of water Resources have informed the Committee that as per constitutional provisions, the subject of flood management including erosion control falls within the purview of the States. The flood management and anti-erosion schemes are planned, investigated and implemented by the State Governments with their own resources as per priority within the State. The Union Government only renders assistance to States which is technical, advisory, catalytic and promotional in nature. The Committee are of the view that since most of the rivers are inter-state flowing across statesvery often the flood control measures taken by one State may have Inter-State ramifications. The Inter-State nature of the rivers makes it difficult to implement long term solutions for flood mitigation as the solutions sometimes lie in a different State and benefits to other State. Further, the Committee also note that there is no specific National Policy on Flood Control and Management,though the National Water Policy talks about management of flood & drought.

2.7 The Committee, therefore, are of the considered opinion that , 'Flood Control' needs to be viewed holistically and as a part of the overall development of river basin water resources. 'Water' as a subject is much broader than rivers, irrigation, floods and drought and all the elements of the water cycle, i.e., evapo-transpiration, precipitation, runoff, river, lakes, soil moisture, and ground water, sea, etc., are interdependent and constitute a hydrological unit. With an everi ncreasing population and rising water needs of a fast-developing nation coupled with adverse effects of climate change, the availability and supply of utilizable water in

futurewould be under great pressure with the likelihood of worsening water disputes among different States and different water user categories. Access to clean drinking water and other domestic needs in many areas still remain an issue. Furthermore, the issues concerning water governance have not been properly addressed. Mismanagement of water resources has contributed to a critical situation in many parts of the country. It is obvious that concerted action requires not only at regional but also at national and international level and in this respect, the Union Government has to play a leading role. The Committee, therefore, recommend that the Government should make concerted efforts for arriving at a national consensus to place "Flood control and Management" under concurrent list and at the same time also formulate an overarching national legal structure for efficient, equitable and conservation of water resources. The Committee are aware of the practical difficulties in brining 'Water' under the concurrent list, but these have be resolved for the overall national interst of integrated development of water resources".

(RecommendationSl.No. 4)

2.8 The Committee recommend that pending the resolution of jurisdictional issues relating to flood control and management, there is a need for greater use of provisions made in entry 56 of Union List pertaining to regulation and development of inter-State riversby the Central Government. These efforts have to be supplemented by expeditious passing of the Dam Safety Bill and the River basin Management Bill by the parliament and also make best use of the existing Disaster Management Act, 2005 which empowers Union Government to issue necessary directions to the State Government/Authorities to take appropriate measures for prevention of any impending disaster. The Committee therefore recommend that the Ministry of Jal shakthimust make concerted efforts for expeditious passage of the Dam Safety Bill and the River Basin Management Bill for optimum utilization and efficient management of water resources and also mitigation of floods.

(Recommendation Sl.No.5)

FLOOD PLAIN ZONING

2.9 The Committee note that despite *its benefits, floodplain zoning has not been earmarked / demarcated in India.*In this regard, a model draft bill for flood plain zoning legislation was also circulated by the Union Government to all the States. However, only the States of Manipur, Rajasthan and Uttarakhand and erstwhile State of Jammu & Kashmir had enacted legislation, though delineation and demarcation of flood plains is yet to be undertaken. Further, Major flood prone States viz Uttar Pradesh, Bihar, West Bengal, Assam, Odisha etc have not taken initiative to enact any legislation with regard to Flood Plain Zoning.

2.10 The Committee believe that one of the prime reasons for extensive damage caused due to floods is ever increasingly human habitations and encroachment of the flood plains. The Committee express their displeasure over the fact that though Bihar is one of the most flood prone states in the country witnessing huge losses in terms of human lives, cattle and properties worth crore of rupees every year, the Model legislation on Flood Plain Zoning is yet to be enacted by the State. The Committee are of the view that while floods are natural, destruction caused by floods is by and large man-made due to unbridled human intervention in the nature's ecosystem in the name of development.Deforestation in the catchment area, constructions on the river banks and in the floodplains area, encroachment on wetlands, changing cropping pattern and a short sighted quick-fix solutions to control floods play a major role in causing devastation due to the floods.

2.11 However, at the same time, the Committee are aware of the various challenges faced in implementing the Flood Plain Zoning policy especially evolving a suitable compensatory mechanism and finding alternative land site to rehabilitate those who have been displaced especially in densely populated States like Bihar, Uttar Pradesh etc. The Committee are therefore of the opinion that the Model Bill must be suitably modified taking into account the socio-political and economic realities of the regions in which it is to be implemented. Further, the

Ministry of Jal Shakti should also consider providing financial assistance to those States that are willing to implement floodplain zoning.

(Recommendation Sl.No.6)

RIVER REGULATION ZONES FOR ALL BASINS

2.12 The Committee are pleased to note that a Special Committee constituted in August, 2017 under the chairmanship of the Chairman, Central Water Commission to identify and demarcate the flood plains of river Ganga for the purpose of regulating activities in flood plains of river Ganga in segment B of Phase- I (Haridwar to Unnao), in its Report submitted in September, 2019had identified the flood plains in aforesaid stretch of river Ganga and categorized the flood plains in two zones viz. No Development Zone and Restricted/ Regulatory Zone. Prohibited and regulatory activities for both these zones have also been specified in the report and in pursuance thereof Government of Uttar Pradesh has initiated the work of identification of flood plain zones as per recommendations of the Committee.While appreciating the steps taken by the Government, the Committee recommend that similar studies should be commissioned for other river basins of the country especially Brahmaputra basin keeping in view, its high proneness to floodingso as to identify and demarcate the flood plains in the Bramaputra river basin.The Committee would like to be apprised of the action taken by the Government within three months of presentation of this Report to parliament.

(Recommendation Sl.No.7)

FLOOD CUSHION

2.13 The Committee note that the Working Group on Flood Management and Region Specific Issues, set up under XII Plan had recommended that as a policy minimum flood cushion of 10% of the live storage capacity should be provided in all new dams and if affordable, with respect to other purposes, providing even a flood cushion upto 20% could be considered. The Department of Water Resources has informed the Committee that in order to promote the concept of safe and efficient dam operations including flood moderation, suitable provisions have been kept in the Dam Safety Bill, 2019, which provides for surveillance, inspection, operation and

maintenance of the specified dam. The Bill also has exclusive provision regarding coordinated reservoir operations of cascading dams. The Committee urge upon the Government that pending passing of theDam Safety Bill by the Parliament,necessary instructions /directives be issued to all the State Govts / dam authorities to provide sufficient flood cushion in all the newly constructed water-storage projects/dams and those which are under construction, so as to absorb any impending flood waters for enabling better flood management. Flood control in highly flood- prone areas should be given top priority even if it requires foregoing some of the irrigation or power generation benefits.

(Recommendation Sl.No.8)

INTERLINKING OF RIVERS

2.14 The Committee note that a National Perspective Plan (NPP) was prepared by the then Ministry of Irrigation (now Ministry of Jal Shakti) in 1980 for transferring water from water surplus basins to water-deficit basins. Under the NPP, the National Water Development Agency (NWDA) has identified 30 links (16 under Peninsular Component and 14 under Himalayan Component) for preparation of Feasibility Reports (FRs). The Pre-feasibility reports of all the 30 links have been completed and circulated to concerned States. The Department informed the Committee that there would be huge benefits on account of implementation of interlinking of rivers as per National Perspective Plan in terms of irrigation, power generation, apart from the incidental benefits of flood control, drought mitigation, navigation, water supply, fisheries, salinity and pollution control etc. The Committee are unhappy to note that although National Perspective Plan (NPP) was formulated way back in 1980, no Project for Inter Linking of Rivers (ILR) has reached the execution stage so far. The Committee understand that evolving consensus among the States is the biggest obstacle in the implementation of this ambitious Programme. However, considering the huge losses caused by floods every year and huge benefits accruing out of the interlinking of rivers, the Committee urge the Department to make concerted efforts

to convince the States and arrive at a national consensus so that the project of ILR becomes a reality.

(Recommendation Sl.No.9)

FLOODS IN ASSAM

2.15 The Committee express their deep anguish over the damage of property worth crore of rupees and loss of lives every year by the devastating floods in Assam and North Eastern region every year. It renders a large population homeless, besides destruction to standing crops in several hectares of agricultural land causing a huge setback to the economy of the State of Assam. The Committee observe that the main factors which create serious flood and erosion problems in Assam and its neighbouring states, are heavy rainfall, physiographic condition, high silt load, encroachment of riverine areas, steep slope, inadequate drainage, deforestation, watershed degradation, obstruction at tributaries' confluence with River Brahmaputra and loss of wetlands.The Committee note that the fury of floods in Assam and North-Eastern region in the long term can be tackled by building storage reservoirs on rivers and their tributaries with adequate provisioning for flood cushion, integrated reservoir operation, interlinking of rivers etc. However, these measures have many constraints such as topographic, geological, geographical, environmental, submergence, interstate & international issues.

