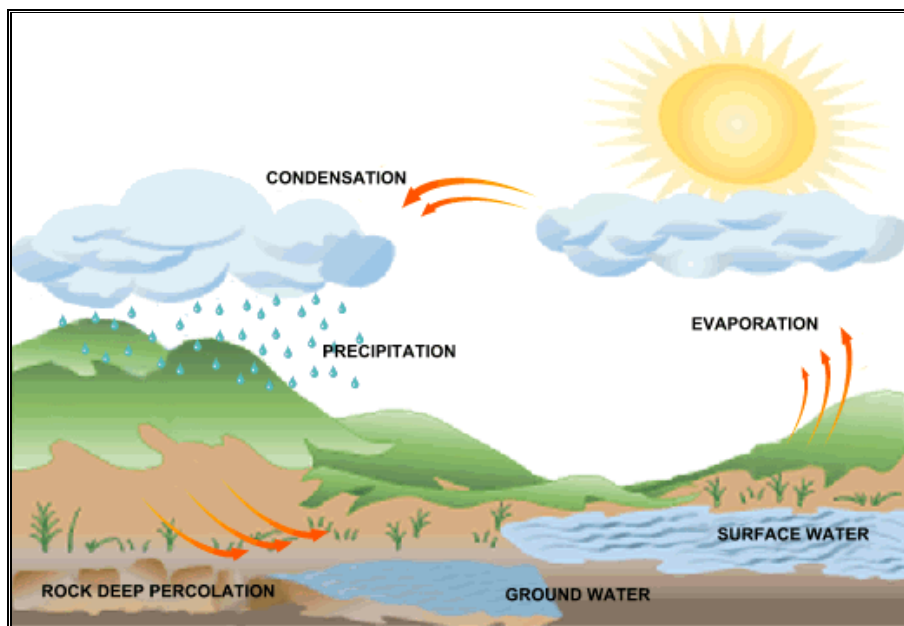


GOVERNMENT OF INDIA  
MINISTRY OF WATER RESOURCES

**NATIONAL WATER MISSION**  
under  
**National Action Plan on Climate Change**



**COMPREHENSIVE MISSION DOCUMENT**

Volume - I

New Delhi  
December 2008

**Comprehensive Mission Document  
of  
National Water Mission**

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## Chapter - 1

### Introduction

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. This threat emanates from accumulated greenhouse gas emissions in the atmosphere, anthropogenically generated through long term and intensive industrial growth and high consumption lifestyles in developed countries. While engaged with the international community to collectively and cooperatively deal with this threat, India needs a national strategy to firstly, adapt to climate change and secondly, to further enhance the ecological sustainability of India's development path.

Climate change may alter the distribution and quality of India's natural resources and adversely affect the livelihood of its people. With an economy closely tied to its natural resource base and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat because of the projected changes in climate.

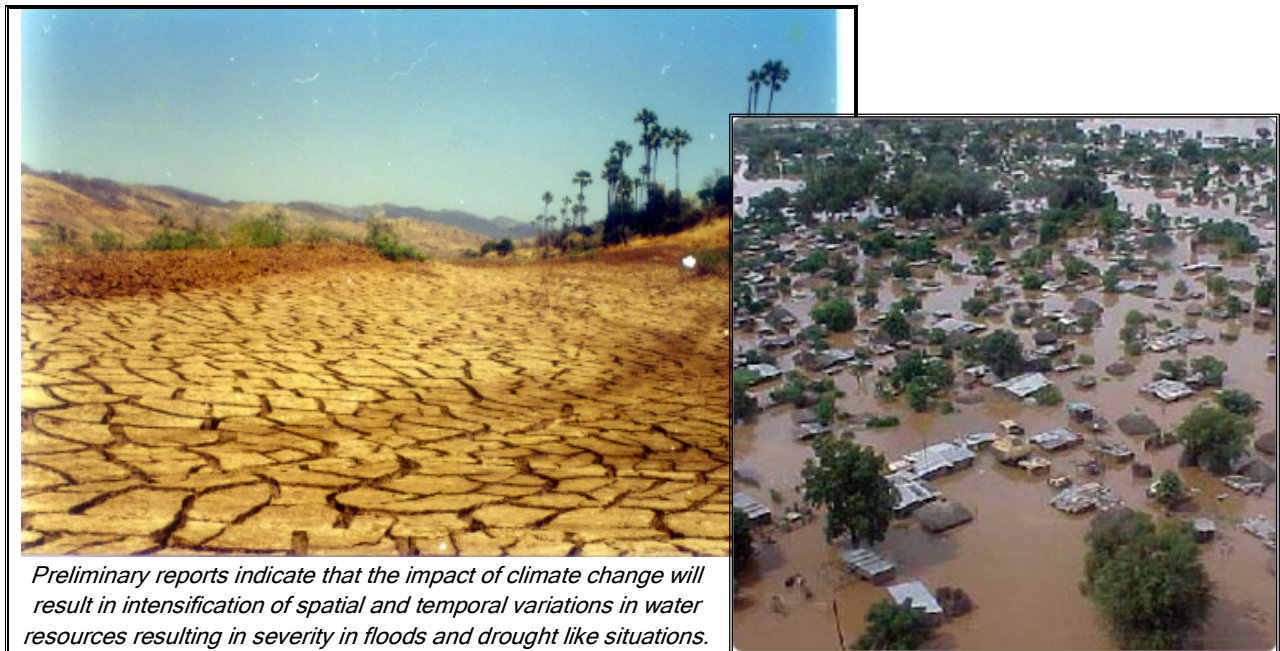
The global warming may affect the hydrological cycle which could result in further intensification of temporal and spatial variations in precipitation, snow melt and water availability. The report on "India's Initial National Communication to the United Nations Framework Convention on Climate Change" published by Ministry of Environment and Forests, Government of India identifies the following projected impacts of climate change on water resources.

*"It is obvious that the projected climate change resulting in warming, sea level rise and melting of glaciers will adversely affect the water balance in different parts of India and quality of ground water along the coastal plains. Climate change is likely to affect ground water due to changes in precipitation and evapo-transpiration. Rising sea levels may lead to increased saline intrusion into coastal and island aquifers, while increased frequency and severity of floods may affect groundwater quality in alluvial aquifers. Increased rainfall intensity may lead to higher runoff and possibly reduced recharge."*

Some of the possible identified implications of climate change on water resources are listed below:

- Decline in the glaciers and the snowfields in the Himalayas;
- Increased drought like situations due to overall decrease in the number of rainy days over a major part of the country;
- Increased flood events due to overall increase in the rainy day intensity;

- Effect on groundwater quality in alluvial aquifers due to increased flood and drought events;
- Influence on groundwater recharge due to changes in precipitation and evapo-transpiration; and
- Increased saline intrusion of coastal and island aquifers due to rising sea levels;



With a view to address the related issues, the National Action Plan on Climate Change (NAPCC) has been prepared by the Government of India, which has been released by the Hon'ble Prime Minister on 30<sup>th</sup> June 2008. The NAPCC has laid down the principles and has identified the approach to be adopted to meet the challenges of impact of climate change through eight National Missions namely, (a) National Solar Mission, (b) National Mission for Enhanced Energy Efficiency, (c) National Mission on Sustainable Habitat, (d) National Water Mission, (e) National Mission for Sustaining the Himalayan Eco-system, (f) National Mission for a Green India, (g) National Mission for Sustainable Agriculture, and (h) National Mission on Strategic Knowledge for Climate Change.

This Comprehensive Mission Document of "National Water Mission" identifies the strategies and methodologies in respect of (a) Assessment of Impact of Climate Change; (b) Changes in Policy, Practices and Institutional Framework; (c) Measures for Mitigation; as well as (d) Measures for Adaptations. Appropriate monitoring and evaluation mechanism have also been proposed in the Document.