2.16 Taking cognizance of the aforesaid facts, the Committee believe that preparing and operating these long-term initiatives in a stand-alone manner may be difficult for individual States. Therefore, for integrated use of water resources, there is a need to move from the conventional, fragmented and localized approach to a comprehensive river basin approach. In order to provide coordinated river basin development including comprehensive flood control, it is necessary to set up River Basin Organizations (RBOs), which would effectively provide immediate, short-term and long-term solutions in addition to the overall development of river basin. The Committee, therefore, recommend that Ministry take concrete measures on priority

basis to enact the River Basin Management Authority for holistic management of water resources of each river basin.

(Recommendation Sl.No.10)

2.17 The Committee note from the submission made by the Government of Assam that 39.58% of total land area of the State is flood prone, and that most of the flood and bank protection structures are very old and have become weak. Further, due to persistent silt accumulation, Highest Flood Level (HFL) of rivers in the floodplain are risingbecause of the extremely shallow river bed of the river and the heavy sediment brought in the monsoon by the river, the measures taken by the Government to mitigate the effects of floods have so far not yielded desired results.In order to provide relief to the State of Assam, Government may consider implementation of long termmeasures / solutions such as increasing the water holding capacity of Brahmaputra and its tributaries by dredging after consulting all the stakeholders and developing the water highway in Brahmaputra river which may in turn boost the economy of the State. Further, with a view to equip Assam in tackling the floods effectively and help in mitigating the impact of flood in the long run, the Committee urge the Government of India to take measures such as develop a flood forecasting model for monitoring release and real-time flow of waters in the river, set up modern weather stations in upstream catchment of all Dams in North Eastern region,install sirens on river banks from Dam site so as to alert downstream population in the event of floods, judicious release of water from the Damsto ensure natural low water level of the river, periodic desiltation and flushing of reservoirsand afforestation and rejuvenation of wetlands.

(Recommendation Sl.No.11)

2.18 The Committee express their concern over the problem of flooding on account of hydropower projects located in Arunachal Pradesh as any extra water released from these dams uphill lead to enormous inundation of Brahmaputra valley. Since these projects are only meant for power generation, they don't have infrastructure for water storage or flood management. Further due to apparent lack of coordination among viz. Ministry of Power and Ministry of Jal Shakti,power projects in Arunachal

Pradesh has been constructed without any plan to combat flooding in theneighbouringflood-prone state of Assam. The Committee urge upon the Ministry of Jal Shakti to take up this matter with Ministry of Power and Government of Arunachal Pradesh so as to find a mutual and amicable solution to this problem.

(Recommendation Sl.No.12)

2.19 The Committee have learnt from the Department of Water Resources, River Development and Ganga Rejuvenation that a large storage dam was planned to be built over Upper Siang which would help in mitigating the flood situation in Assam occurring every year. However, at the same time, concerns are being expressed that would submerge Yingkiongtown which is the headquarters of Upper Siang district and also pose the issue of rehabilitation of the inhabitants of the town. The Committee are of the view that before undertaking any ambitious project such as construction of large storage dam, howsoever it may be useful, a proper study to assess the impact on the environmental and ecology as well as flow of the river need to be conducted. Further, the issues of displacement of local population, their sensibilities and relief rehabilitation have to be suitably addressed in a transparent and justified manner. The Committee therefore urge the Ministry to take confidence of all stakeholders and address their concerns before embarking on such a big project.

(Recommendation Sl.No.13)

2.20 The Committee note with concern that river erosion in Assam is a big perennial problem causing significant economic loss besides displacement of population. The Committee are of the view that it is high time that Government should consider inclusion of river erosion in the admissible list of calamities for availing assistance under National Disaster Response Fund (NDRF)/ State Disaster Response Fund (SDRF).The Committee also recommend the Ministry to take requisite steps to protect the Majuli island by strengthening / improving the peripheral embankment system of the Island.

(Recommendation Sl.No.14)

NORTH EAST WATER MANAGEMENT AUTHORITY (NEWMA) BILL

2.21 The Committee welcome the initiative of the Government for bringing forward a legislation for setting up an apex body *i.e.*North East Water Management Authority (NEWMA) for facilitating integrated management of water resources for whole of North East Region including Sikkim and Brahmaputra Basin area of West Bengal, is under consideration of the Union Government. The Committee express the hope that the proposed apex body will ensure integrated development of all water bodies and river-based projects in the region and take care of conservation of the natural resources. The Committee recommend that the Department should take steps for expeditious finalization of the Bill and its enactment by the Parliament within a time-bound period.

(Recommendation Sl.No.15)

NEED TO STRENGTHEN BRAHMAPUTRA BOARD

2.22 The Committee note that Brahmaputra Board was set up to address the twin problems of floods in north-eastern states and storage of flood water in Brahmaputra basin. The Committee,however, express its concern over the lack of manpower in Brahmaputra Board. The Committee note that as against the sanctioned strength of 161 technical posts, almost 38% posts are lying vacant,and in respect of non-technical Posts, out of 254, 66% posts are lying vacant. The huge shortage of manpower adversely affects the proper functioning of the Board. Keeping in view the paramount importance of Brahmaputra Board for management of floods and erosion in North-East region, the Committee recommend the Department to fill up all the vacant posts on priority basis so as to augment the manpower in the Board for enabling its smooth functioning.

(Recommendation Sl.No.16)

FLOODS IN KERALA

2.23 The Committee note that the typical topography of Kerala along with high intensity rainfall during the monsoon months are the key reasons for the severe flood crisis in the State. The rapid urbanization and high population density have led to drastic changes in

land-use pattern, and low lands reclamation that used to provide cushioning effect to the flood waters and the obstructions caused to the natural drainages etc have worsened the impact caused by floods. The Committee note that the most of the dams in Kerala were constructed between the years 1960 and 1980 and were primarily meant for meeting the needs of irrigation, industrial, power generation and drinking water. The capacity of reservoirs in Kerala is stated to be very limited and these can store only 7 per cent of available water. The State could not commission any new reservoir/dam projects since 1980s due to the stringent Environment and Forest Laws and the resistance from the Environmental Groups. The Attappady Irrigation Project despite getting approval from the Supreme Court has not yet got clearance from the Ministry of Environment, Forest and Climate Change. The Committee recommend that keeping in view the recurring floods in the State of Kerala, the Ministry of Jal Shakti should take up this issue with the Ministry of Environment, Forest and Climate Change and impress upon them to grant clearances without delay so that the Attappady Irrigation Project could be commissioned at the earliest. Besides, the State Government of Kerala should actively engage with the environmentalist groups so as to understand their apprehensions and take into consideration their views and suggestions so that the contentious issue of construction of new dams may be amicably resolved to the satisfaction of all stake holders.

(Recommendation Sl.No.17)

2.24 The Committee have been informed that Kerala is unable to avail the benefits of "Flood Management and Border Areas Programme (FMBAP)", a Centrally Sponsored Scheme owing to non-issuance of mandatory clearances by the State Coastal Zone Management Authority on the ground that the clearance could not be issued unless EIA (Environmental Impact Assessment) for one whole year is carried out. The Committee urge the Department to take up the matter with concerned authorities to look into this matter on priority with positive note.

(Recommendation Sl.No.18)

2.25 The Committee are pleased to note the close monitoring and communication mechanism formed between Kerala and Tamil Nadu helped in preventing floods in the Chalakudy basin during the monsoon season. However, the Committee are perturbed to observe that the rule curves of Mullaperiyar Dam (MPD) and three dams in the

Parambikulam-Aliyar Project (PAP) system are yet to be finalized between the State Governments of Kerala and Tamil Nadu. The Committee feel that this issue needs to be sorted out as early as possible for ensuring the safe operation of these reservoirs. The Committee urge upon the Department of Water Resources, River Development & Ganga Rejuvenation to mediate in the matter and play the role of an honest broker in resolving this contentious issue between the two State Governments by pro-actively engaging all stakeholders. The Committee would like to be apprised of the steps taken by the Government in this regard.