## Chapter - 2

### Objectives of National Water Mission

The National Action Plan on Climate Change (NAPCC) describes the features of National Water Mission as under:

*“A National Water Mission will be mounted to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within states. The Mission will take into account the provisions of the National Water Policy and develop a framework to optimize water use by increasing water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing. It will seek to ensure that a considerable share of the water needs of urban areas are met through recycling of waste water, and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for the use of ocean water.*

*The National Water Policy would be revisited in consultation with States to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change. This will include enhanced storage both above and below ground, rainwater harvesting, coupled with equitable and efficient management structures.*

*The Mission will seek to develop new regulatory structures, combined with appropriate entitlements and pricing. It will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with a special effort to increase storage capacity. Incentive structures will be designed to promote water neutral or water positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation.”*

The NAPCC also describes the procedure for implementation of the Mission as under:

*“These National Missions will be institutionalized by respective ministries and will be organized through inter-sectoral groups which include in addition to related Ministries, Ministry of Finance and the Planning Commission, experts from industry, academia and civil society. The*

*institutional structure would vary depending on the task to be addressed by the Mission and will include providing the opportunity to compete on the best management model.*

*Each Mission will be tasked to evolve specific objectives spanning the remaining years of the 11<sup>th</sup> Plan and the 12<sup>th</sup> Plan period 2012-2013 to 2016-2017. Where the resource requirements of the Mission call for an enhancement of the allocation in the 11th Plan, this will be suitable considered, keeping in mind the overall resources position and the scope for re-prioritization.*

*Comprehensive Mission documents detailing objectives, strategies, plan of action, timelines and monitoring and evaluation criteria would be developed and submitted to the Prime Minister's Council on Climate change by December 2008. The council will also periodically review the progress of these Missions. Each Mission will report publicly on its annual performance.*

*Building Public awareness will be vital in supporting implementation of the NAPCC. This will be achieved through national portals, media engagement, civil society involvement, curricula reform and recognition / awards, details of which will be worked out by an empowered group. The Group will also consider methods of capacity building to support the goals of the National Missions.*

*We will develop appropriate technologies to measure progress in actions being taken in terms of avoided emissions, wherever applicable, with reference to business as usual scenarios. Appropriate indicators will be evolved for assessing adaptation benefits of the actions.*

*These Eight National Missions taken together with enhancements in current and ongoing programmes included in the Technical Document, would not only assist the country to adapt to climate change, but also, importantly, launch the economy on a path that would progressively and substantially result in mitigation through avoided emissions."*

The 'Technical Document' annexed with the NAPCC has identified key elements related to various studies / strategies needed for successful implementation of the National water Mission. Specific studies / strategies identified in the technical document are at Annexure-I.

## Chapter - 3

### Strategies and Methodologies

Water resources schemes and projects are multidisciplinary in nature and are implemented by several departments and agencies of State Governments and various ministries/departments of Central Government. Therefore, it has been considered necessary to examine all related issue through a consultative process. Accordingly, Ministry of Water Resources (MoWR) constituted six Sub-Committees to examine all related aspects in the field of:

- a. Policy and institutional Framework;
- b. Surface Water Management;
- c. Ground Water Management;
- d. Domestic and Industrial Water Management;
- e. Efficient Use of Water for Various Purposes; and
- f. Basin Level Planning and Management.

The reports of the Sub-Committees are given in Volume-II of the Comprehensive Mission Document as Appendix-I to Appendix -VI. Based on the recommendations of the Sub-Committees the strategies in respect of (i) reliable assessment of impact of climate change, (ii) need for changes in policy and practices, (iii) measures for mitigation, and (iv) measures for adaptation have been summarized as follows:

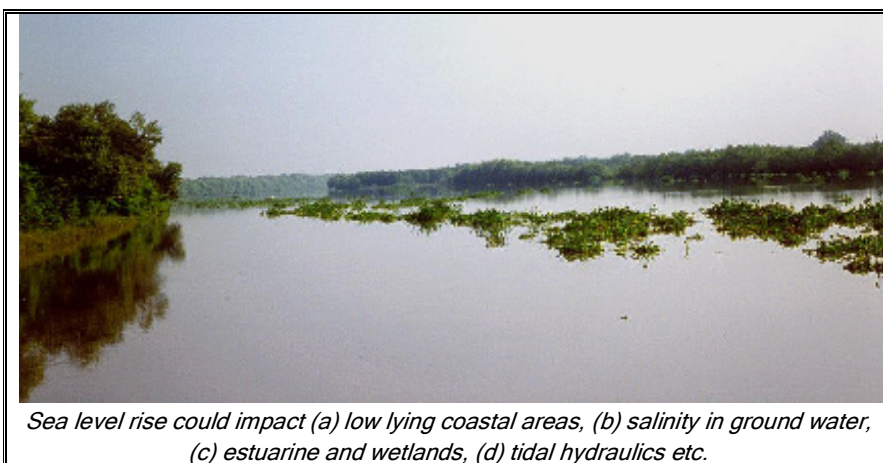
#### 3.1 Assessment of Impact of Climate Change

The first and the foremost action required is the reliable assessment of the impact of climate change on water resources in terms of availability as well as the quality of the water from surface and ground water sources, which inter-alia includes (a) collection of necessary data; (b) research and studies to project impact of climate change on water resources; (c) development of suitable models; and (d) development of suitable techniques for efficient utilization of water and conversion of unsuitable water into fresh water.



*In recent years, increase in the rate of recession of glaciers have been observed which many scientists attribute to climate change*





The action identified in the NAPCC in respect of reliable assessment of impact of climate change on water resources and the strategies recommended to achieve the objectives are summarized as under:

**Table - 3.1: Strategies in respect of Assessment of Impact of Climate Change**

Actions identified in NAPCC	Recommended Strategies	Nodal Agencies identified for implementation of identified strategies
<ul style="list-style-type: none"> <li>• Estimating river flow in mountainous areas</li> <li>• Customizing climate change models for regional water basins</li> <li>• Extending isotopic tracer based techniques of monitoring river water discharge to all major river monitoring stations</li> <li>• Strengthening the monitoring of glacial and seasonal snow covers to assess the contribution of snowmelt to water flow of Indian rivers that originate in the Himalayas</li> <li>• Establishment of a wider network of automatic weather stations and automated rain gauge stations</li> <li>• Developing models of urban storm water flows and estimating drainage capacities for storm water and for sewer based on the simulations</li> <li>• Developing an inventory of wetlands, especially those with</li> </ul>	<p>a. Collection of necessary additional hydro-meteorological and hydrological data for proper assessment of impact of climate change particularly in Himalayan region, coastal region etc including other improvements required in hydrometric networks to appropriately address the issues related to the climate change. The data should inter-alia include:</p> <ul style="list-style-type: none"> <li><i>i. Coastal and estuarine water, salinity and tidal water levels and the changing discharges in both directions in estuarine areas,</i></li> <li><i>ii. Hydrological and hydro-meteorological data in low rainfall areas,</i></li> <li><i>iii. Hydrological and hydro-meteorological data above permanent snowline, glaciated areas, seasonal snow areas in Himalayan region,</i></li> <li><i>iv. Better Network for collection of Evaporation and Rain gauge data using automated sensors,</i></li> </ul>	<p>Central Water Commission (CWC), Brahmaputra Board (BB), Central Ground Water Board (CGWB), Indian Meteorological Department (IMD), State Governments</p>

Actions identified in NAPCC	Recommended Strategies	Nodal Agencies identified for implementation of identified strategies
<p>unique features</p> <ul style="list-style-type: none"> <li>• Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements and human activities and its impact on catchments and water bodies</li> </ul>	<ul style="list-style-type: none"> <li>v. <i>Establishment/strengthening of ground water monitoring network through construction of purpose built observation wells, sanctuary wells for coastal aquifer management and water quality monitoring,</i></li> <li>vi. <i>Repeated collection of data about river geometry and morphology for monitoring erosion and carrying capacity,</i></li> <li>vii. <i>Massive tidal hydraulics data collection,</i></li> <li>viii. <i>Surface and ground water quality data collection,</i></li> </ul> <p>b. Development and implementation of modern techniques including isotopic tracer based techniques for measurement especially for the areas like storm surge, tidal hydraulics, salinity and unsteady flow</p> <p>c. Development of Water Resources Information System which, inter alia, would include (i) inventory of glaciated lakes and water bodies, (ii) wetland especially, those with unique features; and (ii) mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements</p> <p>d. Reassessment of basin wise water situation in present scenario including water quality by using latest techniques, which inter-alia may include:</p> <ul style="list-style-type: none"> <li>i. <i>Development or adoption of comprehensive water balance based model,</i></li> </ul>	<p>CWC, National Institute of Hydrology (NIH)</p> <p>CWC, State Governments</p> <p>CWC, CGWB</p>

Actions identified in NAPCC	Recommended Strategies	Nodal Agencies identified for implementation of identified strategies
	<ul style="list-style-type: none"> <li>ii. <i>Fitting models to basin using current data,</i></li> <li>iii. <i>Assessment of likely future situation, with changes in demands, land use, precipitation and evaporation</i></li> </ul> <p>e. Research and studies specifically for projection of impact of climate change on surface and ground water including its water quality in areas of</p> <ul style="list-style-type: none"> <li>i. <i>Basin efficiency,</i></li> <li>ii. <i>Possibilities of increasing dam heights,</i></li> <li>iii. <i>Identification of minor tanks where FRL can be raised without raising dam heights by installing gates and evaluation of the same,</i></li> <li>iv. <i>Identification of tanks and water bodies which can be effectively de-silted, where silt has commercial value and evaluation of the same,</i></li> <li>v. <i>Improving intra-national equity in usable water for drought management like conducting economics considering land, water and livelihood to plan how much water is necessary to yield reasonable income,</i></li> <li>vi. <i>Water harvesting, provided this is socially desirable and provided that corresponding water saving is possible elsewhere in the region,</i></li> <li>vii. <i>Impact on Intensity-Duration-Frequency relationships in urban areas,</i></li> <li>viii. <i>Impact on Magnitude-Duration-Frequency of drought (agricultural, meteorological and hydrological),</i></li> <li>ix. <i>Study of Water-energy-Climate</i></li> </ul>	<p>NIH, CWC, CGWB and BB</p>

Actions identified in NAPCC	Recommended Strategies	Nodal Agencies identified for implementation of identified strategies
	<p><i>Change relationships,</i></p> <ul style="list-style-type: none"> <li><i>x. Planning tidal embankments to protect against tides and increased flood frequency and increased sea level,</i></li> <li><i>xi. Effect of sea level rise on ground water salinity and prospective measures like groundwater recharge,</i></li> <li><i>xii. Possible tidal channels for fresh water storage,</i></li> <li><i>xiii. Preparation of sediment budgets and accounts for each basin,</i></li> <li><i>xiv. Review the interpretation of regime maintenance on Ganga, after climate change,</i></li> <li><i>xv. Isotope applications in GW dating and contaminant transport,</i></li> <li><i>xvi. GW basin models for conjunctive use of SW &amp; GW and application of RS/GIS in GW management,</i></li> <li><i>xvii. Assessment and strategies for development potential of deeper aquifers,</i></li> <li><i>xviii. Coastal aquifer management including use of hydraulic barriers for control of sea water ingress,</i></li> <li><i>xix. Assessment of feasibility and viability of rainwater harvesting in existing domestic and commercial buildings,</i></li> <li><i>xx. Supporting researchable issues specifically of Atmospheric Science Groups towards downscaling of GCM or RCM to basin/project level and also understanding the effect of climate change on monsoons,</i></li> <li><i>xxi. Supporting water and climate related researches towards studying the sensitivity of</i></li> </ul>	

Actions identified in NAPCC	Recommended Strategies	Nodal Agencies identified for implementation of identified strategies
	<p><i>different hydrologic types of water projects to different climate change scenarios and improvements required in hydrometric networks to incorporate climate change,</i></p> <p>xxii. <i>Building a Universal Soil Loss model depicting erosion and sediment transport etc. Proving the model based on sediment flow and reservoir sedimentation data, Actuating the above model for changed rainfall regime and changed management practices,</i></p> <p>xxiii. <i>Developing, through R&amp;D effort, a combined unsteady flow hydraulics-cum-sediment transport model capable of depicting river erosion in each flood event. Using the model to test river management works,</i></p> <p>xxiv. <i>Water quality modeling for each major river and aquifer,</i></p> <p>xxv. <i>Hydro chemical and solute transport modeling in areas vulnerable for seawater ingress and water quality problems</i></p> <p>f. Projection of water resources availability as a result of impact of climate change.</p> <p>g. Review of the network of automatic weather stations and automated rain gauge stations and establishment of additional stations especially in respect of</p> <p>i. <i>Better network for evaporation data,</i></p> <p>ii. <i>Rain gauge data collection network through automated sensors.</i></p>	<p>CWC, NIH</p> <p>IMD</p>

Detailed strategies are discussed in the recommendations of the Sub-Committees and the same included in the volume - II of the Mission Document.

### 3.2 Changes in Policies and Practices

Various studies in respect of projection of impact of climate change indicates that the hydrological cycle would be affected resulting in further intensification of temporal and spatial variation in water availability. In order to address these issues it would be necessary to identify & implement measures for mitigating the impact along with the measures for adaptation. However, this would require a review of the policies and practices particularly those related to planning and design of water resources system. This inter-alia includes review of National Water Policy, review of practices related to irrigation planning particularly those in respect of crops and cropping pattern etc. There could be a need for modification in the design practices and accordingly in various codes, manuals etc.

Specific actions identified in the NAPCC in respect of policies and institutional framework and the strategies to address the related issues are summarized as under:

**Table - 3.2: Strategies in respect of Changes in Policies and Practices**

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
<ul style="list-style-type: none"> <li>• National Water Policy to be re-visited in consultation with States to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change</li> <li>• Formulating and implementing a regulatory regime to ensure wise use of wetland at the national, the State, and District levels</li> <li>• National Water Mission to ensure more equitable</li> </ul>	<p>a. Review of National Water Policy particularly with a view to ensure (i) integrated water resources management for helping to conserve water, minimize wastage and ensure more equitable distribution, (ii) consideration of precipitation as basic water resource, (iii) evaporation management as an important strategy, (iv) basin level management strategies, (v) appropriate entitlement and pricing, and (vi) appropriate regulatory mechanism</p>	<p>MoWR</p>

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
<p>distribution both across and within States</p> <ul style="list-style-type: none"> <li>• The Mission to seek development of new regulatory structures, combined with appropriate entitlements and pricing</li> <li>• National Water Mission to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within States</li> </ul>	<ul style="list-style-type: none"> <li>b. Consultation with States</li> <li>c. Consultation with Stakeholders (organization of State level and national level workshops)</li> <li>d. Consideration of revised Policy by National Water Board</li> <li>e. Consideration of revised Policy by the National Water Resources Council</li> <li>f. Adoption of policy by the Government</li> <li>g. Revision of State Water Policies by the respective States</li> <li>h. Identification and evaluation of development scenario towards better acceptability</li> <li>i. Review of Policies related to irrigation, crops and cropping pattern for ensuring efficient water use in areas of increasing the use of irrigation through in-basin development as also inter-basin transfers</li> <li>j. Review of Policies for other uses of water e.g., drinking, industrial etc and in context of basin wise situations. <ul style="list-style-type: none"> <li><i>i. Encourage water harvesting,</i></li> <li><i>ii. Encourage non-agricultural type developments of the type where not much water is required,</i></li> <li><i>iii. Piped surface water for clusters of villages with ground water quality problems,</i></li> <li><i>iv. Encouraging leakage control programmes,</i></li> </ul> </li> </ul>	<p>MoWR</p> <p>MoWR</p> <p>MoWR</p> <p>MoWR</p> <p>MoWR</p> <p>State Governments</p> <p>MoWR</p> <p>Ministry of Agriculture (MoA), State Governments</p> <p>Ministry of Rural Development (MoRD) and Ministry of Urban Development (MoUD)</p>

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
	<ul style="list-style-type: none"> <li>v. <i>Careful use of two pipe supply systems,</i></li> <li>vi. <i>Consideration of desalination as an option, for supply to urban coastal communities,</i></li> <li>vii. <i>Regulation for in-house water withdrawals of industries, through royalties and licenses,</i></li> <li>viii. <i>Extending subsidies and incentives for recycling and recovery,</i></li> <li>ix. <i>Revise water tariff based on cost recovery principle,</i></li> <li>x. <i>Option of programmatic Clean Development Mechanism (CDM) in industrial and domestic wastewater as against project approach, potential of efficient water use systems, exploring bilateral joint ventures for funding CDM projects,</i></li> <li>xi. <i>Promotion of water efficient fixtures,</i></li> <li>xii. <i>Incentivisation for recycling waste water,</i></li> <li>k. <i>Review of policies related to financing of water resources projects</i></li> </ul>	<p>Planning Commission</p>