(Recommendation Sl.No.19)

NEED TO EXPAND THE SCOPE OF FLOOD FORECASTING STATIONS

2.26 The Committee note that Central Water Commission (CWC) is the nodal agency for carrying out the work relating to flood forecasting and warning in India. Presently, there are 326 Flood forecast stations of which 128 are Inflow Forecast Stations 198 are Level Forecast Stations. The Committee find that presently only 128 reservoirs in the country are covered by Inflow Forecast Stations. Since the significance and importance of the inflow forecasting for efficient real time reservoir operation is a proven fact, there is anurgent need to strengthen impact-based warning at micro level. The Committee therefore, recommend the Department to take necessary steps to enhance the number of inflow forecast network and also strengthen impact-based warning at micro level.

(Recommendation Sl.No.20)

2.27 The Committee are dismayed to learn that Inflow Forecasting Stations have not been set up by the CWC in the States of Arunachal Pradesh, Assam, Himachal Pradesh and Jammu &Kashmir on the ground that no request from the State Government/Project Authorities has been received in CWC for setting up the same. In this connection, the Committee would like to remind the Department that in the year 2018 when severe floods occurred in Kerala, CWC was not having any flood forecasting station in the State as no request was made by the Government of Kerala to start flood forecasting activity at that point of time. The Committee are therefore of the opinion that the system of setting up flood forecasting station only on the

request from the concerned State Governments needs to be reviewed in the backdrop of increasing incidents of extreme climatic conditions, heavy and unseasonal rainfall and cloudbursts etc. The Committee therefore recommend that instead of waiting for requests from States, the Department should set up flood forecasting stations at the designated places. Further it should identify the risk of deluge to the concerned region and share the information with the States concerned so as to obviate the risk of unpreparedness on account of lack of flood forecasting.

(Recommendation Sl.No. 21)

FUNDING UNDER FLOOD MANAGEMENT PROGRAMMES

2.28 The Committee note that during XI Plan, the Flood Management Programme (FMP) was implemented with an outlay of Rs. 8000 crore and the pattern of funding was 90 % (Centre):10 % (State) for Special Category States and 75 % (Centre): 25 % (State) for General/ Non-Special Category States. However, during XII Plan, though the Programme continued, the funding pattern was revised to 70% (Centre):30 (State) for the special category States viz. North Eastern States, Himachal Pradesh, Jammu & Kashmir and Uttarakhand and for General States it was revised to – 50% (Centre) : 50% (State). The Committee expresstheir concern over slashing the Central share of funding under these Programmes during XII Plan.Given the precarious state of financing of States particularly poor States like Bihar who shares international border with Nepal and other major flood prone States are not in a position to provide adequate budgetary support for flood management works. The Secretary, DoWR, RD & GR during the oral evidence admitted that annual budget of the Ministry for flood management works is only Rs. 500 crore which is awfully low in comparison to the requirement of funds for flood control works/schemes. He further, stated that more than funding pattern, non-allocation of sufficient funds for the scheme is the major roadblock for undertaking flood management works.

2.29 Keeping in view the large scale destruction caused by the floods every year and also the delicate financial position of the States, the Committee urge the Department to vigorously persue with the Ministry of Finance to provide adequate

budgetary support for flood Management Programme. The Committee also recommend that the Department should impress upon the Niti Aayog to revise the existing fund sharing pattern between Union and States under the Flood management schemes with a view to increase Centre's share. Further, to augment the funding for flood management programme, the Committee urge the Department to explore the possibility of setting up a dedicated fund on the lines of Clean Ganga Fund for NamamiGangeProgramme whereby a trust may be set up for seeking contributions from corporate entities as well as individuals. Besides, to incentivize the corporates, the donation to dedicated FMP Fund may be exempted from Income Tax under relevant sections and contribution to FMP Fund may also qualify under Corporate Social Responsibility (CSR) provisions of the Company Act.

(Recommendation Sl.No.22)

2.30 The Committee have been informed that in order to formulate the strategy for flood management works in the entire country and river management activities and works in the border areas for period 2020-2023, a Committee has been constituted by NITI Aayog under the chairmanship of Vice Chairman, NITI Aayog. Officials from various Departments/Ministries of Government of India, experts from the field and Principal Secretaries from States of Jammu & Kashmir, Uttar Pradesh, Bihar, West Bengal, Punjab, Assam, Arunachal Pradesh, Tripura, Madhya Pradesh and Kerala have been included as the members of this Committee. As a part of this exercise, a Sub-Committee was constituted under the chairmanship of Secretary, DoWR, RD & GR, Ministry of Jal Shakti to assist the Committee in formulation of the proposal/strategy of flood management in respect of three broad areas, viz., structural measures, non structural measure and the scheme for financial assistance to states for taking up flood management works and river management activities/works in border areas. It has been informed that the Sub-Committee has submitted it Report to the aforesaid Committee of NITI Ayog in July-2020. The Committee urge the Government to complete the exercise of formulation of the strategy for flood management works in the entire country and river management activities and works in the border areas, within a definite time period so that a

comprehensive and well-defined policy for integrated Flood Management in the country is put in place.

(Recommendation Sl.No.23)

INTEGRATED RESERVOIR OPERATION FOR FLOOD MANAGEMENT

2.31 The Committee take note of the following major instances where release of water from dams has caused flood like situation in other States: (i) Flood like situation in Patna in Bihar and its downstream areas in the year 2016 after releases from Bansagar Dam in Madhya Pradesh and Rihand dam in Uttar Pradesh (ii) Releases from Koyna Dam and other small dams in Maharashtra and Almatti Dam in Karnataka in the year 2019inundated Telangana and Andhra Pradesh (iii) Releases from dams at Chambal basin in Madhya Pradesh and Rajasthan and dams at Betwa Basin dams in Madhya Pradesh and UP caused flood like situation in UP, Bihar and West Bengal and (iv) Releases from Bhakra Beas Management Board (BBMB) Projects in HP and Punjab creating flood like situation in Punjab.The Committee note that most of the Indian rivers are inter-state flowing through more than one State. Many River Valley Projects have been developed on these rivers by the State Governments within their jurisdiction and they are being operated as a single entity in most of the cases. However, it is not possible for each State to operate the reservoir in an integrated manner with reservoir located in other States without having institutional mechanism for the same. Many a times, sudden release of water from dams in one State has created inundation in other State resulting in loss of lives in addition to large scale economic losses to population and infrastructure.

2.32 The Committee express concern over the fact that though dam owners are advised to follow Standard Operating Procedure (SoP) for release of water from their reservoirs and issue advance warnings for the downstream areas, the conflicting objectives and lack of coordination between various States pose a challenge in optimal operation of reservoirs. To obiviate this problem, the Committee recommend that setting up of River Basin Authority for each river basin of the country may be

expedited in order to ensure integrated operation of reservoirs. The Committee would like to be apprised of the steps taken by the Department in this regard.

(Recommendation Sl.No.24)

CRISIS MANAGEMENT PLAN

2.33 The Committee note with concern that although the Flood Crisis Management Teams (FCMTs) which are formed for various river basins issue advisories based on the inflow forecast and the availability of flood cushion in the reservoir, the project authorities are not bound to follow the advisories of FCMT as the decision for release of water from the project falls under the purview of State Governments. The Department have sought the intervention of the Committee in the matter for finding a remedy to the problem through an executive order issued under Disaster Management (DM) Act 2005 or through a legislation such as proposed Dam Safety Bill which has since been passed by Lok Sabha and is to be passed by the Rajya Sabha. The Committee recommend the Government to take expeditious steps for enactment of the legislation for Dam safety and pending enactment of this legislation, an executive order in this regard may be issued under DM Act, 2005 as early as possible.

(Recommendation Sl.No.25)

GUIDELINES FOR REGULATION OF WATER RESERVOIRS IN THE COUNTRY

2.34 The Committee have been informed that CWC publishes guidelines for preparing Operation and Maintenance Manual for dams which contain various aspects of project operation including normal operation and also operation during emergency. Details for preparation of operational rule curve (both for reservoir filling and release) are also part of the guidelines. However, it is the dam owners (States Govts./UTs./Public Sector Undertakings (PSUs) etc.) who are responsible for Operation & Maintenance (O&M) and regulation of water in reservoirs and the role of Central Water Commission is just advisory with little room for proactive intervention in reservoir operation and regulation. The Department in its submission has stated that the Dam Safety Bill, 2019 has exclusive provision regarding coordinated

reservoir operations of cascading dams which will address the problem of regulation of waters in reservoirs. The Committee recommend that till such time the Dam Safety Bill is passed by the Parliament, the Department should take proactive steps in consultation with all State Governments / Project authorities so as to prevent faulty reservoir operations and encourage seamlessexchange of information amongst State Governments for safe release of water from reservoir.