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

### 3.3 Measures for Mitigation

The measures for mitigation of the impact of the climate change in water resources include the conservation of water resources, their efficient use and adoption of better management practices. The measures inter-alia includes: (a) implementation of major and medium irrigation projects by States; (b) implementation of ERM of irrigation project by States; (c) implementation of minor irrigation schemes by States; (d) repair, renovation and restoration of water bodies; (e) conservation of water through rainwater harvesting; (f) conservation of water through recharge to groundwater; (g) integrated



watershed management; (h) central support for expeditious completion of water resources projects; (i) expeditious formulation of the interlinking projects for utilization of surplus flood water for beneficial use of the society and implementation of projects; (j) implementation of schemes for command area development; (k) pursuing the establishment of water regulatory authorities in States; (l) implementation of plan for basin level management; (m) pursuing the enactment of legislation for groundwater management by States; (n) pursuing the enactment of legislation for participatory management by States; (o) hydrological forecasting services which includes strengthening of flood forecasting services and hydrological forecast during non-monsoon including ground water forecast; and (p) Improvement in efficiency of water use and that of water utilization facilities.

Specific actions identified in the NAPCC in respect of measures for mitigation and the strategies identified for addressing the related issues are summarized as under.

**Table - 3.3: Strategies in respect of Measures for Mitigation**

Actions identified in NAPCC	Recommended strategies **	Nodal Agencies identified for implementation of identified strategies
<ul style="list-style-type: none"> <li>• Planning of watershed management in mountain ecosystems</li> <li>• Environmental appraisal and impact assessment of developmental projects on wetland</li> <li>• Exploring options to augment water supply in critical areas</li> <li>• Strengthen links with afforestation programmes and wetland conservation</li> <li>• Enhancing storage capacities in multipurpose hydro-projects and integration of drainage with irrigation infrastructures</li> <li>• Restoration of old water tanks</li> <li>• Incentive structures will be designed to promote recharging of underground water sources</li> <li>• Enhancing recharge of the sources and recharge zones of deeper ground aquifers</li> </ul>	<p>a. Speedier implementation of major and medium irrigation projects by States in areas / situations sensitive to climate change</p> <p>b. Speedier implementation of ERM of irrigation projects by States in areas / situations sensitive to climate change</p> <p>c. Speedier implementation of minor irrigation schemes including schemes for ground water development by States in areas / situations sensitive to climate change</p> <p>d. Speedier implementation of programme for repair, renovation and restoration of water bodies in areas / situations sensitive to climate change by <i>i. Increasing capacity of minor</i></p>	<p>State Governments</p> <p>State Governments</p> <p>State Governments</p> <p>State Governments</p>



Actions identified in NAPCC	Recommended strategies**	Nodal Agencies identified for implementation of identified strategies
<p>programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation</p> <ul style="list-style-type: none"> <li>• Creating awareness among people on importance of wetland</li> <li>• Mandating water harvesting and artificial recharge in relevant urban areas</li> <li>• Increase in the efficiency of water use in domestic and industrial sector</li> <li>• Need for incentives to adopt water-neutral or water-positive technologies</li> <li>• Water recycle and reuse</li> <li>• Water purification technologies</li> <li>• Ensuring more effective management of water resources</li> <li>• Integrated water policies to cope with variability in rainfall and river flow at the basin level</li> </ul>	<p>j. Implementation of schemes for command area development including correction of conveyance efficiency, reclamation of water logged, saline and alkaline lands including feasibility study on conjunctive use of SW and GW in areas having water logging or rising water level problems.</p> <p>k. Pursuing the establishment of Water Regulatory Authorities in States and State and Central Dam Safety Services</p> <p>l. Implementation plan for basin level management</p> <p>m. Pursuing the enactment of appropriate legislation for ground water by States</p> <p style="margin-left: 20px;"><i>i. Preparation of state wise ground water bill based on model bill circulated by MoWR including guidelines for RWH &amp; AR.</i></p> <p style="margin-left: 20px;"><i>ii. Regulation of local ground water markets and subsidies on power tariff for agriculture pumping of ground water</i></p> <p style="margin-left: 20px;"><i>iii. Enact enabling legislation to regulate ground water use during droughts</i></p> <p>n. Pursuing the enactment of legislation for participatory management by States</p> <p>o. Mandatory water assessment and audits including those for drinking water industries</p> <p>p. Hydrological forecasting services [(a) strengthening of flood forecasting services and</p>	<p>MoWR and State Governments</p> <p>MoWR</p> <p>MoWR and State Governments</p> <p>MoWR</p> <p>MoWR</p> <p>MoWR, MoRD, MoUD</p> <p>CWC, CGWB</p>

Actions identified in NAPCC	Recommended strategies**	Nodal Agencies identified for implementation of identified strategies
	<p>(b) hydrological forecast during non-monsoon including ground water forecast including development of flood wave transport models</p> <p>q. Improvement in efficiency of water use and that of water utilization facilities <i>for increasing food and water security through increasing usable water by</i></p> <ul style="list-style-type: none"> <li>i. <i>Minimising inadvertent evaporation from water logged areas, barren land, agricultural fields between crops, wet soil between crop rows in irrigated fields</i></li> <li>ii. <i>Increasing storages in water use systems by use of ground water space as storage, through enhanced fluctuations like pumping water from Terai to deplete ground water before floods, conjunctive use in time, with larger ground water use in bad years, more efficient use of vadose zone moisture storage, repeated use of surface storage during wet season, increasing storages and carry over storages through implementing a programme for raising dam heights</i></li> <li>iii. <i>Increasing water use efficiency by encouraging re-use of return water, modernization of canals and distribution systems</i></li> <li>iv. <i>Participatory management by water users for increased efficiency</i></li> </ul> <p>r. Mapping of areas likely to experience flood, establishing</p>	<p>CWC, CGWB and State Governments</p> <p>MoWR, CWC, State Governments</p>

Actions identified in NAPCC	Recommended strategies**	Nodal Agencies identified for implementation of identified strategies
	hydraulic and hydrologic models for propagation of floods and developing comprehensive schemes for flood management  s. Implementation of tidal channels for fresh water storages with user participation  t. Adoption of Better Management practices including Decision Support Systems in canal irrigation and Automation in canal irrigation including soil moisture monitoring	MoWR, CWC   CWC

\*\* : For all these strategies under items (a) to (e) and (g), the preparation of guidelines etc shall be with the involvement of CWC/MoWR

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

### 3.4 Measures for Adaptation

Alongwith the measures for mitigating the impact of climate changes, it is important to create awareness and identify measures for adaptation through appropriate changes in practices for design and planning, changes in agricultural practices as also in practices for other uses of water.

Specific actions identified in the NAPCC in respect of measures for adaptation and the strategies to address the related issues are summarized as under.

**Table - 3.4: Strategies in respect of Measures for Adaptation**

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
<ul style="list-style-type: none"> <li>The Mission to seek to ensure that a considerable share of the water needs of urban areas are</li> </ul>	a. Awareness programme for policy makers and professionals including appropriate plans for	MoWR, CWC, State Governments

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
<p>met through recycling of wastewater; and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for use of ocean water</p> <ul style="list-style-type: none"> <li>• Creating awareness among people on importance of wetland</li> </ul>	<p>Capacity Building in related areas which, inter-alia include;</p> <ol style="list-style-type: none"> <li><i>i. Construction of carry over storages,</i></li> <li><i>ii. Dependability related concept-reliability of outputs and not input dependability,</i></li> <li><i>iii. Reliability criteria regarding water availability,</i></li> <li><i>iv. Direct use of partially treated domestic effluents in irrigating non-food crops,</i></li> <li><i>v. Public bodies/ industrial States to construct common effluent treatment plants through soft loans/ subsidies and technical support,</i></li> <li><i>vi. Implication of the comparatively good waters for diluting pollution loads with insistence on treatment,</i></li> <li><i>vii. Regular Monitoring of RWH structures including existing water conservation measures,</i></li> <li><i>viii. Unsteady flow modeling,</i></li> <li><i>ix. Linking DEM for low lying areas with hydraulic models to understand flood situations under different floods,</i></li> <li><i>x. Linking storm surge models, tidal hydraulic models and flood flow models,</i></li> <li><i>xi. 2-D unsteady flow hydraulic models for dam / embankment break situations,</i></li> <li><i>xii. Water quality matters,</i></li> <li><i>xiii. Conservation and augmentation of water supply through community participation and PPP (e.g. Corporate Social Responsibility initiatives) and NGO's,</i></li> <li><i>xiv. Restructuring of state Water Resources Departments and strengthening of WALMI's,</i></li> </ol>	

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
	<p><i>xv. Constitution of Groups of Technical Experts for Technology Forecasting in water resources.</i></p> <p>b. Mass awareness programme</p> <p>c. Modification in acceptability criteria, design criteria and codes for practices and development of methodologies for raising dam heights, management plans like</p> <p><i>i. Adjusting to changing flood regime for dam safety, planning of flood control works</i></p> <p><i>ii. Urban storm water drainage improvements</i></p> <p><i>iii. Planning of reservoir sedimentation, erosion control and river management using more liberal acceptability criteria,</i></p> <p><i>iv. Dam break and embankment break studies done routinely</i></p> <p><i>v. Building codes and bye-laws, municipal bye-laws for rain water harvesting and mandatory connection of toilets to sewerage systems</i></p> <p>d. Identification and evaluation of crop varieties using extreme conditions of water, design for appropriate cropping patterns and adoption of integrated farming system etc. including incentives for efficient use of water</p> <p>e. Changes in codes etc. in respect of domestic and industrial water supply including promotion of decentralized sewage treatment systems</p> <p>f. Providing incentives for water neutral and water positive</p>	<p>MoWR</p> <p>CWC, CGWB</p> <p>MoA, State Governments</p> <p>MoRD, MoUD</p> <p>MoUD, Ministry of Commerce and</p>

Actions identified in NAPCC	Recommended strategies	Nodal Agencies identified for implementation of identified strategies
	technologies including allowing attractive financial packages combined with penalties to users/defaulters to build and operate modern effluent treatment plants and re-circulation arrangements in order to reduce penalties. Review of “zero effluent” policy in water short areas; insist on return of treated effluents.	Industry (MoCI)

The strategies are described in details in the report of the Sub-Committees and the same are included in the volume - II of the Mission Document. More than one Sub-committee has discussed some of the strategies. This is due to the fact that various issues related to the impact of climate change on water resources are closely inter-related and there is considerable inter-dependence. However, efforts have been made to minimize the scope of duplication while finalizing the overall target and the timeliness for planning and monitoring by the High Level Steering Committee [as discussed in chapter 4].



## Chapter - 4

### Monitoring & Evaluation Mechanism, Institutional Setup and Plan of Action

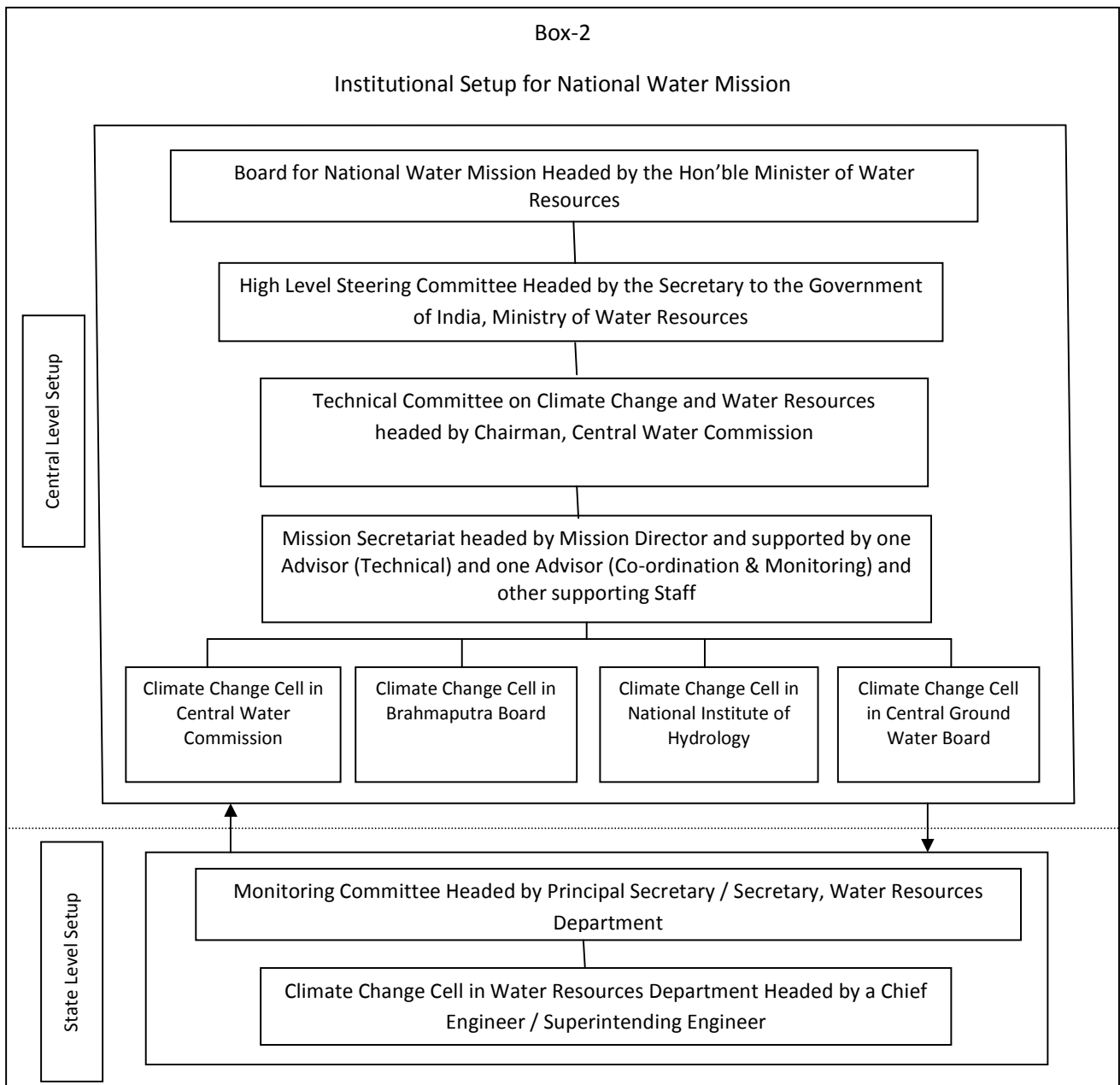
As discussed earlier, the impact of climate change could primarily be in the form of further intensification of variability in river flow and increase in the intensity of extreme events, which requires to be established in quantitative terms. Therefore, the first and the foremost task is to carry out research and studies for realistic assessment of the impact of climate change followed by expeditious actions on implementation of projects in respect of conservation of water resources and adoption of better management practices with emphasis of optimal utilization and increase in efficiency. Obviously, this calls for immediate review of the policies and continuous monitoring of the implementation of programme, their critical review from time to time and identification of corrective measures.

Most of the programmes related to water resources comes under the purview of the State Governments and are being implemented by them. Further several Central Ministries and Organisations are responsible for implementation of activities related water resources [Refer Box-1].