(Recommendation Sl.No.26)

MEASURES TO COMBAT GLACIAL LAKE OUTBURST FLOOD (GLOF)

2.35 Flood forecasting by CWC assist the authorities concerned to a large extent in framing a relief and mitigation response to riverine floods by providing advanced information. However, disasters such as flash floods, GLOF, and landslides, which are expected to become more common in the future due to climate change, constitute a threat in terms of assessing and forecasting their perilous impact in a prompt way. The Committee note with concern that, of late, Climate change has had a great impact on glacier movement in the Indian Himalayan region. In general, glaciers have been rapidly melting and retreating resulting in formation of a number of moraine dammed glacial lakes, posing numerous threats particularly to the population and infrastructure located nearby due to their outbursts. Recognizing and spotting of dangerous glacial lakes is very important so that all the stakeholders i.e.planners, scientists, academics, and the general public may evolve, adopt and carry out suitable mitigation steps such as monitoring, early warning, evacuationand relief and rehabilitation. The Committee therefore recommend that the Ministry make concerted efforts to set up and widen the network of high altitude meteorological and discharge stations equipped with modern technology including Synthetic-Aperture Radar imagery to automatically detect changes in water bodies, including new lake formations, covering glaciers, glacial lakes and watersheds in the Indian Himalayan region. Besides, it should also work in close collaboration with other agencies involved in glacial management and analyzing the mountain hazardous by sharing data with them.

(Recommendation Sl.No.27)

LOSSES DUE TO EROSION DURING FLOODS

2.36 The Committee note with concern that the Department has not furnished specific information pertaining to losses caused due to soil erosion during floods and sand /debris deposition in agricultural farmlands in terms of acreage, and number of farmers affected. Further, the Committee have learnt from the reply of the Department that there does not exist any scheme to make those farmlands cultivable which were damaged and became uncultivable due to erosion during floods and deposition of sand/debris. The Committee are appalled at the conditions of the hapless farmers whose standing crops are destroyed and their agriculturallands submerged due to the floods and lack of financial assistance from the Government to make their agricultural lands cultivable. The Committee urge the Department of Water Resources, River Development & Ganga Rejuvenation to compile data regarding the losses caused by erosion during floods and deposition of sand/debris in the agriculture lands in terms of acreage number of farmers affected and financial losses and also formulate a scheme to extend all kinds of assistance including financial to these farmersfor making their uncultivable land cultivable in coordination with the Ministry of Agriculture and Farmers' Welfare.

(Recommendation Sl.No.28)

INDUS WATER TREATY BETWEEN INDIA AND PAKISTAN

2.37 The Committee note that the Indus Water Treaty was signed between India and Pakistan for sharing of waters of Indus basin in 1960 after eight years of negotiations under the aegis of the World Bank. Total quantity of waters of the Eastern Rivers viz. Sutlej, Beas, and Ravi is allocated to India for unrestricted use while the waters of Western rivers i.e. Indus, Jhelum, and Chenab is allocated largely to Pakistan. However, India is permitted to use the water of the western rivers for domestic use, non-consumptive use, agricultural and generation of hydro-electric power. The Committee are pleased to learn that important projects like Ranjit Sagar Dam, Pong Dam and Bhakhra Nangal Dam have been built on these rivers which help India to make major use of waters of the rivers flowing to Pakistan as per the Indus

Water Treaty. However, the Committee are concerned that the canals in Punjab and Rajasthan have become very old and are also not properly maintained resulting in lowering their water carrying capacity. Further, the canals like Rajasthan feeder and Sarhind feeder are working below their capacity (only 1/3 of their full capacity) resulting in release of water from Harike Barrage to Pakistan. The Committee, therefore, urge upon the Government that projects like Ujh and Shahpur Kandi may be completed expeditiously so as to exploit full potential of the western rivers for irrigation and other purposes. Further, the Committee recommend that the canal system in Rajasthan and Punjab may be repaired strengthened and properly maintained in order to increase their water carrying capacity.

(Recommendation Sl.No.29)

2.38 The Committee are constrained to note that though India as per the Indus Water Treaty has the right to create water capacity storageupto 3.6 Million Acre-Feet (MAF) on Western rivers, however, no storage capacity has been created so far by India. Further, out of estimated power potential of about 20000 MW (Mega Watt), which could be harnessed from Western rivers power projects, only capacity of 3482 MW have been constructed so far on Western rivers. Besides, the Treaty provides India, the right to develop Irrigated Cropped Area (ICA) of 13,43,477 acres (9,12,477 acres without creating any storage and 4,31,000 acres after creation of conservation storage and release of a specified quantum of water into the river annually) through waters of Western rivers. However, as per the latest data for the crop year 2019-20, the ICA developed by India on Western rivers is 7,59,859 acres.Keeping in view the aforestated position, the Committee recommend that Government of India should examine the feasibility of making maximum use of the provisions of the Indus Water Treaty, in terms of full utilization of all accessible water of the eastern rivers and maximum utilization of the irrigation and hydropower potential of western rivers including permissible water storage as per the provisions of the treaty.

(Recommendation Sl.No.30)

2.39 The Committee observe that although Indus Water Treaty has stood the test of time, they are of the view that the Treaty was framed on the basis of knowledge and technology existing at the time of its agreement in 1960s. The perspective of both the nations at that time was confined to river management and usage of water through construction of dams, barrages, canals and hydro-power generation. Present day pressing issues such as climate change, global warming and environmental impact assessment etc.were not taken into account by the Treaty. In view of this, there is a need to re-negotiate the Treaty so as to establish some kind of institutional structure or legislative framework to address the impact of climate change on water availability in the Indus basin and other challenges which are not covered under the Treaty. Hence, the Committee urge the Government of India to take necessary diplomatic measures to renegotiate the Indus Water Treaty with Pakistan.

(Recommendation Sl.No.31)

INDO-CHINA WATER RELATIONS

2.40 From the submission made by the Department of Water Resources, River Development and Ganga Rejuvenation, the Committee note that presently there is no water treaty with China. However, Memoranda of Understandings (MoUs) on Brahmaputra and Sutlej rivers have been signed by the two nations, which will be in force for five years and are renewed regularly. Besides, an Expert Level Mechanism (ELM) between both the nations has also been set up for ensuring co-operation with regard to provision of hydrological data by China during flood season, emergency management and other issues regarding trans-border rivers as agreed upon by the two countries. The Committee express their satisfaction over the fact that China is sharing hydrological data with regard to rivers of Brahmaputra and Sutlej, though on payment basis. The only aberration is the year 2017 when no data was supplied by it.

2.41 Further, the Committee have been apprised by the Ministry of External Affairs that three hydropower projects on the main stream of Brahmaputra River in Tibet Autonomous Region have been approved by the Chinese authorities and a hydropower project at Zangmu was declared fully operational by Chinese authorities in October 2015. It has also been stated that the Government of India is carefully monitoring all the developments on the Brahmaputra River and has consistently conveyed its views and concerns to the Chinese authorities in order to ensure that the interests of downstream States like India are not harmed by any activities undertaken in upstream areas. China has conveyed to India on several occasions that they are undertaking run-of-the-river hydropower projects which do not involve diversion of the waters of the Brahmaputra. The Committee express apprehension that though 'run of the river' projects undertaken by China per se may not lead to diversion of waters, but there is every possibility that water can be stored in pondages and released for running the turbines , which may lead to certain diurnal variation in downstream flow and as a consequence have an impact on water flows in Brahmaputra river and thus affect india's endeavours to tap the region's water resources.The Committee recommend that India should constantly monitor the Chinese actions so as to ensure that they do not pursue any major interventions on Brahmaputra river which would adversely affect our national interests .

(Recommendation Sl.No.32)

NEW DELHI;
03 August, 2021
12 Sravana, 1943 (Saka)

Dr. Sanjay Jaiswal
Chairperson,
Standing Committee on Water Resources

MINUTES OF THE ELEVENTH SITTING OF THE STANDING COMMITTEE ON WATER RESOURCES HELD ON THURSDAY, 6 AUGUST, 2020

The Committee sat from 1400 hours to 1545 hours in Committee Room 'C', Ground Floor, Parliament House Annexe, New Delhi.

PRESENT

Dr. Sanjay Jaiswal – Chairperson

MEMBERS

LOK SABHA

2. Shri Vijay Baghel
3. Shri Bhagirath Chaudhary
4. Shri Nandkumar Singh Chauhan
5. Dr. Heena Vijaykumar Gavit
6. Dr. K. Jayakumar
7. Shri Kaushal Kishore
8. Shri Hasmukhbhai Somabhai Patel
9. Shri Dipsinh Shankarsinh Rathod

RAJYA SABHA

10. Shri Pradeep Tamta
11. Shri Arun Singh
12. Shri Subhash Chandra Singh

SECRETARIAT

1.	Shri Manoj K. Arora	-	OSD (LSS)
2.	Shri M.K. Madhusudhan	-	Director

WITNESSES

I. Ministry of Jal Shakti- Department of Water Resources, River Development & Ganga Rejuvenation

1. Shri U.P Singh, Secretary (WR, RD & GR)
2. Shri R. K. Jain, Chairman (CWC)
3. Smt. Debashree Mukherjee, Additional Secretary (WR, RD & GR)
4. Shri Atul Jain, Commissioner (WR, RD & GR)
5. Shri Sharad Chandra, Director (CWC)

2. At the outset, the Hon'ble Chairperson welcomed the Members to the Sitting of the Committee and apprised the Members of the agenda of the Sitting i.e., briefing by the representatives of the Ministry of Jal Shakti –(Department of Water Resources, River Development & Ganga Rejuvenation) on the subject "Flood Management in the country and evolving Decision Support System for release of water from Dams" and consideration and adoption of draft Report on Action Taken by Government on the observations/ recommendations contained in the Second Report of the Committee(17th Lok Sabha) on "Demands for Grants (2019-20)" of the Ministry of Jal Shakti (Department of Drinking Water and Sanitation).

[The representatives of the Department of Water Resources, River Development & Ganga Rejuvenation were, then, ushered in]

3. The Chairperson then welcomed the representatives of the Department of Water Resources, River Development & Ganga Rejuvenation, to the sitting and drew their attention to Direction 55(1) of the Directions by the Speaker regarding the confidentiality of the proceedings of the Committee. Thereafter, the representatives of the Department made a power point presentation on the subject, *inter alia* highlighting the various measures/steps taken by the Department to combat the menace of floods in the country. Then the Members, one by one, sought clarifications and raised queries on the issues pertaining to the subject. The important issues/ topics raised during the discussion on the subject, amongst others, included the following:

(i) Integrated River Basin Management.

(ii) Issues regarding fund sharing pattern between the Centre and State on the scheme -Flood management programme(FMP)

(iii) The Concept of Flood Plain Zoning and issue of not enacting the Model Bill on Flood Plain Zoning by several States

(iv) Need for integrated operation of reservoirs and role of dams in mitigating the devastating floods.

(v) Limitations of embankments in controlling impacts of floods.

(vi) Dredging of Rivers.

(vii) Need for Inflow Marking of the cross border river waters coming from Nepal

(viii) Need for national Strategies to combat floods in hilly areas.

(ix) Interlinking of Rivers.

4. The Chairperson then thanked the representatives for making presentation on the various aspects of the subject and replying to the queries raised by the Members. He then

asked the Secretary, to furnish written replies to those points/queries raised by the Members which could not be readily replied and/or on which detailed statistical replies are required ,within a week's time .

[The witnesses, then, withdrew]

5. XX XX XX XX XX XX XX XX XX XX XX XX XX

6. A copy of the verbatim record of the proceedings of the sitting of the Committee has been kept.

The Committee, then, adjourned.

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MINUTES OF THE TWELFTH SITTING OF THE STANDING COMMITTEE ON WATER RESOURCES HELD ON MONDAY, 17 AUGUST, 2020

The Committee sat from 1130 hours to 1345 hours in Committee Room 'C', Ground Floor, Parliament House Annexe, New Delhi.

PRESENT

Dr. Sanjay Jaiswal – Chairperson

MEMBERS

LOK SABHA

2. Shri Vijay Baghel
3. Shri Bhagirath Chaudhary
4. Dr. Heena Vijaykumar Gavit
5. Dr. K. Jayakumar
6. Shri Kaushal Kishore
7. Shri Kuruva Gorantla Madhav
8. Shri HasmukhbhaiSomabhaiPatel
9. Shri DipsinhShankarsinh Rathod
10. Shri Prajwal Revanna
11. Shri D. K. Suresh

RAJYA SABHA

12. Shri Pradeep Tamta
13. Shri Arun Singh
14. Shri Subhash Chandra Singh

SECRETARIAT

1.	Shri Manoj K. Arora	-	OSD (LSS)
2.	Shri M.K. Madhusudan	-	Director
3.	Shri R. C. Sharma	-	Additional Director

WITNESSES

I. Ministry of Jal Shakti- Department of Water Resources, River Development & Ganga Rejuvenation

1. Shri U.P Singh, Secretary (WR, RD & GR)
2. Shri R. K. Jain, Chairman ,CWC
3. Smt. Debashree Mukherjee, Additional Secretary (WR, RD & GR)
4. Shri Atul Jain, Commissioner (WR, RD & GR)

5. Shri Sharad Chandra, Director ,CWC

GOVERNMENT OF ASSAM

1. Shri Syedain Abbasi, Additional Chief Secretary
2. Shri Dibakar Bhattacharjee, OSD to Hon'ble Minister, WRD, Govt. of Assam
3. Shri Borsing Rongpi, Chief Engineer

GOVERNMENT OF KERALA

1. Shri Sanjay Garg, IAS, Resident Commissioner & Principal Secretary
2. Shri Biju B., Chief Engineer
3. Shri Bibin Joseph, Director
4. Shri James Wilsom, Member of the Expert Advisory Group Reservoir Operation

GOVERNMENT OF BIHAR

Shri P.K. Jha, Superintending Engineer

2. At the outset, Hon'ble Chairperson welcomed the Members to the Sitting of the Committee and apprised them of the agenda of the Sitting i.e., Evidence of the representatives of Ministry of Jal Shakti (Department of Water Resources, River Development & Ganga Rejuvenation) and State Governments of Assam, Kerala and Bihar in connection with the examination of the subject "Flood Management in the country and evolving Decision Support System for release of water from Dams with special reference to the measures taken for flood control in the States of Bihar, Assam and Kerala", and consideration and adoption of draft Report on Action Taken by the Government on the observations/ recommendations contained in the First Report of the Committee(17th Lok Sabha) on "Demands for Grants (2019-20)" of the Ministry of Jal Shakti– Department of Water Resources, River Development & Ganga Rejuvenation.

[The representatives of the Department of Water Resources, River Development & Ganga Rejuvenation, State* Governments of Assam, Kerala and Bihar *were, then, ushered in]

3. The Chairperson then welcomed the representatives of the Department of Water Resources, River Development & Ganga Rejuvenation and the State Governments of Assam, Kerala and Bihar, to the Sitting and drew their attention to Direction 55(1) of the Directions by the Speaker regarding the confidentiality of the proceedings of the Committee .Thereafter, the representative of the State Government of Bihar apprised the Committee about the flood control measures taken by the State and the constraints and challenges faced by the State in Flood Management particularly on account of flood waters flowing from Cross border rivers flowing from Nepal. Thereafter, the representatives of the State

Governments of Assam and Kerala made a power point presentation highlighting the flood situation in their respective States, steps taken by them to control the impact of floods and various problems faced by them in flood control.

4. Then the Members, one by one, sought clarifications and raised queries on the issues pertaining to the subject. The important issues/ topics raised during the discussion on the subject, amongst others, included the following:

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(i) Massive destruction in the State of Bihar due to uncontrolled inflow of waters coming from rivers in Nepal.

(ii) Breach of embankments and rise in flood prone area despite increase in the length of embankment.

(iii) Non-Identification of several flood prone districts by the Ministry of Jal Shakti in the State of Bihar.

(iv) Non-inclusion of any new project from Bihar in the Flood Management Programme (FMP)

(v) Need to extend river management activities relating to bordering areas to all the rivers of bordering districts in Bihar in addition to Gandak and Kosi .

(vi) Need to explore alternative ways of funding to finance flood controlling measures.

(vii) Inadequacy of manpower in Brahmaputra Board.

(viii) Need for construction of reservoirs on the upstream side of Assam to control the fury of floods.

(ix) Issue of funding as well as fund sharing pattern between Centre and States with regard to Flood management Programme

(x) Cooperation between State Government of Kerala and Tamil Nadui in inter-reservoir /dam management.

(xi) The issue of interlinking of rivers.

(xii) Non- construction of new dams for flood control in the State of Kerala.

(xiii) The issue of Hydro Electric Projects located in Arunachal Pradesh causing floods in Assam.