Box-1 Central Ministries / Organisations responsible for various Activities related to Water Resources Development and Management		
Sl. No.	Activities	Ministry / Organisations
1.	Overall Policy Issues, Assessment of Water Resources, Major and Medium Irrigation, Minor Irrigation, Ground Water and Flood Management	Ministry of Water Resources
2.	Rural Drinking Water	Department of Water Supply, Ministry of Rural Development
3.	Urban Drinking Water	Ministry of Urban Development
4.	Industrial Water	Ministry of Urban Development / Ministry of Commerce and Industry
5.	Hydropower Development	Ministry of Power
6.	Inland Navigation	Ministry of Transport
7.	Environmental Issues	Ministry of Environment and Forests
8.	Overall Planning for Water Resources Development and Fund Allocation	Planning Commission
9.	Watershed Development	Ministry of Agriculture / Ministry of Environment and Forests / Ministry of Rural Development
10.	(a) Water planning for Agriculture, (b) Micro Irrigation & (c) Management of Water related Disaster (Drought)	Ministry of Agriculture
11.	Management of Water related Disaster (Flood)	Ministry of Home Affairs

#### 4.1 Proposed Monitoring and Evaluation Mechanism

In view of above cited position, appropriate measures for mitigation of the impact of climate change on water resources, as also the adaptive measures are required to be undertaken by respective ministries and the State Governments. However, for identification of the most appropriate measures from the national perspectives and for ensuring effective implementation of the identified activities, it is necessary to have proper co-ordination among all the stakeholders on one hand and the various implementing agencies on the other hand.



In view of above, a two-tier setup has been proposed one at Central level and the other at State level. The setup is illustrated in Box-2. A Board under the chairmanship of Hon'ble Union Minister of Water Resources is proposed to be apex body for framing the policies and guidelines for implementation of the National Water Mission. The proposed Board will have representative from States and Central Ministries / Organizations, experts, representatives from professional organizations etc. The composition of the Board is at Annexure-II. A High Level Steering Committee headed by the Secretary to the Government of India, Ministry of Water Resources and comprising of members representing concerned Ministries, Experts, Non-Governmental Organisations (NGOs) etc. has since been constituted. It is proposed to further expand the Steering Committee to include representatives from State Governments and representatives from professional organizations and private agencies dealing with water resources. The proposed composition of the High Level Steering Committee is at Annexure - III.

Similarly, MoWR has also constituted a Technical Committee on Climate Change and Water Resources under the Chairmanship of Chairman, CWC. The Technical Committees also includes representatives from NGOs. It is proposed to further strengthen the Committee by including representatives from Water Resources Departments of State Governments / State Government Organizations dealing with research and management of water resources. The revised Composition of the Technical Committee is at Annexure - IV. Specific cells for carrying out research and studies on the impact of climate change on water resources have been created at NIH, CWC and BB. A similar cell is proposed to be created at CGWB.

#### 4.2 Institutional Set-up

As indicated above, the objective of the "National Water Mission" can be achieved only through proper co-ordination, closed monitoring and in-depth evaluation at regular interval. Therefore, a dedicated Secretariat is considered necessary. It is proposed to have a very compact Mission Secretariat headed by a Mission Director (who could be a professional or an expert) in the rank of Additional Secretary to the Government of India. The Mission Director would be equipped with necessary financial & administrative powers and would be accountable for implementation of the identified programme. The Mission Director would be supported by two Advisors - one Advisor to be fully devoted to technical evaluations and the other for co-ordination and monitoring. The advisors could be in the rank of Joint Secretary (or equivalent) or Director (or equivalent), the choice being mainly on the basis of the expertise and capability of the persons. MoWR would be required to make an appropriate choice depending upon the work requirements and suitability of the persons with a view to ensure that the objectives of the National Water Mission are implemented in a time bound manners. The

posts of Mission Director for National Water Mission and the two Advisors are proposed to be created. Necessary secretarial assistance could be either provided by the MoWR or outsourced. The proposed composition of the Mission Secretariat is at Annexure - V. The three cells created in NIH, CWC and BB and the one proposed at CGWB for research and studies on impact of climate change on water resources would provide necessary input and assistance to the Mission Secretariat. The Mission Secretariat may also engage the services of consultant or outsource the services of professionals on specific matters as and when required.

State Governments would be requested to set up Monitoring Committee under the Chairmanship of the Principal Secretary / Secretary in charge of Water Resources. The State Government would also be requested to create Climate Change Cell at appropriate level. In case of States with considerable potential for water resources development, the cell should be headed by an officer in the grade of Chief Engineer whereas in smaller States, it would be headed by a Superintending Engineer.

#### 4.3 Plan of Action and Timelines

The identified strategies for addressing the issues related to impact of climate change on water resources are described in Chapter - 3. The timeline for implementation of the identified strategies are at Annexure -VI.

## **Research and Development, Training and Capacity Building**

One of the most important area for research and development is the “Climate changes and water resources”, particularly in the field of (a) impact of climate change on water resources, (b) efficacy for various measures for mitigating the impact of the projected changes in the water resources, (c) changes needed in policy & planning and management practices to optimally utilize the resources; and (d) adaptation measures, their impacts and efficacy. MoWR has duly identified the need for research in the area of impact of climate change on water resources and this area constitutes an important component of the scheme for “Research and Development” for XI Plan. IIT, a premier research institute in the field of hydrology has already initiated research in the area. CWC and BB have also taken up studies in the field and have initiated actions for establishment of additional hydrological observation sites particularly those required for assessment of impact of climate change and glaciers and snowmelt. With a view to actively associate the reputed academic institutions, MoWR has also decided to create “Professorial Chairs”. These institutions have been associated for specific studies related to impact of climate change on water resources. Indian Institute of Technology, Roorkee and National Institute of Technology, Srinagar are associated with studies in respect of Indus basin. Indian Institute of Technology, Kanpur and National Institute of Technology, Patna has been assigned with the responsibility of research and studies related to Ganga basin. Indian Institute of Technology, Guwahati and Indian Institute of Technology, Kharagpur will contribute in assessment of impact of climate change in respect of Brahmaputra basin. MoWR has also assigned studies to Indian Institute of Science, Bangalore in respect of impact of climate change in rainfall and water resources of peninsular river basins.

Capacity Building, particularly those of Research Institutes, Water and Land Management Institutes and Academic Institutions in various states has been identified as an important activity under the Plan scheme for “Research and Development” of the MoWR. Ministry has already invited proposals from various institutes in this regard.

Mass awareness programme, focused awareness programmes for policy makers and training of professionals is very important and is considered necessary for better understanding of the complex issues and identification of strategies in right perspective. This is more so in view of the fact that the present techniques for projection of impact of climate change on water resources etc. are based on numerous assumptions and need considerable improvement. Further, in view of considerable variation in factor affecting such changes, the techniques developed in a specific country or in a region may not be replicated. It is considered necessary to have trained professional in the area. Although

there are schemes for training in the area of water resources, it is proposed to provide additional resources for the purpose and ensure that the policy makers are fully conversant with various aspects and the professional are adequately trained to address the issues. The training programme will include study tours and specialized training abroad also.

## Chapter - 6

### **Additional Fund Requirement**

The important issue of climate change and its impact on water resources were duly considered by the “Working Group for XI Plan on Water Resources” constituted by the Planning Commission. The related issues are broadly reflected in the recommendations of the Working Group. The XI Plan scheme of the MoWR for “Research and Development” has also laid due emphasis on the research in the area of impact of climate change as also on the need for improving the efficiency of water use and that of the facilities created for water utilization. The allocations for XI Plan have, therefore, some specific provisions in respect of research and development in the area of impact of climate change on water resources.

The various Sub-Committees have identified additional funds requirements for implementation of activities for addressing the specific issues related to impact of climate change on water resources. The total estimated additional fund required during XI plan for addressing the specific issues related to impact of Climate Change on water resources works out to be Rs 28,651 crores with Rs 10,038 crores in Central sector and Rs 18,613 crores in State sector. It is also proposed to make necessary provisions for setting up of a dedicated Secretariat at the Ministry of Water Resources for which the fund requirement has been estimated to be Rs 5 crores during XI Plan. Thus the total additional fund requirement for XI Plan works out to be about Rs 28,656 crores. The details of the specific activities and the additional fund requirements for the same during the XI Plan are given at Annexure - VII. The projections for the additional fund requirements are over and above the outlay provided for various activities during the XI Plan.