5. The Chairperson, then, thanked the representatives of the Ministry of Jal Shakti and the representatives of the State Governments of Assam, Kerala and Bihar for making presentation on the various aspects of the subject and replying to the queries raised by the Members. The Chairperson asked the Secretary, Department of Water Resources, River Development & Ganga Rejuvenation to furnish written replies to those queries raised by the Members which could not be replied readily by them, within a fortnight.

[The witnesses, then, withdrew]

6. XX XX XX XX XX XX XX XX XX XX XX XX XX

7. A copy of the verbatim record of the proceedings of the sitting of the Committee has been kept.

The Committee, then, adjourned.

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MINUTES OF THE SECOND SITTING OF THE STANDING COMMITTEE ON WATER RESOURCES HELD ON TUESDAY, 17 NOVEMBER, 2020

The Committee sat from 1500 hours to 1630 hours in Committee Room 'D', Ground Floor, Parliament House Annexe, New Delhi.

PRESENT

Dr. Sanjay Jaiswal – Chairperson

MEMBERS

LOK SABHA

2. Shri Nandkumar Singh Chauhan
3. Shri Guman Singh Damor
4. Dr. K. Jayakumar
5. Shri M. Dhanush Kumar
6. Shri Kuruva Gorantla Madhav
7. Shri Hasmukhbhai Somabhai Patel
8. Shri Dipsinh Shankarsinh Rathod

RAJYA SABHA

9. Shri Subhash Chandra Singh
10. Shri Pradeep Tamta

SECRETARIAT

1.	Shri Manoj K. Arora	-	OSD (LSS)
2.	Shri M.K. Madhusudhan	-	Director
3.	Shri R. C. Sharma	-	Additional Director

WITNESSES

I. Ministry of Jal Shakti- Department of Water Resources, River Development & Ganga Rejuvenation

1. Shri U.P Singh, Secretary (WR, RD & GR)
2. Smt. Debashree Mukhrjee, Additional Secretary, DoWR, RD & GR
3. Shri R.K. Sinha, Member, CWC
4. Shri Atul Jain, Commissioner (FM)
5. Shri P. K. Saxena, Commissioner (Indus)

6. Shri T. S. Mehra, Commissioner (B & B)
7. Shri Rakesh Toteja, Senior Joint commissioner

Ministry of External Affairs

1. Shri Arun K. Chatterjee, Additional Secretary
2. Shri Arindam Bagchi, Joint Secretary (North)
3. Shri Anil Kumar Rai, Joint Secretary (Parliament and Coordination)
4. Shri J.P. Singh, Joint Secretary (PAI)
5. Shri Satish Kumar Sivan, Director (EA)
6. Shri Amit A. Shukla, Director (North)

2. At the outset, the Hon'ble Chairperson welcomed the Members to the Sitting of the Committee and apprised them that the Sitting has been convened to take oral evidence of the representatives of the Ministries of Jal Shakti –(Department of Water Resources, River Development & Ganga Rejuvenation) and External Affairs , on the subject "Flood Management in the Country including international water treaties in the field of water resource management/flood control with particular reference to treaty/agreement entered into with Nepal, China, Pakistan and Bhutan".

[The representatives of the Department of Water Resources, River Development & Ganga Rejuvenation and the Ministry of External Affairs were, then, ushered in]

3. The Chairperson then welcomed the representatives of the Department of Water Resources, River Development & Ganga Rejuvenation and Ministry of External Affairs, to the sitting and drew their attention to Direction 55(1) of the Directions by the Speaker regarding the confidentiality of the proceedings of the Committee. Thereafter, the representatives of the Department of Water Resources, River Development & Ganga Rejuvenation, made a power point presentation *inter alia*, highlighting the issues relating to trans-boundary rivers contributing to the problem of floods in the country and sharing of waters of trans border rivers. Then the Members, sought clarifications and raised queries on the various issues pertaining to the subject. Thereafter, the representatives of the Ministry of External Affairs, made a brief presentation on the subject highlighting the steps taken by the Government of India at the diplomatic level with Nepal, Pakistan, China and Bhutan in finding a solution to the problem of floods and sharing of waters of trans border rivers. The important issues/ topics raised during the discussion on the subject, amongst others, included the following:

(i) Funding of upstream embankments by the Ministry of Jal Shakti located in Nepal region

(ii) Providing of financial assistance by Govt of India to the Government of Bihar for maintenance of Kosi and Gandak Barrages.

(iii) Delay in execution of Pancheshwar Multi-Purpose Project.

(iv) Differences of opinion between Governments of India and Nepal regarding the interpretation of *Mahakali* treaty.

(v) Issue of sharing of cost and benefits with regard to Pancheshwar multi-purpose project between Governments of India and Nepal.

(vi) Reasons for delay in completion of survey for Saptakoshi Sunkoshi project

(vii) Need for enhanced cooperation between India and Nepal in speedy execution of the Projects.

(viii) Indus Water Treaty and steps taken by the Government of India to make full use of water allotted to India as per the treaty.

(ix) Issues of improper maintenance of canals in Punjab and Rajasthan resulting in additional flow of water to Pakistan from Harike Barrage.

(x) Issue of real time data sharing with China in containing floods.

(xi) Issue of having Memorandum of Understandings (MoUs) with China rather than water treaty.

4. The Chairperson then thanked the representatives for making presentation on the various aspects of the subject and replying to the queries raised by the Members. He then asked the Secretary, to furnish written replies to those points/queries raised by the Members, which could not be readily replied and/or on which detailed statistical replies are required, within a fortnight time.

[The witnesses, then, withdrew]

5. A copy of the verbatim record of the proceedings of the sitting of the Committee has been kept.

The Committee, then, adjourned.

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Minutes of the Thirteenth Sitting of the Standing Committee on Water Resources held on Tuesday, 3 August 2021

The Committee sat from 1500 hours to 1645 hours in Committee Room No. '139', First Floor, Parliament House Annexe, New Delhi.

PRESENT

Dr. Sanjay Jaiswal – Chairperson

MEMBERS

LOK SABHA

2. Shri Vijay Baghel
3. Shri Bhagirath Chaudhary
4. Shri Nihal Chand Chauhan
5. Shri Guman Singh Damor
6. Dr.Heena Vijaykumar Gavit
7. Dr. K. Jayakumar
8. Shri P. Raveendranath Kumar
9. Shri Kuruva Gorantla Madhav
10. Shri Hasmukhbhai Somabhai Patel
11. Shri Sanjay Kaka Patil
12. Shri Sunil Kumar
13. Ms. Agatha K. Sangma
14. Shri D.K. Suresh

RAJYA SABHA

15. Shri Harshvardhan Singh Dungarpur
16. Dr.KirodiLal Meena
17. Shri Subhash Chandra Singh

WITNESSES

MINISTRY OF JAL SHAKTI-DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION

1.	Shri Pankaj Kumar	Secretary
2.	Shri Rajeev Ranjan Mishra	DG, NMCG
3.	Shri Rozy Aggarwal	Exe-Director, NMCG
4.	Shri D. P. Mathuria	Exe-Director, NMCG
5.	Shri Ashok Kumar	Exe-Director, NMCG
6.	Shri Binod Kumar	Director, NMCG

CENTRAL GROUND WATER BOARD (CGWB)

7.	Shri Nanadkumaran P.	Chairman, CGWB

CENTRAL WATER COMMISSION (CWC)

8.	Shri S. K. Haldar	Chairman, CWC

CENTRAL POLLUTION CONTROL BOARD (CPCB)

9.	Shri Naresh Pal Gangwar	JS, MoEF & Chairman, CPCB
10.	Dr. Prashant Gargava	Member Secretary, CPCB

SECRETARIAT

1.	Shri Manoj K. Arora	-	OSD (LSS)
2.	Shri M.K. Madhusudhan	-	Director
3.	Shri R.C. Sharma	-	Additional Director

2. At the outset, the Chairperson welcomed the Members to the Sitting of the Committee convened to – (i) take further evidence on the subject-"Conservation, Development, Management and Abatement of pollution in river Ganga and its tributaries under Namami Gange programme with particular reference to project deliverables and timelines as well as performance of State Governments" with special reference to implementation of the Programme in the States of Bihar, UP and West Bengal; and (ii) consideration and adoption of the draft Report on "Flood Management in the Country including International Water treaties in the field of Water Resource Management with particular reference to Treaty/Agreement Entered into with China, Pakistan And Bhutan".

3. Thereafter, the Committee took up for consideration the draft Report and adopted the same with slight modification in Recommendation no.1 (Para 2.1). The Committee then authorized the Chairperson to present the Report on their behalf to both the Houses of Parliament, during the current Session.

[The representatives of the Ministry of Jal Shakti - Department of Water Resources, River Development and Ganga Rejuvenation were then ushered in]

5. XX XX XX XX XX XX XX XX XX XX XX XX XX

6. XX XX XX XX XX XX XX XX XX XX XX XX XX

7. XX XX XX XX XX XX XX XX XX XX XX XX XX

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Annexure I

Statement showing State-wise data regarding damages due to floods/heavy rain for the year 2018 and all India averaged data over the period 1953 to 2018

										Tenative	
Sl. No.	Name of State	Area affected in	Population affected in	Damage to Crops		Damage to Houses		Cattle lost	Human lives lost	Damage to public utilities	Total damages crops,house, & public utilities
		Mha	Million	Area mha	Value in Rs Crore	Nos.	Value in Rs Crore	Nos.	Nos.	Value in Rs Crore	in Rs.Crore
1	2	3	4	5	6	7	8	9	10	11	12
1	ANDHRA PRADESH	0.170	1.910	0.170	237.480	51849	243.910	1259	22	3205.781	3687.171
2	ARUNACHAL PRADESH	0.743	NR	0.743	462.915	1647	589.949	47	33	860.963	1913.827
3	ASSAM	0.043	1.322	0.031	23.490	102737	84.010	122	53	2373.480	2480.980
4	BIHAR	0.034	0.150	0.001	5.137	1074	0.413	0.000	1.000	0.010	5.560
5	CHATTISGARH	0.005	0.194	0.004	12.246	10831	4.140	183	135	25.304	41.689
6	GOA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
7	GUJARAT	2.378	18.600	0.054	47.820	2635	2.068	212	57	68.160	118.048
8	HARYANA	0.079	0.000	0.079	88.446	54	0.580	0	3	0.000	89.026
9	HIMACHAL PRADESH	0.006	6.865	0.411	12.570	6023	43.030	1285	343	10.300	65.900
10	JAMMU & KASHMIR	NR	NR	NR	NR	17	NR	38	6	NR	NR
11	JHARKHAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	0.200	0.200
12	KARNATAKA	0.328	0.350	0.232	2220.700	14955	367.510	1207	215	2032.570	4620.780
13	KERALA	3.150	5.412	0.087	168.480	324386	998.131	47953	450	2154.149	3320.760
14	MADHYA PRAADESH	Nil	Nil	Nil	Nil	315	1.670	36	31	Nil	1.670
15	MAHARASHTRA	NR	NR	NR	NR	NR	NR	65	68	NR	NR
16	MANIPUR	0.005	0.127	0.005	NR	17846	NR	400	9	NR	NR
17	MEGHALAYA	0.000	0.000	0.000	0.038	0	0.029	0	0	0.000	0.066
18	MIZORAM	NR	NR	0.000	NR	987	NR	3	11	NR	NR
19	NAGALAND	0.002	0.261	0.002	NR	5209	NR	794	13	NR	NR
20	ODISHA	0.033	0.624	0.026	29.020	43360	23.980	164	21	246.840	299.840
21	PUNJAB	0.057	NR	0.057	120.410	1477	4.110	29	26	0.000	124.520
22	RAJASTHAN	0.002	0.017	0.002	2.200	2159	2.160	341	26	27.368	31.728
23	SIKKIM	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
24	TAMILNADU	0.191	0.560	0.191		220000		1040	52		3500.000
25	TRIPURA	0.004	0.250	0.025	24.282	40897	115.945	3905	22	805.950	946.178
26	UTTAR PRADESH	0.445	0.592	0.383	230.364	28063	13.724	149	105	303.336	547.423
27	UTTARAKHAND	0.001	NR	0.001	NR	2062	NR	895	101	NR	NR
28	WEST BENGAL	0.043	0.157	0.011	22.410	34755	13.268	17	31	18.328	54.006
29	A & N ISLAND	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.000
30	CHANDIGARH	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.000
31	D & N HAVELI	0.000	0.000	0.000	0.000	0	0.000	0	0	0.000	0.000
32	DAMAN & DIU	0.000	0.000	0.000	0.000	0	0.000	0	0	0.000	0.000
33	DELHI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
34	LAKSHADWEEP	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.000
35	PUDUCHCHERRY	Nil	0.007	0.000	0.180	76	0.030	135	Nil	0.180	0.600
	TOTAL	7.718	37.398	2.515	3708.187	913414	2508.656	60279	1839	12132.919	18349.763