In this regard, it is observed that most of the activities are to be implemented by the respective State Governments. Further, the activities are closely inter-linked with the several ongoing schemes for water resources development and management. It may also be observed that the allocation for water sector - both State Plan and Central Plan has been considerably increased during XI Plan. The total allocation under State and central plan for irrigation, command area and flood control has been increased from about Rs. 95,700 crore during X Plan to Rs. 2,32,311 crore during XI Plan.

It is, therefore, considered necessary to seek the views of the State Governments on the proposed additional fund requirements and suitably modify the same at the stage

of mid-term appraisal of the XI Plan. The fund requirement during XII plan for addressing the specific issues related to impact of Climate Change on water resources could also be firmed up at the time of mid-term appraisal of the XI plan.



*Reliable data collection on scientific basis is the most important tool to understand the impacts of climate change on water resources.*



**Specific Strategies/Strategies related to Water Resources as identified in the Technical Document annexed with the “National Action Plan on Climate Change”**

General

- Increasing the efficiency of water use
- Exploring options to augment water supply in critical areas
- Ensuring more effective management of water resources
- Need for new regulatory structures with appropriate entitlements and pricing and incentives to adopt water-neutral or water positive technologies
- Integrated water policies to cope with variability in rainfall and river flows at the basin level

Studies on Management of Surface Water Resources

- Estimating river flows in mountainous areas
- Customizing climate change models for regional water basins
- Extending isotopic-tracer-based techniques of monitoring river water discharge to all major river monitoring stations
- Developing digital elevation models of flood prone areas for forecasting floods
- Mapping areas likely to experience floods and developing schemes to manage floods
- Strengthening the monitoring of glacial and seasonal snow covers to assess the contribution of snowmelt to water flows of Indian rivers that originate in the Himalayas
- Establishment of a wider network of automatic weather stations and automated rain gauge stations
- Planning of watershed management in mountain ecosystems

Management and Regulation of Ground Water Resources

- Mandating water harvesting and artificial recharge in relevant urban areas
- Enhancing recharge of the sources and recharge zones of deeper groundwater aquifers
- Mandatory water assessments and audits; ensuring proper industrial waste disposal
- Regulation of power tariffs for irrigation

### Upgrading Storage Structures for Freshwater and Drainage Systems for Wastewater

- Prioritizing watersheds vulnerable to flow changes and developing decision support systems to facilitate quick and appropriate responses
- Restoration of old water tanks
- Developing models of urban storm water flows and estimating drainage capacities for storm water and for sewers based on the simulations
- Strengthen links with afforestation programmes and wetland conservation
- Enhancing storage capacities in multipurpose hydro projects, and integration of drainage with irrigation infrastructures

### Conservation of Wetlands

- Environmental appraisal and impact assessment of developmental projects on wetlands
- Developing an inventory of wetlands, especially those with unique features
- Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements and human activities and its impact on catchments and water bodies
- Creating awareness among people on importance of wetland ecosystems
- Formulating and implementing a regulatory regime to ensure wise use of wetlands at the national, the state, and district levels

### Development of Desalination Technologies

- Sea water desalination using Reverse Osmosis and multistage flash distillation to take advantage of low grade heat energy e.g. from power plants located in the coastal region or by using renewable energy such as solar
- Brackish water desalination
- Water recycle and reuse
- Water purification technologies

**Proposed Composition of Advisory Board under the chairmanship of  
Union Minister of Water Resources**

1.	Minister of Water Resources	Chairman
2.	Minister In charge of Water Resources from 5 States/UTs [by	Member
to	rotation for 2 years]	
6.		
7.	Secretary, Ministry of Water Resources	Member
8.	Secretary, Ministry of Agriculture and Cooperation	Member
9.	Secretary, Ministry of Environment and Forests	Member
10.	Secretary, Ministry of Urban Development	Member
11.	Secretary, Ministry of Rural Development	Member
12.	Advisor, Planning Commission	Member
13.	3 Experts on water Resources [Preferably one each on	Member
to	surface water, ground water & planning by rotation for 2 years]	
15.		
16.	Representatives of 3 NGOS actively associated with water	Member
to	resources [by rotation for 2 years]	
18.		
19.	Representatives of 3 Organizations representing industries,	Member
to	professional organization etc. [CII, FICCI, Chamber of	
21.	Commerce, Association of Pump Manufacturers, IWRS, IAH	
	etc.] by rotation for 2 years	
22.	Additional Secretary, Water Resources	Member
23.	Chairman, Central Water Commission	Member
24.	Chairman, Central Ground Water Board	Member
25.	JS&FA, Water Resources	Member
26.	Mission Director	Secretary

### Proposed Composition of High Level Steering Committee for National Water Mission

1.	Secretary, Ministry of Water Resources	Chairman
2.	Finance Secretary (or nominee)	Member
3.	Principal Advisor, Planning Commission	Member
4.	Secretary, Ministry of Science & Technology (or nominee)	Member
5.	Secretary, Department of Agriculture and Cooperation (or nominee)	Member
6.	Secretary, Ministry of Environment and Forests (or nominee)	Member
7.	Secretary, Department of Drinking Water Supply (or nominee)	Member
8.	Secretary, Ministry of Urban Development (or nominee)	Member
9.	Secretary, Ministry of Earth Sciences (or nominee)	Member
10.	Director, National Centre for Medium Range Weather Forecasting	Member
11.	Director, India Meteorological Department	Member
12.	Representatives of two Non Governmental Organizations (by rotation for a period of 2 years)	Member
13.		
14.	Representatives of two professional Organizations (by rotation for a period of 2 years)	Member
15.		
16.	2 Experts / representatives of academic institutions (by rotation for a period of 2 years)	Member
17.		
18.	Principal Secretary / Secretary of Water Resources of five States to Government / Union Territories (by rotations for 2 years)	Member
22.		
23.	Chairman, Central Water Commission	Member
24.	Additional Secretary, Ministry of Water Resources	Member
25.	Chairman, Central Ground Water Board	Member
26.	Chairman, Brahmaputra Board	Member
27.	Director, National Institute of Hydrology	Member
28.	Director, Central Water & Power Research Station	Member
29.	Director, Indian Institute of Tropical Meteorology	Member
30.	Joint Secretary & Financial Advisor, MoWR	Member
31.	Commissioner (Project), MoWR	Member
32.	Commissioner, CAD, MoWR	Member
33.	Mission Director	Member-Secretary

**Composition of Technical Committee on Climate Change and Water Resources**

1.	Chairman, Central Water Commission	Chairman
2.	Member (River Management), Central Water Commission	Member
3.	Chairman, Brahmaputra Board	Member
4.	Chairman, Central Ground Water Board	Member
5.	Representative of Indian Meteorological Department	Member
6.	Director, Central Water & Power Research Station	Member
7.	Director, Indian Institute of Tropical Meteorology	Member
8.	Director, National Institute of Hydrology	Member
9.	Director, National Centre for Medium Range Weather Forecasting	Member
10.	Representative of State Government/State Government to Organization dealing with research and management in water resources- [5 by rotation for 2 years]	Member
14.		
15.	A representative of Ministry of Agriculture	Member
16.	A representative of National Remote Sensing Centre, Hyderabad	Member
17.	A representative of Director General, India Meteorological Department	Member
18.	A representative of Govind Ballabh Pant Institute of Himalayan Environment and Development, Koshi Katarmal, Almora	Member
19.	A representative of Director General, Survey of India	Member
20.	A representative of Director General, Geological Survey of India	Member
21.	A representative of Wadia Institute of Himalayan Geology, Dehradun	Member
22.	A representative of Space Application Centre, Ahmedabad	Member
23.	A representative of Director, Snow and Avalanche Study Establishment, Ministry of Defence	Member
24.	Chief Engineer, HSO, Central Water Commission	Member
25.	A representative of M S Swaminathan Research Foundation, Chennai	Member
26.	Chief Engineer (P&D), Central Water Commission	Member-Secretary

**Proposed Composition of Secretariat for National Water Mission**

1.	Mission Director	1
2.	Advisor (Technical)	1
3.	Advisor (Co-ordination and Monitoring)	1
4.	Personal Secretary	1
5.	Personal Assistant	2
6.	Section Officer	1
7.	Upper Division Clerk / Lower Division Clerk	1
8.	Peon	2

## Activities identified for monitoring by National Water Mission

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks	
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year				
<b>A. GENERAL</b>													
<b>1. Institutional Mechanism</b>													
1.1 Setting up of Mission Secretariat at MoWR for National Water Mission													
1.2 Setting up of Climate Change Cells in States													To be setup by States
1.3 Setting up of Climate Change Cells in various organizations in MoWR													Climate Change Cells have already been setup in NIH, CWC, and BB from their own resources.