NOTE- NR= NOT REPORTED

Annexure II

INDIA

STATEMENT SHOWING DAMAGE DUE TO FLOODS / HEAVY RAINS DURING 1953 TO 2018

Sl. No.	Year	Area affected in m.ha.	Population affected in million	Damage to Crops		Damage to Houses		Cattle Lost	Human live Lost	Damage to Public Utilities in	Total damages
				Area in m. ha.	Value in Rs.Crore	Nos.	Value in Rs.Crore	Nos.	Nos.	Rs.Crore	Crops, Houses & Public utilities in Rs.Crore (col.6+8+11)
1	2	3	4	5	6	7	8	9	10	11	12
1	1953	2.290	24.280	0.930	42.080	264924	7.420	47034	37	2.900	52.400
2	1954	7.490	12.920	2.610	40.520	199984	6.561	22552	279	10.150	57.231
3	1955	9.440	25.270	5.310	77.800	1666789	20.945	72010	865	3.980	102.725
4	1956	9.240	14.570	1.110	44.440	725776	8.047	16108	462	1.140	53.627
5	1957	4.860	6.760	0.450	14.120	318149	4.979	7433	352	4.270	23.369
6	1958	6.260	10.980	1.400	38.280	382251	3.896	18439	389	1.790	43.966
7	1959	5.770	14.520	1.540	56.760	648821	9.418	72691	619	20.020	86.198
8	1960	7.530	8.350	2.270	42.550	609884	14.309	13908	510	6.310	63.169
9	1961	6.560	9.260	1.970	24.040	533465	0.889	15916	1374	6.440	31.369
10	1962	6.120	15.460	3.390	83.180	513785	10.655	37633	348	1.050	94.885
11	1963	3.490	10.930	2.050	30.170	420554	3.701	4572	432	2.740	36.611
12	1964	4.900	13.780	2.490	56.870	255558	4.588	4956	690	5.149	66.607
13	1965	1.460	3.610	0.270	5.870	112957	0.195	7286	79	1.070	7.135
14	1966	4.740	14.400	2.160	80.150	217269	2.544	9071	180	5.736	88.430
15	1967	7.120	20.460	3.270	133.310	567995	14.264	5827	355	7.857	155.431
16	1968	7.150	21.170	2.620	144.610	682704	41.112	130305	3497	25.373	211.095
17	1969	6.200	33.220	2.910	281.900	1268660	54.423	270328	1408	68.112	404.435
18	1970	8.460	31.830	4.910	162.780	1434030	48.606	19198	1076	76.441	287.827
19	1971	13.250	59.740	6.240	423.130	2428031	80.241	12866	994	129.113	632.484
20	1972	4.100	26.690	2.450	98.560	897301	12.460	58231	544	47.174	158.194
21	1973	11.790	64.080	3.730	428.030	869797	52.482	261016	1349	88.489	569.001
22	1974	6.700	29.450	3.330	411.640	746709	72.434	16846	387	84.942	569.016
23	1975	6.170	31.360	3.850	271.490	803705	34.097	17345	686	166.050	471.637
24	1976	11.910	50.460	6.040	595.030	1745501	92.160	80062	1373	201.495	888.685
25	1977	11.460	49.430	6.840	720.610	1661625	152.290	556326	11316	328.948	1201.848
26	1978	17.500	70.450	9.960	911.090	3507542	167.574	239174	3396	376.100	1454.764
27	1979	3.990	19.520	2.170	169.970	1328712	210.606	618248	3637	233.627	614.203
28	1980	11.460	54.120	5.550	366.370	2533142	170.851	59173	1913	303.283	840.504
29	1981	6.120	32.490	3.270	524.560	912557	159.630	82248	1376	512.314	1196.504
30	1982	8.870	56.010	5.000	589.400	2397365	383.869	246750	1573	671.607	1644.876
31	1983	9.020	61.030	3.290	1285.850	2393722	332.327	153095	2378	873.429	2491.606
32	1984	10.710	54.550	5.190	906.090	1763603	181.308	141314	1661	818.164	1905.562
33	1985	8.380	59.590	4.650	1425.370	2449878	583.855	43008	1804	2050.043	4059.268
34	1986	8.810	55.500	4.580	1231.580	2049277	534.410	60450	1200	1982.535	3748.525
35	1987	8.890	48.340	4.940	1154.640	2919380	464.490	128638	1835	950.590	2569.720
36	1988	16.290	59.550	10.150	2510.900	2276533	741.600	150996	4252	1377.800	4630.300
37	1989	8.060	34.150	3.010	956.740	782340	149.820	75176	1718	1298.770	2405.330
38	1990	9.303	40.259	3.179	695.610	1019930	213.733	134154	1855	455.266	1708.920
39	1991	6.357	33.889	2.698	579.015	1134410	180.421	41090	1187	728.893	1488.329
40	1992	2.645	19.256	1.748	1027.578	687489	306.284	78669	1533	2010.670	3344.532
41	1993	11.439	30.409	3.206	1308.627	1926049	528.324	211193	2864	1445.534	3282.485
42	1994	4.805	27.548	3.963	888.622	914664	165.206	52315	2078	740.762	1794.590
43	1995	5.245	35.932	3.245	1714.787	2001898	1307.894	62438	1814	679.627	3702.308
44	1996	8.049	44.729	3.827	1124.491	726799	176.589	73208	1803	861.393	3005.743
45	1997	4.569	29.663	2.258	692.743	505128	152.504	27754	1402	1985.934	2831.181
46	1998	10.845	47.435	7.495	2594.167	1932874	1108.783	107098	2889	5157.771	8860.721
47	1999	7.765	27.993	1.753	1850.873	1613260	1299.057	91289	745	462.830	3612.760
48	2000	5.382	45.013	3.580	4246.622	2628855	680.943	123252	2606	3936.979	8864.544
49	2001	6.175	26.463	3.964	688.481	716187	816.474	32704	1444	5604.461	7109.416
50	2002	7.090	26.323	2.194	913.092	762492	599.368	21533	1001	1062.083	2574.543
51	2003	6.120	43.201	4.268	7307.230	775379	756.481	15161	2166	3262.154	11325.866
52	2004	5.314	43.725	2.888	778.694	1664388	879.601	134106	1813	1656.090	3314.385
53	2005	12.562	22.925	12.299	2370.923	715749	380.531	119674	1455	4688.219	7439.672
54	2006	1.096	25.224	1.822	2850.668	1497428	3636.848	266945	1431	13303.926	19790.922
55	2007	7.145	41.402	8.795	3121.532	3280233	2113.108	89337	3389	8049.037	13283.677
56	2008	3.427	29.910	3.186	3401.563	1566809	1141.891	101780	2876	5046.481	9589.935
57	2009	3.844	29.537	3.592	4232.609	1235628	10809.795	63383	1513	17509.353	32551.758
58	2010	2.624	18.297	4.994	5887.380	293830	875.952	39706	1582	12757.253	19520.586
59	2011	1.895	15.973	2.718	1393.847	1152518	410.475	35982	1761	6053.570	7857.892
60	2012	2.141	14.689	1.950	1534.108	174526	240.572	31558	933	9169.968	10944.648
61	2013	7.546	25.927	7.484	6378.078	699525	2032.830	163958	2180	38937.843	47348.751
62	2014	12.775	26.505	8.007	7255.151	311325	581.978	60196	1968	7710.948	15548.077
63	2015	4.478	33.203	3.374	17043.948	3959191	8046.969	45597	1420	32200.182	57291.098
64	2016	7.065	26.555	6.658	4052.723	278240	114.676	22367	1420	1507.926	5675.325
65	2017	6.076	47.342	4.972	8951.978	1252914	9384.018	26673	2063	12329.849	30665.845
66	2018	7.718	37.399	2.515	3708.187	913414	2508.656	60279	1839	12132.920	21849.972
	TOTAL	474.054	2125.006	258.533	114933.808	81631407	56283.018	6109628	109374	224192.922	400097.019
	AVG	7.183	32.197	3.917	1741.421	1236840	852.773	92570	1657	3396.862	6062.076
	MAX	17.500	70.450	12.299	17043.948	3959191	10809.795	618248	11316	38937.843	57291.098
	(YEAR)	1978	1978	2005	2015	2015	2009	1979	1977	2013	2015

Annexure-III

Statement showingState-Wise Works Approved, Works Completed and Funds Released under Flood Management Programme(FMP) since start of XI Plan (Rs in Cr)

Sl. No.	State	XI Plan			XII Plan			Total (XI + XII Plan)					2017-18	2018-19	2019-20	Total funds released
		Works Approved		Funds Released (XI Plan)	Works Approved		Funds Released (XII Plan)	Works Approved		Works completed	Works shifted/foreclosed	Works ongoing	Funds Released (XI + XII Plan)	Funds released	Funds released	Funds released	
		Nos.	Estimated Cost		Nos.	Estimated Cost		Nos.	Estimated Cost								
1	Arunachal Pradesh	21	224.69	81.69	0	0.00	87.91	**21**	**224.69**	21	0	0	169.60	21.18			190.78
2	Assam	100	996.14	748.86	41	1386.97	64.89	**141**	**2383.11**	105	30	6	813.75	245.49	142.118	85.03	1286.39
3	Bihar	43	1370.42	723.18	4	447.63	184.64	**47**	**1818.05**	42	1	4	907.82		16.583		924.41
4	Chhattisgarh	3	31.13	15.57	0	0.00	3.75	**3**	**31.13**	3	0	0	19.32				19.32
5	Goa	2	22.73	9.98	0	0.00	2.00	**2**	**22.73**	2	0	0	11.98				11.98
6	Gujarat	2	19.79	2.00	0	0.00	0.00	**2**	**19.79**	2	0	0	2.00				2.00
7	Haryana	1	173.75	46.91	0	0.00	0.00	**1**	**173.75**	1	0	0	46.91				46.91
8	Himachal Pradesh	3	225.32	165.98	4	1139.62	221.87	7	**1364.94**	5	1	1	387.85	87.50	162.6	176.41	814.36
9	Jammu & Kashmir	28	408.22	252.57	15	562.47	169.95	**43**	**970.69**	19	3	21	422.52	110.40	52.1984	92.81	677.93
10	Jharkhand	3	39.30	18.44	0	0.00	4.27	**3**	**39.30**	3		0	22.71				22.71
11	Karnataka	3	59.46	23.80	0	0.00	0.00	**3**	**59.46**	2	1	0	23.80				23.80
12	Kerala	4	279.74	63.68	0	0.00	55.22	**4**	**279.74**	2	2	0	118.90	19.05			137.95
13	Manipur	22	109.34	66.34	0	0.00	24.36	**22**	**109.34**	22		0	90.70				90.70
14	Meghalaya	0	0.00	3.81	0	0.00	0.00	**0**	**0.00**	0		0	3.81				3.81
15	Mizoram	2	9.13	14.48	0	0.00	1.93	**2**	**9.13**	1	1	0	16.41	0.47			16.88
16	Nagaland	11	49.35	28.96	6	74.52	54.17	**17**	**123.87**	14		0	83.12		10.841		93.96
17	Orissa	67	169.00	101.12	1	62.32	0.00	**68**	**231.32**	66	2	3	101.12				101.12
18	Puducherry*	1	139.67	7.50	0	0.00	0.00	**1**	**139.67**	0	1	0	7.50				7.50
19	Punjab	5	153.40	40.43	0	0.00	0.00	**5**	**153.40**	4	1	0	40.43				40.43
20	Sikkim	28	104.92	83.69	17	261.40	8.15	**45**	**366.32**	28	17	0	91.84				91.84
21	Tamilnadu	5	635.54	59.82	0	0.00	0.00	**5**	**635.54**	5		0	59.82				59.82
22	Tripura	11	26.57	23.62	0	0.00	0.00	**11**	**26.57**	11		0	23.62				23.62
23	Uttar Pradesh	26	667.57	290.69	3	291.70	111.22	**29**	**959.27**	24	2	3	401.91	13.55	15.575	39.15	470.18
24	Uttarakhand	12	119.82	49.63	10	715.72	153.98	**22**	**835.54**	16	2	4	203.61		4.634	35.58	243.82
25	West Bengal	17	1822.08	643.26	1	438.94	158.75	**18**	**2261.02**	16		2	802.01	65.03	23.652	117.12	1007.81
	Total	**420**	**7857.08**	**3566.00**	**102**	**5381.28**	**1307.07**	**522**	**13238.36**	**414**	**64**	**44**	**4873.07**	**562.67**	**428.20**	**546.09**	**6409.96**