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	<p><b>2. Assessment of Impact of Climate Change</b></p> <p>2.1 Collection of necessary additional hydro-meteorological and hydrological data for proper assessment of impact of climate change particularly in Himalayan region, coastal region etc including other improvements required in hydrometric networks to appropriately address the issues related to the climate change</p> <p>2.2 Development and implementation of modern techniques including isotopic tracer based techniques for measurement especially for the areas like storm surge, tidal hydraulics, salinity and unsteady flow</p>											
											CWC, NIH	



Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	<p>2.3 Development of Water Resources Information System which, inter alia, would include (i) inventory of glaciated lakes and water bodies, (ii) wetland especially, those with unique features; and (ii) mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements</p> <p>2.4 Research and studies specifically for projection of impact of climate change on surface and ground water including its water quality</p>											
										NIH, CWC, CGWB and BB		

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
2.5 Reassessment of basin wise water situation in present scenario including water quality by using latest techniques											CWC and CGWB	
2.6 Projection of water resources availability as a result of impact of climate change											CWC and NIH	
2.7 Review of the network of automatic weather stations and automated rain gauge stations and establishment of additional stations											IMD	
<b>3. Review of Water Related Policies</b>												
3.1 Review of National Water Policy											MoWR	
3.2 Consultation with States											MoWR	

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	3.3 Consultation with Stakeholders (Organization of State Level and National Level Workshops)											
3.4 Consideration of Revised Policy by National Water Board											MoWR	
3.5 Consideration of Revised Policy by National Water Resources Council											MoWR	
3.6 Adoption of Policy by the Government											MoWR	
3.7 Revision of Water Policies by the States											State Governments MoWR	
3.8 Identification of Development scenario towards better acceptability												

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year		1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year		
3.9 Review of Policies related to irrigation, crops and cropping pattern for ensuring efficient water use in areas of increasing the use of irrigation through in-basin development as also inter-basin transfers											MoA, State Governments	
3.10 Review of Policies for other uses of water e.g. drinking, industrial etc.											MoRD and MoUD	
<b>B MEASURES FOR MITIGATION</b>												
<b>4. Infrastructural Development</b>												
4.1 Speedier implementation of major and medium irrigation projects by States in areas / situations sensitive to climate change											State Governments	

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	4.2 Speedier implementation of ERM of irrigation projects by States in areas / situations sensitive to climate change											
4.3 Speedier implementation of minor irrigation schemes including schemes for ground water development by States in areas / situations sensitive to climate change										State Governments		
4.4 Speedier implementation of programme for repair, renovation and restoration of water bodies in areas / situations sensitive to climate change										State Governments		

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	4.5 Speedier implementation of programme for conservation of water through recharge of ground water including in rainwater harvesting in areas / situations sensitive to climate change											
4.6 Exploration of ground water including ground water exploration to decipher deeper fresh water aquifers up to 1000/1500m										State Governments and CGWB		
4.7 Speedier implementation of programme for integrated watershed management										MoA and MoRD		

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	<p>4.8 Central support for expeditious completion of water resources projects including construction of tidal embankments</p> <p>4.9 Expeditious formulation of the inter-linking projects for utilization of surplus flood water for beneficial use of the society and implementation of projects after evaluating costs and land acquisition problem</p>											
										National Water Development Authority (NWDA) and State Governments		

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	<p>4.10 Implementation of schemes for command area development including correction of conveyance efficiency, reclamation of water logged, saline and alkaline lands including feasibility study on conjunctive use of SW and GW in areas having water logging or rising water level problems</p>											
<p><b>5. Improvement in Water Management Practices</b></p> <p>5.1 Pursuing the establishment of Water Regulatory Authorities in States and state and Central Dam Safety Services</p>										MoWR	Action to be initiated by States	



Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year		1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year		
5.2 Implementation plan for basin level management											MoWR and State Governments	A Plan scheme for "River Basin Organisation / Authority has been proposed by MoWR during XI Plan
5.3 Pursuing the enactment of appropriate legislation for ground water by States											MoWR	
5.4 Pursuing the enactment of Legislation for Participatory Management by States											MoWR	
5.5 Mandatory water assessment and audits including those for drinking water industries											MoWR, MoRD, MoUD	

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	5.6 Hydrological forecasting services [(a) strengthening of flood forecasting services and (b) hydrological forecast during non-monsoon including ground water forecast including development of flood wave transport models											
5.7 Improvement in efficiency of water use and that of water utilization facilities for increasing food and water security through increasing usable water utilization facilities											CWC, CGWB and State Governments	

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	5.8 Mapping of areas likely to experience flood, establishing hydraulics and hydrologic models for propagation of floods and developing comprehensive schemes for flood management											
5.9 Implementation of tidal channels for fresh water storages with user participation										MoWR and CWC		
5.10 Adoption of Better Management practices including Decision Support Systems in canal irrigation and Automation in canal irrigation including soil moisture monitoring										CWC		

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year		1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year		
<b>C. MEASURES FOR ADAPTATION</b> <b>6. Awareness Programme</b> 6.1 Awareness programme for policy makers and professionals including appropriate plans for Capacity Building in related areas												
												MoWR, State Governments
6.2 Mass Awareness Programme												
												MoWR
<b>7. Changes in Practices for Design and Planning</b> 7.1 Modification in acceptability criteria, design criteria and codes for practices and development of methodologies for raising dam heights, management plans etc.												
												CWC and CGWB

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
<b>8. Changes in Agricultural Practices</b> 8.1 Identification and evaluation of crop varieties using extreme conditions of water, design for appropriate cropping patterns and adoption of integrated farming system etc. including incentives for efficient use of water											MoA, State Governments	Action to be taken by MoA
<b>9. Changes in Policies and Practices for Domestic and Industrial Water Supply</b> 9.1 Changes in codes etc. in respect of domestic and industrial water supply including promotion of decentralized sewage treatment systems											MoRD and MoUD	Action to be taken by MoRD, MoUD, MoEF etc.

Description	XI Plan					XII Plan					Organisations / Agencies to initiate the process	Remarks
	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year			
	<p>9.2 Providing incentives for water neutral and water positive technologies including allowing attractive financial packages combined with penalties to users/defaulters to build and operate modern effluent treatment plants and re-circulation arrangements in order to reduce penalties. Review of “zero effluent” policy in water short areas, insist on return of treated effluents</p> <p><b>D. FINANCING OF WATER RESOURCES PROJECTS</b></p> <p><b>10. Review of policies related to financing of Water Resources Projects</b></p>											
											Planning Commission	

## Additional fund requirements for identified activities during XI Plan

Sl. No.	Specific areas of activities	Additional requirement of funds during XI Plan		Sl. No.	Specific areas of activities	Additional requirement of funds during XI Plan	
		Central Plan	State Plan			Central Plan	State Plan
1	Data collection	50	100	13	Ground water management	110	256
2	Research support	249	541	14	Rainwater harvesting	642	1498
3	Studies related to impact of climate change on water resources	42	93	15	Increasing storages	133	267
4	River basin organizations	49	-	16	Conservation by reducing evaporation	167	333
5	Water regulatory authorities	-	90	17	Incentives for recycling of water	-	200
6	Water users' association	-	105	18	Domestic and industrial water management	725	1450
7	Water use efficiency	42	83	19	Desalination	33	67
8	Micro irrigation	-	1000	20	Flood management programme	67	133
9	Command area development	400	225	21	Awareness programme	39	462
10	Expeditionous completion of irrigation projects including ERM projects	7000	7800	22	Institutional reforms and capacity building	40	100
11	O&M of irrigation facilities	-	2810	23	Secretariat for National Water Mission	5	-
12	RRR of water bodies	250	1000				
					<b>TOTAL</b>	<b>10043</b>	<b>18613</b>
							<b>28656</b>